

# Towards the Interpretation of Cultural Landscapes through Cognitive Grammars

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# Cultural Landscapes through Cognitive Grammars

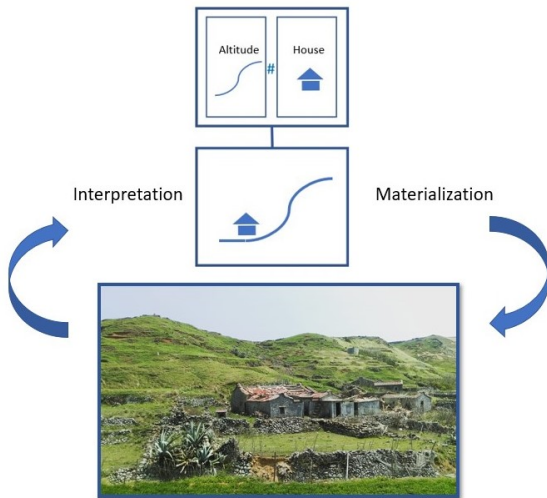
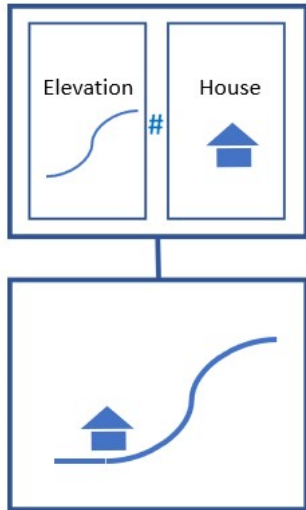


Figure 1

## Purpose: Link different layers

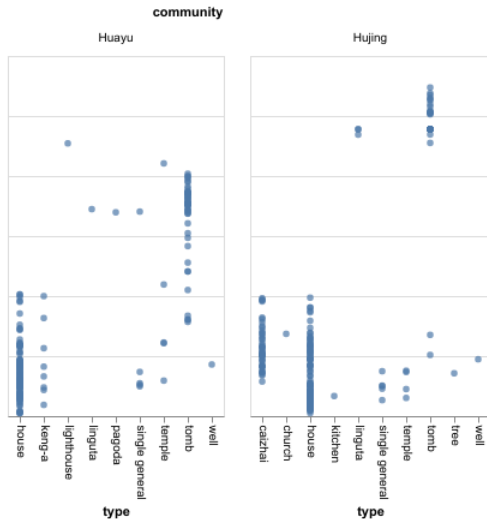
To create interpretations





# Theory: Towards a Grammar of Culture

## In Search of Interpretations



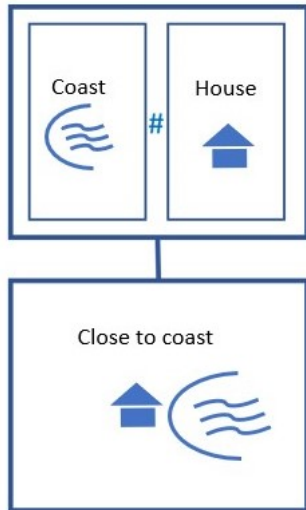
## Theory: Towards a Grammar of Culture

### Leach 1976, Culture and Communication

In what follows I shall assume that all the various non-verbal dimensions of culture, such as styles in clothing, village lay-out, architecture, food, cooking, music, physical gestures, postural attitudes and so on are organised in patterned sets so as to incorporate coded information in a manner analogous to the sounds and words and sentences of a natural language. I assume therefore it is just as meaningful to talk about the grammatical rules which govern the wearing of clothes as it is to talk about the grammatical rules which govern speech utterances.

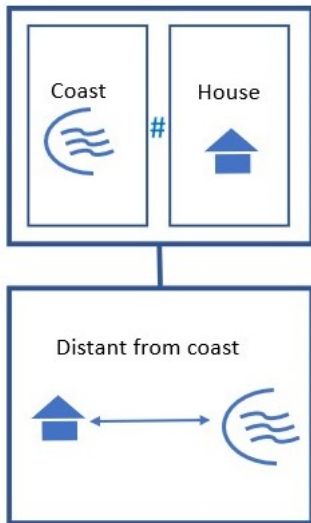
## Theory: Towards a Grammar of Culture

Rule Examples: Build close to the coast/harbor



## Theory: Towards a Grammar of Culture

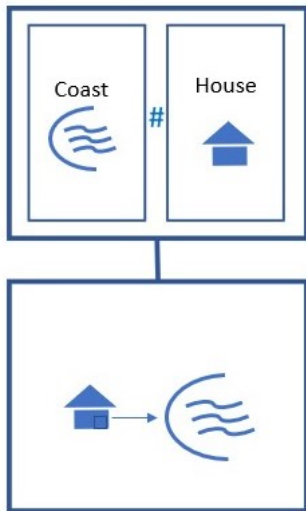
Rule Examples: Build in a distance from the coast/harbor





