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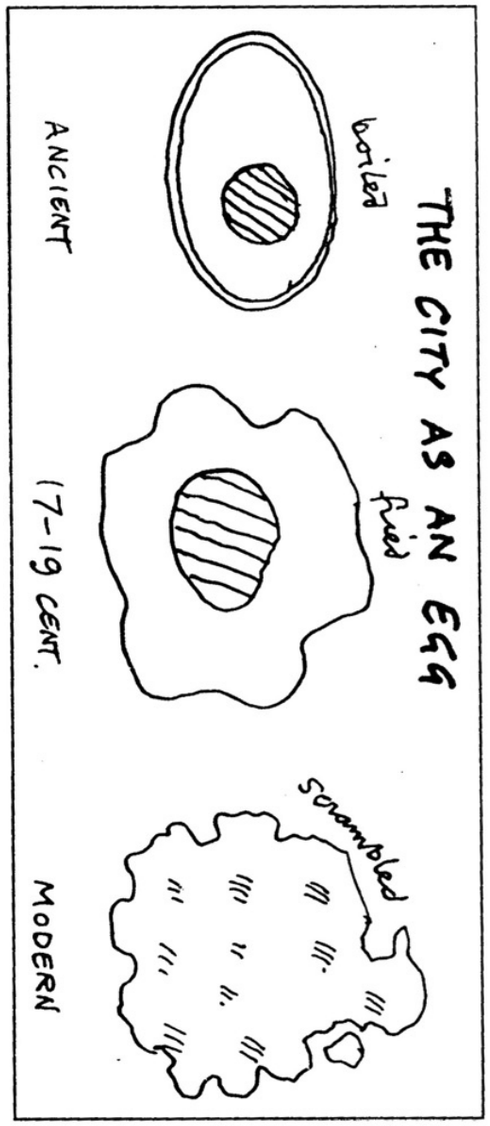


http://www.ecomplexcity.org/wp-content/uploads/2012/10/iss016-e-026150_denver.jpg

Introduction to Geodesign

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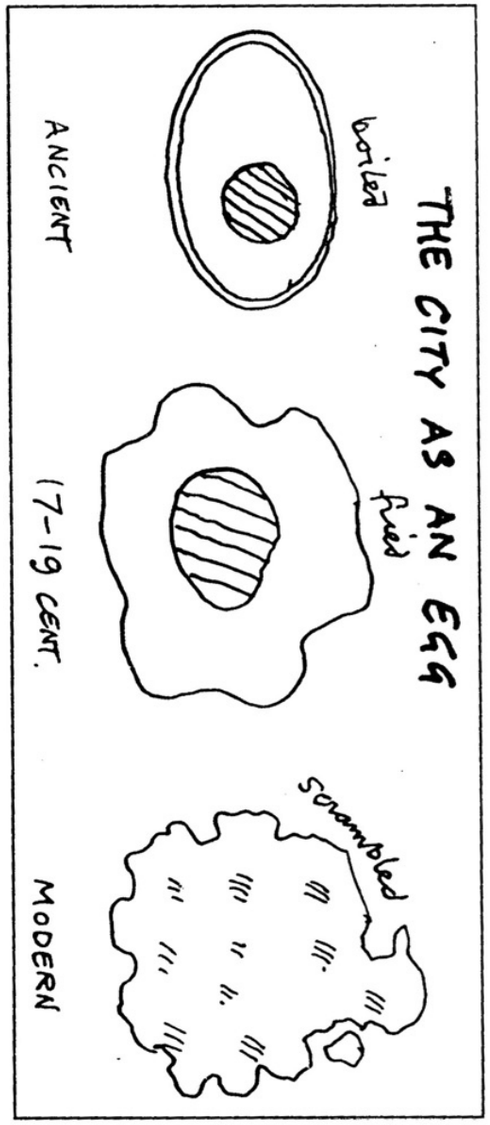
EVOLUTION OF THE CITY



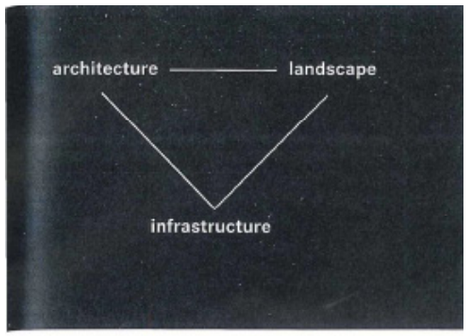
THE CITY AS AN EGG.
CEDRIC PRICE (1991)

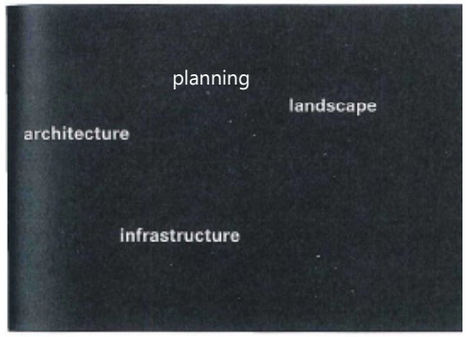
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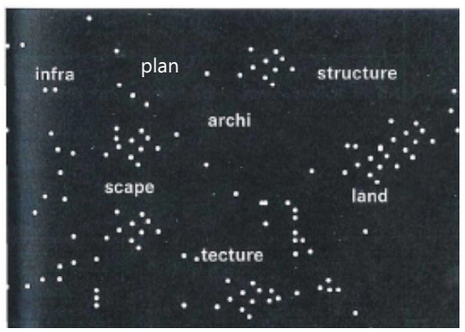
EVOLUTION OF THE CITY, DISCIPLINES



THE CITY AS AN EGG.
CEDRIC PRICE (1991)







RELATIONSHIP OF ARCHITECTURE, LANDSCAPE AND INFRASTRUCTURE.
ANGELLI, KLINGMANN (1999)

Space

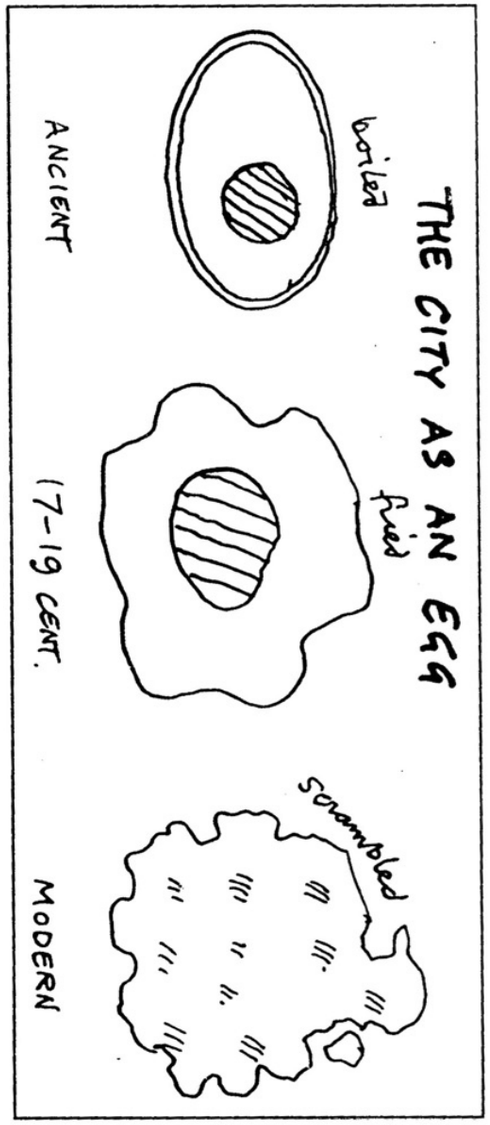
'The metropolitan region is not just a spatial form of unprecedented size in terms of concentration of population and activities. It is a new form because it includes in the same spatial unit urbanised areas and agricultural land, open space and highly dense residential areas: there are multiple cities in a discontinuous countryside. It is a multi-centred metropolis that does not correspond to the traditional separation between central cities and their suburbs (Castells, 2010: 2739)'.

Society

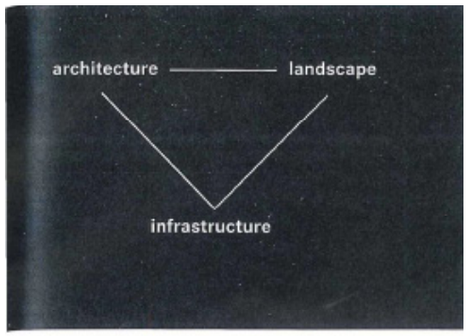
'The city is a chaotic situation of competing systems (...) produced non-centrally by actors designing systems across vast territories, without regard for each other's decisions, each adding their own system as a new layer to existing topography, historic structures, and landscapes' (Shane 2005: 305).

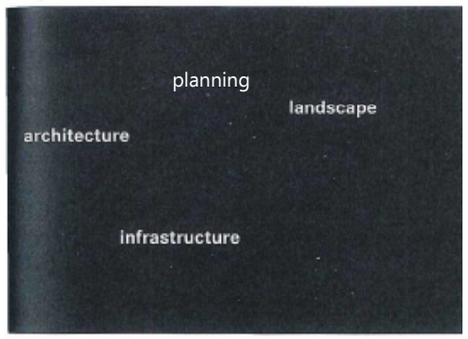
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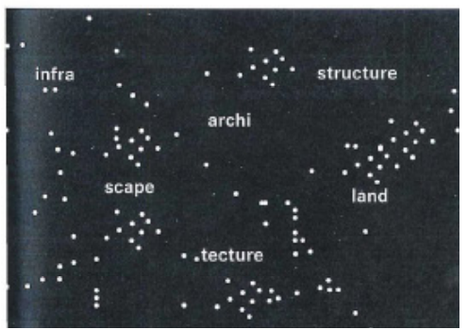
EVOLUTION OF THE CITY, DISCIPLINES AND TECHNOLOGY



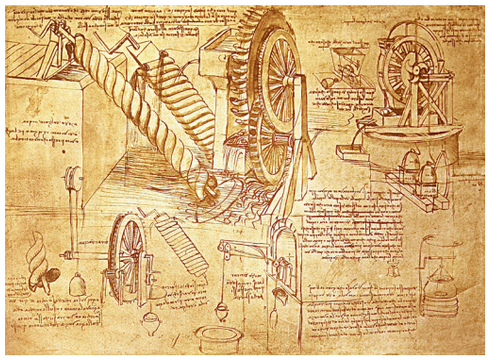
THE CITY AS AN EGG.
CEDRIC PRICE (1991)



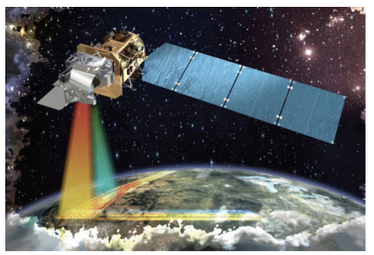




RELATIONSHIP OF ARCHITECTURE, LANDSCAPE AND INFRASTRUCTURE.
ANGELLI, KLINGMANN (1999)









CHANGING TECHNOLOGY OVER TIME

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URBANIST ARE CONFRONTED WITH LARGE AMOUNT OF DATA



REAL TIME, HIGHLY SPECIALISED, MULTI DISCIPLINARY, QUANTITATIVE AND QUALITATIVE, MULTI ACTOR ENVIRONMENTS,...

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DO WE HAVE THEORIES, METHODS AND TOOLS TO DEAL WITH THIS SITUATION?

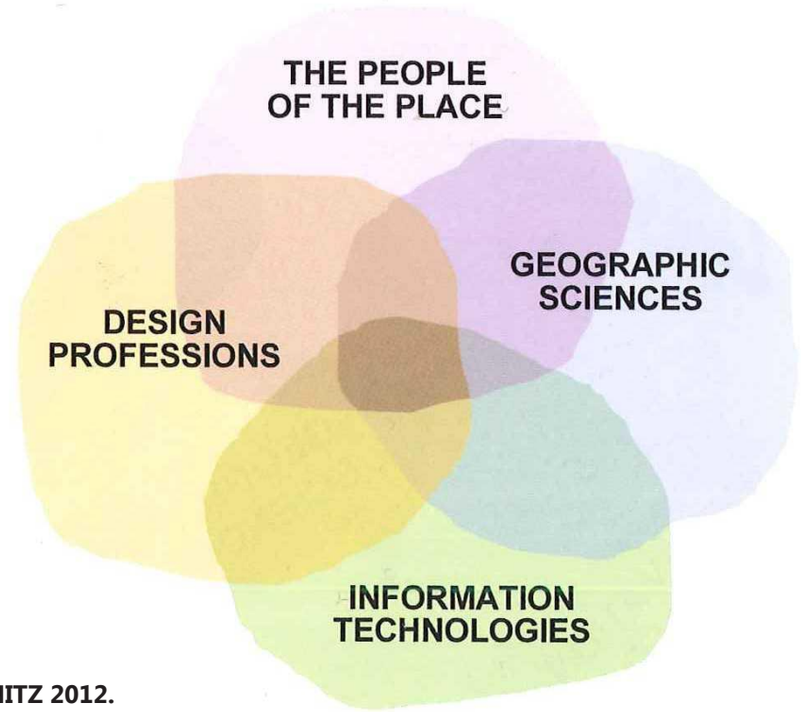
GEODESIGN DEFINITIONS:

Geodesign bridges the geospatial sciences and geographical information system (GIS)-related techniques with the design professions to inform better land-use decisions. (Paradis et al. 2013)

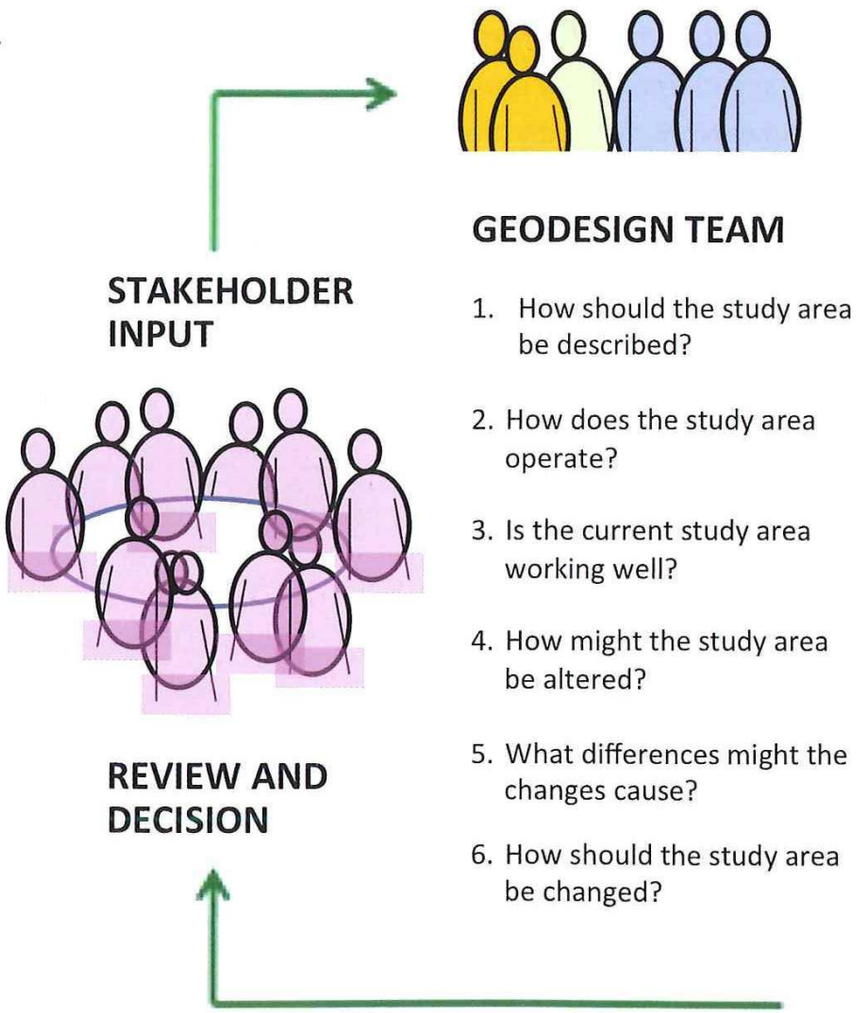
Geodesign is changing geography by design - GeoDesign brings geographic analyses into the design process, where initial design sketches are instantly vetted for suitability against a myriad of database layers describing a variety of physical and social factors for the spatial extend of a project. (Miller, 2010)

GeoDesign is a process of creating solutions for geospatial problems, involving design and decision making activities at various stages of the process. (Spatial Decision Support Knowledge Portal,2013)

THE IDEAS BEHIND GEODESIGN (based on Steinitz 2012)



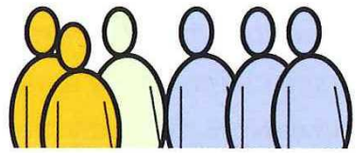
SOURCE: STEINITZ 2012.



GEODESING REQUIRES COLLABORATIONS AMONG THE DESIGN PROFESSIONS, GEOGRAPHICAL SCIENCES, INFORMATION TECHNOLOGIES AND THE PEOPLE IN PLACE (STEINITZ 2012).

THE IDEAS BEHIND GEODESIGN (based on Steinitz 2012)

THERE IS NOT ONE GEODESIGNER BUT A TEAM :



GEODESIGN TEAM

THE PEOPLE OF THE PLACE AND

DESIGN PROFESSIONS: architects, planners, urban designer, landscape architects, civil engineers, banker and lawyers,

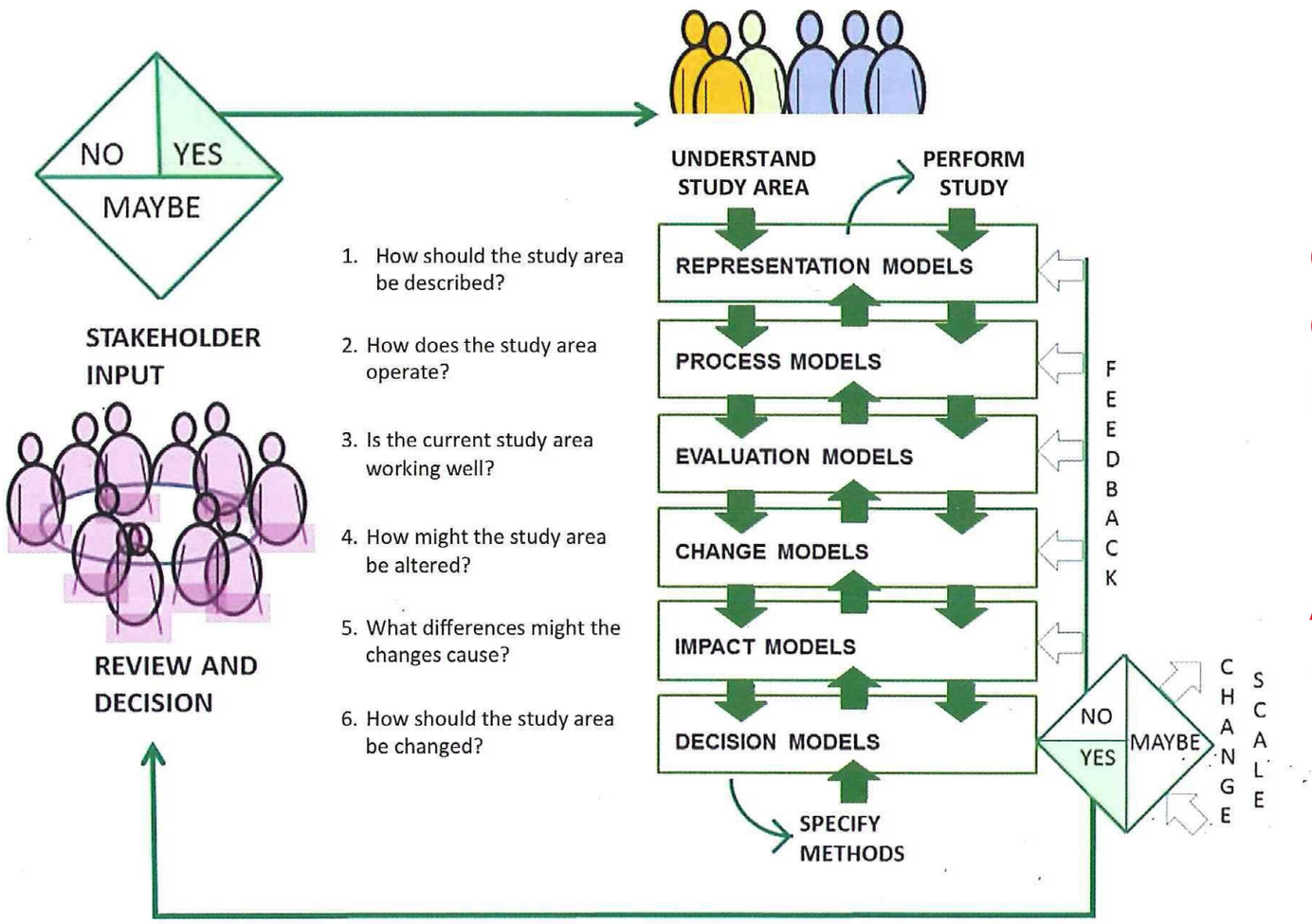
- going beyond information given;
- if a model points to a problem - the what/where/when solution beyond the model is needed = design aspect of Geodesign.

