IE Courses and Options

Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE & ENGINEERING

Presenters

- **Professor Mathew Mackay**
  - *Associate Chair of MIE Undergraduate Studies*

- **Professor Michael Gruninger**
  - *Information Engineering*

- **Professor Birsen Donmez**
  - *- Human Factors*

- **Professor Michael Carter**
  - *- Operations Research*

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Information Engineering

Professor Michael Gruninger

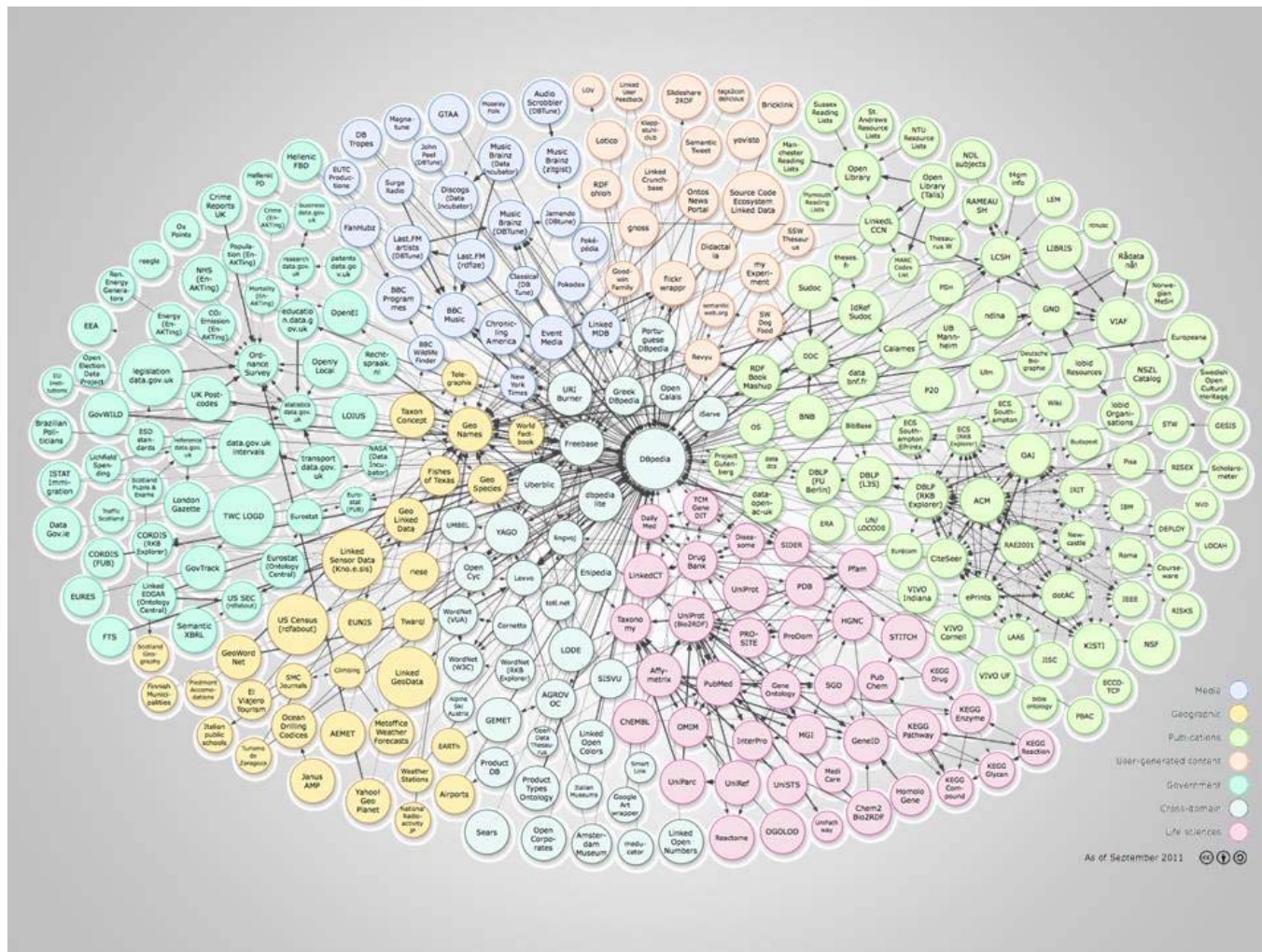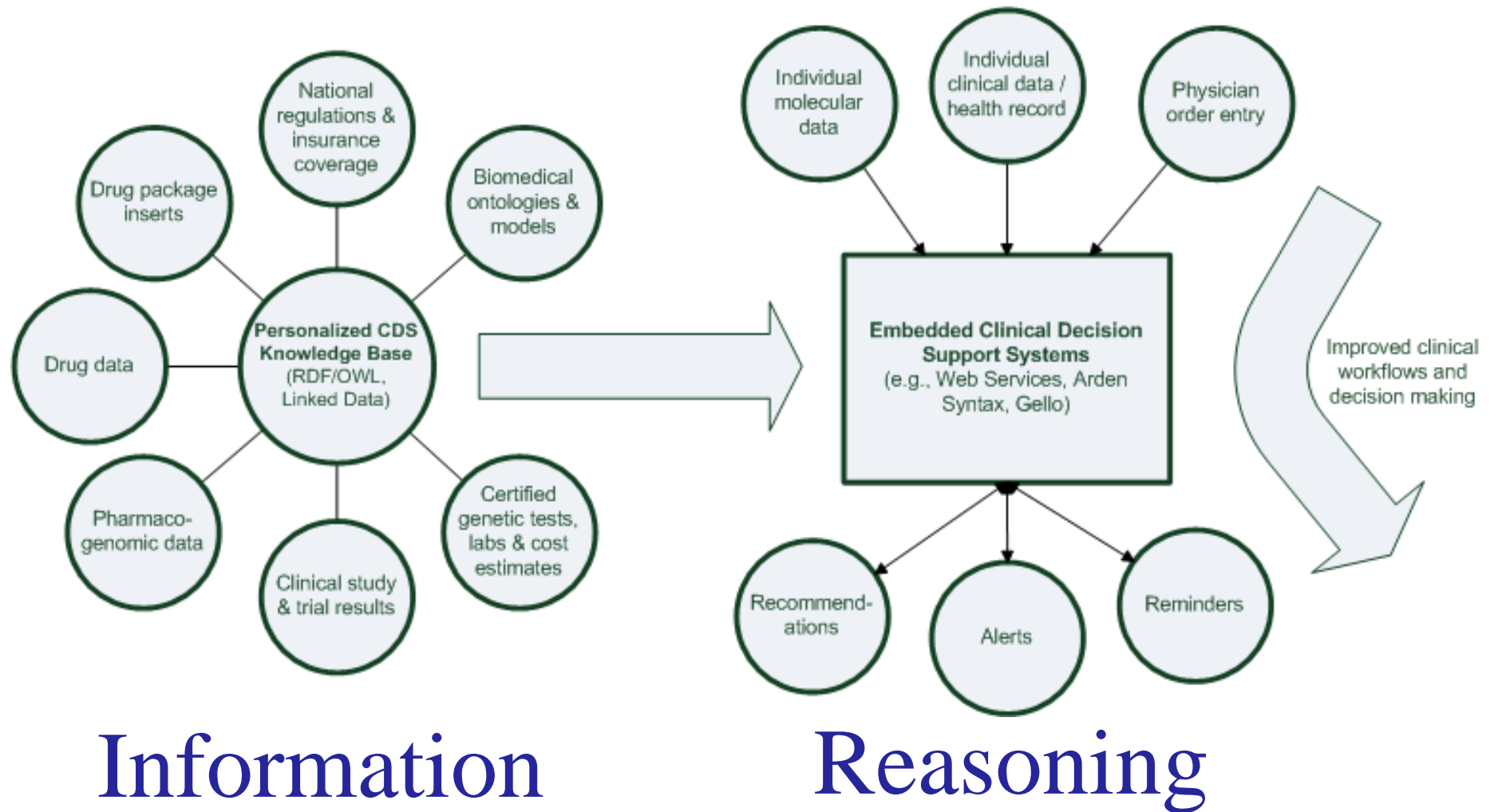http://stl.mie.utoronto.ca/gruninger.html