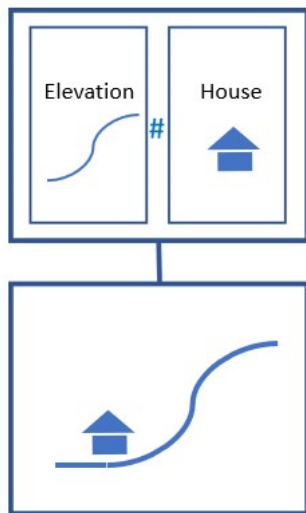
## Theory: Towards a Grammar of Culture

Rule Examples: Direct your house to the coast/harbor



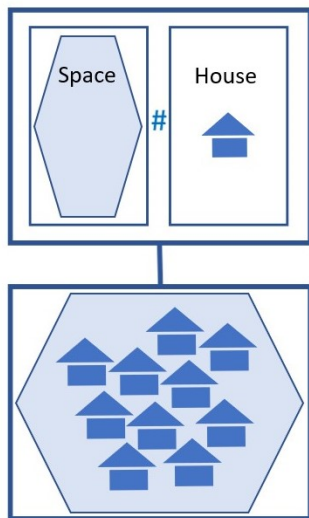
## Theory: Towards a Grammar of Culture

Rule Examples: Build in low areas



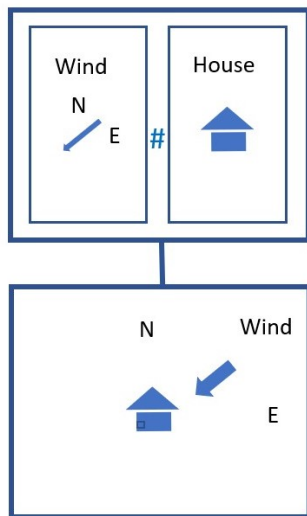
# Theory: Towards a Grammar of Culture

Rule Examples: Build close to the next house



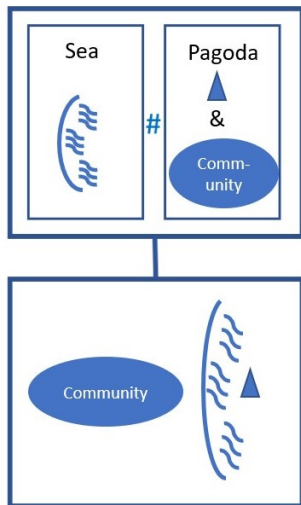
## Theory: Towards a Grammar of Culture

Rule Examples: Turn away houses from the wind



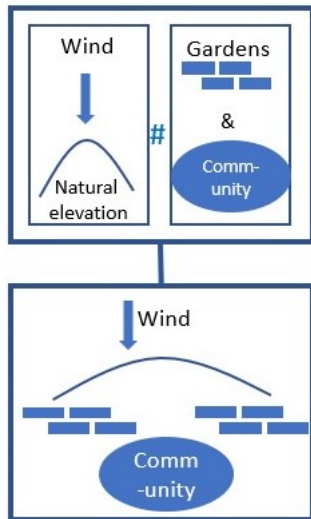
# Theory: Towards a Grammar of Culture

Rule Examples: Place the pagoda into the sea



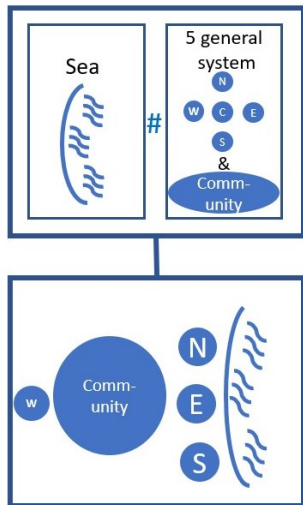
## Theory: Towards a Grammar of Culture

Rule Examples: Community and gardens are protected by an elevation



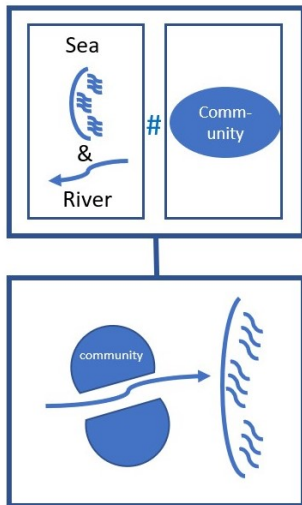
# Theory: Towards a Grammar of Culture

Rule Examples: Arrange the generals to protect from the sea



# Theory: Towards a Grammar of Culture

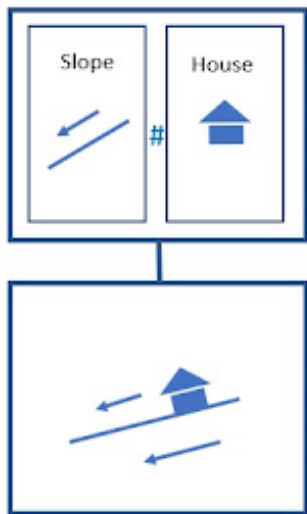
Rule Examples: Let the river flow through the village





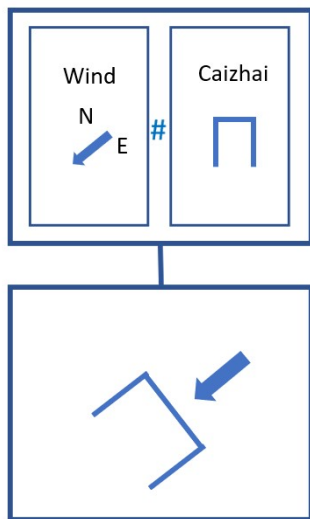
## Theory: Towards a Grammar of Culture

Rule Examples: Orient houses downhill