GEOGRAPHICALLY ORIENTATED NATURAL AND SOCIAL SCIENTISTS: geographers, hydrologist, ecologists, sociologists, economists,...

THEIR TECHNOLOGISTS: geomatics, applied mathematics, ICT-Experts, computer scientists, mediators,...

THE IDEAS BEHIND GEODESIGN (based on Steinitz 2012)

THERE IS NOT ONE GEODESIGN BUT IT IS A COLLABORATIVE PROCESS BASED ON A SET OF QUESTIONS AND METHODS.



multidisciplinary collaboration profits from a clear framework

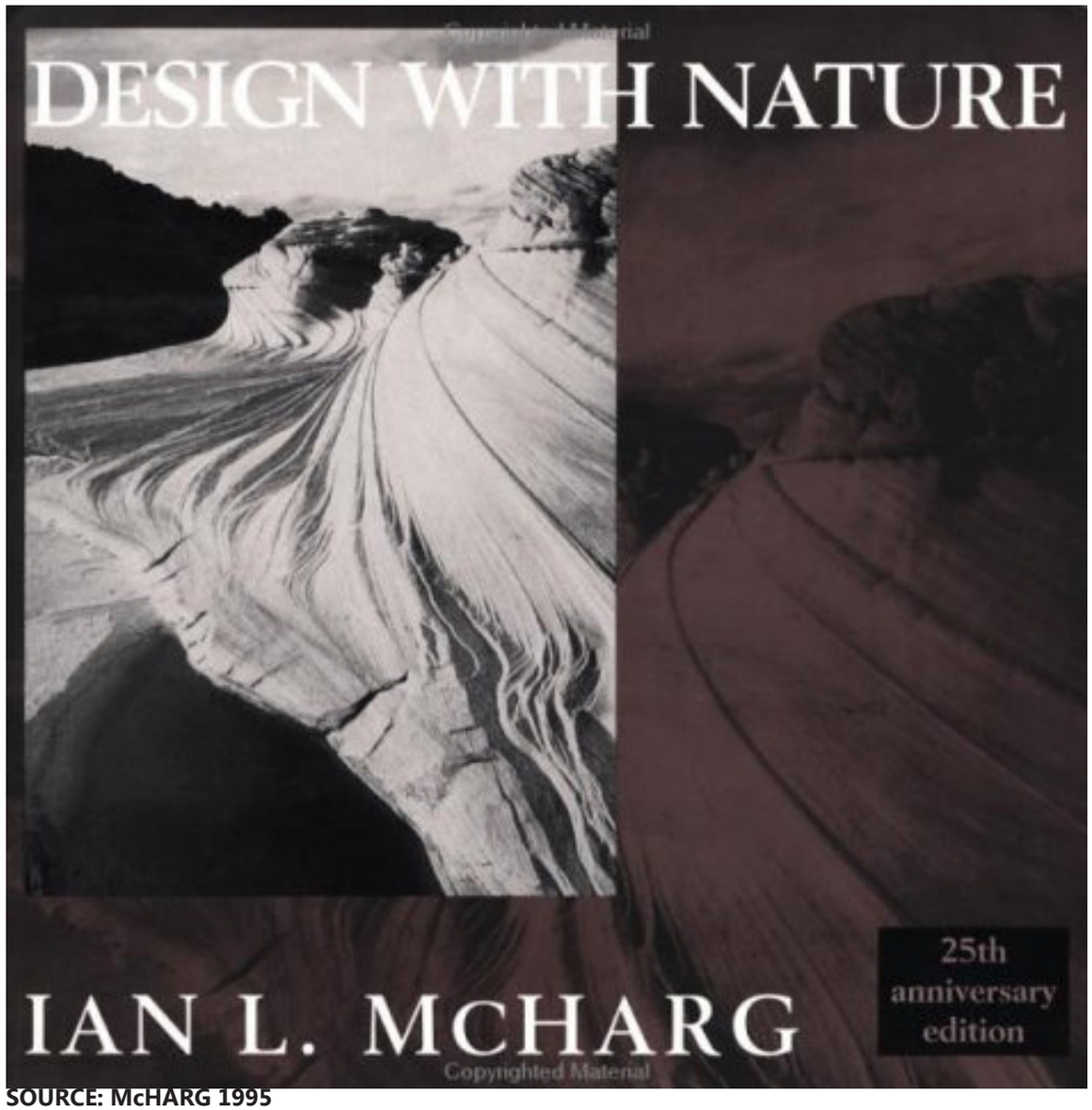
Carl Steinitz - Urbanist from Graduate School of Design, Harvard University.

A framework of Geodesign (2012) ESRI Press, New York

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THE IDEA(S) BEHIND GEODESIGN: CONTEXTUAL DESIGN

The context of our geographic space conditions what and how we design (that is, how we adjust and adapt to our surroundings) is as old as we started to adapt our spatial surroundings.



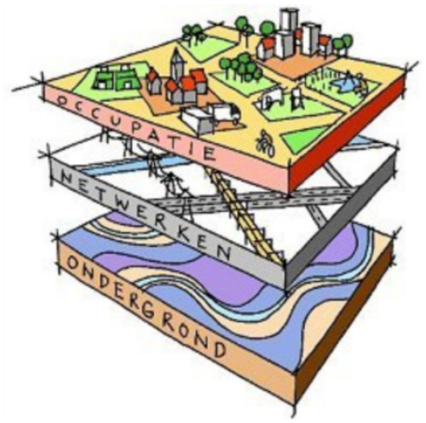
SOURCE: McHARG 1995

THE IDEA(S) BEHIND GEODESIGN: LAYER APPROACH

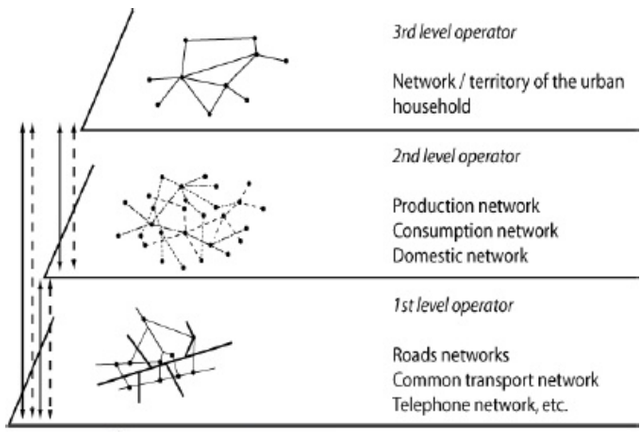
Ian McHarg
Design with Nature

one of the first layer approaches and overlay analyses for site analyses.

developed the beginnings of a land classification analysis => GIS



SOURCE: MCHARG 2012



determines which areas are develop-able and for what uses =>
LAND SUITABILITY

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THE IDEA(S) BEHIND GEODESIGN: COMBINING INFORMATION WITH LOCATION

Spatial Analyses

In 1832 French geographer Charles Picquet when he applied spatial analysis in epidemiology.

Starting from there, John Snow used the method possibly meant as the earliest use of geographical method when he depicted a cholera outbreak in London and related it to the locations of water pumps in 1854.



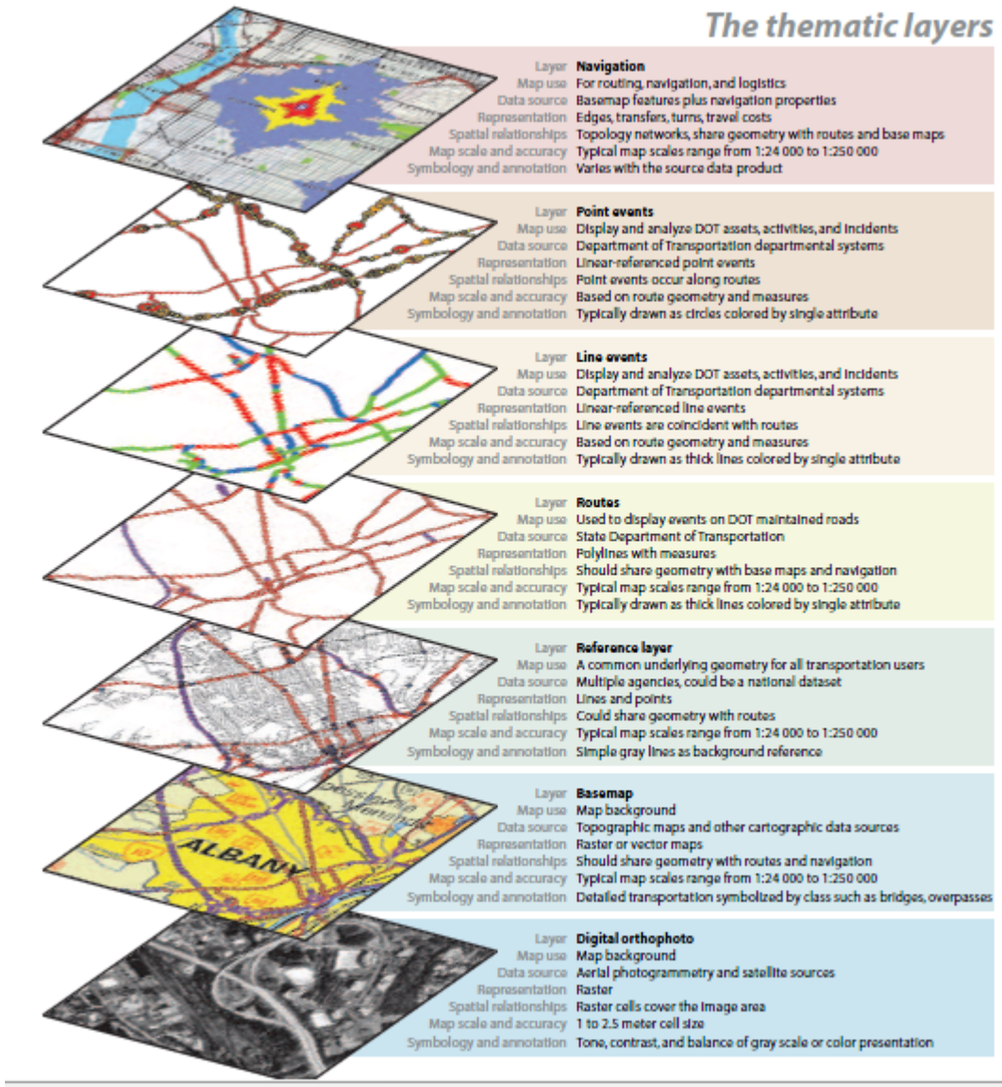
Source:: Wikimedia Commons

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THE IDEA(S) HAVE BEEN TRANSFORMED BY

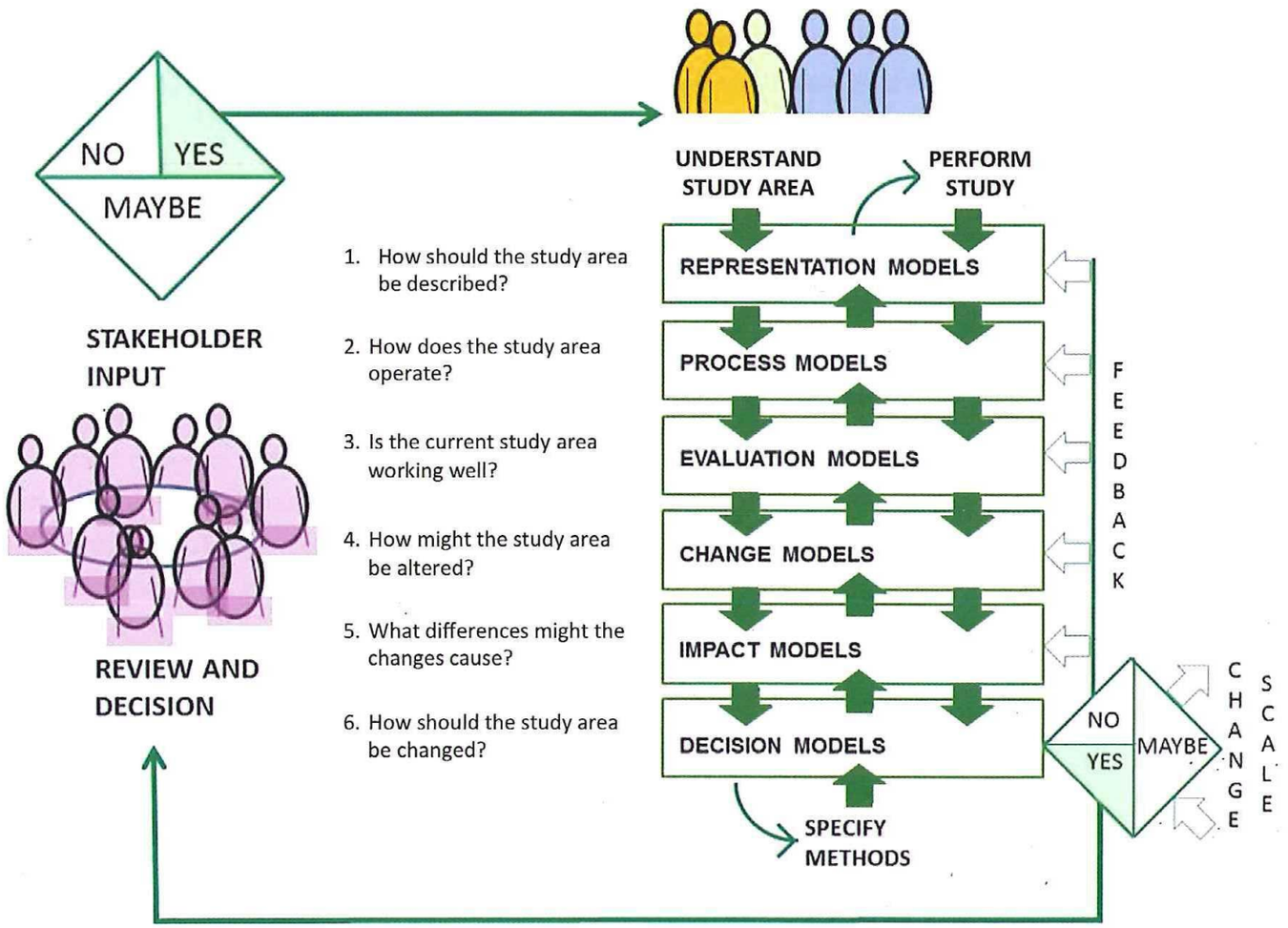
modern tools including digital databases, representational and analysis software tools (CAD, GIS, BIM, et al.), and modern communications technologies, practices, interfaces and approaches, including embedded sensors, multimedia feedback, web-based interactions, group decision making, mobile devices, social networks, ...

(Source: GEODESIGN.ORG, 2013)



STEINITZ FRAMEWORK OF GEODESIGN (based on Steinitz 2012)

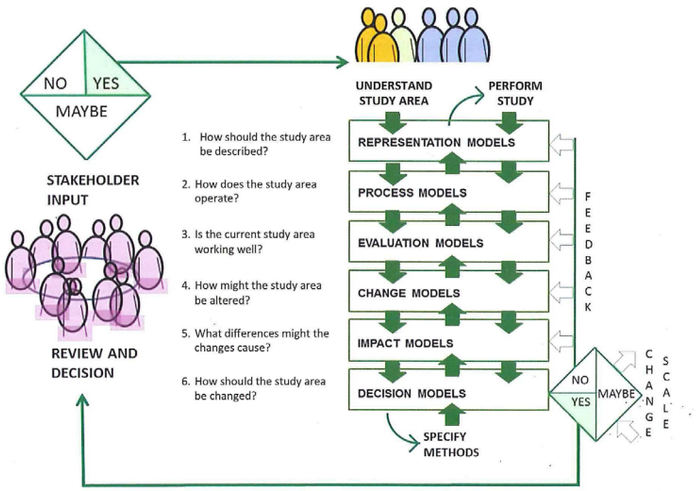
THERE IS NOT ONE GEODESIGN BUT IT IS A COLLABORATIVE PROCESS BASED ON A SET OF QUESTIONS AND METHODS.



6 questions

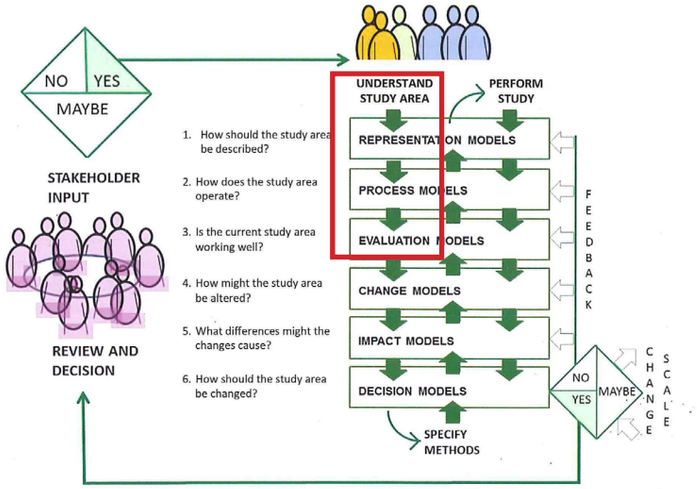
3 iterations

2 decision moments



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STEINITZ FRAMEWORK OF GEODESIGN QUESTIONS - MODELS - METHODS



First iteration understanding the area
Why Questions?

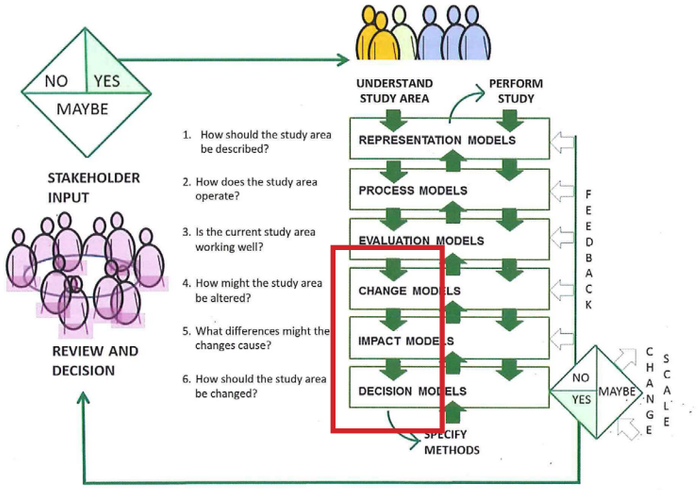
Representation:
How is the study are defined? Physical, ecological economic and social geographies?

Process:
What are the major physical, ecological economic and social and how are they linked?

Evaluation:
Is the area attractive? Why, why not, for whom?
Are ther Environmental, social economic problems?

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STEINITZ FRAMEWORK OF GEODESIGN QUESTIONS - MODELS - METHODS



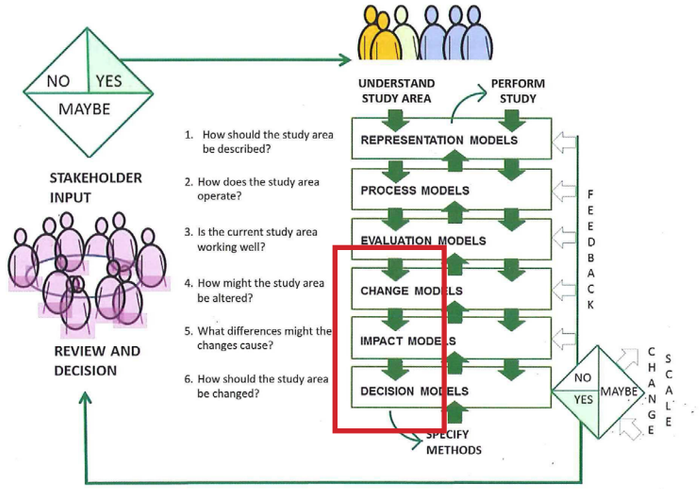
First iteration understanding the area
Why Questions?

Change:
What are the major foreseen changes? Major drivers of change?

Impact
Are anticipated changes seen beneficial of harmful? To whom?

