Preview Questions

1. Is GIScience a tool or a science?
2. What is the research agenda of GIScience?
3. How has the research agenda of GIScience changed since 1990?
4. What are the major accomplishments of GIScience since 1990?
5. What are the relevant institutions of GIScience?
6. What should we expect GIScience to accomplish over the next 20 years?

Summary Notes

*Beginnings of GIScience*

* The term “geographic information science” was coined in 1990.
* Geographic information is a collection of facts linking properties to locations on or near the Earth’s surface at some point in time or a time interval.
* Geodesy is a discipline that requires a systematic and scientifically based approach to the problem of accurately measuring position on a planate that has a complex, non-spherical shape and gravity field.
* Progress in photogrammetry relies on finding solutions to a series of technical problems thus it is more likely to be identified as a branch of engineering.
* Geography is the discipline that studies the social and environmental phenomena of geographic space – there has been debate as to whether or not it is a science.
* The term “geographic information systems” was coined in the 1960s.
* The five potential research areas specific in the 1987 NSF solicitation overlapped the domains of other traditional disciplines but brought them together in a novel multidisciplinary way.
  + Spatial analysis and spatial statistics
  + Spatial relationships and database structures
  + Artificial intelligence and expert systems
  + Visualization
  + Social, economic, and institutional issues
* In the 1980s, there was much discussion about how GIS research could achieve the status needed for election to the U.S. National Academy of Sciences (NAS) or the equivalent in other countries.
* The posing of a research question does not guarantee useful results.
* There might be general truths about geographic space that are not necessarily true of other spaces (e.g., the human brain, human genome, etc.)
* Definition of geographic information science: the development and use of theories, methods, technology, and data for understanding geographic processes, relationships, and patterns (University Consortium for Geographic Information Science).
* Definition of GIScience in report to the National Science Foundation (NSF) in 1999: the basic research field that seeks to redefine geographic concepts and their use in the context of geographic information systems.
* Topics for the research agenda of GIScience proposed by Goodchild in 1992:
  + Data collection and measurement;
  + Data capture;
  + Spatial statistics;
  + Data modeling and theories of spatial data;
  + Data structures, algorithms, and processes;
  + Display;
  + Analytical tools; and
  + Institutional, managerial, and ethical issues
* Conceptual framework for GIScience proposed by the National Center for Geographic Information and Analysis (NCGIA) comprised a triangle with three points with GIScience research topics located according to the importance of the domains to each of them:
  + Domain of the computer
  + Domain of the individual user
  + Domain of society
* Criteria for inclusion of research topics
  + Address scientific problems that are not yet solved
  + Confidence that general truths remain to be discovered
  + Problems are generic such that result are likely to be general
  + Problems are difficult and scientists in other domains would reasonably recognize them as so

*Major Accomplishments of GIScience*

* Achievements are considered significant based on the following criteria:
  + Widely adopted
  + Led to scientific breakthroughs or benefits
  + Improved data or the understanding of information
  + Led to increase ease of use
* Kate Beard (University of Maine) list of major accomplishments:
  + Specification of spatial data types
  + Specification of spatial relations
  + Conditional simulation
  + Local spatial statistics
  + Common user-interface icons and tools
  + Geographic brushing
  + Standardization
  + Dorling cartograms
  + Generalization as constrained optimization
  + Google Earth
* According to Marc Armstrong (University of Iowa) GIScience is more about transformation (from paper map to machine) than discovery.
  + Abstraction and theory
  + Topological concepts
  + Hierarchical data structures
  + Ontologies
* Sara Fabrikant (University of Zurich) reframed the question as what are the significant discoveries, contributions, outcomes, and products of the GIScience community:
  + The 9-intersection model
  + Map algebra
  + Geostatistics
  + The geolibrary
  + Geography awareness among the masses
  + Geographic visualization
  + Agent-based, spaito-temporal simulations and cellular automata
  + Spatial reasoning and cognition
  + Formalization of spatial concepts
  + An increased awareness of issues of representation, semantics, social networks, and dynamics.
* Citation analysis of Andre’ Skupin (San Diego State University):
  + Data modeling and representation, ontology, linguistics, cognitive issues
  + Environmental modeling and topography
  + Spatial analysis
* Goodchild list of accomplishments:
  + Error and uncertainty
  + Representing the infinite complexity of the real geographic world in the binary computer language
  + General principles of the geographic world
* Institutional accomplishments
  + Proliferation of journals and conferences
  + Access to the national academies

*GIScience in the Coming Decades*

* Knowing where everything is at all times
* Increasing role of citizens as producer as well as consumer of geographic information
* Real time analysis and modeling
* “2.5D” is the term referring to how the third topographic dimension is handled in the two-dimensional technology of GIScience (i.e., elevation is a function of location).
* The fifth dimension of GIScience is the various attributes that may exist at locations in space-time.
* Lack of understanding of basic GIS concepts leads to critical errors
* GIScience literacy among the masses (i.e., the education question has changed from how to educate an elite group of professional experts to how to provide a basic level of understanding to GIScience principles to everyone)
* GIScience is unlikely to be absorbed into one of the intersecting disciplines of geography, computer science, or information science.
* GIScience will likely have greater interaction with the broader domain of spatial information science.

Additional Questions of Interest

1. None.