## Theory: Towards a Grammar of Culture

Rule Examples: Turn gardens away from the winter monsoon



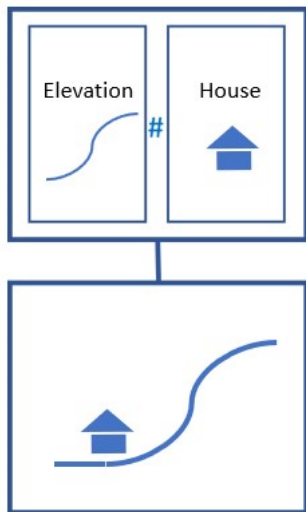
# Hierarchy of Cognitive/Spatial Grammars

- 1 innate cognition
- 2 body related cognition, e.g. elaborations of 2D and 3D space, counting, measurement, angle
- 3 vision, geometry, measurement, angle (cultural, but huge overlaps)
- 4 cognition with space as metaphor, e.g. time, social hierarchy, mathematics (more and more culture specific)

# Socio-Cognitive Grammar: Rule 1

## Focus on commonalities

- Name: Build in low areas
- Environment: Slope
- Structure: House
- Motivation: Winter monsoon
- Etic Description1: Build structures in low areas protected from the wind
- Emic Description1: Good Fengshui
- Emic Description2: Protection from wind
- Testing: Comparing the elevation of a randomly drawn houses to a random elevation of the community



## Emic Perspectives

### Interviewee Nb. 1: Mr. Hong

講實在一點，澎湖自然災害最大的就是風災。澎湖算是個很單純的環境... 因為澎湖很少下雨，淹水其實也很快就退了。

To be honest, the biggest natural disaster in Penghu is the wind. Penghu has a very simple environment... Because in Penghu, it rarely rains, if there is flooding it will quickly recede.

