What kind of ‘Design’? Let’s assume geo-spatial: landscape/site/urban design…

Then can we enumerate some ‘fundamental spatial concepts’?

**Fundamental Spatial Concepts**: symmetry / pattern / shape / motif / clustering / scale / rhythm / proportion / texture / axiality / form / concentricity / repetition / sequence, et al. (Lynch Good City Form, e.g.)

**Spatial Prepositions** are important in design and **spatial reasoning**: west-of, uphill, beside, along, surrounded-by, half-inside, in the lee of, …

Use ‘neighborhood’ spatial analysis, perhaps w/ non-euclidean distances.

Integration with CAD & 3D: 2nd-order 3D relations: ‘in shadow of’, ‘visible-from’ …

What about ‘formal’ / ‘grand’ / ‘clear’ / ‘confusing’ / ‘serpentine’ / ‘human scale’

Are these spatial? computable?

A modest research/development program: to extend the modeling vocabulary in GIS to include these (kinds of) terms.
To what extent can the fundamental cognitive operations of design be addressed with GIS?


There is some literature on design thinking; two cornerstones:
GIS
rational
repeatable
science
left brain
“large scale”
clumsy
...

Design
not
unique
art
right
“small scale”
agile

interactive, knowledge-based, complex, graphical, social, multi-criteria, multi-dimensional, multi-scale, place-oriented...
For understanding GIS <-> Design, consider several models of ‘design’:

1. **Generate & Test** (Herbert Simon) – Trial & Error; Student & Instructor; Eye-Hand coordination. GIS as test, or first-try generator (suitability map, e.g.)

2. Design by **Decomposition** (C. Alexander) – disaggregate by sub-problem, layer, or feature/theme; find overlaps/isolations; re-combine

3. **Design with Nature** (McHarg) : overlay / aggregate; scientific processes

4. **Diagrammatic** Design: “A plan is the result of a diagram meeting a site” (attributed to J. Habraken) : extraction/instantiation/specification of diagrams

5. **Landscape Architects Design Process** (K. Hanna): Linear... Cyclic

6. Design by **Analogy** (J. Gero) ; look for ‘similar’ situations in other conditions / domains; other sources of ‘invention’ or ‘surprise’; emergent form
Because the site analysis is a visual tool, it can be "drawn on" the same way you would draw on a tracing paper overlay. This GIS site analysis is a "face value" document that will allow you to study the bubble diagrams and locate each use zone and linkage in a suitable place on the site, based on your judgment. This image making is exactly the way you would work with tracing paper and pencil, except now you will draw with a mouse or a computerized pen, either within the GIS or in a graphics program.
Design: Fusion of Form & Function

Design seeks ‘elegant’, multi-functional, many-layered solutions
Making ’smooth’ / ‘visually pleasing’ designs…(not always a good idea?)

Design invents; adapts; re-states; integrates; improves ‘fit’; pleases…

There are rational(defensible) design processes, and irrational ones.
(“the right brain seems to flourish dealing with complexity, ambiguity and paradox”)
“Computer Aided Design”

What is Design, that we might aid it, with a mindlessly literal, very fast assistant with a relentless memory and no imagination (i.e. a computer)?

Designers Manipulate Representations (so do programmers)

Designers Program – write code; need expressive high-level languages

out, forward

program == design

something written, a mark

out, off

mark

source: Oxford English Dictionary, thanks: Martin Brynskov

thanks to mark gross
“Design is ..not finding the solution to a problem, but finding a solution to the problem....”

Designers don’t just answer, but ask & (re-)formulate questions.

Design involves both **Enlarging and Narrowing the Solution Space.**

Choosing one-of-many; Remaking the criteria. Accepting partial matches.

**Pattern Recognition**: Visual congruity; finding/making patterns (in representations & in real world) (‘right-brain’ operations)

Overlaid/Imposed vs inherent/Discovered form / order / pattern / structure / etc

**Emergent Form**: designers read, interpret & transform re-presentations

Finding, defining, reversing opportunities / constraints
Figure 1.13
Three house projects by Frank Lloyd Wright:


b. Ralph Jester House, Palos Verdes, California, 1938

c. Vigo Sundt House, near Madison, Wisconsin, 1941

- B bedroom
- B’ Sundt bedroom
- C car port
- D dining-room
- E entrance
- F family room
- I bathroom
- J kitchen
- K living-room
- L office
- P pool
- T terrace
- Y yard
Design Essentials

Levels of Abstraction: (LOA) need multiple levels, in conception, analysis, and representation; diagrams -> details.

Levels of Detail, Multiple Scales: not the same, but equally important

Fuzziness: “We need to be able to represent ‘Maybe’.” (M. Minsky)

Multiplicity; multi-valence: We need to be able to represent ‘Both’.

Multiple Representations: we need to be able to switch

Uncertainty: We need to be able to represent contradiction & ambiguity.

Rule-based Design: we need to be able to invoke, and break, rules

Design DNA – lineage, history, precedent, family-resemblance

Social Design - teamwork/collaborative design & design communication(s)
How can we embed ‘design’ operations in a ‘GIS’ framework?

- ‘Generator’: Sketching, Diagramming, Programming: abstract expression / instantiation / specification / modification tools; access to library, precedents, analogies, agents, rules, algorithms...

- Real-time feedback – design ‘dashboard’ concept

- Incremental refinement – interactive, iterative generate & test

- Multiple, temporary, linked states, history, seamless switching, recombining

Rather: Embed GIS in a design framework. (e.g., Steinitz framework) primarily: GI management, transformation, analysis, display operations

GIS / Design Software, System, or Science; requires:

• Approaches
• Attitudes
• Algorithms
• Apparatus (Tools, software)