Scanning
Information Science

INSC 702: Advanced Topics in Information Science

Shimelis Assefa

Outline

- The landscape of Information science.
- Informatics as a science.
- Information Problems.
- Information Theory.
- Bibliometrics, Scientometrics, Informetrics, Webometrics, Altmetrics

The Landscape of Information Science

- Information science?
  - Properties & behavior of information
  - Forces governing the flow of information
  - Means of processing information for optimum accessibility and usability

The Landscape of Information Science

- Concerned with the body of knowledge related to:
  - Creation
  - Collection, acquisition
  - Organization
  - Storage
  - Retrieval
  - Interpretation
  - Transmission
  - Transformation
  - Utilization

The Landscape of Information Science

- From - Classification Schemes of Information Science: Twenty-Eight Scholars Map the Field – only a few examples here

Aldo de Albuquerque Barreto

1. Information Production and Organization
1.1 Information Nature, qualities & value
1.2 Production of stocks of information
1.3 Information management & control
1.4 Technologies & practices of information

2. Information Distribution
2.1 Users & information communities
2.2 Communication of information
2.3 Information sources
2.4 Channels of information & its flow

3. Information consumption and use
3.1 Information availability & access
3.2 Information Uses & Applications
3.3 Cognition Aspects of Information
3.4 Assimilation of information
3.5 The production of knowledge

4. History, Philosophy, Legal, Ethics, and Ancillary Aspects of Information
4.1 Legal Structure of Information (e.g., Copyright)
4.2 Ethics of Information
4.3 Policy & Politics
4.4 Globalization aspects
4.5 History, Philosophy, Environment

1. Foundations of IS
1.1 History of IS
1.2 History of Librarianship
1.3 Archival Science
1.4 History of knowledge Formats: Manuscripts, Print & digital
1.5 IS Epistemology

2. Methodology
2.1 Quantitative & qualitative research
2.2 Bibliometrics, Informatics
2.3 Bibliology
2.4 Domain Analysis
2.5 Webometrics

3. Information/Learning Society
3.1 Social & cultural aspects in the information society
3.2 Sociology of Knowledge
3.3 Social Communication
3.4 Scientific Communication
3.5 E-learning
3.6 Information Literacy
3.7 IS Education
3.8 Lifelong Learning

4. Information Technology
4.1 Communication & Computer networks.
4.2 Document Delivery Systems
4.3 Structure of Computerized Systems
4.4 Programming languages
4.5 Multimedia
4.6 Information retrieval Systems
4.7 Systems Analysis
4.8 Artificial Intelligence
4.9 Human Computer Interaction
4.10 Information Architecture
4.11 digital security systems
4.12 websites construction
4.13 Net works technologies
4.14 Knowledge Representation
4.15 search tools

5. Data organization & Retrieval
5.1 Classification Schemes
5.2 Metadata
5.3 Indexing
5.4 Abstracting
5.5 Knowledge organization
5.6 Taxonomies
5.7 Thesauri
5.8 Ontology
5.9 Vocabulary Control
5.10 Online Searching techniques
5.11 Reference work
5.12 The semantic web

6. Information industry Economic & Management
6.1 Competitive Intelligence
6.2 Databases
6.3 Digital Libraries
6.4 Electronic publishing
6.5 Information Industry Market
6.6 Information Management
6.7 Information Manipulation
6.8 Knowledge Management
6.9 Information centers & Libraries management.
6.10 Collection management
6.11 Electronic comers

7. Information Ethic and Law
7.1 Copyright
7.2 Digital Security
7.3 Digital divide
7.4 Censorship
7.5 Internet crime
7.6 Free Access to Information
7.7 Information Policies

8. User studies
8.1 Human Information Behavior
8.2 Information seeking Behavior
8.3 Information Needs
8.4 Reference interview
8.5 User- information scientist-interaction

9. Diffusion studies
9.1 Information Dissemination
9.2 Communication Theory
9.3 Message Theory
9.4 Information centres & Libraries

