FROM METROPOLIS TO ALLOTMENT: SCALED SYSTEM THINKING
IN ADVANCING LANDSCAPE STUDIO KNOWLEDGE
Dr Siqing Chen and Prof Dr Virginia Lee
University of Melbourne
Outline

• What is scaled system thinking?
• How does it compare with other geodesign frameworks/methodologies
• Challenges in teaching scaled system thinking in landscape studios
Theoretical basis for scaled system thinking

Complicated system

```
System ABCD
  ├── Subsystem A
  │     ├── A1
  │     └── A2
  ├── Subsystem B
  │     └── B1
  └── Subsystem C
      └── C1
```

Complex system

Difference in interactions between (A) complicated system and (B) complex system
(Source: WILLIAM, 2002)

Low

Number of *interacting* components and degrees of complexity

High
System thinking and geodesign

- Michael Flaxman (2012): “…informed by the geographic context”
- Carl Steinitz (2012): “…changing geography by design”
- Design intention: functionality, QOL, problem solving, etc.
  - Interactions/Relationships of system components
  - Geodesign as a tool to understand the established and modified interactions of the components (A, B, C, D …) of landscape systems (the geo part)
  - Understand established interactions (representation, process, evaluation models)
  - Understand modified interactions (change model and impact model)
- Jane Birkland (2008): “net positive development”
System thinking and geodesign: the Interactions in a geography

- **Fundamental biogeochemical processes:**
  - Carbon cycle, N cycle
  - Water cycle,
  - Energy flow

\[
6 \text{ CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2
\]

\[
\text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2 \rightarrow 6 \text{ CO}_2 + 6\text{H}_2\text{O}
\]

- **Fundamental ecological processes**
  - Predation
  - Natural selection
  - Succession

- **Scale:** Time + Space

- Geodeisn has to visualize these invisible processes and make people (at least ppl at the place) appreciate these processes

A cartoon of the global carbon cycle. Pools (in black) are gigatons (1Gt = 1x10^9 Tons) of carbon, and fluxes (in purple) are Gt carbon per year. Illustration courtesy NASA Earth Science Enterprise. Image © NASA
Theoretical basis: system thinking

Interactions of basic components of a geography on urban form: water, soil, vegetation, climate, etc.

If A – urban form to be designed; B - soil; C - hydrology D – vegetation

Then
BC - interactions between soil and hydrology driven by vegetation (carbon cycle) through photosynthesis, decomposition, etc.
BD - interactions between soil and vegetation driven by hydrology (water cycle) through processes of transpiration, surface runoff, infiltration, etc.
CD - interaction between vegetation and hydrology triggered by soil through processes of nutrients cycling
BCD - interactions between soil, water, and vegetation through succession leading to ecological climax which is detrimental to local physical geography ...

ABCD is the geodesigned urban form with least interruption to the established ecologies in the ‘geography’ or the landscape system

Geodesign is design that realizes design intention but costs least [negative] changes in the geography, or least interruptions to the established interactions (including social economic, cultural interactions) within the geography, as to be evaluated in a broader space and longer time scale.
Theoretical basis: scale thinking

Design intervention requires at least one scale up and one scale down from the scales at which designs are conceptualized and realized (3 scales in total in many case studies).
Steinitz: Geodesign ‘problems’ are complex with at least ten systems; At least ten ways to change and improve a system:
10 ways X 10 systems = 100 system.ways
Across at least scales 3 scales: 100 X 3 = 300ssws
Low
Number of interacting components or subcomponents and degrees of complexity
High
Scaled System Thinking for Urban Hydrology at Metropolis, suburb, allotment scales
If Roof area ratio = 50%

Then inflow to local streams is reduced by 50%

Its impacts should be tested!
Scaled System Approach: Conceptual Way of Thinking about Geodesign

- Landscapes are complex systems [at each scale]
- Scaled system thinking integrates scale thinking and system thinking to understand the ‘interactions’ across space and time
- Interactions between components of systems at different scales must be explicitly mentioned, thoroughly investigated clearly represented, and thoughtfully coped with
- Scaled system thinking facilitates geodesign aiming at the conceptualization and realization of designs that do ‘permanent good’ [changes] in the geography.
2. How is scaled system approach compared with other approaches?