Decision:
Purpose of the study? Main Stakeholders? Existing conflicts? Legal Framwork?

STEINITZ FRAMEWORK OF GEODESIGN QUESTIONS - MODELS - METHODS

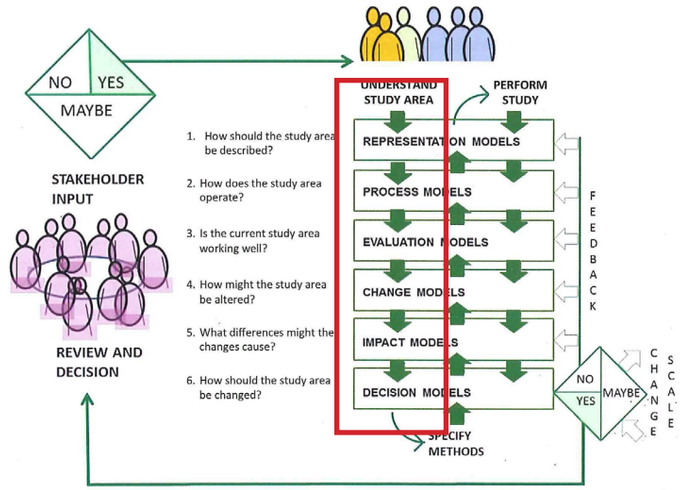


First iteration understanding the area
Why Questions?

‘Traditional’ methods of analyses like:
morphological studies,
flow studies, metabolism studies
actor network studies,
field work, interviews,
SWOT

supported and managed by a GIS system.

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What is a GIS ?

Geographic Information Systems (GIS) are designed for the purposes of capturing, storing, manipulating and presenting geographical data. (DLSR)

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analysing, and displaying all forms of geographically referenced information. (ESRI)



MRPC Geographic Information Systems (GIS)

"Exploring data using GIS turns data into information into knowledge"

Enter

Planning questions:

What is where?
How many?
What Kind?
What if?
Why is it there?
Why should I care?

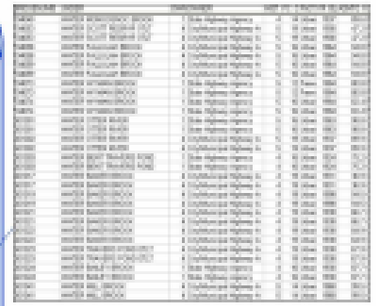
Information System



Staff

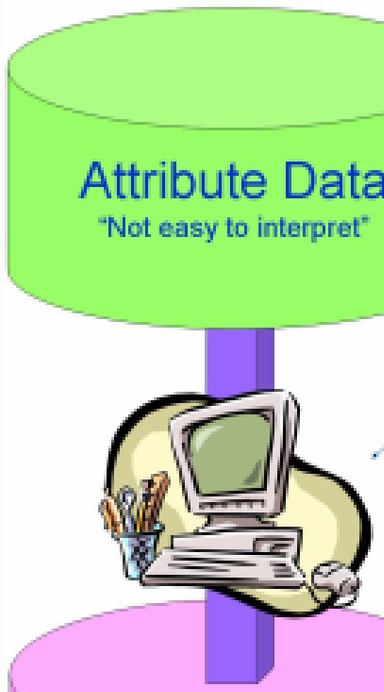
Planners, GIS Specialists, …

DATA from:
Towns
Regional Planning Agencies
State Agencies, MassGIS
Federal Agencies …



Attribute Data

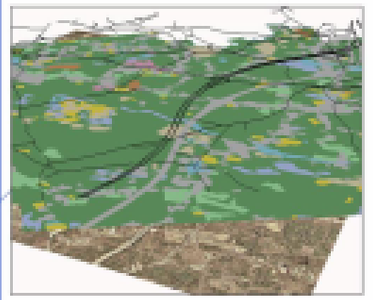
"Not easy to interpret"



Spatial Data

"Visualization worth
10 thousand words"

Attribute and Spatial data are linked by the GIS Software (ArcInfo, ArcView, Spatial Analyst, 3D Analyst)

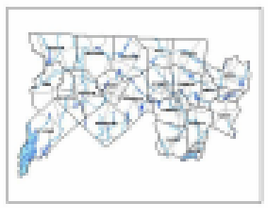


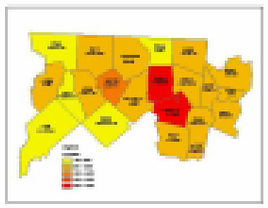
Capture, store, update, manipulate, analyze, and display all forms of geographically referenced information

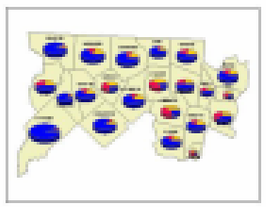
Exit

Words, Charts, Graphs, Tables, Paper Maps and Interactive Maps

Everything you will need to help in decision making







Source: http://www.mrpc.org/

A GIS is not..

.
.. a method of urban analyses.
but a GIS software package provides a set of tools to perform spatial analyses.

...interpreting the data and its spatial configu-ration. This is still the task of the team!



"Using GIS software, I was able to overlay topographical maps of Afghanistan, Kuwait, and Montana on top of each other. Now, if you'll notice, it kind of looks like a winged pony. See the tail...?"

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With a GIS we can:

Map Where Things Are

Map Quantities

Map Densities

Find What's Inside

Find What's Nearby

Map Change

Analyse if there is a spatial correlation between aspects.



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Research Questions

Does Amsterdam have an urban heat island?

Is there a relation between different types of land use and the intensity of the heat island?

Is there are spatial concentration of vulnerable parts of the population?

Which measure can be taken to minimise the risk for vulnerable people?

http://books.bk.tudelft.nl/index.php/press/catalog/book/17

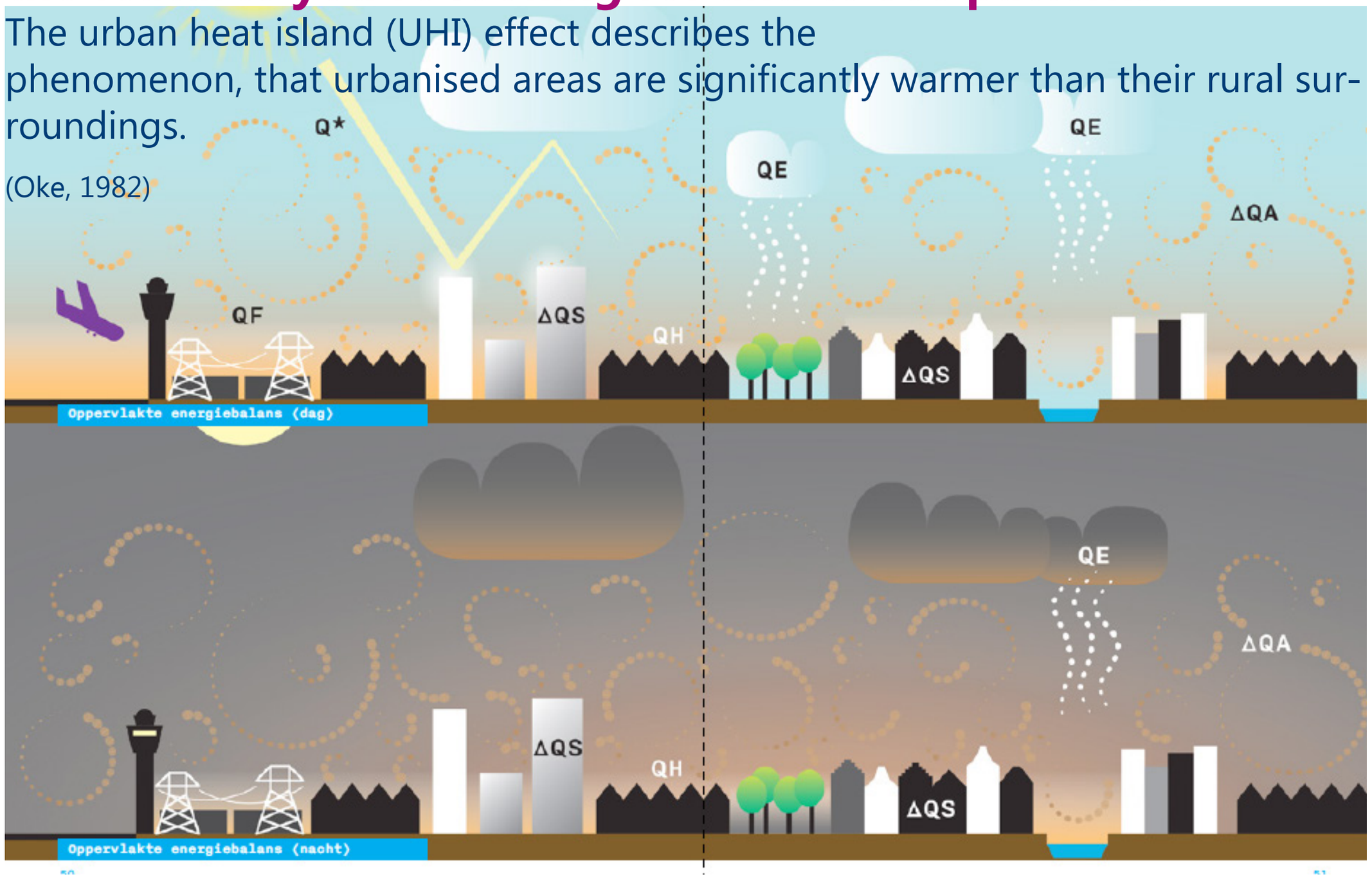


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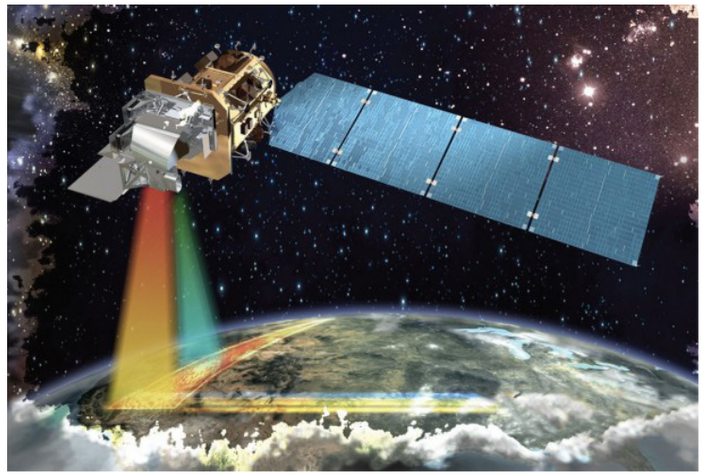
Mapping where things are lets you find places that have the features you're looking for and to see patterns.

The urban heat island (UHI) effect describes the phenomenon, that urbanised areas are significantly warmer than their rural surroundings.

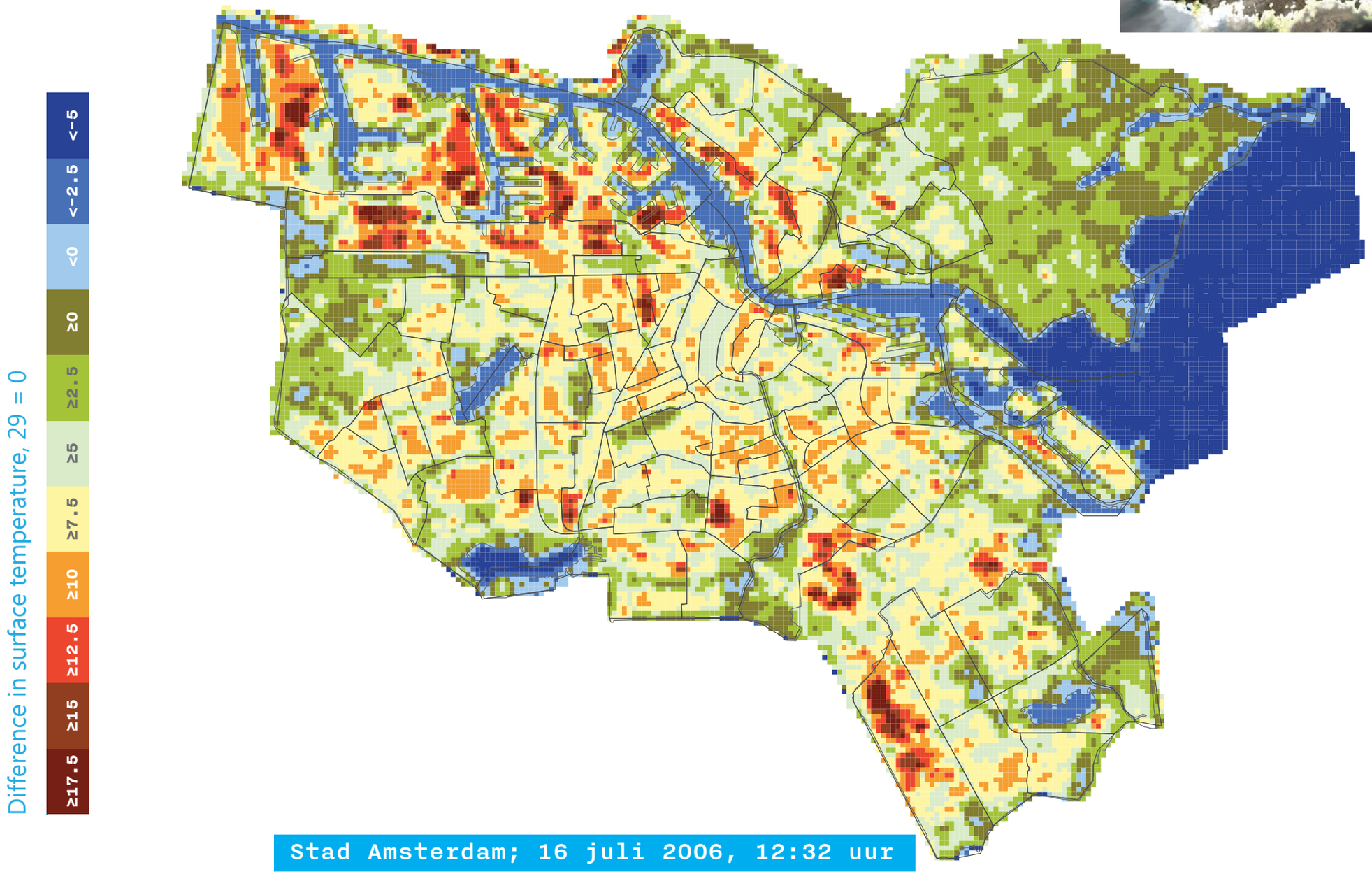
(Oke, 1982)



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Surface Temperature - Day



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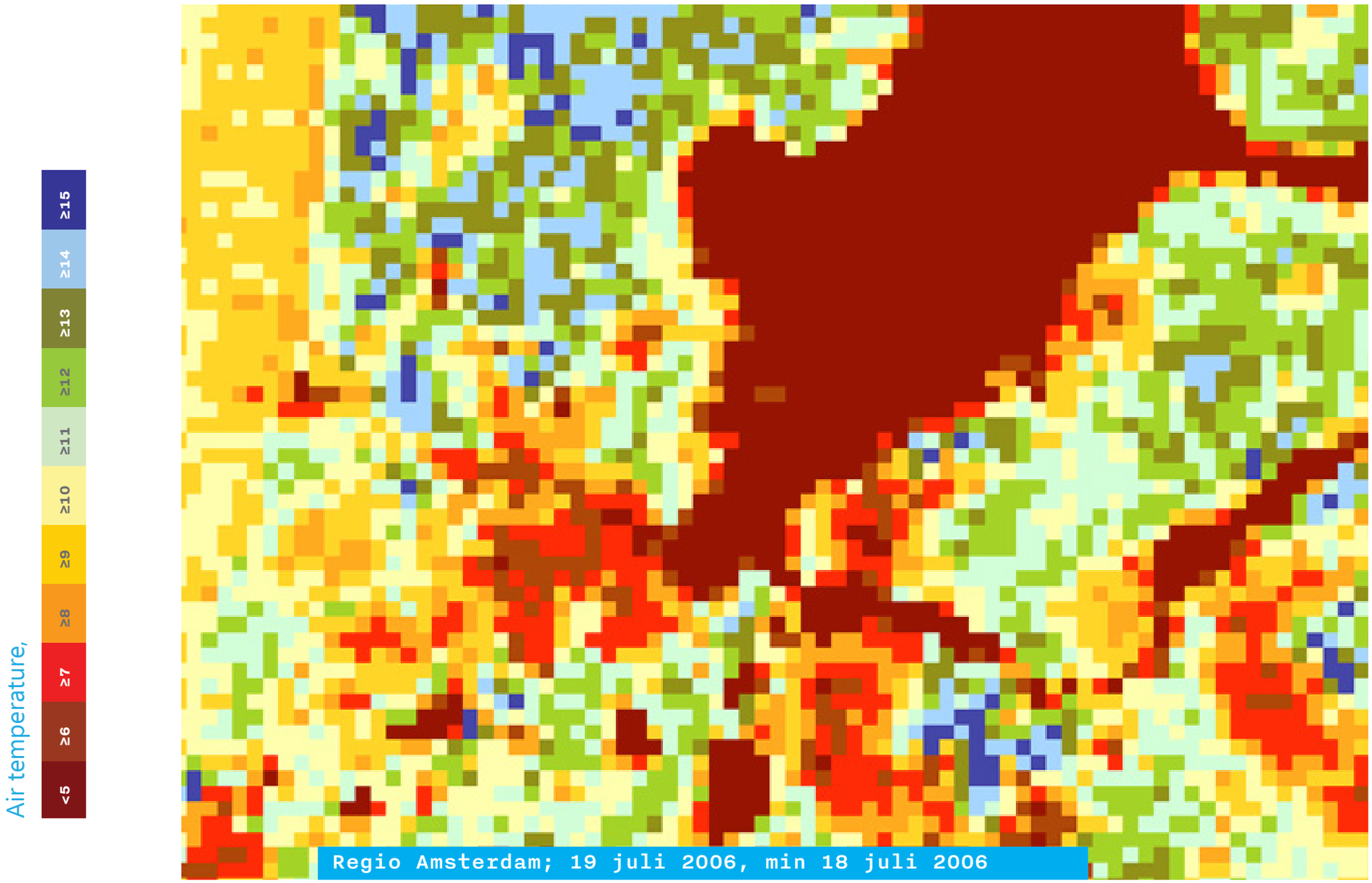
Map Quantities

Maping quantities to find places that meet their criteria and take action.

Where does the city not cool down over night? => most stressful for our health.

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Air temperature - Day minus Night



21

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Map Densities

A density map lets you measure the number of features using a uniform areal unit so you can clearly see the distribution.

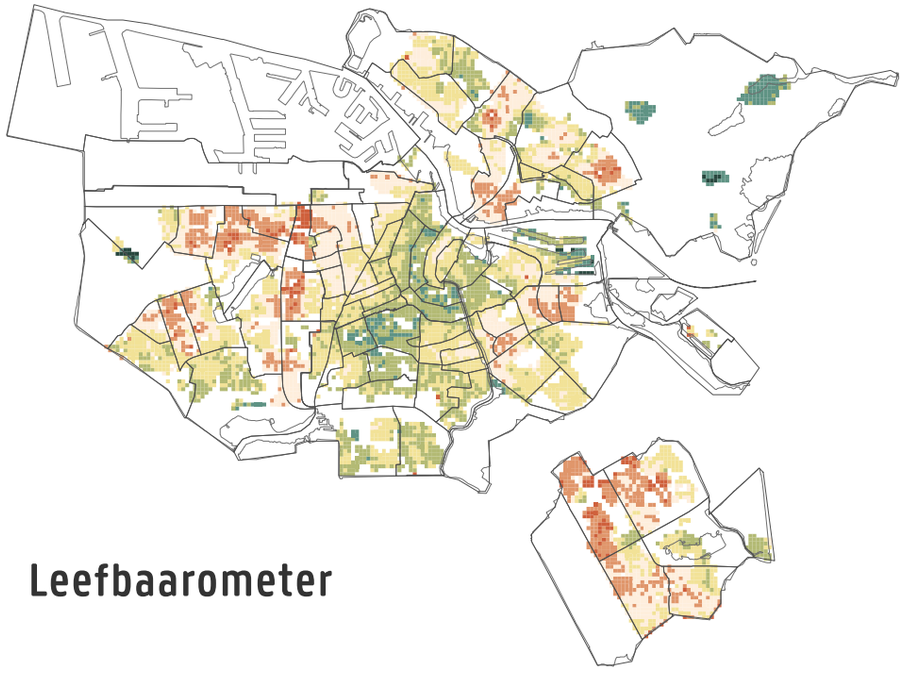
Where do the most elderly people live?

