(BEFORE) **ANALOG TO** a **DIGITAL** (FUTURE)

Carl Steinitz

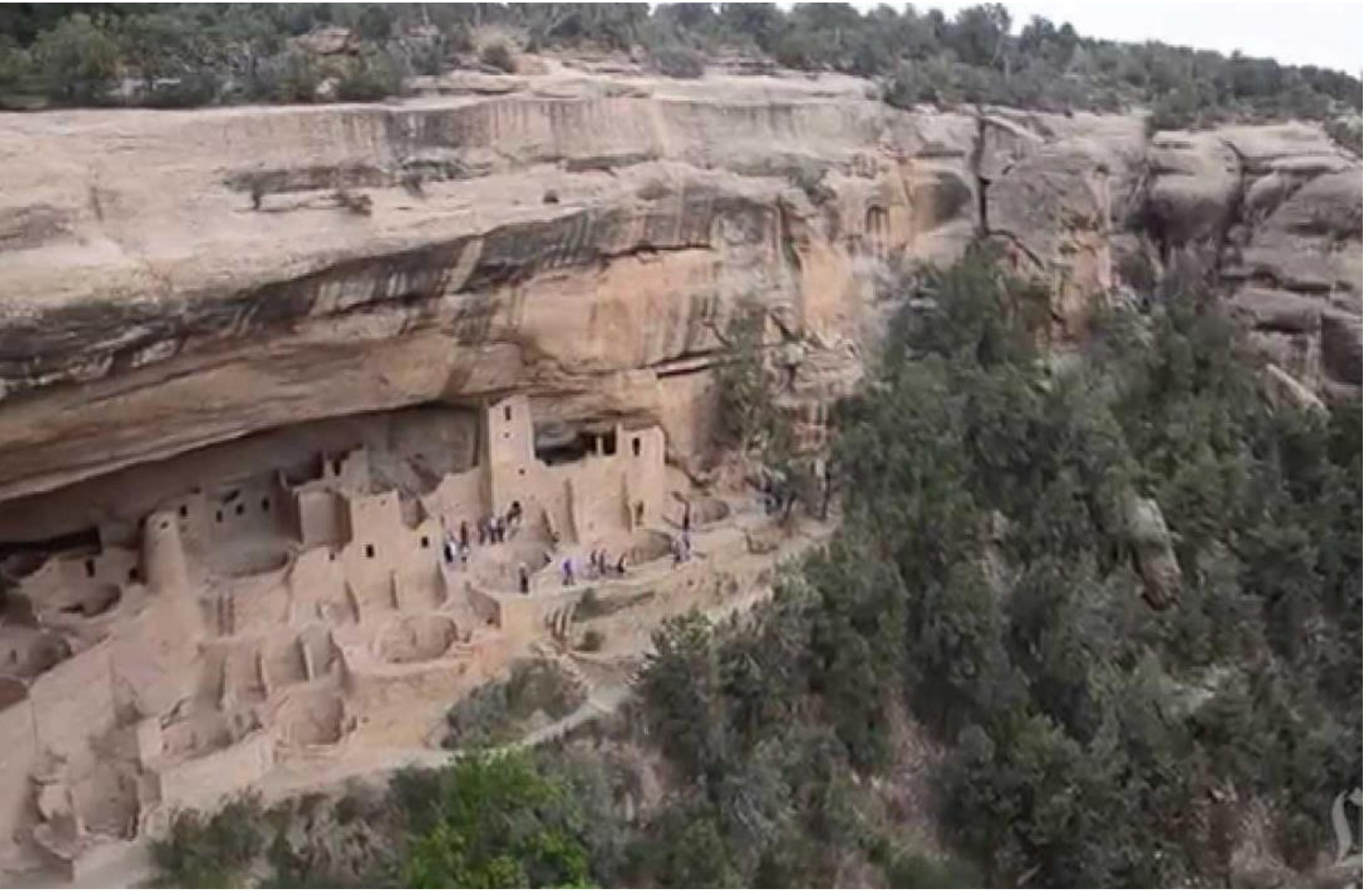
a personal perspective

Digital Landscape Architecture The Bauhaus Dessau Germany May 23, 2019

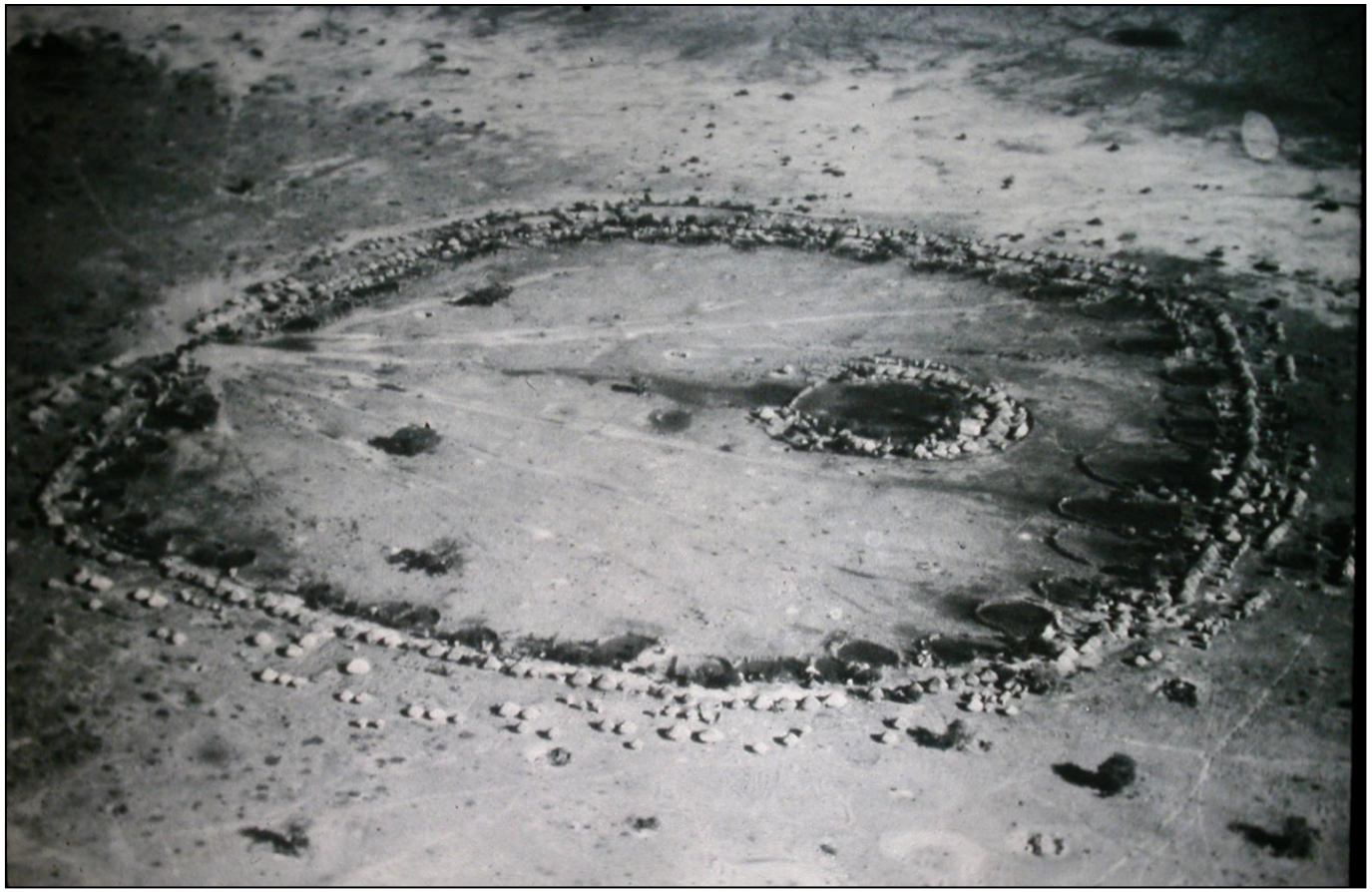
(BEFORE) **ANALOG** **TO** a **DIGITAL** (FUTURE)

Digital Landscape Architecture The Bauhaus Dessau Germany May 23, 2019

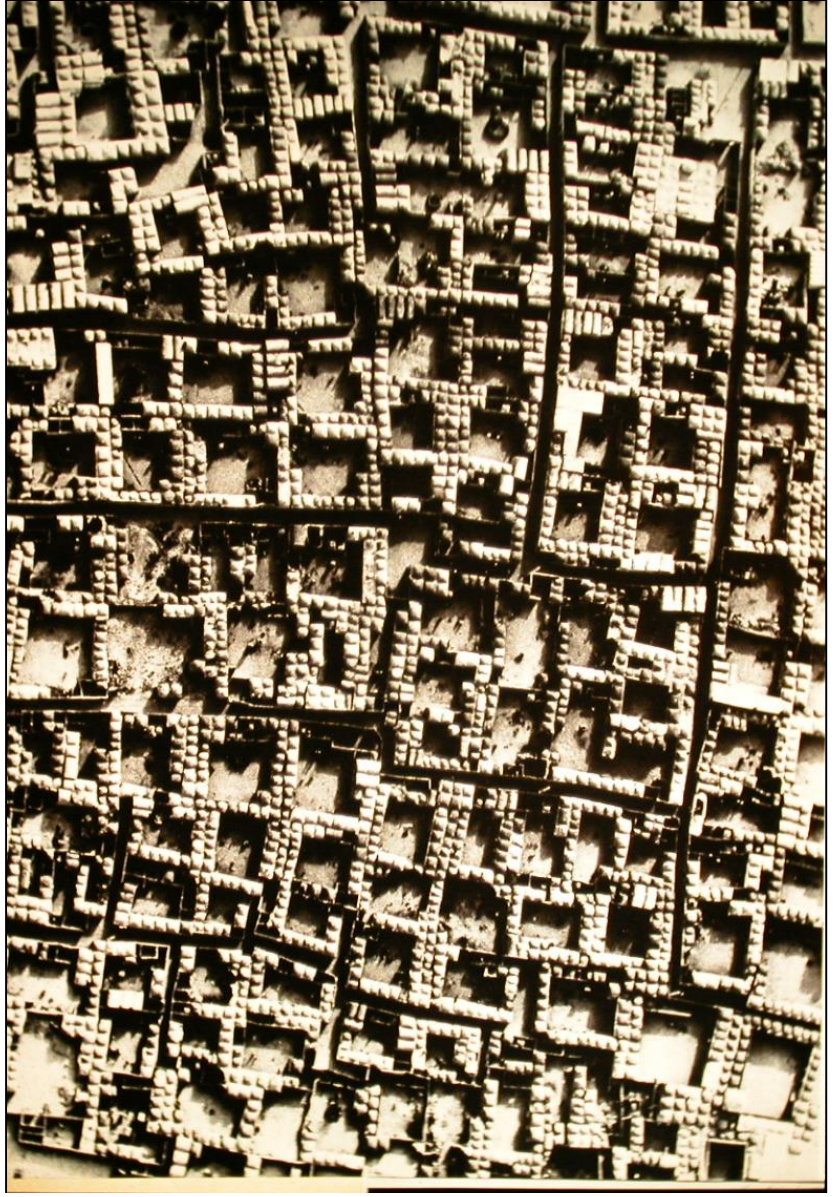
Luzon,
The Philippines
Charles Harris
1956



Mesa Verde, USA



Bernard Rudofsky, Architecture Without Architects, 1964

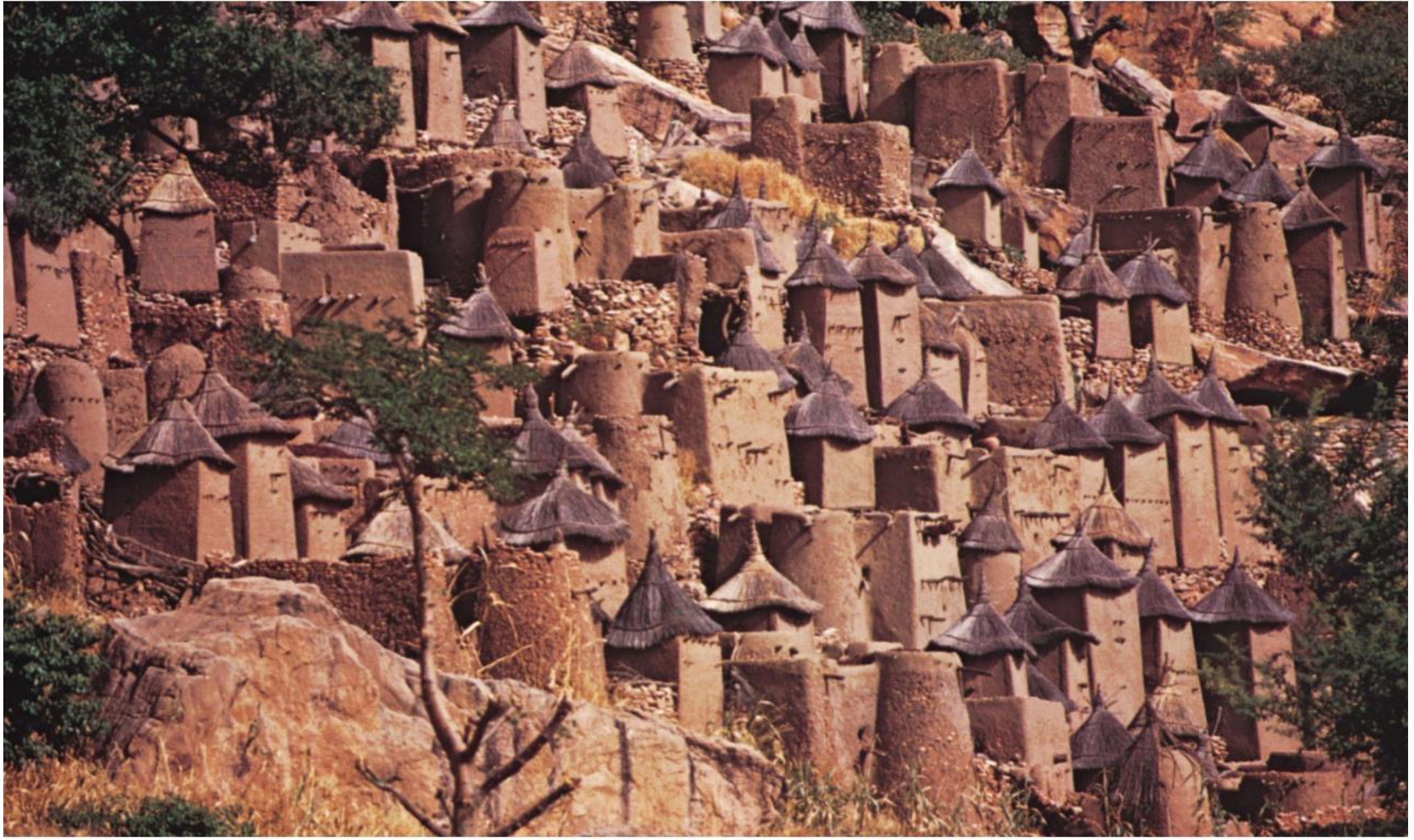




Bernard Rudofsky, Architecture Without Architects, 1964

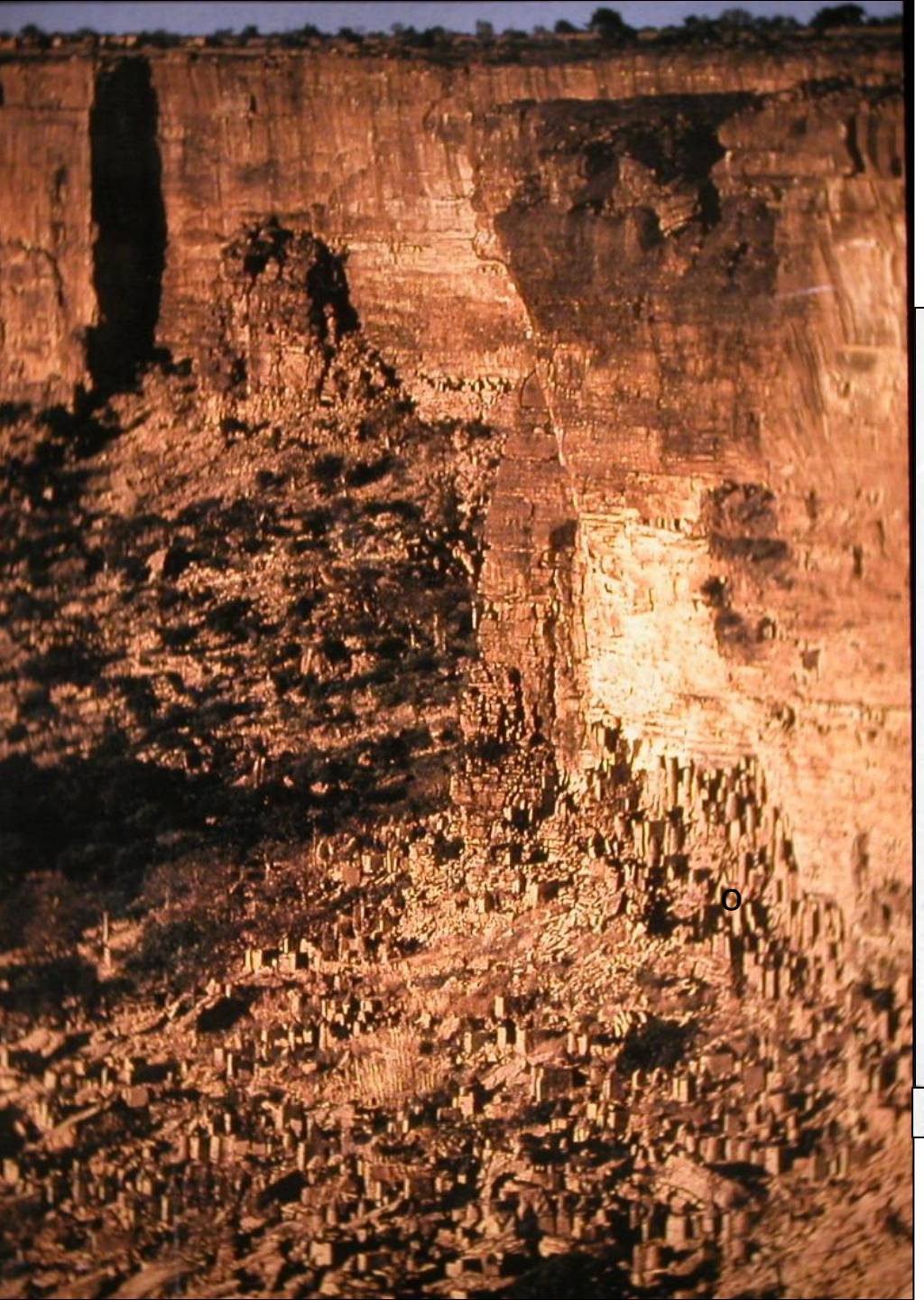
(BEFORE) **ANALOG** **TO** a **DIGITAL** (FUTURE)

noun: **analog**
1.
a person or thing seen as comparable to another.
"an interior analogue of the exterior world"

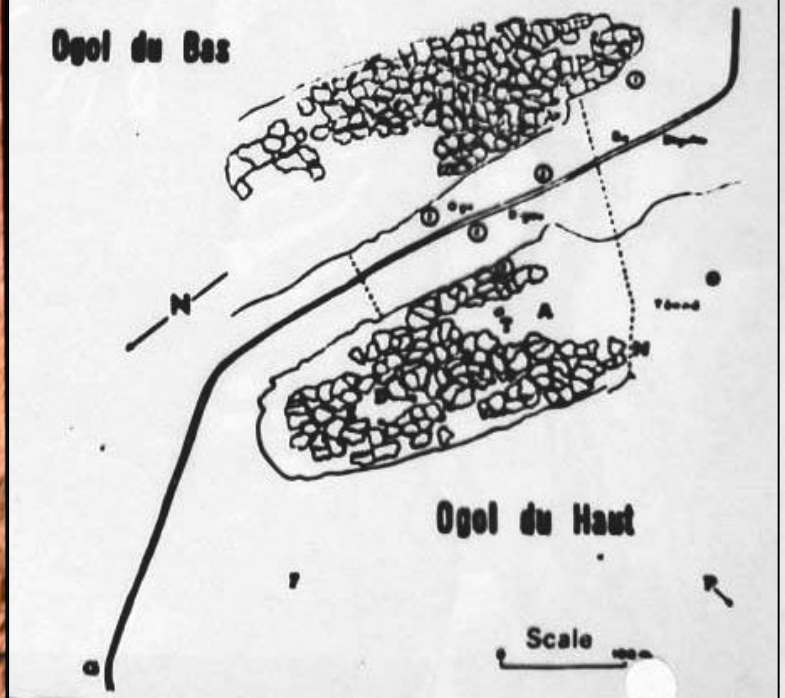
Digital Landscape Architecture Dessau Germany The Bauhaus May 23, 2019



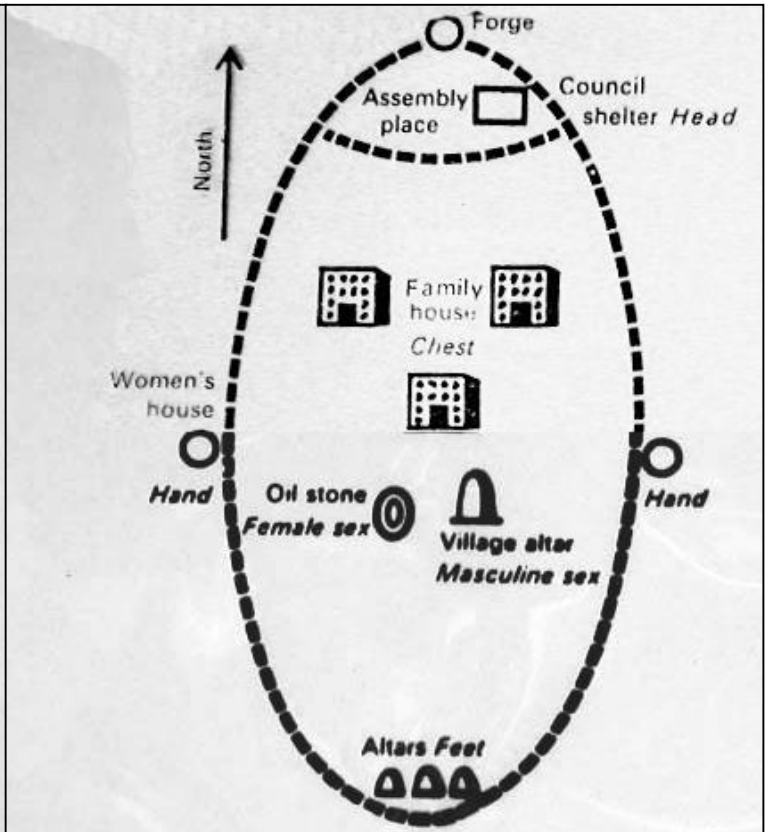
The Dogon
Upper and Lower Ogol, Mali



Ellipsoid model of the Dogon settlement (according to M. Griaule, Dieu d'Eau).
Chessboard model of the Dogon settlement.
Plan of the Dogon large house (based on a figure by M. Griaule, L'Image du Monde au Soudan).
The Dogon settlement Ogol (according to M. Griaule et G. Dieterlen, Le Renard Pale).

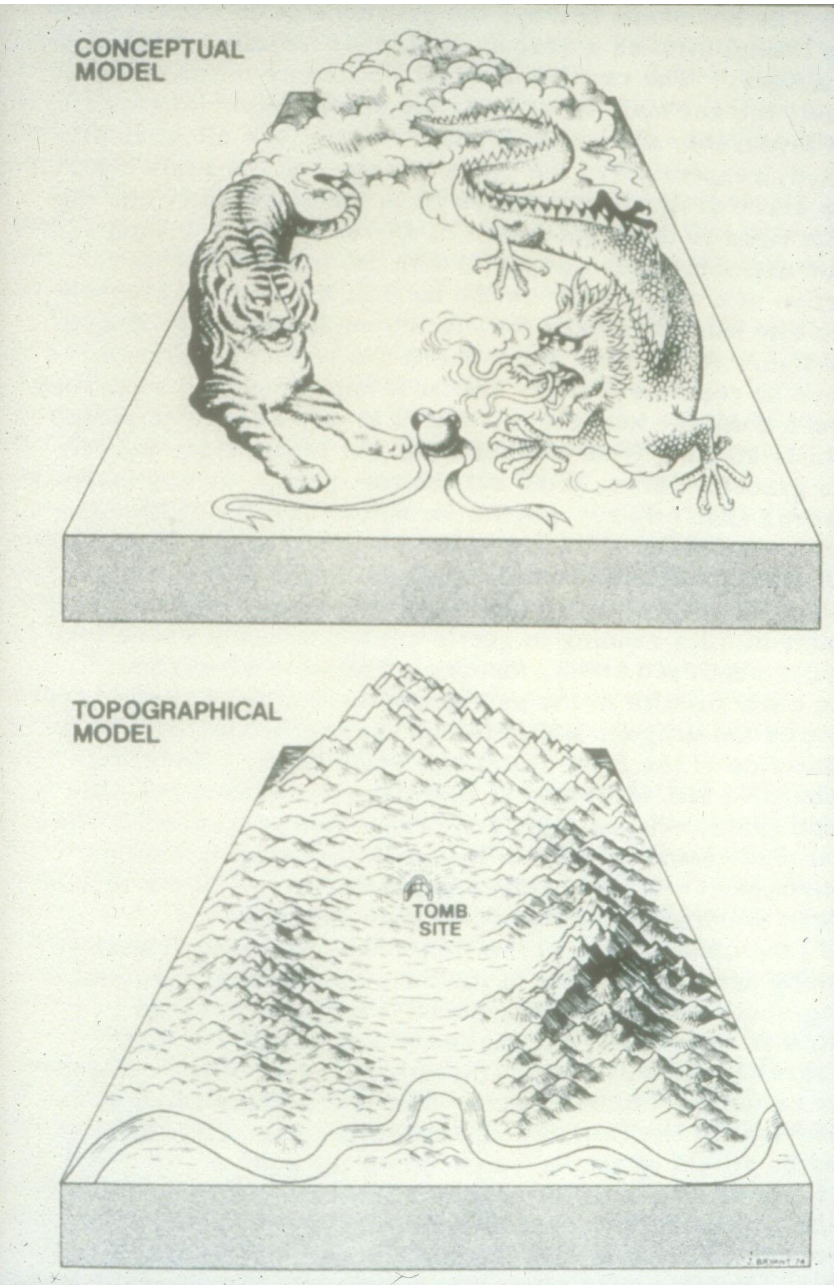


The Dogon settlement Ogol (according to M. Griaule et G. Renard Pale).



Ellipsoid model of the Dogon settlement (according to M. Griaule, Dieu d'Eau).

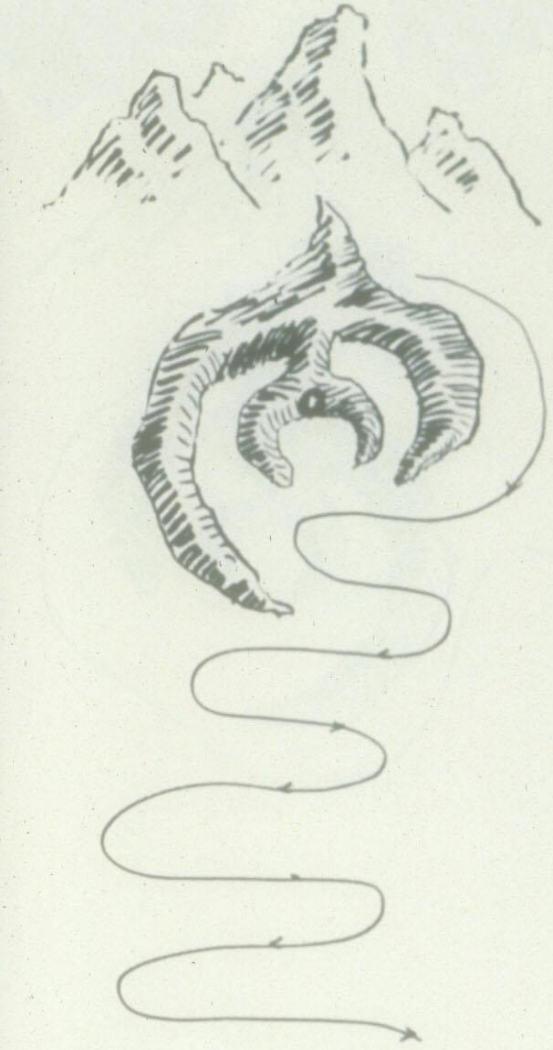
The Dogon
Upper and Lower Ogol, Mali



Xu Ping Feng Shui, est. 3500 B. C.

Form School

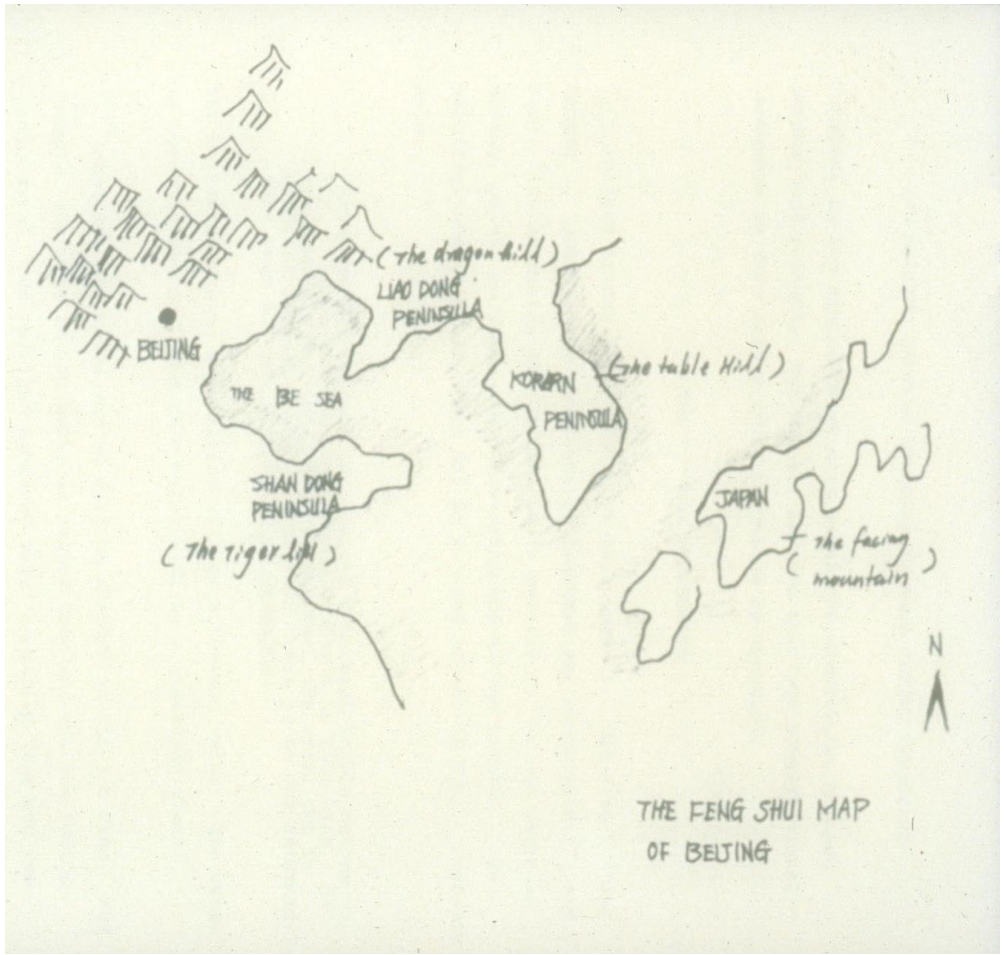
Compass School



In front the location of a grave there is a winding water and hold with hills. The future generations will win promotion and get rich.

GOOD LUCK (with winding water)

Xu Ping


(the dragon hill)
LIAO DONG PENINSULA
BEIJING
THE BE SEA
KOREAN PENINSULA
(the table Hill)
SHAN DONG PENINSULA
(the tiger hill)
JAPAN
(the facing mountain)
N
THE FENG SHUI MAP OF BEIJING

Xu Ping

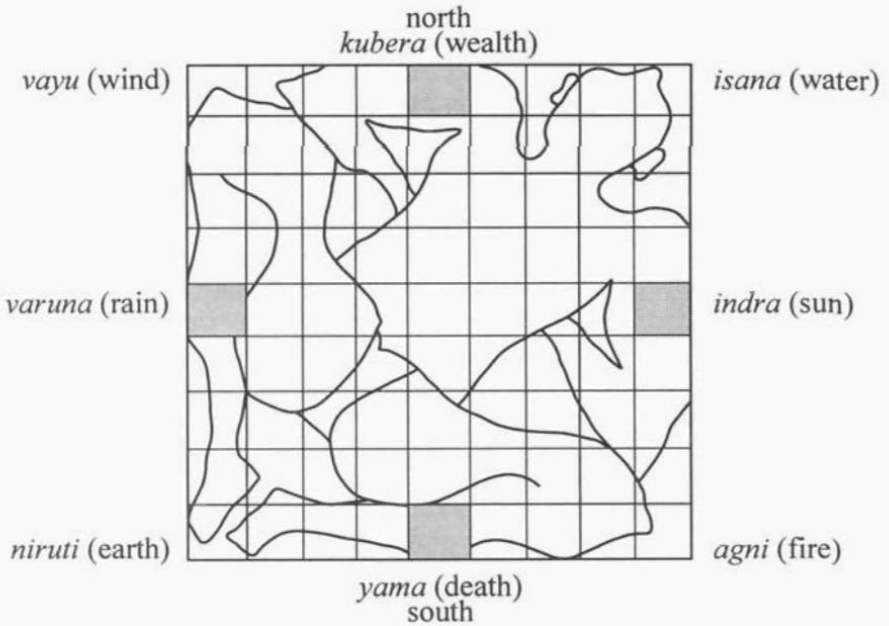
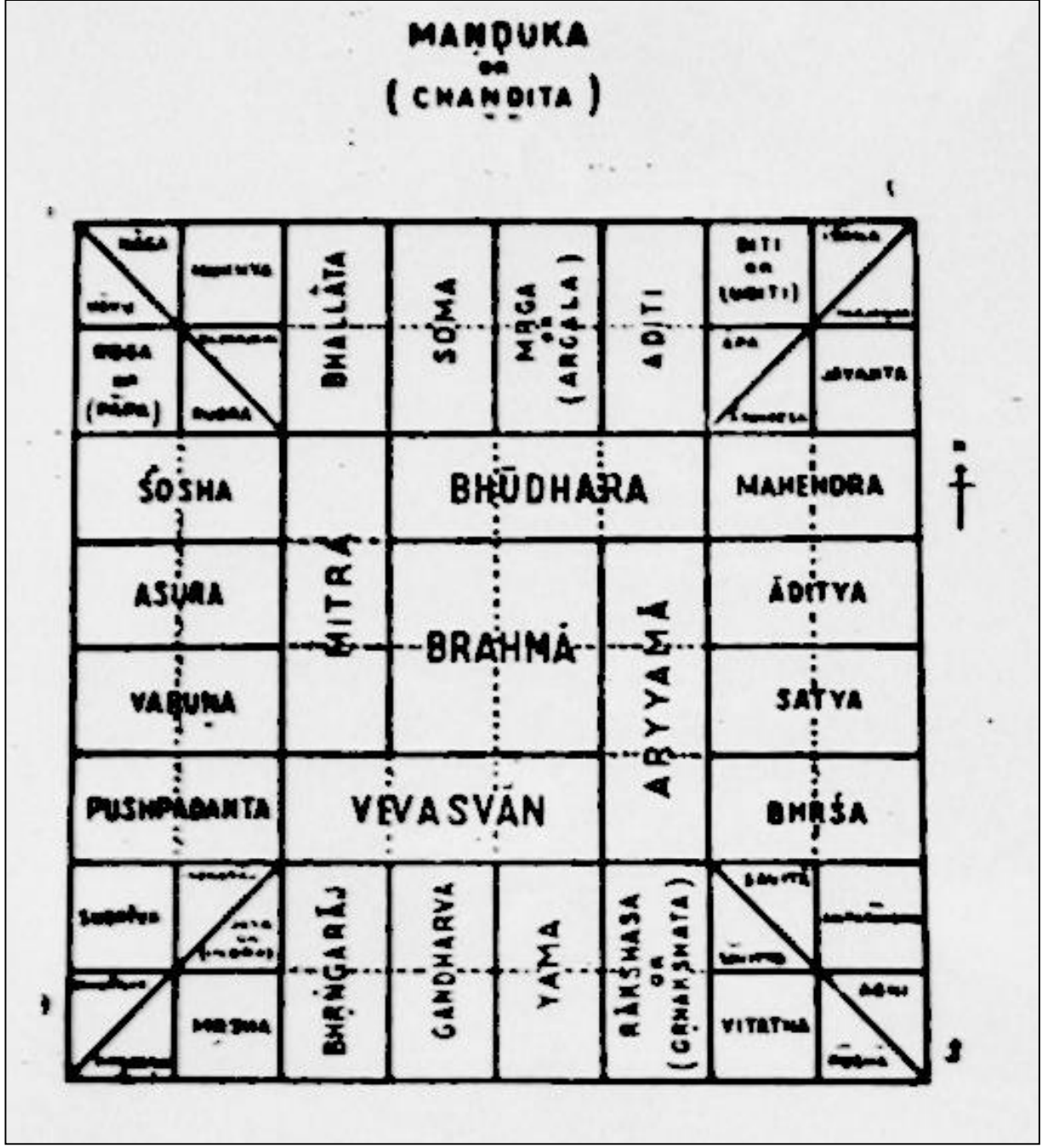
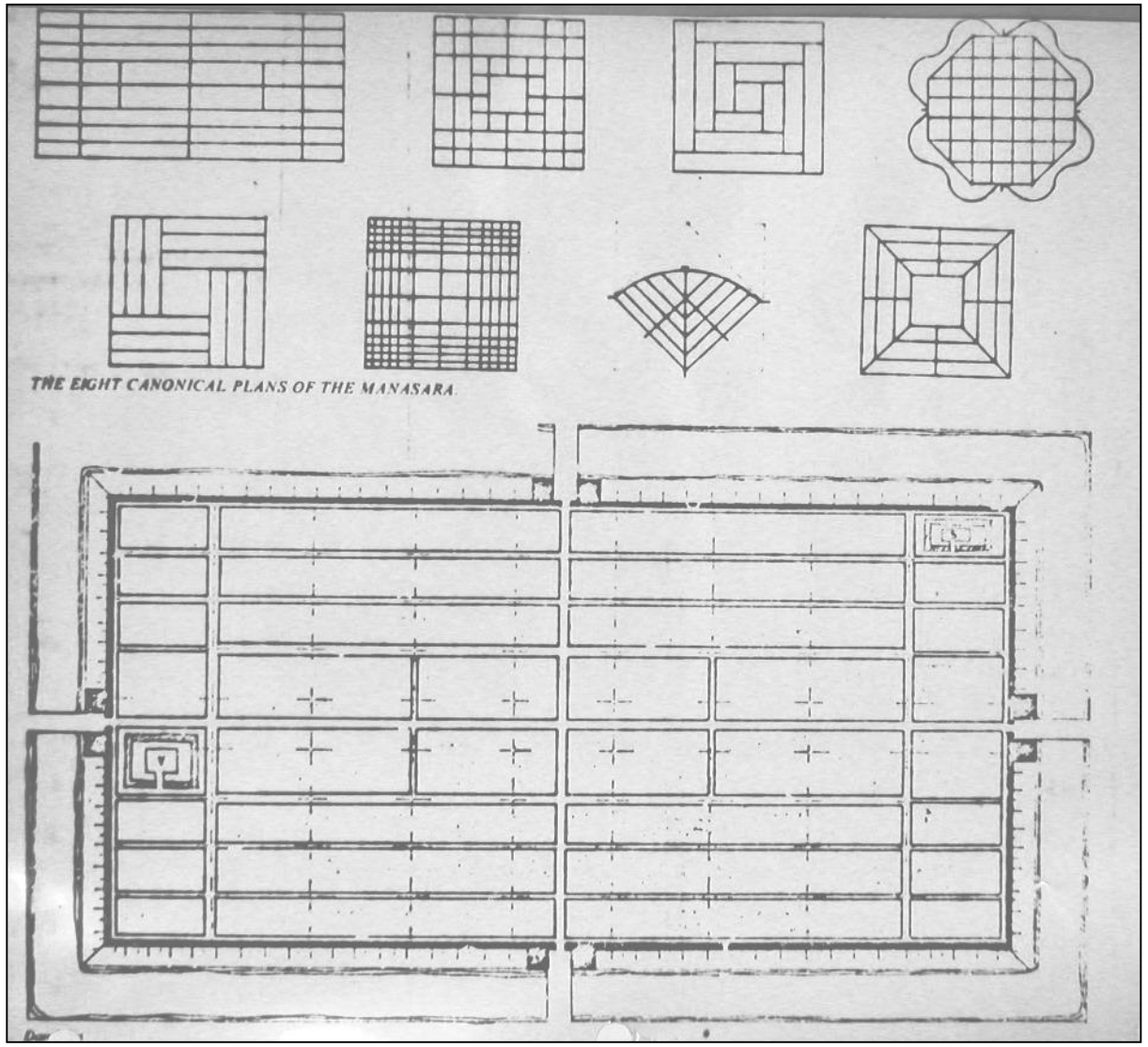


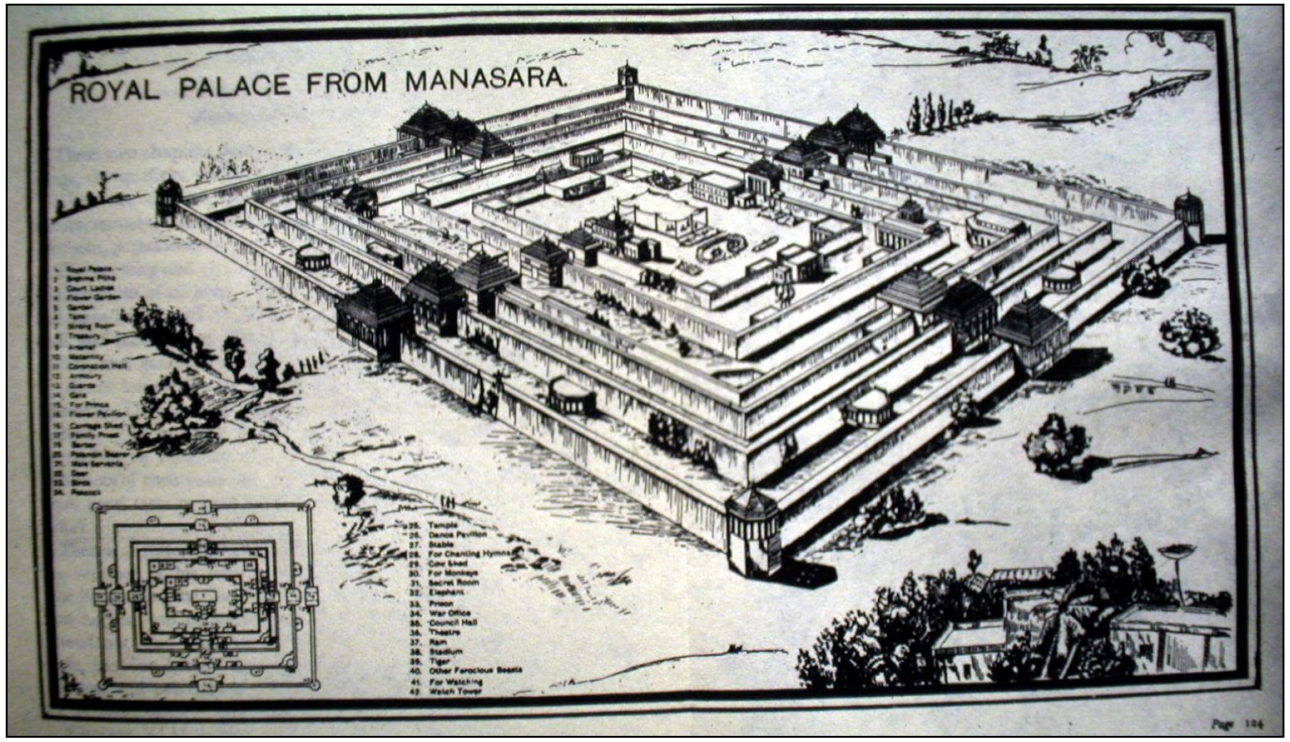
Fig. 1. Vaastu purusha mandala.

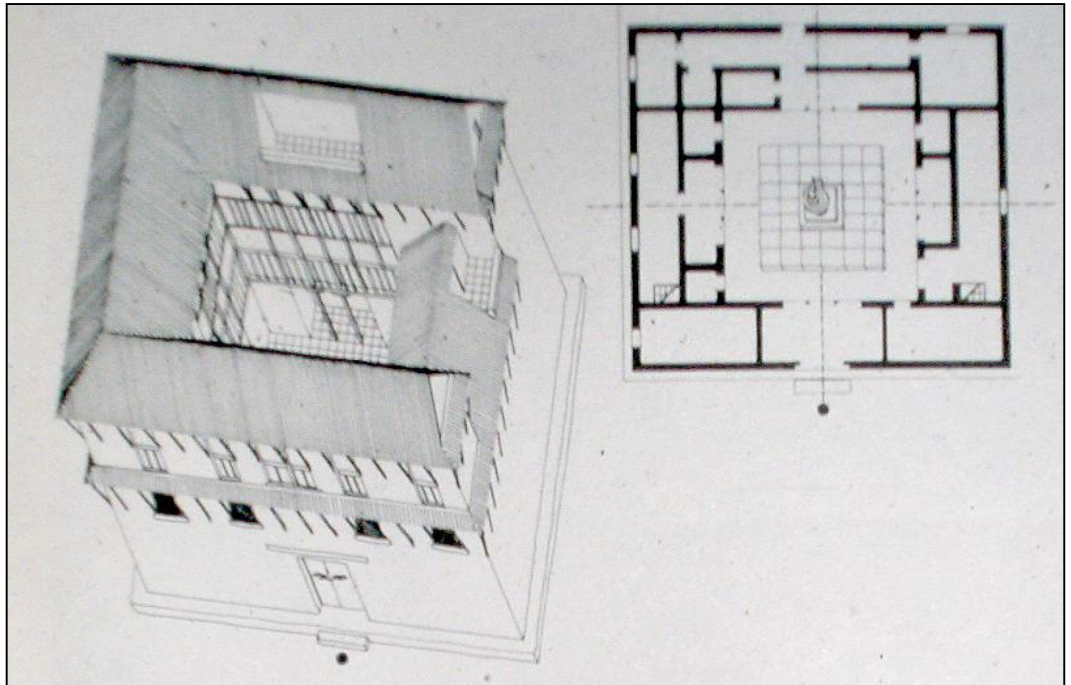
The vaastu shastras describe types of mandalas that can be used as building and town plans. The mandala of 49 squares which underlies the multiple enclosures in South Indian temples is divided into four zones—the innermost sacred zone occupied by Brahma, surrounded by eight squares of gods, 16 squares of men and the outermost 24 squares occupied by goblins (Kramrisch 1946). This hierarchy is reflected in caste quarters assigned to various sectors of a settlement. Usually the center is occupied by a temple complex. Built next to it are the royal palace complex and the neighborhood of Brahmins. All the other castes are located with respect to the center in accordance with their position in the social hierarchy. Another principle for location is directionality—higher castes are located in the east and north or face those directions. The vaastu-shastras give varying locations to caste quarters in settlements. Whatever their exact location, the homology between spatial organization and the form of the purusha is clear.