## The Island Communities Involved in our Pilot Study

Community	Site	N	p-value	Area (km <sup>2</sup> )	Max. Height
Penghu	house	553	0.0*		
Dacang	house	2	0.585	0.1905	20
Dongji	house	23	0.0*	1.7712	47
Huayu	house	105	0.002*	1.4729	53
Hujing	house	140	0.0*	2.1331	60
Jiangjun'ao	house	140	0.0*	1.5617	30
Jibei	house	17	0.707	3.0573	18
Niaoyu	house	26	0.600	0.3472	27
Tongpan	house	20	1.000	0.3439	29
Xiaomen	house	13	0.195	0.4737	23
Yuanbei	house	25	0.230	0.251	40
Zhongtun	house	36	0.817	1.4077	18

## A grammar rule and its relation to the reference

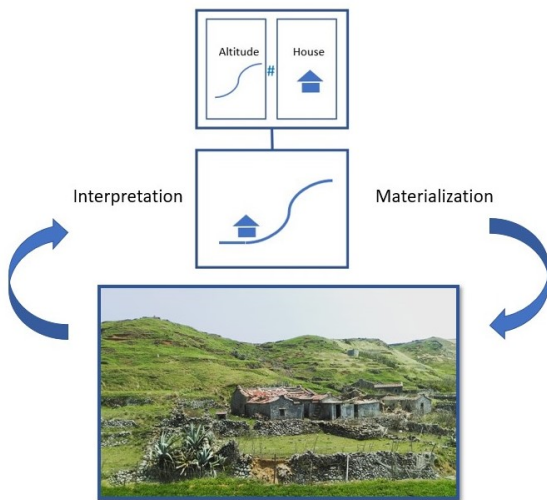
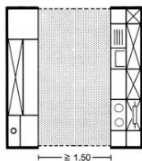


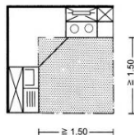
Figure 16

# Inspiration (normative)

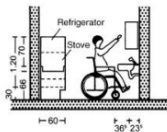
## Ernst Neufert "Architects' Data/Baentwurfslehre" (1936)



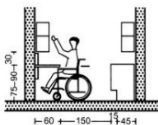
5 Movement area in a double-space kitchen



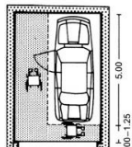
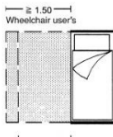
6 Movement area in an L-layout kitchen



7 Dimensions at the sink, stove and refrigerator



8 Dimensions in the kitchen



### Accessibility without steps

All rooms belonging to a dwelling and the communal facilities of a house must either be without steps, or have a lift → p. 22 ①, or be accessible with a ramp → p. 22 ②. Door stops and thresholds at the bottom of doors should be avoided, but if absolutely necessary may not be higher than 2 cm.

### Wheelchair parking place

A wheelchair parking place is to be included in the design for each wheelchair user, preferably located in the entrance area, for transferring from street to indoor wheelchair. Space requirement and movement area → p. 22 ①.

### Bathroom

The bathroom is to be provided with a wheelchair-accessible shower. The later installation of a bath should be possible near the shower. The movement area to the right or left of the WC must be at least 95 cm wide and 70 cm deep. From one side of the WC towards the wall, or furniture, there must be a distance of min. 30 cm → ② - ④. No bathroom doors may open inwards.

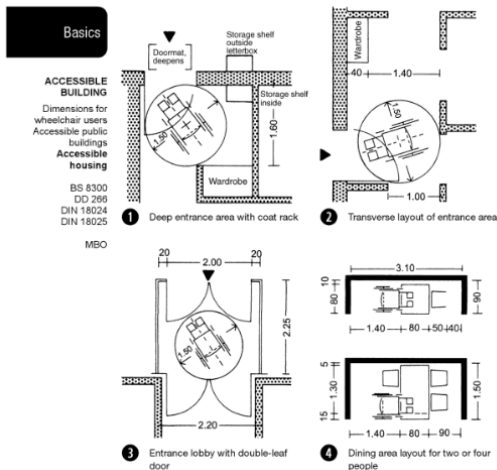
### Kitchen

The main items of equipment items like the refrigerator, stove and sink, plus the worktop, are to be arranged as close as possible to each other. It must be possible for a wheelchair to pass under the sink and worktop without limitation. For the sink, this means that either a waste fitting behind the plaster or a flat fitting on the surface is necessary. Shelf space must be accessible for the wheelchair user and no tall units should be included in the design. The horizontal reach area is about 60 cm, and the vertical activity range is 40-140 cm. The optimum height of the worktop (approx. 75-90 cm) should be discussed with the disabled person and fixed at a height to suit the user → ⑦ + ⑧.