Where are the worst buildings and neighbourhoods?

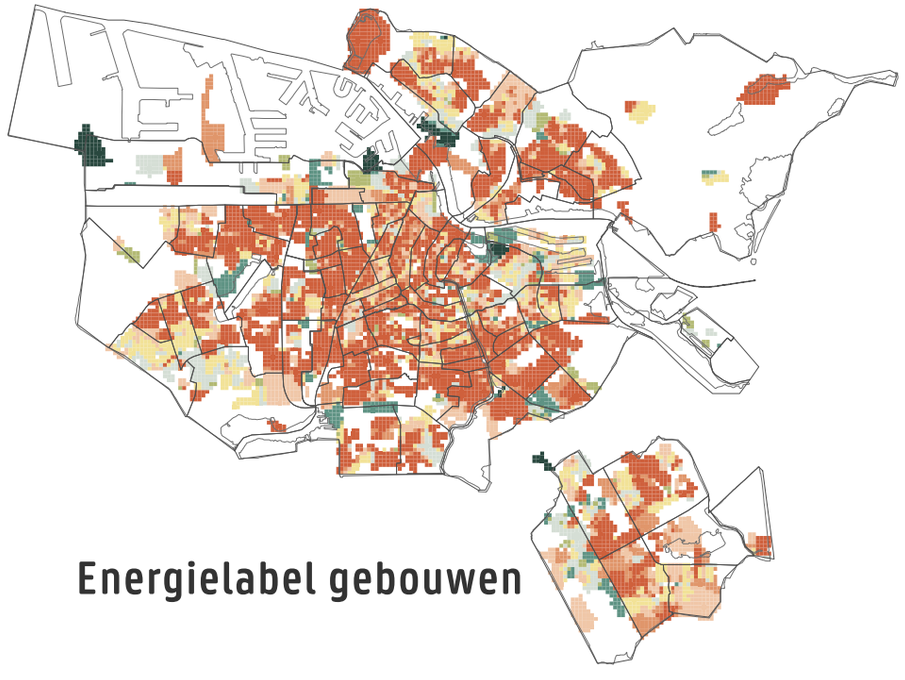


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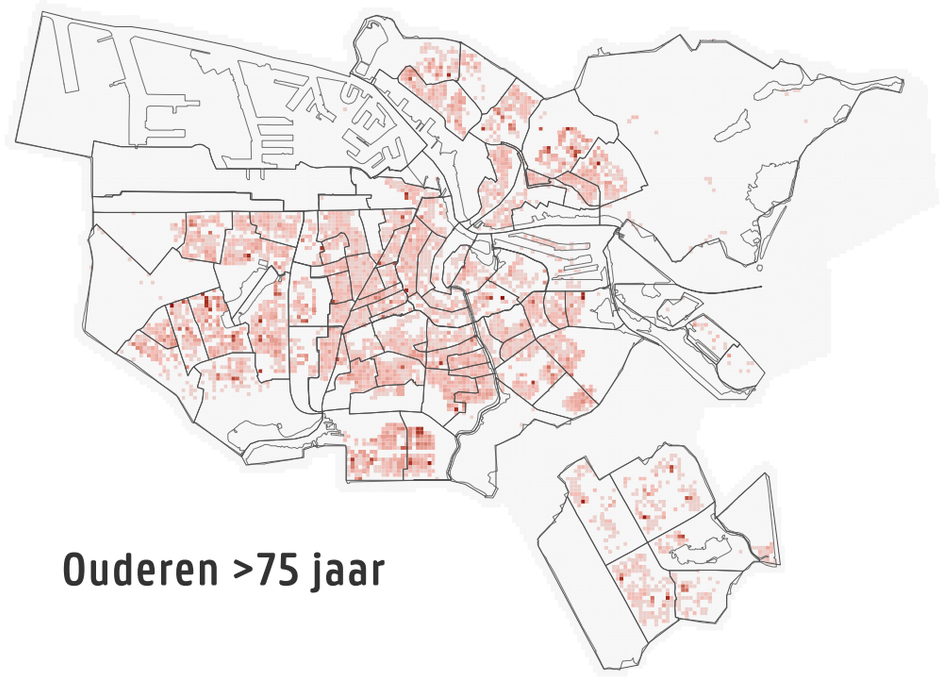
Vulnerability



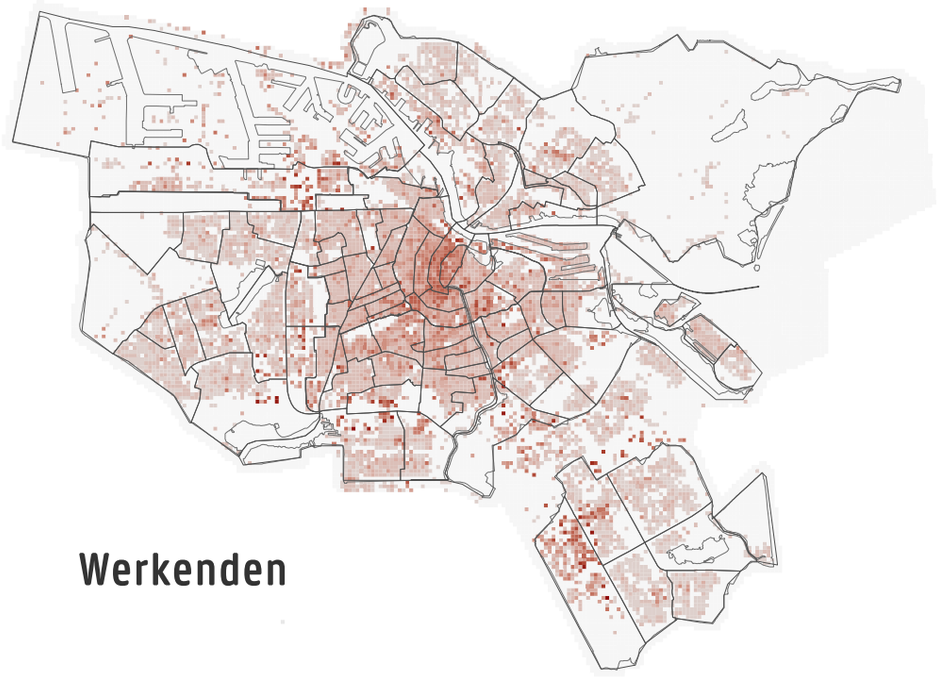
Leefbaarometer



Energielabel gebouwen



Ouderen >75 jaar



Werkenden

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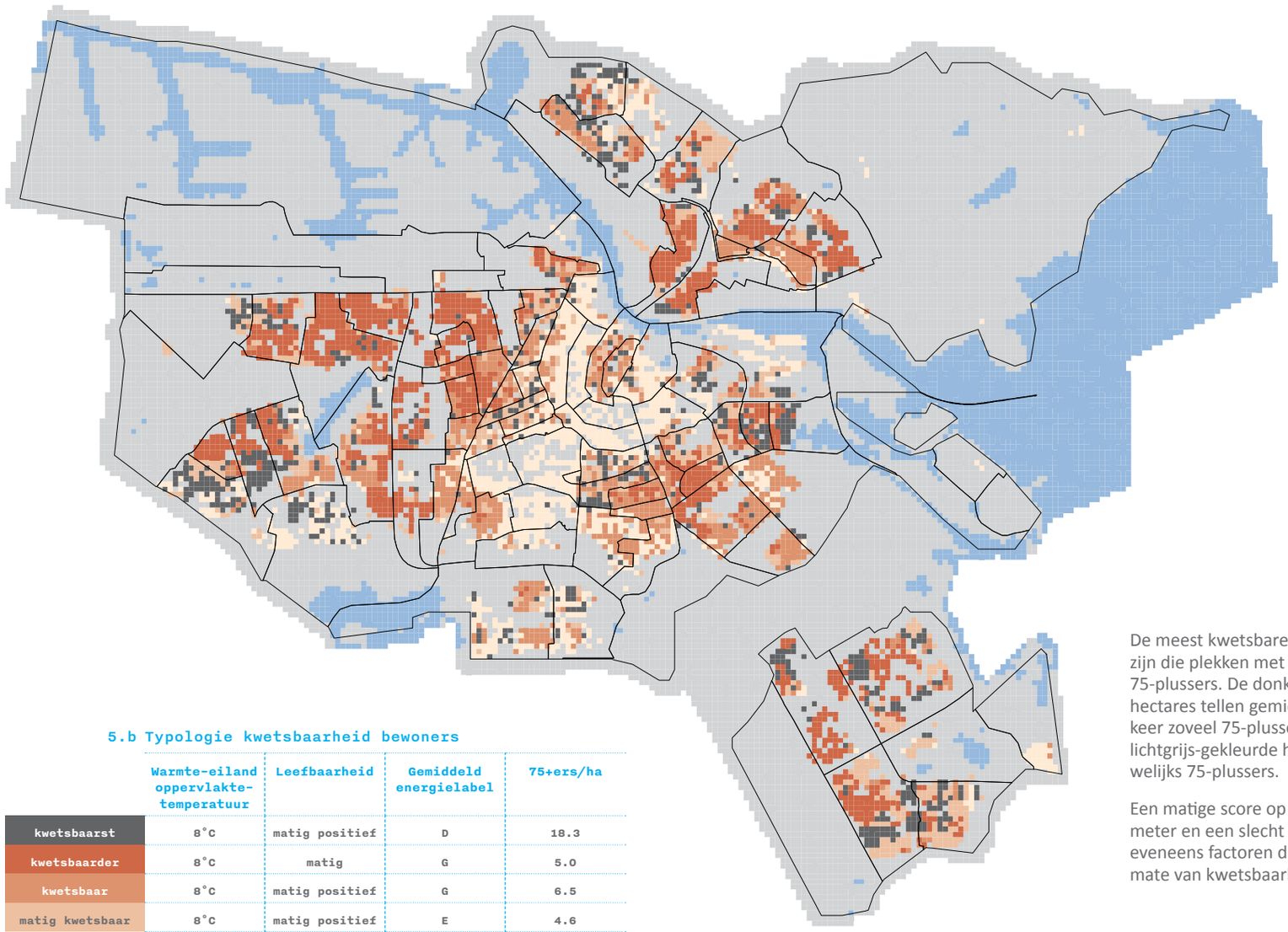
Find What's Inside

Use GIS to monitor what's happening and to take specific action by mapping what's inside a specific area.

Where do vulnerable people live, in bad houses in not liveable neighbourhoods that are heating up the most? (Cluster Analyses)

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Vulnerability of 75+



5.b Typologie kwetsbaarheid bewoners

	Warmte-eiland oppervlakte-temperatuur	Leefbaarheid	Gemiddeld energielabel	75+ers/ha
kwetsbaarst	8°C	matig positief	D	18.3
kwetsbaarder	8°C	matig	G	5.0
kwetsbaar	8°C	matig positief	G	6.5
matig kwetsbaar	8°C	matig positief	E	4.6
matig kwetsbaar	7°C	positief	G	4.5
overig	-	-	-	< 1.5
water	-6 C°	-	-	0

De meest kwetsbare delen van de stad zijn die plekken met hoge concentraties 75-plussers. De donkergrijs-gekleurde hectares tellen gemiddeld drie tot vier keer zoveel 75-plussers dan de rest. De lichtgrijs-gekleurde hectares tellen nauwelijks 75-plussers.

Een matige score op de Leefbaaro-meter en een slecht energielabel zijn eveneens factoren die bijdragen aan de mate van kwetsbaarheid.

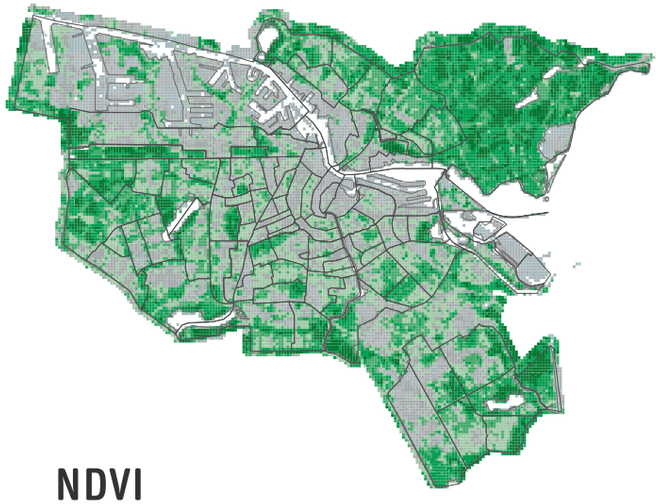
Analyse if there is a spatial correlation between aspects.

Spatial regression methods capture spatial dependency in regression analysis, avoiding statistical problems such as unstable parameters and unreliable significance tests, as well as providing information on spatial relationships among the variables involved.

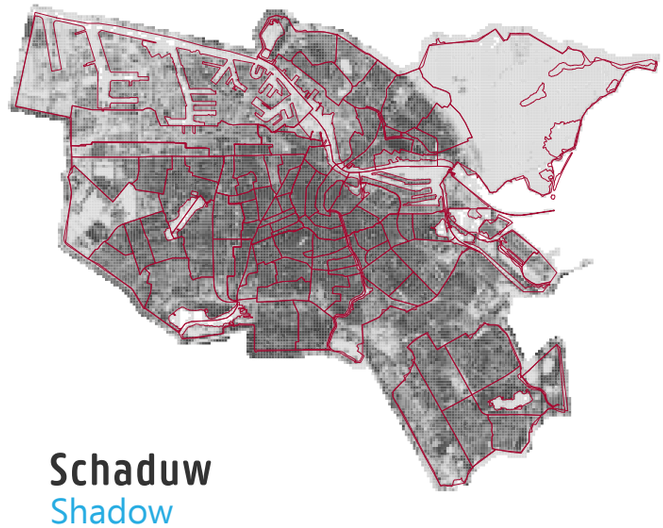
Can the intensity of the urban heat island be explained by aspects of urban form?

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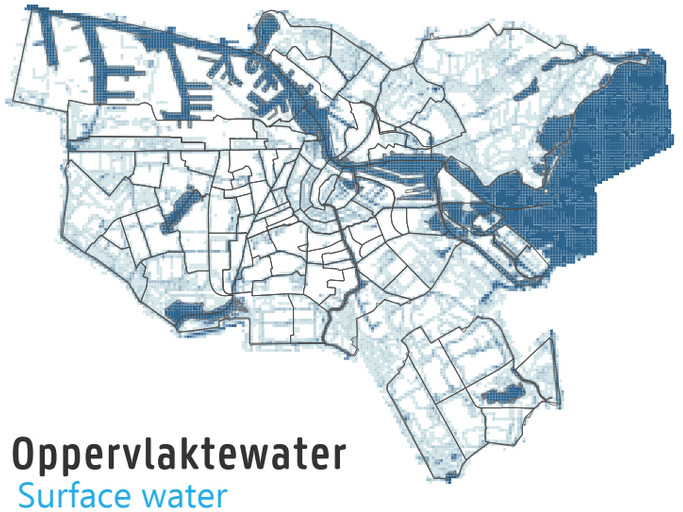
Urban form and land use: influence on urban heat island



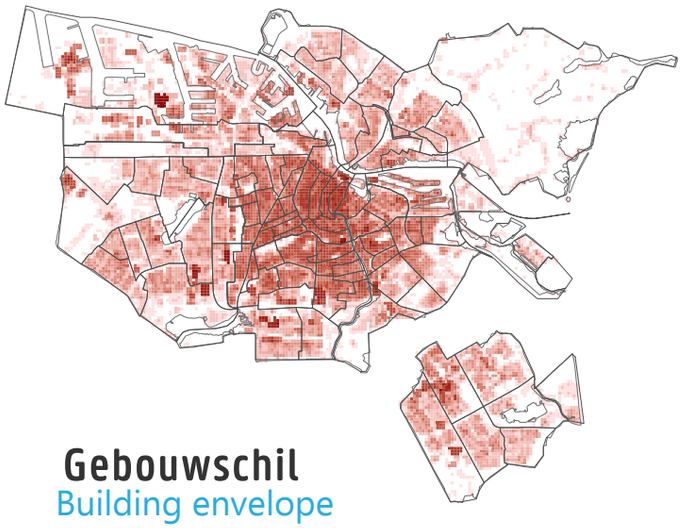
NDVI
Vegetation



Schaduw
Shadow



Oppervlaktewater
Surface water



Gebouwschil
Building envelope



Verkeersruimte
Traffic space



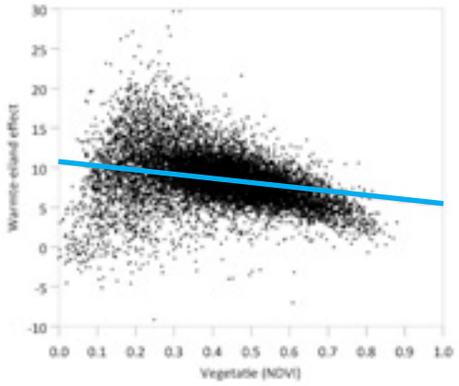
Verharding
Impermeable surface

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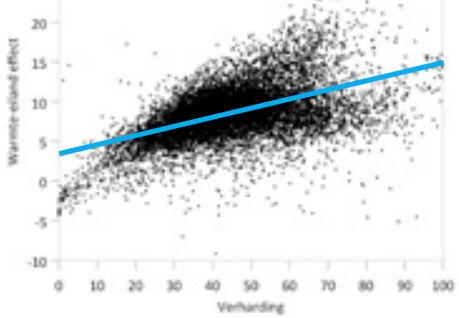
Urban form and land use: influence on urban heat island

Verband oppervlaktetemperatuur - ruimtegebruik

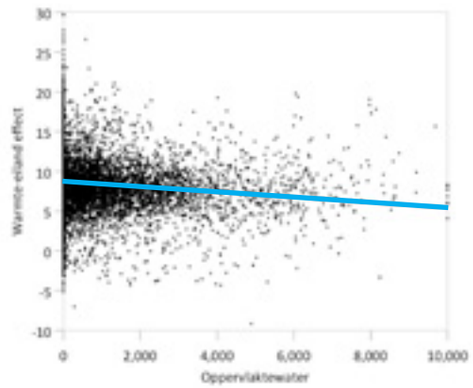
indicator ruimtegebruik	minimum/maximumwaarde	gemiddelde verandering oppervlaktetemperatuur
Schaduw	0 - 600	-3.6˚C
Sky-view	0 - 1.0	-3.0˚C
Albedo	0 - 0.5	8.2˚C
Vegetatie (NDVI)	0 - 1.0	-5.3˚C
Oppervlaktewater	0 - 100%	3.3˚C
Verharding	0 - 100	11.6˚C
Verkeersoppervlak	0 - 100%	-1.0˚C
Gebouwschil	0 - 120.000	2.0˚C



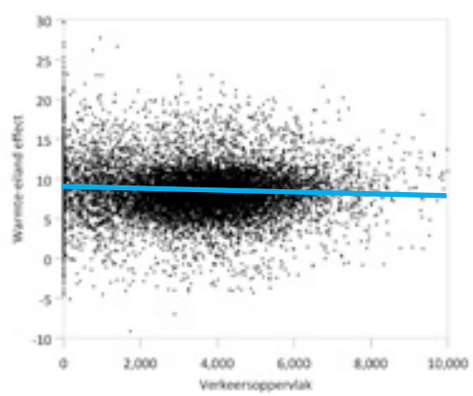
4. Vegetatie (NDVI)



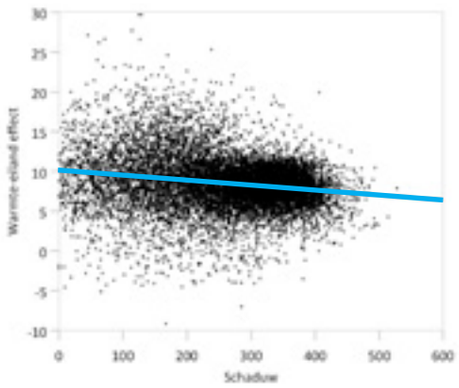
6. Verharding



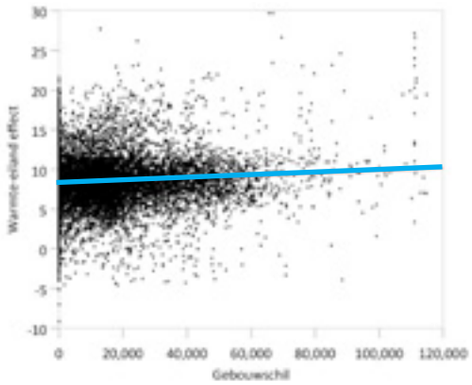
5. Oppervlaktewater



7. Verkeersruimte



1. Schaduw



8. Gebouwschil

Land use typology



5.a Typologie ruimtegebruik

	Satellietbeeld			Gemeente GIS		3D-model	
	Warmte-eiland opper-vlakte-temp.	Verhar-dings-index 0-100	Vege-tatie index (NDVI) 0-1	% Opper-vlakte water	% Ver-keersop-pervlak	Gebouw-schil index	Schaduw 0-600
warmst	10°C	52	0.4	5%	49%	1.8	281
warmer	9°C	56	0.4	6%	30%	4.9	321
heet	9°C	50	0.3	14%	9%	0.4	148
warm	7°C	33	0.5	5%	37%	0.9	278
koel	3°C	18	0.7	11%	15%	0.2	293
koeler	2°C	11	0.7	7%	3%	0.0	30
koelst	0°C	19	0.3	72%	4%	0.1	76
fris	-5°C	2	0.0	98%	0%	0.0	9

De typologie ten aanzien van het ruimtegebruik is gebaseerd op een Landsat 5 beeld van juli 2006.