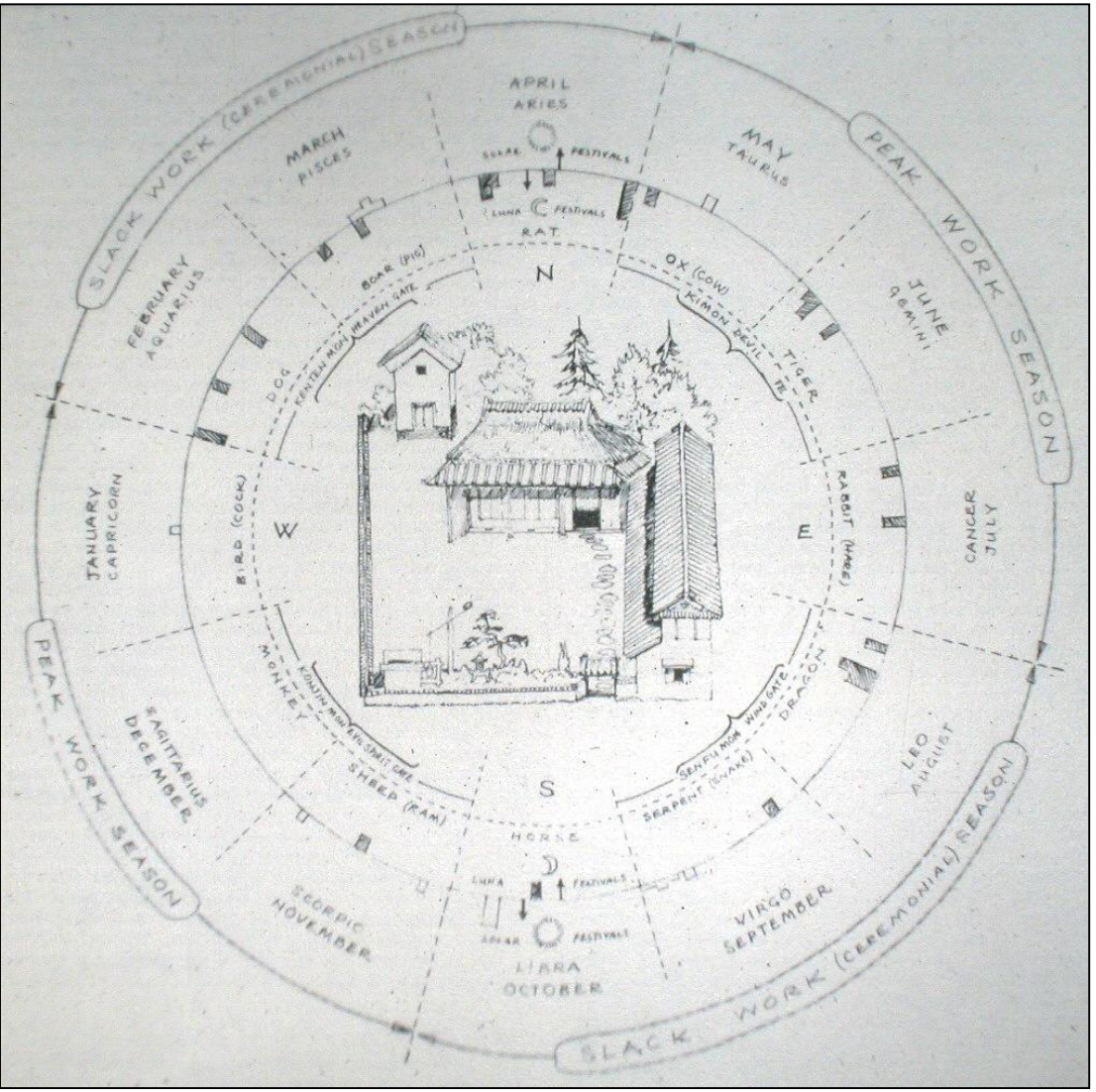
Manasara, Hindu text 6th C.

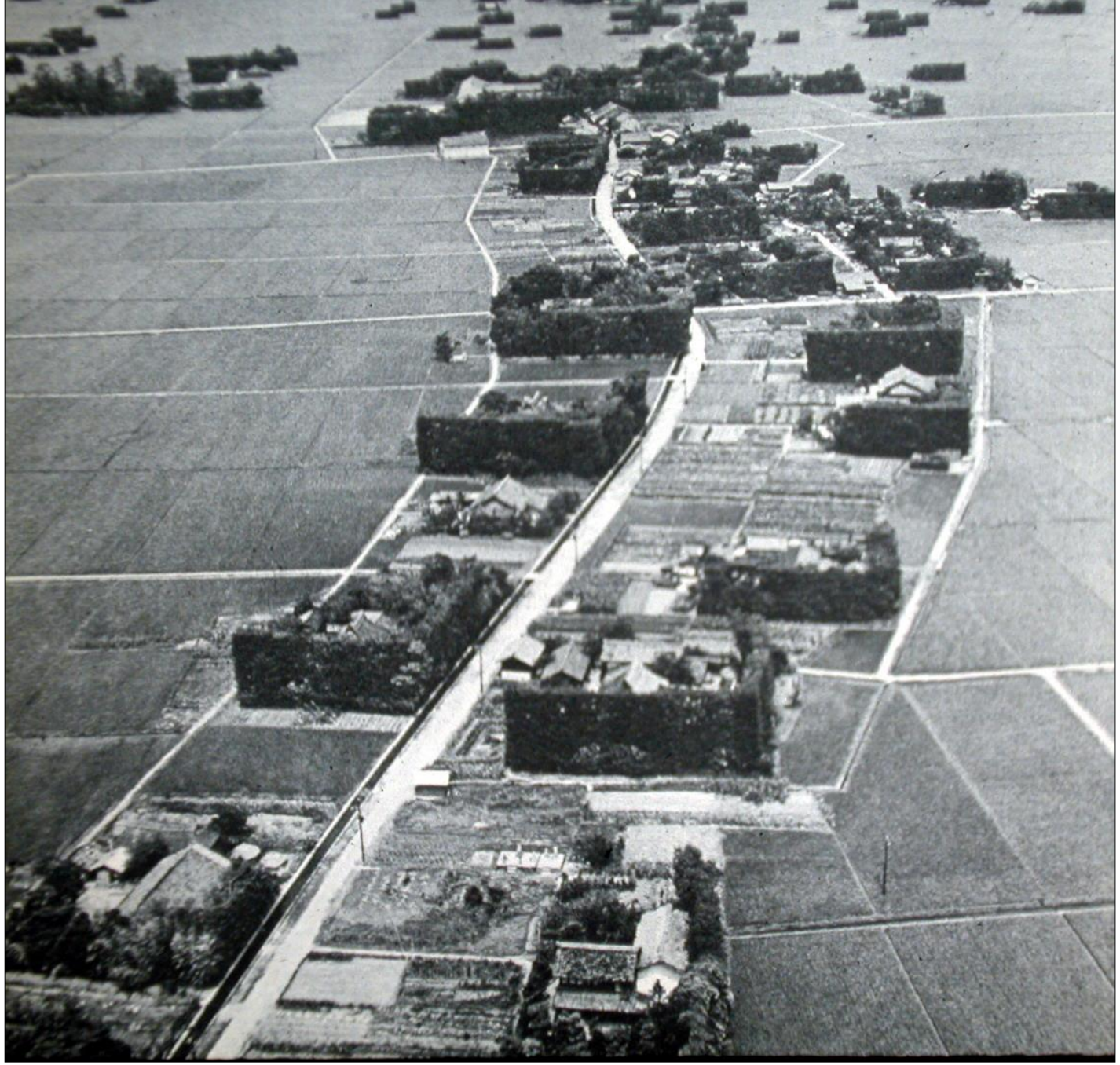






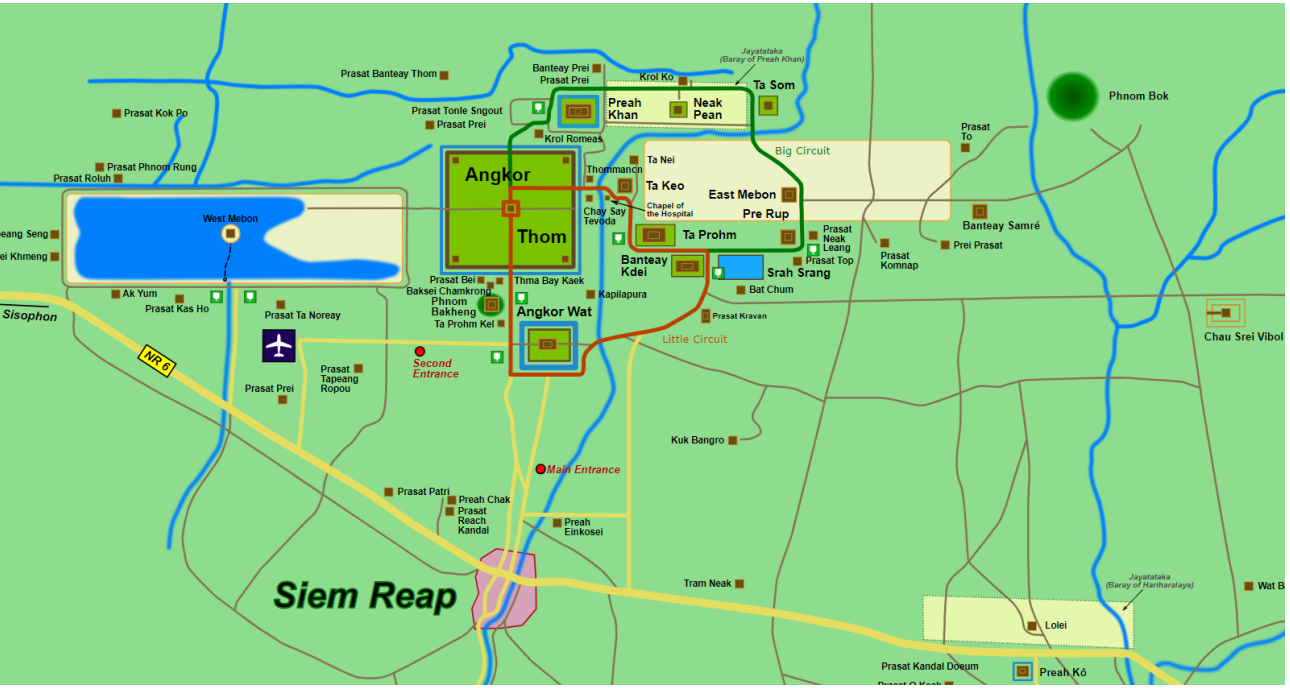
Manasara, Hindu text 6th C.



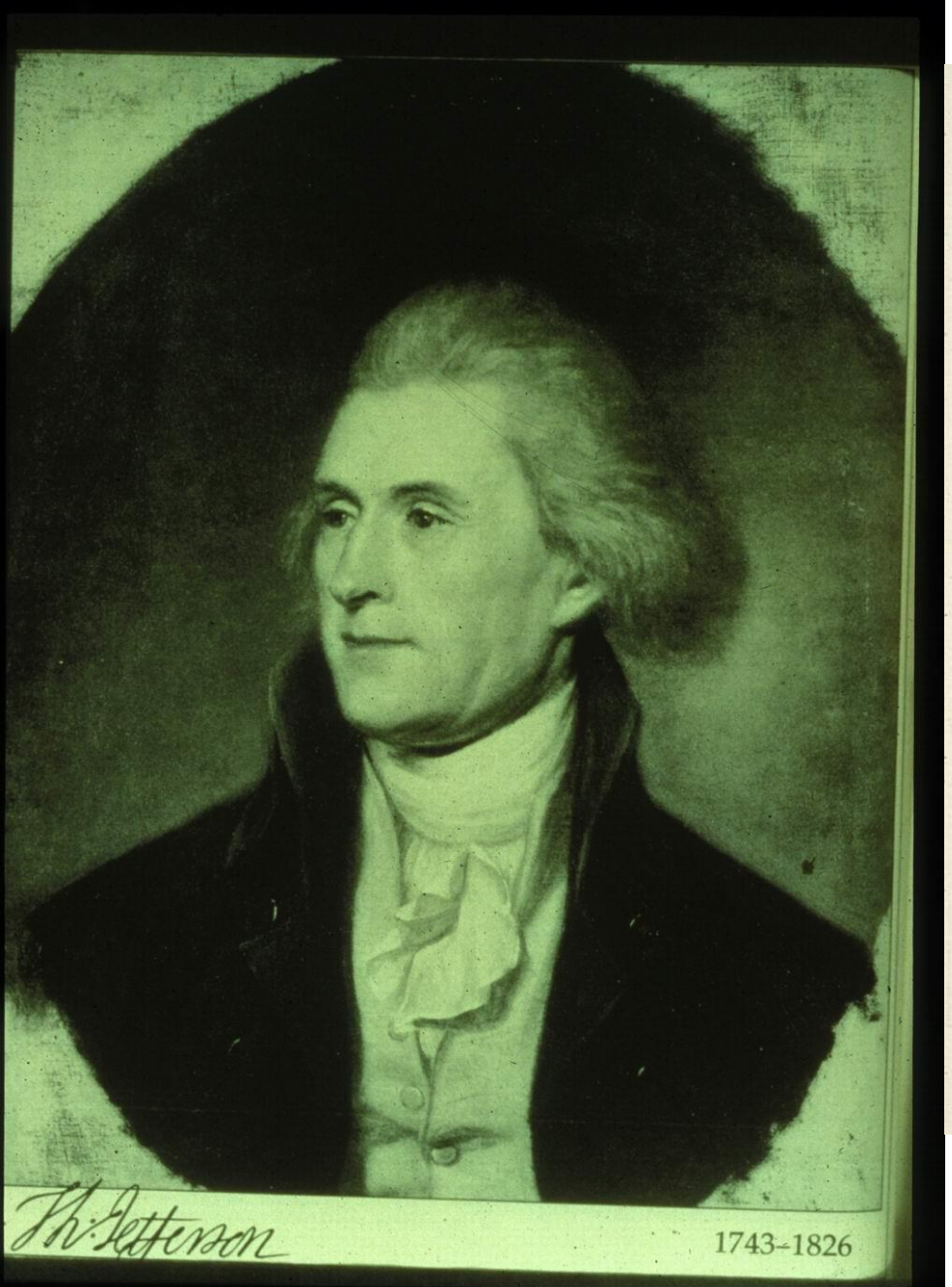


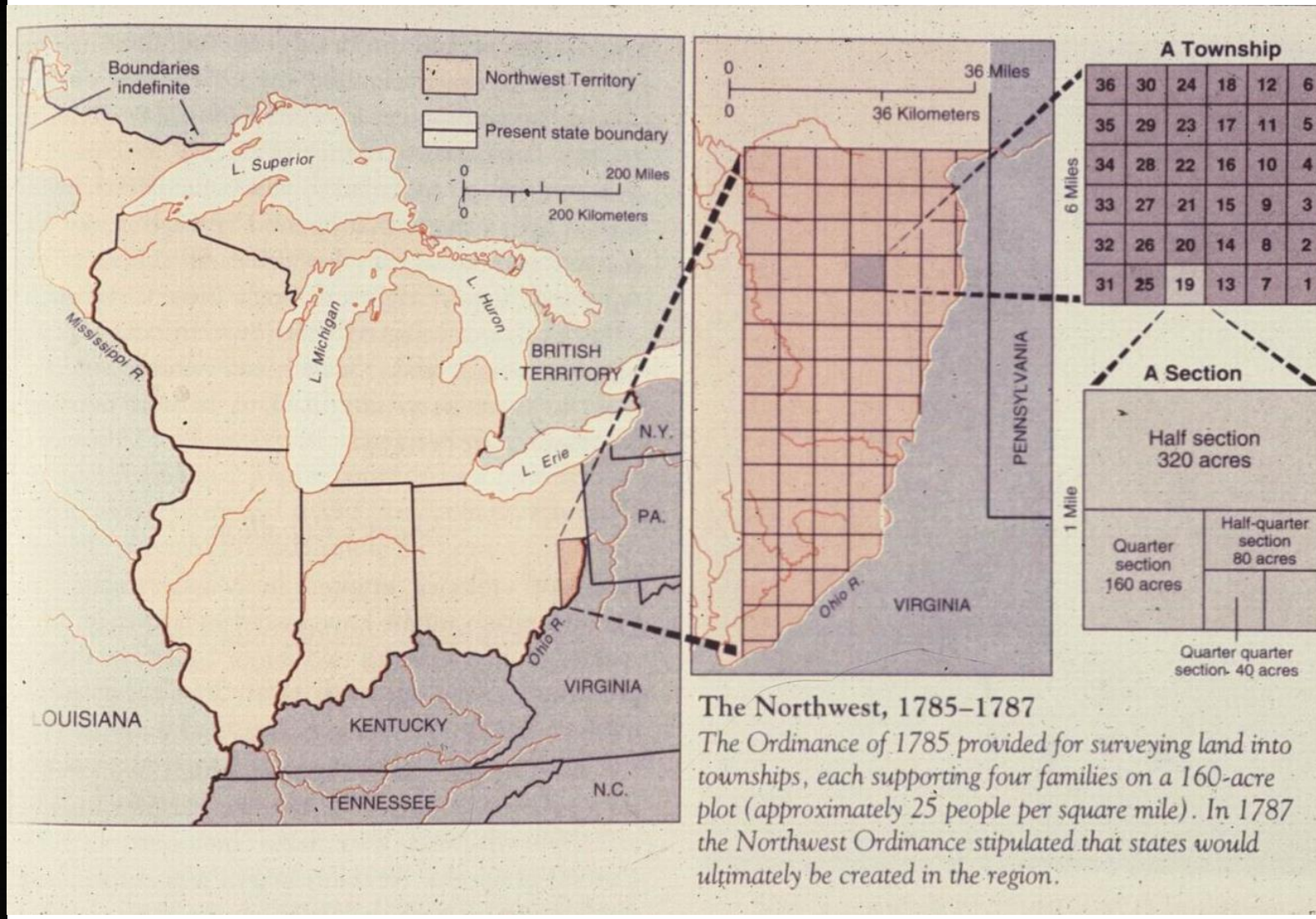
Bernard Rudofsky, Architecture Without Architects, 1964

Surveying in ancient Egypt to divide land for taxation and for building, 3000 +- BC



Angkor Wat region, Cambodia, 12th C.

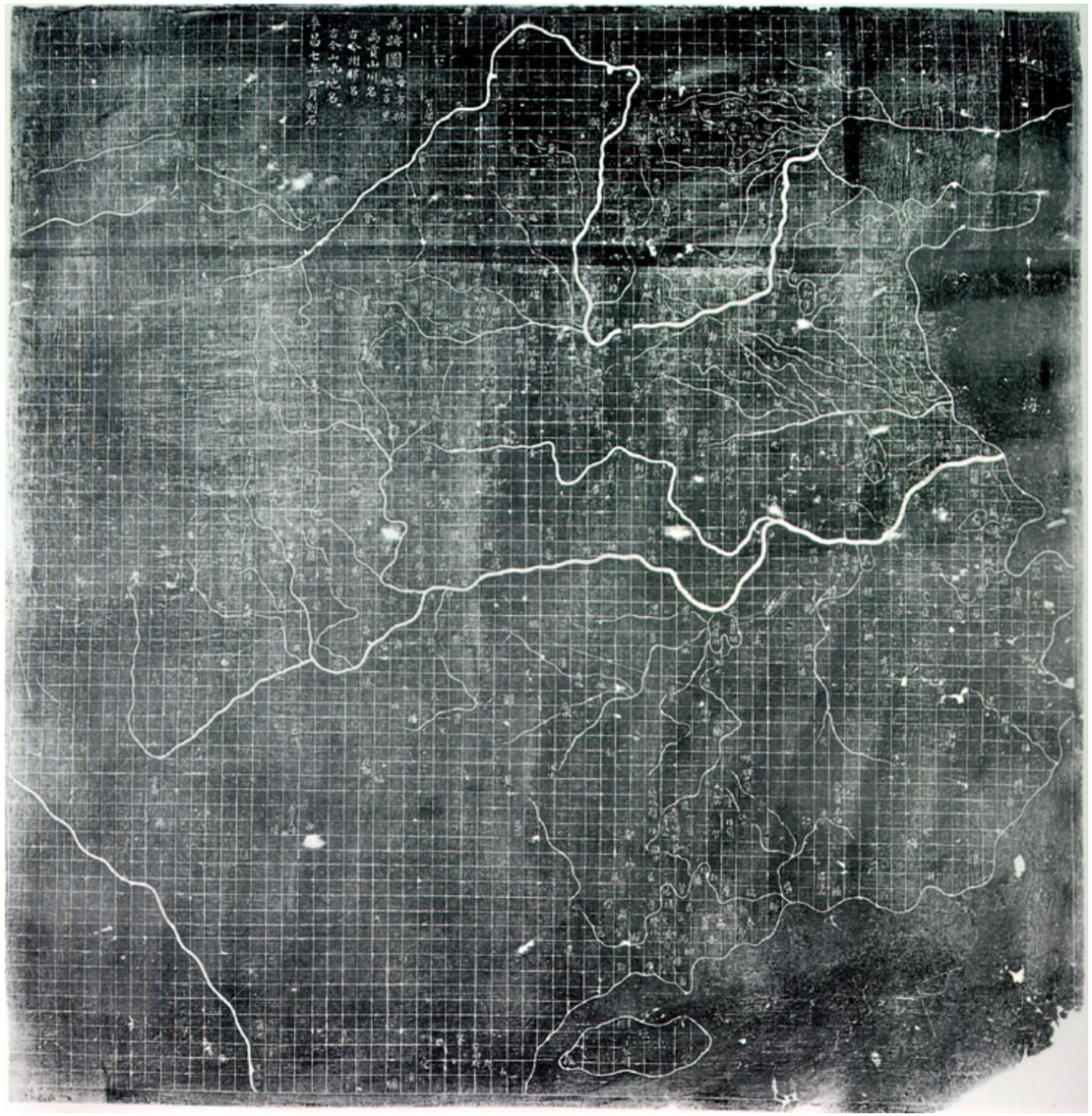




The Northwest, 1785–1787

The Ordinance of 1785 provided for surveying land into townships, each supporting four families on a 160-acre plot (approximately 25 people per square mile). In 1787 the Northwest Ordinance stipulated that states would ultimately be created in the region.

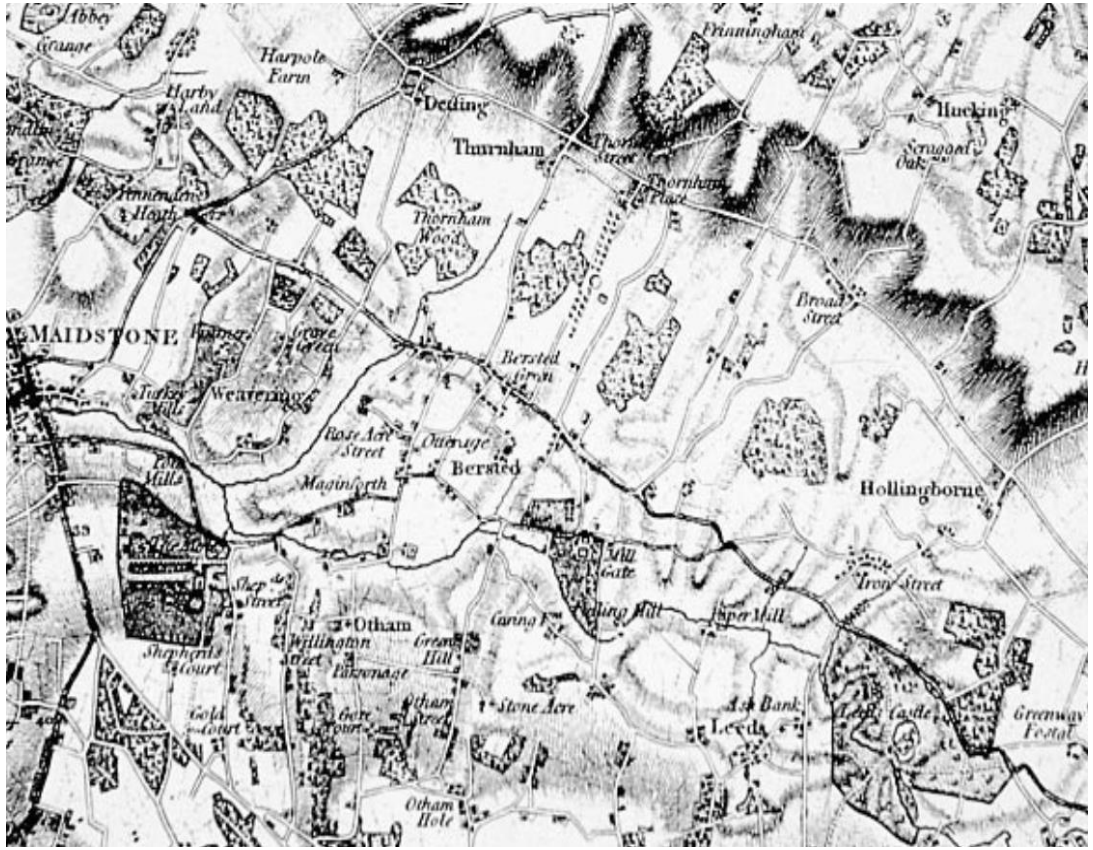
Map of Nippur, to scale, 1500 +- B.C.



The *Yu Ji Tu*, or *Map of the Tracks of Yu Gong*, carved into stone in 1137, located in the Stele Forest of Xian.
This 3 ft (0.91 m) squared map features a graduated scale of 100 li for each rectangular grid.
China's coastline and river systems are clearly defined and precisely pinpointed on the map. Wikipedia

Before and After

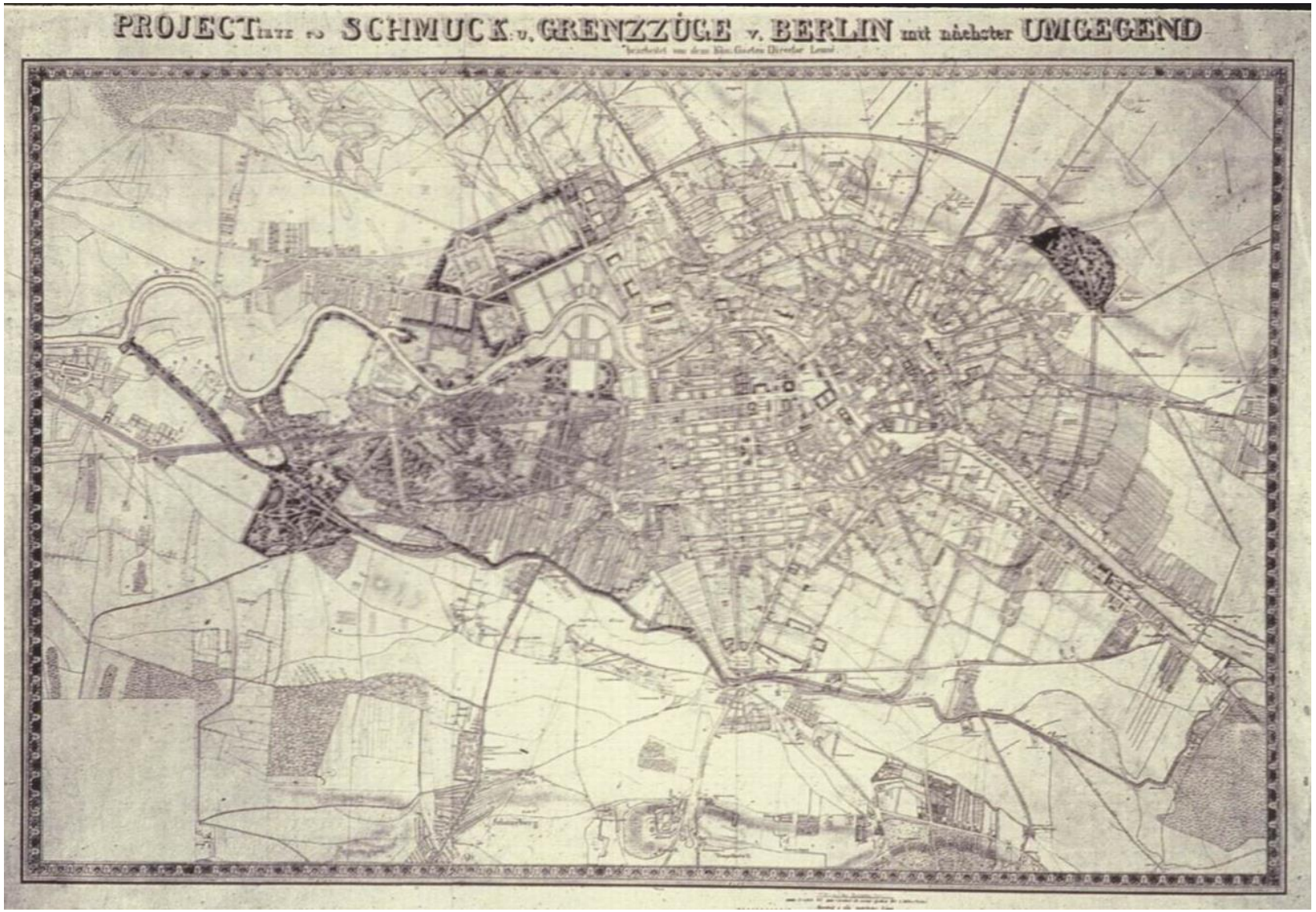
Humphrey Repton (1752 – 1818)
Wentworth, UK, 1790



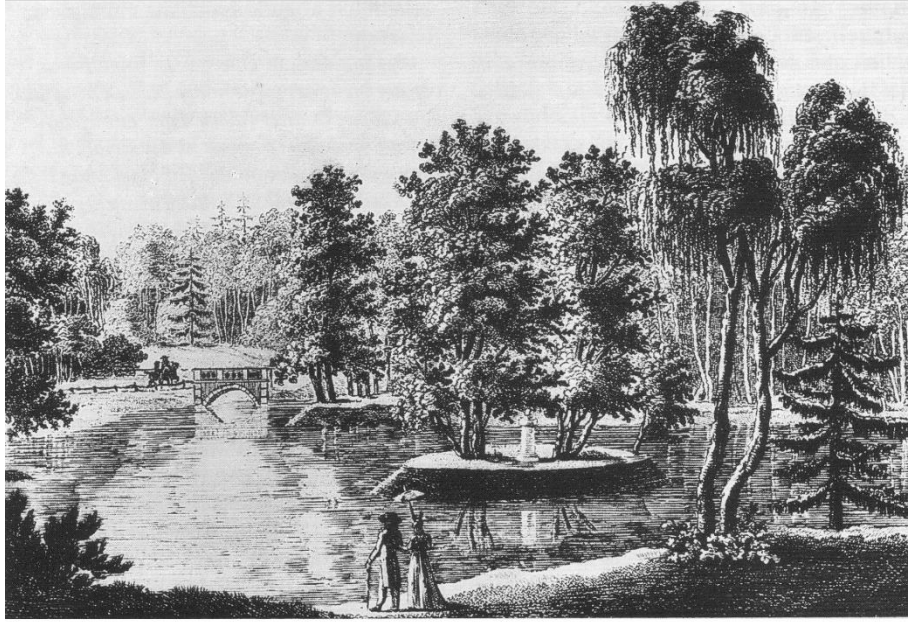
England, Ordinance Survey, 1801

›Nichts gedeiht ohne Pflege;
und die vortrefflichsten Dinge
verlieren durch unzweckmäßige Behandlung
ihren Wert.‹

Lenné



1833



Großer Tiergarten, early-19th-century engraving

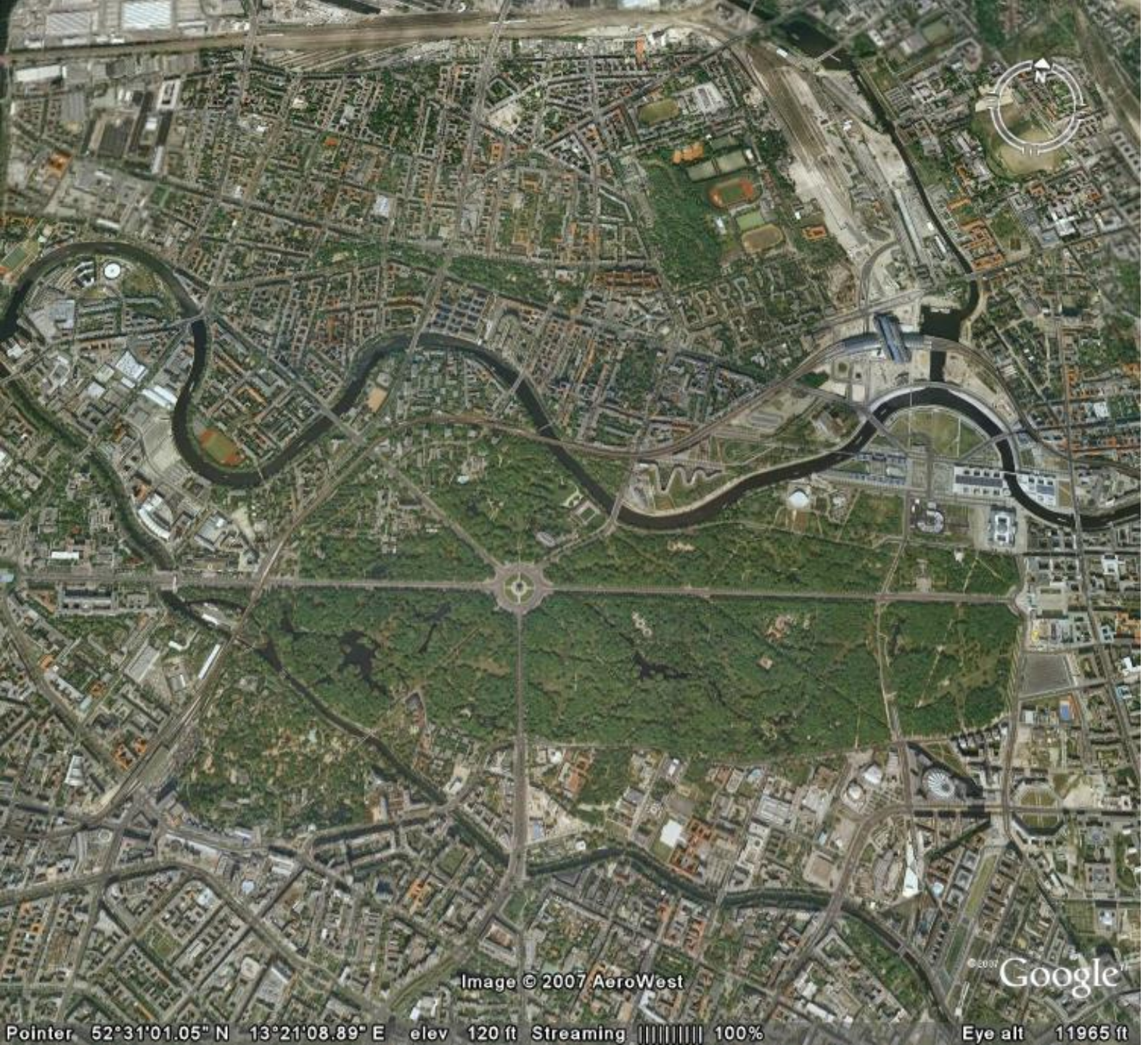
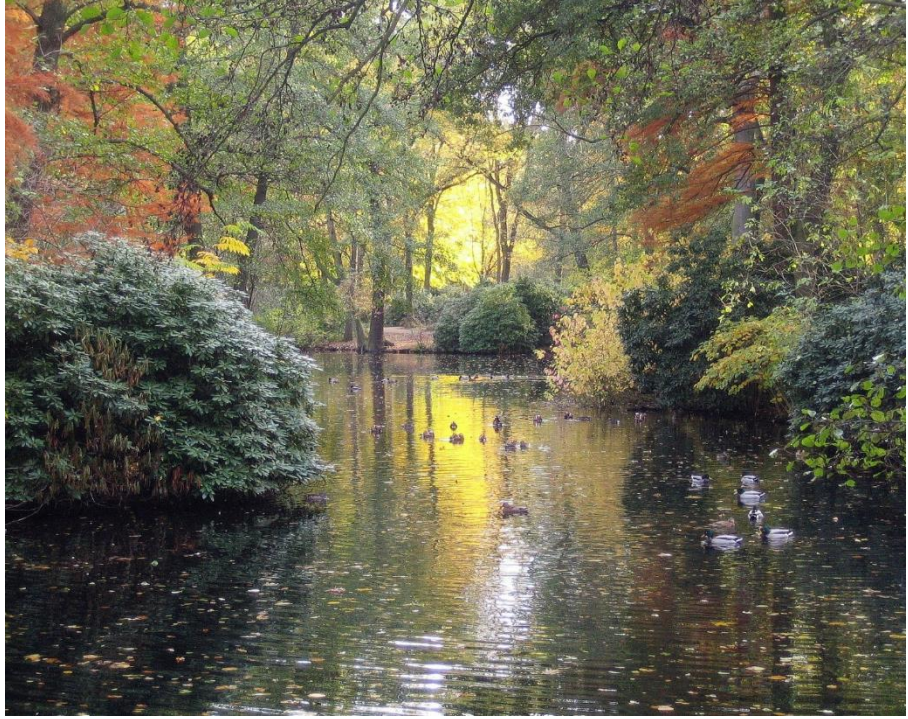
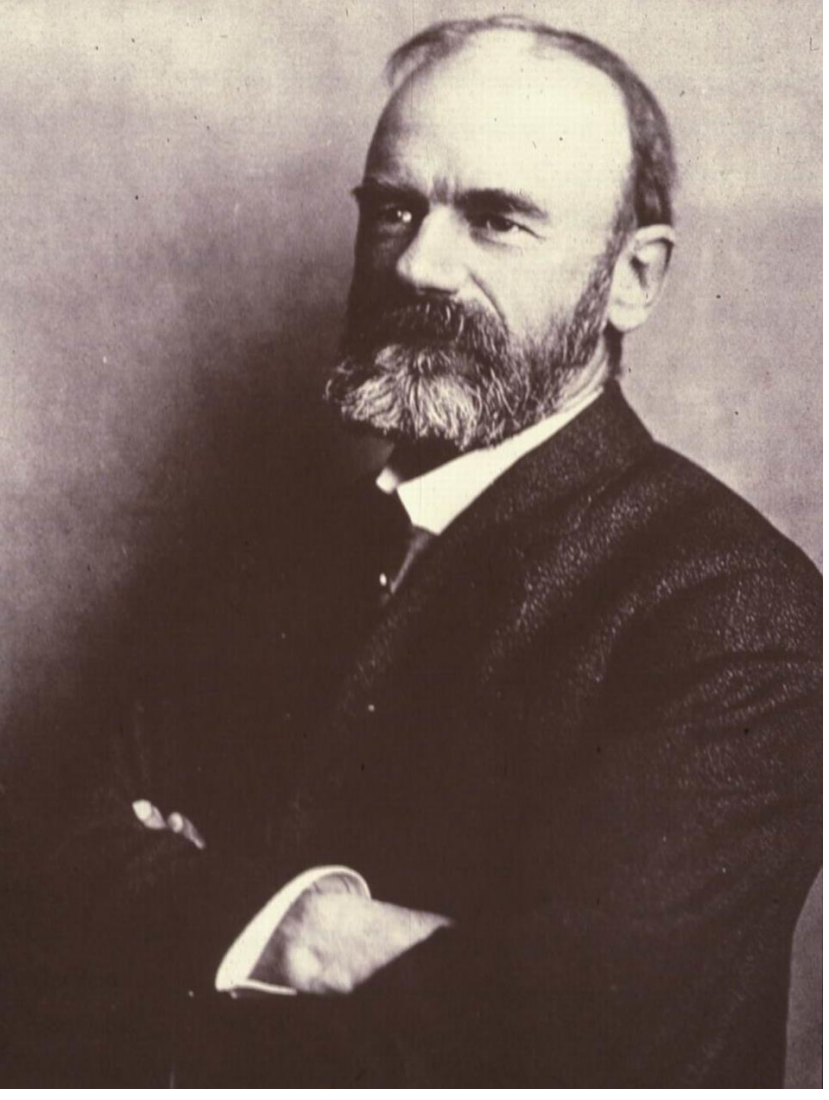
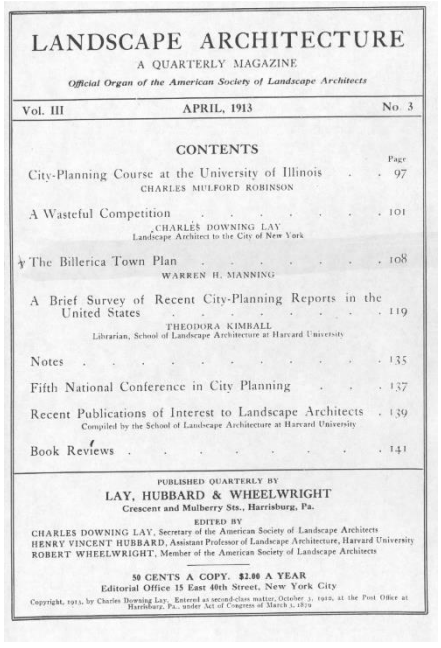


Image © 2007 AeroWest
©2007 Google
Pointer 52°31'01.05" N 13°21'08.89" E elev 120 ft Streaming 100%
Eye alt 11965 ft





Warren Manning (1860-1938)