# Inspiration (normative)

## Ernst Neufert "Architects' Data/Bauentwurfslehre" (1936)



## ACCESSIBLE BUILDING

### Accessible Housing

#### Housing suitable for wheelchairs

Wheelchair users must be able to travel into all the rooms of a dwelling, and into all rooms available to the residents of a house in common, and to use all facilities. The wheelchair user must be in a position to be mostly independent of outside help. This applies notably to the blind and visually impaired, the deaf and hearing-impaired, the physically disabled, old people, children and people of exceptionally short or tall stature.

In order to turn 180°, a wheelchair user requires at least 1.50 m<sup>2</sup> → **1** + **2**. This space requirement determines the size of, and movement area in, corridors, rooms, garages etc. In residential apartment blocks, access through corridors or hallways is the most frequent arrangement. In this case, angles and corners are to be avoided as far as possible; a straight access corridor is suitable. The minimum area of an entrance hall should be 1.50 × 1.50 m, and an entrance lobby with a single-leaf door 1.70 × 1.60 m. A window with a clear view from a parapet height of 60 cm should be provided in at least one living room of a dwelling. An entry phone at the flat or house door is an important item of equipment for a blind resident.

#### Living area

Adequate freedom of movement for wheelchair users is important in living rooms. There should also be room for at least two further wheelchair users as visitors. For a living room with an eating area, the minimum floor area should be: in a flat for one person 22 m<sup>2</sup>, for 2–4 people 24 m<sup>2</sup>, for five people 26 m<sup>2</sup> and for six people 28 m<sup>2</sup>; minimum room width 3.75 m (1–2 person household).

Figure 18

# Inspiration (normative)

## Ernst Neufert "Architects' Data/Bauentwurfslehre" (1936)

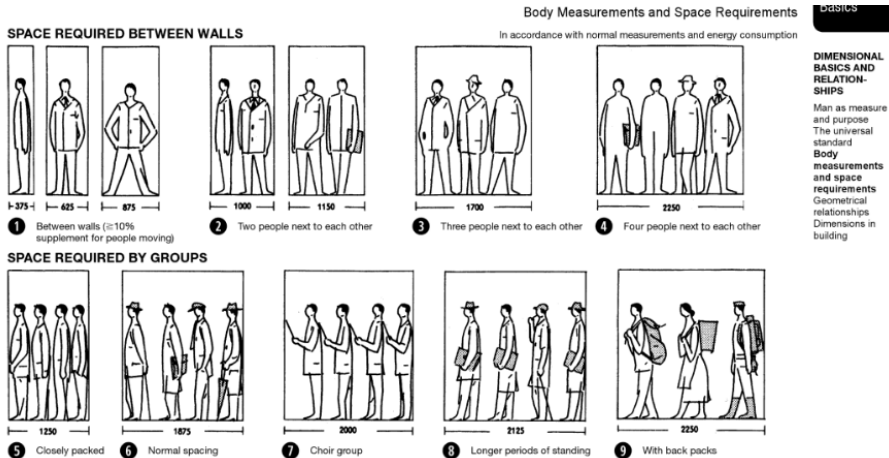
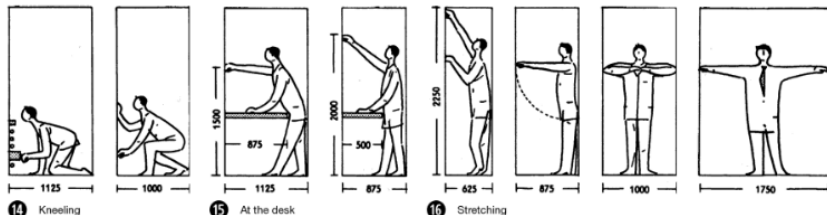


Figure 19

# Inspiration (normative)

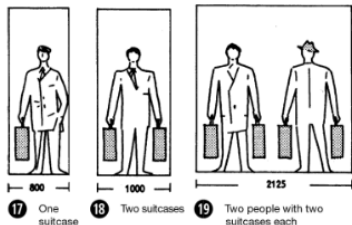
Ernst Neufert "Architects' Data/Bauentwurfslehre" (1936)

## SPACE REQUIRED FOR VARIOUS BODY POSTURES



(e.g. cable car)