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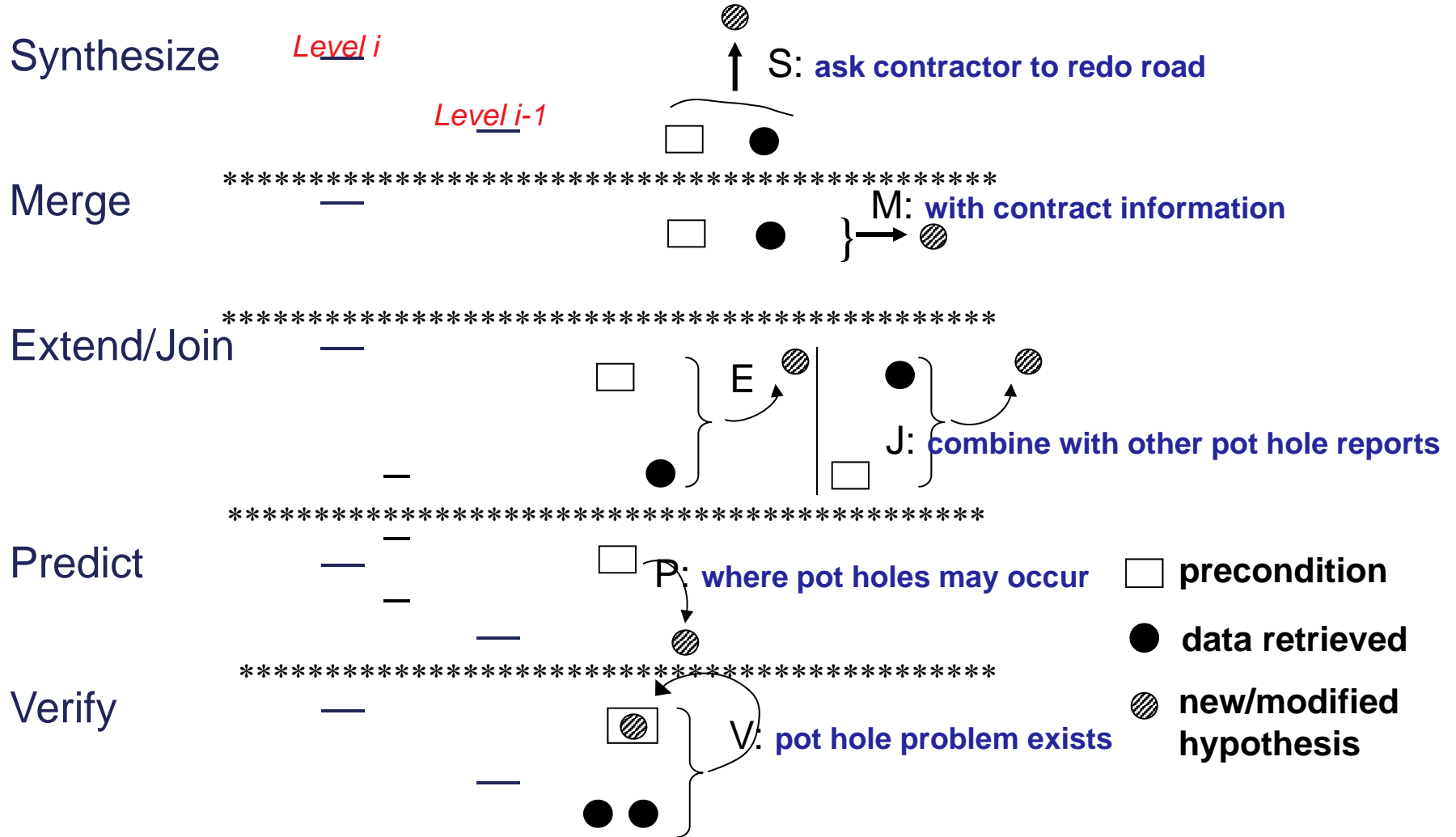ENGINEERING

