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URBAN SOLUTIONS
AND SUSTAINABILITY
R&D CONGRESS 2023
BUILDING SUSTAINABLE, RESILIENT, AND LIVEABLE CITIES OF TOMORROW

4TH – 5TH OCTOBER 2023

Urban Nature for Mentally-Healthy Cities:
Contemplative Landscapes
Dr Agnieszka Olszewska-Guizzo & Alicia Soh

Nature For Health in Cities

- Health: sanitary revolution

- Mental Health: ART, Biophilia hypothesis...

- My hypothesis: There are specific attributes of landscape scenes, which, just from the passive exposure, induce the brain activity associated with positive emotions and relaxation.

- Research between 2010 and 2018 proved the hypothesis true.

- **Contemplative Landscape Model (CLM)** was created and tested for reliability and validity.

A man's eyes cannot be as much occupied as they are in large cities by artificial things . . . without a harmful effect, first on his mental and nervous system and ultimately on his entire constitutional organization"
Olmsted, 1886

Power of scenery: *" to refresh and delight the eye and through the eye, the mind and the spirit"*
Olmsted, 1886

THE CONTEMPLATIVE LANDSCAPE MODEL (CLM)*

* Olszewska, A., Marques, P. F., Ryan, R. L., & Barbosa, F. (2016). What makes a landscape contemplative? Environment and Planning B: Urban Analytics and City Science, 45(1), 7-25.

	Layers of the Landscape	Landform	Biodiversity	Colour & Light	Compatibility	Archetypal Elements[4]	Character of Peace & Silence
6 / 5	·Far-distance view (≥400m) ·Fore, middle & background visible ·Layers greatly enhance the visual quality	·Undulating ·Natural lines ·Stimulation to look up to the sky	·High diversity of plant & animal species ·Vegetation seems native & spontaneous ·Visible changes & motion[1]	·Harmonious, natural, broken or warm colours ·Visibility of light & shade[3]	·Physical & visual relations between elements are worked out ·Explicit spatial order, simplicity, harmony between natural & created	·Strongly influence overall perception	·Explicit ·Contrast to urban environment ·Accessible & safe ·No technology ·Invites to rest and relax ·Gives sense of solitude
4 / 3	·Layers moderately enhance the overall visual quality	·Landform is not very significant to the setting OR ·Hard to say	·Moderate diversity of species ·Moderate changes & motion	·Moderate amount of contrasting colours ·Moderate amount of light & shade	·Physical visual relations are unclear OR ·Some elements disturbing the harmony & balance	·Are present but not important for the overall perception	·Moderate AND/OR ·Moderate sense of solitude AND/OR ·Less contrast with urban environment
2 / 1	·Layers are not visible OR ·Layers do not enhance the overall visual quality	·Flat OR ·Rugged	·Low diversity of species ·No visible changes or motions OR ·Presence of bio-phobic phenomena[2]	·Lots of vivid contrasting colours ·Light & shade not visible	·Physical & visual relations not worked out well or not at all OR ·Chaos, clutter, lack of harmony	·No archetypal elements	·No character of peace & silence ·Busy ·No contrast with urban environment

Therapeutic benefits

Average park score

[1]Dynamic natural phenomea, e.g., seasonal diurnal changes of vegetation, flying birds, bees, etc. Ignore this point for photo evaluation.

[2]Biophobic phenomena include, but are not limited to, snakes, spiders, darkness, etc.

[3]In case of overcast weather, imagine the sunny conditions.

[4]Archetypal elements include water (still or running water body, waterfall, sea), path, clearing, mountain/hill, single old tree, stone, forest, desert, grave, circle, dome, arc.

Landscape Contemplation

- ✓ *Being rather than doing*

- ✓ *Contemplation of landscape stimulates the connection between the **outer** experience and an **inner** world.*

- ✓ *Contemplation calms and empowers the mind, regulates emotions, and leads to better cognitive performance, among other benefits.*

- ✓ *It can be calming or insightful.*

CALMING

Inner silence
Sense of solitude
Distraction from everyday problems
Relaxing
Soft fascination*
Serenity
Tranquil
Feeling immersed and engaged***
Sense of presence
Being-away**
Sense of safety*
Soothing
Reorientation
Peaceful
Familiarity*

INSIGHT

Experience of sublime
Reminiscing the past
Feeling a part of collective human family
Feeling small and mortal
Feeling gratitude
Distraction from banality of life
Feeling subject to natural cycles
Feeling part of nature
Pondering
Awe-inspiring
Evoking memories
Reorientation within a larger order
Acceptance of whatever is
Experience of divine
Banality of human existence

*Attributes associated with the Kaplans' attention restoration theory : *Compatibility, **Being-Away, ***Extent belong to Calming Contemplation type.*

Landscape Contemplation & Passive Recreation Programming

Walking, seating, bird watching etc...