IJburg valt grotendeels in categorieën die sterk weg hebben van bedrijventerreinen. Dat komt omdat IJburg in 2006 nog opgespoten terrein was.

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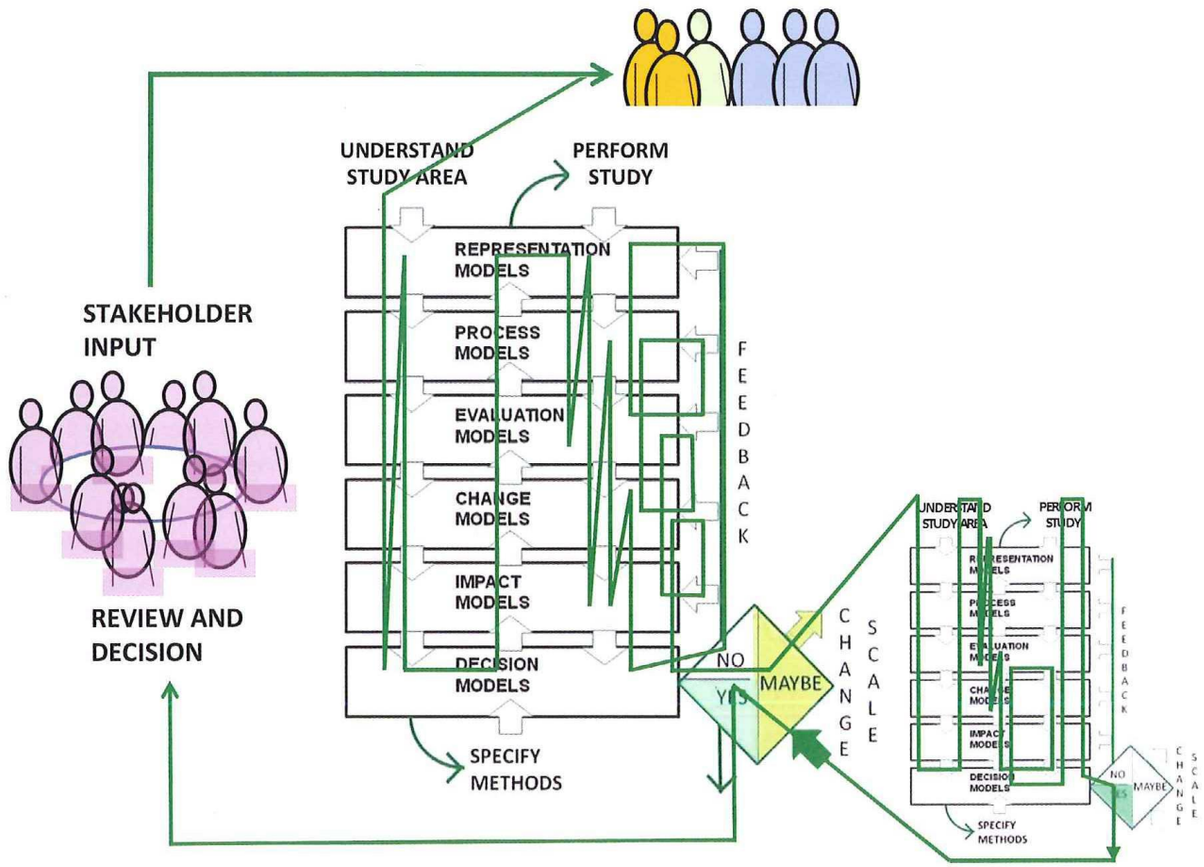
Urban-Renewal

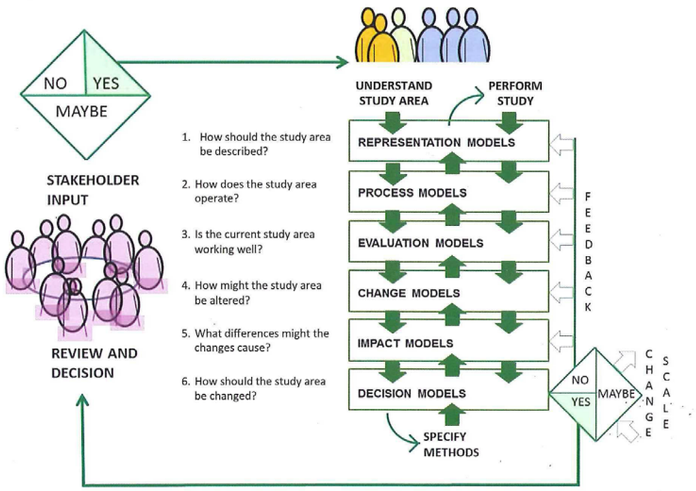
Is this an improvement?



STEINITZ FRAMEWORK OF GEODESIGN (based on Steinitz 2012)

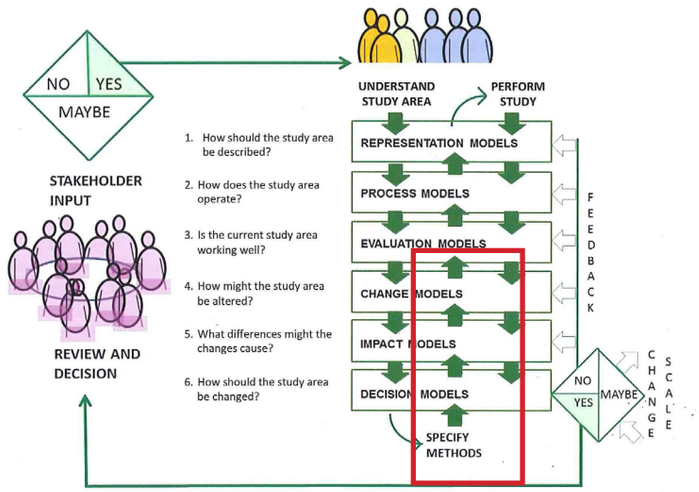
THERE IS NOT ONE GEODESIGN BUT IT IS A COLLABORATIVE PROCESS
IN PRACTICE IT IS NOT LINEAR BUT ITERATIVE!





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STEINITZ FRAMEWORK OF GEODESIGN QUESTIONS - MODELS - METHODS



Second iteration understanding the area

How Questions?

inverse direction to be decision driven and not data driven.

Decision:
What do the decision maker need to know? What is the bases of their decision? Cultural norms, legal standards, costs,..?

Impact:
Which impacts of possible changes are most important? How complex has the impact assessment to be? How much, where, when and to whom is seen as good and bad?

Change:
Who assumes the assumption of changes? Which scenarios should be considered? Time horizon, scale?

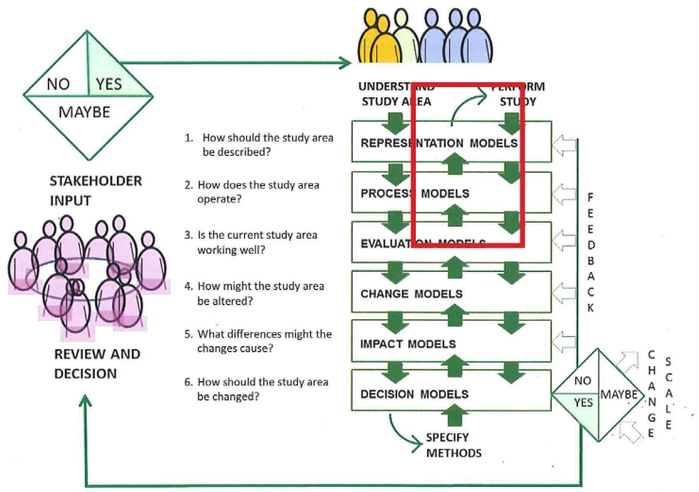
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STEINITZ FRAMEWORK OF GEODESIGN QUESTIONS - MODELS - METHODS

Second iteration understanding the area

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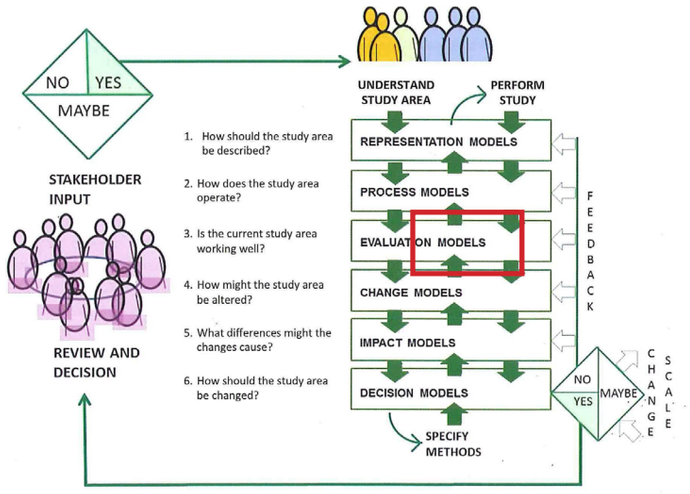
Evaluation:
What are the measures of evaluation? In ecological, economic, political and visual preferences?

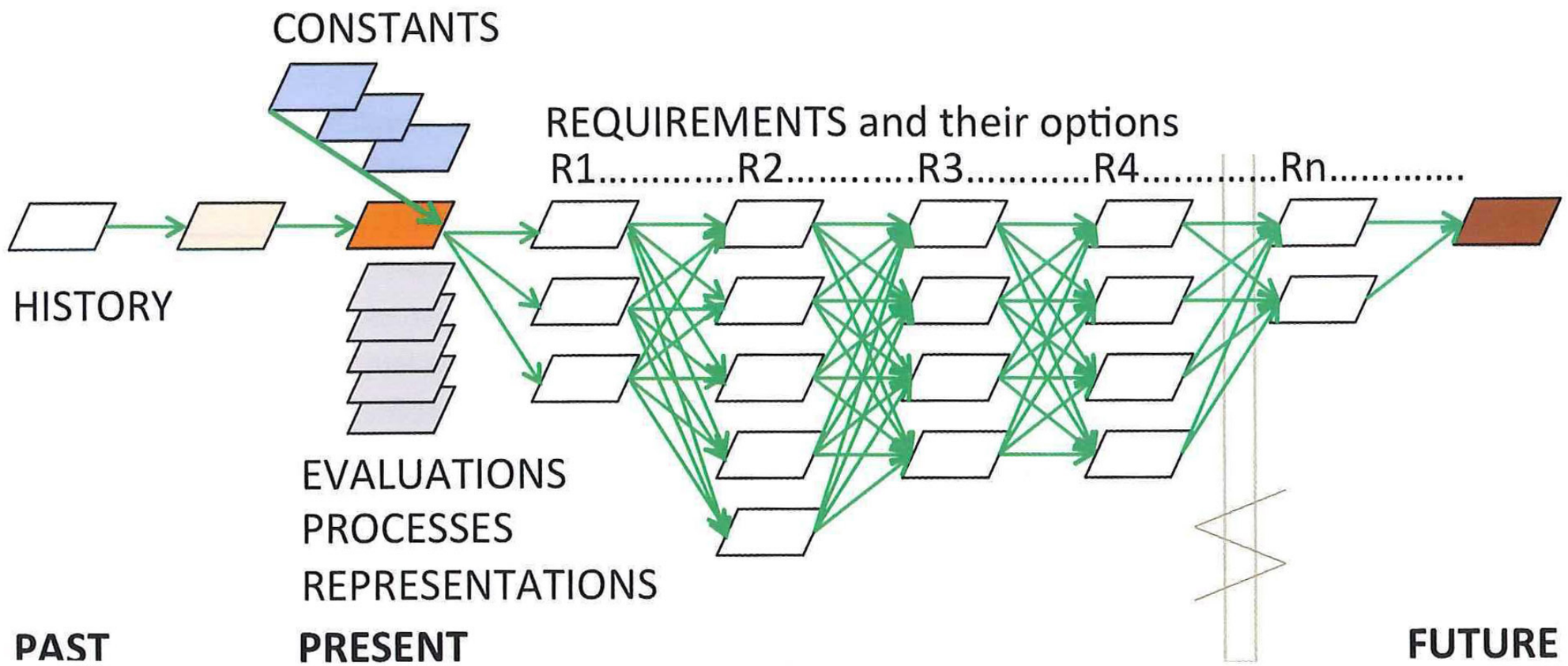
Process:
Which process model should be included? Detail, time horizon(s)?

Representation:
Where – exactly- is the study area and why choose which boundaries?
Which data needed? Time series? Sources? Costs?

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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

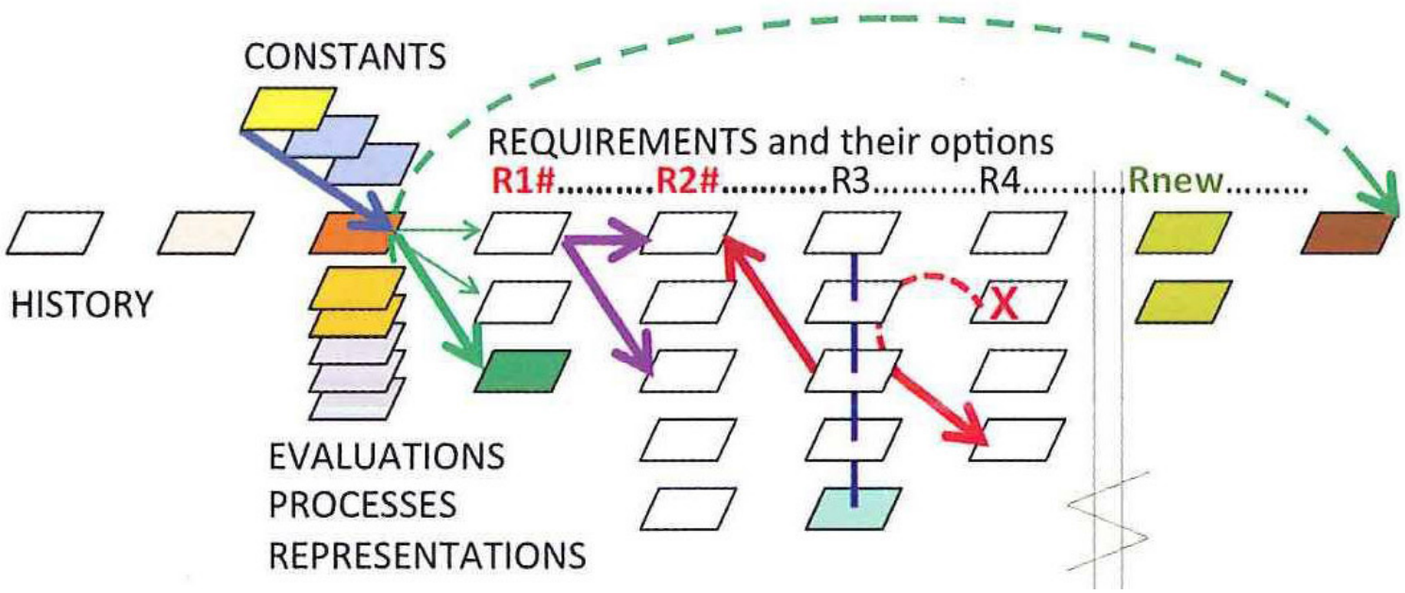




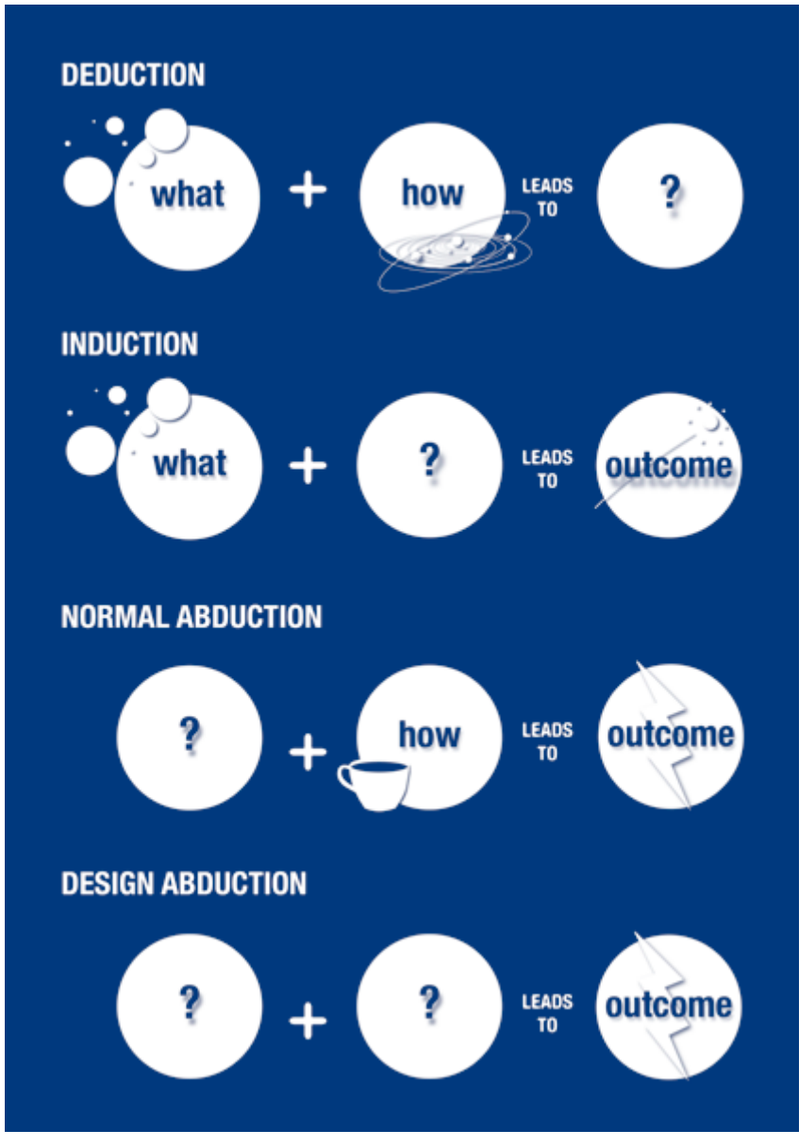
How to come from left to right?

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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS



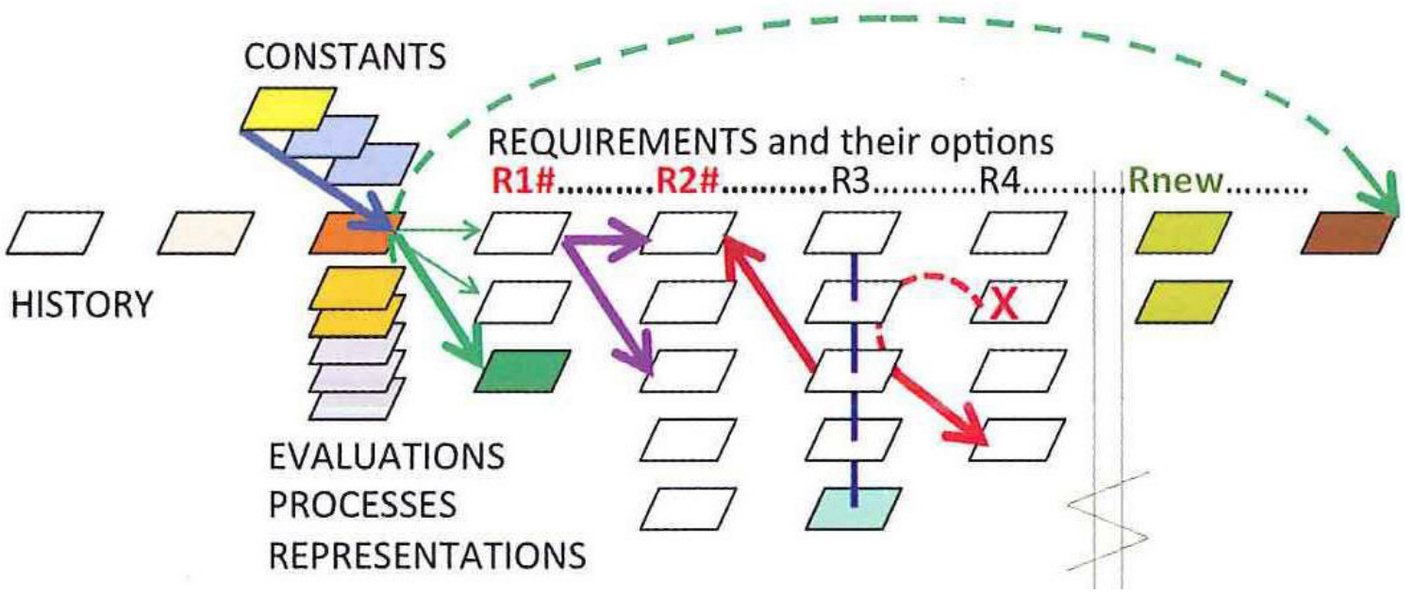
Different types of problem solving ask for different methods and tools!