10. Social information Science
10.1 Information needs of Different cultures
10.2 Information Education, Power & ethics
10.3 Social information Banks
10.4 Social information sections in school & public Libraries
10.5 Self help sources-printed Electronic
10.6 The social information scientist
10.7 Community Information.
10.8 Information diffusion in multi cultural societies
10.9 Health information centres

1. Concepts
1.1 Abstracting
1.2 Artificial intelligence
1.3 Categorization & classification
1.4 Classification theory
1.5 Cognition
1.6 Communication
1.7 Competitive Intelligence
1.8 Digital preservation
1.9 Digital security
1.10 Human information behavior
1.11 Information Architecture
1.12 Information ethics
1.13 Information Science Epistemology
1.14 Informetrics
1.15 Library Science
1.16 Memetics
1.17 Message theory
1.18 Ontology
1.19 Operations Research
1.20 Philosophy of Information science
1.21 Semiotics, Social, legal, & ethical aspects of information
1.22 Taxonomies

2. History
2.1 Foundations of information science
2.2 History of information science
2.3 Indexing

3. Information System development
3.1 Domain Analysis
3.2 Evaluation
3.3 Information need Evaluation
3.4 Knowledge representation
3.5 Knowledge structures Organization of Information
3.6 Readership studies
3.7 Subject analysis
3.8 Systems analysis
3.9 Thesauri
3.10 Vocabulary control
3.11 Estimation of Info Tech projects
3.12 Sizing of Software

4. Information Processing
4.1 High-Density Book Storage Systems
4.2 Information manipulation
4.3 Information processing
4.4 Information retrieval
4.5 Information storing
4.6 Information structures
4.7 Information use and user
4.8 Knowledge management
4.9 Metadata
4.10 Online searching
4.11 Publishing
4.12 Scientific Communication

5. Information System Implementation
5.1 Data bases
5.2 Information dissémination,

6. Quality assurance of Information
6.1 Information Quality
6.2 Information Science Education
6.3 Research evaluation
6.4 Testing of Software
6.5 Quality assurance of Software

7. Applications
7.1 Access systems
7.2 Archival Science
7.3 Aviation informatics
7.4 Bibliometrics
7.5 Community Informatics
7.6 Diffusion of info studies
7.7 Digital libraries
7.8 Distributed networked environments
7.9 Document Delivery Systems
7.10 Economics of information
7.11 Electronic Information Industry
7.12 E-journals
7.13 E-learning
7.14 Health/Biomedical Informatics
7.15 Information industry
7.16 Information technology
7.17 Internet
7.18 Labor in information systems
7.19 Music-information-retrieval
7.20 Philosophy of Librarianship
7.21 Public Information Policies
7.22 Social information/Social Informatics
7.23 Information in traditional & User
7.24 Web
7.25 Webometrics

8. Information project management
8.1 Information management
8.2 Management

1. Foundations of IS
1.1 Classification theory
1.2 Cognition science
1.3 Communication theory
1.4 Foundations & history of IS
1.5 IS epistemology
1.6 Library science
1.7 Philosophy of information
1.8 Museology
1.9 Archive science

2. Technology
2.1 Buildings & equipment
2.2 Multimedia
2.3 Internet, intranets, extranets
2.4 "High tech"
2.5 ICT
2.6 Information processing tools
2.6.1 Classification schemes
2.6.2 Structured vocabularies
2.6.3 Metadata & schema
2.6.4 Information & data models
2.7 Information workers

3. Activities
3.1 Systems analysis & design
3.1.1 Information (& knowledge) architecture
3.1.2 Information (& knowledge) audit
3.1.3 Website design
3.1.4 Typology & graphic design
3.1.5 Standardisation
3.2 Knowledge management
3.3 Information management
3.3.1 Library management
3.3.2 Records & archives management
3.3.3 Document management
3.4 Museum documentation
3.5 Information processing
3.5.1 Information analysis
3.5.2 Writing and journalism
3.5.3 Collection management
3.5.4 Indexing
3.5.5 Abstracting
3.5.6 Cataloguing
3.5.7 Classification & categorisation
3.5.8 Information storage
3.5.9 Information curation
3.5.10 Information retrieval
3.5.11 Information dissemination