Minimal environmental impact

Minimal facilities

Available for all

Easy self-care practice (no guidance required)

Minimum 10-20 min a day for psychological benefits
(Meredith et al., 2020)

Effects last for 2-4h after

(Barton & Pretty, 2010)

Brain & Behaviour Research with CLM

MND-funded project: *Effects of Landscapes on Brain Activity,* 2018-2021.

- Green spaces **CL** x **non-CL** x **control**

- Experts scoring urban greenspace

- Adults: healthy and patients

- Europe and Singapore

- Neuroscience measurements: EEG, fNIRS

- Other measurements: mood, preference, severity of depression, environmental confounders

- Laboratory vs. outdoor

Main findings:

❖ Significant differences CL vs NCL[1,2,3]

❖ Landscapes high in CLM <u>causing</u> mood improvement [2,4]

❖ Strong positive correlation between CLM scores and
Alpha and Theta brainwaves (only in-situ)[1]

❖ Strong positive correlation between CLM scores and
self-reported positive emotions[1]

TOTAL MOOD DISTURBANCE

(2% drop in the TMD)   TMD increased by 7%

Highly Contemplative Garden   Generic Residential Green   Busy Urban Space with no Green

□ Before ■ After

Frontal

p=0.054

1. Olszewska-Guizzo, A., Sia, A., Fogel, A., Ho, R. Features of Urban Green Spaces Associated with Positive Emotions, Mindfulness and Relaxation (2022) *Nature Scientific Reports*
2. Olszewska-Guizzo, A., Fogel, A., Escoffier, N., Sia, A., Nakazawa, K., Kumagai, A., & Ho, R. (2022). Therapeutic Garden With Contemplative Features Induces Desirable Changes in Mood and Brain Activity in Depressed Adults. *Frontiers in Psychiatry*, 13.
3. Olszewska-Guizzo, A. A., Paiva, T. O., & Barbosa, F. (2018). Effects of 3D contemplative landscape videos on brain activity in a passive exposure EEG experiment. *Frontiers in Psychiatry*, 9, 317.
4. Olszewska-Guizzo, A., Sia, A., Fogel, A., & Ho, R. (2020). Can exposure to certain urban green spaces trigger frontal alpha asymmetry in the brain?—Preliminary findings from a passive task EEG study. *International Journal of Environmental Research and Public Health*, 17(2), 394.
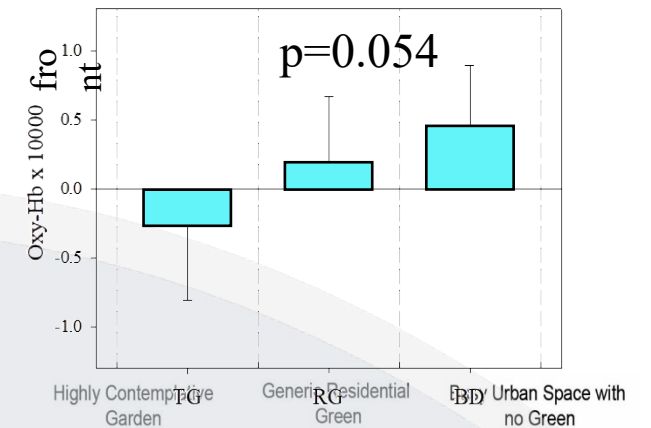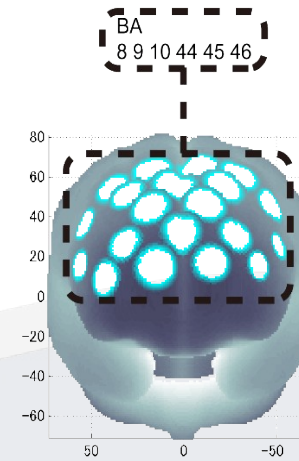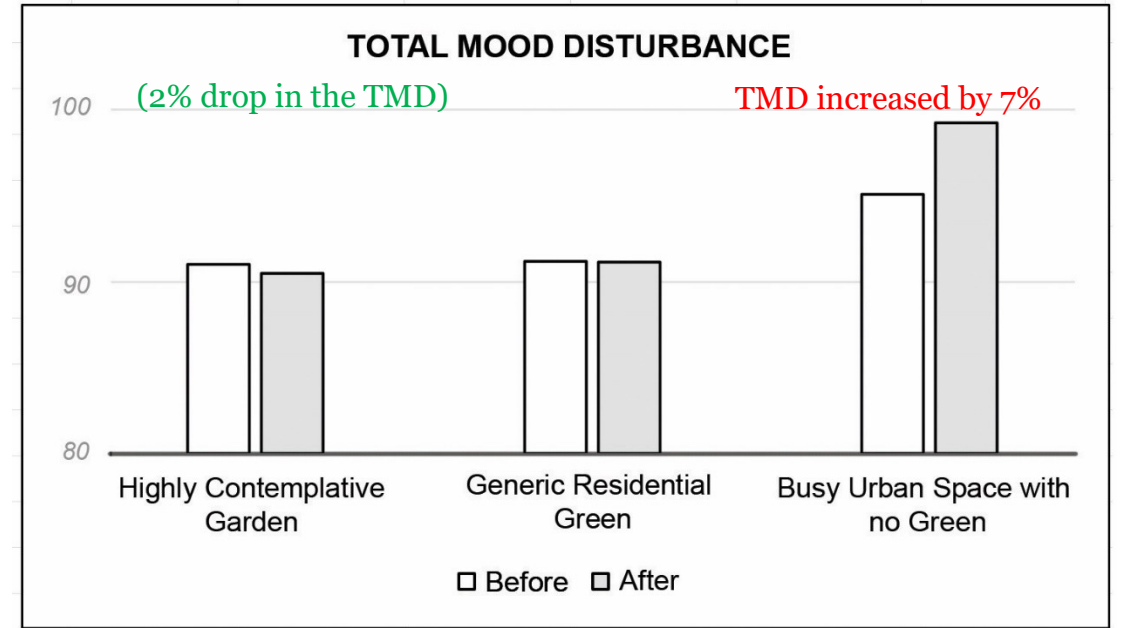
Main Takeaways