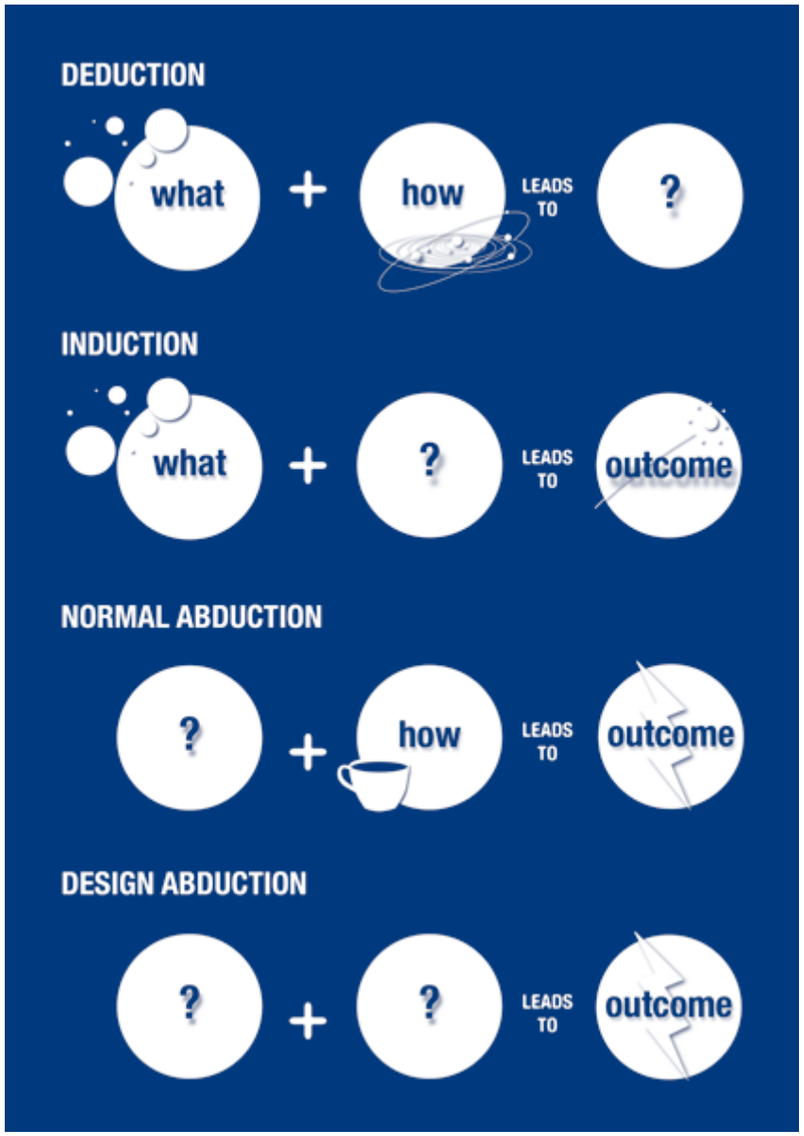
Four basic types of problem solving challenges that lead to different patterns of reasoning: (Kees Dorst, 2013)

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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS



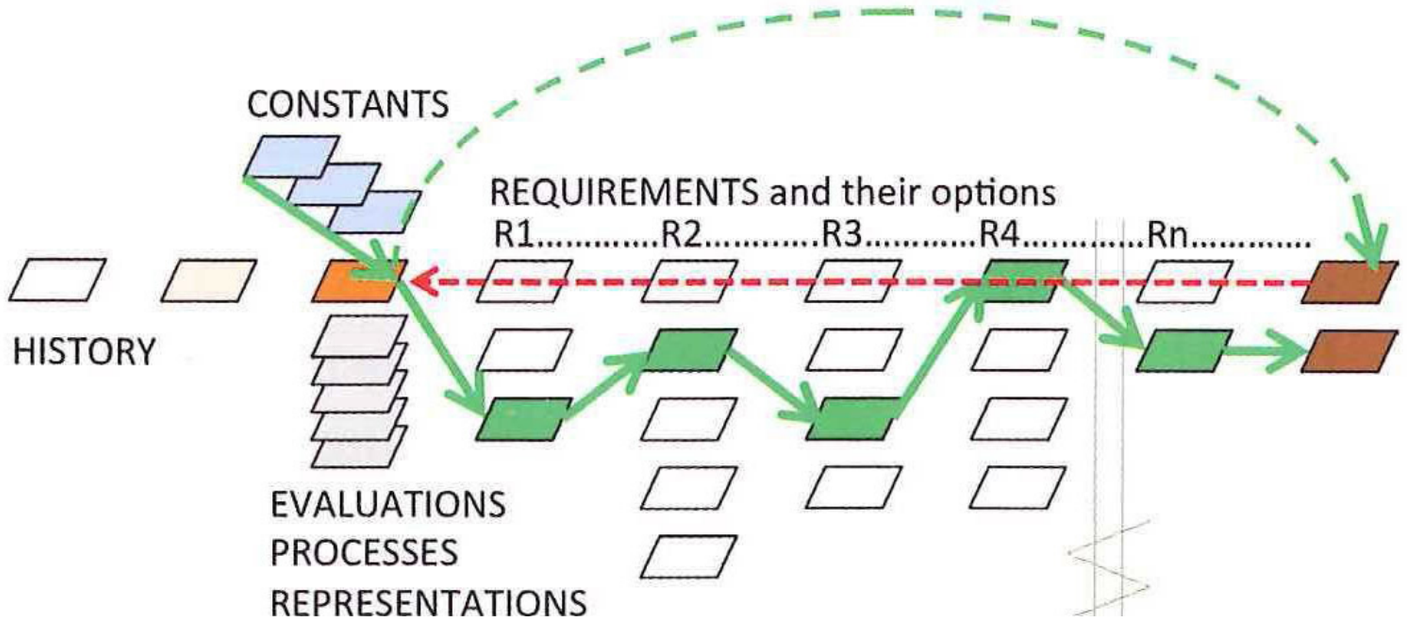
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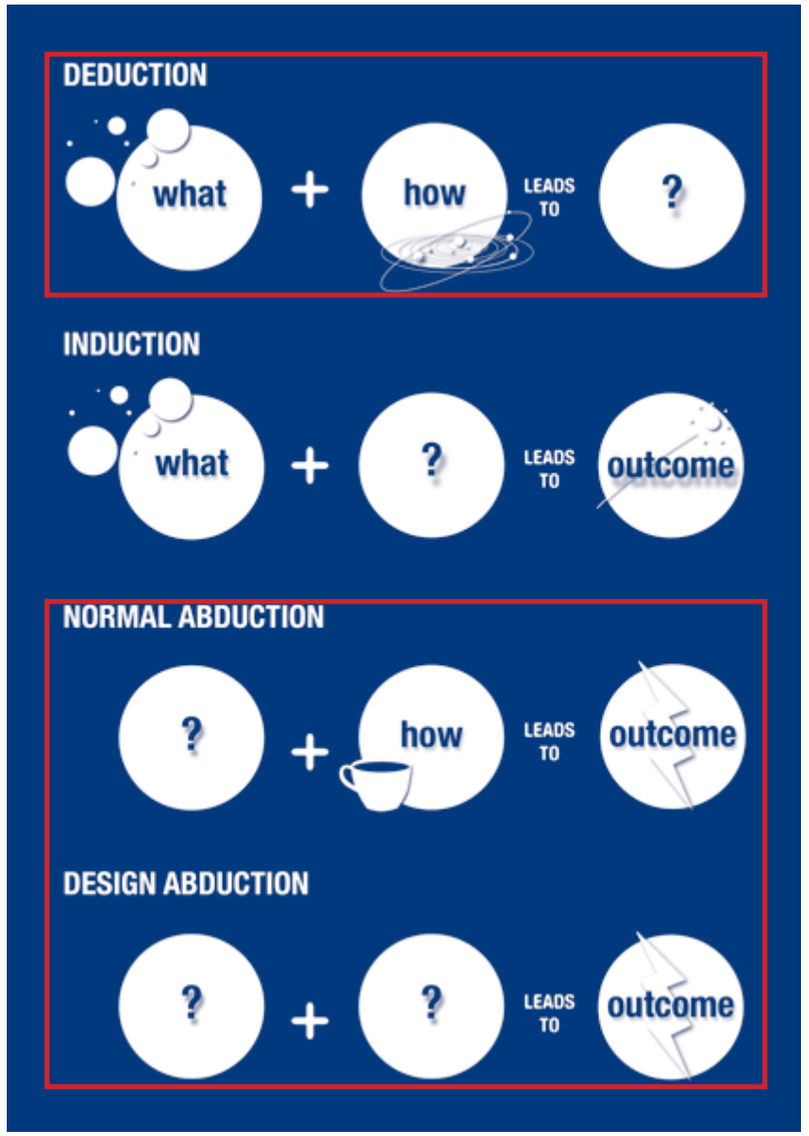


Four basic types of problem solving challenges that lead to different patterns of reasoning: (Kees Dorst, 2013)

STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

Anticipatory change model



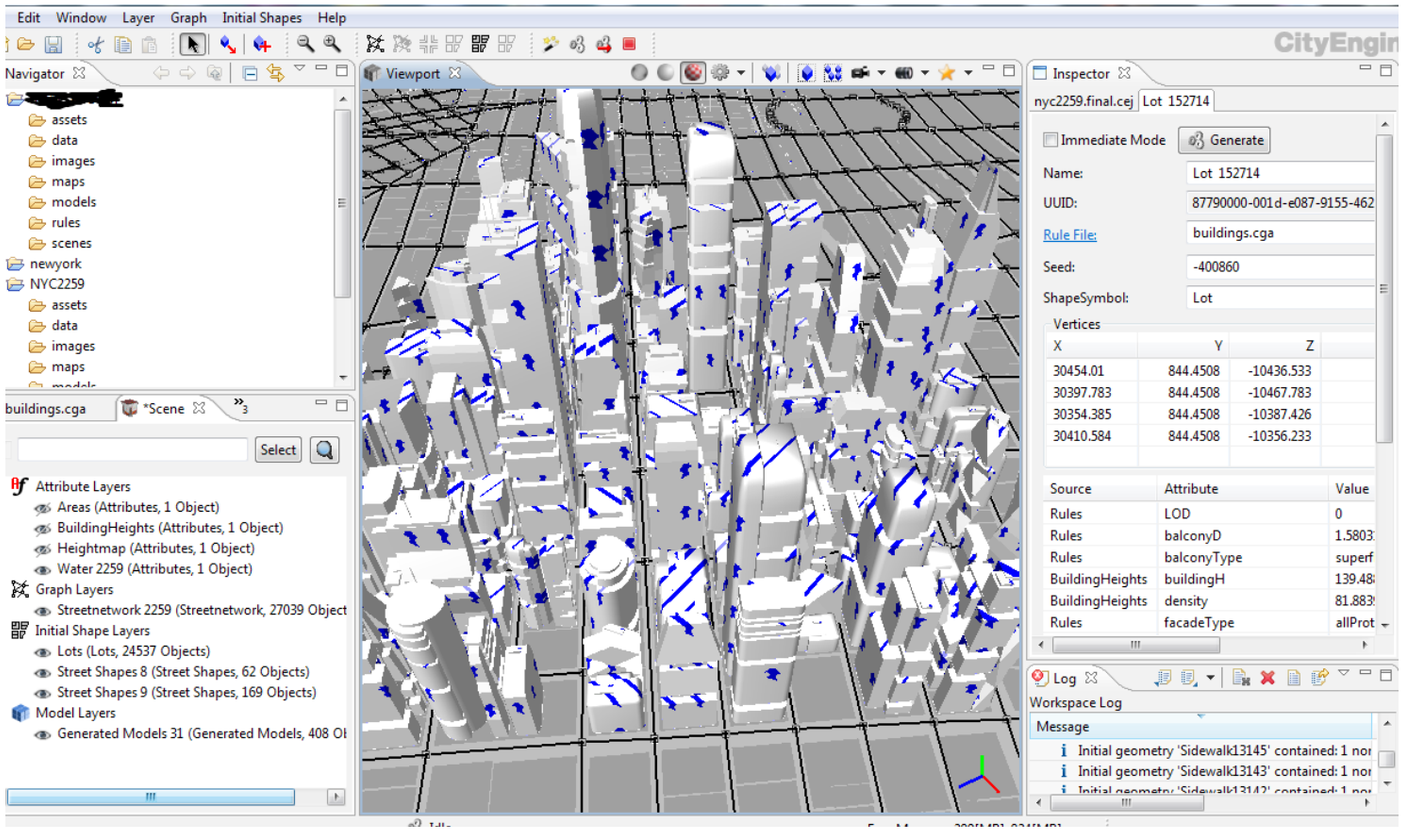


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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

Traditional design plus 2D and 3D-GiS or procedural modeling software



Source:: Interface of City Engine, ESRI

3D models and textures from sets of rules.

Apply algorithms for producing scenes.

Large scenes can be generated from a small amount of rules.

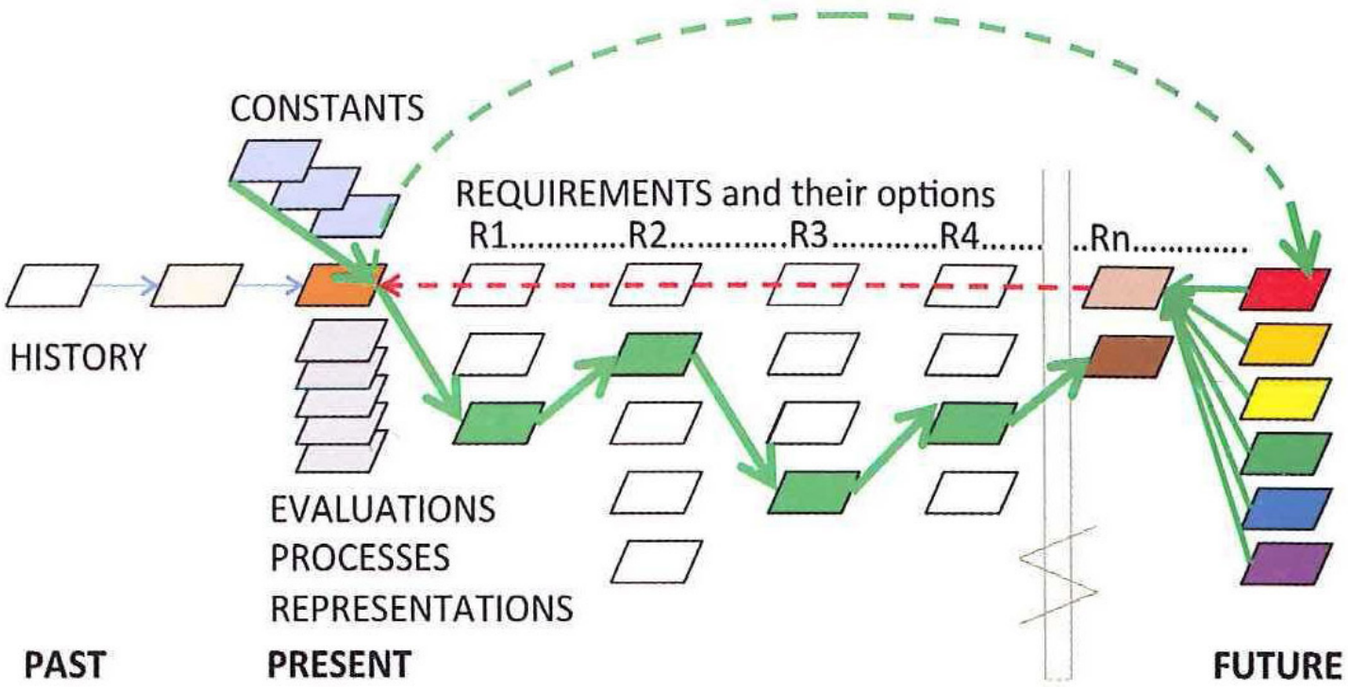
Strong sketching abilites are integrated.

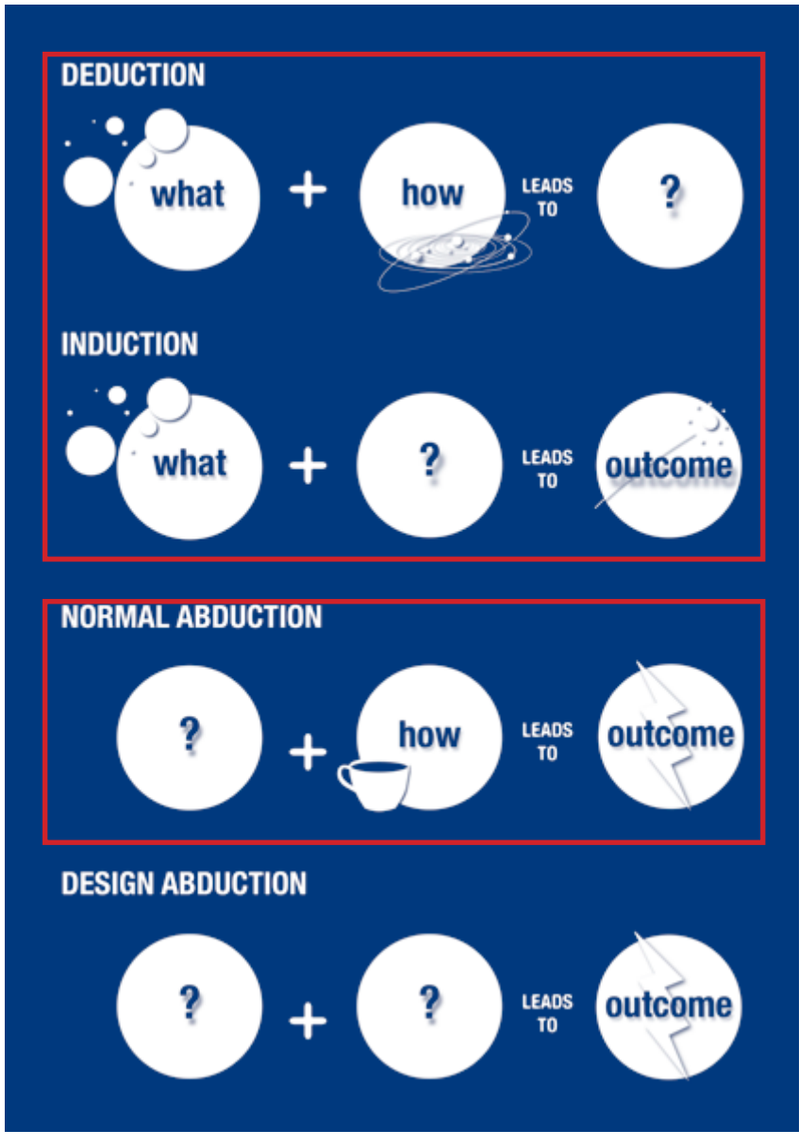
Examples are: Sketchup pro, Rhino, City engine

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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

Participatory change model





Four basic types of problem solving challenges that lead to different patterns of reasoning: (Kees Dorst, 2013)

STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

GIS-based decision support software and tools



Source:: Interface of Community Viz 360; source http://placeways.com/

3D visualisation tools

Gis based impact tools

Multiple scenario evaluation

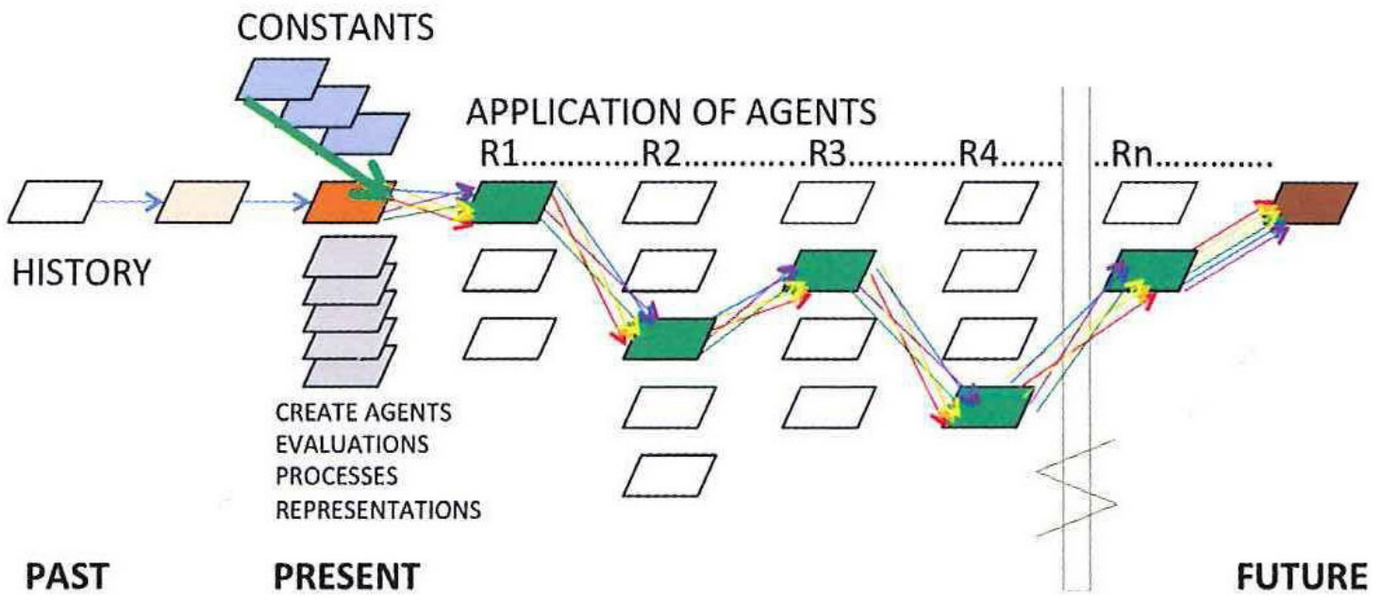
Interactive multiuser interface

Examples are: Community Viz 360, ...