LANDSCAPE ARCHITECTURE

A QUARTERLY MAGAZINE

Official Organ of the American Society of Landscape Architects

Vol. III APRIL, 1913 No. 3

CONTENTS

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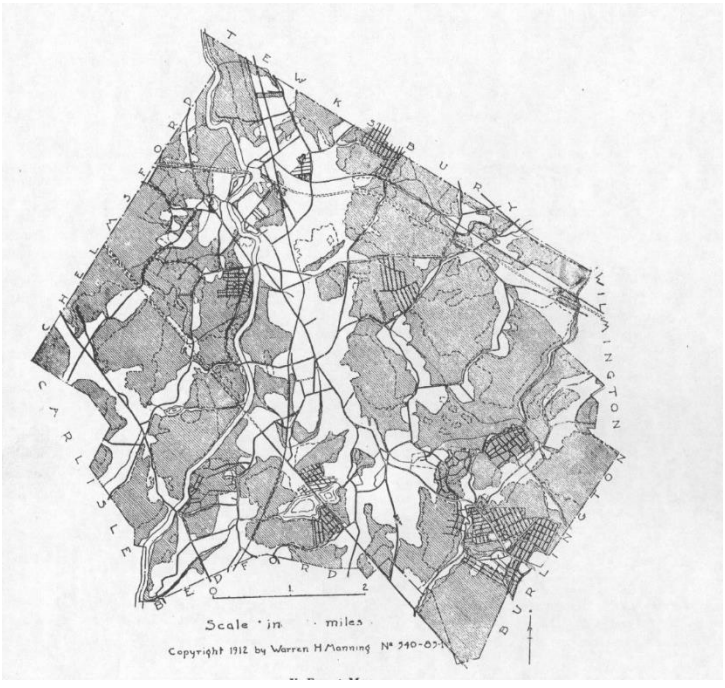
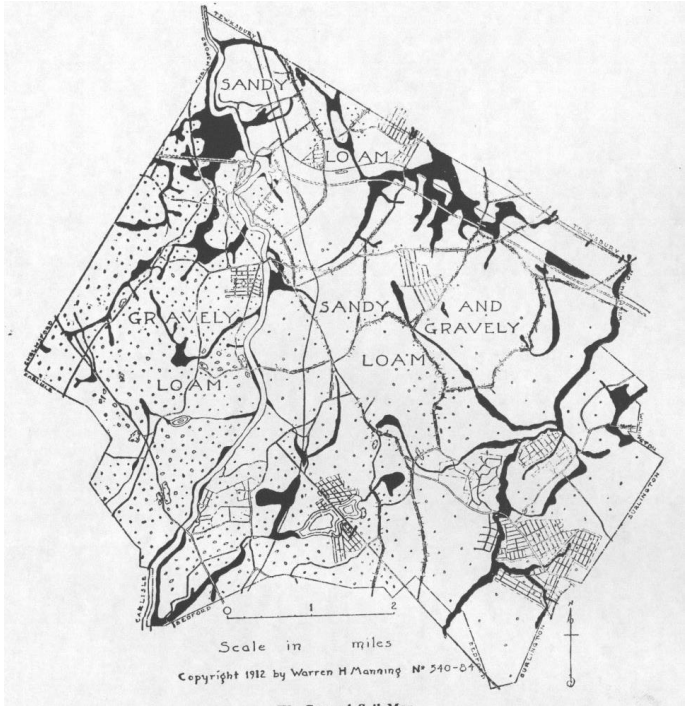
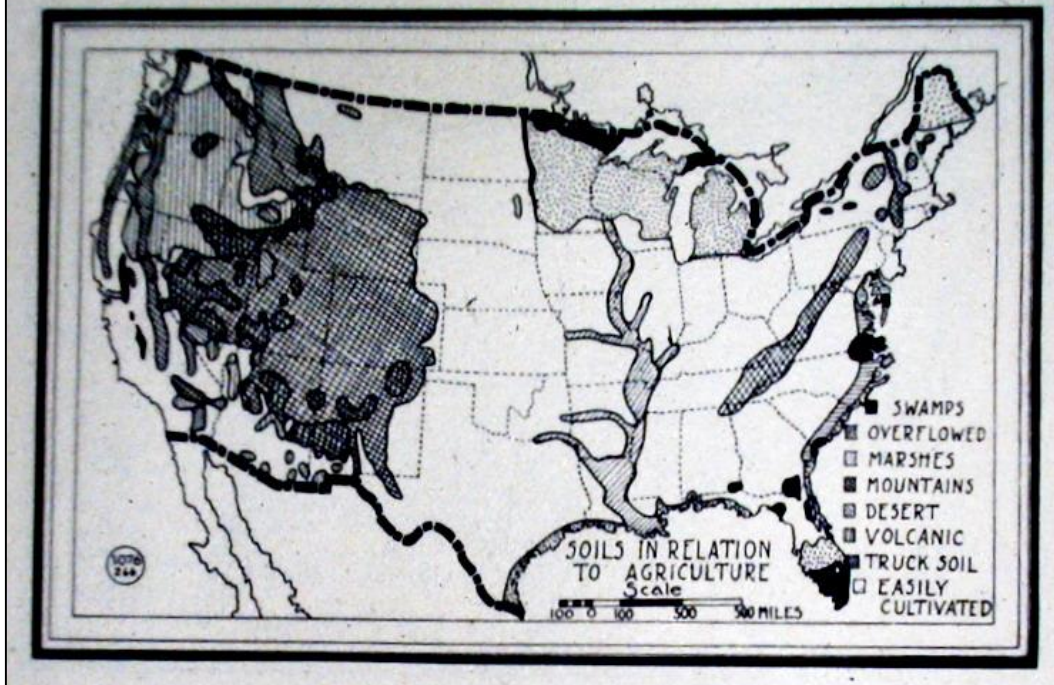
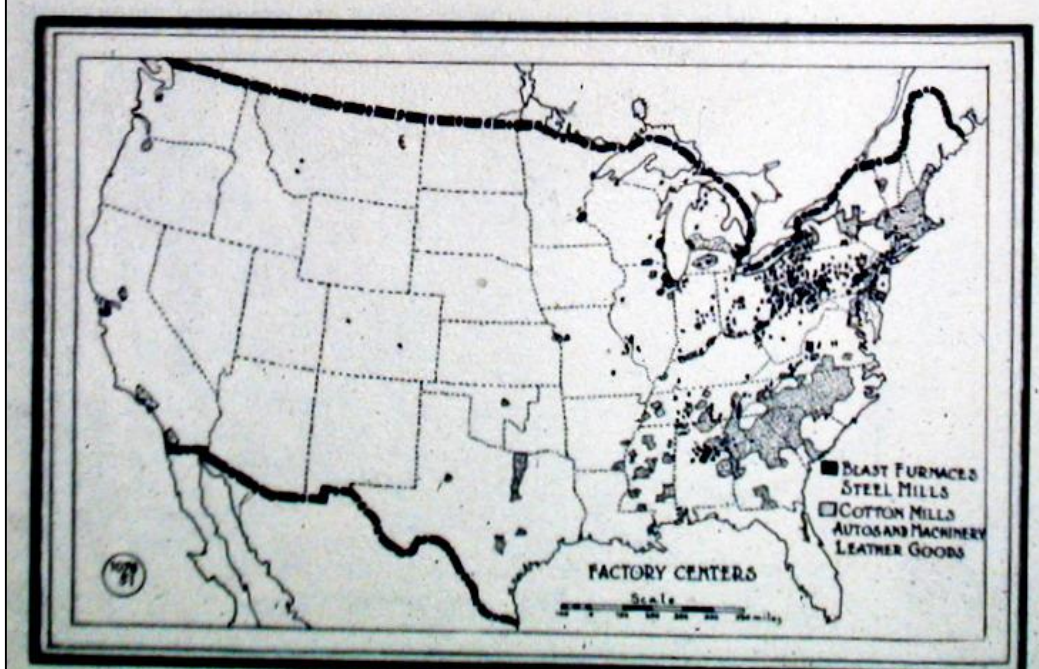
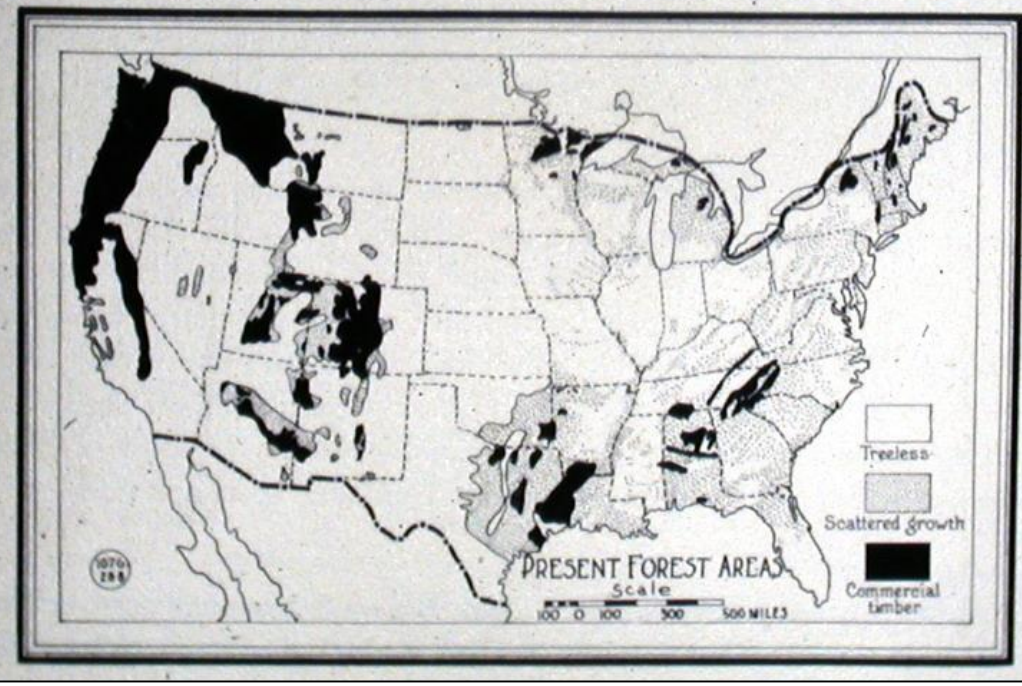


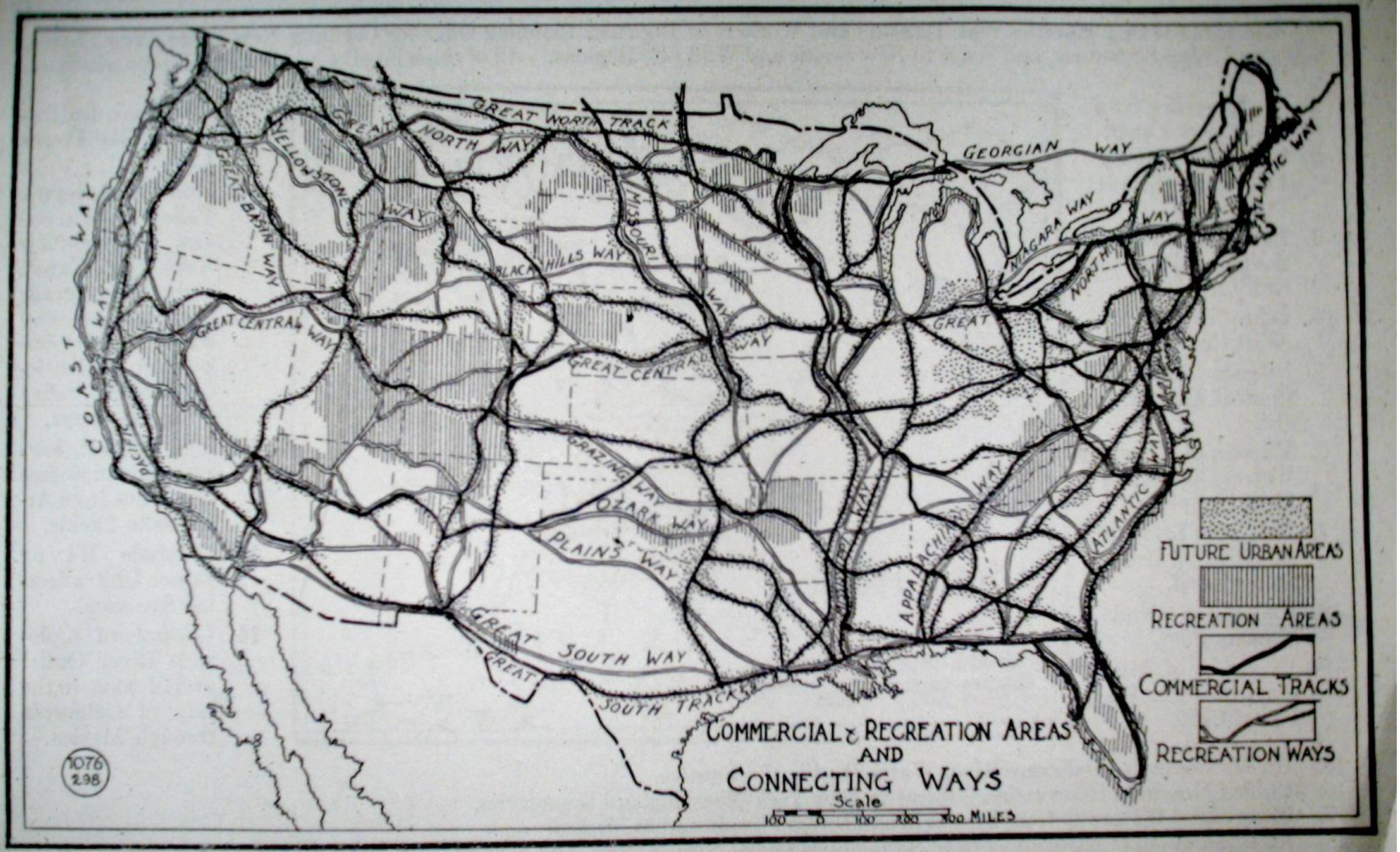



SWAMPS
OVERFLOWED
MARSHES
MOUNTAINS
DESERT
VOLCANIC
TRUCK SOIL
EASILY CULTIVATED
SOILS IN RELATION TO AGRICULTURE
Scale
100 0 100 500 500 MILES


Treeless
Prairie
Original forest regions
ORIGINAL FOREST AREAS
Scale
500 MILES


BLAST FURNACES
STEEL MILLS
COTTON MILLS
AUTOS AND MACHINERY
LEATHER GOODS
FACTORY CENTERS
Scale


Treeless
Scattered growth
Commercial timber
PRESENT FOREST AREAS
Scale
100 0 100 500 500 MILES



FROM *Landscape Architecture*, JULY, 1923

An Introduction to *Regional Surveying*

By

C. C. FAGG, F.G.S., F.R.A.I.
and
G. E. HUTCHINGS, F.G.S.

CAMBRIDGE
AT THE UNIVERSITY PRESS
1930

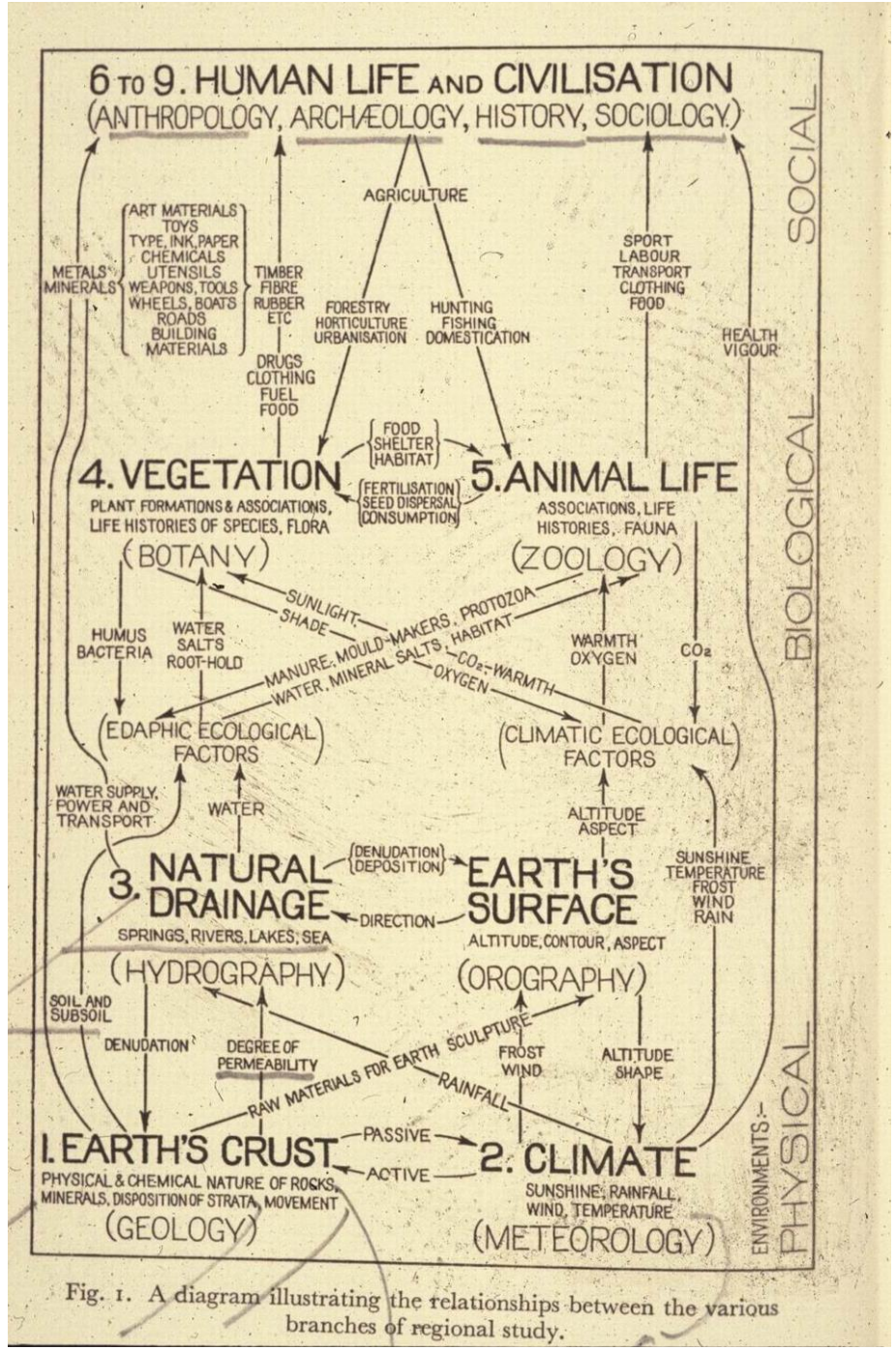


Fig. 1. A diagram illustrating the relationships between the various branches of regional study.

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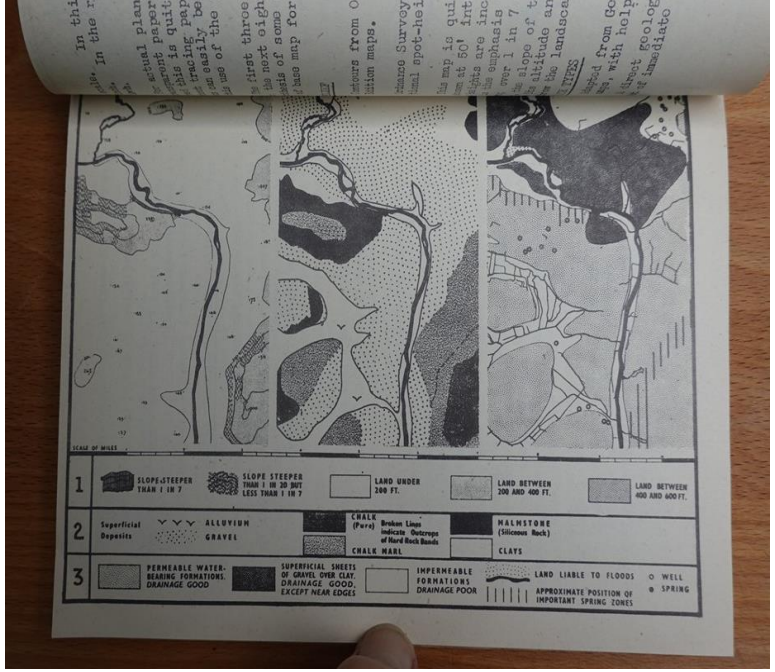

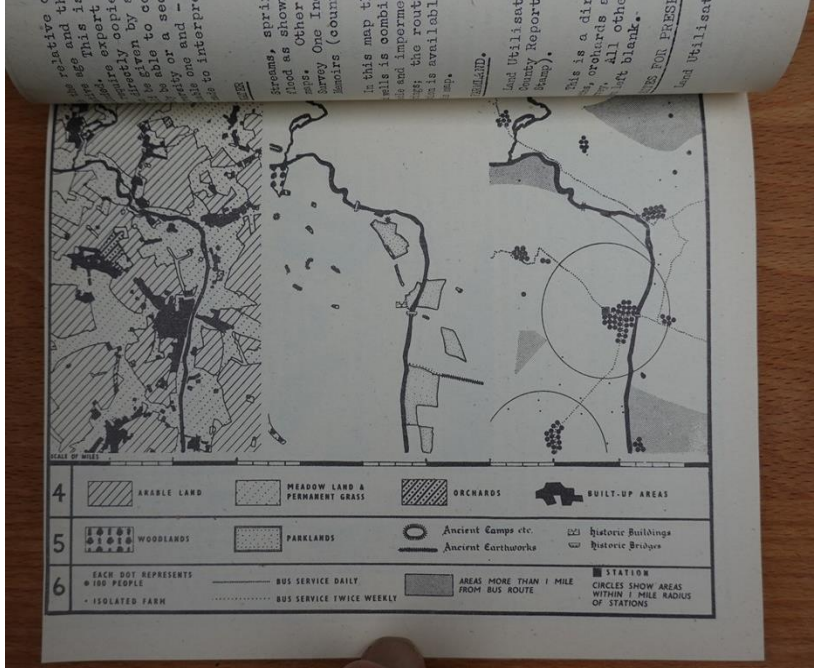

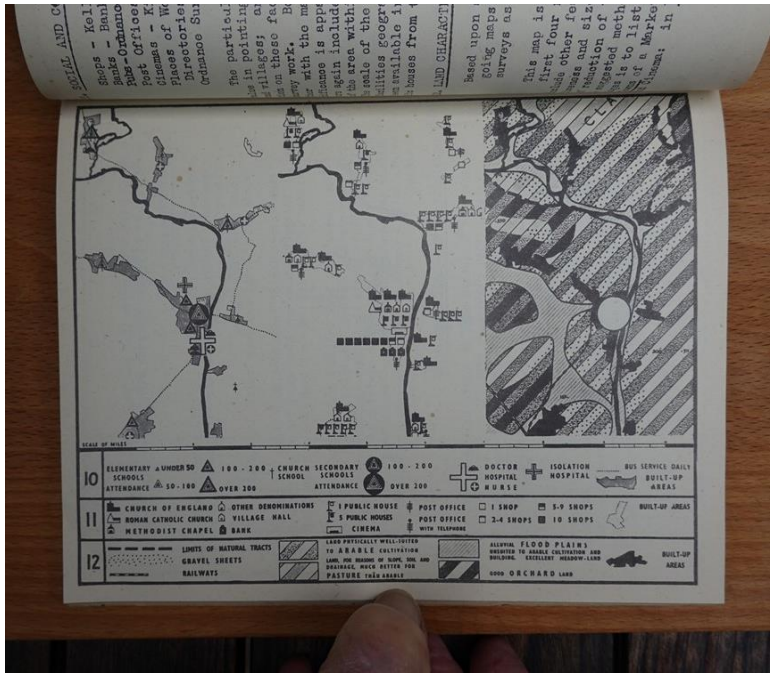

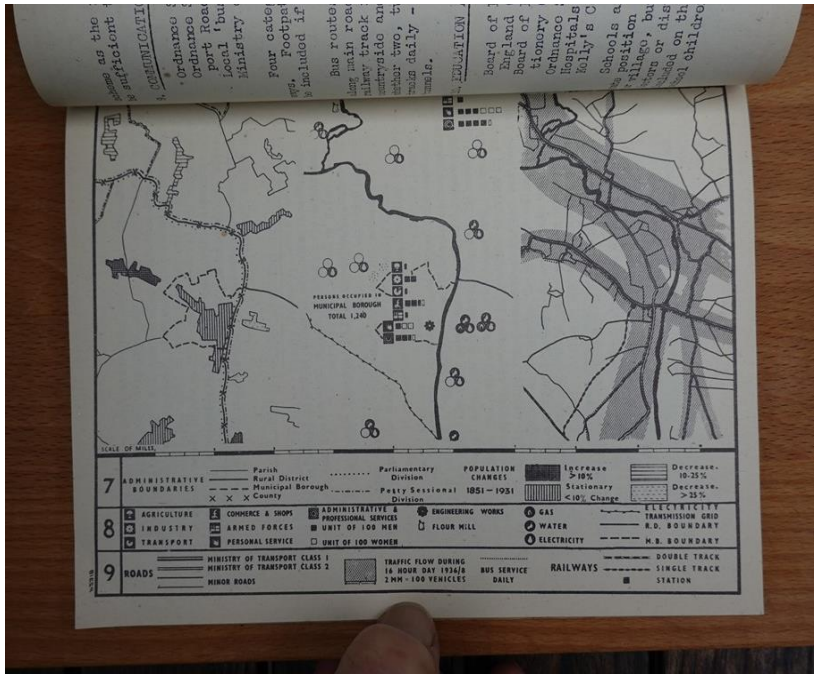

1945, United Kingdom

REGIONAL PLANNING

An outline of the scientific data relating to planning in Great Britain

by

L. B. ESCRITT
Assoc.M.Inst.C.E., M.I.S.E., M.R.San.I.
Hon.M.Inst.S.P., F.G.S.
Chartered Civil Engineer.

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1943

the following manner. In the first place copies of the various maps showing suitability of land for different purposes would be made on tracing or detail paper, the boundaries of the areas being shown. The maps would then be hatched in widely spaced

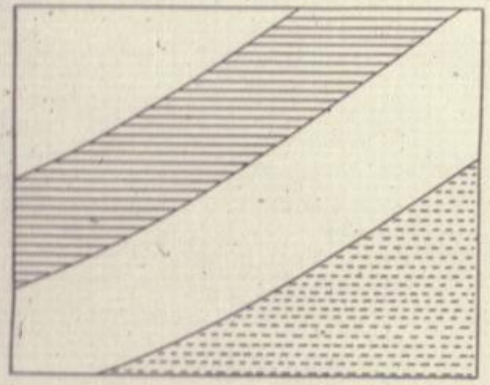


Fig. 4.
Suitability Map, Purpose "A."

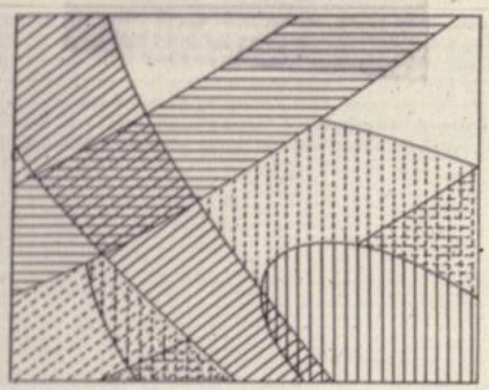


Fig. 7.
Map of Possible Surface Utilisation.

unfertile land would be left blank. Using a different colour he would then prepare a similar plan showing land particularly suitable for housing, land fitted for housing and land unfitted for housing. Proceeding on the same lines he would prepare a similar

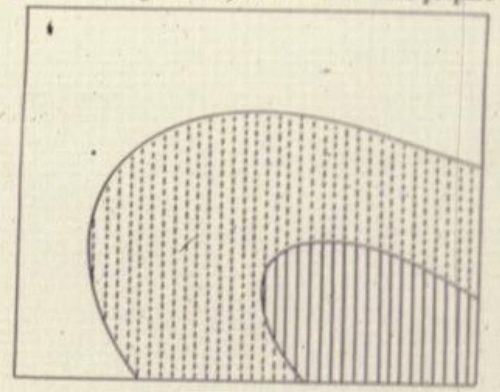


Fig. 5.
Suitability Map, Purpose "B."

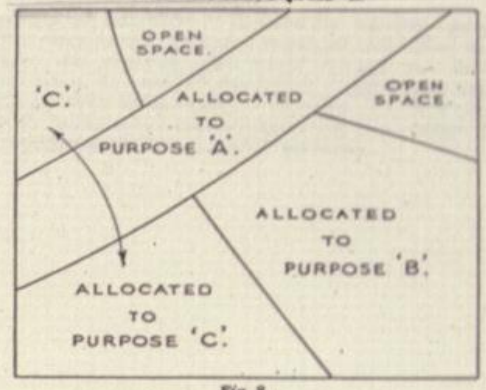
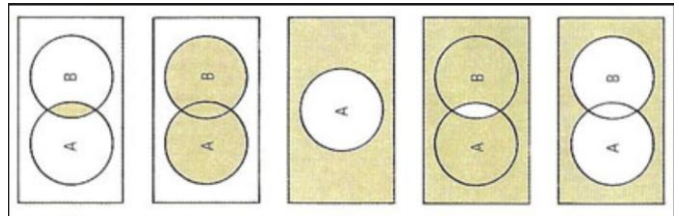


Fig. 8.
Map of Tentative Allocation of Land.

Boolean logic



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WAR OFFICE (A.E.3.)
April 1945

PART II

FIG.3

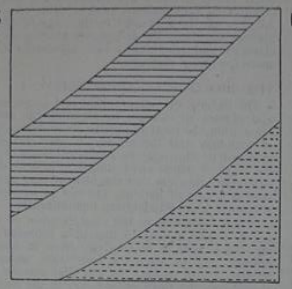


FIG.4

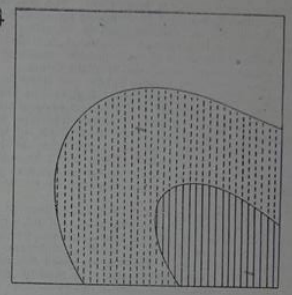


FIG.5

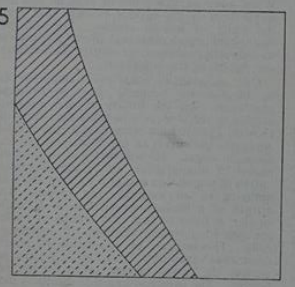


FIG.6

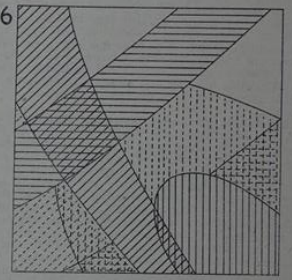
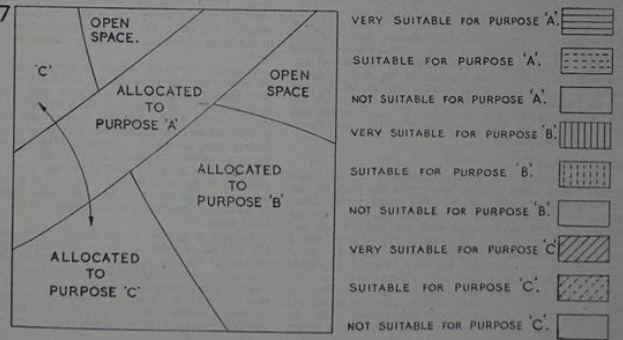


FIG.7

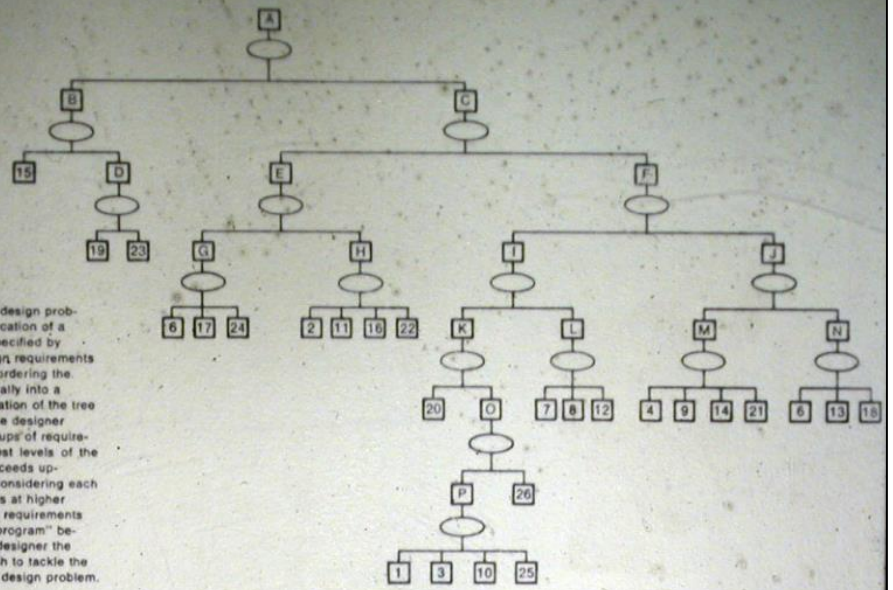


Exeter, United Kingdom

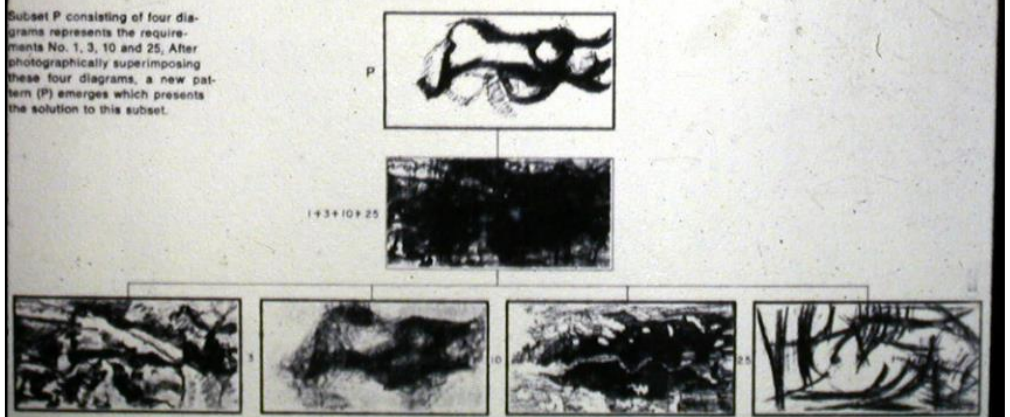
1945, United Kingdom

1. Earthwork Costs.
2. Comfort and Safety.
3. Regional Development.
4. Local Land Development.
5. Obsolescence.
6. Interference During Construction.
7. User Costs.
8. Services.
9. Travel Time.
10. Pavement and Subgrade Costs.
11. Drainage Patterns.
12. Bridge Costs.
13. Land Costs.
14. Eyesores.
15. Noise.
16. Air Pollution.
17. Weather Effects.
18. Non-Recompensable Public and Private Losses.
19. Public Financial Losses.
20. Major Current Traffic Desires.
21. Catchment Areas.
22. Local Accessibility and Integrity.
23. Future Transportation Systems.
24. Existing Transportation Systems.
25. Duplication of Facilities.
26. Self-Induced Congestion.

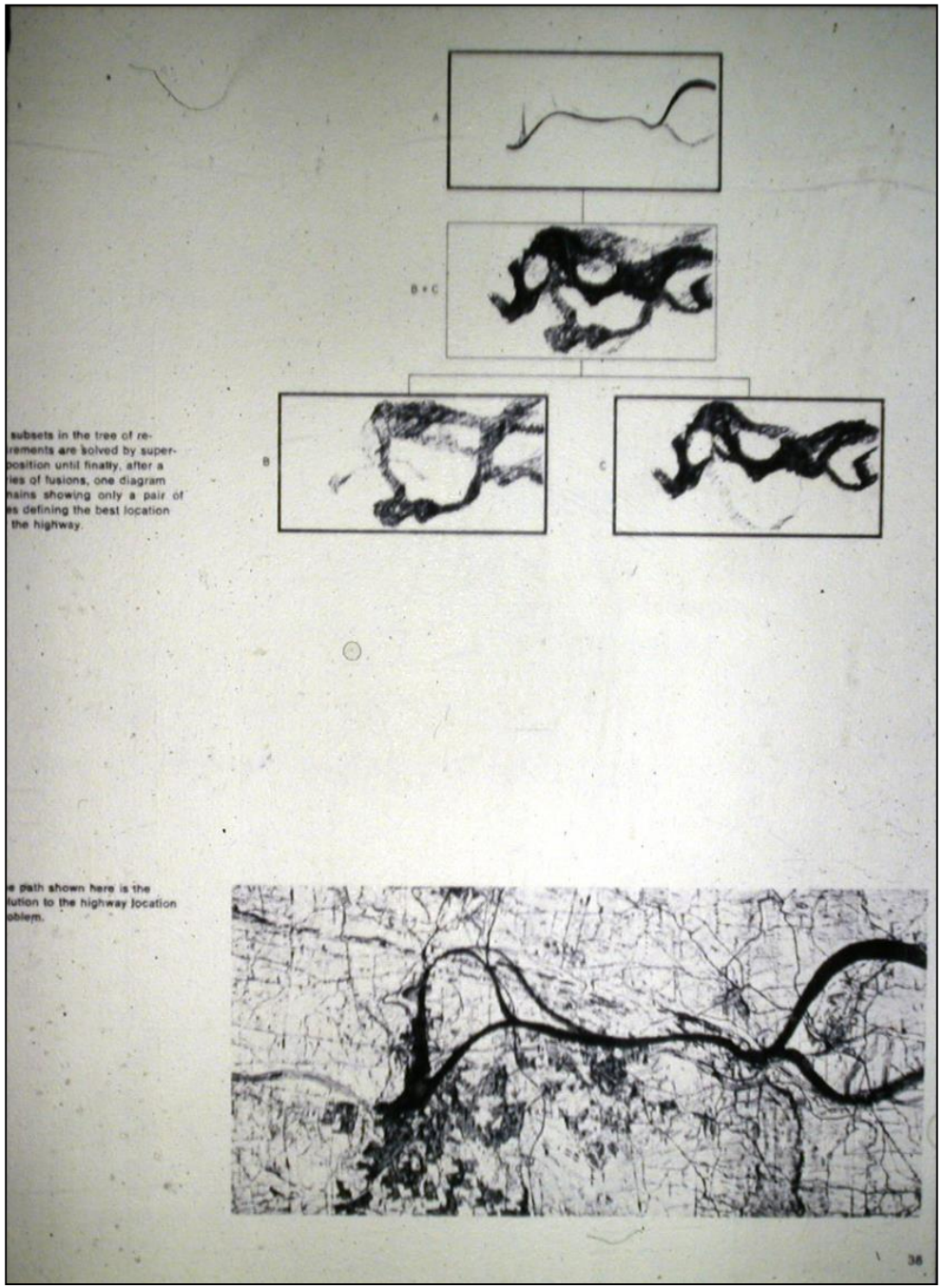
Christopher Alexander
and
Marvin Mannheim
MIT 1964



The structure of a design problem such as the location of a highway can be specified by grouping the design requirements into subsets, and ordering the subsets hierarchically into a "tree." The implication of the tree structure is that the designer starts with the groups of requirements at the lowest levels of the tree, and then proceeds upwards, gradually considering each of the other groups at higher levels. The tree of requirements can be called a "program" because it shows a designer the best order in which to tackle the requirements in a design problem.



Subset P consisting of four diagrams represents the requirements No. 1, 3, 10 and 25. After photographically superimposing these four diagrams, a new pattern (P) emerges which presents the solution to this subset.



subsets in the tree of requirements are solved by superposition until finally, after a series of fusions, one diagram remains showing only a pair of values defining the best location for the highway.

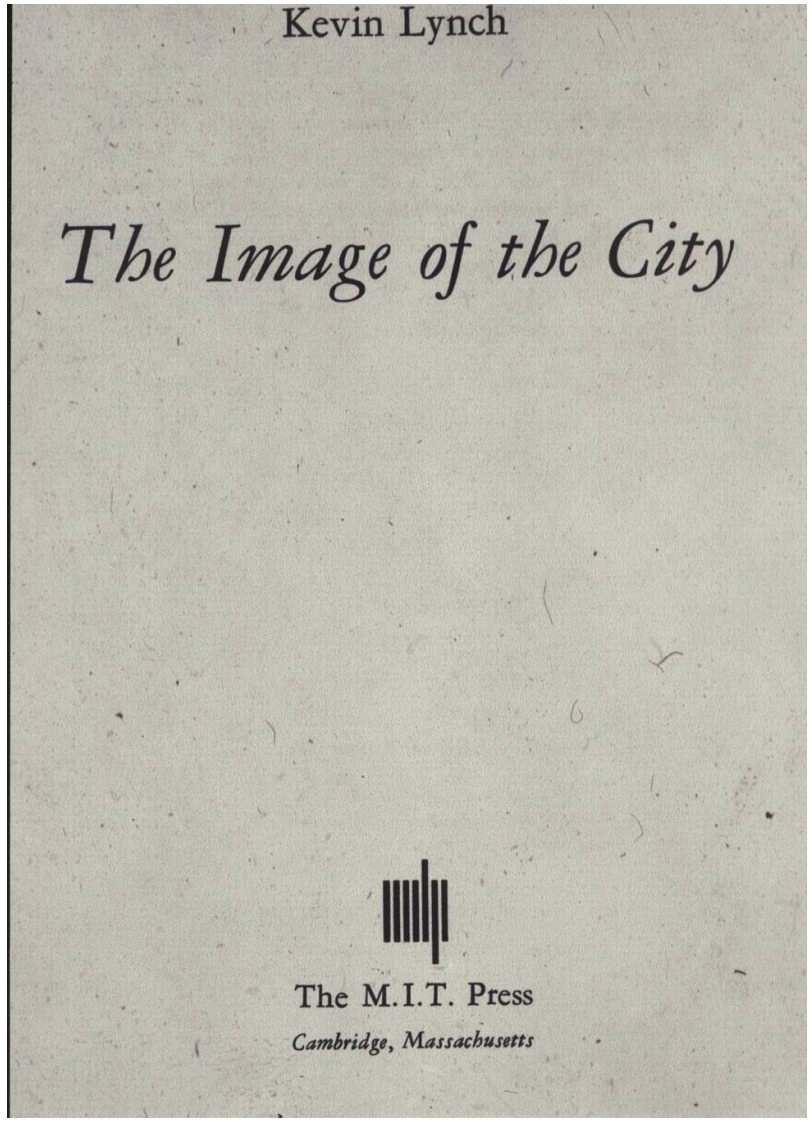
e path shown here is the lution to the highway location oblem.

Christopher Alexander
and
Marvin Mannheim
MIT 1964

(BEFORE) **ANALOG TO** a **DIGITAL** (FUTURE)
the 1960s
a personal perspective

Digital Landscape Architecture Dessau Germany The Bauhaus May 23, 2019

Kevin Lynch, MIT (1918 – 1984)



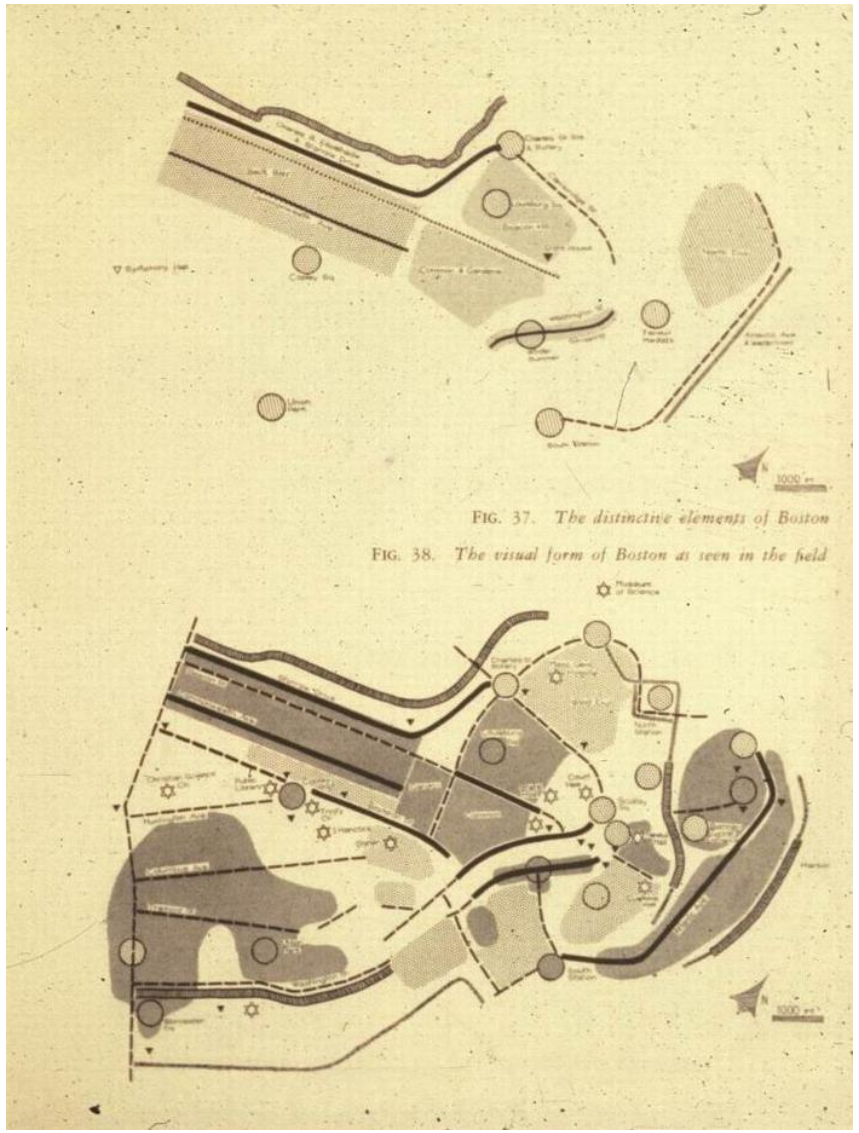
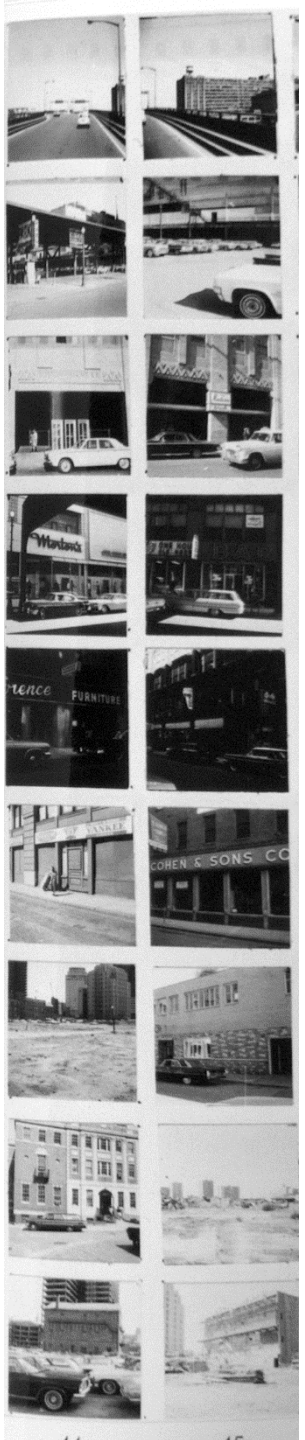


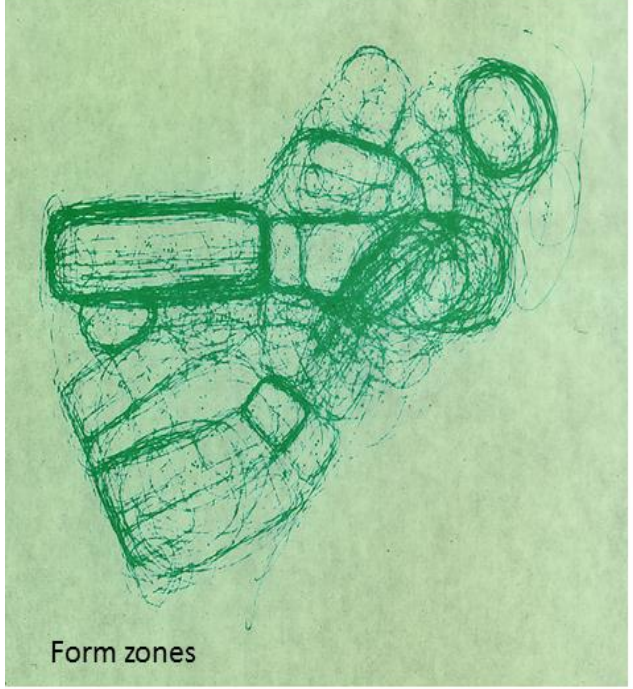
FIG. 37. The distinctive elements of Boston

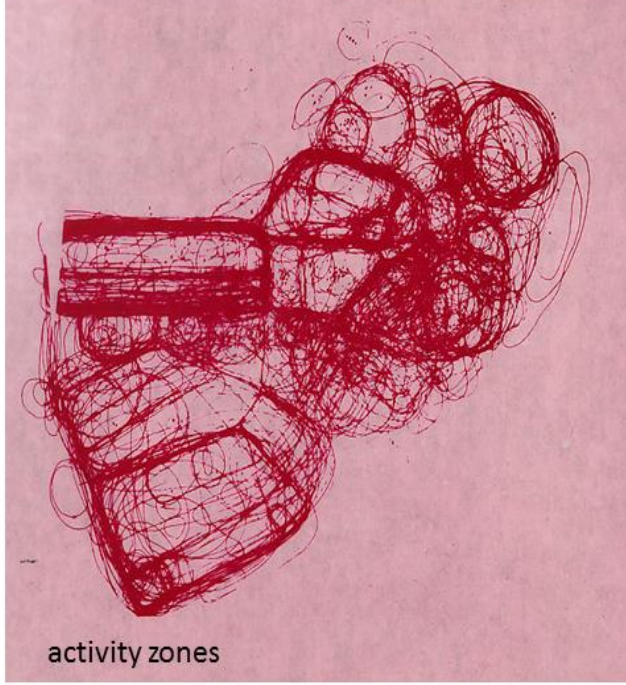
FIG. 38. The visual form of Boston as seen in the field