## SPACE REQUIRED WITH HAND LUGGAGE



## SPACE REQUIRED WITH WALKING STICK AND UMBRELLA

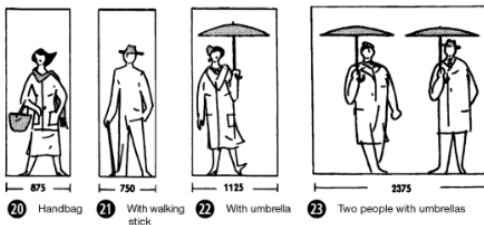
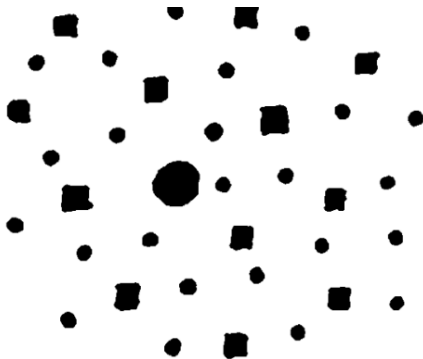


Figure 20

## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)



**towns of 1,000,000 – 250 miles apart**

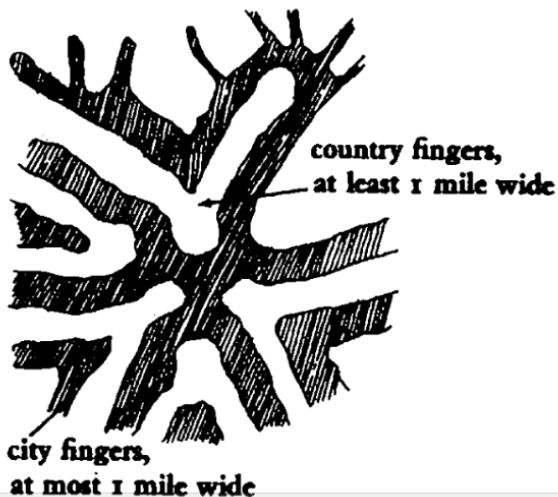
**towns of 100,000 – 80 miles apart**

**towns of 10,000 – 25 miles apart**

**towns of 1,000 – 8 miles apart**

## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)



## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)

**hills for building**

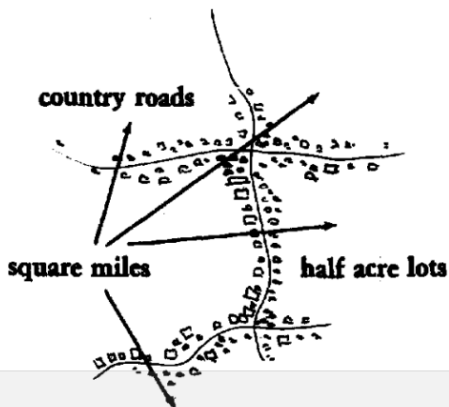


Keep town and city development along the hilltops and hill-sides—**CITY COUNTRY FINGERS (3)**. And in the valleys, treat the ownership of the land as a form of stewardship, embracing basic ecological responsibilities—**THE COUNTRYSIDE (7)**. . . .

## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)

**Build homesteads along these roads, one lot deep, on lots of at least half an acre, with the square mile of open countryside or farmland behind the houses.**



## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)

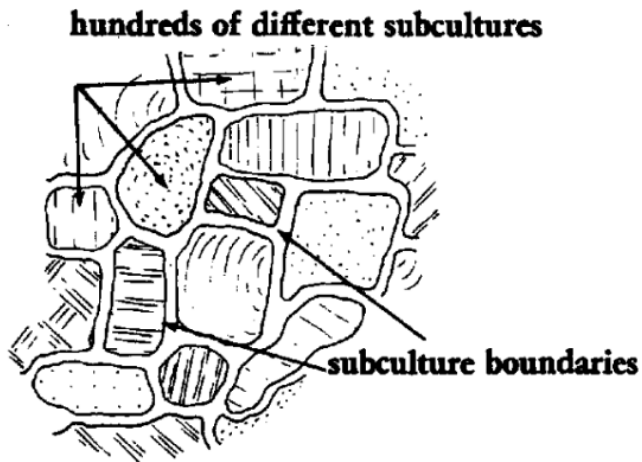


*Mosaic of subcultures.*



## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)



## Inspiration (normative)

Christopher Alexander "Design Patterns" (1977)

