The NCGIA Core Curriculum in GIScience

Outline

Legend

- Numbers in brackets indicate each unit's unique key number.
- *Italicized names* indicate unit authors.
- *GC notes* links to related materials in the Geographer's Craft.
- *old CC* links to the on-line version of the original Core Curriculum.
- *CCTP* refers to the Core Curriculum for Technical Programs
- Bulleted items in Arial font are additional, suggested unit topics.

0. **What is GIS?** (002), Michael Goodchild

1. Fundamental Geographic Concepts for GIScience (004)

   1.1. **The World in Spatial Terms** (005), ed. Reg Golledge
       1.1.1. Human Cognition of the Spatial World (006), Dan Montello
       1.1.2. Asking Geographic Questions (007), Tim Nyerges and Reg Golledge

   1.2. **Representing the earth digitally** (008)
       - features, pictures, variables; points, lines, areas, fields, 3D; processes and time

   1.3. **Position on the earth** (012), ed. Ken Foote
       1.3.1. Coordinate Systems Overview (013), Peter Dana
       1.3.2. Latitude and Longitude (014), Anthony Kirvan
       1.3.3. The Shape of the Earth (015), Peter Dana
       1.3.4. Discrete Georeferencing (016), David Cowen
       1.3.5. Global Positioning Systems Overview (017), Peter Dana

   1.4. **Mapping the earth** (018)
       1.4.1. **Projections and transformations** (019), **from the old CC, see also GC notes**
       1.4.2. **Maps as Representations of the World** (020), Judy Olson

   1.5. **Spatial relationships** (021)
       - connections and topology; networks; distance and direction; flow and diffusion; spatial hierarchies; boundaries; spatial patterns; attributes of relationships
1.6. Abstraction and incompleteness (030)
   1.6.1. Sampling the World (031), **from the old CC
   1.6.2. Line Generalization (034), **from the old CC
   - scale and geographic detail; uncertainty; generalization

2. Implementing Geographic Concepts in GISystems (035)

   2.1. Defining characteristics of computing technology (036)
      2.1.1. Fundamentals of Data Storage - Carol Jacobson (037)
      2.1.2. Algorithms (040)
         2.1.2.1. Simple Algorithms for GIS I: Intersection of Lines (184), **from the old CC
         2.1.2.2. Simple Algorithms for GIS II: Operations on Polygons, (185) **from the old CC
         2.1.2.3. The Polygon Overlay Operation (186), **from the old CC
   - data versus processes; history; object orientation

   2.2. Fundamentals of computing systems (042)
   - operating systems; programming languages and software engineering; developing algorithms; user interfaces; computer networks; hardware for GISystems

   2.3. Fundamentals of information science (050)
      2.3.1. Information Organization and Data Structure (051), Albert Yeung
      2.3.2. Non-spatial Database Models (045), Thomas Meyer
   - data modeling

   2.4. Representing fields (054), Michael Goodchild
      2.4.1. Rasters (055), Michael Goodchild
      2.4.2. TINs (056), **from the old CC
      2.4.3. Quadtrees and Scan Orders (057), Michael Goodchild
   - polygon coverages

   2.5. Representing discrete objects (059)
   - storing relationships; computing relationships; topology for geodata; object hierarchies

   2.6. Representing networks (064), Benjamin Zhan

   2.7. Representing time and storing temporal data (065)
   - creating digital data - sampling the world; remote sensing; GPS as a data source; digitizing and scanning; editing
   - accessing existing data - data exchange; open GIS; finding data; data conversion; transfer standards; distributed networked databases; generating data from existing data
   - metadata

   2.8. Populating the GISystem (066) - see the GC notes and the CCTP
   - administrative boundary data; demographic and health data; global data
2.10. **Handling uncertainty** (096), ed. Gary Hunter (see also GC notes)
   2.10.1. *Managing Uncertainty in GIS* (187), Gary Hunter
   2.10.2. *Uncertainty Propagation in GIS* (098), Gerard Heuvelink
   2.10.3. *Detecting and Evaluating Errors by Graphical Methods* (099), Kate Beard
   2.10.4. *Data Quality Measurement and Assessment* (100), Howard Veregin
     - storing uncertainty information

2.11. **Visualization and cartography** (101)
   2.11.1. Cartographic fundamentals (102) - GC notes
     - principles of graphic design; digital output options; scientific visualization; animation and virtual worlds; cognitive basis of visualization

2.12. **User interaction** (107)
   - user interfaces; forms of user interaction with GIS

2.13. **Spatial analysis** (110)
   - combining data; map algebra; terrain modeling; finding and quantifying relationships; generalization; spatial statistics; geostatistics; spatial econometrics; spatial interpolation; spatial search; location/allocation; districting; spatial interaction modeling; cellular automata; distance modeling; neighborhood filtering; pattern recognition; genetic algorithms

2.14. **Implementation paradigms** (126)
   2.14.2. *Exploratory Spatial Data Analysis* (128), Robert Haining and Stephen Wise
   2.14.4. *Multimedia and Virtual Reality* (131), George Taylor
   2.14.5. *WebGIS* (133), Kenneth Foote and Anthony Kirvan
   2.14.6. *Artificial Neural Networks for Spatial Data Analysis* (188), Suchi Gopal
     - interoperability; object oriented GIS; knowledge based and expert systems; collaborative spatial decision making

3. **Geographic Information Technology in Society** (135), Robert Maher

3.1. **Making it work** (136)
   - needs assessment; conceptual design of the GIS; survey of available data; evaluating hardware and software; database planning and design; database construction; pilot studies and benchmark tests; acquisition of GIS hardware and software; GIS system integration; GIS application development; GIS use and maintenance

3.2. **Supplying the data** (143)
   3.2.1. *Public access to geographic information* (190), Albert Yeung
   3.2.2. *WWW Basics* (148), Albert Yeung
   3.2.3. *Digital Libraries* (191), Albert Yeung
   3.2.4. Legal Issues (147) - GC notes and old CC
     - transfer standards; national and international data infrastructures; marketing data

3.3. **The social context** (149)
   - digital democracy; geographic information in decision making; human resources and education; ethics of GIS use
3.4. **The industry** (154)
  - history and trends; current products and services; careers in GIS

3.5. **Teaching GIS** (158), *David Unwin*
  3.5.1. Curriculum Design for GIS (159), *David Unwin*
  3.5.2. Teaching and Learning GIS in Laboratories (160), *David Unwin*

4. Application areas and case studies (161)

  4.1. **Land Information Systems and Cadastral Applications** (164), *Steve Ventura*
  4.2. **Precision Agriculture** (194), links to material by *PrecisionAg.org*
  - also: facilities management; network applications; emergency response and E911;
  - recreation, resource management (agriculture, forestry), urban planning and management,
  - environmental health, environmental modeling, emergency management, studying and
    learning geography, business and marketing (real estate)