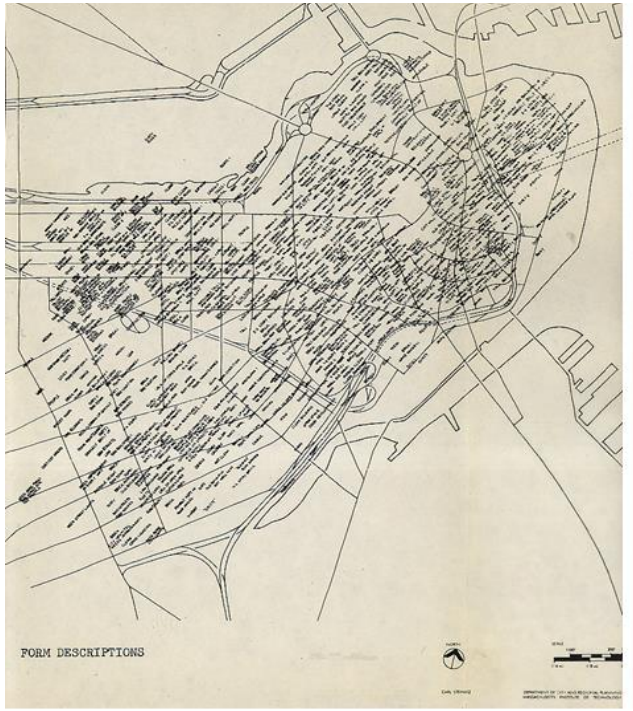
Boston, Massachusetts, USA

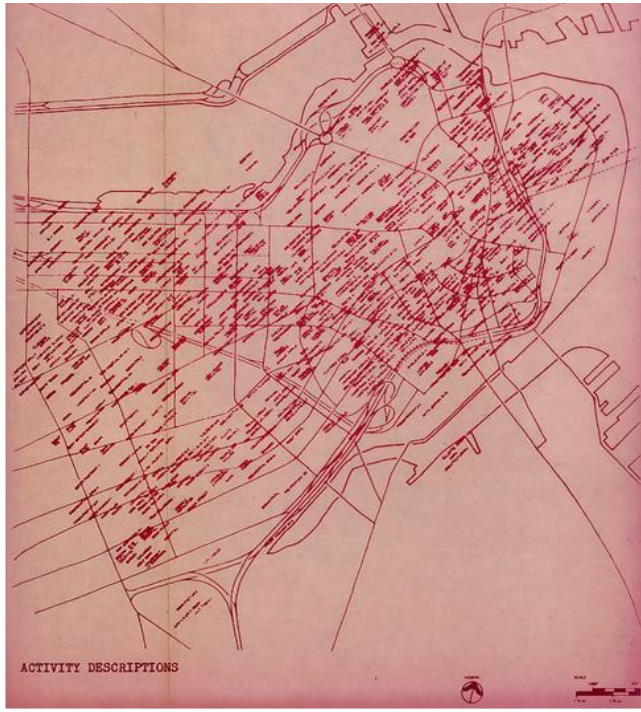

PECK & PECK
Morton's
Morton's
FURNITURE
COHEN & SONS CO



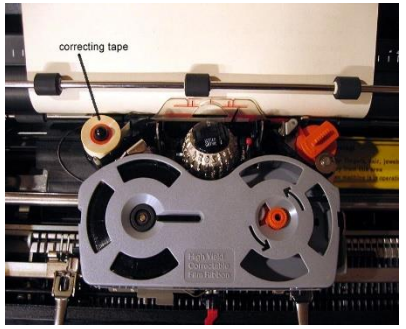

Form zones

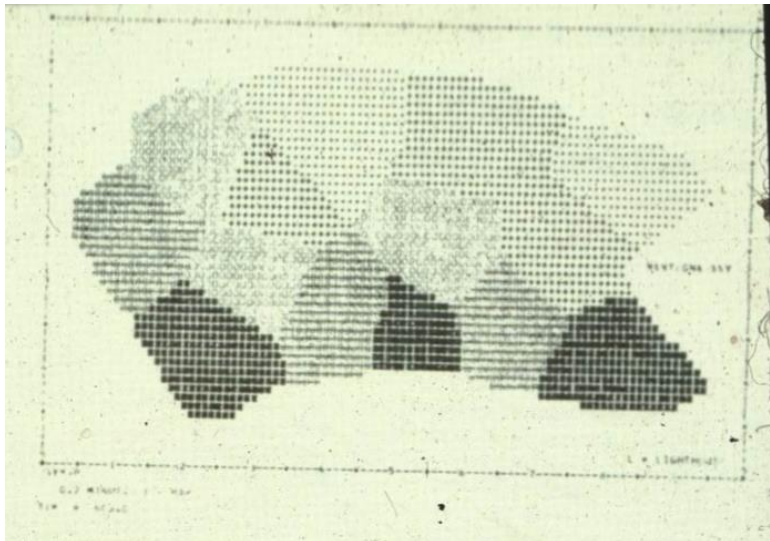

activity zones


FORM DESCRIPTIONS

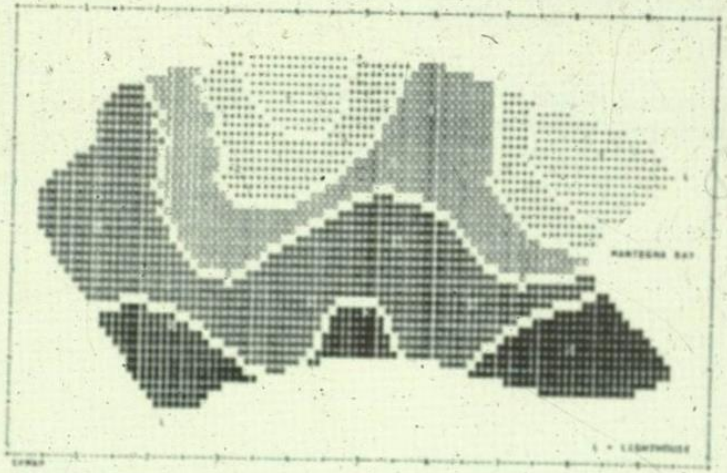

ACTIVITY DESCRIPTIONS

Howard Fisher and the Laboratory for Computer Graphics, Harvard GSD, 1964



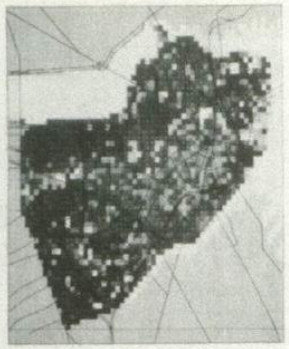


Conformant Map

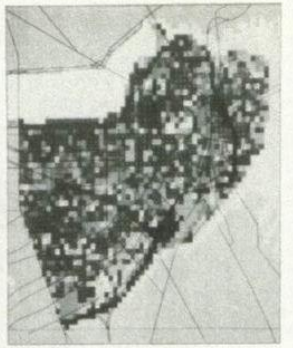


Contour Map with Contour Lines

Howard Fisher and the Laboratory for Computer Graphics, Harvard GSD, 1964



Form Type
Frequency

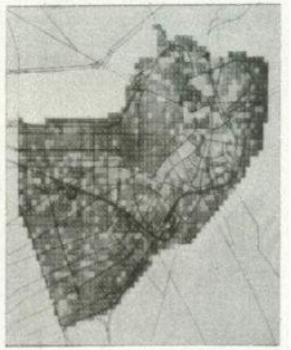


Activity Type
Frequency

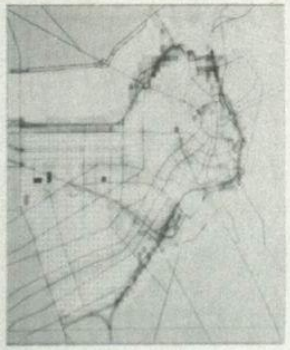
Type Congruence

Form Intensity

Activity Intensity

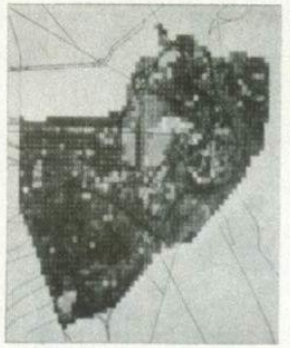


Intensity Congruence

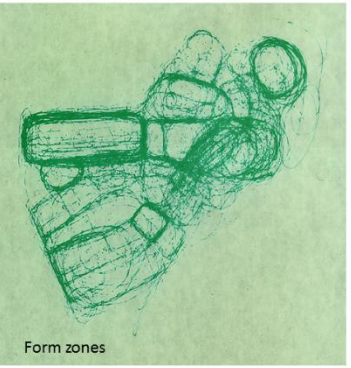


Form Exposure

Activity Significance

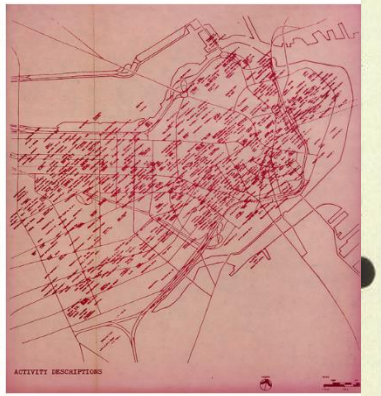


Significance
Congruence



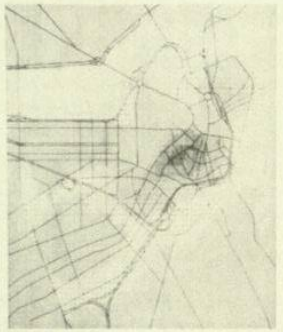
Form zones

activity zones

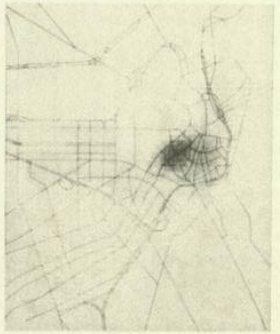


Form Type Responses

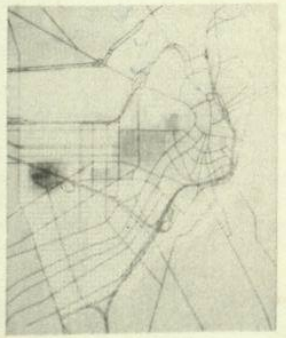
Activity Type Responses



Form Intensity Responses



Activity Intensity Responses



Form Exposure Responses

Activity Significance Responses

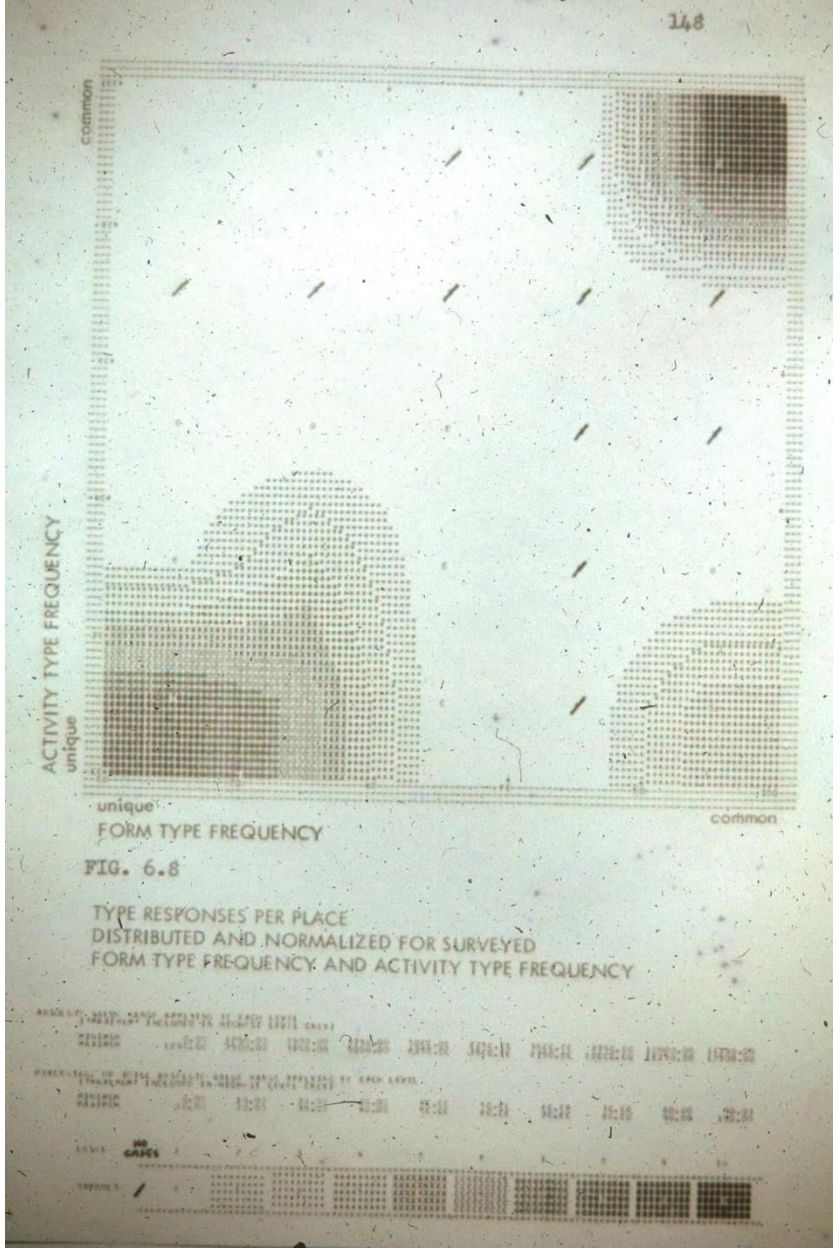
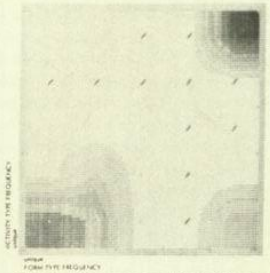


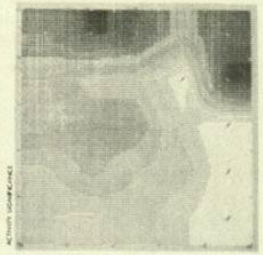
FIG. 6.8

TYPE RESPONSES PER PLACE
DISTRIBUTED AND NORMALIZED FOR SURVEYED
FORM TYPE FREQUENCY AND ACTIVITY TYPE FREQUENCY



Type Responses Per Place Distributed for Surveyed Form Type Frequency and Activity Type Frequency

Intensity Responses Per Place Distributed for Surveyed Form Intensity and Activity Intensity

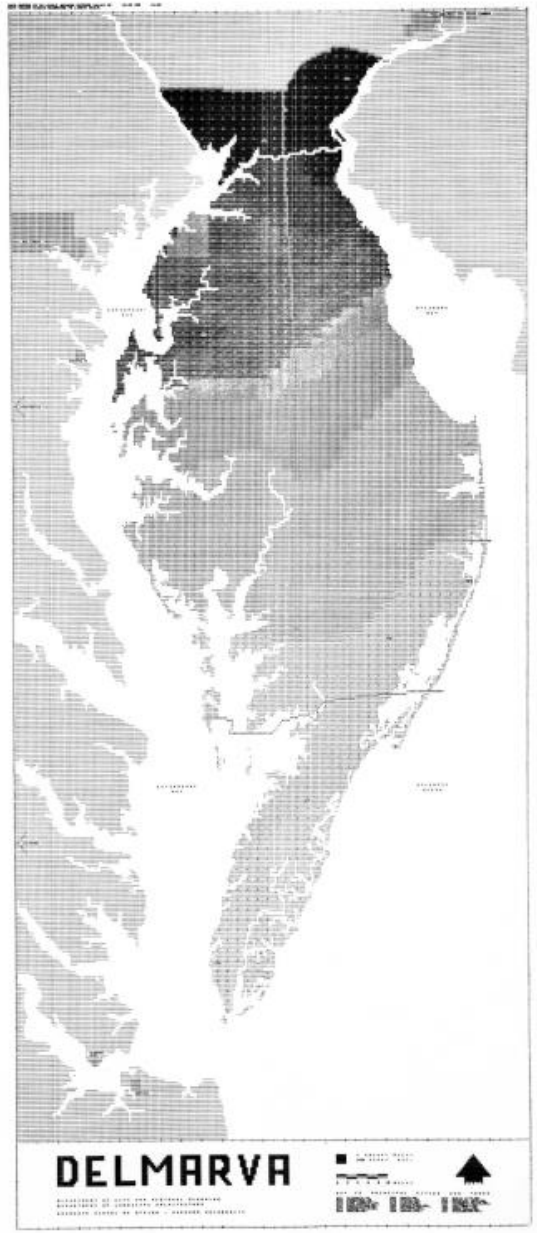


Significance Responses Per Place Distributed for Surveyed Form Exposure and Activity Significance

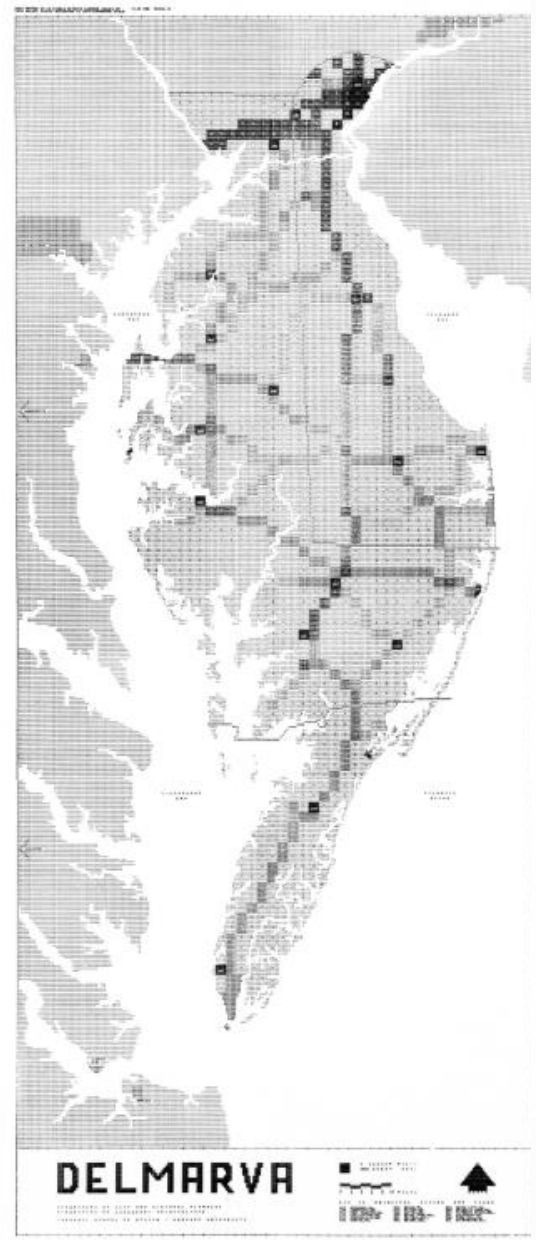
Carl Steinitz 1965-6

The Conservation Foundation and Harvard GSD

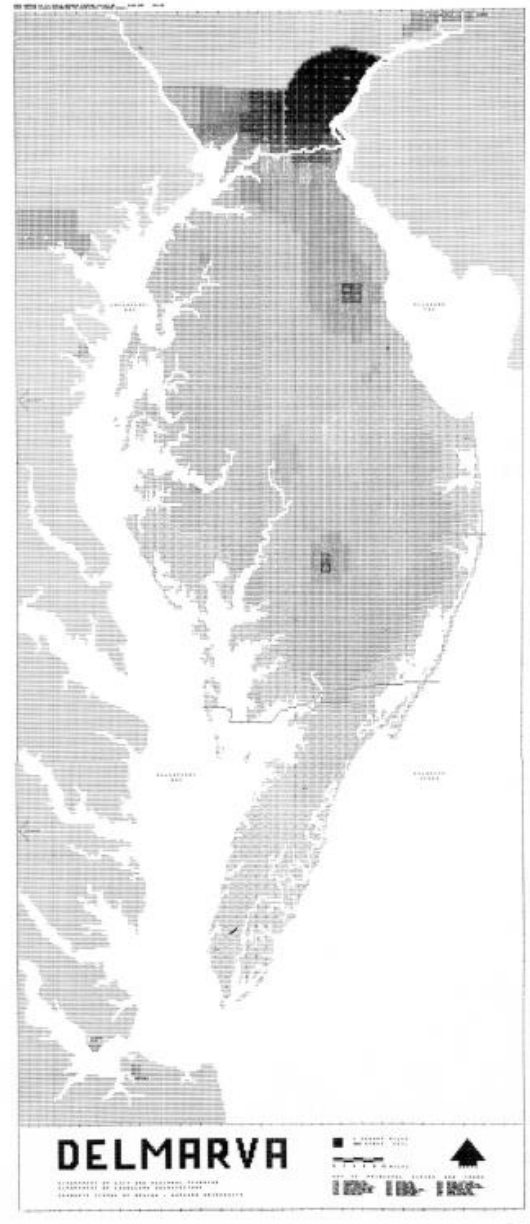
EXTERNAL POPULATION POTENTIAL, 1960



INTER-URBAN, AVERAGE DAILY TWO WAY TRAFFIC FLOWS

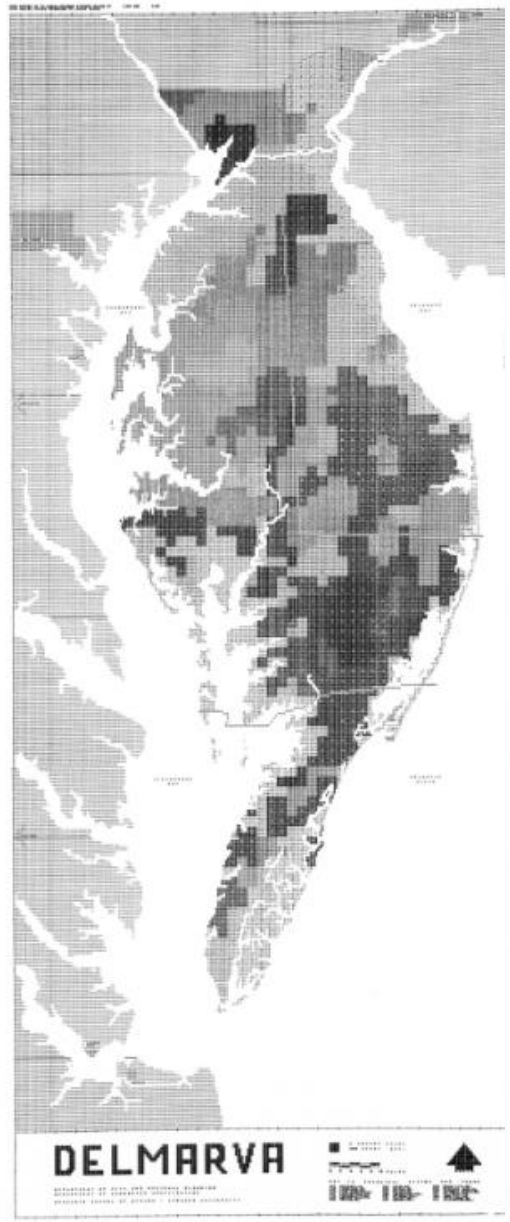


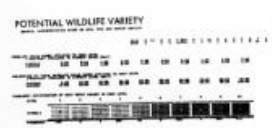
INTRAPENINSULAR POPULATION POTENTIAL, 1960

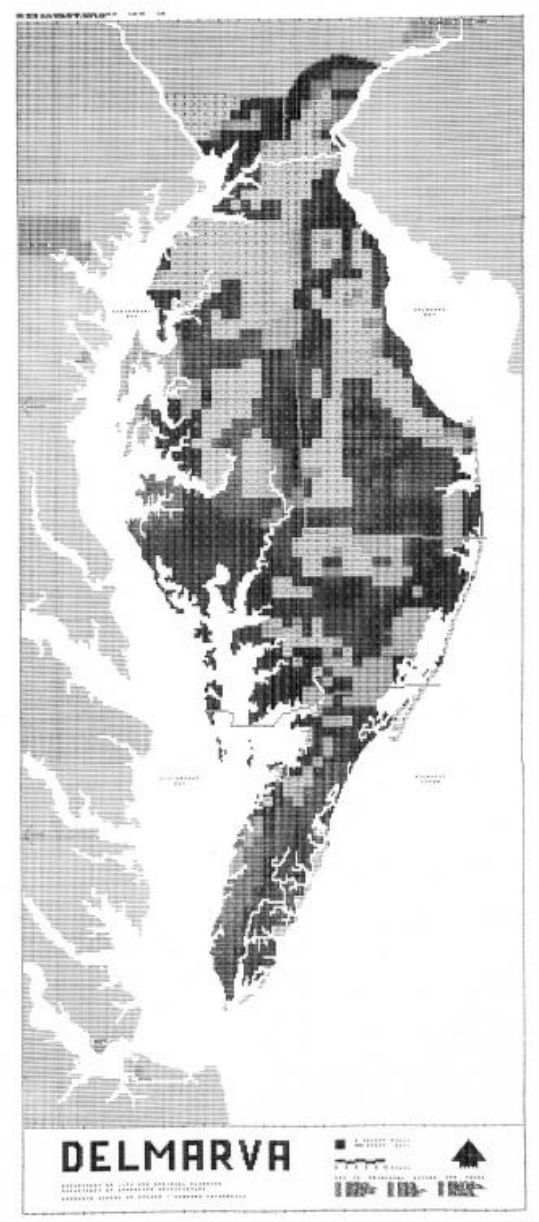



SOIL CAPABILITY FOR AGRICULTURE
DELMARVA

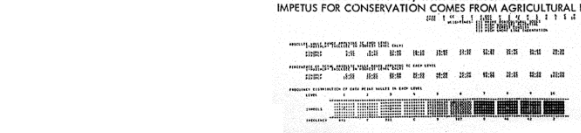

FOREST DENSITY

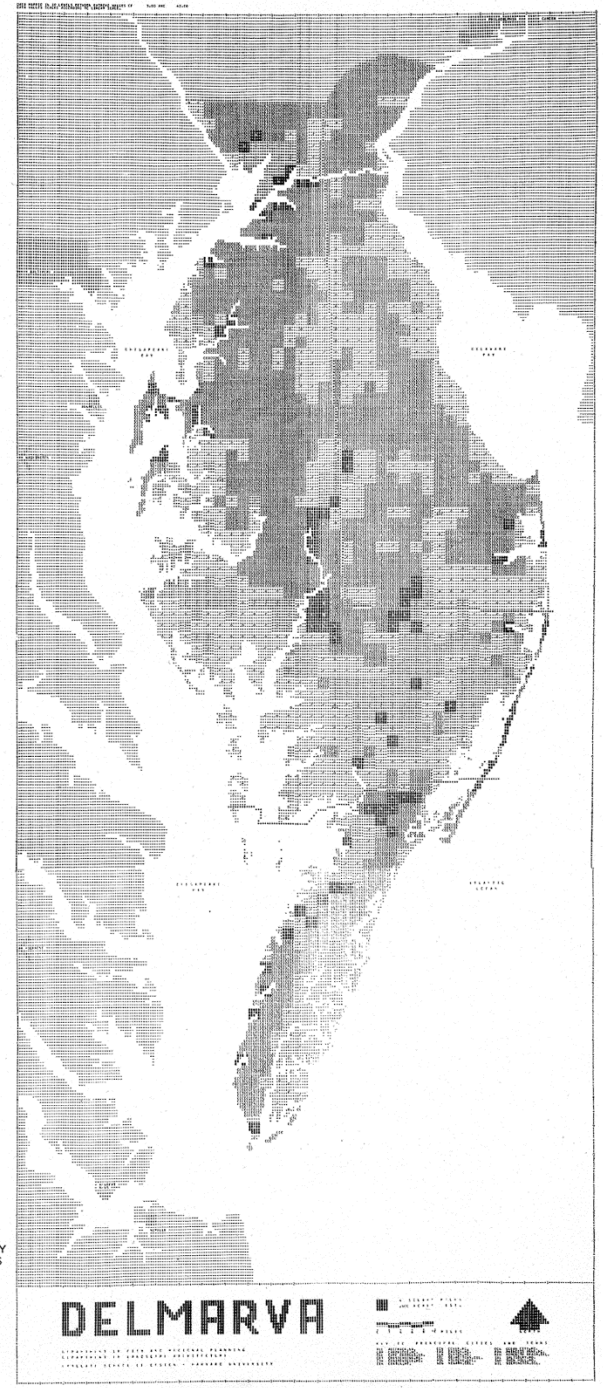

DELMARVA


POTENTIAL WILDLIFE VARIETY

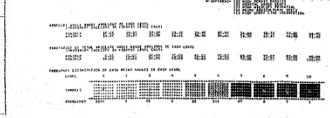

DELMARVA

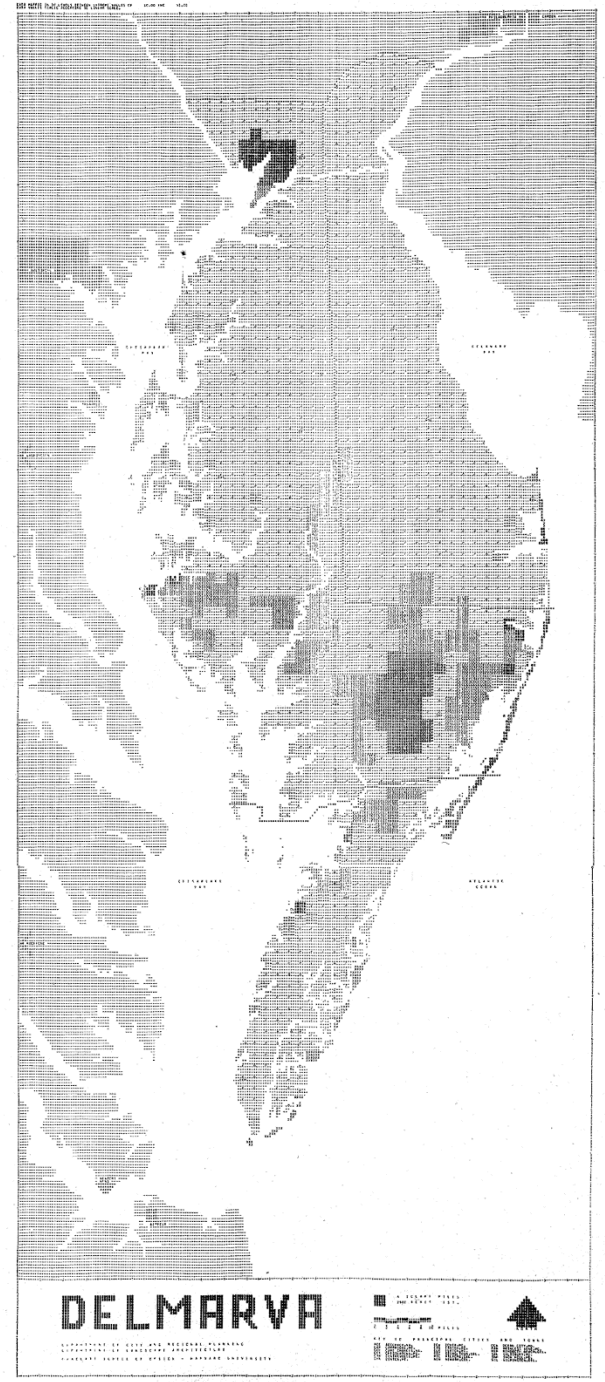
AREAS FOR CONSERVANCY, WITH THE ASSUMPTION THAT THE PRIMARY IMPETUS FOR CONSERVATION COMES FROM AGRICULTURAL INTERESTS

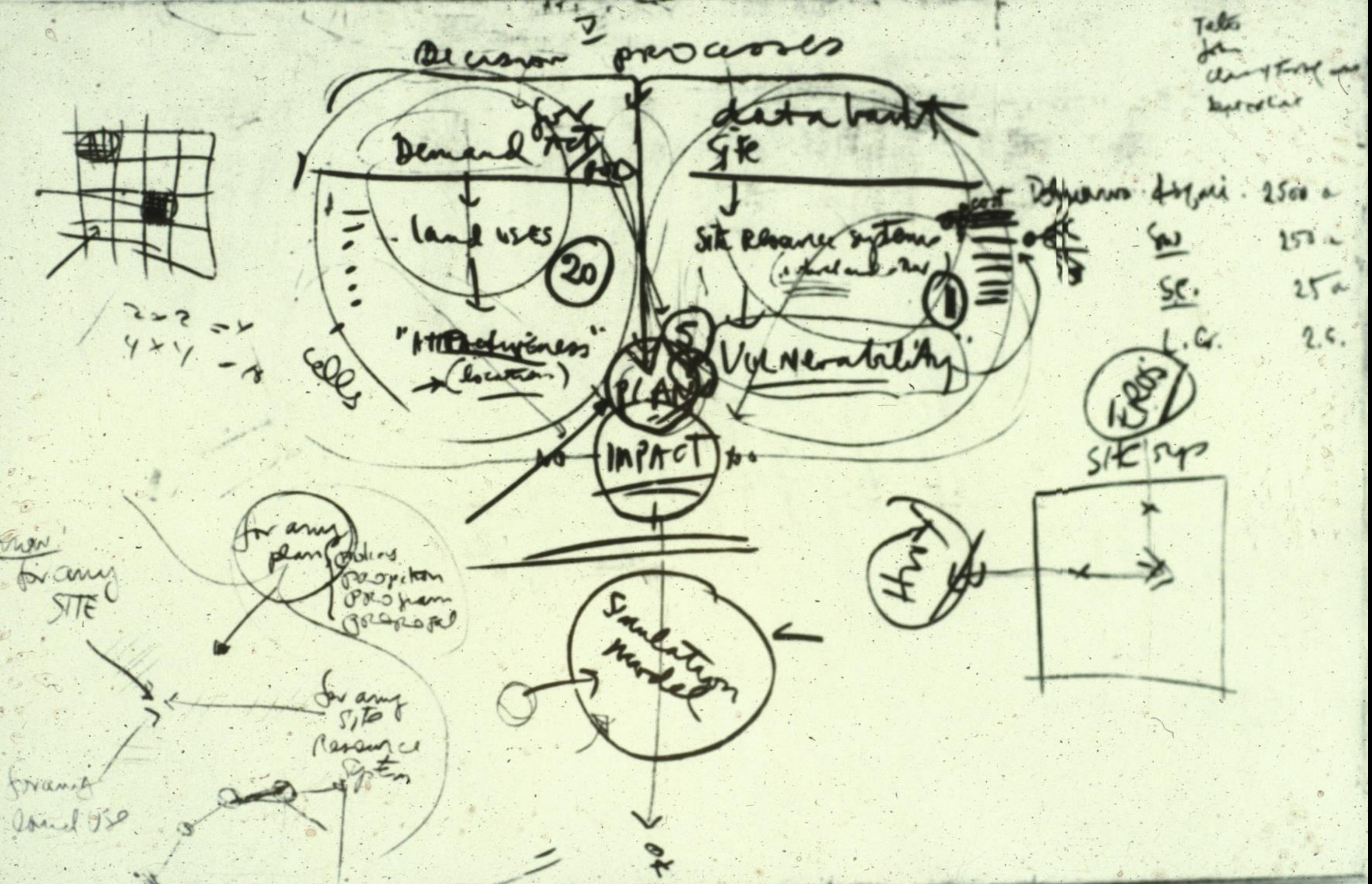




AREAS FOR CONSERVANCY, WITH THE ASSUMPTION THAT THE PRIMARY IMPETUS FOR CONSERVATION COMES FROM CONSERVATION INTERESTS

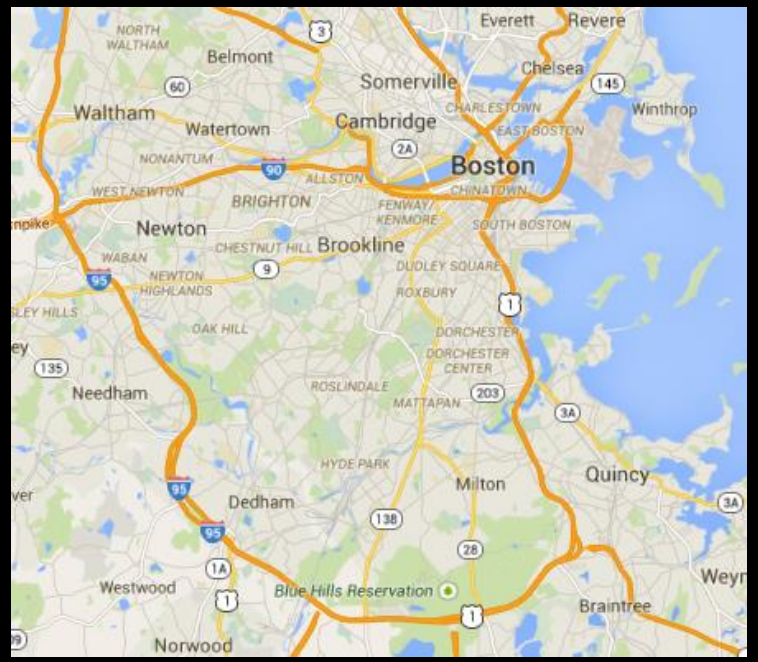


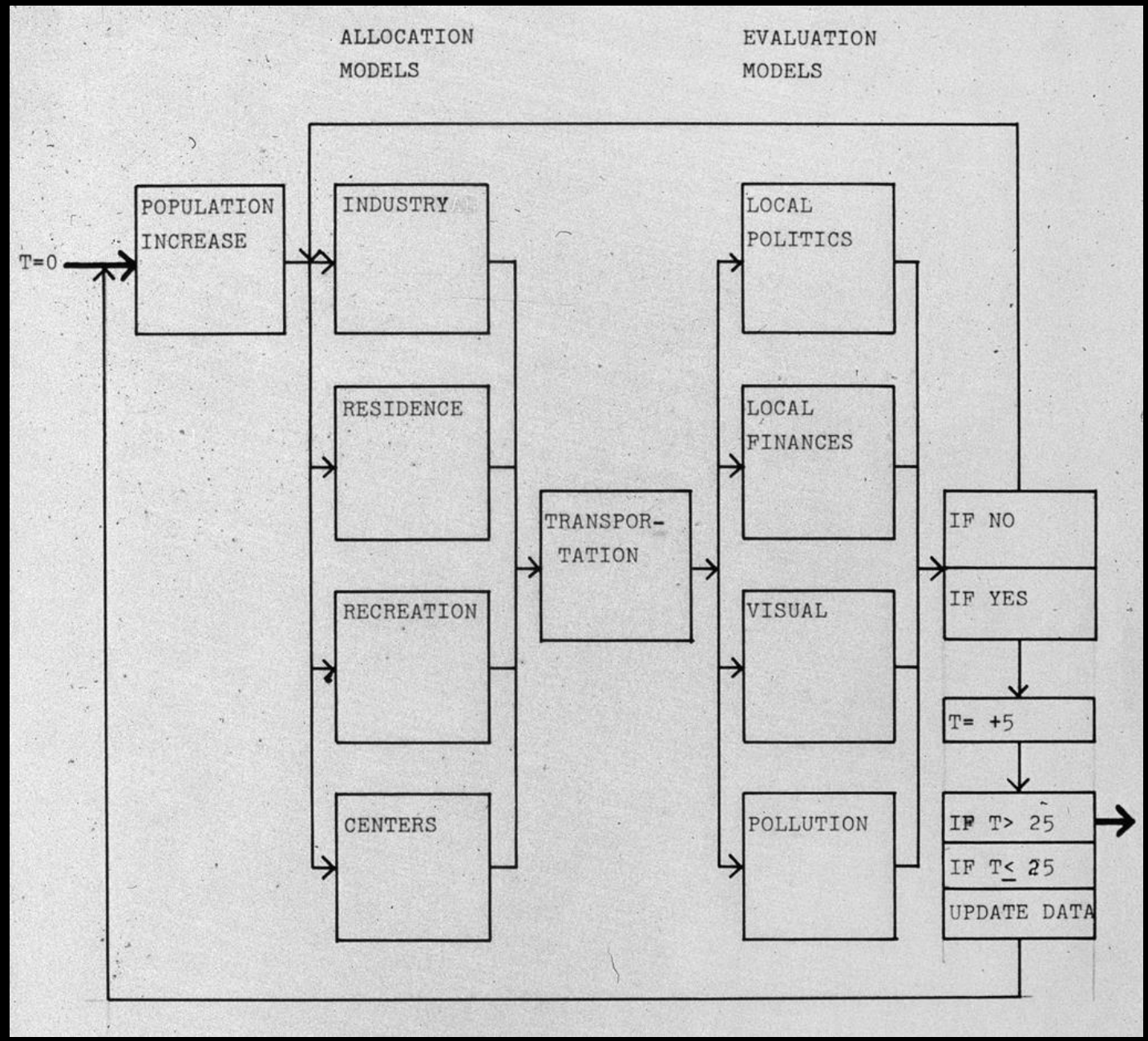



Decision processes
Demand
data bank
Site
land uses
20
"Attractiveness"
(location)
cells
Site Resource systems
Vulnerability
PLAN
IMPACT
Simulation model
Site sys
for any plan
for any SITE
for any site resource system

CS 1966

Charles Eliot, 1893

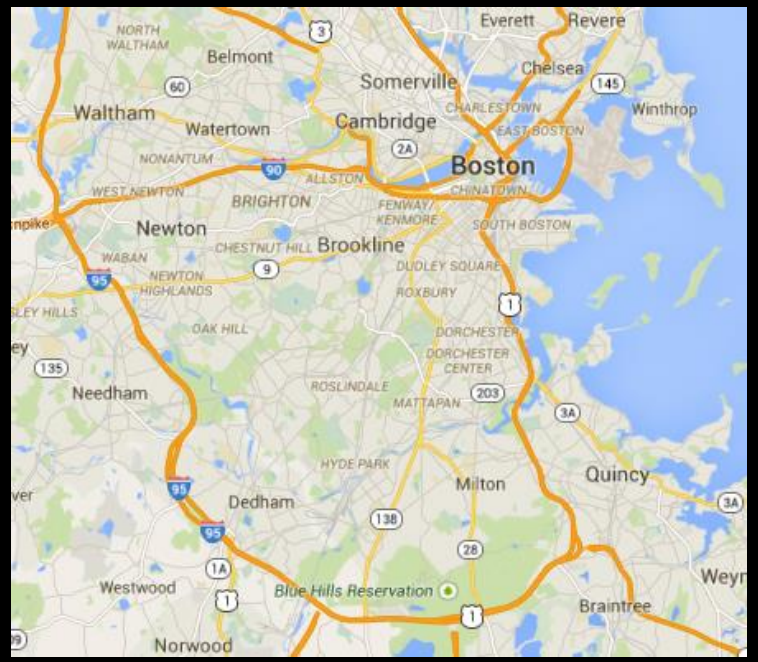


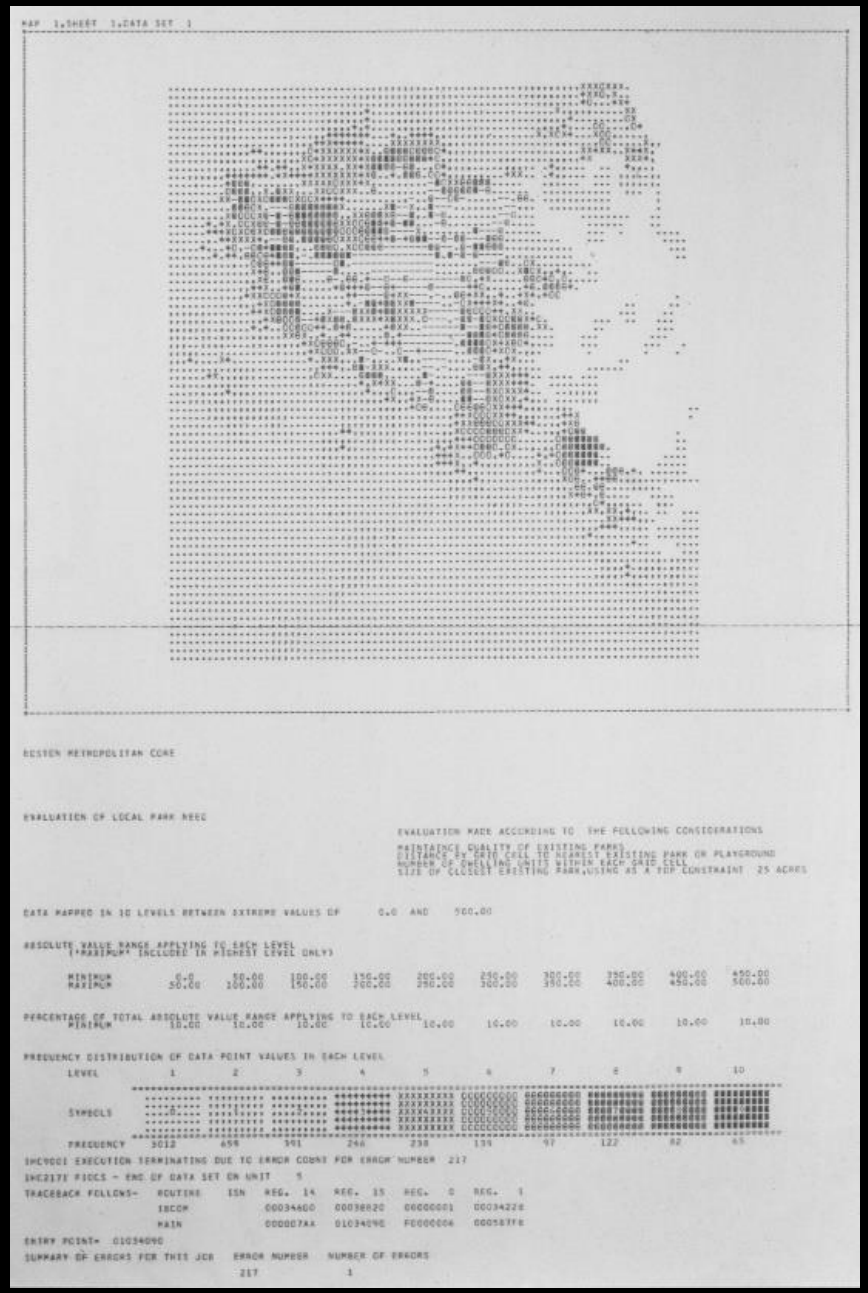


Peter Rogers, Carl Steinitz, et al

1967-8

Charles Eliot, 1893





BOSTON METROPOLITAN CORE

EVALUATION OF LOCAL PARK NEED

EVALUATION MADE ACCORDING TO THE FOLLOWING CONSIDERATIONS
MAINTAINCE QUALITY OF EXISTING PARKS
DISTANCE BY GRID CELL TO NEAREST EXISTING PARK OR PLAYGROUND
NUMBER OF DWELLING UNITS WITHIN EACH GRID CELL
SIZE OF CLOSEST EXISTING PARK,USING AS A TOP CONSTRAINT 25 ACRES