4. Metrics, Evaluation & Research
4.1 Evaluation of information systems
4.2 Evaluation of retrieval
4.3 User needs studies
4.4 Usability studies
4.5 Diffusion studies, SNA
4.6 Economics of information
4.7 Evaluation of information quality
4.8 Biblio-, Infor-, Sciento-metrics
4.9 Webometrics
4.10 Research methods
4.11 Evaluation of research

5. Information use & users
5.1 Information needs & use
5.2 User typologies
5.3 Information behaviour
5.4 Group psychology
5.5 Information usability
5.6 Info & IT literacy

6. Supporting disciplines
6.1 Management
6.1.1 Strategy & planning
6.1.2 Financial management
6.1.3 Human resource mgmt
6.1.4 Facilities management
6.1.5 Operations research
6.1.6 Decision support systems
6.1.7 Management information
6.2 Mathematics & logic
6.2.1 Bayesian probability
6.2.2 Vector space analysis
6.2.3 Information theory
6.2.4 Bradford-Zipf analysis
6.3 Linguistics & logic
6.3.1 NLP
6.3.2 Computational linguistics
6.3.3 Semiotics
6.3.4 Semantics
6.3.5 Speech recognition
6.4 Artificial intelligence
6.5 Psychology
6.6 Information politics
6.7 Communication

7. Application areas
7.1 Information industry
7.1.2 Electronic Publishing
7.1.3 Libraries
7.1.4 Digital libraries
7.1.5 Primary Information Services
7.1.6 Secondary Information Services
7.1.7 Tertiary Information services
7.1.8 Intellectual capital
7.1.9 Business intelligence
7.1.10 Geospatial Systems (GIS)
7.1.11 Patent analysis
7.1.12 Market research
7.2 Discipline-oriented systems
7.2.1 Chemical informatics
7.2.2 Medical informatics
7.2.3 Music information retrieval
7.3. Function-oriented systems
7.3.1 Marketing
7.3.2 Finance & accounting
7.3.3 Educational systems
7.3.4 Health informatics
7.3.5 Legal information systems
7.3.6 e-Government
7.3.7 Citizen's information systems
7.4. Media-based
7.4.1 Text-based systems
7.4.2 Pattern recognition
7.4.3 Content-Based Image Retrieval
7.4.4 Video systems
7.4.5 Audio systems
7.4.6 World Wide Web
7.4.7 Portals and gateways

8. Legal, Ethical & Social issues
8.1 Intellectual property
8.2 Information ethics
8.3 Freedom of Information
8.4 Data privacy, Censorship
8.5 National information policy
8.6 Social exclusion
8.7 Third World problems

9. IS Education
9.1 Training
9.2 e-Learning

The Landscape of Information Science

- Let's single out Semiotics as one area of Information Science
  - Sign in Semiotics, and
  - Informative Object in Information Science.
  - Signifier and signified
  - Mimesis - Semiosis
  - Parole and langue
  - Text and content
  - The physical metaphor (information-as-thing) & the cognitive metaphor (information-as-thought)
  - Sign, Value, & Meaning
  - Word-idea-indeterminacy
  - Syntagmatic & Paradigmatic relations
  - Linguistics – information Science

The Landscape of Information Science

- The word semiotics comes from the Greek for symptom.
- Semiotics studies systems of signs.
- Semiotics is generally defined as the study of signs.
- It regards all sign systems as the product of a single human faculty for creating order.
- Two traditions of the study of signs can be identified: A European and an American.