**decentralized production**

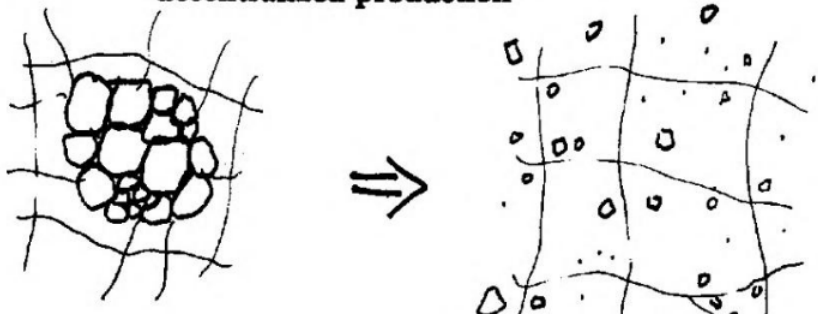
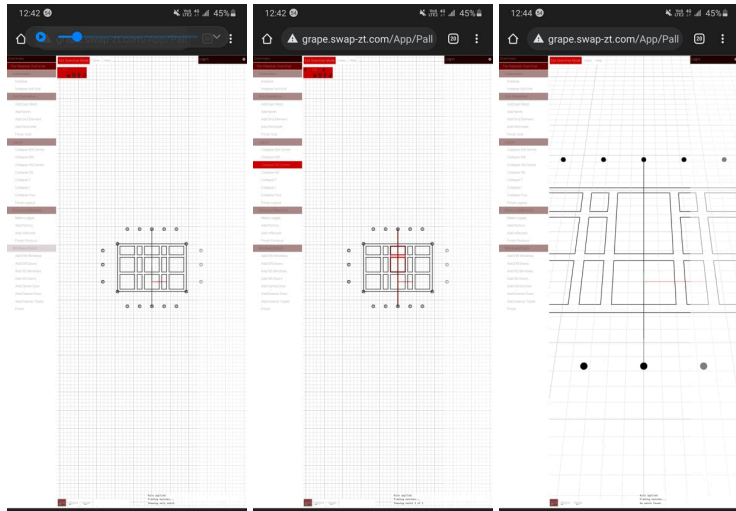


Figure 27

# Shape Grammars (generative)

Stiny and Gips “Shape grammars and the generative specification of painting and sculpture” (1971)



## Socio-Cognitive Grammar: Rule 2

Name: Build close to the coast

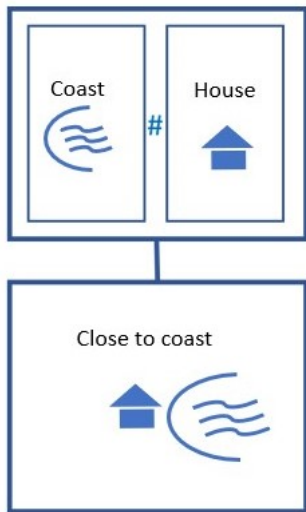
Environment: Coast

Structure: House

Motivation: Daily life

Etic Description: Build houses close to the harbor to facilitate the transport of fish and nets between house and harbor.

Testing: Comparing the distance of a random spot of the community to a randomly chosen house as to their distance to their nearest point of the coast.



## Socio-Cognitive Grammar: Rule 3

Name: Build distant from the coast

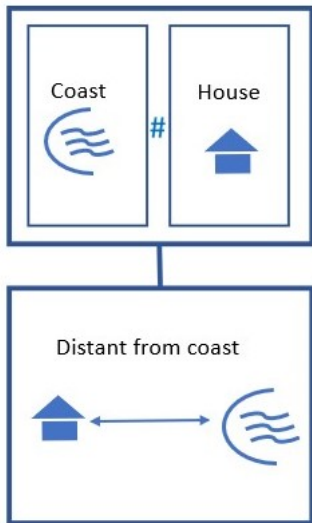
Environment: Coast

Structure: House

Motivation: Typhoon, waves, flooding, destruction

Etic Description: Build houses at a distant from the harbor to avoid being hit by high waves.

Testing: Comparing the distance of a random spot of the community to a randomly selected house and comparing their distances to the nearest point on the coast.