DATA MAPPED IN 10 LEVELS BETWEEN EXTREME VALUES OF 0.0 AND 500.00

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
(*MAXIMUM* INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	0.0	50.00	100.00	150.00	200.00	250.00	300.00	350.00	400.00	450.00
MAXIMUM	50.00	100.00	150.00	200.00	250.00	300.00	350.00	400.00	450.00	500.00

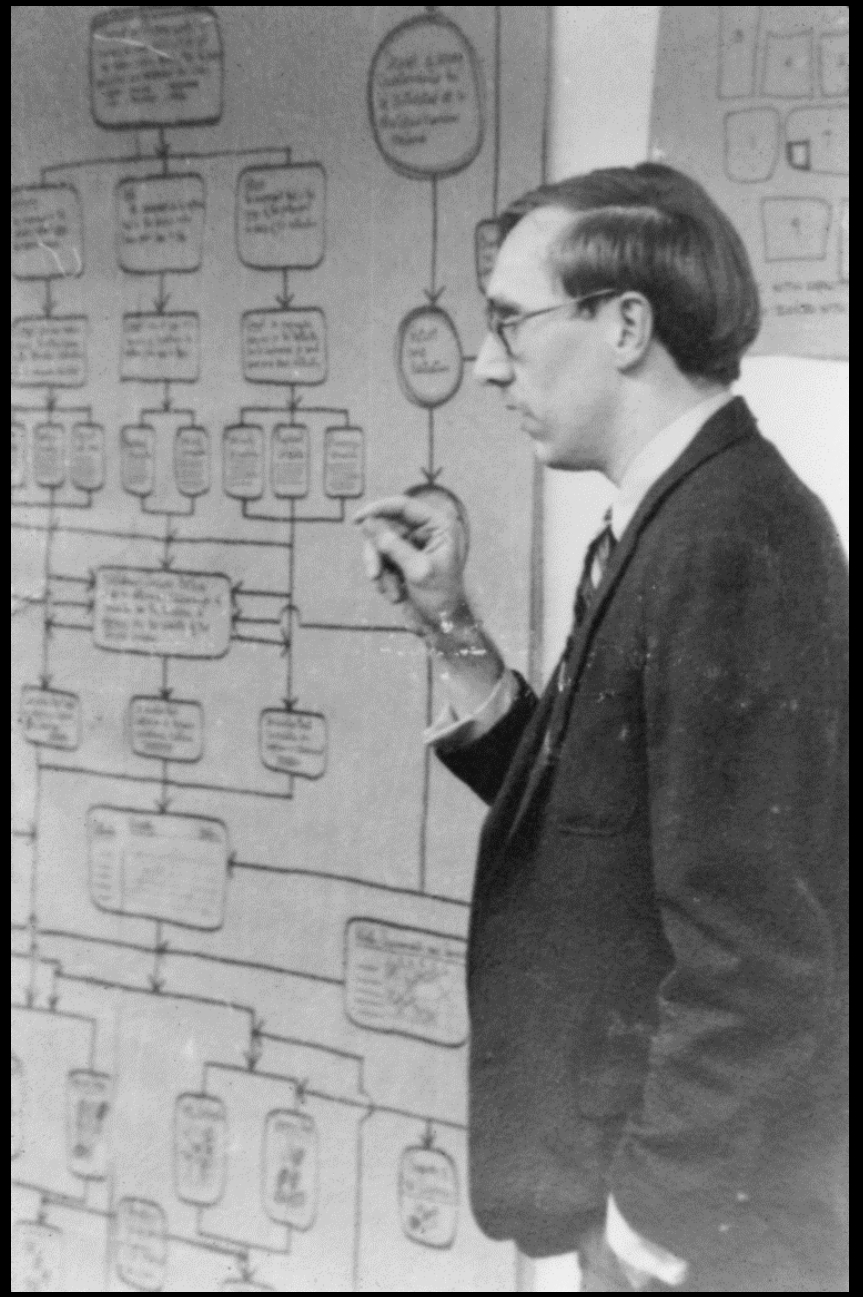
PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

MINIMUM	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

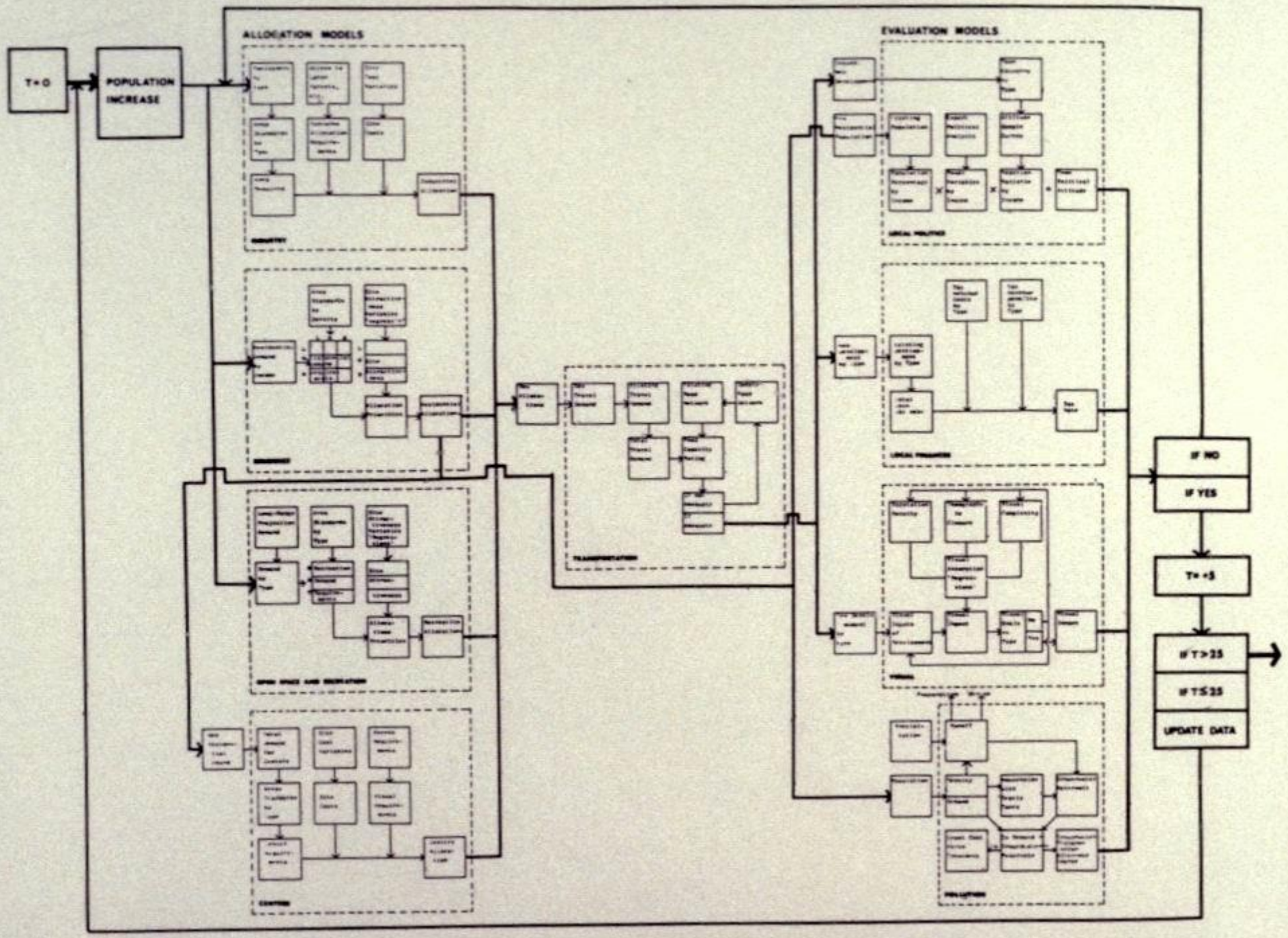
FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

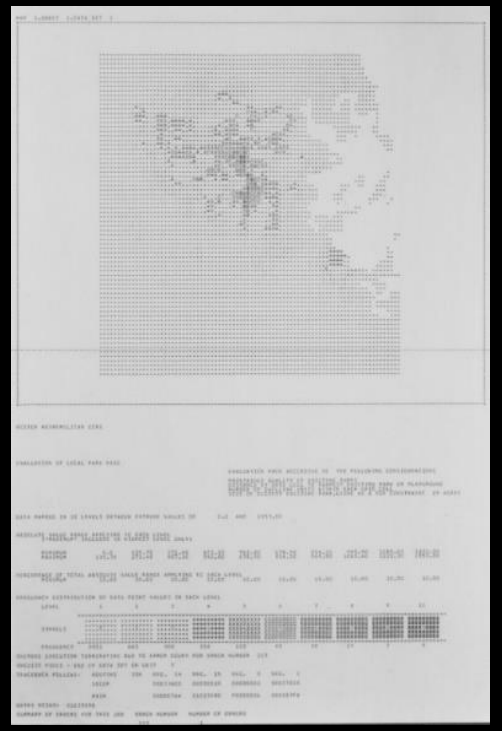
LEVEL	1	2	3	4	5	6	7	8	9	10
SYMBOLS	.	-	+	X	#	@	%	&	$	*
FREQUENCY	3012	659	391	246	238	134	97	122	82	65

IHC900I EXECUTION TERMINATING DUE TO ERROR COUNT FOR ERROR NUMBER 217
IHC217I FIOCS - END OF DATA SET ON UNIT 5
TRACEBACK FOLLOWS- ROUTINE ISN REG. 14 REG. 15 REG. 0 REG. 1
ISCOM 00034A00 00038820 00000001 00034220
MAIN 000007AA 01034090 F0000004 00058770
ENTRY POINT= 01034090
SUMMARY OF ERRORS FOR THIS JOB ERROR NUMBER NUMBER OF ERRORS
217 1

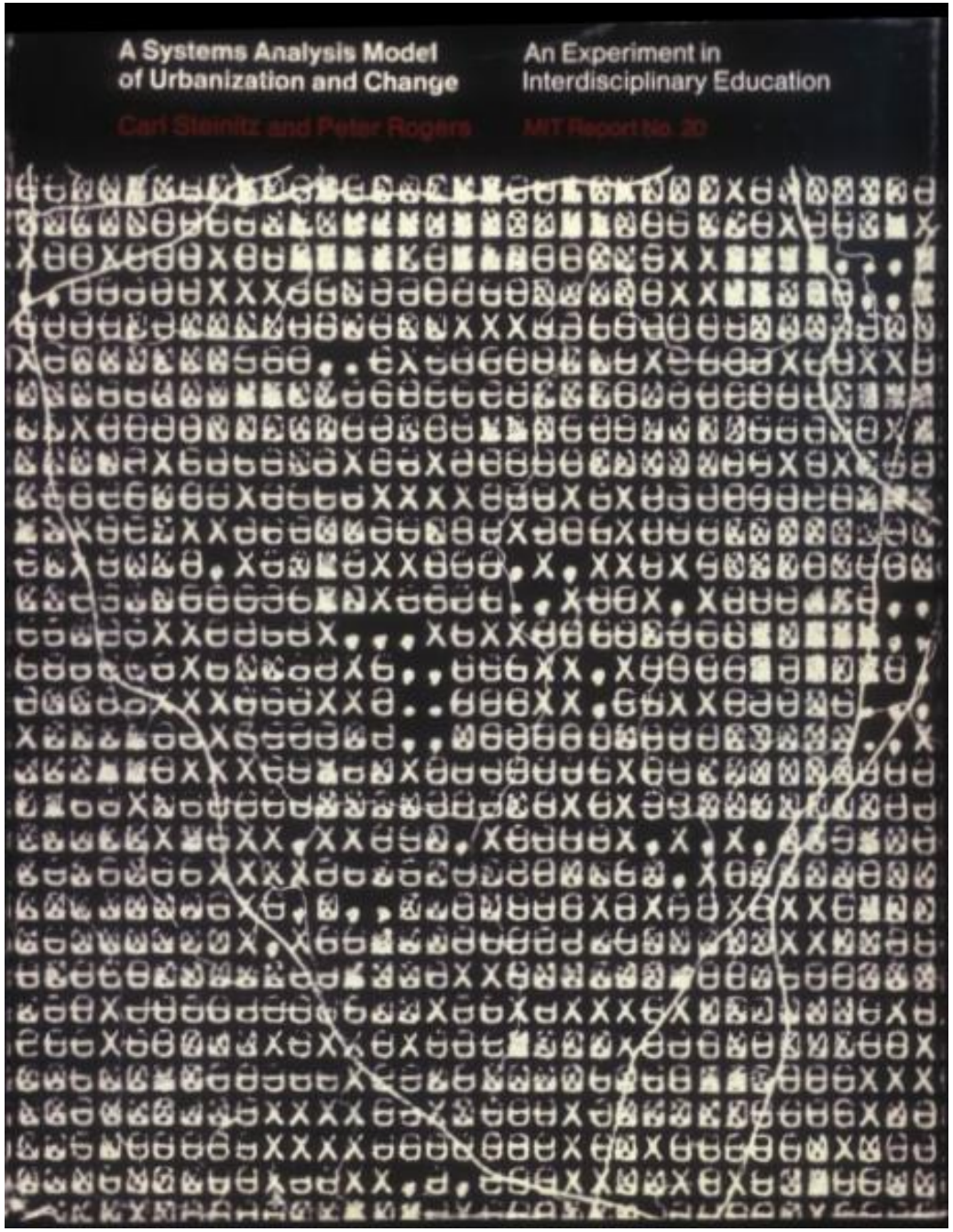



QUESTIONS
RES CON
COOP
RECREATION - OPEN SPACE
VISUAL

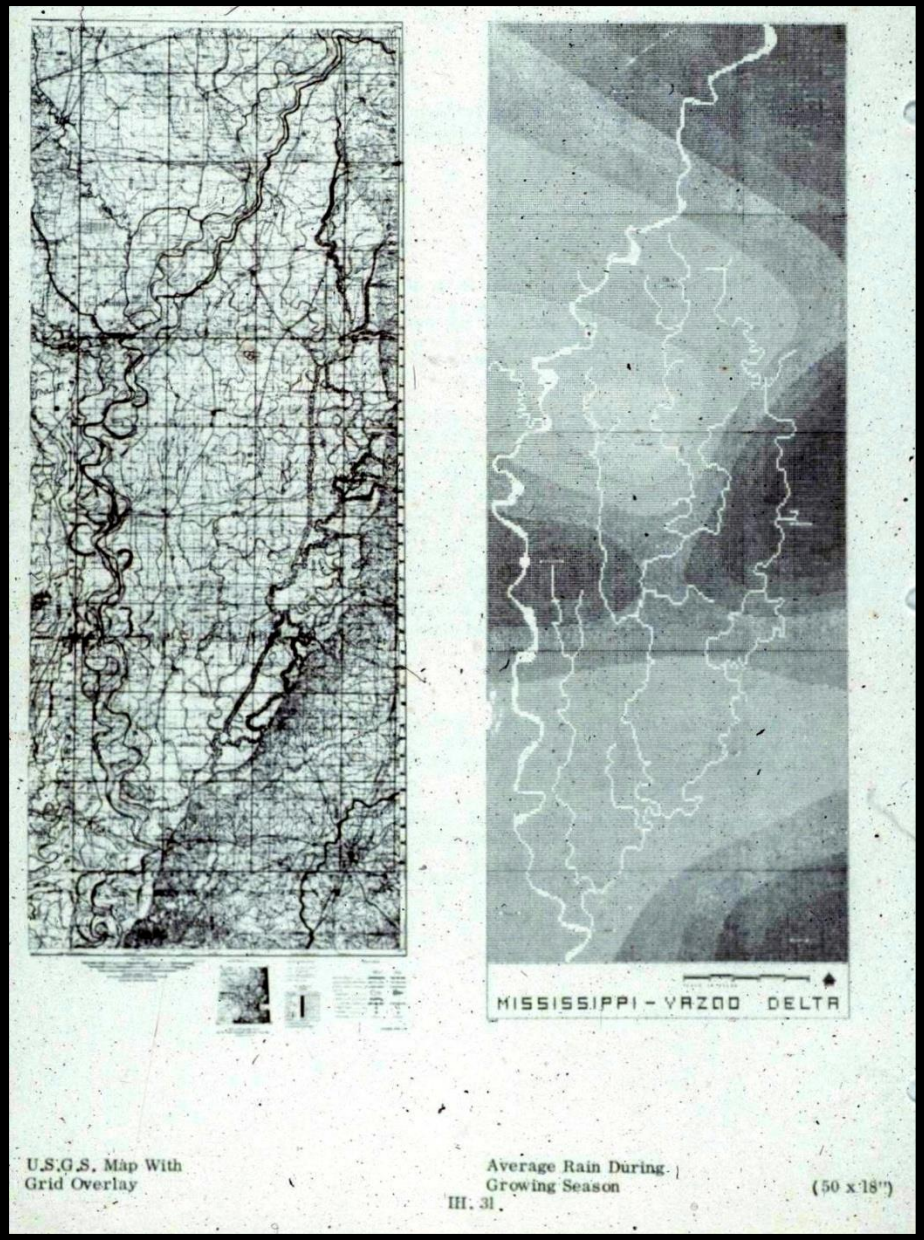

T=0
POPULATION INCREASE
ALLOCATION MODELS
EVALUATION MODELS
IF NO
IF YES
T=+5
IF T>25
IF T≤25
UPDATE DATA




DORCHESTER
HULL



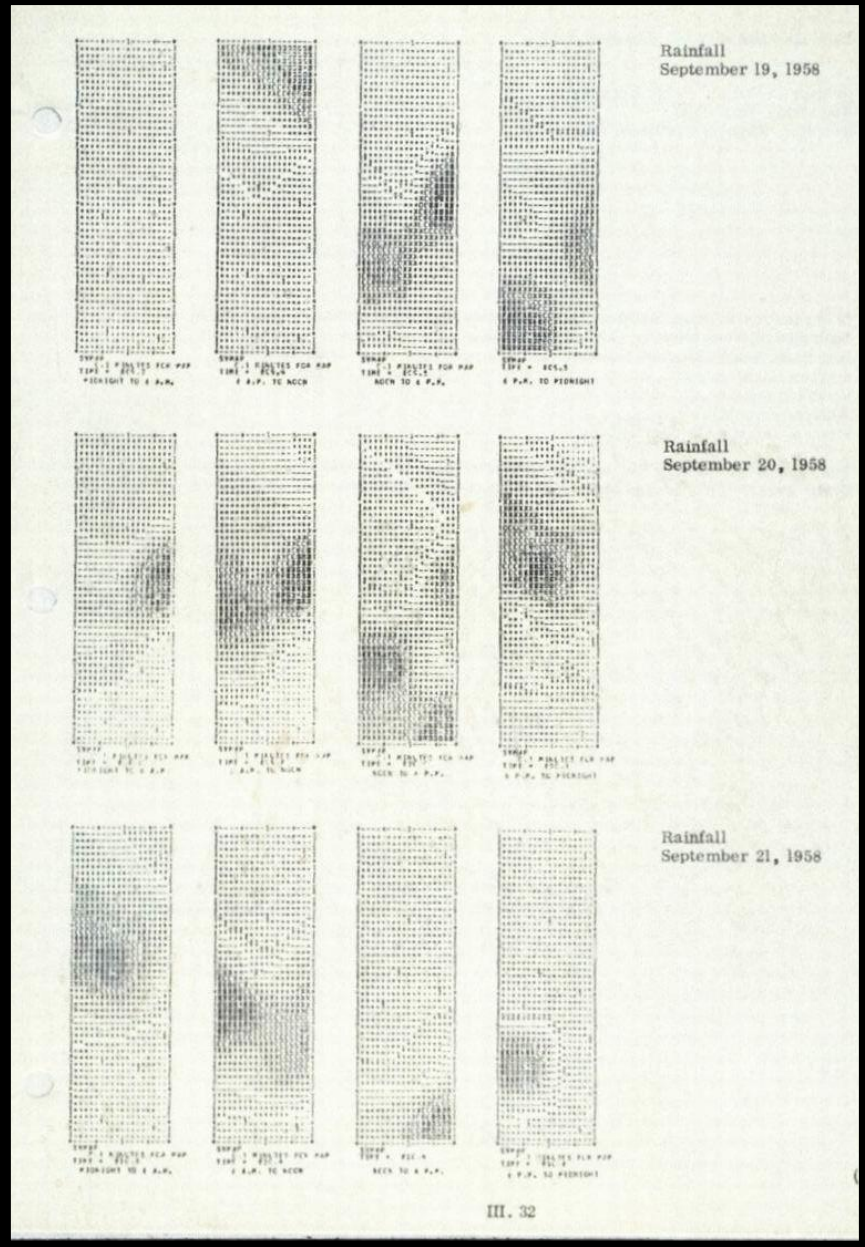
Carl Steinitz and Peter Rogers MIT Press 1969



U.S.G.S. Map With Grid Overlay

Average Rain During Growing Season (50 x 18")

III. 31



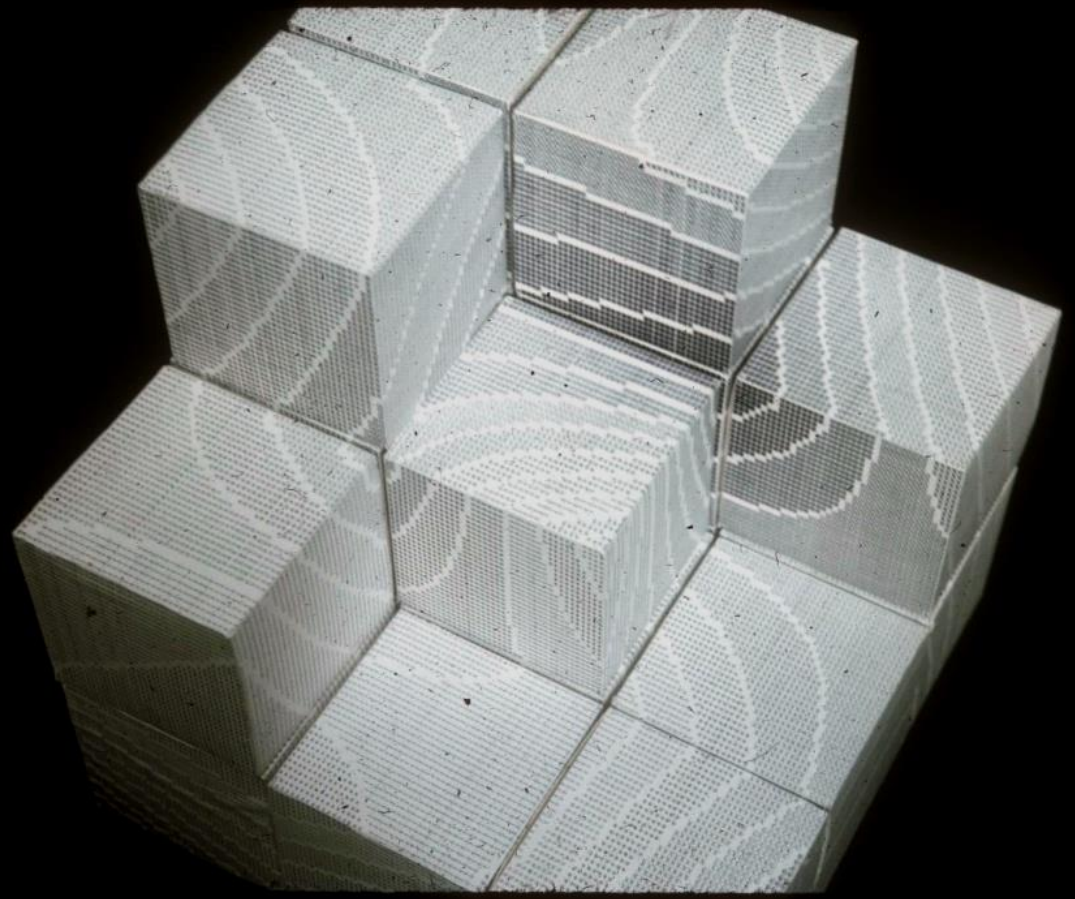
Rainfall September 19, 1958

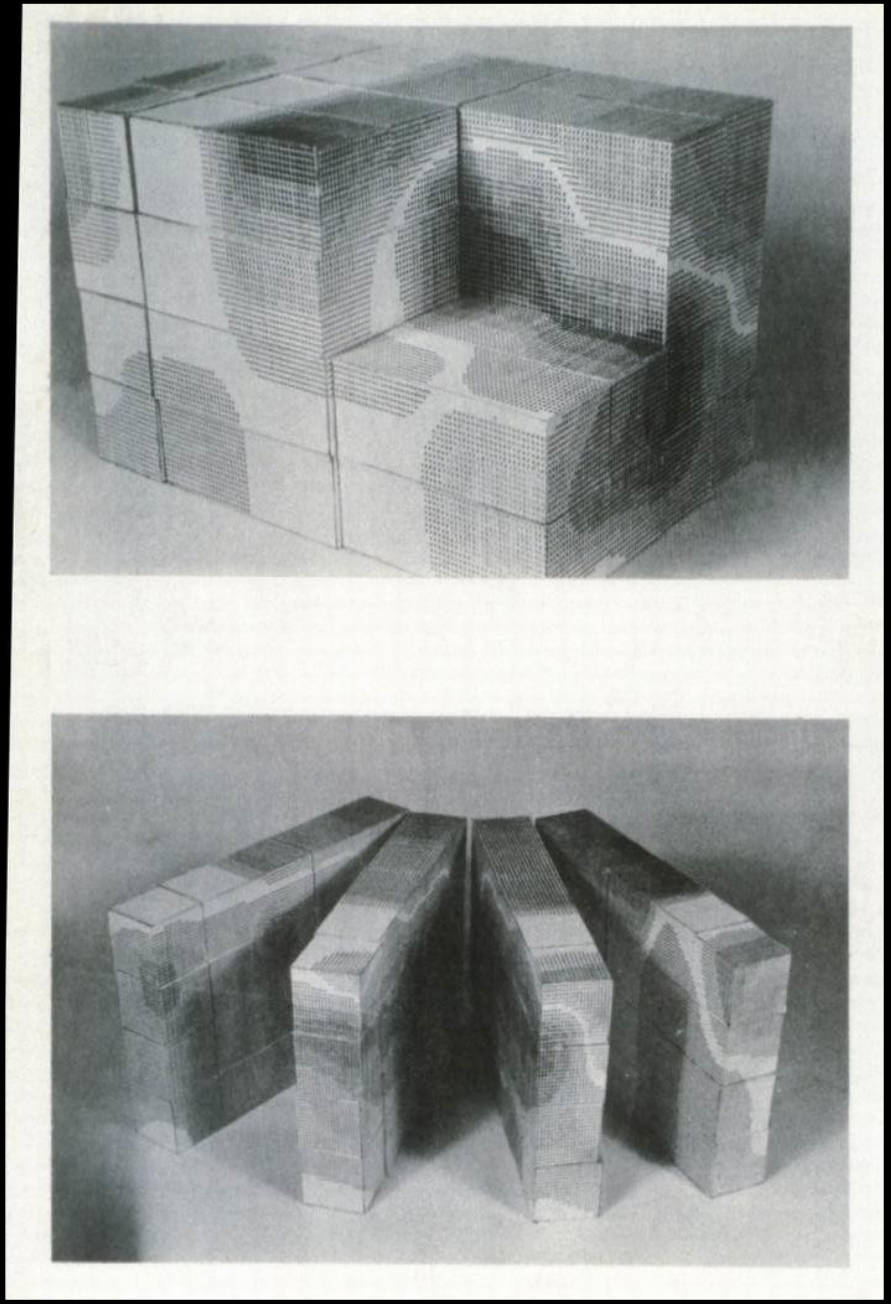
Rainfall September 20, 1958

Rainfall September 21, 1958

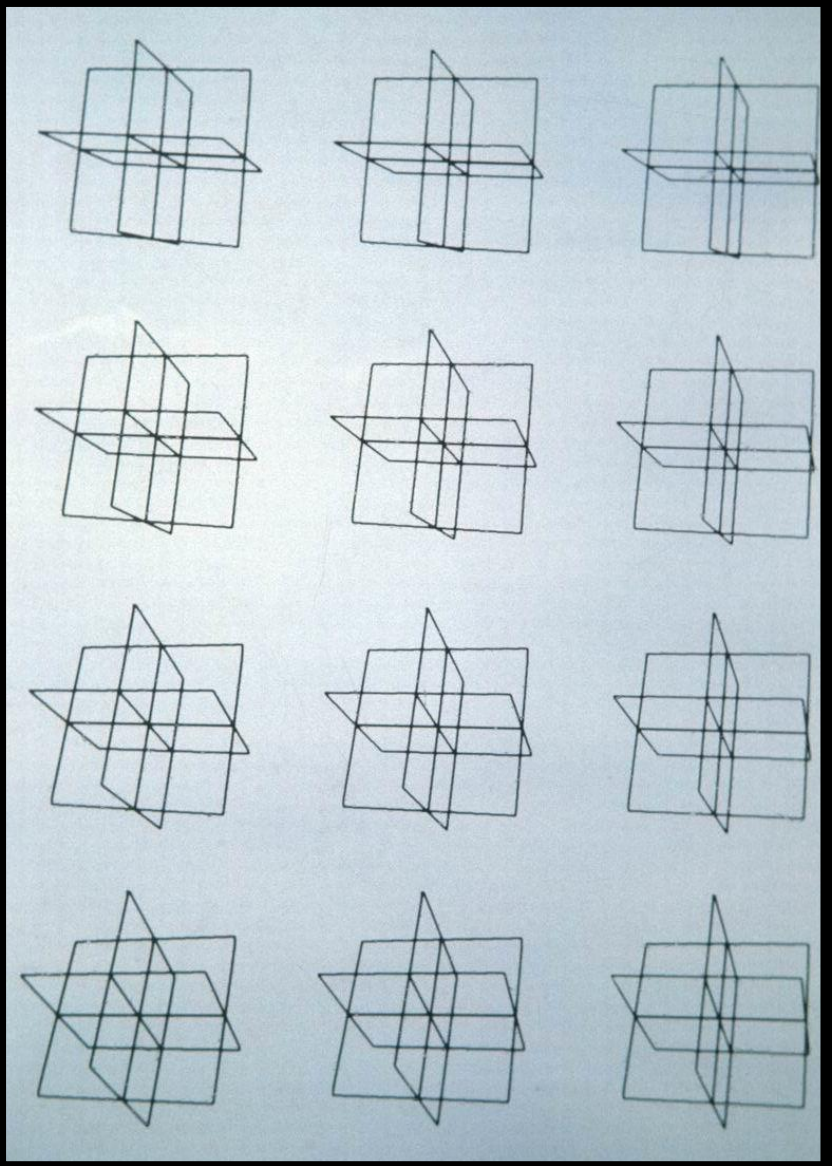
III. 32

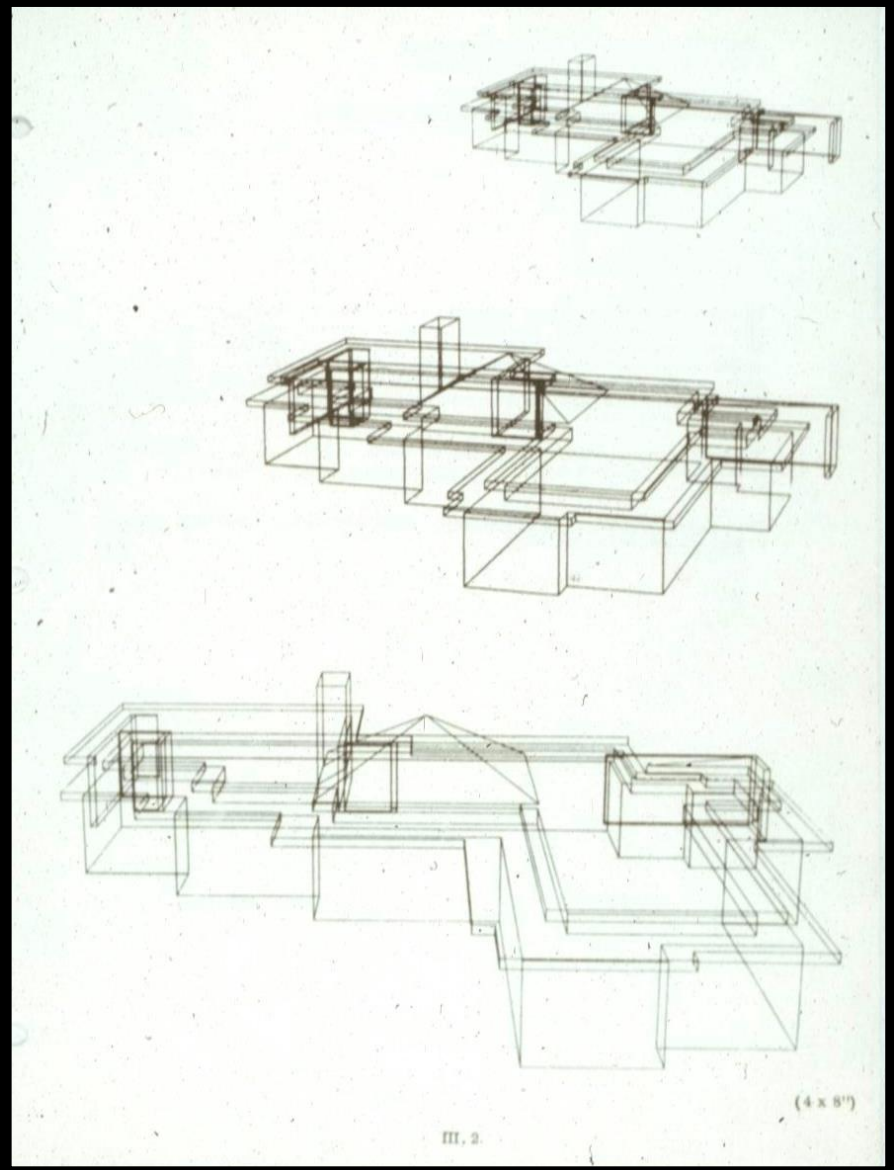
Peter Rogers

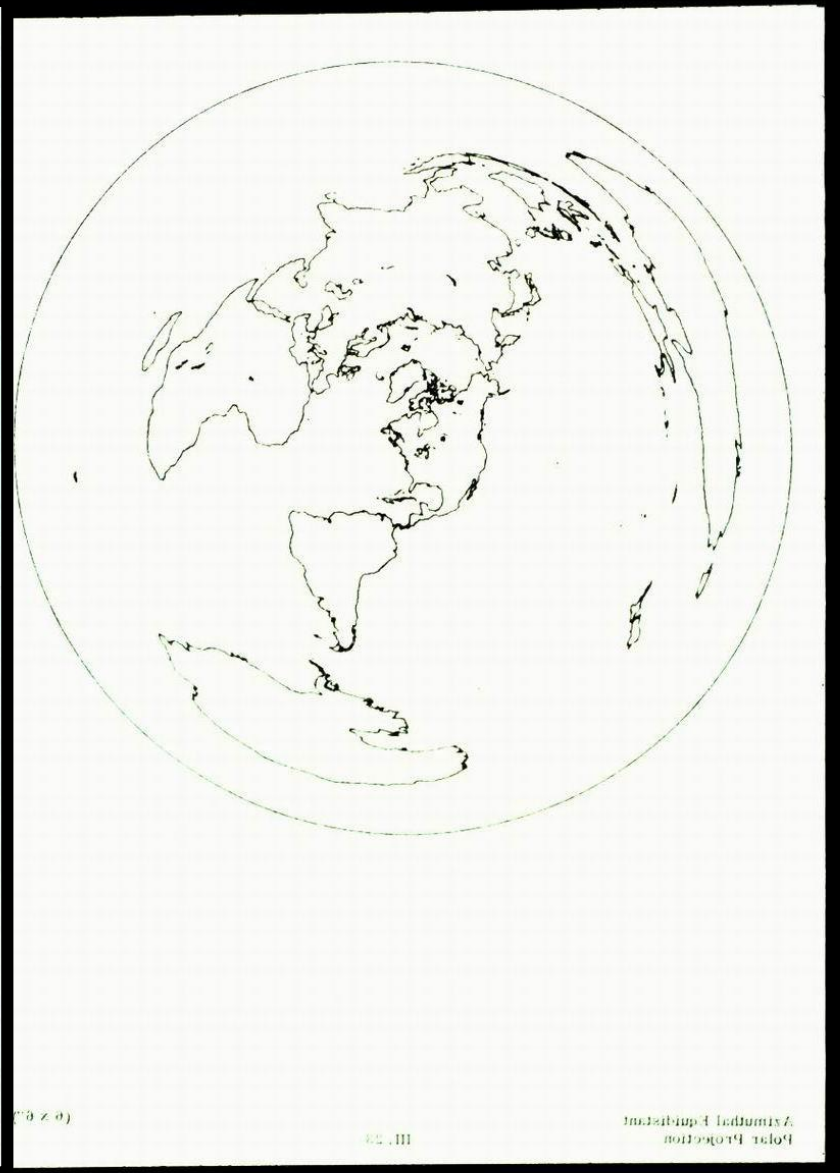




Howard Fisher







Frank Rens SYMVU, 1967

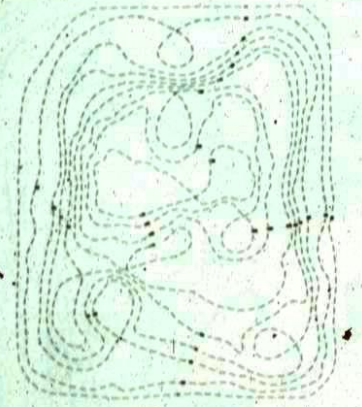


Figure 2: Selected Contours, Chosen to Show, by Their Self-Crossing, The Locations of Passes and Pales

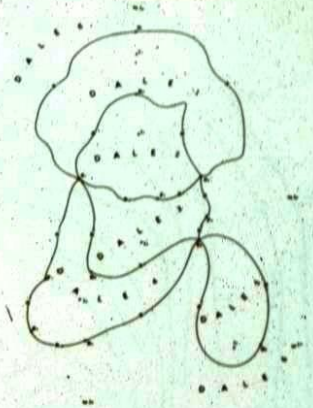


Figure 4: Dales, Defined by Ridge Lines Running From Peak to Peak Through Passes or Pales

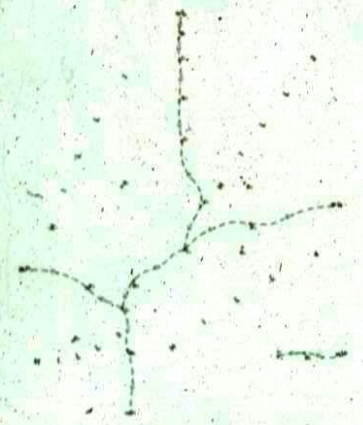


Figure 3: Hills, Defined by Course Lines Running From Pit to Pit Through Passes or Pales

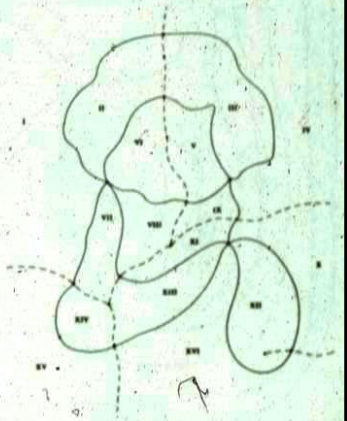


Figure 5: Territories Bounded by Course Lines and Ridge Lines

II. 27

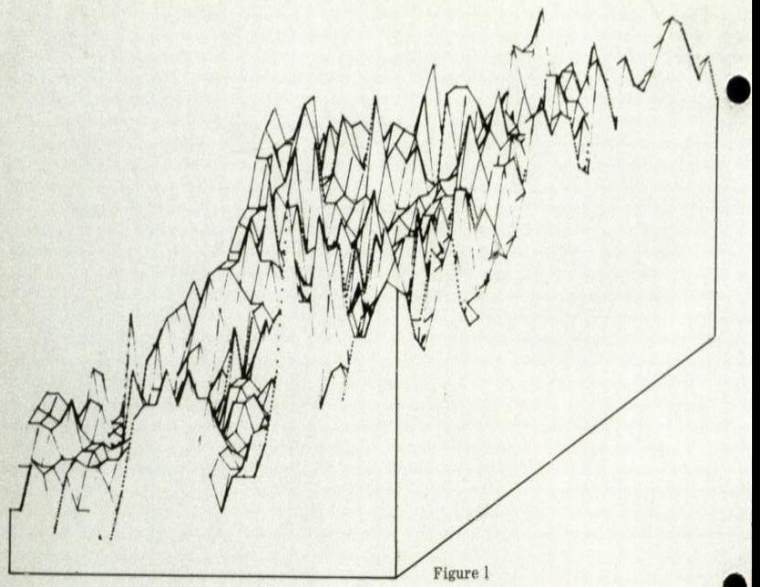


Figure 1

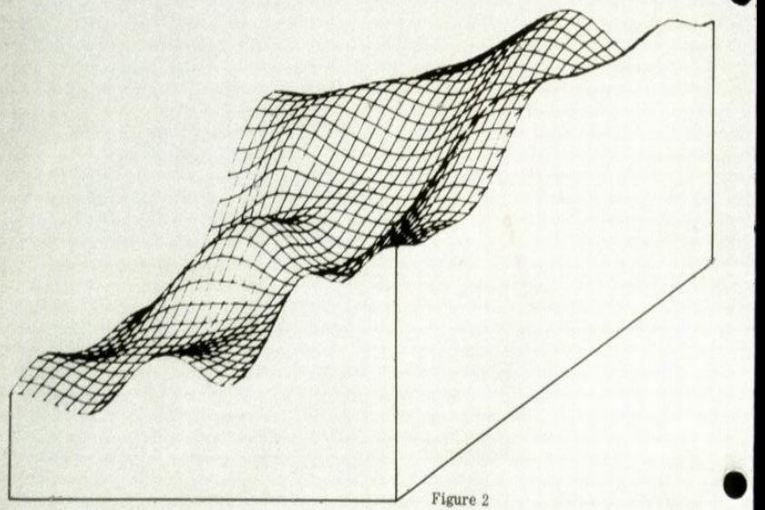
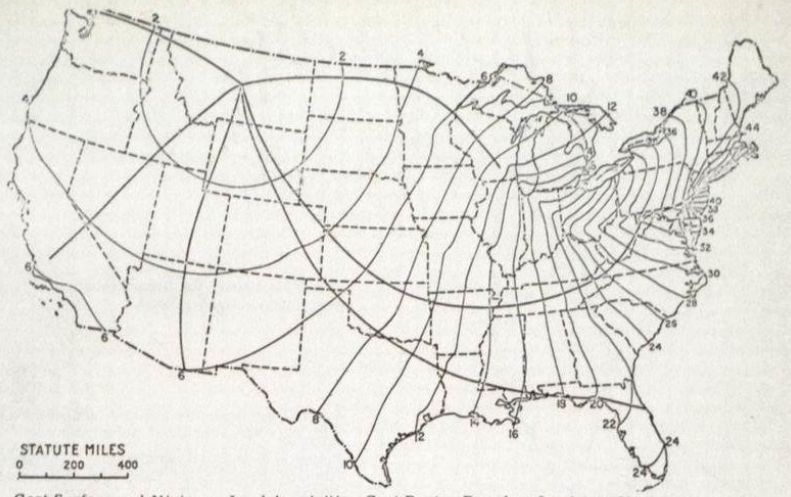
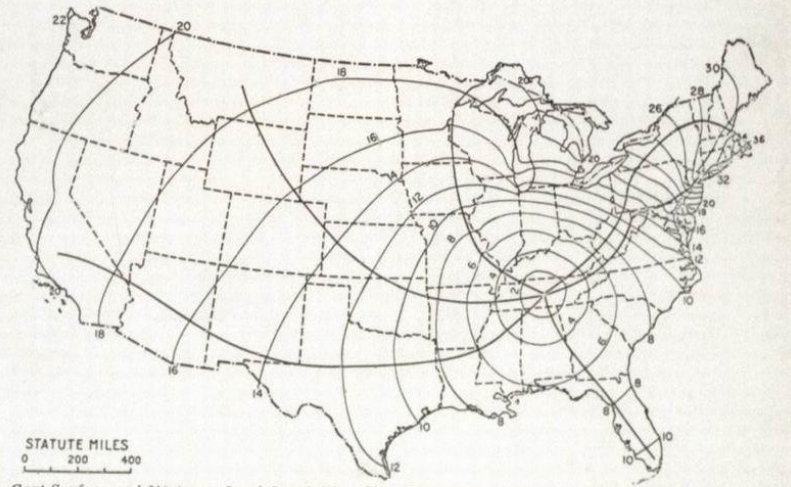


Figure 2



Cost Surface and Minimum Land Acquisition Cost Routes Based on Lewiston, Montana
(In Hundred of Thousands of Dollars)

