

# **On the Proper Use of Man and Machines**

# What Is Medical Informatics?

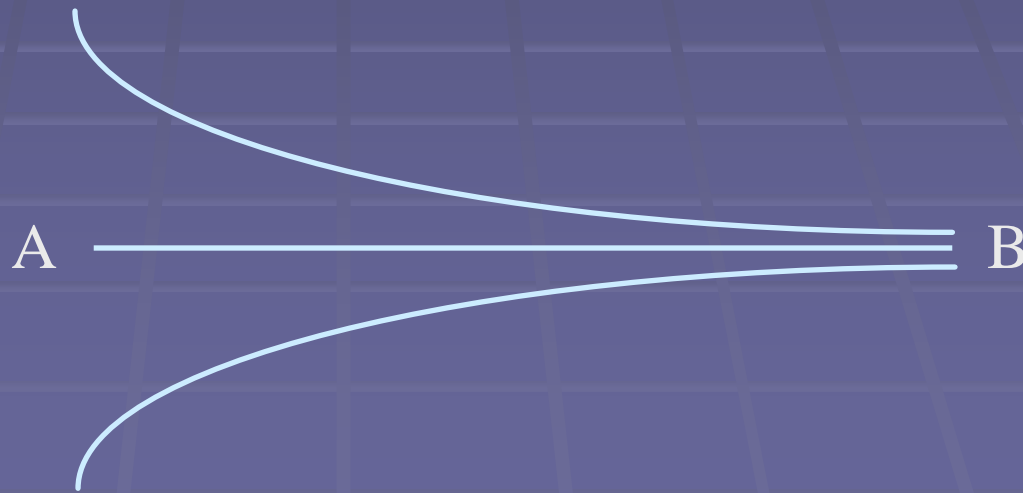
- “The field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine.” (MeSH)
- “A field of study concerned with the application of information science and technology to medicine”
  - How do you use technology effectively?
    - Organizing information
    - Discovering new relationships
  - What is the experience with patients like mine?
- Not just “Show and Tell”

# An Aside into History

- The Setting - Strong AI
- Conventional Wisdom
  - Machines mirror mans mind
  - Man's fallibility will be replaced by machines (infallible)
- Blois' Response
  - Clinical Judgment and Computers
  - NEJM, 1980

# The Argument

- Where do machines work well?
- What things do humans do best?
- The funnel



# A Digression into Experience

# Current Medical Information and Terminology (CMIT)

- 3,000+ Diseases
- Structured description
  - Telegraphic Style
  - Uncontrolled vocabulary
- Produced by AMA

# The RECONSIDER experience

- Used CMIT
- Suggested possible diagnoses
  - Selectivity scores of terms
  - Used synonym dictionary

# Selectivity Scores

- Kayser-Fleischer rings
  - Pathognomonic
  - A sufficient attribute
  - Occurs in 1 description
- Rash
  - Occurs in 300+ descriptions
- Score =  $1 - (n/3262)$

# A Clinical Trial

- 100 consecutive first admissions to University Hospital
- Data abstracted at admission
- Entered by 4 persons blinded to patient
- List scored after patient discharged

# Results

- 61% of diagnoses overall suggested correctly
- But 93% of correct diagnosis suggested at least once
- Harder with multiple diagnoses
- Some interesting anecdotes
  - Liver and kidney failure with fever
  - Skin rash and intermittent arterial blockage

# Cooperative Computation

- Effective use of technology
- Example - Recall versus Judgment
- Let humans do what they do best
- Let machines do what they do best
- Complementary, not competitive

# What Humans Do Well

- Recognize Context
- Exercise Judgment
- Recognize Patterns
- Communicate despite differences
  - Locke's private language
  - Shared ideas

# Processes of Information Handling

- Generalization and Specialization
- Abstraction
- Both Can be Described as Attribute Analysis

# Generalization

- Specialization
  - Separate primates from mammals
- Generalization
  - Change a description of a primate to one of mammals
  - What do you eliminate?

# Abstraction

- A model
- “Throwing away bits of the truth” - Bohr
- Diseases
- How do you know if it is a good model?
- RxNorm model of clinical drugs

# What Machines Do Well

- Symbol Manipulation
- Memory (Recall)
- Reproducible
- NOT Recognition of Context

# Contextual Communication

- Structured Text
- Syntax approximates Semantics
- Information Model

# Formalization

- Enables Computation
- Technological necessities
  - Tokenize (symbolize) objects
  - Establish formal methods of manipulation
- Hard for humans to manipulate
  - Higher level programming languages
  - Shades of meaning (and puns) not allowed
- Aids Conception
  - Rigor in model and expression
  - Requires highly functional interfaces

# Terminological Imperative

- Necessity for Cooperative Computation
- Machine processible
- Human understandable