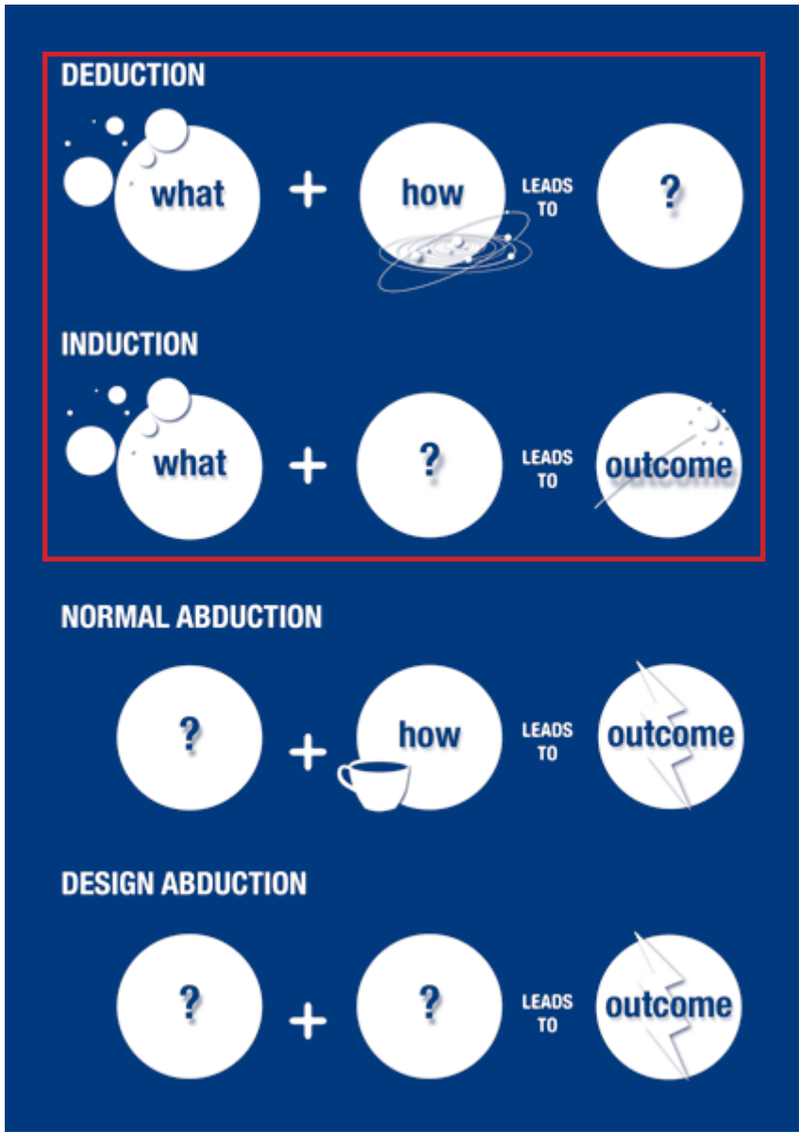
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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

Agentbased change model



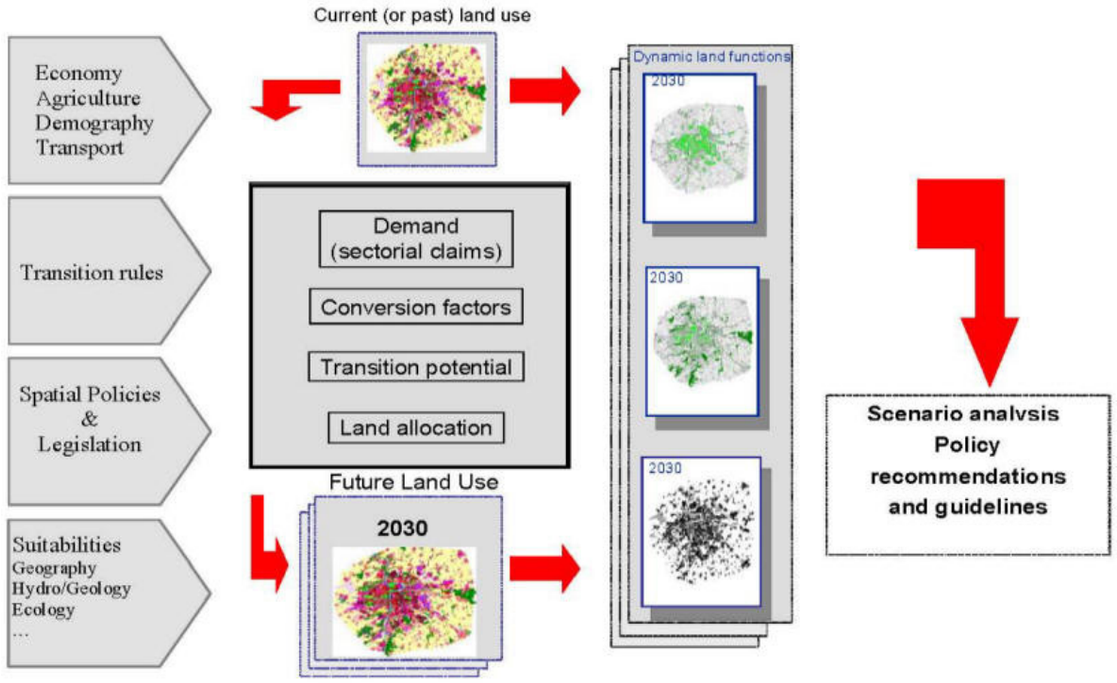
The future state of the study area is the result of interactions among policy and design decisions that, direct, attract or constrain the independent but rule based actions of independent agents.



Four basic types of problem solving challenges that lead to different patterns of reasoning: (Kees Dorst, 2013)

STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

GIS-based decision support software and tools



Source:: LUMP - Land Use Modelling Platform

rule based

simulate self organicing processes.

allows simultanious interaction of multiple models.

computer-intensive

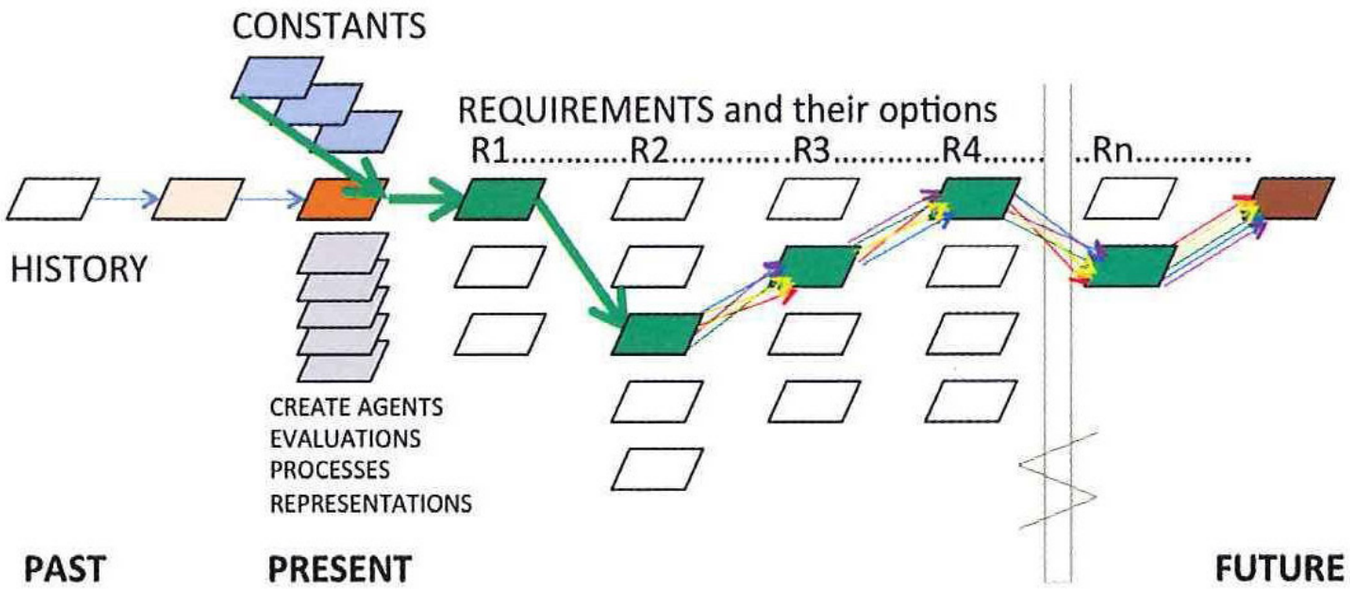
designer 'unfriendly'

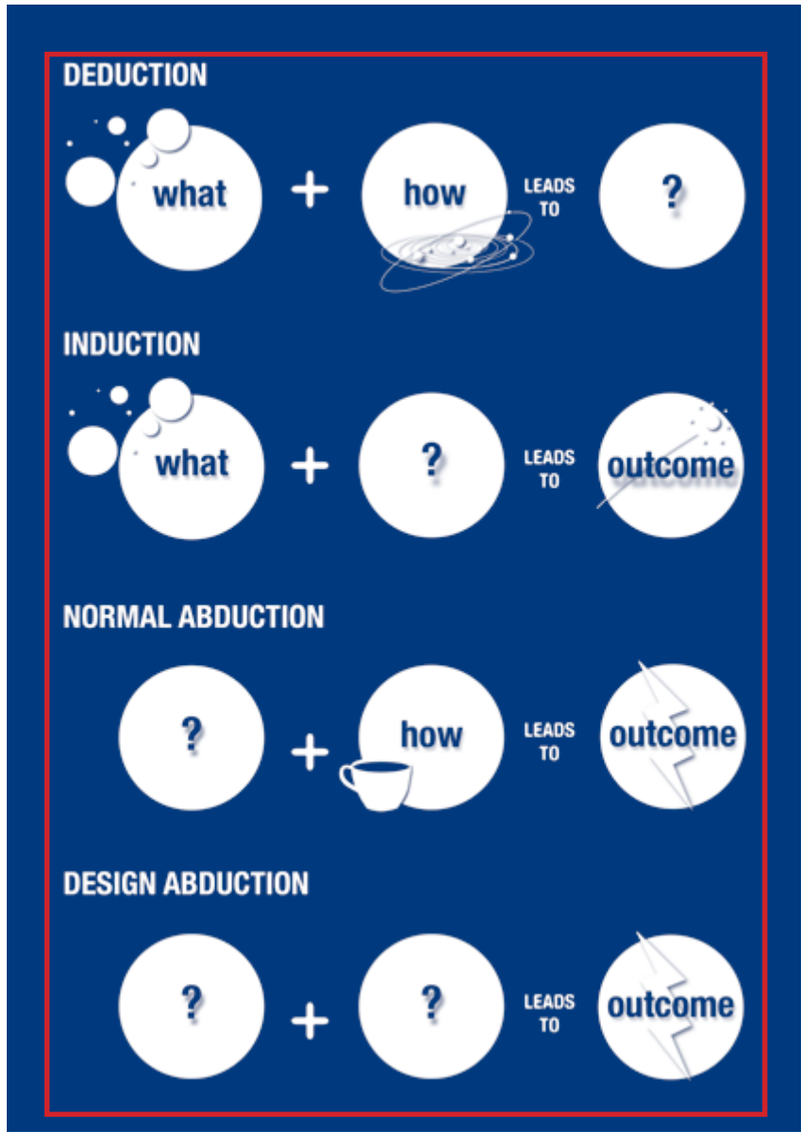
Examples are: Net-Logo, LUMP

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STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

mixed change model

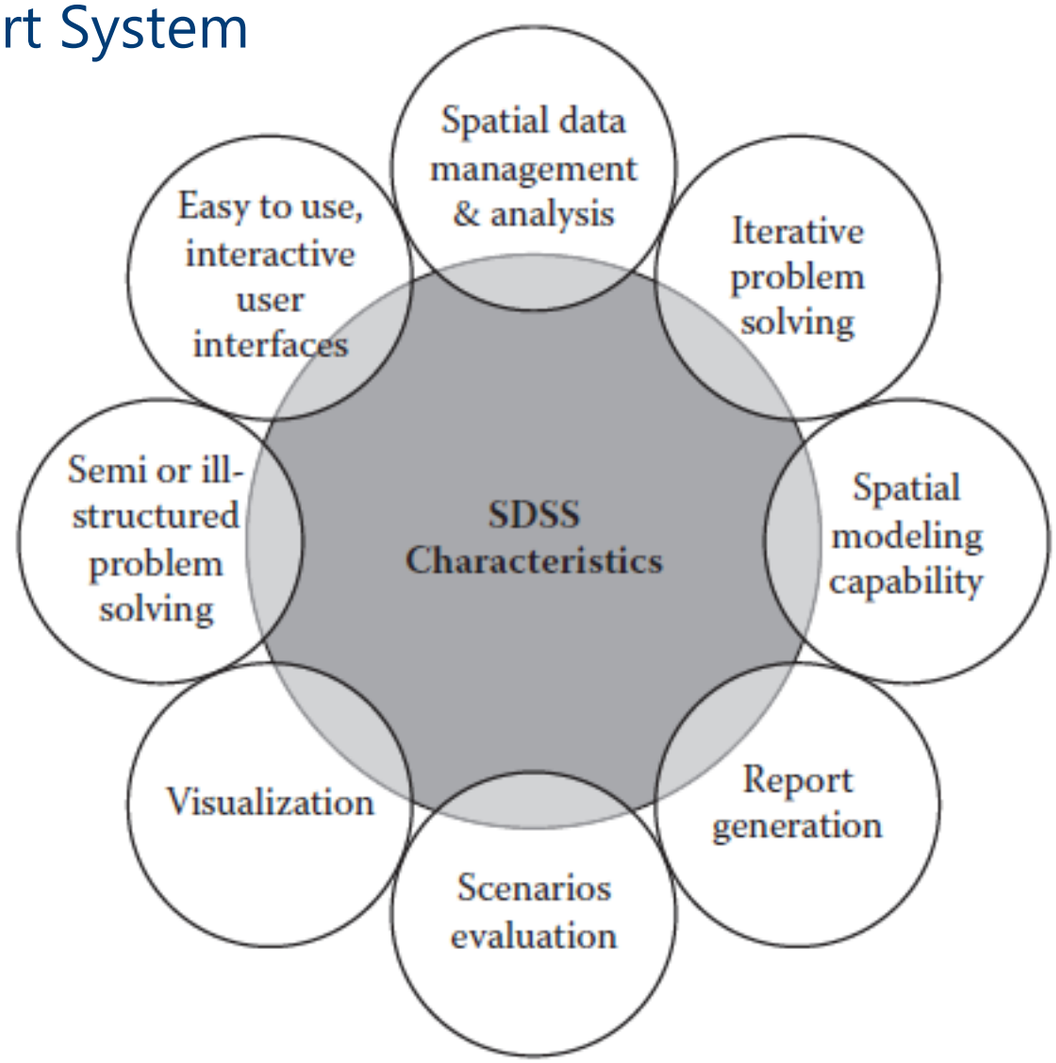




Four basic types of problem solving challenges that lead to different patterns of reasoning: (Kees Dorst, 2013)

STEINITZ FRAMEWORK OF GEODESIGN CHANGE MODELS

Spaial Decision Suport System



Source: Sugumaren, R. DeGroote, J. (2011) Spatial Decision Support Systems: Principles and Practices. Taylor and Francis Boca Raton

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sprintcity

Indicators

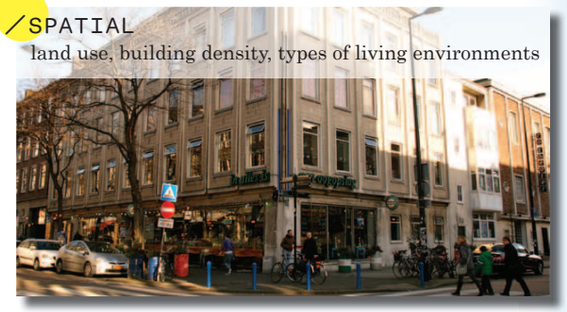
/SOCIOECONOMIC

population density, employment, real estate market



/SPATIAL

land use, building density, types of living environments



/CONNECTIVITY

connections to other modes of transit, levels of service

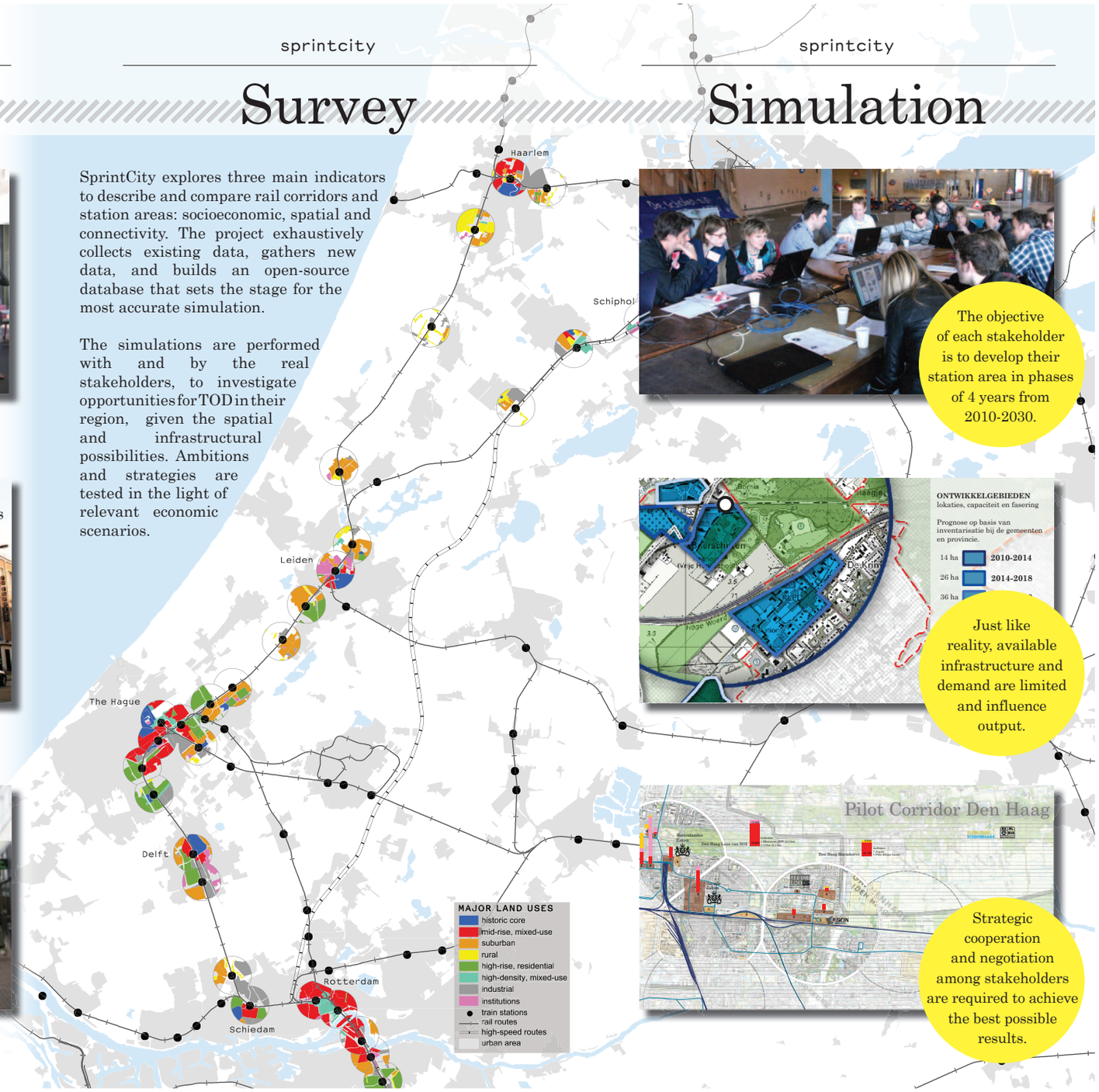


sprintcity

Survey

SprintCity explores three main indicators to describe and compare rail corridors and station areas: socioeconomic, spatial and connectivity. The project exhaustively collects existing data, gathers new data, and builds an open-source database that sets the stage for the most accurate simulation.