Connecting Information Across the World

Integrated Proactive Medicine

Information   Reasoning

From Information to Knowledge to Action: Toronto 311

Synthesize

Level i

Level i-1

S: **ask contractor to redo road**

****

Merge

M: **with contract information**

****

Extend/Join

E

J: **combine with other pot hole reports**

****

Predict

P: **where pot holes may occur**

□ **precondition**

● **data retrieved**

****

Verify

V: **pot hole problem exists**

▨ **new/modified hypothesis**

Supply Chain
Integrating Materiel, Manufacturing and Retail

Information Engineering

- Information Engineering is the engineering of
  - Information, knowledge, and decision support, and

    the systems with which they are delivered

  to support the achievement of organizational goals through the efficient and flexible operation of business processes.

Information Engineers...

- ...form a bridge between the technical side (software engineers, data modelers) and the business side (business analysts, process planners, managers)

- Focus on the strategic role of information systems in achieving business goals
  - not only how to build an information system but also why

Information Engineers...

Third Year Fall

– **MIE350:** Design and Analysis of Information Systems

Technical Electives:

– **MIE354:** Business Process Engineering

Third Year Winter

– **MIE335:** Algorithms & Numerical Methods

Technical Electives:

– **MIE344:** Ergonomic Design of Information Systems

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Information Engineers...

Fourth Year Fall

– **MIE463**: Integrated System Design

Technical Electives:

– **MIE354:** Business Process Engineering
– **MIE451:** Decision Support Systems
– **MIE498H/Y:** Research Thesis

Fourth Year Winter

– **MIE459:** Organization Design

Technical Electives:

– **MIE344:** Ergonomic Design of Information Systems
– **MIE457:** Knowledge Modelling and Management
– **MIE498H/Y:** Research Thesis

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Information Engineering Faculty

- Michael Gruninger

Christopher Beck

- Mariano Consens

Michael Gruninger

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Careers for Information Engineers

*insert a few points about different careers here

Graduate Studies for Information Engineers

*insert some points about research/graduate studies and what career paths that may lead to (can segway talk about your own research here and where your past students have went on to work (academic vs non-academic)

Human Factors (HF)

Professor Birsen Donmez
http://www.mie.utoronto.ca/faculty/donmez/

Human Factors Faculty

Birsen Donmez   Mark Chignell   Greg Jamieson   Paul Milgram
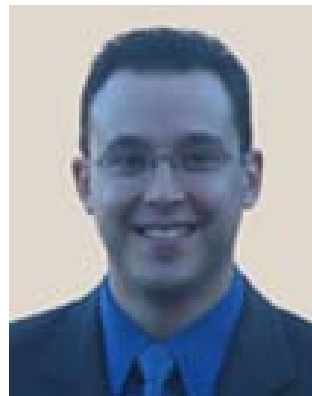
Adjunct Faculty
Justin Hollands   Olivier St-Cyr   Paul White

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Human Factors Engineering

"Yes, we are continuing to develop the software. We are improving the modeling capability for the new version. The plans for roll out and testing have been completed, hopefully it will be easy to use. But as always this is rather complex issues and you need a base knowledge to handle the software."

If a system doesn't work for people, it doesn't work!

Human Factors Engineering

- A skill set for every engineer

- A unique career

- In terms of number of undergraduate courses offered, HF program at UofT is among the largest in North America

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Human Factors Courses

Year 2

- **MIE 242:** Psychology for Engineers (core)
- **MIE240:** Human-centred systems design (core)

Year 3

- **MIE343:** Industrial Ergonomics and the Workplace (core)
- **MIE345:** Case Studies in Ergonomics (tech elective)
- **MIE344:** Ergonomic Design of Information Systems (tech elective)

Year 4

- **MIE344:** Ergonomic Design of Information Systems (tech elective)
- **MIE345:** Case Studies in Ergonomics (tech elective)
- **MIE448:** Engineering Psychology and Human Performance (tech elective)
- **MIE542:** Human Factors Integration (tech elective)
- **MIE498H/Y:** Research Thesis*