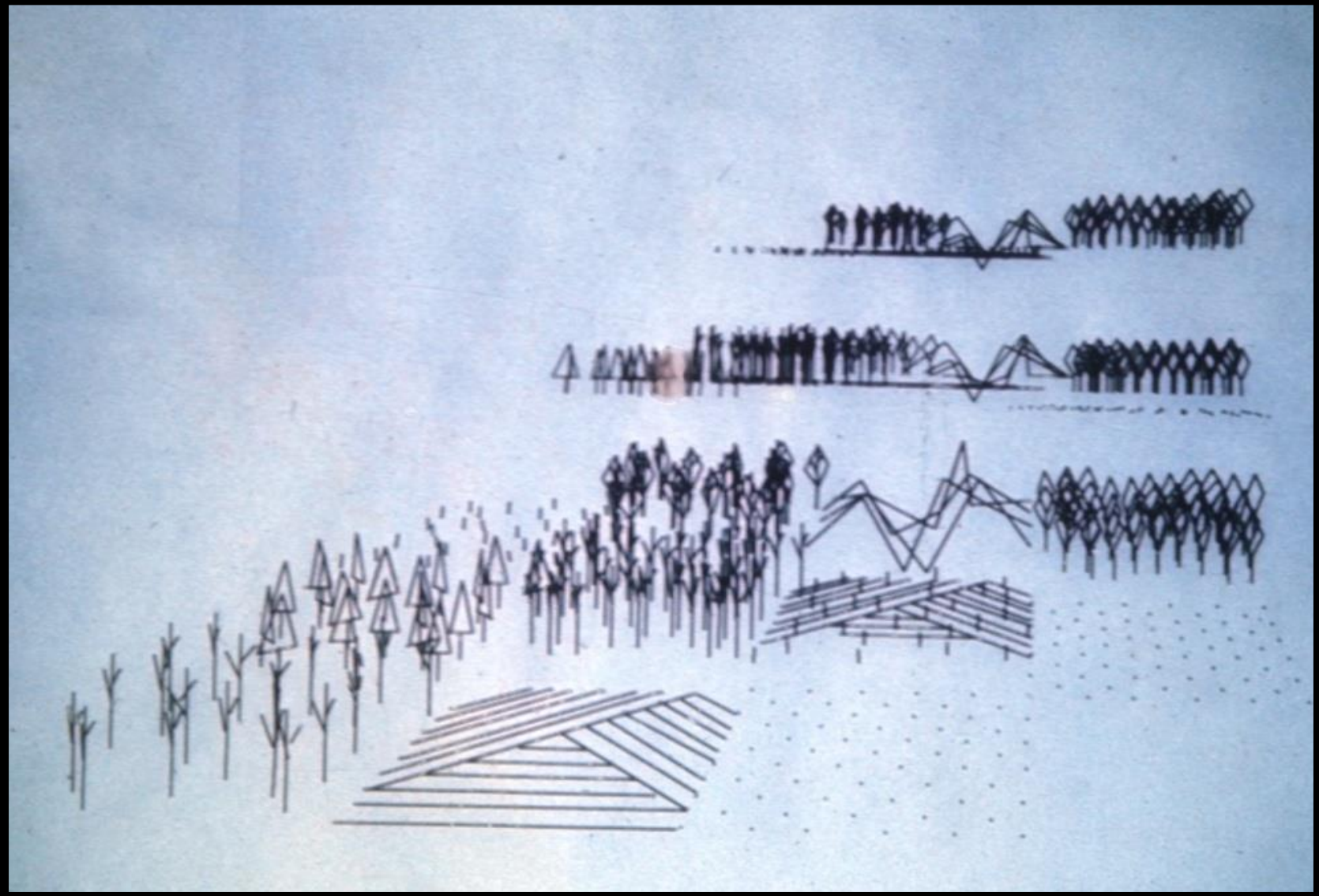


Cost Surface and Minimum Land Acquisition Cost Routes Based on Murfreesboro, Tennessee
(In Hundreds of Thousands of Dollars)

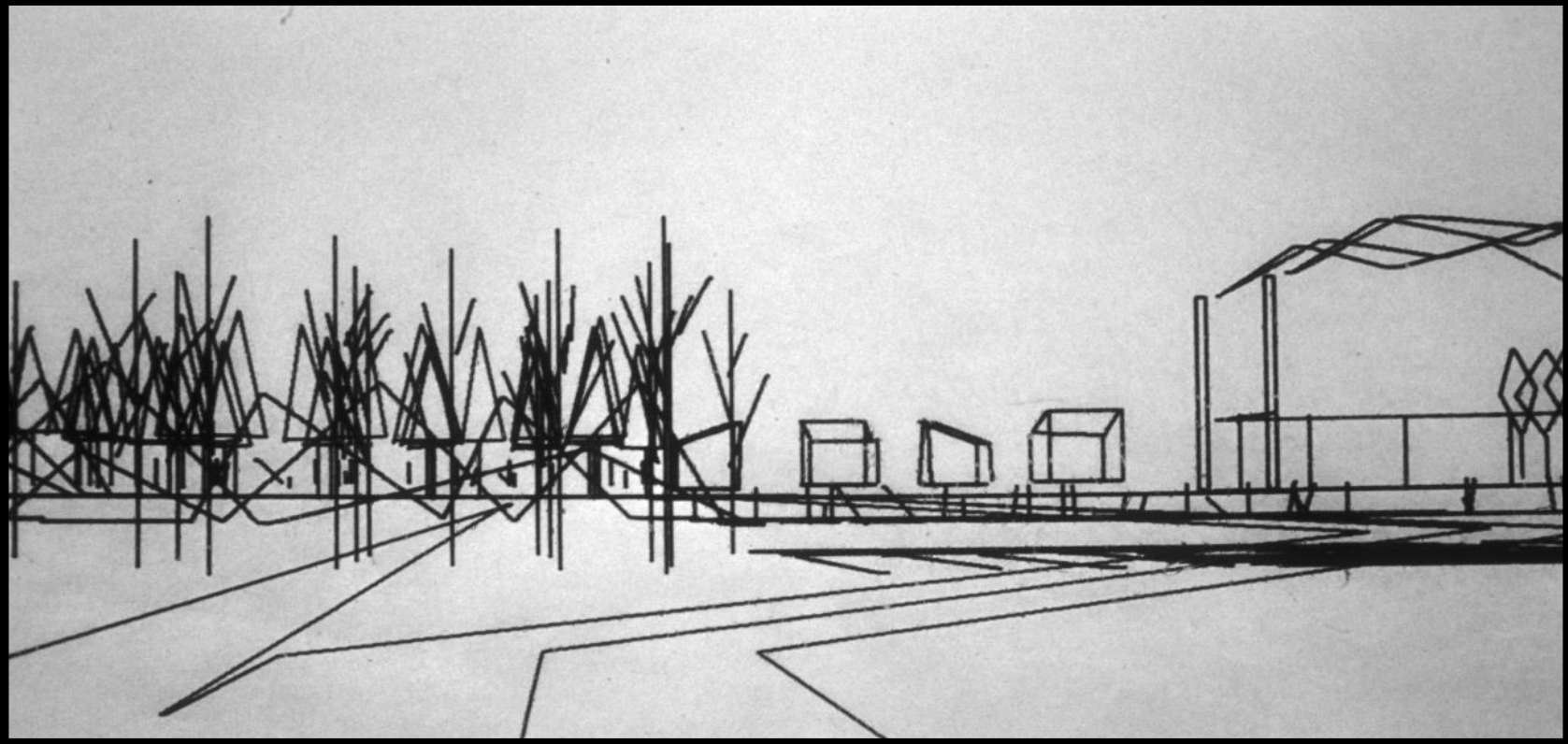
III. 84

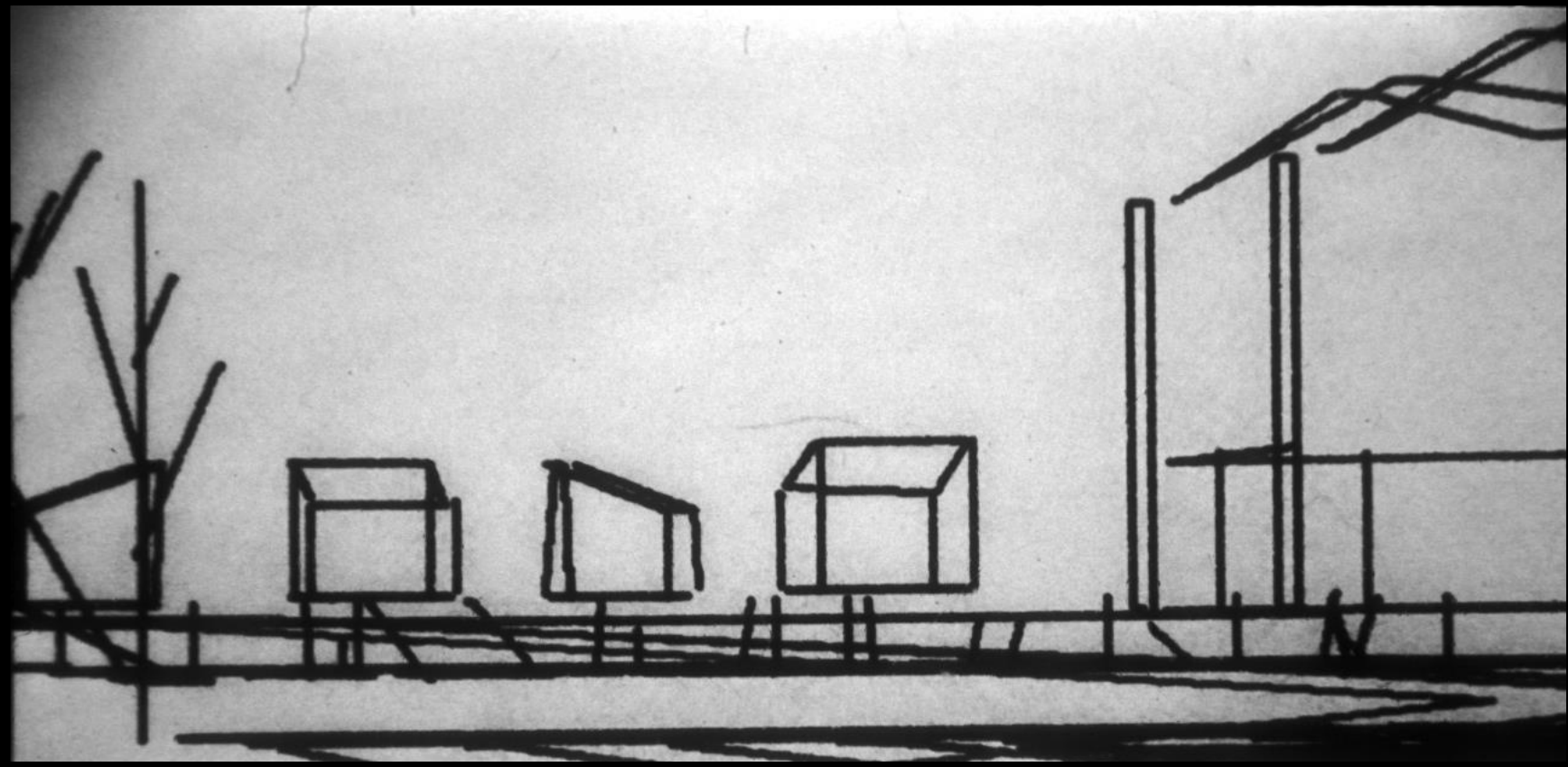
William Warntz

COMPUTER-GENERATED ALLOCATION AND ANIMATION CS

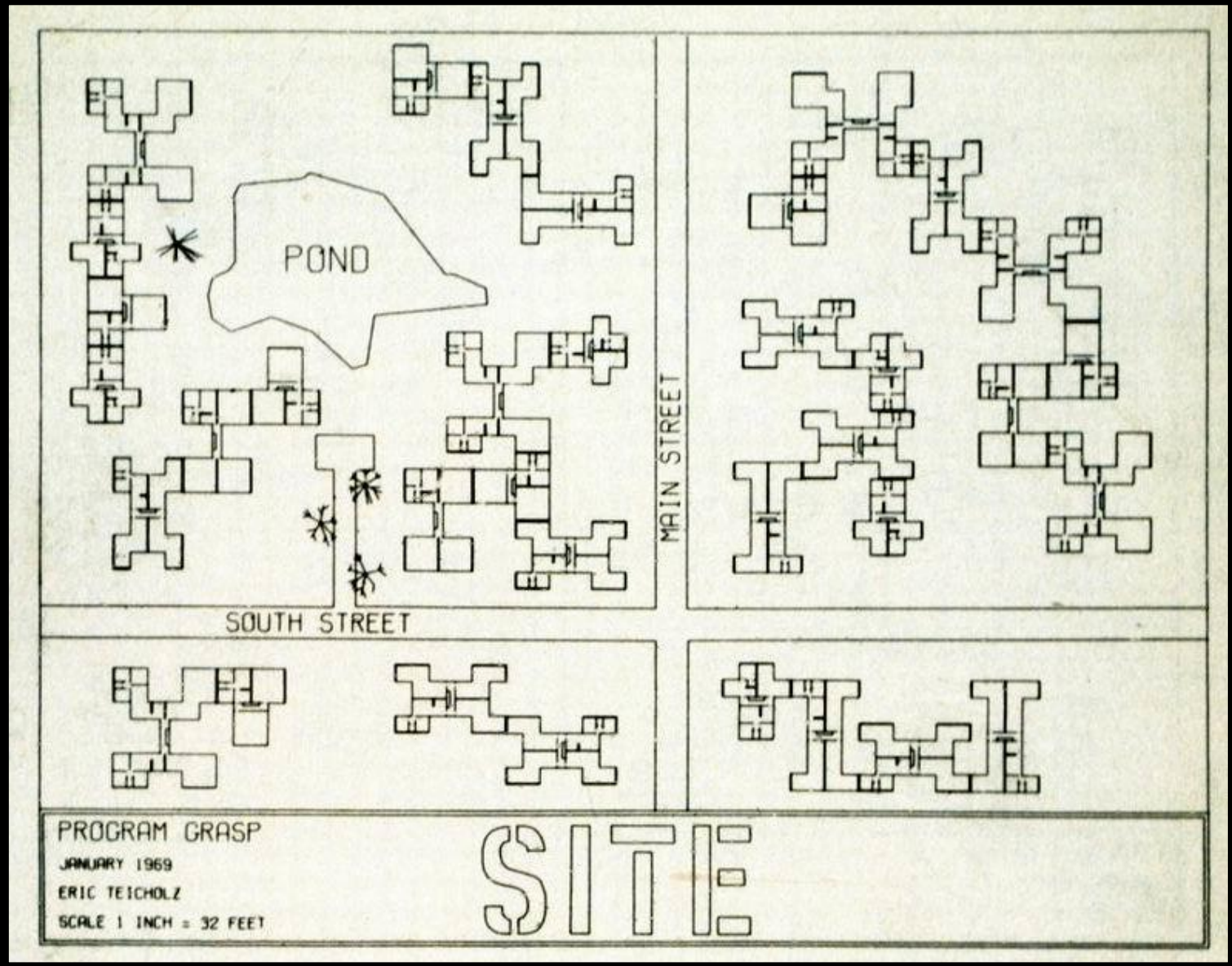


PERSPECTIVES FOR ANIMATION CS



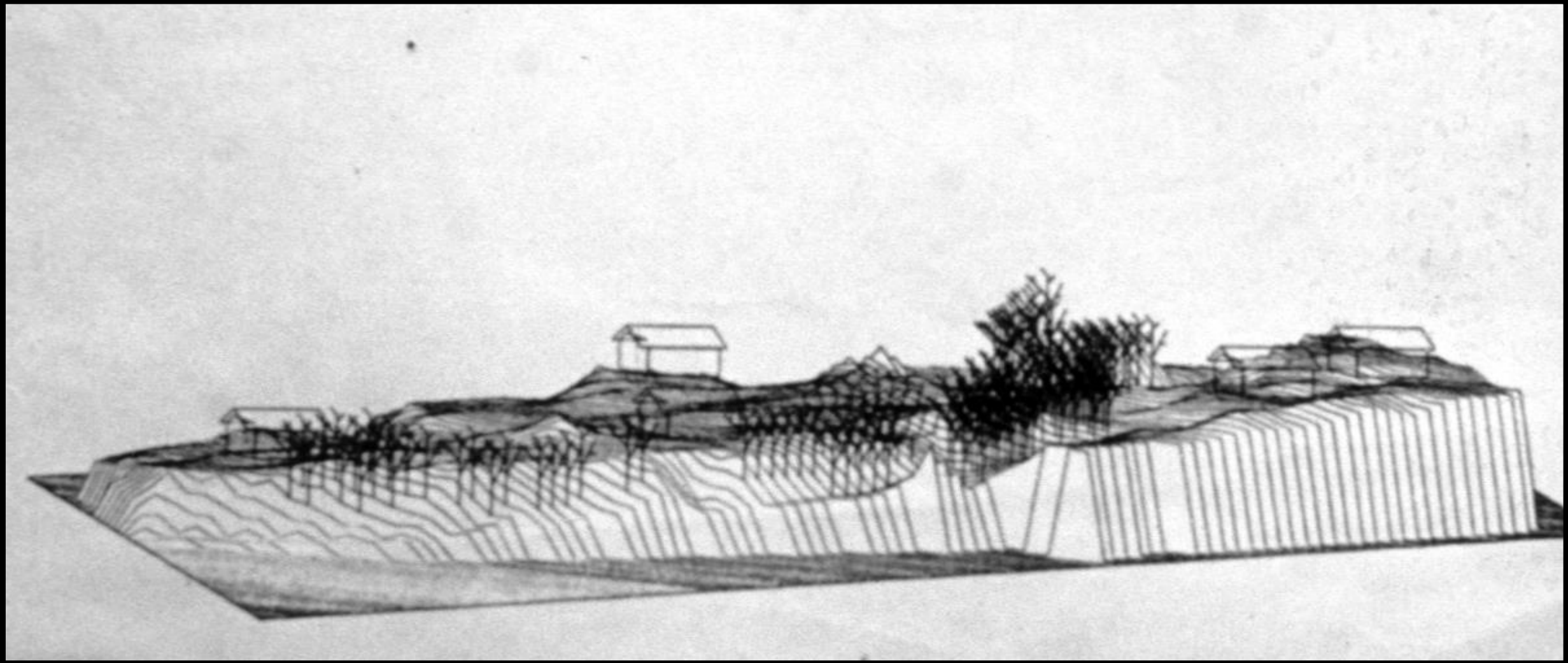


RULE-BASED DESIGN



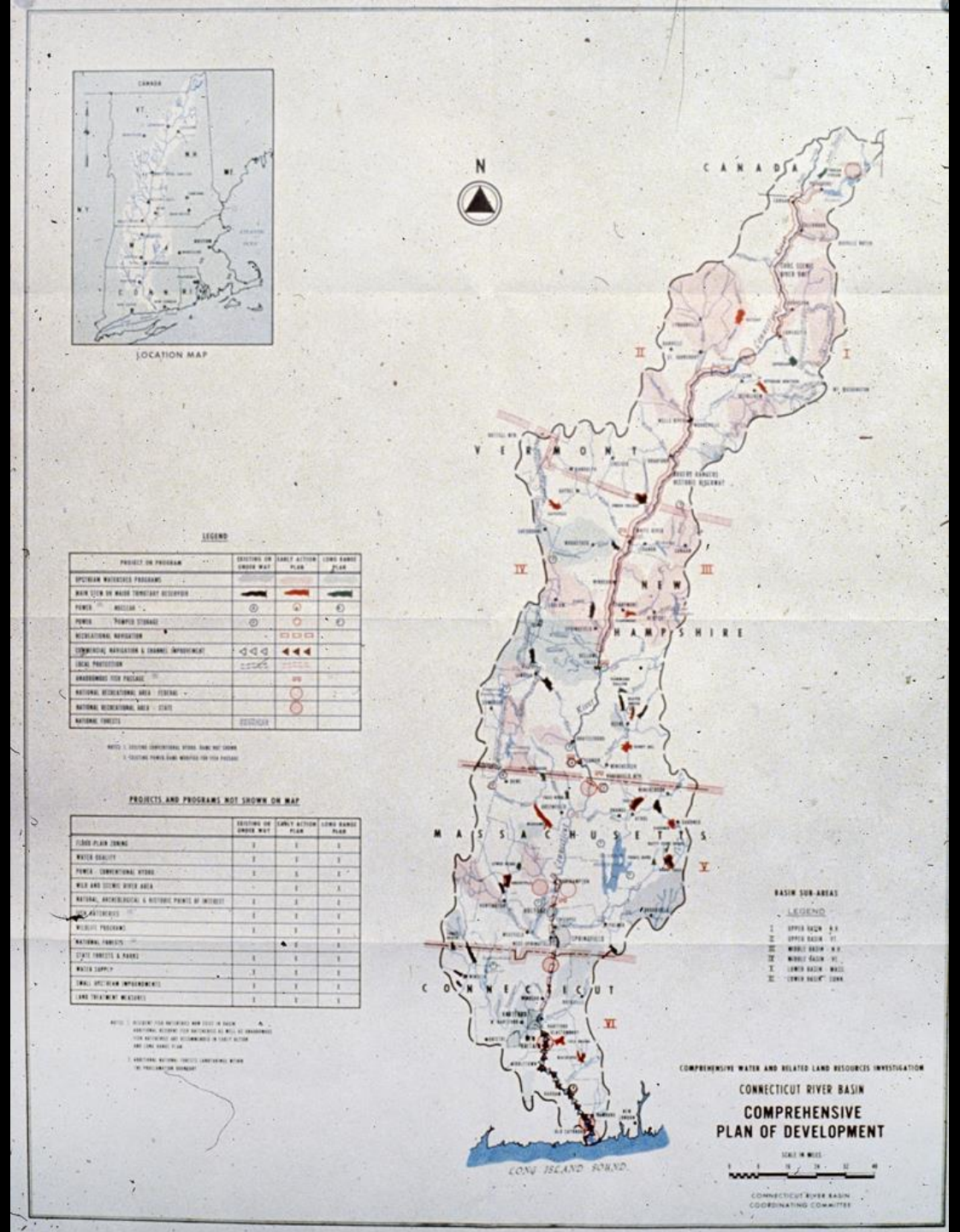
Eric Teicholz with Carl Steinitz

COMPUTER ALLOCATION ON TERRAIN CS



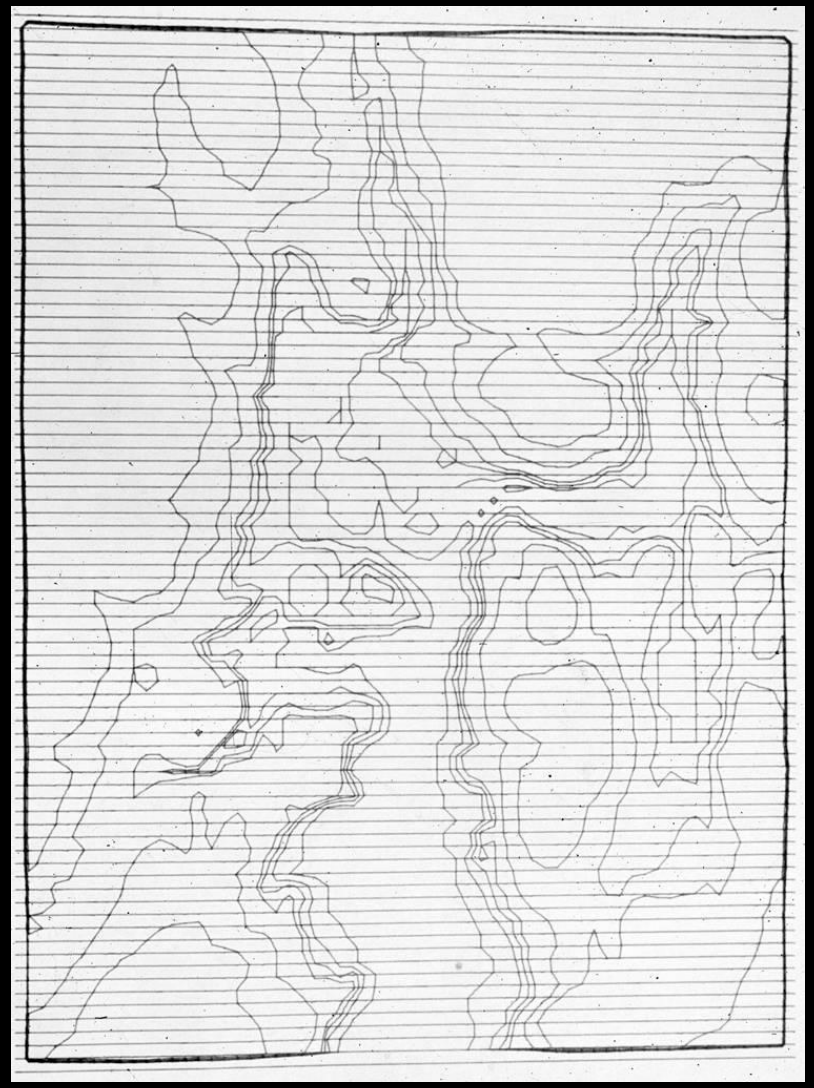
Connecticut River 1956 flood

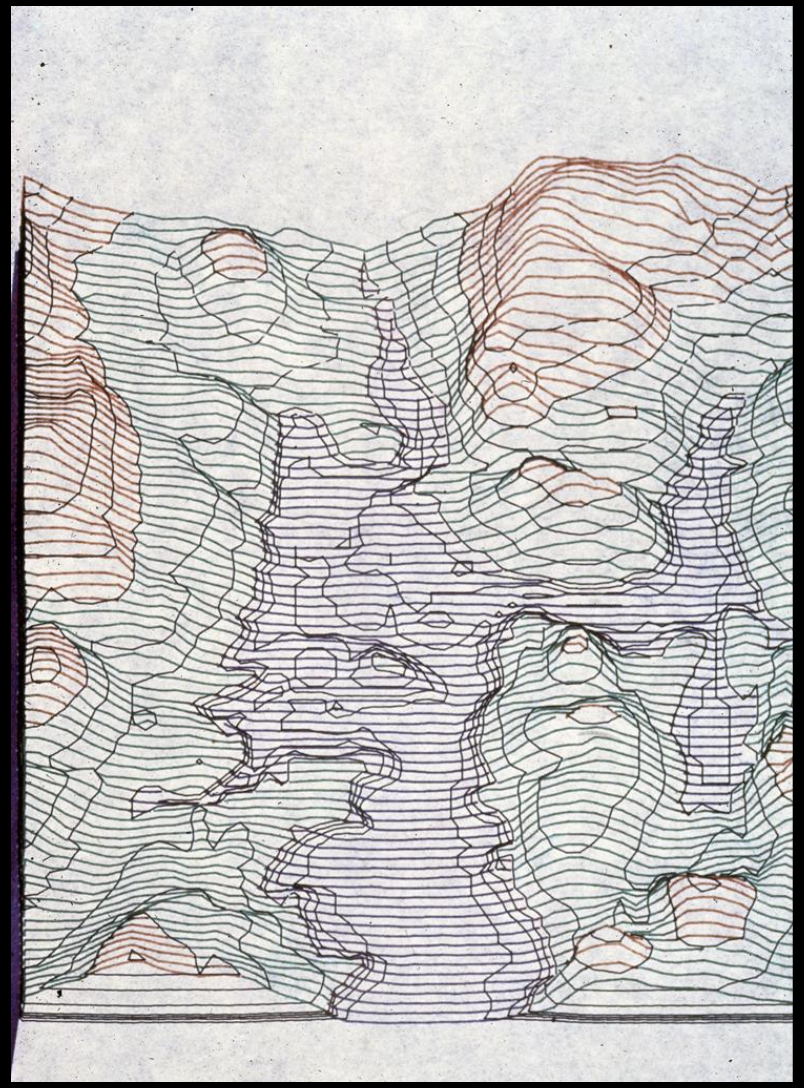
U S Army Corps of Engineers
Connecticut River mitigation plan

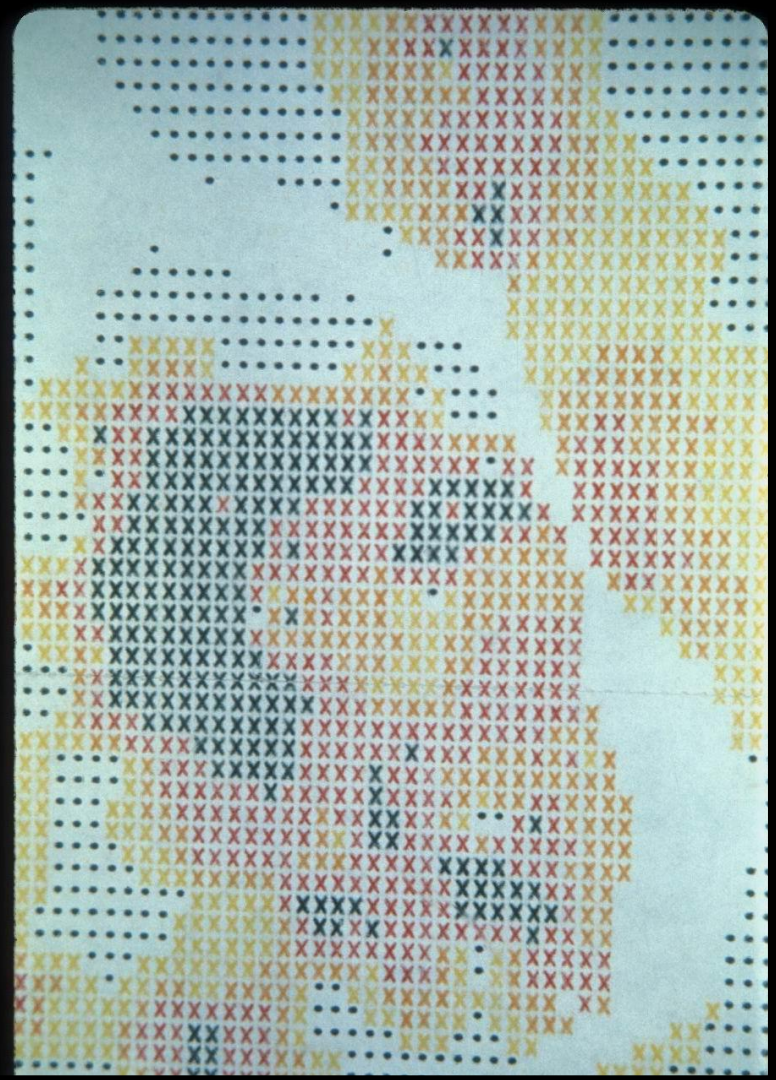


Carl Steinitz, Peter Rogers, Richard Toth, Tim Murray, Douglas Way
U.S.Army Corps of Engineers 1968 - 9

TERRAIN IN PERSPECTIVE, IN COLOR CS

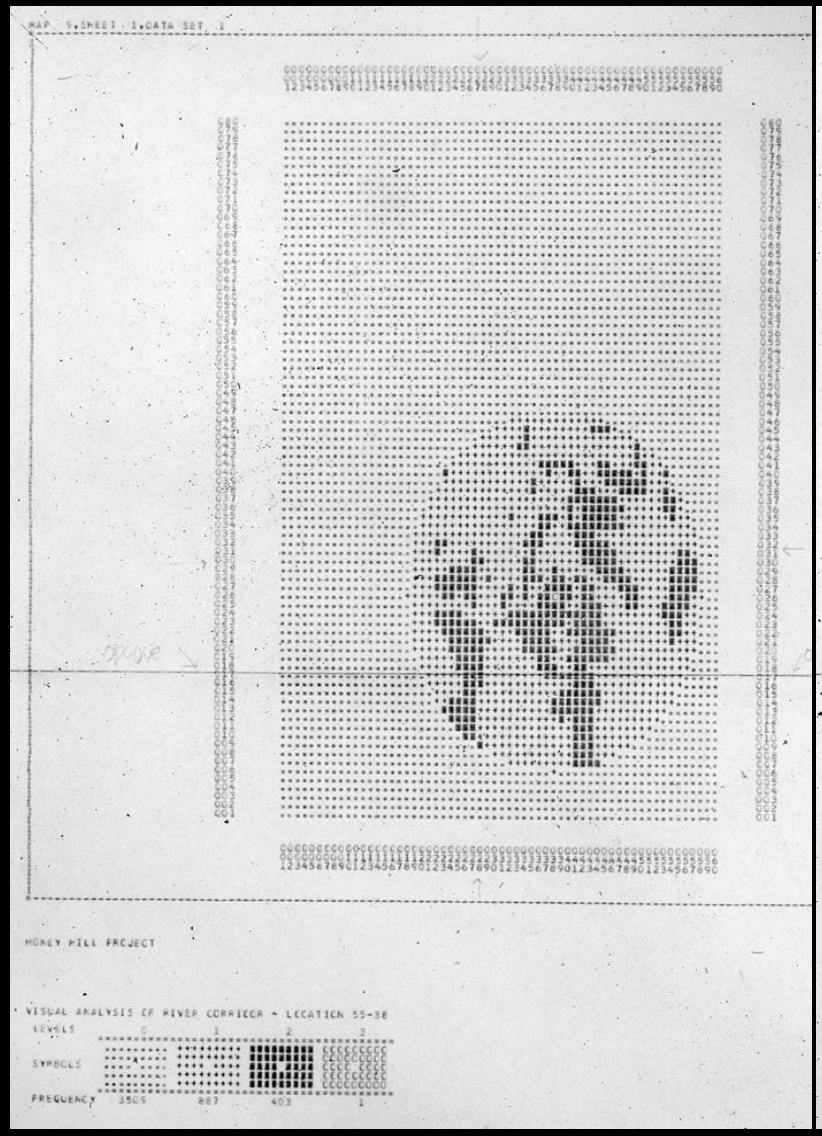


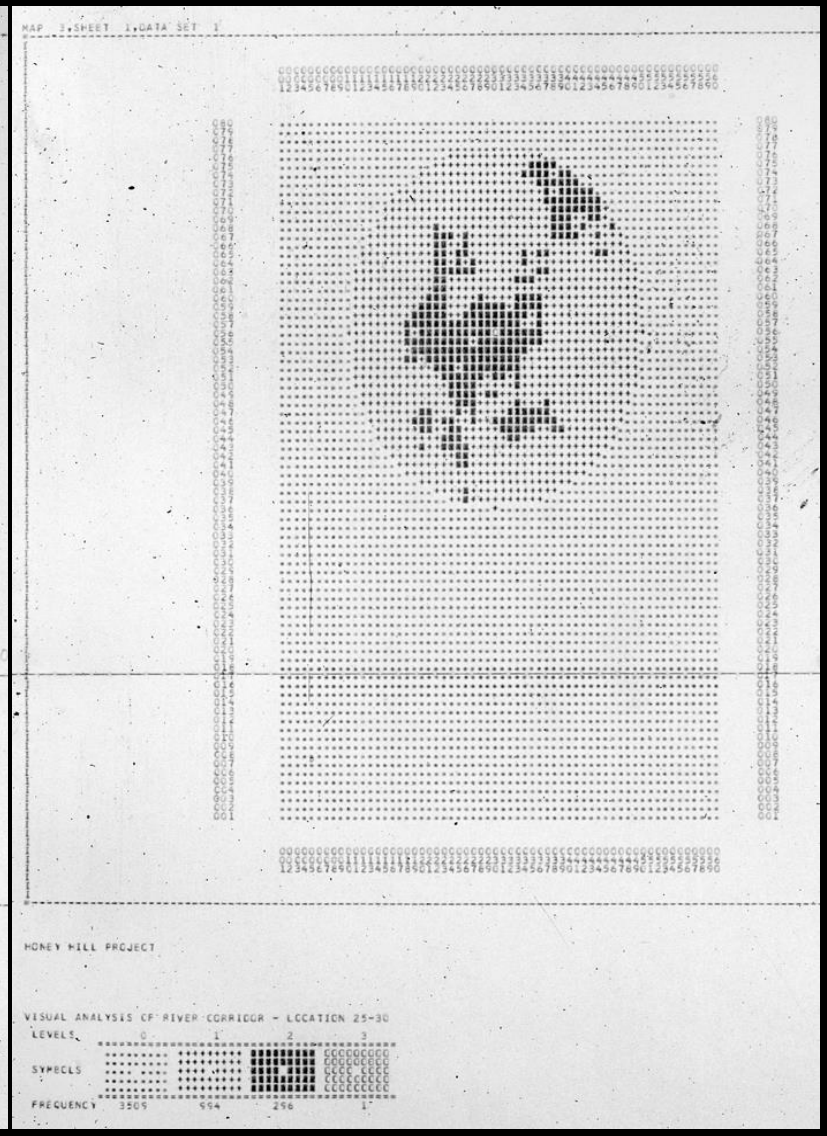


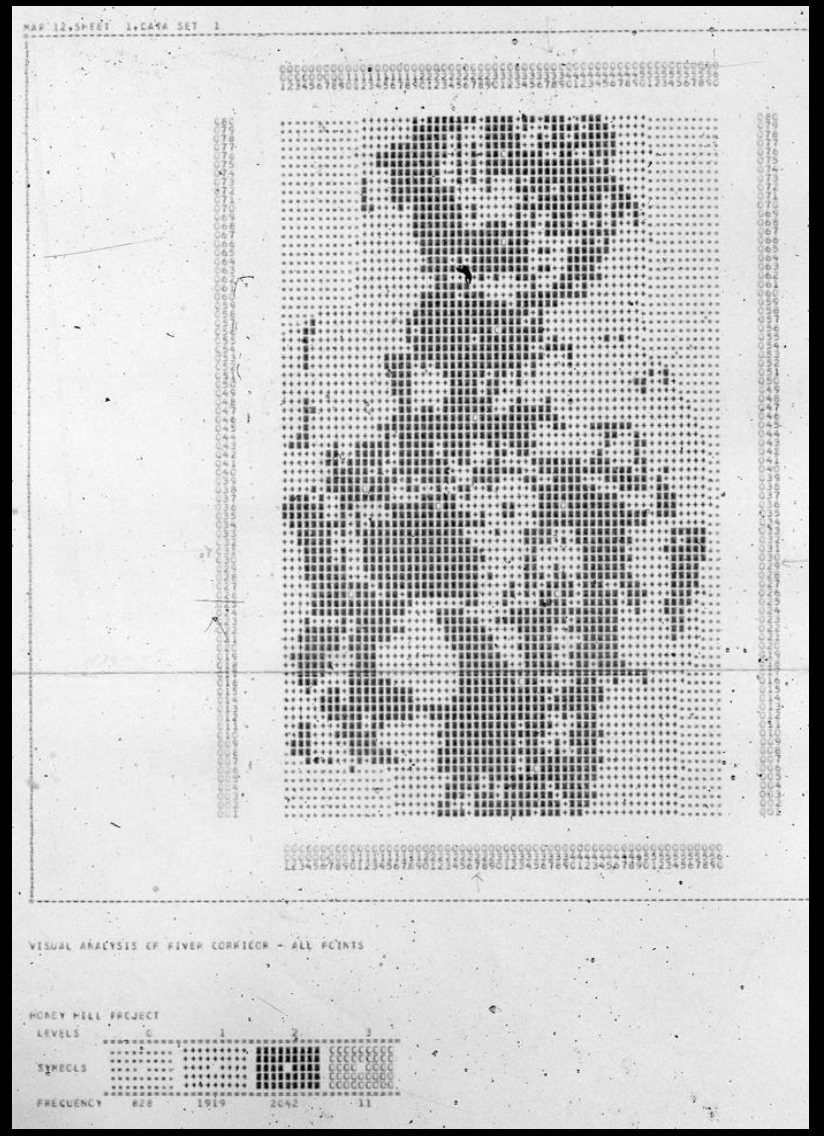


POINTS OF INTER-VISIBILITY ASSESSMENT

SUMMARY CS

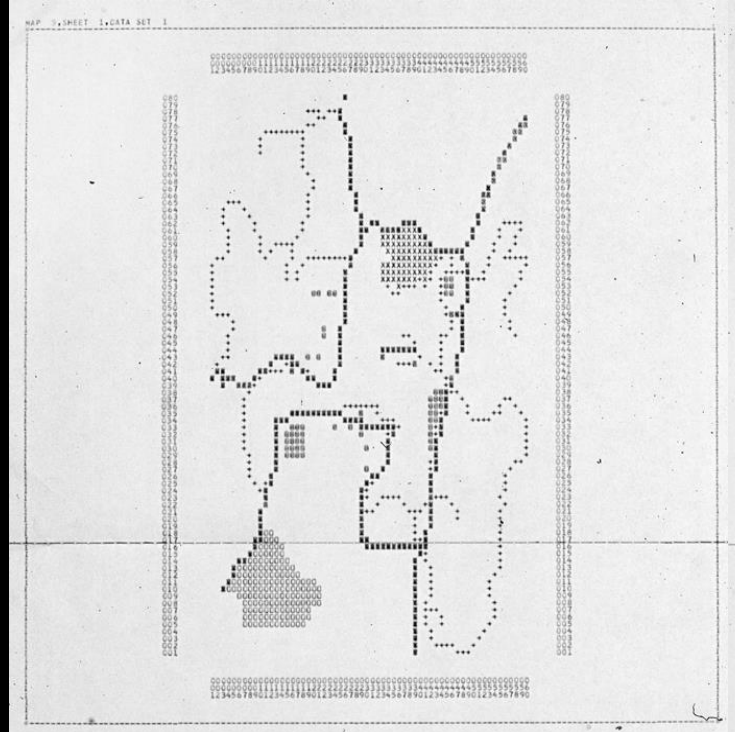


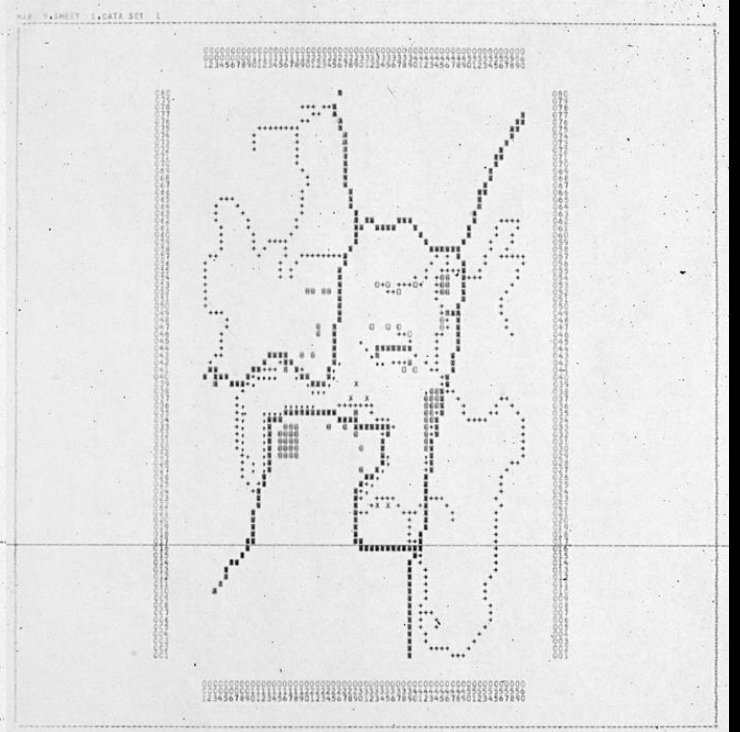




Doug Way Tim Murray Dick Toth Carl Steinitz

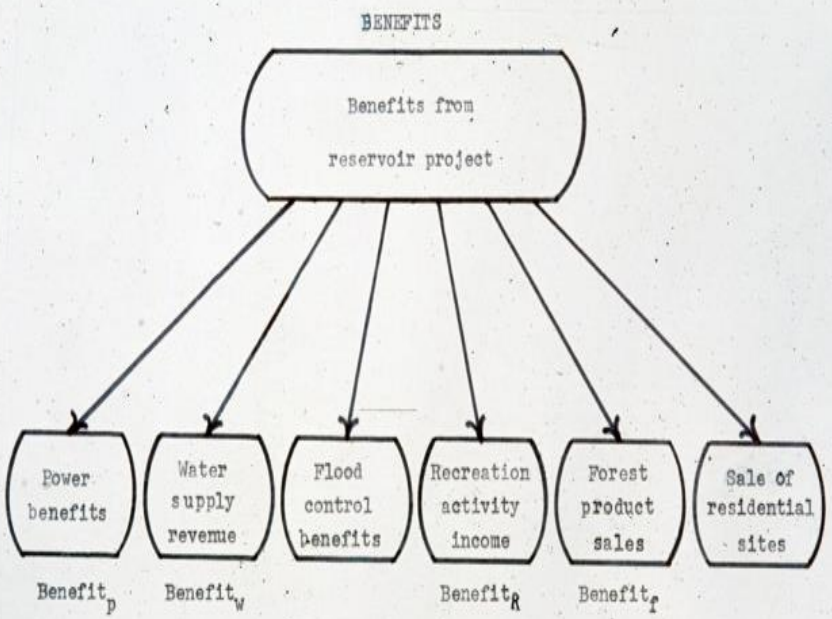
Tim Murray



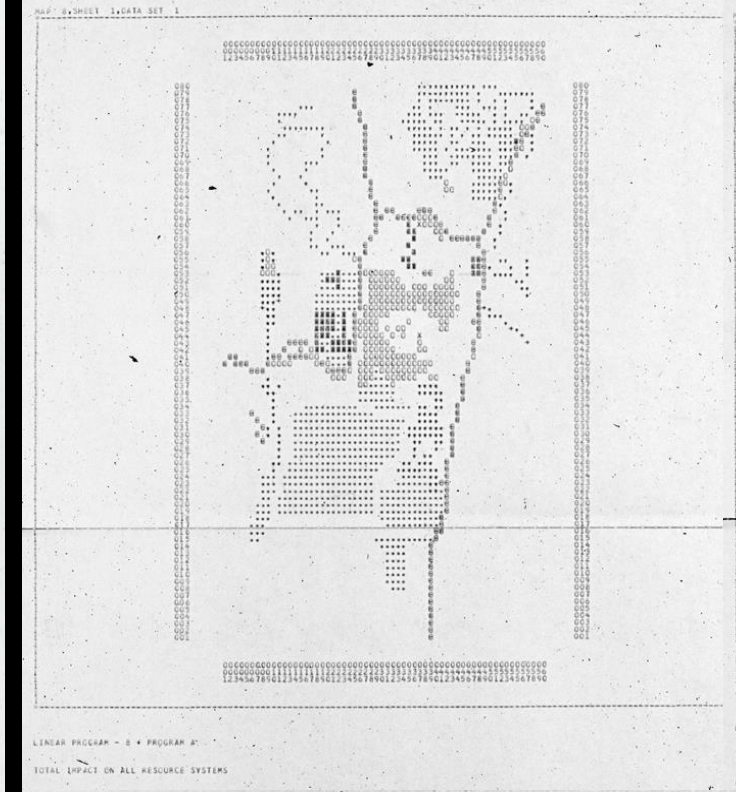


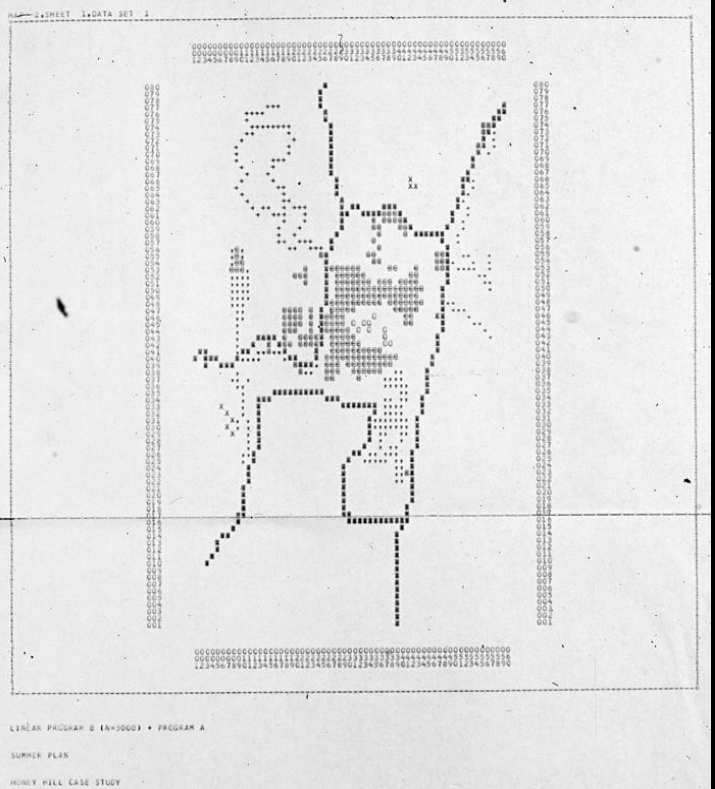
	Initial Plan	+ Impact Evaluations	+ Attractiveness Evaluations	+ Simulation Evaluations
1. SUMMER PLAN				
Attractiveness (mean mean)	36.13	32.22	42.65	44.97
Impact (mean mean)	1.314	1.373	1.298	1.261
No. of people crowded	234	0	0	0
No. of people turned away	1,084	0	0	0
$ local income	69,541	118,814	118,814	118,814
$ regional income	172,211	302,165	302,165	302.165
$ capital cost	19,784,000	17,077,098	19,934,079	20,023,072
$ capital cost w/o res.	1,184,000	1,477,098	1,334,079	1,423,072
2. WINTER PLAN				
Attractiveness (mean mean)	40.11	34.72	47.42	48.63
Impact (mean mean)	1.314	1.373	1.298	1,261
No. of people crowded	234	0	936	0
No. of people turned away	568	0	94	0
$ local income	162,336	200,760	195,613	196.764
$ regional income	430,833	536,698	535,281	538,458
$ capital cost	19,744,078	16,862,013	19,962,032	20,009,072
$ capital cost w/o res.	1,144,078	1,262,013	1,262,032	1,409,072

Figure 2. Benefit components of the reservoir development.