- CLM scores can predict and moderate positive brain response in most people.

- Public spaces can be shaped to improve (from baseline) residents' well-being as they move around the city.

- Urban greenspaces (but not all) are the most promising spatial element to deliver the therapeutic effects in cities.

- Landscape views with high contemplative score can offset the negative effects of exposure to busy urban areas or indoors.

Therapeutic Garden @ HortPark, MND-funded project: *Effects of Landscapes on Brain Activity,* 2018-2021.

Potential Applications

Government Agencies
- Identify, protect existing contemplative landscapes
- Implement new ones
- Cost effective mental health promotion
- Meeting wellbeing goals especially among vulnerable communities
- Space promotion/health tourism

Medical and Academic Community
- Health promotion intervention
- Personalized treatments
- Green prescription programs
- More research

Urban Planning and Design Industry
- Include visual quality analysis in design process
- Creating healthy places using CLM as a design tool
- Identify well-being targets

Integration of CLM and AI technology

- **Contemplative Landscape Automated Scoring System (CLASS)** – ANN-based software (prototype) that enables instant scoring of large numbers of digital landscape images (i.e. artificial expert) [1]

- **GreenInCities** – New Horizon Europe Project (2024-2028) - it aims to develop methodologies and tools for nature-based urban planning approaches, specifically for deprived areas, using CLM.
  - ➢ It features the Mental-Health Digital Twin (MHDT), which reconstructs the brain activity of a person or a group in a given environment. Data collected pre and post-construction, using neuromining devices are transferred to the MHDT, together with environmental, urban development, psychological and neuroscience metrics. The simulator allows to identify the nuances of mental health response to changes in the environment.

