48-747 Shape Grammars

The Grammar of Taiwanese Traditional Vernacular Houses
my variation on a theme
undertake a *study* of an architectural *style*,

*extract* from it mathematical and *computational principles*,

*formalized* into a *system* of compositional *rules*,

that can be described in a *language* – which,

ultimately, will provide the means

for *visual* and *interactive explorations* on a computer

*a personal motivation*
Historic preservation of Chinese buildings
Effect on contemporary Chinese designs
Teaching of Chinese architecture and architectural history

a public why?
no extant plans ... no drawings, no designs (as such)

(instead) there was a process – the gao-chi

da cultural excursion + a variation on a theme
what is traditional Taiwanese architecture?

People

- Min-nán
- Zhāng
- Quán
- Kè-jīā ...

Chinese

- Hàn
- Mǎn
- Méng
- Huí
- Zàng ...

Style in “traditional” style

Place

island of Taiwan (Formosa), the Republic of China

Period

prior to 1920
influence of Fujian and Guangdong architecture on the province of Taiwan

based on the work of chiou, shang-chia

southern style chinese architecture
a branch of chinese architecture
architectural style of the south east coast
factors that affect Chinese architecture

people
courtyard
roof
feng-shui
human proportions
confucian order
yi ching (change)

**factors** that affect Chinese architecture
predominantly northern style

si-hé yuàn

courtyard style

courtyard style

predominantly southern style

san-hé yuàn
Si-he yuan
Predominantly Northern Style

courtyard style
spatial concept – boundary of human beings
compositional unit

Terminology for a typical tang-wu

<table>
<thead>
<tr>
<th>jin (finished)</th>
<th>sho (tip/end)</th>
<th>ci (secondary)</th>
<th>ming (light)</th>
<th>ci (secondary)</th>
<th>sho (tip/end)</th>
<th>jin (finished)</th>
</tr>
</thead>
</table>

jian (bay)
ethical order concept
roof style

northern style

southern style
Ju-zhe

roofs

Ju-jia
Ju-zhe

roofs

Ju-jia
roofs
"A site should be surrounded on three sides by higher land, like the crook of the elbow in a curved arm, to provide protection from inclement weather or an enemy. The lie of the land should be gently sloping and, if possible, there should be a river or valley nearby to allow surface water to drain easily."

**The Burial Book** (Zang-shu trans. by Lawrence Liu (1989))

*feng-shui: wind + water*
yi-jing (change)
heavenly orders
The “Lu-Ban” application is used to determine pre-design or pre-construction information, namely “Propitious Location,” “Auspicious Construction Date,” and “Fortunate Dimensions,” in Chinese or Taiwanese traditional architecture. They are based on the principles of Feng-shui (Chinese geomancy).

LuBan: Compass for Fortunate Dimensions

<table>
<thead>
<tr>
<th>Location</th>
<th>Facing</th>
<th>Orientation</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shen</td>
<td>Yin</td>
<td>60° 0’ 0”</td>
<td>metal</td>
</tr>
</tbody>
</table>
Lu Ban ruler
A Lu Ban foot = 10 Lu Ban inches = 29.69 cms

Opening Ruler
(Mén-guǎng chí)
8 intervals = 1' 4.4" = 42.76 cms

Worship Ruler
(Ding-lán chí)
10 intervals = 1' 2.8" = 38.01 cms

Stride Measure (bù-fâ) a stride = 4' 5" (1.336 m)
Step Measure (tà-fâ) a step = 3.5" (10.6 cms)
Lu Ban: Fortunate Dimensions

The "fortunate dimensions" refer to a set of measurements for the main spaces of a traditional building. The dimensions, regarded as means of good fortune and still widely used in Taiwan and China, are based on the principles of Feng Shui.

Constraint (Lu-Ban foot)
- Height: min.: 10 max.: 15
- Depth: 1.3 x Height min.: 13 max.: 20
- Width: 1.0 x Height min.: 10 max.: 15
  - Default

Fortunate measurements (Lu-Ban foot/inch)
- Lu-Ban foot 12 ➙ good metal identical
- Lu-Ban inch 3 ➙ fair wood destroy
  - Height ➙ Depth ➙ Width

Conversion
- Lu-Ban strides 2.73 steps 35.14 centimeters 365.27
  - Opening Ruler ➙ Worship Ruler

Lu Ban: Propitious Location & Auspicious Construction Date

The "propitious locations" are based on principles of Feng Shui, known as "right buildings," for determining the location's fortunate orientation. The "auspicious construction dates" can be decided either by orientation using the "Canon of Buildings" or by the owner's date of birth using the "Two Books of Buildings for Feng Shui.

Person's birth information (in Lunar Calendar)
- Gender: masculine
- Year: 1965 Month: 8 Day: 11 Hour: 11:23

Solar Calendar: Clear

Innate Characteristics
- Feature
- Heavenly ➙ YI_Si ➙ YI_You ➙ GuI_Hai ➙ Wu_Wu
- Cycle ➙ Essence ➙ Category ➙ Gen ➙ West:

Propitious Location

Auspicious Construction Date (in Lunar Calendar)
- Based on the "Canon of Buildings"
- Location ➙ Fortunate Month ➙ Unfortunate Months
  - Shen 9 3; 12

lu ban
1. Examine site, choose auspicious orientation
2. Negotiate (artisan, owner, geomancer)
3. Decide upon the ‘form’
4. Purchase materials
5. Breaking ground (ceremony)
6. Marking the layout on the site
7. Construct platform
8. Construct main walls
9. Erect main walls, place main beams
10. Construct roof and mortar walls
11. Clean up
12. Thanking the gods (ceremony)
Defining the initial shape
Defining the scales of the building
Computing the fortunate dimensions of the central room
Generating the central room
Adding extra space to the central room and refining it
Adding openings to the central room
Extending the main building by adding rooms laterally
Refining the main building with openings and extra space
Generating a courtyard
Generating a secondary building
Clearing labels
Generating the raised platform
Generating the form of the central room
Generating the entire form of the main and secondary building
zhou family house
Defining the initial shape
Defining the scales of the building
Computing the fortunate dimensions
Generating the central room
Adding extra space to the central room and refining it
Adding openings to the central room
Extending the main building by adding rooms laterally on each side
Refining the main building with openings and extra spaces
Generating courtyard
Generating the layout of the secondary building
Clearing labels
Generating the raised platform
Generating the form of the central room
Generating the entire form of the main and secondary buildings

zhou family home
perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away.

antoine de saint exupéry

simplicity was the goal
Generation of Zhāi-zing shān-zhūn
(A three dimensional exposition)