## Cognitive/Spatial Grammar as low level interface

- different, conflicting emic and etic conceptions
- ranking according to contextual features
- computational approaches/modeling/testing
- intellectual challenge to redefine higher level concepts
- material for interviews or experiments with community members

# Formal Properties of Spatial Grammars

- VRML Virtual Reality Modeling Language
- GIS Geographic Information Systems
- VRML + GIS

## Socio-Cognitive Grammar: Rule 4

Name: Gardens turn away from Monsoon

Environment: Winter monsoon

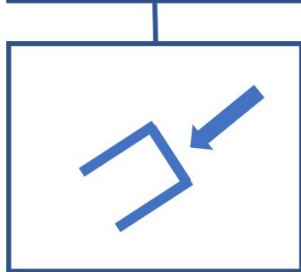
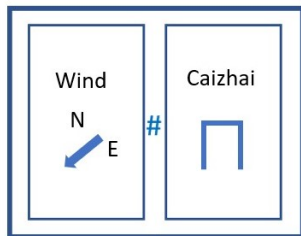
Structure: Garden with wall

Motivation: Winter monsoon, destruction of crops, erosion

Etic Description: Build the wall of gardens such that the highest wall faces the winter monsoon wind

Emic Description: 這個就跟我們這邊所謂疊菜宅的護體，同一個道理。菜宅都會有所謂的圍牆，他也是在擋東北季風 (This is the same principle as our stacked vegetable house. There will be walls in the vegetable house, and they will also block the northeast monsoon)

Testing: The leeward orientation of randomly selected gardens is between 180 and 270 degree





## Testing Rule 4

Community	Site	N	p-value
Penghu	garden	91	0.145
Hujing	garden	30	0.348
Jiangjun'ao	garden	16	0.0*
Jibei	garden	2	0.0*
Tongpan	garden	4	0.0*
Xiaomen	garden	35	0.055
Yuanbei	garden	4	0.232

## Discussion: Exception Hujing

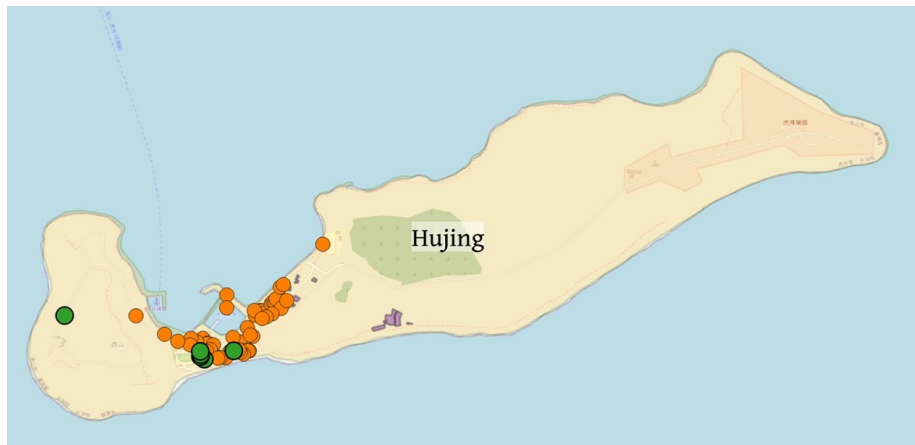


Figure 28

## The Ranking of Preferences and Perceptions for Penghu

Ordered by p-value (degree of significance)

	Motivation	Rule	p-value
Penghu	winter monsoon	Rule 1	0.0
Penghu	winter monsoon, destruction of crops, erosion	Rule 4	0.145
Penghu	winter monsoon, destruction of crops, erosion	Rule 5	0.194
Penghu	daily life	Rule 2	0.241
Penghu	typhoon, waves, flooding	Rule 3	0.758

## Future Activities

- Rework the data, correct geo-references, capture more sites
- Identify the key concepts and their relations in interviews (geography, climate, culture, disaster, risk)
- Associate interviews with rules
- Refine rules through testing and adding contextual features
- Build complex grammar models for each island

## Conclusions

- Using a rule-base (grammar) approach, we can effectively model and test environmental conceptions
- Our modeling can accommodate psychological, anthropological and sociological conceptions and theories
- Testing geo-referenced data will show where assumptions that are wildly held are not precise
- Testing geo-referenced data highlights cognitive biases
- Emic and etic rules might be articulated in different languages but eventually share a same reference and motivation
- The combination of theoretical research, extensive empirical fieldwork and a computational approaches might be necessary to bridge the gap in our understanding of the conditions and limits of how culture can adapt to environmental conditions for a sustainable life in traditional communities