1. Navickas, L., Olszewska, A., & Mantadelis, T. (2016, June). CLASS: Contemplative landscape automated scoring system. In Control and Automation (MED), 2016 24th Mediterranean Conference on (pp. 1180-1185). IEEE

Fort Canning Park

Rifle Range Park

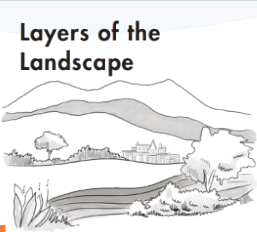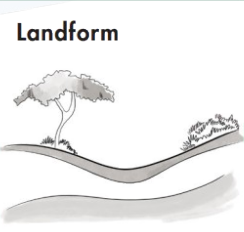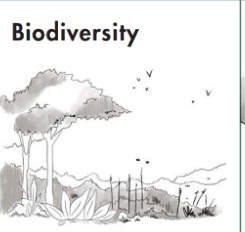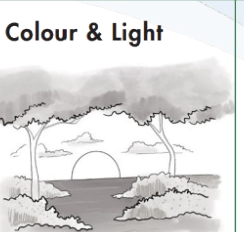# Methodology of CLM Application

CLM Questionnaire
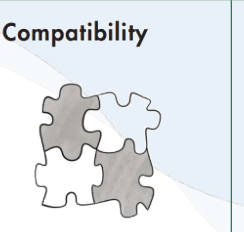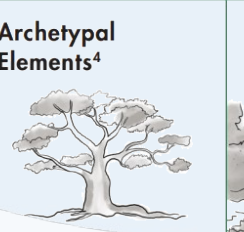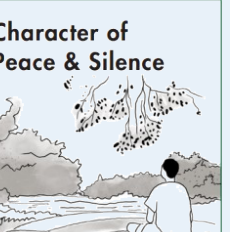
Designing with CLM

Contemplative Landscape Model (CLM) Questionnaire

- Test it with experts and check if CLM is reliable tool

- Evaluation of existing sites or pictures, and also design drawings

- Identify the characteristics that are missing

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Design Guidelines for Contemplative Landscapes

- Technical report aims to translate research findings into application principles

- Targets landscape designers

- Enables the design of landscapes that promotes mental wellbeing

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Design Guidelines for
Contemplative Landscapes

Dr. Agnieszka Olszewska-Guizzo
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Jason Wright
Jeff Seow

NATIONAL PARKS

Designing with CLM

Landscape Layers
- Depth of view with fore-, middle- & background
- Incorporate Open, Closed and Borrowed views

Therapeutic Garden at Bedok Reservoir Park

Borrowed Views

Closed

Open

Landform

- Natural topography with undulating lines, asymmetry, enclosure and mystery

1. Mounds + meandering paths hides views creating a sense of mystery

2. Viewpoints that open up to vistas that has hidden spaces, prompting discovery. Enclosures creates a sense of security.

3. Incorporate elements to encourage skyward oriented views

One North Park Fusionopolis

Singapore Botanic Gardens

Singapore Botanic Gardens

Biodiversity

- High species diversity of flora and fauna that respects the site heritage

1. Tiered Planting

Sembawang Hot Spring Park

2. Diverse plant selection that attracts fauna

Sembawang Hot Spring Park

3. Understanding site history to tailor the plant choices to restore natural habitats. E.g. 1945 Khatib Bongsu used to be a mangrove forest

1945 Map

Colour & Light

- Play of light + shade with harmonious colours through the day/ year

1. Choices of plants that create change.
E.g. *Tunera subtulata* (white buttercup) flowers opens in the morning and closes by noon, *Tabebuia rosea* (Singapore's Sakura) flowers March/ April and August/ September.