The Landscape of Information Science

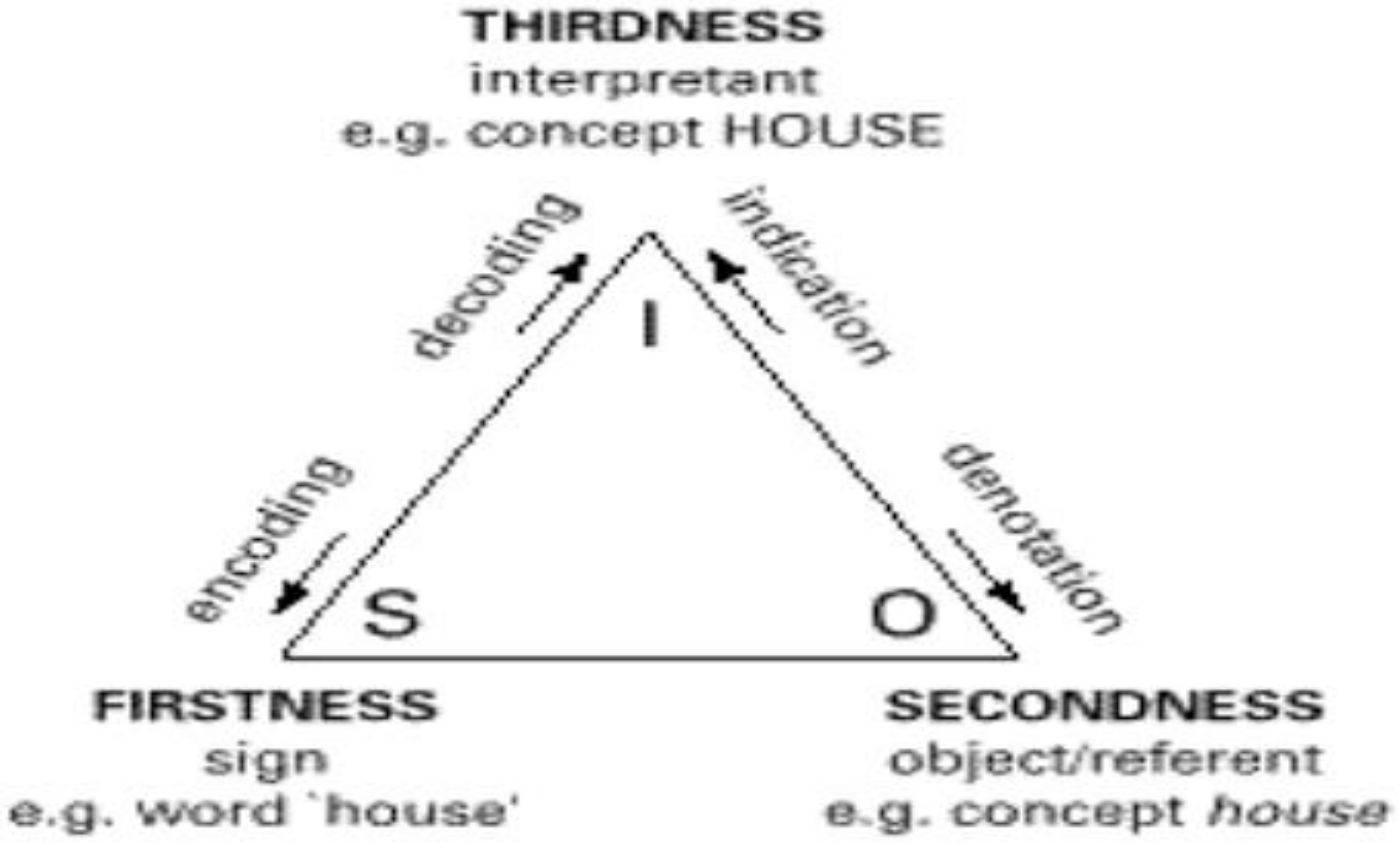
- The European tradition is based on the work of the French linguist Ferdinand de Saussure (1857–1913)
- This school is usually named Semiology, the study of "the life of signs in society."
- The American tradition is based on the work of the American scientist and philosopher Charles Sanders Peirce (1839–1914) and is called semiotics (or semeiotic, as Peirce preferred to spell it).
- The two traditions are distinct.
- Saussure's theory is a theory of how to derive meaning from words.
- Peirce's theory is about how signs in general, and not only words, are attributed meaning.

The Landscape of Information Science

- Three distinct fields of semiotics: syntactics (or syntax), semantics and pragmatics.
- Peirce named three categories of signs: icon, index and symbol.
- The subjects of study for semiotics are all kinds of signs: verbal language, pictures, literature, motion pictures, theatre, body language, and more.
- Information Science (IS) would seem to have some unnoticed affinities with semiotics in its concerns with the retrieval and transmission of material products of the semiotic faculty and with meaning to concept relations.