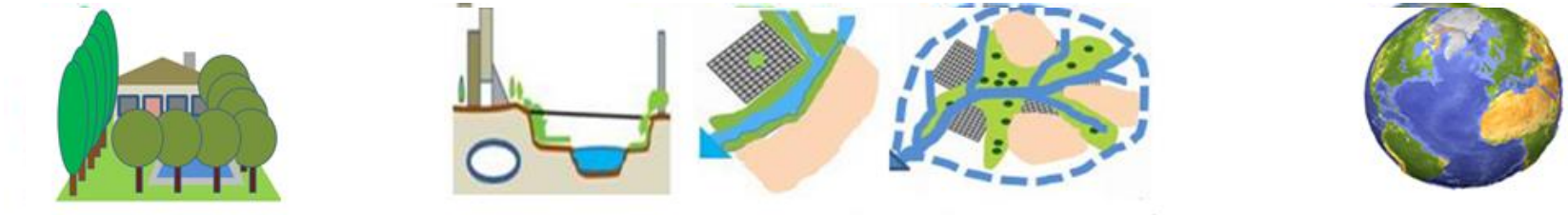


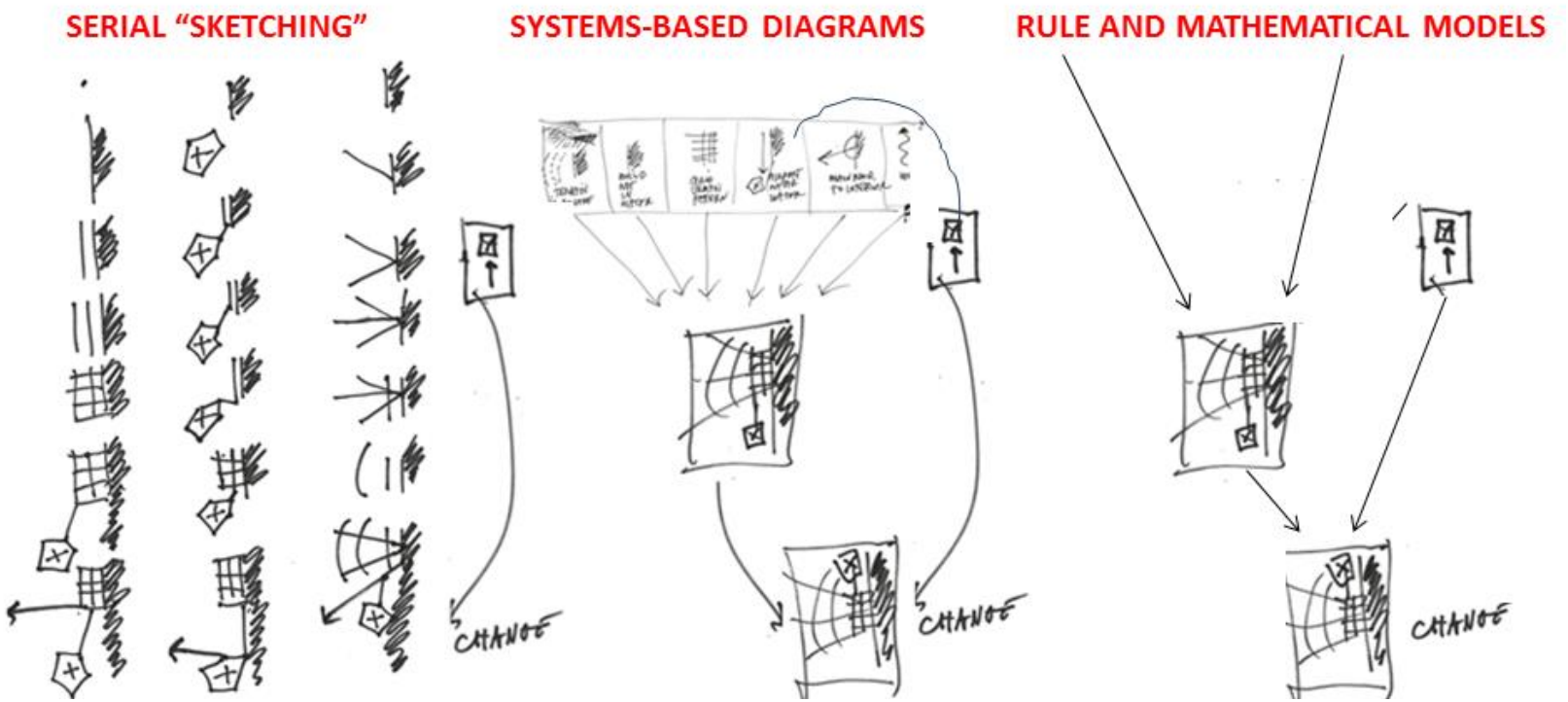
Peter Rogers
Design guided by a linear program





	Initial L. P. Plan	+ Program "B"	+ Simulation Evaluation
1. SUMMER PLAN			
Attractiveness (mean mean)	37.79	41.65	45.41
Impact (mean mean)	1.090	0.706	0.699
No. of people crowded	0	0	0
No. of people turned away	0	0	0
$ local income	97,349	143,661	143,661
$ regional income	266,117	370,744	370,744
$ capital cost	1,657,027	20,013,002	20,084,037
$ capital cost w/o residence	1,657,027	1,413,002	1,484,037
2. WINTER PLAN			
Attractiveness (mean mean)	42.05	62.19	63.34
Impact (mean mean)	1.090	0.706	0.699
No. of people crowded	0	0	0
No. of people turned away	0	0	0
$ local income	207,249	213,162	213,162
$ regional income	559,220	570,926	570,926
$ capital cost	1,635,017	19,935,017	20,182,017
$ capital cost w/o residence	1,635,017	1,335,017	1,582,017





2014 Steinitz, C "Which Way of Designing?", in Lee, Danbi, Dias, Eduardo, Scholten Henk, (Eds.), Geodesign by Integrating Design and Geospatial Sciences, Springer, pp 11 - 43

http://video.esri.com/watch/4162/experiments-in-geodesign-synthesis

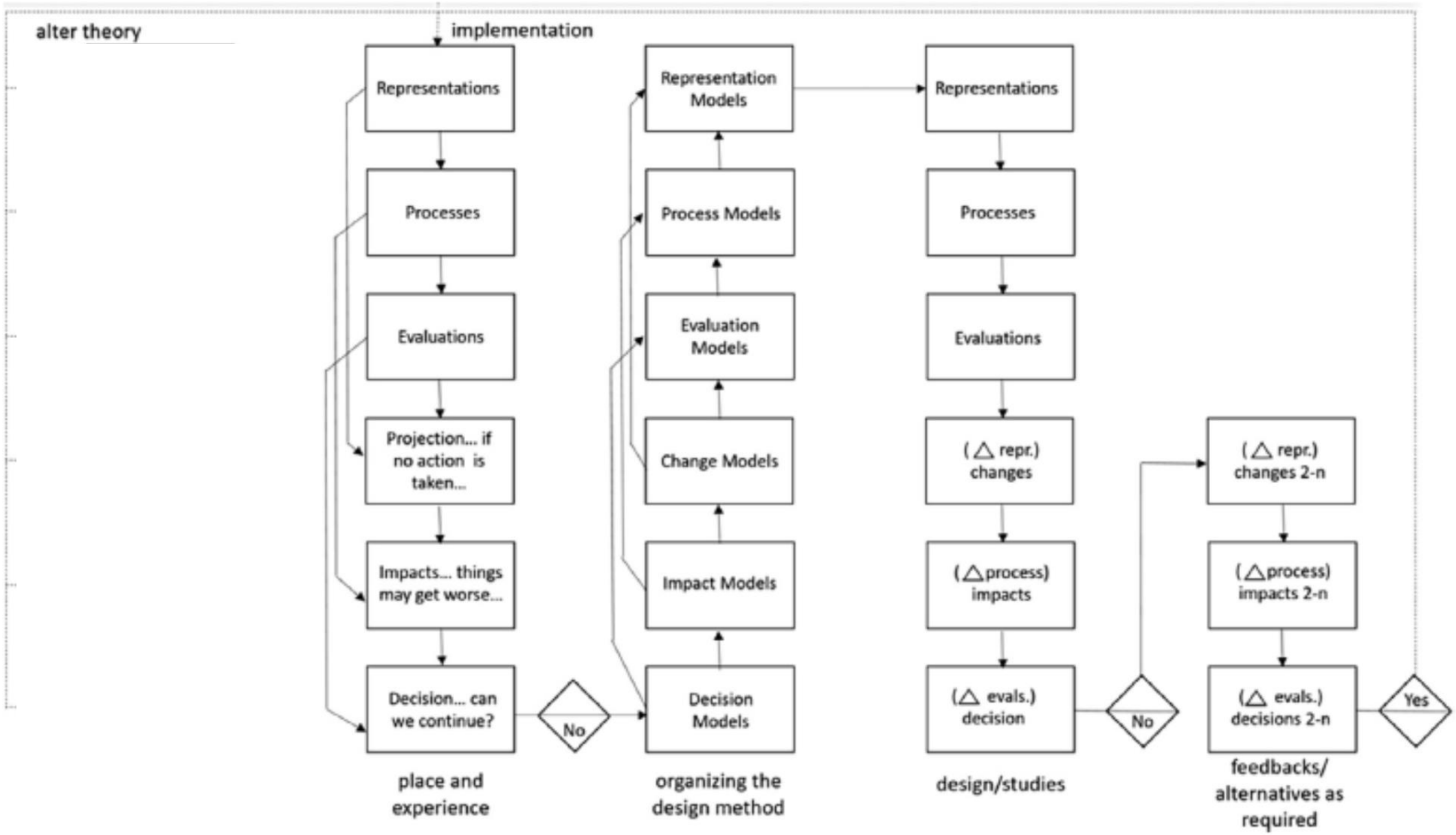
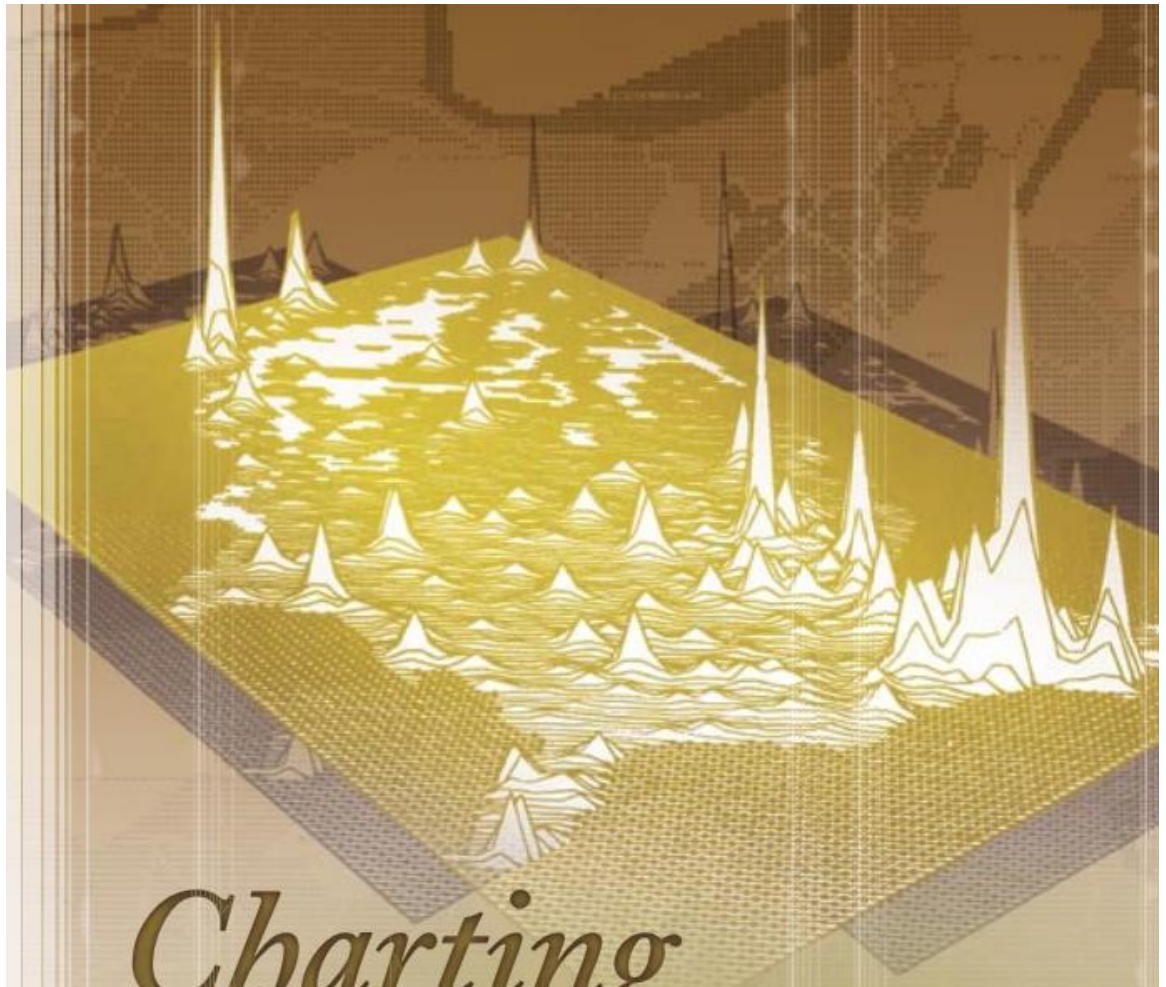


Fig. 1. Steinitz framework as published in "A Framework for Theory Applicable to the Education of Landscape Architects (and Other Environmental Design Professionals)". Source: Figure 1. A Framework for Theory: General Structure, from Steinitz (1990, p. 138). Reproduced by author from hand-drawn original.



Charting the Unknown

How computer mapping at Harvard became GIS

Nick Chrisman

The History of Geographic Information Systems

Perspectives from the Pioneers

Timothy W. Foresman, Editor

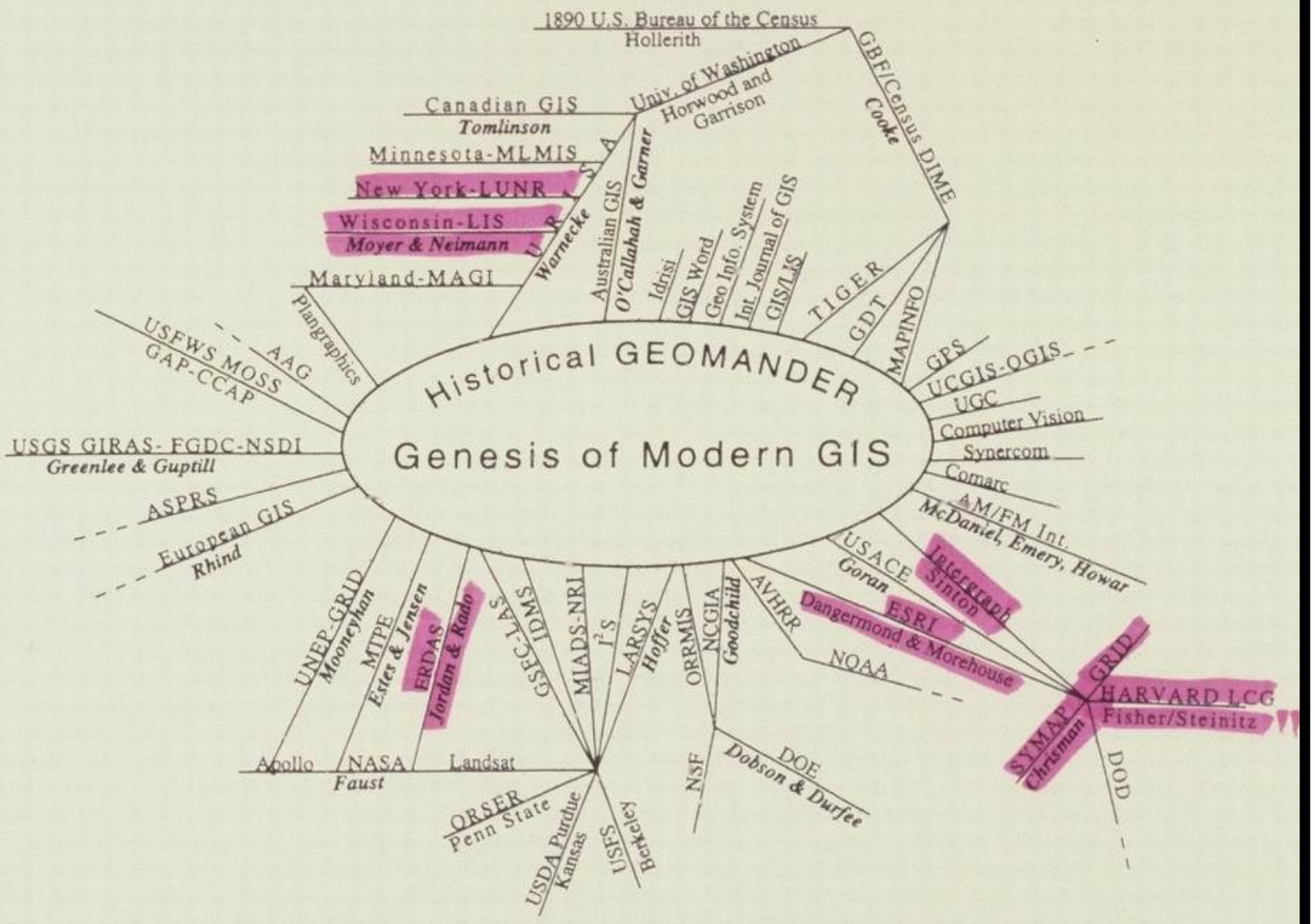
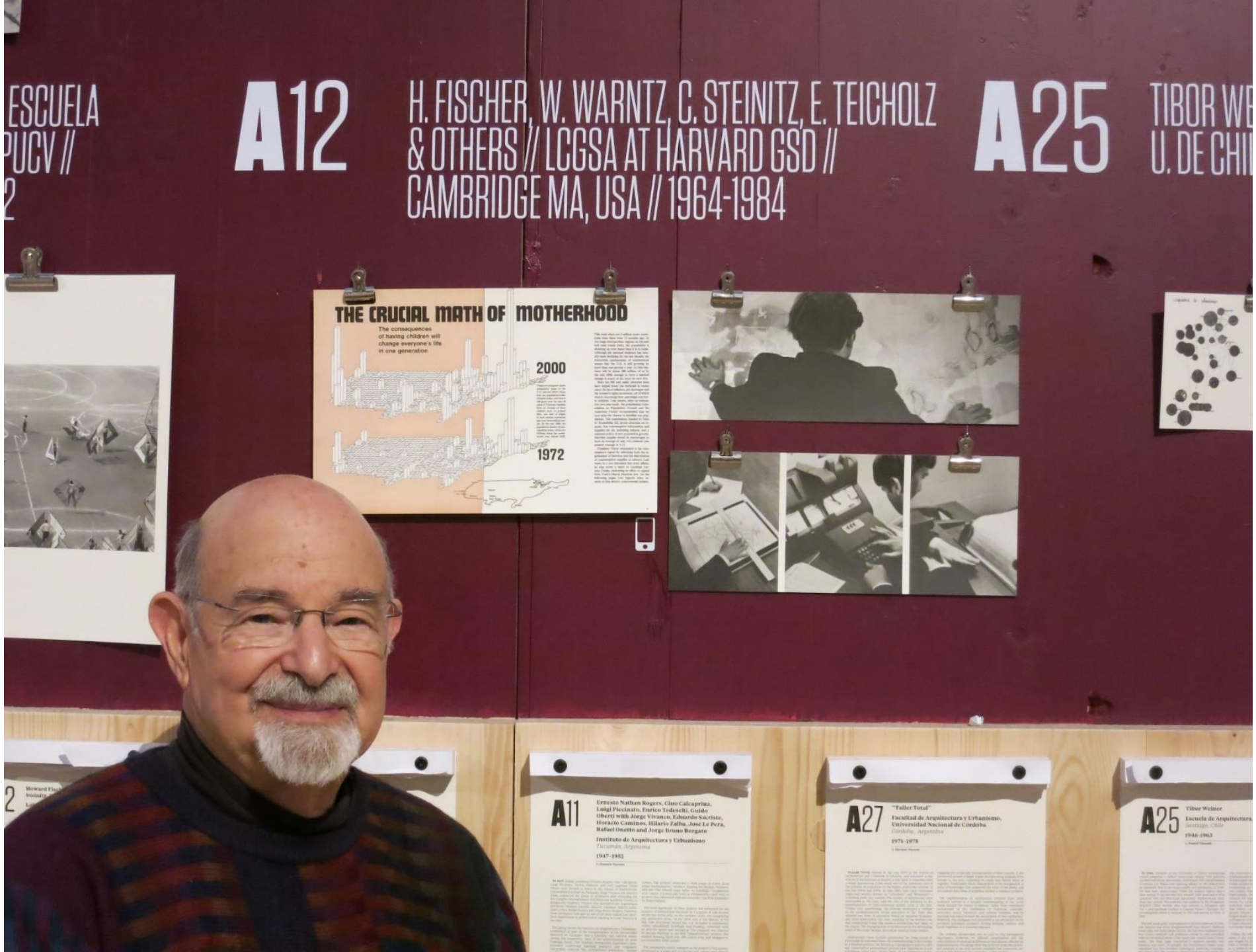


Figure 1.1 Diagram of historic pathways and connections for the genesis of modern GIS.

Venice, Biennale of Architecture, 2014

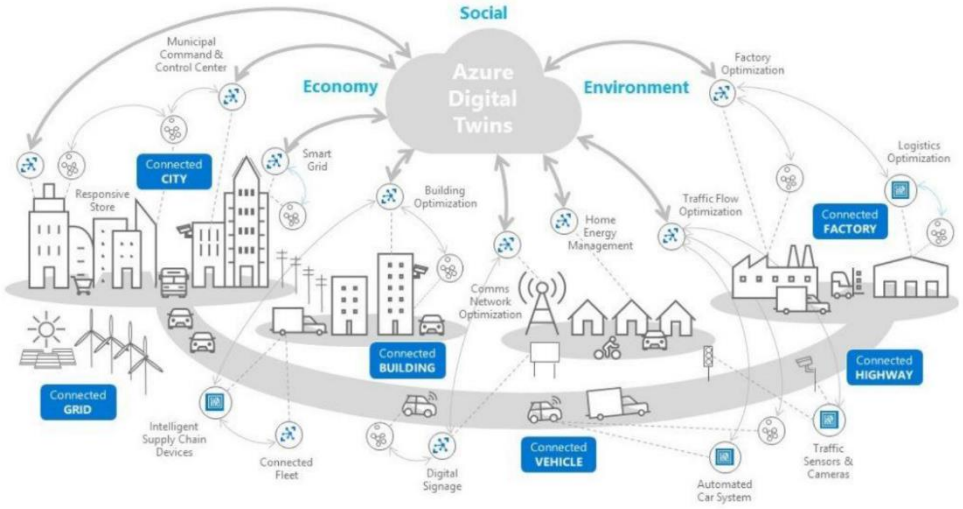
Prof. Beatriz Colomina, Britt Eversole, Ignacio G. Galán,
Evangelos Kotsioris, Anna-Maria Meister, Federica Vannucchi


ESCUELA
PUCV //
2
A12
H. FISCHER, W. WARNTZ, C. STEINITZ, E. TEICHOLZ
& OTHERS // LCGSA AT HARVARD GSD //
CAMBRIDGE MA, USA // 1964-1984
A25
TIBOR WE
U. DE CHI
THE CRUCIAL MATH OF MOTHERHOOD
The consequences
of having children will
change everyone's life
in one generation
2000
1972
A11
Ernesto Nathan Rogers, Cino Calcaprina,
Luigi Piccinato, Enrico Tedeschi, Guido
Oberti with Jorge Vivanco, Eduardo Sacriste,
Horacio Caminos, Hilario Zalba, José Le Pera,
Rafael Onetto and Jorge Bruno Bergato
Instituto de Arquitectura y Urbanismo
Tucumán, Argentina
1947–1952
A27
"Taller Total"
Facultad de Arquitectura y Urbanismo,
Universidad Nacional de Córdoba
Córdoba, Argentina
1971–1978
A25
Tibor Weiner
Escuela de Arquitectura,
Santiago, Chile
1946–1963

(PRE) **ANALOG TO a DIGITAL** (FUTURE)

Digital Landscape Architecture Dessau Germany The Bauhaus May 23, 2019

“Digital Twinning”

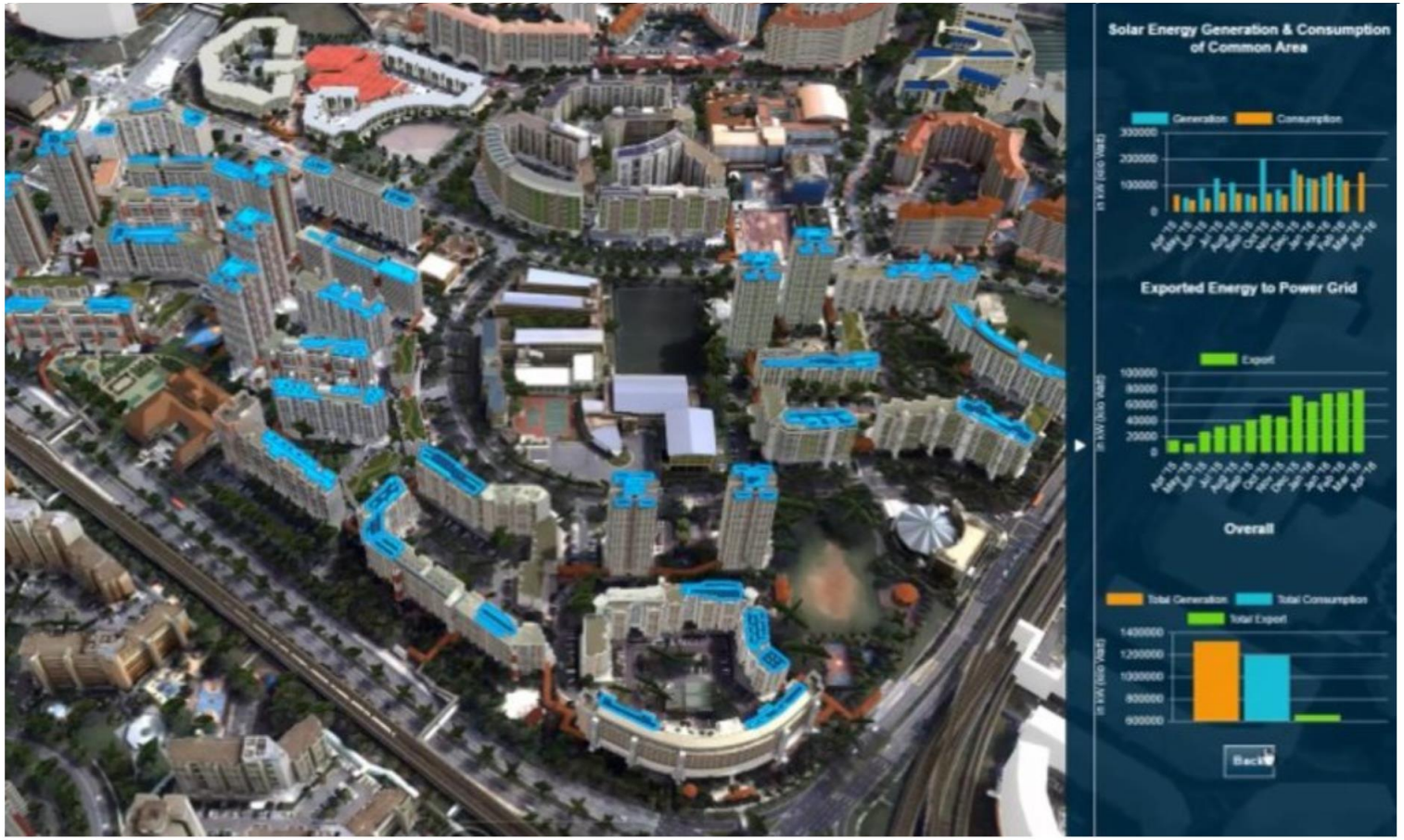


Source: Microsoft blog – https://blogs.microsoft.com/iot/2018/09/24/announcing-azure-digital-twins-create-digital-replicas-of-spaces-and-infrastructure-using-cloud-ai-and-iot/

Virtual Singapore Is More Than Just a 3-D Model, It’s an Intelligent Rendering of the City

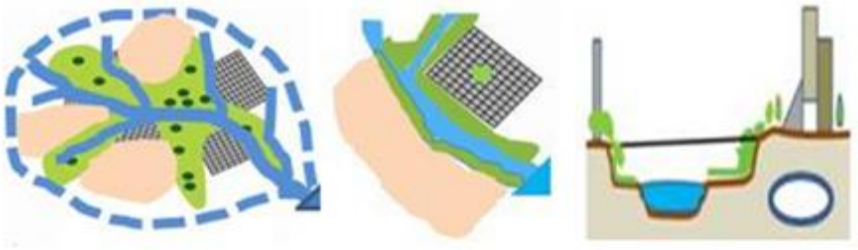
Planners of the $73 million Virtual Singapore project are working with government agencies to see how they might best make use of the simulated city.

BY ADAM STONE / FEBRUARY 22, 2017



A screengrab of Virtual Yuhua, which shows how urban planners can analyze the buildings that have a higher potential for solar energy production, and are therefore more suitable for installation of solar panels. VIRTUALSG

COLLABORATIVE NEGOTIATION AS A GEODESIGN METHOD



GEOGRAPHIC SCIENCES

SUPPLY-BASED

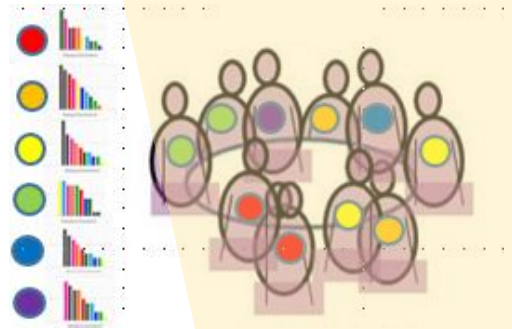
"DEFENSIVE" STRATEGIES

GEODESIGN IS COLLABORATION AND NEGOTIATION

DESIGN PROFESSIONS

DEMAND-BASED

"OFFENSIVE" STRATEGIES



INFORMATION TECHNOLOGISTS

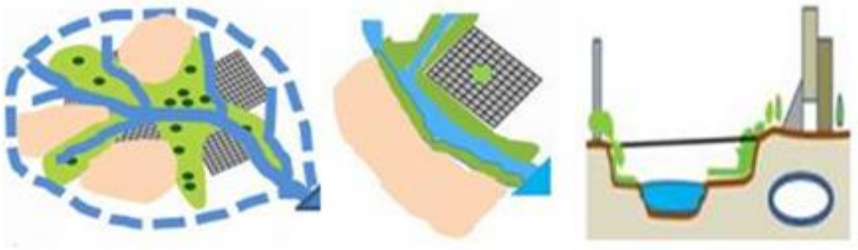
THE PEOPLE OF THE PLACE

GIS ⟷ **GEODESIGN** ⟷ **BIM**

ALLOCATION — ORGANIZATION — VISUALIZATION

LONGER TERM MANAGEMENT — STRATEGIC DESIGN — SHORTER TERM MANAGEMENT

COLLABORATIVE NEGOTIATION AS A GEODESIGN METHOD



GEOGRAPHIC SCIENCES

SUPPLY-BASED

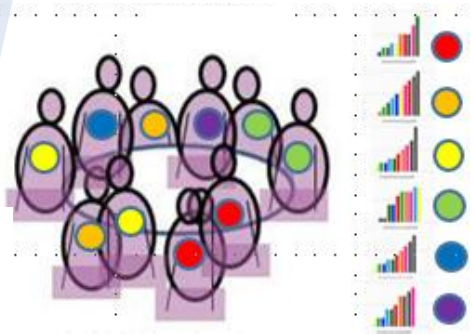
"DEFENSIVE" STRATEGIES

GEODESIGN IS COLLABORATION AND NEGOTIATION

DESIGN PROFESSIONS

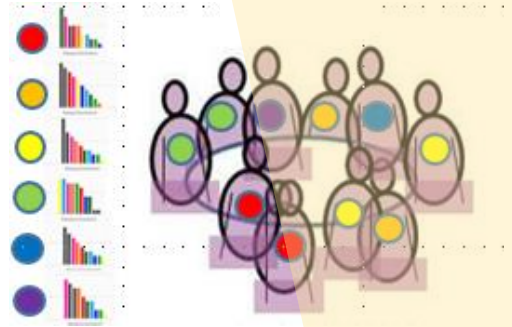
DEMAND-BASED

"OFFENSIVE" STRATEGIES



INFORMATION TECHNOLOGISTS

THE PEOPLE OF THE PLACE



GIS ⟷ **GEODESIGN** ⟷ **BIM**

ALLOCATION

LONGER TERM MANAGEMENT

ORGANIZATION

STRATEGIC DESIGN

VISUALIZATION

SHORTER TERM MANAGEMENT

ASSESSMENT

DATA

KNOWLEDGE

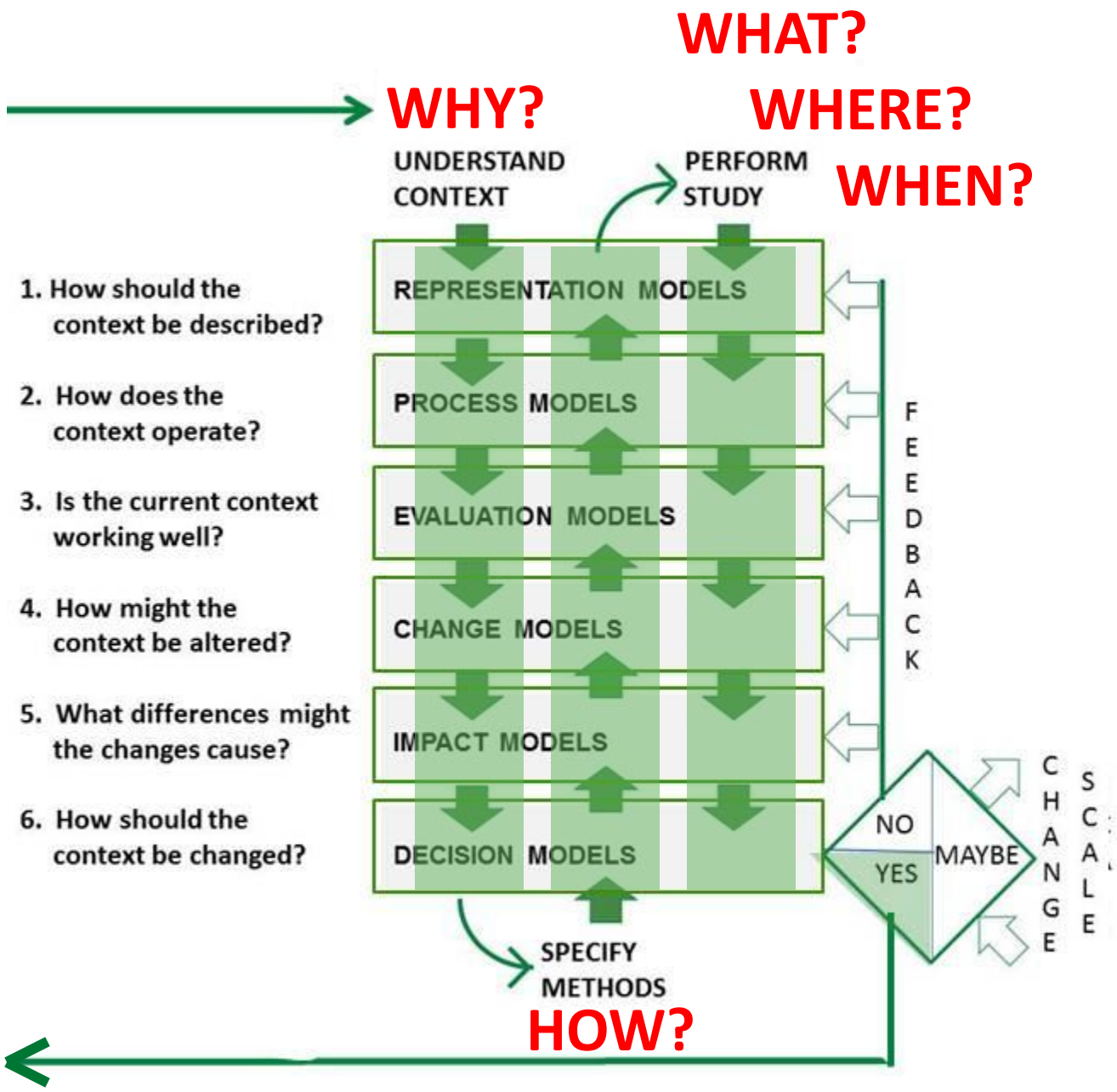
VALUES

INTERVENTION

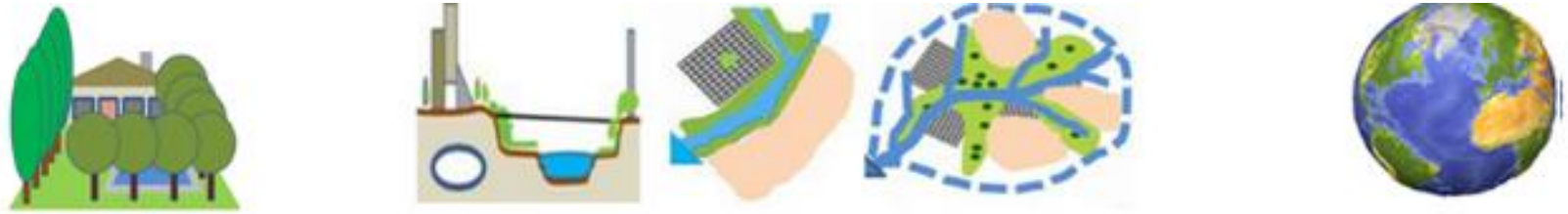
DATA

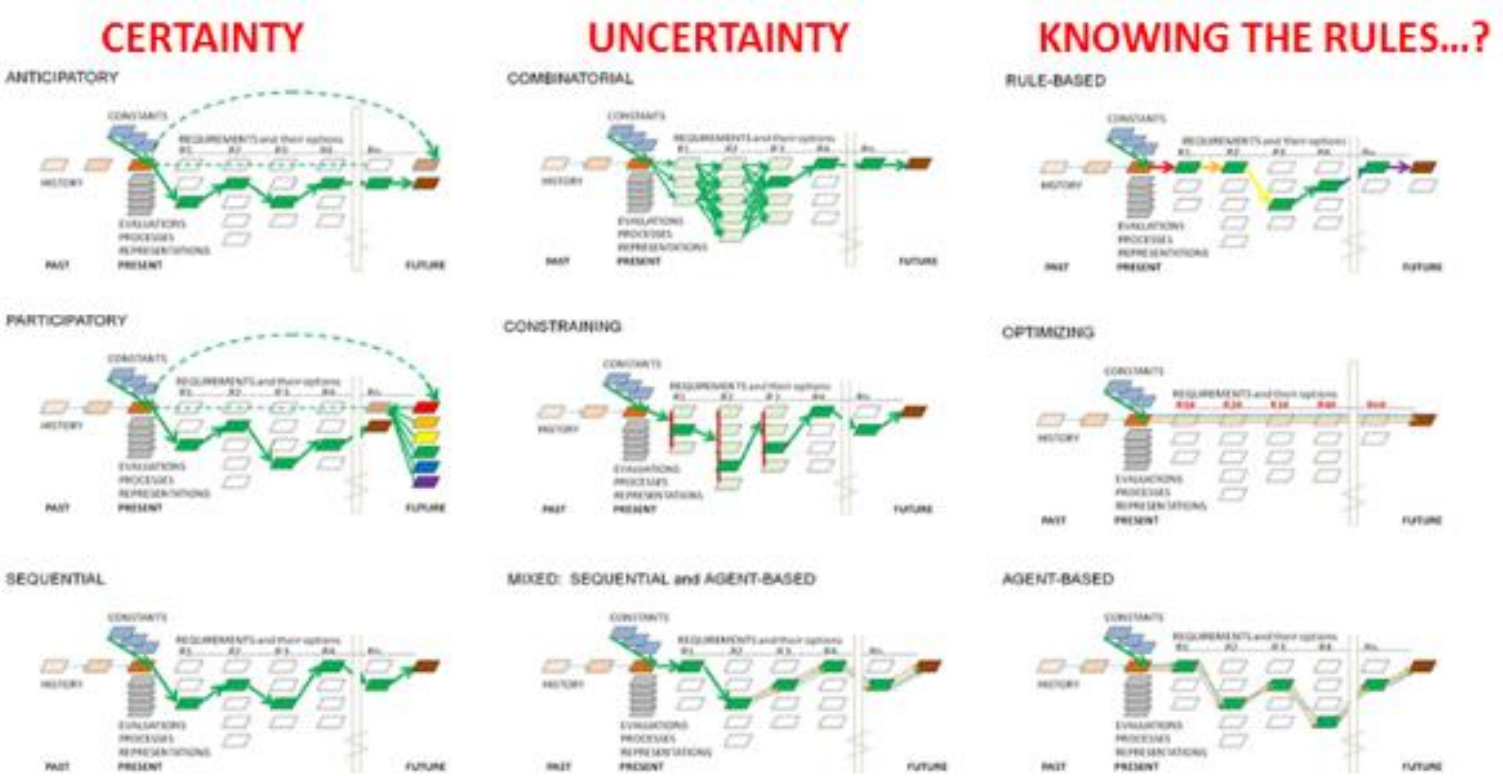
KNOWLEDGE

VALUES



2012 Steinitz, C "A Framework for Geodesign", Esri Press, 2012





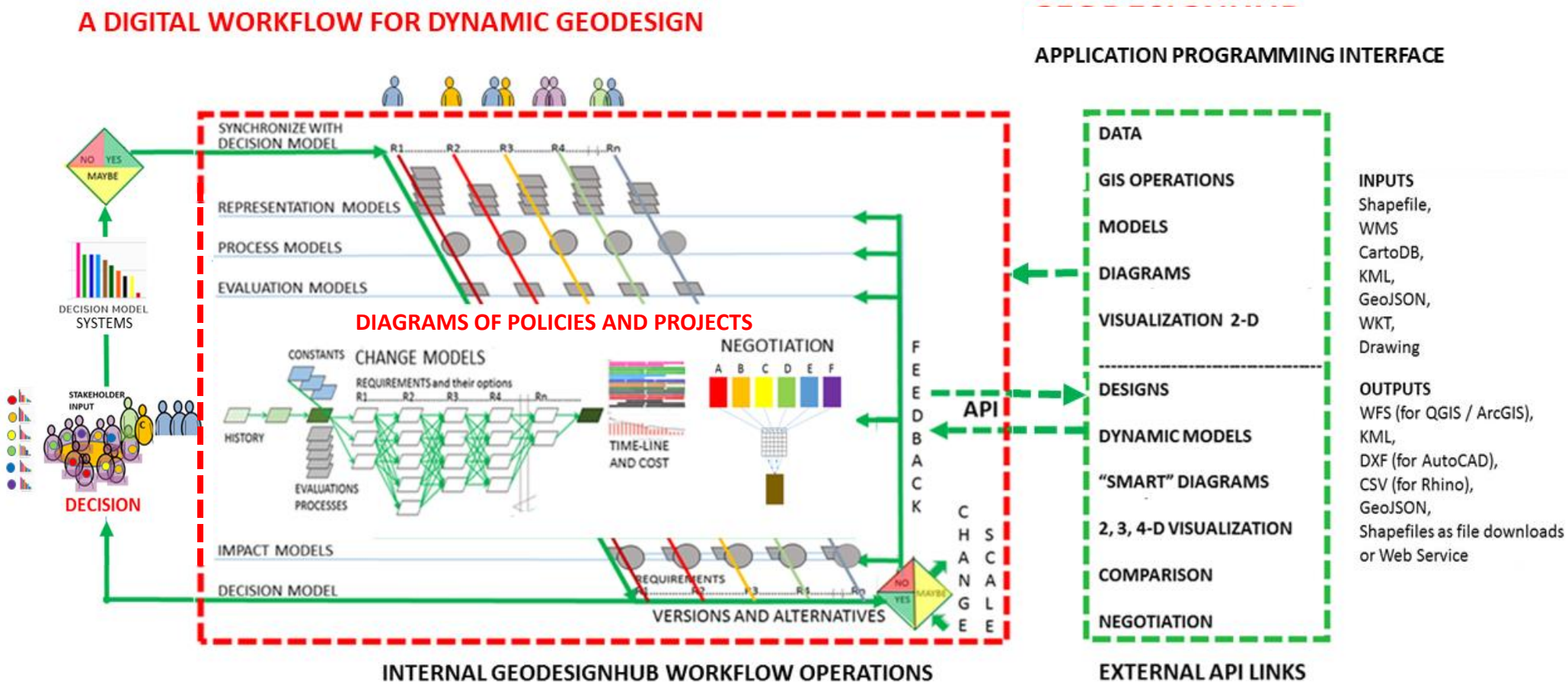
2012 Steinitz, C "A Framework for Geodesign", Esri Press, 2012

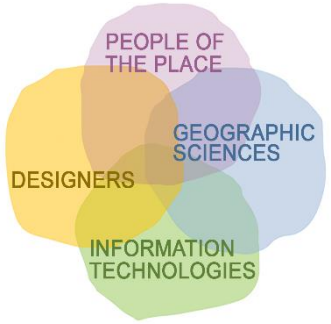
http://video.esri.com/watch/4162/experiments-in-geodesign-synthesis

GEODESIGNHUB

Hrishi Ballal, Geodesignhub.com

Geodesignhub is a cloud-based, free and open access, open platform software built by Hrishi Ballal.
It is designed to link with other tools and models via APIs rather than to contain complex substantive algorithms itself. Geodesignhub is designed to support collaboration and negotiation towards agreement.
It aims to be as simple as possible: easy to learn, set up, use and (most importantly) easy to understand.