Therapeutic Garden at
Pasir Ris Park

Singapore Botanic
Garden

2. Introduce contrasting warm colours that stimulates the mind and senses. Specifically where more activities are envisioned
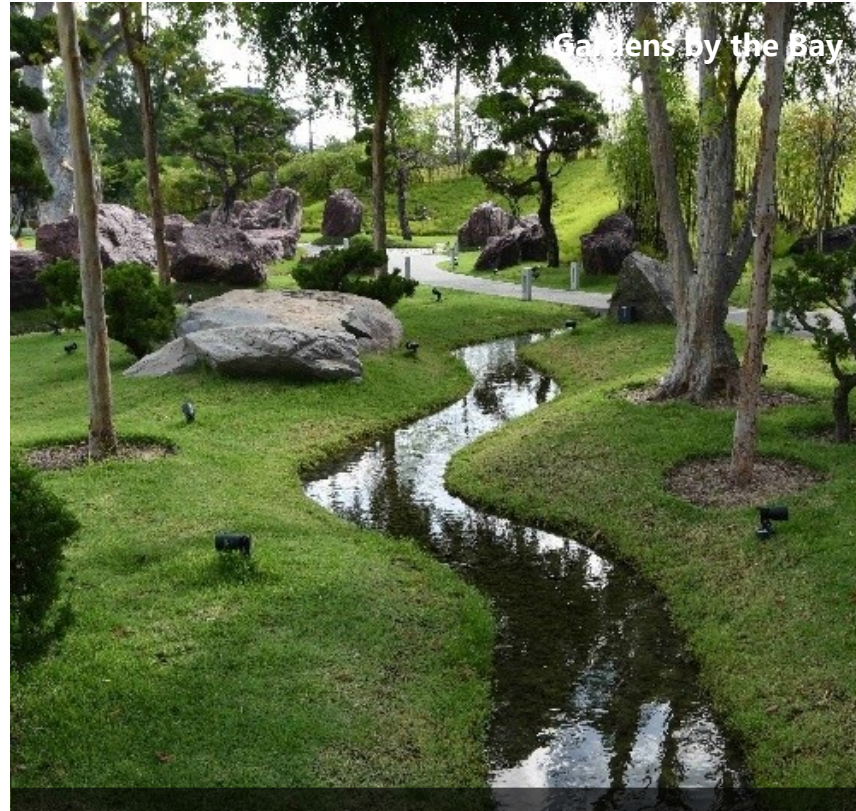
Compatibility

- Spatial order, simplicity and harmonious balance between landscape element
- Mimicking an untouched natural environment

Gardens by the Bay

1. Create focal points and plan for unobstructed views toward it

Gardens by the Bay

2. Spatial order and harmonious positioning of natural elements to create a tranquil environment

Capella Singapore

3. Balance between natural and man-made elements. Balance in proportions

Archetypal Elements

- Elements with symbolic meaning that subconsciously promote contemplation
- E.g. water bodies, streams, sea views, forest, old tree

1. Water bodies or elements

Bishan Park

Rail Corridor

2. Naturalistic paths

Characters of Peace and Silence

- Contrast to busy urban life, inviting to rest and provides comfort and solitude.
- Tranquil, serene, solitude, sense of comfort

1. Landscape as buffer to create visual enclosure

Singapore Botanic Gardens

2. Terracing with lush planting

Fort Canning Park
Spice Garden

3. Water features with subtle water flow

Singapore Botanic Gardens

Case Study 1 – Toa Payoh Blk 149

Low scores:

