Diversity in the Information Age

Nova Scotia Roundtable

October 11, 2001
Diversity: Changing Paradigms

- Discrimination and fairness
- Access and legitimacy
- Learning and effectiveness

Objectives

- Provide framework for discussion of diversity in science & engineering
- Present analysis
- Identify trends
- Stimulate comment from Roundtable participants
AUDIENCE WARNING

Simplification of complex scenarios may lead to inaccurate conclusions.

This presentation contains simplifications.

Segmentation is simplification.
Alternatives to Segmentation

- Statistical distributions. Note: outliers influence perceptions.
- Fuzzy sets. (Sort of tall)
- Multiple dimensions.
Gender Differences

- Abilities - NO
  - test scores - maybe

- Motivations - YES
  - affective influence
  - value of contribution
  - work-life balance

- Thinking styles - YES
Thinking style affects ...

- Communication
- Information handling
- Problem solving
- Learning and teaching
Thinking Styles

Hierarchical
- Progression
- Axiomatic
- Pure math
- Structured program
- Highly specialized

Relational
- Patterns
- Intuition
- Applied Math
- Bricolage *
- Interdisciplinary

*Levi-Strauss, *The Savage Mind*
Axiomatic Tradition

- Legacy of the Greek schools
- Legitimacy through argument & proof
- Concept is primary; experience is secondary
- Progression is hierarchical
Relational Thinking

- Characteristic of the arts
- **Legitimacy** through observation & experience
- Relationships are primary; formalism is secondary
- Application & extension are continuous
Relational Learners in Axiomatic Environment

- Question legitimacy
- Question motivation & relevance
- Anxiety due to missing legitimacy
- Miss steps in progression or are slower initially

(Booth and Brooks 1985)
WOMEN %
MEN %

ACTIVE EXPERIMENT

CONCRETE EXPERIENCE

REFLECTIVE OBSERVATION

ABSTRACT CONCEPT

Kolb: Learning Style Inventory

Related Formulation

Seagal: *Human Dynamics Model* (1985)

Mental: ideas & content; focused

Relational: experience & communication; multi-tracking.

Physical: task-oriented, thorough.
# Scientific Process

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Some Relational Thinkers

“… it was necessary to continue the development of the picture as the method, before the mathematics could really be done.”
- Richard Feynman

“The way the two triple sets of axioms are contrasted in (the book) is not at all the way things happened in the process of actual thinking. This was merely a later formulation of the subject matter.”
- Albert Einstein
## Creative Process

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Scientific Validity (Truth)

Axiomatic validity is necessary, but not sufficient.

Result must also be consistent with all related observations and results.
Scientific Validity (Truth)

Consistency with all related observations and results is necessary, but not sufficient.

Axiomatic argument must lead to equivalent result.
Interim Result

- Range of thinking styles is an example of diversity.
- Hierarchical & Relational attributes provide a framework for discussion of diversity in science & engineering.
- Analysis: Diversity is “ok”.
Nonlinear Dynamics

- Chaos theory, complexity, fractals
- Simple laws give rise to apparently chaotic systems
- Simple patterns repeat at different scales
- Applications in biology, economics, astronomy, information theory.
Information Age Trends

- Increasing amounts of information
  - collected or produced
  - analysed and compared
  - stored

- Information processing
  - modelling
  - simulation
  - pattern recognition
Infographics

The statistics, patterns, and trends in information;

the characteristics of the information landscape.
Trends from Infographics

Quantities increase $\rightarrow$ patterns emerge

Patterns complex $\rightarrow$ fields emerge

Fields complex $\rightarrow$ fields merge

$\rightarrow$ Emergence of relational technologies
Relational Technologies

- Fuzzy logic - automation and control
- Neural networks - system modelling
- DNA - and genetic engineering
- World wide web
- Climate modeling - global warming
Summary

- Hierarchical & Relational thinking styles illustrate diversity.
- Science tradition is hierarchical.
- Infographics trend is relational.
- Diversity challenges traditions.