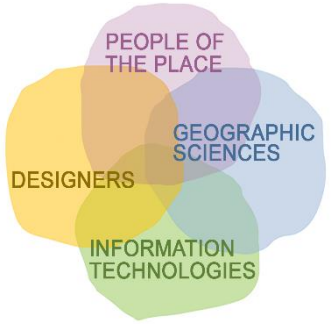




INTERNATIONAL GEODESIGN COLLABORATION

Changing Geography by Design

PARTICIPANTS IN THE INTERNATIONAL GEODESIGN COLLABORATIVE IGC 2019



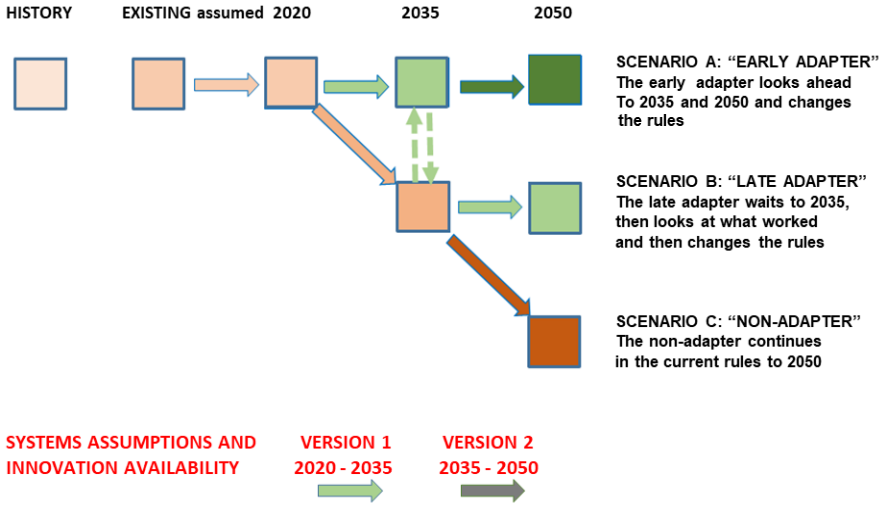
INTERNATIONAL GEODESIGN COLLABORATION

Changing Geography by Design

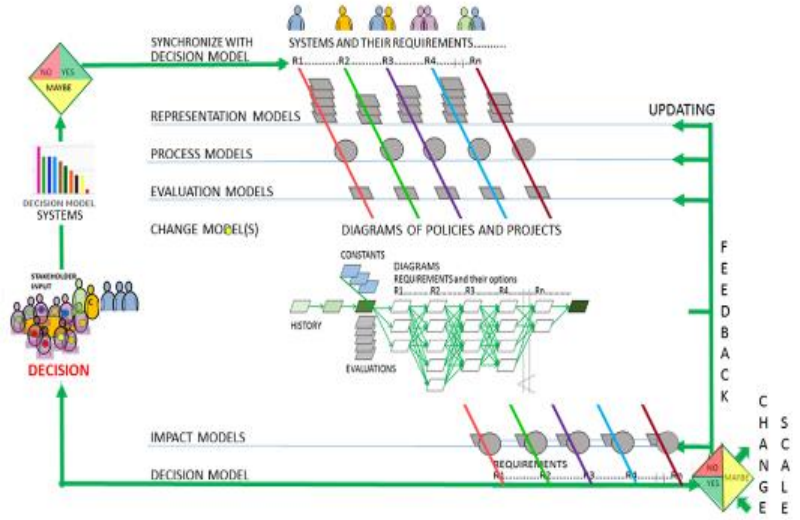
THE TEN IGC SYSTEMS AND COLOR CODES

WATER INFRASTRUCTURE 113 184 255	175 215 255	OCEAN, RIVERS, LAKES
	113 184 255	WATER SUPPLY, TREATMENT, RECYCLING
AGRICULTURE 194 230 153	194 230 155	AGRICULTURE
	120 198 121	FORESTRY
GREEN INFRASTRUCTURE 48 163 85	48 163 85	RECREATION
	0 104 55	NATURAL LANDSCAPE
ENERGY INFRASTRUCTURE 205 50 155	225 140 200	ENERGY PRODUCTION
	205 50 155	ENERGY DISTRIBUTION
TRANSPORT INFRASTRUCTURE 13 13 13	64 64 64	RAIL, AIRPORT, SHIP PORT
	175 215 255	ROAD TRANSPORT
INDUSTRY AND COMMERCE 116 45 159	175 111 215	LIGHT INDUSTRY AND COMMERCE
	116 45 159	HEAVY INDUSTRY
RESIDENTIAL, LOWER DENSITY 255 204 0	255 230 153	RESIDENTIAL, RURAL
	255 204 0	RESIDENTIAL, LOW DENSITY
MIXED, RESIDENTIAL WITH COMMERCE 132 60 12	218 128 28	MIXED RESIDENTIAL, MEDIUM DENSITY
	132 60 12	MIXED RESIDENTIAL, HIGH DENSITY
INSTITUTIONAL 36 73 110	59 119 179	INSTITUTIONAL, GOVERNMENT, MILITARY
	36 73 110	INSTITUTIONAL, EDUCATION, HEALTHCARE
FLEXIBLE AS NEEDED	222 45 38	COMMERCIAL, OFFICES
	252 146 114	COMMERCIAL, SHOPPING
	0 166 162	TOURISM, CULTURAL
	0 102 102	TOURISM, HISTORICAL
	225 182 113	SPECIAL LANDSCAPE, E.G. DESERT
	115 155 50	SPECIAL LANDSCAPE, E.G. MANGROVE

THE IGC SCENARIOS AND TIME STAGES



A WORKFLOW FOR GEODESIGN



THE IGC SCHEDULE

UNIVERSITY COLLEGE LONDON / CASA

Existing 2020

THE CAMKOX CORRIDOR

The Centre for Advanced Spatial Analysis of University College London organized the CAMKOX workshop within the guidelines of the International Geodesign Collaboration. It was conducted by Carl Steinitz, Hrishi Ballal and Tess Canfield in a two day workshop in November 2018 using Geodesignhub technology. The assumptions of the National Infrastructure Commission were accepted: to add 780,000 housing units in the CAMKOX Corridor and 1,450,000 people to the existing population of around 3,300,000.

INNOVATIONS

AGR 2035/2050 4 CARBON FARMING

IGC

Can Dirt Save The Earth?

"Agriculture could pull carbon out of the air and into the soil – but it would mean a new way of thinking about how to tend the land."

By Moises Velasquez-Manoff
April 18, 2018

Carbon is and has been known to be one of the building blocks of life.

Source - https://www.nytimes.com/2018/04/18/magazine/dirt-save-earth-carbon-farming-climate-change.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=first-column-region&region=top-news&WT.nav=top-news

The idea of carbon farming, removing carbon from the atmosphere and sequestering it in the pedosphere (living soil at the earth's surface) by way of plants' photosynthesis and other regenerative agricultural practices like composting and non-tilling, seem to be solutions of the future to mitigate greenhouse gas emissions and decelerate climate change/global warming.

This idea aims to farm sustainably in a way to improve the land by focusing on soil health and soil carbon build-up. Increasing soil carbon yields benefits like improving soil fertility, water retention and crop resilience, reduce fertilizer needed, and minimize soil disturbance.

Farmers are supporting this regenerative agricultural practice because it has proven not only to grow more crops per acre but moreover has reduced their spending on fertilizer and other inputs that allow them to produce each bushel more cheaply.

Other references: https://www.marincarbonproject.org/carbon-farming/carbon-farm-plans ; http://www.carboncycle.org/ ; https://www.cdfa.ca.gov/healthysoils/ ; http://www.regenerationinternational.org/4p1000 ; https://www.nature.com/scitable/knowledge/library/soil_carbon_storage_84223790

AGR 2035 18 CONTROLLED-ENVIRONMENT AGRICULTURE (CEA)

IGC

Controlled-environment agriculture (CEA) is a technology-based approach toward food production. The aim of CEA is to provide protection and maintain optimal growing conditions throughout the development of the crop. Production takes place within an enclosed growing structure such as a greenhouse or building. CEA optimizes the use of resources such as water, energy, space, capital and labor. CEA technologies include hydroponics, aeroponics, aquaculture, an aquaponics.
Controllable variables:
Temperature (air, nutrient solution, root-zone, leaf)
Humidity (%RH)
Carbon dioxide (CO_2)
Light (intensity, spectrum, duration and intervals)

Nutrient concentration
Nutrient pH (acidity), and
Pests.
Replicating a conventional farm with computers and LED lights is expensive but proves cost-efficient in the long run by producing up to 20 times as much high-end, pesticidee-free produce as a similar-size plot of soil.
Using CEA methods increase food safety by removing sources of contamination, and increases the security of supply as it is unaffected by outside environment

conditions, and by eliminating seasonality create stable market pricing which is good for farmer and consumer alike.

Sources: Wikipedia
Science Illustrated, February 2011

ENE 2035/2050 1 RENEWABLE ENERGY SOURCES

IGC

„Industrial production is projected to increase by a factor of four between now and 2050. In the absence of a strong contribution from energy efficiency improvements, renewable energy and CO2 capture and storage (CCS) will need to make a significant impact if industry is substantially to reduce its consequent greenhouse-gas (GHG) emissions."

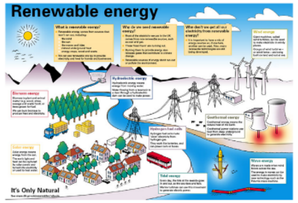
Source:
Renewable Energy in Industrial Applications An assessment of the 2050 potential
https://www.solarthermalworld.org/sites/gstec/files/unido_renewables_industrial_applications.pdf

„The present analysis of the long-term potential for renewable energy in industrial applications suggests that up to 21% of all final energy use and feedstock in manufacturing industry in 2050 can be of renewable origin."

„Across all industrial sectors, biomass has the potential to contribute 37 EJ/yr."

„Solar thermal energy has the potential to contribute 5.6 EJ/yr to industry by 2050."

„Heat pumps also have a part to play in low temperature process applications and are estimated to contribute 4.9 EJ/year in 2050."



By continuing to use renewable energy sources in industry, it will not be necessary to supply solid fuels to factories or build their landfills.

Source:
https://ohs9sciencestelr.weebly.com/renewable-energy-sources.html

GRN 2035 1 RESILIENT LANDSCAPE INFRASTUCTURE

Vision:
Greener, healthier, attractive towns and villages sustainably connected to the rich tapestry of distinctive landscapes, wildlife habitats and waterways – valued, enjoyed and cared for by local people.

Objectives:
- mitigating and adapting to climate change;
- integrating sustainable movement and access for all;
- promoting a distinctive townscape and landscape;
- maintaining and enhancing biodiversity, water and air quality;
- providing opportunities for sport, recreation, quiet enjoyment and health;
- retaining and enhancing a quality environment for investment and through development; and
- providing community involvement and opportunities for education.

Source: Green-and-Blue-Infrastructure-Strategy-Maidstone Borough Council June 2016 (http://www.maidstone.gov.uk/__data/assets/pdf_file/0004/164659/Green-and-Blue-Infrastructure-Strategy-June-2016.pdf)

GRN 2035/2050 9 CONNECTIVITY AND ELEMENTS

IGC

Connected green infrastructure
City of Surrey
Source:
Green Infrastructure Network, UK
Biodiversity Conservation Strategy

Source:
Land Trust Alliance, UK
Urban Green Infrastructure

WAT 2035/2050 2 WATER RETENTION

Increased water demand due to increased population and agriculture production

Intensified weather events: intensified storms and snows (IPCC).

- Nature based solutions: restoration of lakes, rivers, basins etc.
- Low impact drainage/stormwater management
- Local water buffering techniques
- Keep polluted stormwater on site (out of waterways)
- Green roofs

Stormwater management pond

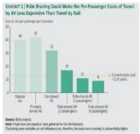
Source : wikipedia.org

Terraced agriculture

TRA 2035 8 SELF-DRIVING CARS WILL DISRUPT THE TRAIN INDUSTRY

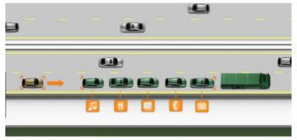
IGC

Self-Driving Cars Will Disrupt the Train Industry, Too - CityLab
"…a new report released Monday from the Boston Consulting Group concentrates on the potential impact AVs will Have on an older, globally popular form of transportation: passenger rail. "Will Autonomous Vehicles Derail Trains?"



Trains will remain the least expensive mode of transport during peak times in urban areas. But during off-peak hours and in rural environments, they will lose riders to AVs. Rail companies may even end up in a downward spiral: with reduced overall ridership, rail companies' overall unit costs for all remaining passengers will escalate because of the inherently high proportion of fixed costs in operating a train network. This could trigger price increases or reduced schedules, which would result in a further reduction in ridership. It is difficult to operate fewer off-peak trains without affecting the costs of peak trains.

Source--https://www.citylab.com/transportation/2016/10/self-driving-cars...trains.../502430/



IND/COM 2035 2 INDUSTRIAL ROBOTICS

In the near future industrial robots will be cheaper and more and more useful. They will replace employees who have been doing simple works so far. The factory staff will be reduced to process controllers and service technicians who will take action in the event of a breakdown. Therefore, the social parts of the factories will be significantly reduced. There will also be no need to design such large parking lots as it is now. On the other hand, reducing the number of jobs for poorly educated employees will entail an increase in unemployment and a lowering of the standard of their living, and even social problems in this class.

New six-axis robot has a lightweight but robust design with a reach of 1124 mm and payload capacity up to 20 kg, ideal for transfer and assembly applications. *(Courtesy of TM Robotics)*

The Robotmakers – Yesterday, Today and Tomorrow

„2017 was another record-breaking year for the robotics industry. For seven straight years now, North American robot shipments have continued their upward trend. Last year shipments were up 9 percent over the previous year."

Source:
https://www.robotics.org/content-detail.cfm/Industrial-Robotics-Industry-Insights/The-Robotmakers-Yesterday-Today-and-Tomorrow-Part-2/content_id/7144

New series of 4-axis and 6-axis robots are Industry 4.0-ready with features designed for easier implementation and seamless integration with IT systems. *(Courtesy of Mitsubishi Electric Automation, Inc.)*

IND/COM 2035 5 RAPID PROTOTYPING AND INDIVIDUALIZATION OF PRODUCTS

Rapid prototyping „is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology."

Source:
https://en.wikipedia.org/wiki/Rapid_prototyping

A rapid prototyping machine using selective laser sintering (SLS)

Because in this technology it is possible to obtain the product basing on the data entered into the modeling program, in the future we will order items precisely tailored to our needs, or clothes perfectly matching the specific construction of our body.

The Adidas brand, together with the technological start-up called Carbon released in January 2018 a new edition of FUTURECRAFT 4D shoes, whose sole has been printed using a novel method, polymer resin hardened with UV light. Daniel Arsham, a designer, was invited to cooperate in creating the model.

The running shoes are extremely elastic, flexible, durable and comfortable. The sole is ecological biodegradable). The company plans to develop innovative technology, going in the direction chosen by clothing brands some time ago, that is personalization. This time, however, individualization will go a step further.

After scanning the client's foot, the shoes are to be perfectly matched to it at the production stage. This would not be possible without the use of 3D printing, which will enable production on a microscale. In this way, mass producers are circling the circle, leaning towards the craft of the future.

Source: https://www.highsnobiety.com/p/daniel-arsham-adidas-futurecraft-4d-release-date-price/

IND 2035 14 INTERNET-BASED COMMERCIAL DISTRIBUTION ROBOTICS

Kiva is an Amazon company. In Kiva's approach, items are stored on portable storage units. When an order is entered into the Kiva data base system, the software locates the closest automated guided vehicle(bot) to the item and directs it to retrieve it. The mobile robots navigate around the warehouse by following a series of computerized barcode stickers on the floor. Each drive unit has a sensor that prevents it from colliding with others. When the drive unit reaches the target location, it slides underneath the pod and lifts it off the ground through a corkscrew action. The robot then carries the pod to the specified human operator to pick the items.

Kiva's relatively new approach to automated material handling systems for order fulfillment is gaining traction in eCommerce fulfillment, retail restocking, parts distribution and medical device distribution operations. The system is much more efficient and accurate than the traditional method of having human workers traveling around the warehouse locating and picking items.
As of September 2017 Amazon had more than 100,000 of the robots working in their warehouses.

Source:
https://en.wikipedia.org/wiki/Amazon_Robotics

MIX 2035 16 SUSTAINABLE URBAN INFRASTRUCTURE

Stormwater Management: Reduce the runoff volume and improve water quality. This can be achieved by replicating the natural hydrology and water balance of the site, based on historical conditions and undeveloped ecosystems in the region.

Heat Island Reduction: Minimize effects on microclimates and human and wildlife habitats by reducing heat islands. Use existing plant materials, vegetation orenergy generation system to provide shade for 50% of non-roof site paving; High-Reflectance and Vegetated Roofs; Use roofing materials that have at least 0.75 SRI.

On-Site Renewable Energy Sources:
Reduce environmental and economic harms associated with fossil fuel energy by increasing self-supply ofrenewable energy; Incorporate on-site nonpolluting renewable energy generation, such as solar, wind, geothermal, small-scale or micro-hydroelectric, or biomass, with production capacity of at least 5% of the project's annual electrical and thermal energy cost.

District Heating & Cooling: Encourage development of energy efficient neighborhoods by employing district heating and cooling strategies that reduce energy use and energy-related environmental harms.

Solid Waste Management Infrastructure: Include a recycling center available to all occupants, dedicated to separating, collecting and storing materials for recycling.

Wastewater Management: New design and construction projects should retain at least 25 percent of the average annual wastewater on site generated by the project.

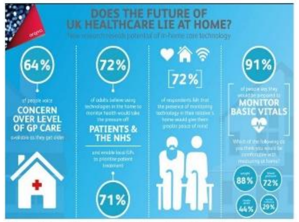
Source:https://w5.siemens.com/web/si/sl/corporate/portal/raziskave/Documents/sustainable_urban_infrastructure-study_london.pdf

INS 2035/2050 4 THE FUTURE OF HOME HEALTH CARE

IGC

Future of Home Health	
1	Home health as the "big winner" in payment and delivery reforms
2	Varying perspectives around how to modify the HH benefit
3	No single model identified for managing patients
4	Opportunity for innovation in benefits for community-referred beneficiaries
5	Home health agencies must adapt to the changes to Medicare payment and delivery
6	Caregiver burden is a crisis necessitating a long-term care solution

Source: Avalere.com, What Will the Future of Home Health Look Like? http://avalere.com/expertise/managed-care/insights/what-will-the-future-of-home-health-look-like



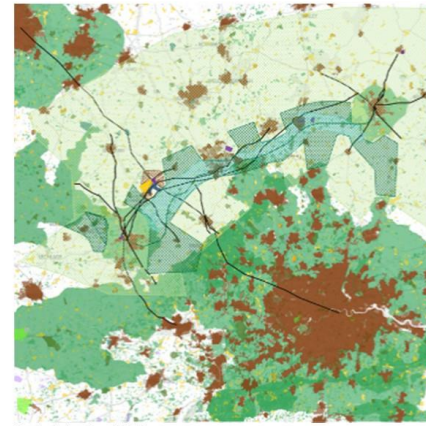
Source: Visual.ly, Does the Future of UK Healthcare lie at Home? https://visual.ly/community/infographic/health/does-future-uk-healthcare-lie-home

Cambridge

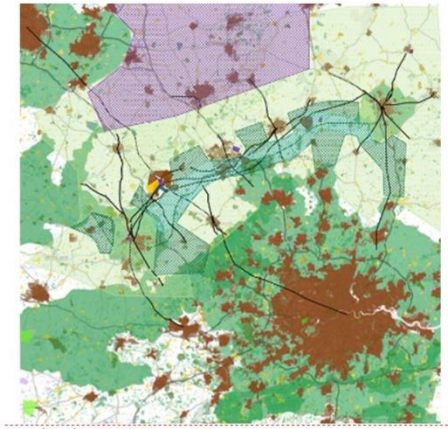
Milton Keynes

Oxford

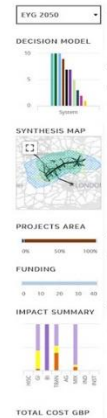
Existing 2020



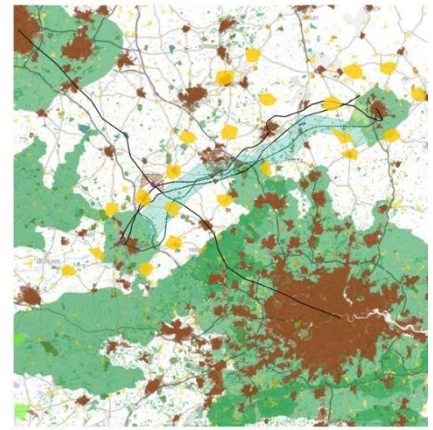
Early Adopter 2035



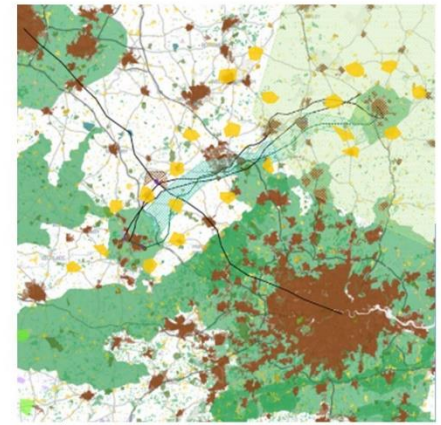
Early Adopter 2050



The Early Adopter teams first introduced conservation policies for prime soils, water, agriculture and the historic-cultural landscape. They retained the London greenbelt but not all of those of Cambridge and Oxford, while also promoting a new national park and large regional expansion of linked conserved landscapes. They designated large areas of non-prime soils for conversion to industrial, controlled-environment agriculture. Urban development was focused on mixed higher density residential and services, and concentrated along the CAMKOC corridor. This also retained the highly dispersed pattern of villages and towns. One major development area is preplanned by 2035 at the intersection with HS2, with a proposed multimodal transfer point. The decision to not rebuild the train link between Cambridge and Bedford was made, and to rely on multimodal transport on roads designed and redesigned for car-based trains. This reflected lower overall regional densities. Train links would continue to be improved between the major towns and London and northern cities.



Non Adopter and Late Adopter 2035

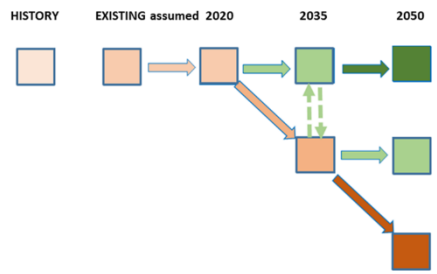


Late Adopter 2050

While recognizing growth pressures, the Late Adopter teams reflected the conservative planning attitudes that characterize the region. They adopted the proposed expressway and train plans of the National Infrastructure Commission, relocating and remaking the Cambridge to Bedford train link by 2035. They also continued the preferred lower density development patterns, and distributed growth among many of the smaller towns in the region. This also reflected the NIC's preferred competition winner Tibbalds proposal (see below). The exception is Milton Keynes' plan for higher density mixed development by 2026. Their conservation focused on retaining agriculture and its associated landscapes and villages. After 2035, innovative policies and projects promote mixed higher density development, in part to support the prior infrastructure investments. This also involved proposing a link between the new infrastructure and HS2. Conservation was focused on special protection for the most travelled tourism zone.

THE IGC SCENARIOS AND TIME STAGES

IGC



SCENARIO A: THE EARLY ADOPTER
looks ahead to 2035 and then 2050 and changes the rules by 2020.

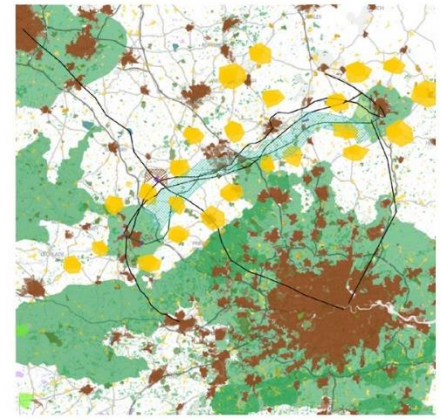
SCENARIO B: THE LATE ADOPTER
waits to 2035 and then looks at what worked and then changes the rules.

SCENARIO C: THE NON-ADOPTER
continues in the current rules to 2035 and 2050….while looking ahead….

SYSTEMS ASSUMPTIONS AND INNOVATION AVAILABILITY

VERSION 1 2020 - 2035

VERSION 2 2035 - 2050



Non Adopter 2050

The Non-Adopter teams accepted the proposed expressway and train plans of the National Infrastructure Commission, relocating and remaking the Cambridge to Bedford train link by 2035. They continued the preferred lower density development patterns, and distributed growth among many of the smaller towns in the region. This also reflected the NIC's preferred competition winner's proposal (see below). The exception is in Milton Keynes' plan for higher density mixed development by 2026. Their conservation was focused on retaining agriculture and its associated landscapes and villages.
These overarching policies and projects were continued to 2050, enlarging the distributed, town-based lower density development pattern throughout the CAMKOX Corridor.

Day Two:
-Making Version 3 with Negotiation
-Presentation
-Sociogram
-Organized Negotiation To Make the Final Design

The final Negotiated Design

Impacts, Timeline, Cost

Participants

Carl Steinitz	UCL CASA/Harvard
Hrishi Ballal	UCL CASA/Geodesign Hub
Mike Batty	UCL CASA
Adam Dennett	UCL CASA
Tess Canfield	UCL CASA
Asya Natapov	UCL CASA
Shlomit Flint	UCL CASA
Richard Milton	UCL CASA
Ana Basiri	UCL CASA
Sue Batty	UCL CASA

Nick Falk	Director URBED
Michael Neuman	University of Westminister
George Breckenridge	Cambridge University
Na'amah Hagiladi	City of London
Mark Stileman	UK Ordnance Survey
Richard Kingston	Manchester University
Carina Schneider	UCL Bartlett
Hormoz Goodarzy	Cambridge College USA
Mireille Tchapi	University of Westminister
Li Wan	Cambridge University
Robin Morphet	UCL CASA
Vincent Goodstadt	Royal Town Planning Institute, URBED
Eime Tobari	AECOM
Simon Navin	UK Ordnance Survey

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URBED
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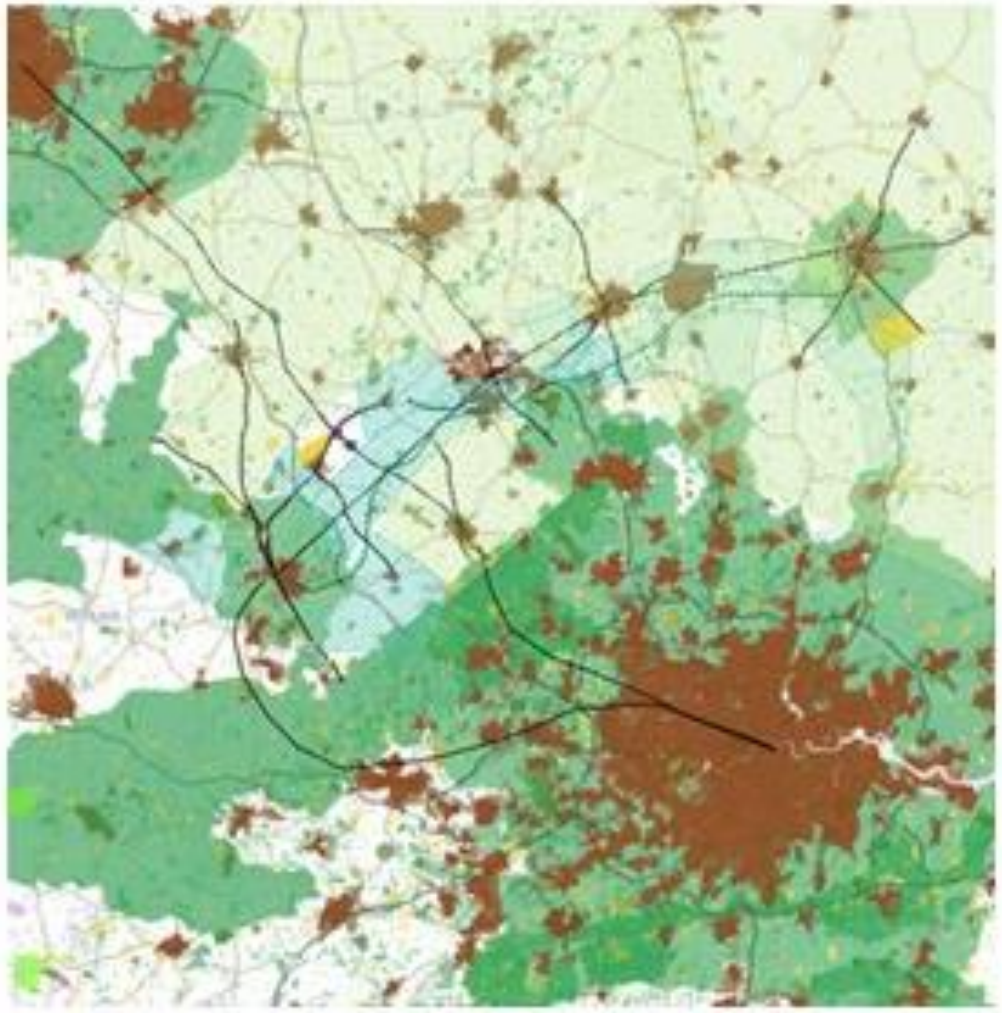
Tess Canfield, photographs



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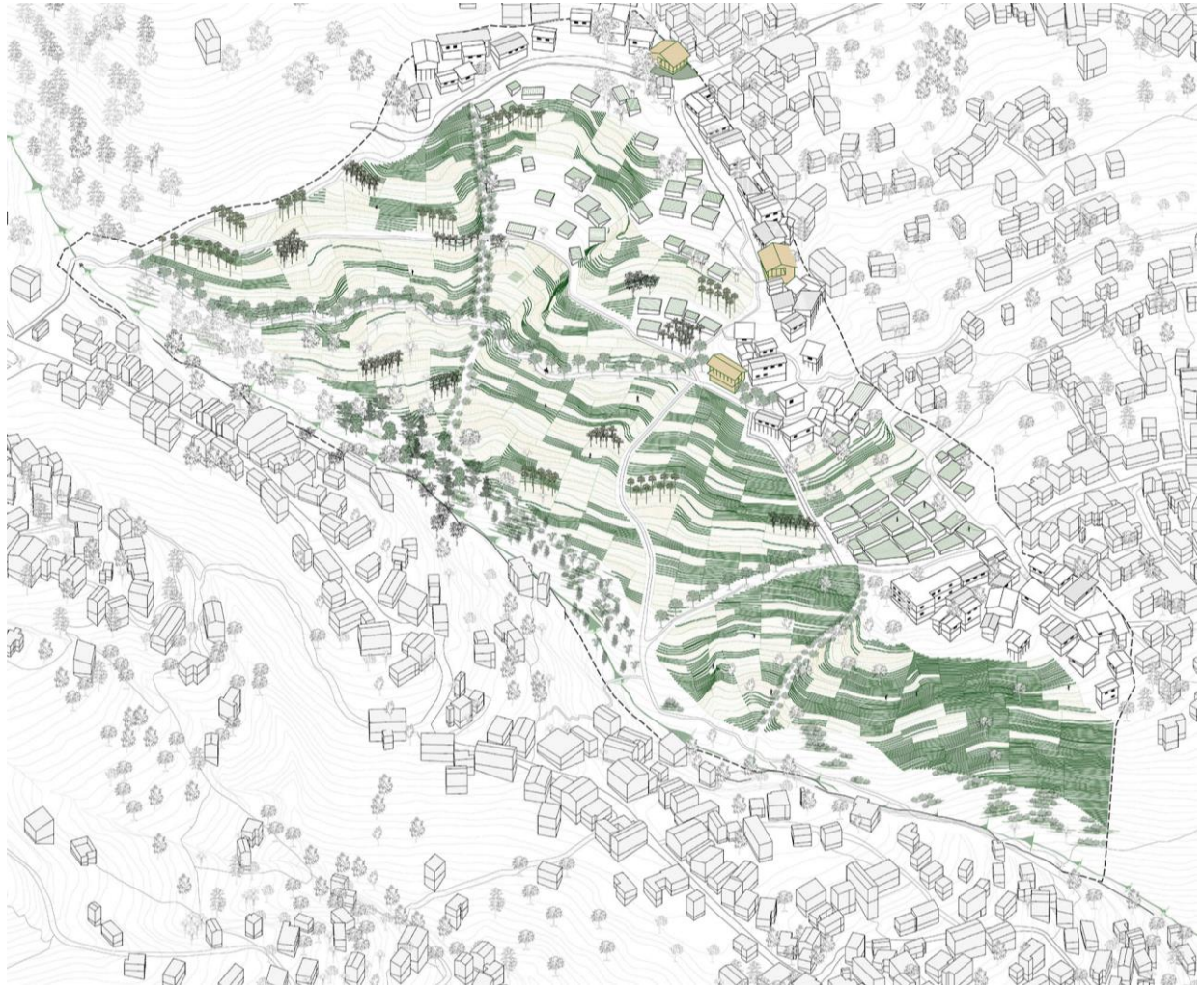

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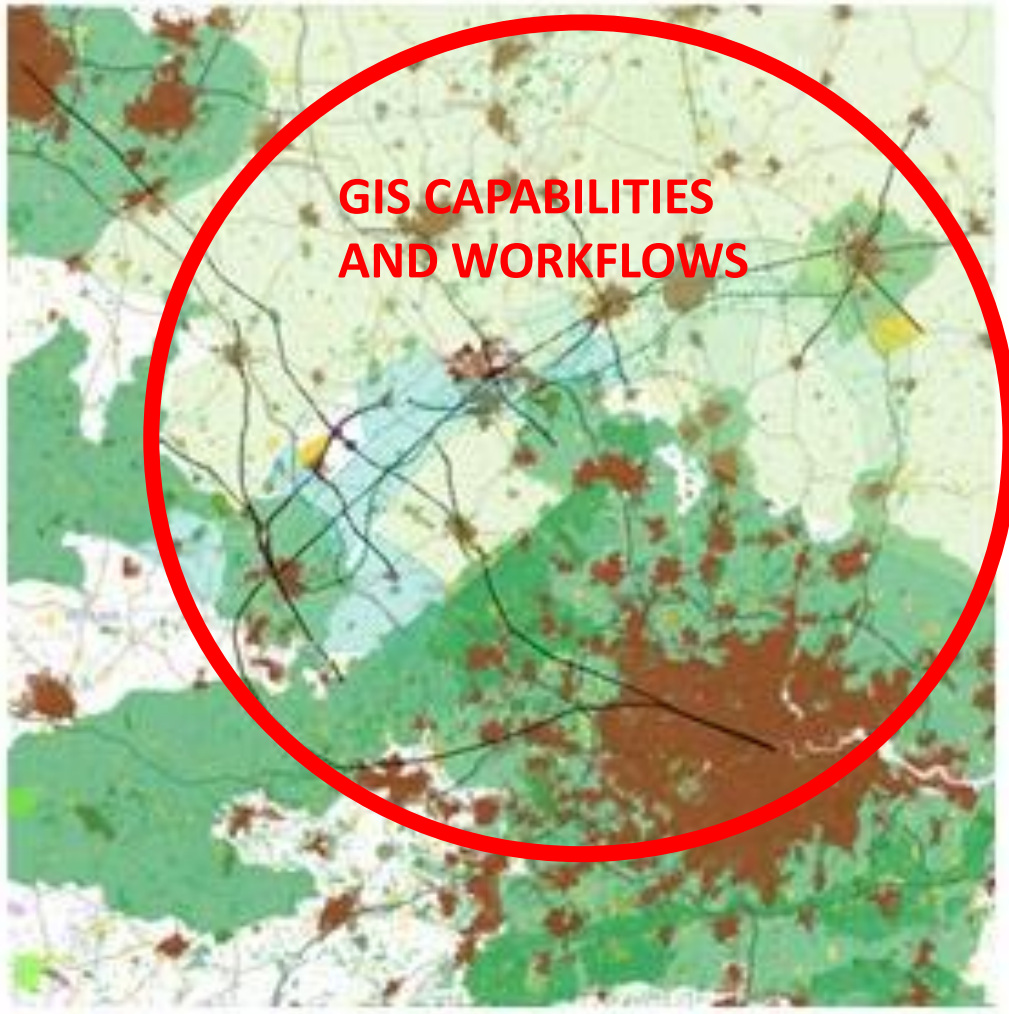

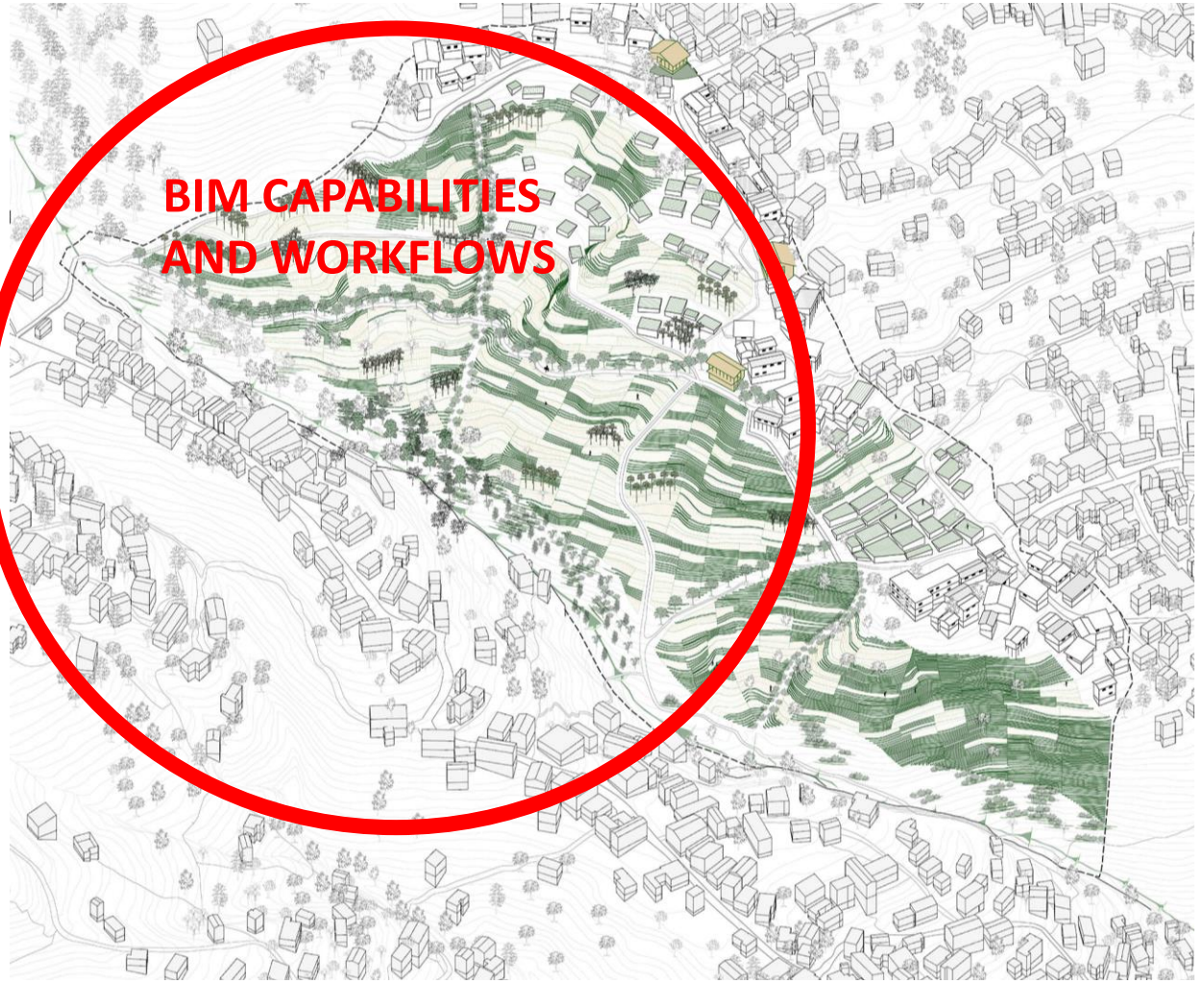

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Participants

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Hrishi Ballal	UCL CASA/Geodesign Hub
Mike Batty	UCL CASA
Adam Dennett	UCL CASA
Tess Canfield	UCL CASA
Asya Natapov	UCL CASA
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Richard Milton	UCL CASA
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Nick Falk	Director URBED
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George Breckenridge	Cambridge University
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Hormoz Goodarzy	Cambridge College USA
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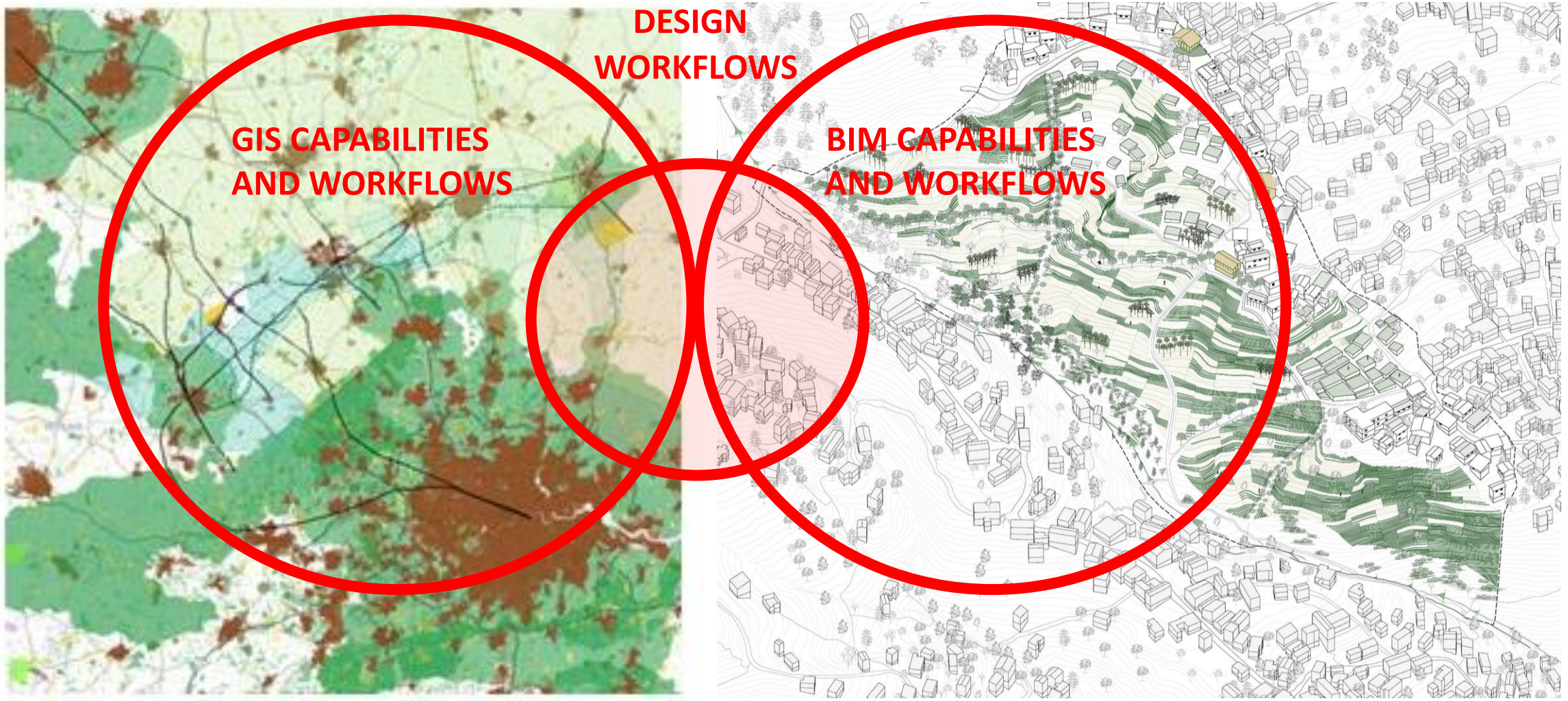

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“The most important thing is not the method or the technology…. *It is to know the rules*.”

Carl Steinitz