GEOG 281A

GIScience Research

GEOG 281A is designed to help students pursue rigorous geographic research by connecting the development and use of core spatial methods to their theoretical foundations in geographic information science. Readings and activities in the course are sequenced to help students enhance their spatial thinking skills and prepare to apply those skills to research problems using geographic information systems.

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DEFINING SPATIAL THINKING

PROMPT

(1) Think about a research question you either are, or intend to study. Why does that question require spatial thinking?

(2) Write your current definition of spatial thinking.

DEFINITION

A critical spatial thinker uses spatial concepts and geographic principles to understand problems, derive solutions, and communicate effectively about geographic processes, patterns, and outcomes, whether they are producing or consuming that information

Adapted from Sinton (2016)

COGNITION

In space	Thinking within the everyday world – packing, navigation, …
About space	Reasoning about the structure and function of spatial phenomena across scales
With space	Using spatial structure to reason about concepts of any type – concept maps, …

PROMPT

Reconsider the research question you identified earlier during this class. Which of the three contexts were you operating in? What functions were you performing in answering that research question?

COMPONENTS OF SPATIAL THINKING

Table 1.1 Spatial Concept and Task Ontology

Source: Golledge (1995), Marsh et al. (2007), Golledge et al. (2008)

Label	Concepts	Tasks
Primitives	Identity, Location, Magnitude, Time	Identify objects by type, recognize differences in occurrences, …
Simple	Distance, Boundary, Sequence, Arrangement, …	Recognize paths, determine spatial limits, recognize spatially determined membership, …
Difficult	Adjacency, Angle, Grid, Polygon, …	Recognize closeness in space, express direction from a location, develop an areal referencing system, …
Complicated	Buffer, Connectivity, Gradient, Scale, …	Develop an are around a node, measure slopes, create a cross section, …
Complex	Interpolation, Map Projection, Relational Space, …	Measure similarity, represent curved surface on a flat surface, …

ACTIVITY

Purpose: To practice classifying spatial concepts and recognizing the relationships between concepts.

Task: In small groups, identify the level of each concept in the following list. Then, for each concept above the primitive level, identify which lower-level concepts it is built from.

> *Location, distance, boundary, region, hierarchy, magnitude, scale, diffusion, pattern*

BREAK

ACTIVITY

Purpose: To illustrate how basic spatial concepts have also been identified in other domains, and in a more general understanding of the environment.

Task: Draw a map of your home.

Table 1.2 Elements of Mental Maps

Source: Lynch (1960)

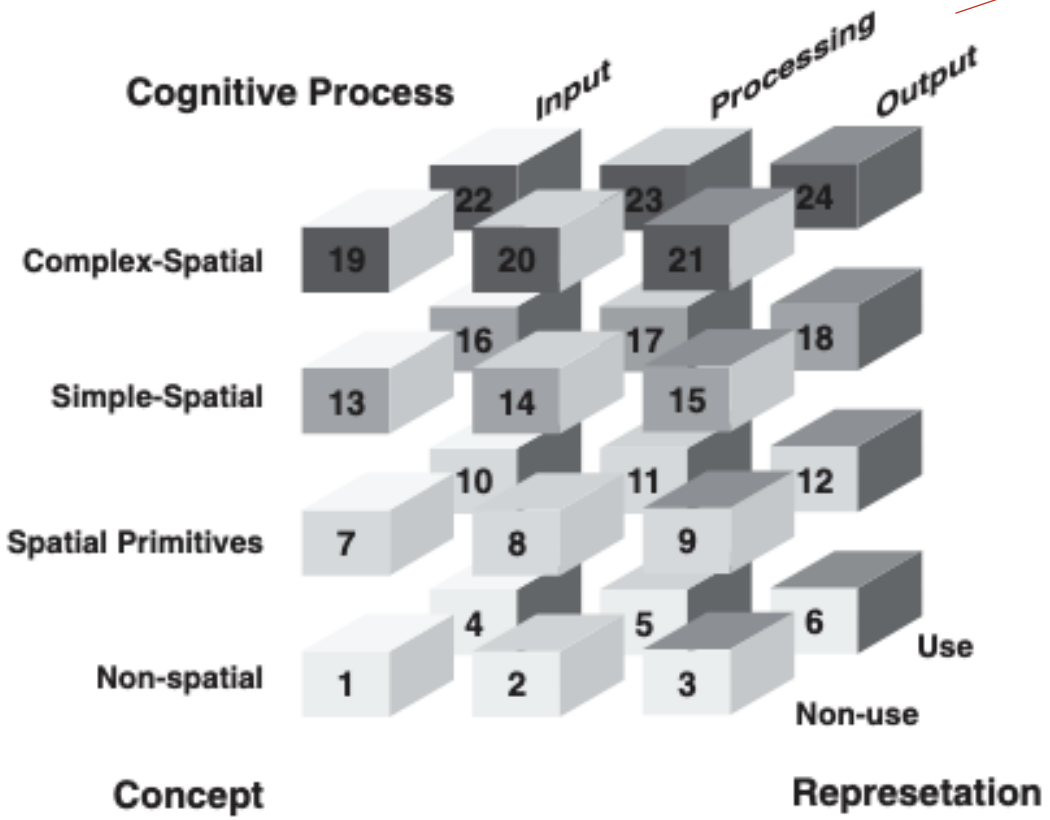
Label	Concepts
Paths	The channels along which people move (streets, walkways, transit lines, canals).
Edges	Linear boundaries that are not paths; they separate one area from another (shorelines, walls, railroad cuts, edges of development).
Districts	Medium-to-large sections of the city that people mentally "enter" and recognize as having a common identifying character (a neighborhood, a business district).
Nodes	Strategic focal points that people can enter, typically intersections or convergence points (a town square, a major junction, a transit hub).
Landmarks	External reference points used for orientation but not typically entered; identified by their singularity or contrast with surroundings (a church steeple, a distinctive building, a monument).

LEVELS OF REASONING

Input	Recalling, identifying, and describing spatial data without transformation
Processing	Comparing, classifying, analyzing spatial data
Output	Evaluating, hypothesizing, creating solutions from spatial data

TOWARD CRITICAL SPATIAL THINKING

Processing system
from Costa (2001)



Spatial concept
schema from Golledge

Figure 1.1 A Taxonomy of Spatial Thinking

Source: Jo & Bednarz (2009)

ACTIVITY

Purpose: To identify and articulate the spatial concepts and reasoning strategies used in your work, and to explain how they connect to spatial thinking frameworks

Task: Reflect on the research question and analysis you identified at the beginning of class. Attempt to answer the following questions.

1. What spatial concepts are you working with when answering that question? Classify each as primitive, simple, or complex.
2. What representations will you use? Why?
3. What level of reasoning did the task require?
4. Where would you place your question on the taxonomy of Jo & Bednarz (2009)