Local scale hydrological system:
- reduced inflow from surface runoff into streams
- stream ecology degradation

Regional scale hydrological system:
- degraded stream ecology in the region may increase risk of urban flood in the event of extreme climate conditions (e.g. storm dumping large volume of water in a short time)

Allotment scale hydrological system:
- stormwater harvest and reuse;
- rain garden
- [reduced] surface runoff
The Geodesign framework
by Carl Steinitz

1. How should the study area be described?
2. How does the study area operate?
3. Is the current study area working well?
4. How might the study area be altered?
5. What differences might the changes cause?
6. How should the study area be changed?
## MLA Curriculum, MSD, UoM

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>MLA Studio 1: Design Techniques</th>
<th>Shaping the Landscape</th>
<th>Plant Material and Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 2</td>
<td>MLA Studio 2: Site &amp; Design</td>
<td>History of Landscape Architecture</td>
<td>Ecosystems for Planning and Design</td>
</tr>
</tbody>
</table>

### Entry (300pts)

### 1st Year MLA

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>MLA Studio 3: Speculations</th>
<th>Contemporary Landscape Theory</th>
<th>Landscape Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 2</td>
<td>MLA Studio 4: Strategies</td>
<td>Landscape Detail Design</td>
<td>Landscape Elective</td>
</tr>
</tbody>
</table>

### Entry (200pts)

### 2nd Year MLA

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>MLA Studio 5: Sustainable Urbanism</th>
<th>Constructed Ecologies</th>
<th>Graduate School Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>Master of Urban Design Studio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>MSD Travelling Studio</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3rd Year MLA

<table>
<thead>
<tr>
<th>Semester 2</th>
<th>Thesis Studio</th>
<th>Landscape Practice</th>
<th>Graduate School Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>MSD Travelling Studio</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### KEY

- 25 points Design Studio
- 12.5 points Core Subject
- Landscape Elective
- Graduate School Elective
UNA’s geodesign program fitted into Steinitz’s diagram

**GSP Core Course Key:**
130: Mapping the World
150: Physical Geography
201: Community, Planning & Change
206: Public Participation & Comm.
240 or 241: World Geography West/East
303: Community Design & Preservation
331: GIS Foundations I: Map Design
371: The Urban Realm
375W: Community & Global Analysis
405C or 480C: Capstone Professional Project

**Source:** Paradis, T. 2011
Adapted from Steinitz, C., 2011 GeoDesign Summit Presentation.

**Figure 3.** The Steinitz Geodesign Framework with GSP course numbers embedded. Course location is based on a qualitative estimate of their weighting toward one or more geodesign areas. Source: Tom Paradis, Mark Manone.
Speculations Studio Project: Studio 3

The primary challenges:

• To approach given urban situations in environments selected by the student group primarily through accessing readily available digital mapping and global positioning systems.

• To access a wide variety of research, documentation and data on the landscapes dynamics of their chosen cities and extensive detail of sites through digital mapping

Sequencing the speculations studio 3 overview approach is a valuable precursor to the strategies studio 4

Studio 3 knowledge is based upon a range of published mapping techniques to support studio 4 intensive instruction in gis and geodesign approaches and tools.
The speculations studio requires landscape architecture students to:
Imagine critical issues for design strategies and concepts in unfamiliar international places.
The studio premise describes the intersection of ecological & social issues & landscape events.

PHOENIX ARIZONA INFRASTRUCTURAL OASIS KATE GRANT 2014
The strategies studio is an instructional GIS based studio applied to the Melbourne metropolitan area as the case in general and a specific suburb suitable for future urban growth. This regional design studio introduces the conceptual framework for regional landscape planning, framed by landscape design principles; and a working knowledge of the tools as applied to landscape planning and design.

The primary challenges:

- Des
- IT (with no prior GIS experience)
- 10 systems (Geo + Pop):
  - hydrology (WSUD)
  - soil (food security)
  - vegetation (biodiversity)
  - parks and open space
  - walkability
  - transport
  - microclimate (UHI)
  - energy security: renewable energy supply
  - job opportunity
  - housing affordability
  - other social economic and cultural issues

- 10 ways to improve
- Scale thinking
- System thinking
- Scaled system thinking
- Geodesign
Students Studio Project: Studio 4
Conclusion: Scaled system thinking as a framework for geodesign

• Scale is not only spatial, but also temporal
• Seek design solution by understanding interaction of landscape components across time and space
• Understand impacts of design intervention at one scale (space and time) on the landscape in another space and time
• Evaluate effects of local projects on changing regional geography and understand immediate regional or even global impact of site design decision
Conclusion: Teaching Scaled System Thinking in Design Studio

• Students can generally employ system thinking and understand interactions between landscape components at one scale, but are not strong in system thinking across scales

• Push students to think the design problem as a system problem,

• Encourages students to imagine system thinking across scale and apply to seek design solution by understanding interaction of landscape components across time and space
Scaled system approach and geodesign research and practice

- City wide green roof system
- 10,000 rain gardens for city of Wuhan
- The collective impact on the interacting relationship in the geography must be evaluated prior to actions being taken
- Knowing planetary impact of site decision

http://baybridgehouse.org/tag/green-roof/