The Landscape of Information Science

- Semiotics as a process of semiotic activity



The Landscape of Information Science

- Semiotics and information science
- Both semiotics and IS are concerned with the nature of the relations between:
  - content and its representation,
  - signifier and signified,
  - reference and referent,
  - IOs and their meaning.
- Representation & the relationship between representation & what is represented, are at the heart of both semiotics and IS.

The Landscape of Information Science

- Semiotics –sign, Signifier and signified.
- Information science –Informative object (IO), Text and content.
- Both share a complex relation.
- An article in a journal –as an IO.
- Understanding exactly what the article signifies is a complex task.
- A surplus of meaning can intrude upon interpretation.
- The difficulty affects both ends of the information retrieval process.

The Landscape of Information Science

- Front end –difficulty of system of organization, assigning an accurate and adequate representative description to a given text.
- Back end –the difficulty of assessing whether or not the accessed text is actually relevant to the need that prompted its retrieval.
- The central object of both semiotics and IS bears an unmistakable indeterminacy.

The Landscape of Information Science

- Word –arbitrary sound –associated with the expression of an idea –same idea can be expressed by a variety of sounds.
- The study of language engages a number of dualities.
- No speech without thought , yet without speech, thought will find no articulation.

The Landscape of Information Science

- For Saussure, Speech (so communication) is a combination of:
  - Physiological production of sounds,
  - A physical transmission of sounds,
  - A psychological association of sounds with sound-images that signify concepts or ideas.
- This combination occurs in a social context that associates the same sound-images with the same concepts for most speakers.

The Landscape of Information Science

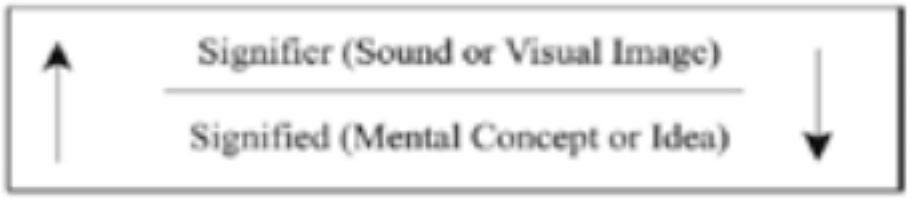
- Speaking (parole) is –individual, willful, and intellectual.
- Language (langue) is a social phenomenon, with a history independent of any given speaker.
- Association exists between language and information.
- Text can be regarded as something akin to Parole, willfully created by an individual who wishes to communicate with others.

The Landscape of Information Science

- Text is unique, a product of choice, and almost unlimited with regard to what it might be.
- The content of text is much like langue.
- It is a social phenomenon, constrained by history and culture and serving as the shared set of concepts and meanings from which texts are constructed.
- IS lacks the equivalent of Saussure's distinction between parole and langue.
- Information in IS must do a double duty –signifying both speech (regardless of medium) and thought (both text as well as content).

The Landscape of Information Science

- The linguistic sign is a ‘double entity’ uniting a concept and a sound-image.
- The sign is a two-sided psychological entity through which concept (the signified) and sound-image (the signifier) are intimately united.
- The signified is an idea or mental entity grounded on some referent in the social or material world.



The Landscape of Information Science

- The signifier is the pointer or the signal of the presence of that idea and its deployment in discourse and communication.
- The sign displays two “primordial characteristics.”
  - It is an absolutely arbitrary construction
  - The signifier is linear in nature

The Landscape of Information Science

- Index term assigned to represent text and its content is a second degree signification, and can’t be arbitrary.
- Index term, as a signifier, must be selected on the basis of an a priori logical and semantic relation to the text it will signify.
- Indexing language (represented by thesauri) – avoids arbitrariness and ambiguity.

The Landscape of Information Science

- The apparent contradiction between the
  - Sign as essential arbitrary nature, and
  - Essential need to control the IO, is a dilemma
- The simultaneous mutability and immutability of the sign resolves the dilemma.
- The sign is an arbitrary creation, yet it is also fixed
- At the same time, the sign “is exposed to alteration because it perpetuates itself.”
- Over time this results in a “shift in the relationship between the signified and signifier.