The simulations are performed with and by the real stakeholders, to investigate opportunities for TOD in their region, given the spatial and infrastructural possibilities. Ambitions and strategies are tested in the light of relevant economic scenarios.



sprintcity

Simulation

The objective of each stakeholder is to develop their station area in phases of 4 years from 2010-2030.

Just like reality, available infrastructure and demand are limited and influence output.

Strategic cooperation and negotiation among stakeholders are required to achieve the best possible results.

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IMPORTANCE OF GEODESIGN FOR DECISION MAKING

Integration of value and science based design => evidence informed decision making

Useful as collaboration and interdisciplinary tool => co-creation instead of expert design.

Real time evaluation of different design proposals => scenario evaluation

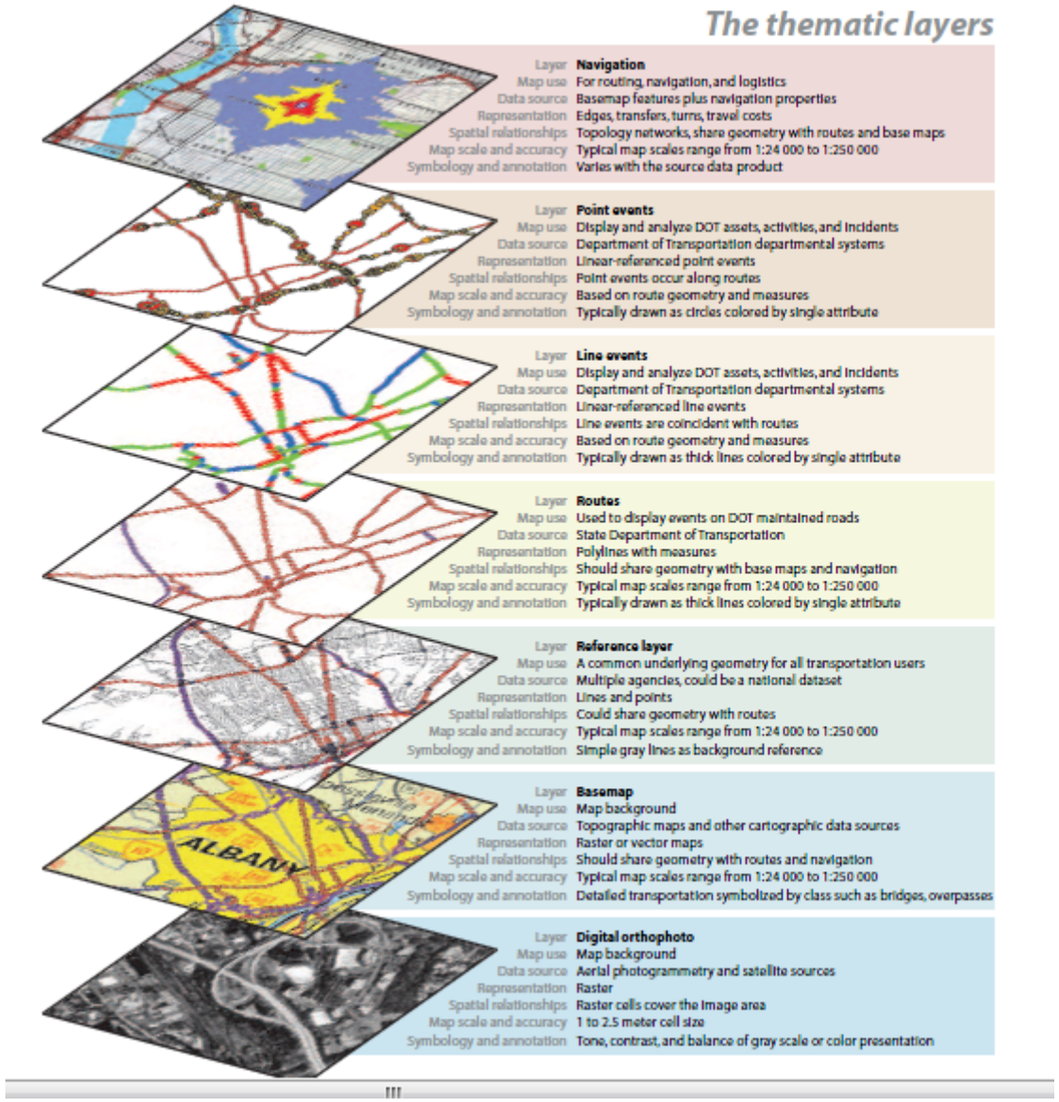
Strong visualisation capabilities => strong report and visualisation capabilities.

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CHALLENGES FOR TECHNOLOGICAL COMPONENTS OF GE-ODESIGN

(Miller, 2012)

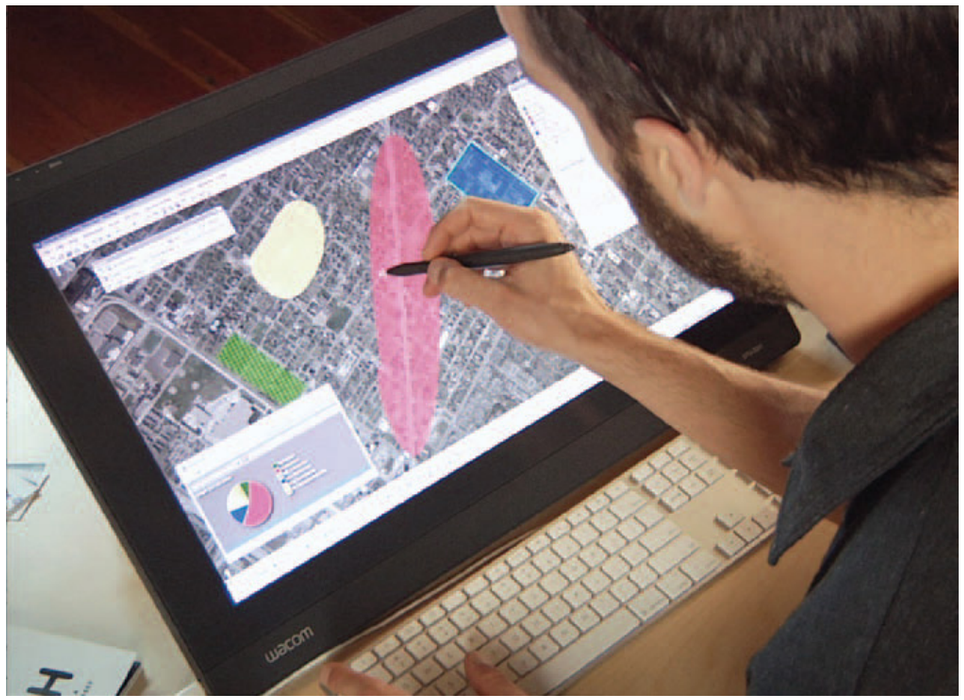
MANAGING COMPLEXITY WITH INTUITIVE TOOLS ?

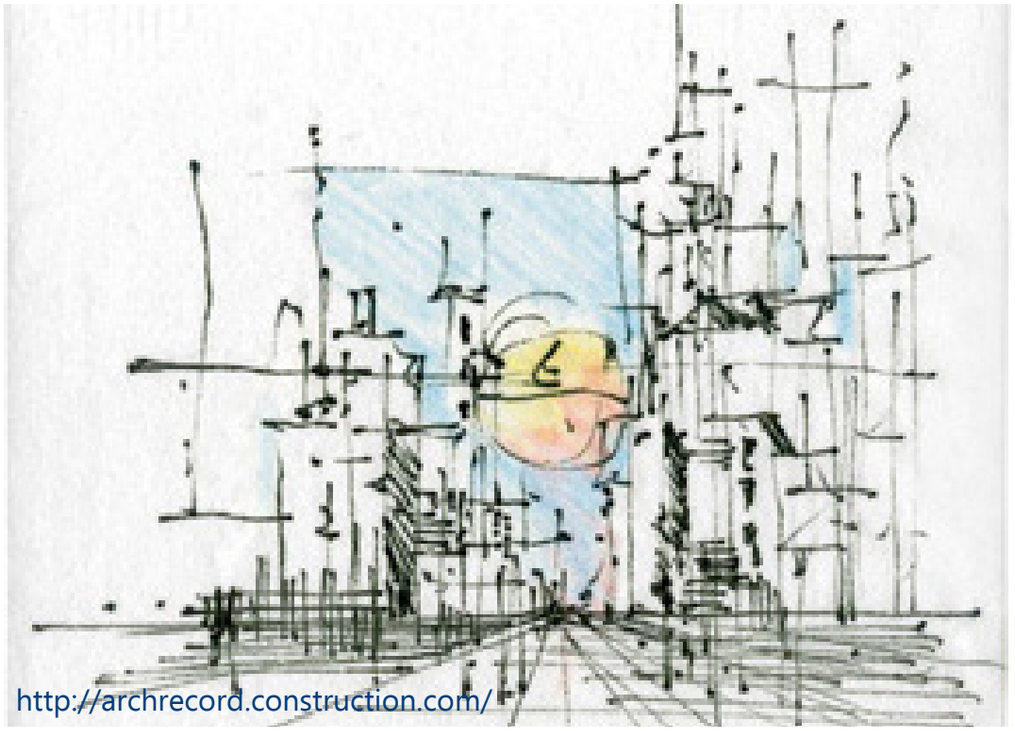




Smart visualisations provide additional information.
http://www.youtube.com/watch?v=1ake22nfomg

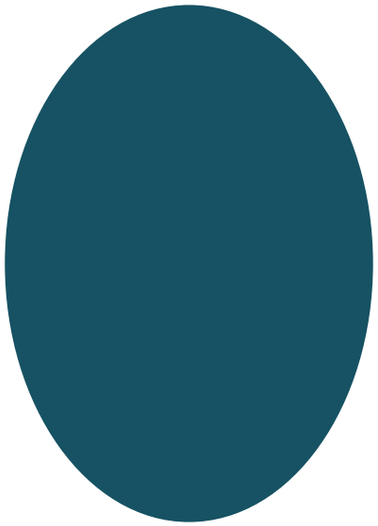
OPERATIONAL FRAMEWORK




http://archrecord.construction.com/

... includes everything the user sees and touches, including hardware (display screens, keyboards, mice, touch screens, styluses, audio devices, interactive tables, tablets, and cell phones) and software (operating systems, application environments, user interfaces, and web-related services).

DATA MODELS

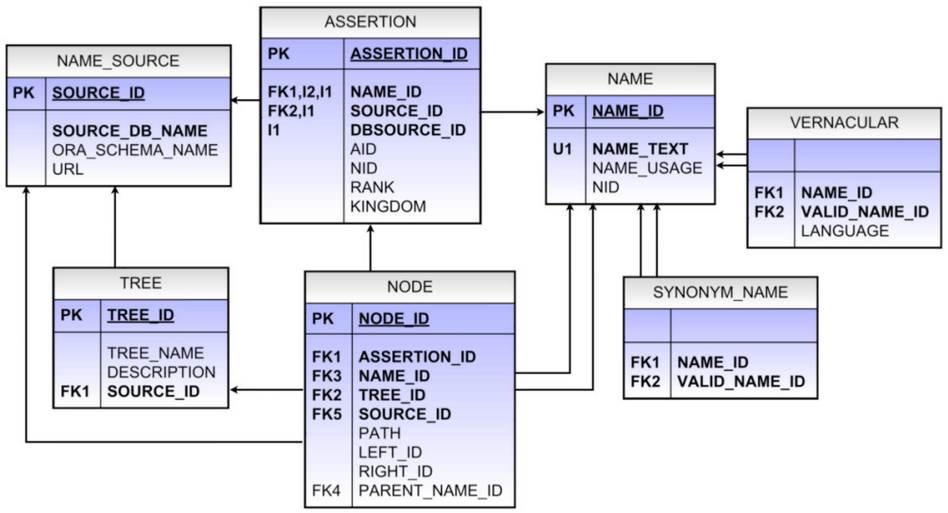


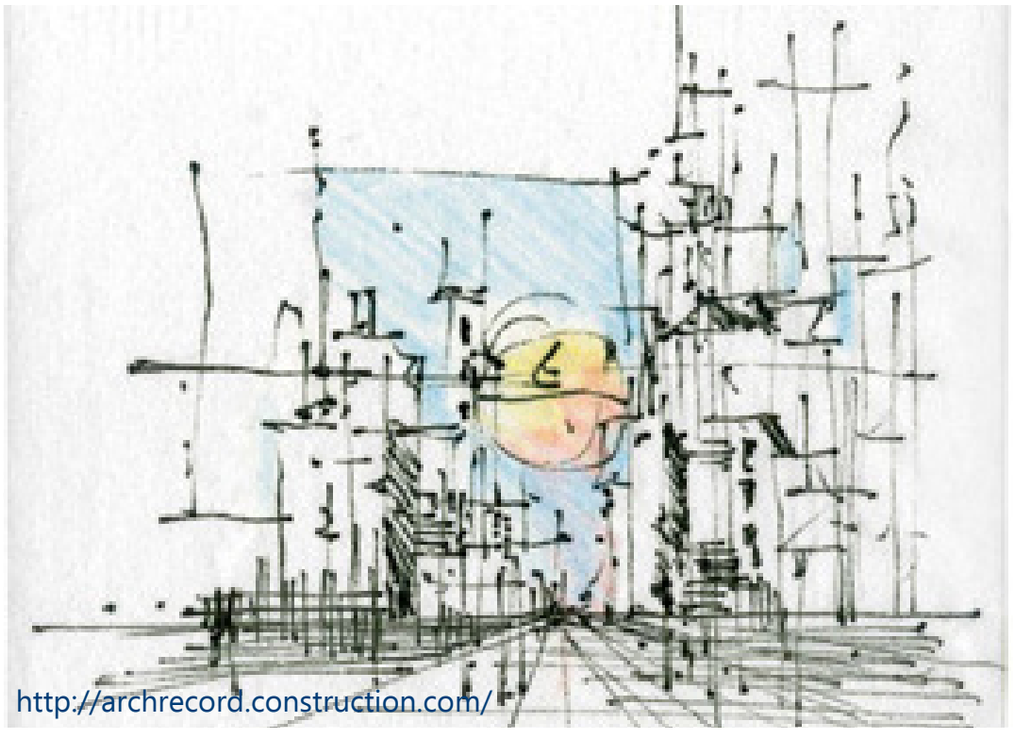
Lake



Most of the feature types referenced in a GIS are predicated on two-dimensional geospatial geometry, and while they offer the user a powerful and efficient way to represent domain-specific information the lack often 3D and qualitative aspects.

CREATION AND MODIFICATION TOOLS

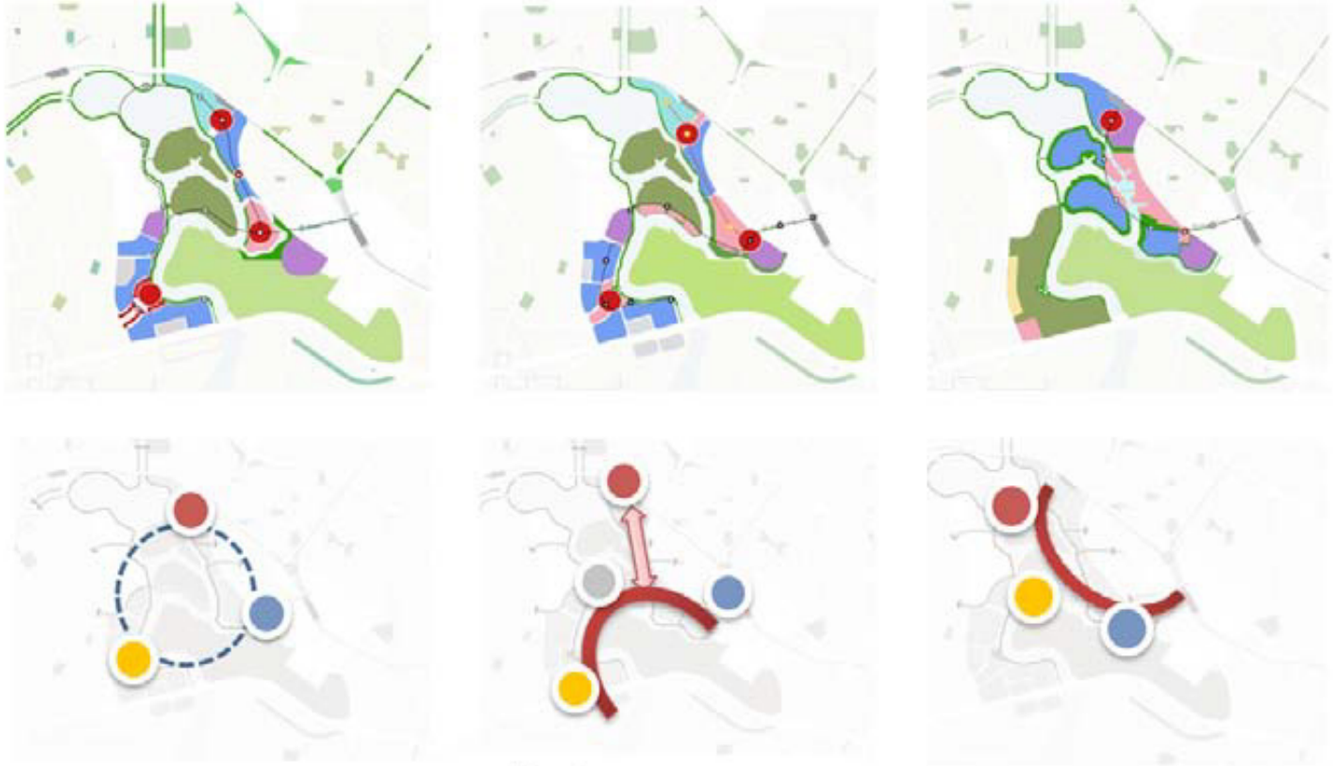



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These tools exist in GIS software, but they have been designed to support careful feature editing with respect to the integrity of a well-structured geodatabase as opposed to the rapid creation of features generated by a designer. To be successfully they have to compete with pencil and paper.

AR2U090
RESEARCH & DESIGN METHODOLOGY FOR URBANISM
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SCENARIO MANAGEMENT TOOLS



Scenario management tools need to be developed to facilitate the creation and management of alternative geodesign scenarios. These tools need to support all aspects of scenario management, including the creation of scenarios and how they are referenced, stored, retrieved, compared, revised, including how portions of one scenario can be combined with portions of another scenario to create a third scenario.

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COLLABORATION TOOLS



Collaboration forms the conceptual basis for working with a team, most particularly during the accumulation of intellectual capital, the application of that capital to the assessment of conditions, and how those conditions affect the creation of something. It also provides the operational context for co-creating that something (e.g., a land-use plan).

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http://www.ecomplexcity.org/wp-content/uploads/2012/10/iss016-e-026150_denver.jpeg

Thank You