- Flat surface of the lawn and lack of skyline visibility

- Species diversity is minimal

- Space organisation is unorderly, not integrated and dominated by the building

	Before
Landscape Layers	2.3
Landform	1.2
Biodiversity	1.8
Colour & Light	2.5
Compatibility	2.2
Archetypal Elements	1.7
Char. of Peace & Silence	2.3
Ave CLM score	**2.0**
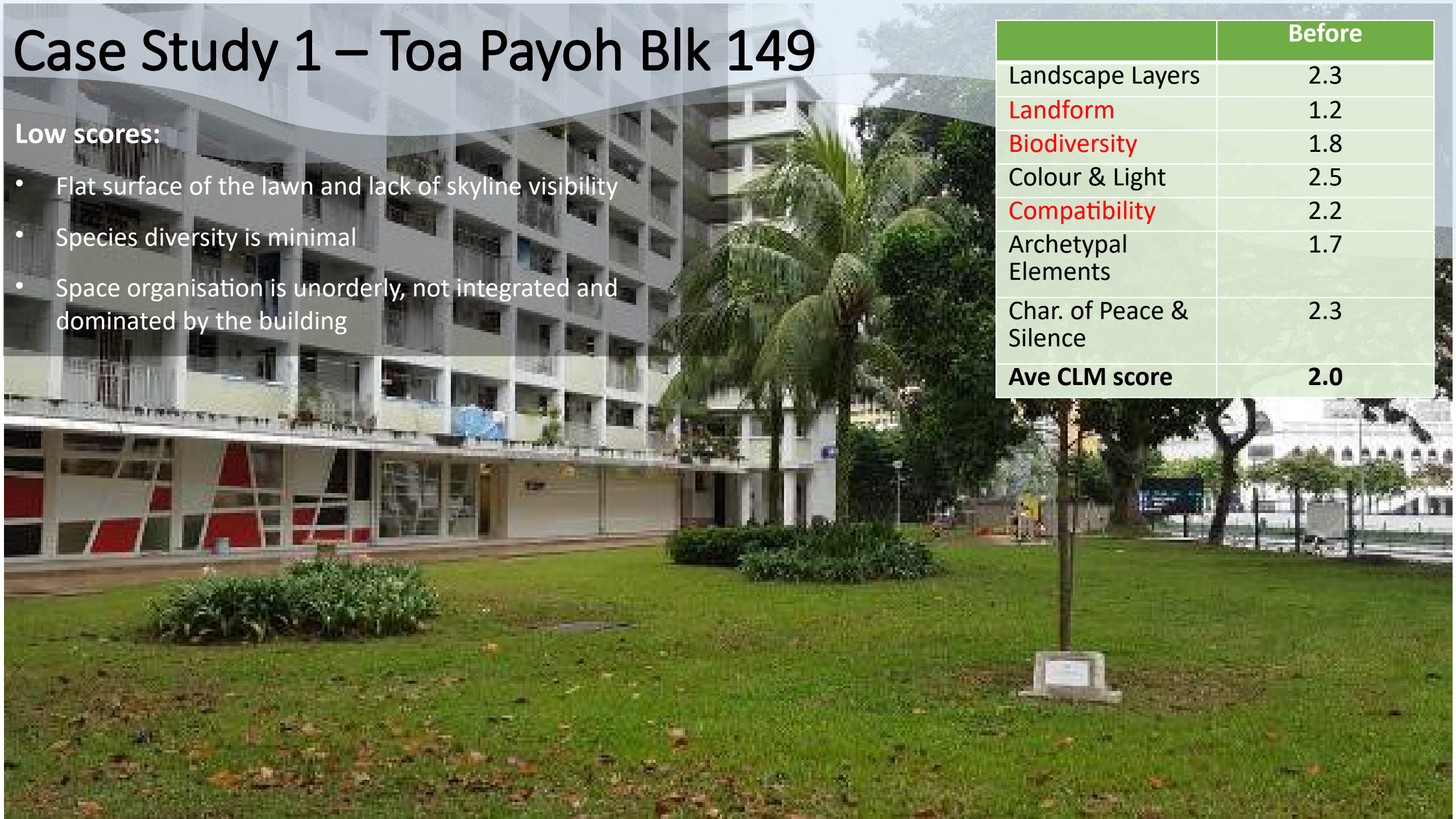
Evaluation – Toa Payoh Blk 149

Enhancements:

- Undulating lines on the ground creates a more naturalistic feel & illusion of natural topography

- More diverse plant species

- Viewer's attention is shifted away from the monolithic façade into the landscape

	Before	After
Landscape Layers	2.3	3.6
Landform	1.2	3.2
Biodiversity	1.8	3.6
Colour & Light	2.5	4.2
Compatibility	2.2	4.6
Archetypal Elements	1.7	3.6
Char. of Peace & Silence	2.3	3.6
Ave CLM score	**2.0**	**3.8**

Case Study 2 – Sun Plaza Park

	Before
Landscape Layers	3.8
Landform	2.0
Biodiversity	2.5
Colour & Light	4.1
Compatibility	3.8
Archetypal Elements	3.0
Char. of Peace & Silence	4.8
Ave CLM score	**3.6**

Low scores:

- Flat topography with stark straight lines of the shelter

- Dappled shade dominated by green tones

- Presence of basic archetypal elements

Evaluation – Sun Plaza Park

	Before	After
Landscape Layers	3.8	4.5
Landform	2.0	3.9
Biodiversity	2.5	5.3
Colour & Light	4.1	5.5
Compatibility	3.8	4.9
Archetypal Elements	3.0	5.2
Char. of Peace & Silence	4.8	5.7
Ave CLM score	**3.6**	**5.0**

Enhancements:

- Raised shelter serves as a vantage point revealing natural lines and tiered planting

- Softscape enhancements bring vibrant colours and a sense of visual harmony

- Warm hardscape material, water feature and transition space from shelter to landscape

Summary

- CLM can be used as a tool throughout the design process.

- The guidelines consists of the 7 key principles in the CLM model, to achieve a contemplative landscape scene in an urban context that has qualities of an untouched natural environment that is perceived as contemplative by the human mind.

- As evidence-based design is an iterative process hence, post evaluation is important to gather pointers to improve the next landscape design.

Therapeutic Garden at Pasir Ris Park

Thank you!
Questions?

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My Book *"Neuroscience for Designing Green Spaces:*
Contemplative Landscapes" by Routledge

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