The Landscape of Information Science

- The IO, like the sign, is relatively immutable.
- Although arbitrary in the sense that the signs used to compose a text are essentially arbitrary in nature, once the selections are made and the text composed, it remains fixed and will not recompose itself.
- Information can also experience change over time.
- The relations between texts and their content manifest change.
- As a signifier, the text remains constant, but as a signified, the content changes as the viewpoint brought to bear on the IO changes.

The Landscape of Information Science

- The changing relation
  - between text and content and
  - between signifier and signified
  - constitutes a change in the meaning of the IO, as new meanings are assigned to existing objects.
- The simultaneous immutable and mutable quality of the IO allows the possibility of second order representation for the purpose of organization and access.
- Much as culture orders and controls the meaning of signs, indexing languages must necessarily change over time.
- Information, constituted by IOs is like language constituted by signs.
- Both are social institutions subject to the same social forces.

Informatics as a Science

From - Informatics: A Focus on Computer Science in Context

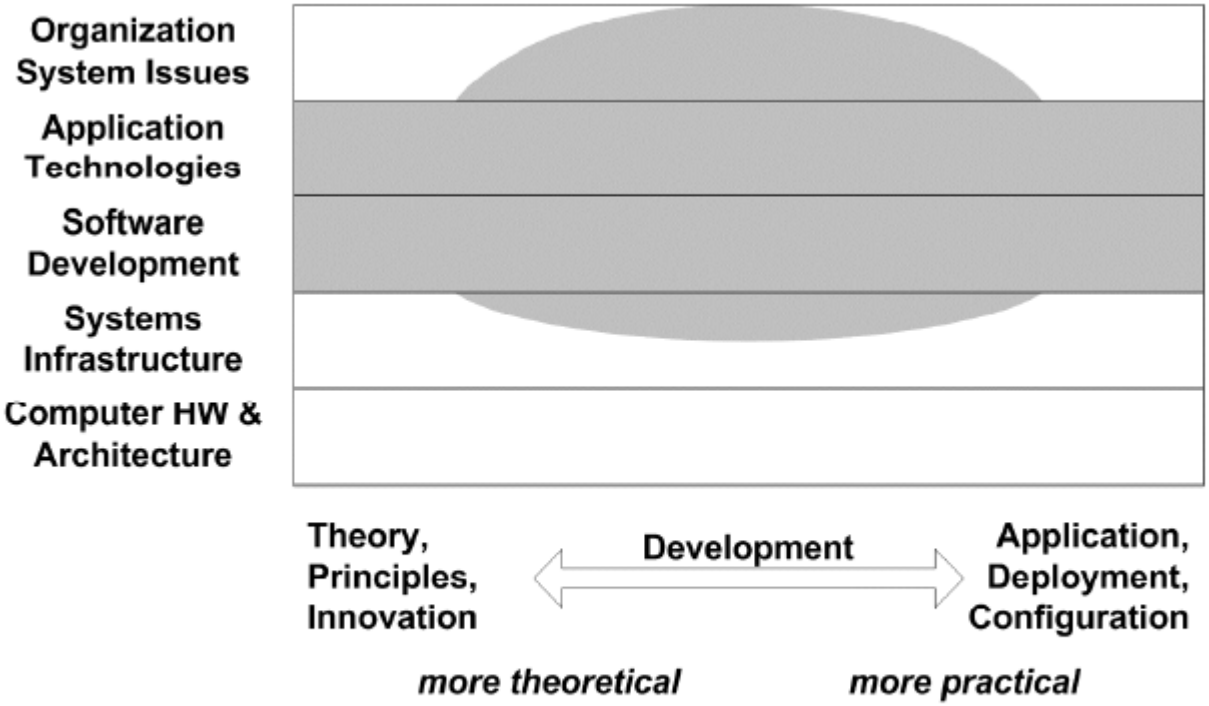


Figure 2. Areas of concern for Informatics.

Information problems

- The issues or problems occur at the intersection of
  - Information
  - Data
  - People
  - Technology , and
  - Use