MIE343
Industrial Ergonomics and the Workplace

1. Anatomical & physiological factors underlying design of equipment and work places.

2. Biomechanical factors governing physical workload and motor performance.

3. Circadian rhythms & shift work.

4. Measurement and specification of heat, light, and sound with respect to design of work environments.
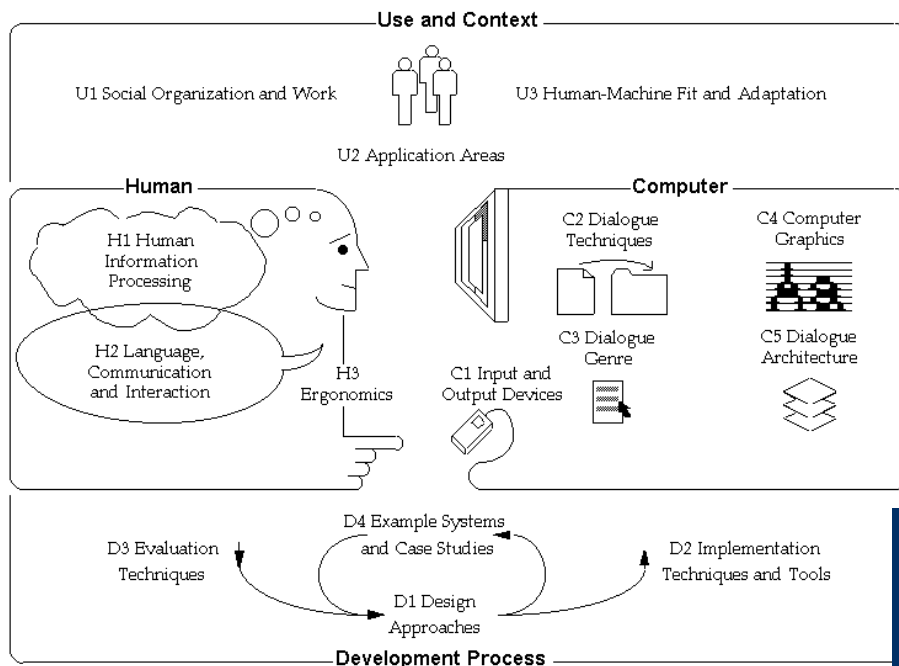
MIE344
Ergonomic Design of Information Systems

1. Design of human-machine interfaces, and analysis of the impact of computers on people

2. Usability engineering, rapid prototyping design, analysis of user mental models and their compatibility with design models, and quantitative modelling of human-computer interaction

3. New developments in social computing and collaboration technologies that are relevant to interaction design

Use and Context

U1 Social Organization and Work   U3 Human-Machine Fit and Adaptation

U2 Application Areas

Human

H1 Human Information Processing

H2 Language, Communication and Interaction   H3 Ergonomics

Computer

C2 Dialogue Techniques   C4 Computer Graphics

C3 Dialogue Genre   C5 Dialogue Architecture

C1 Input and Output Devices

D3 Evaluation Techniques   D4 Example Systems and Case Studies   D2 Implementation Techniques and Tools

D1 Design Approaches

Development Process

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MIE345
# Case Studies in Ergonomics

- A detailed analysis of numerous *cases* in which HF methods have been applied to improve the efficiency with which human-machine systems operate.

- e.g., wayfinding, expert witness testimony / human factors forensics, proposal writing, healthcare, nuclear power, driver distraction

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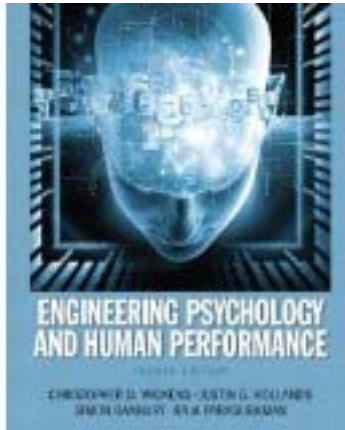
MIE448: Engineering Psychology and Human Performance

Examines relationship between information processing and design of (complex) human-machine systems.
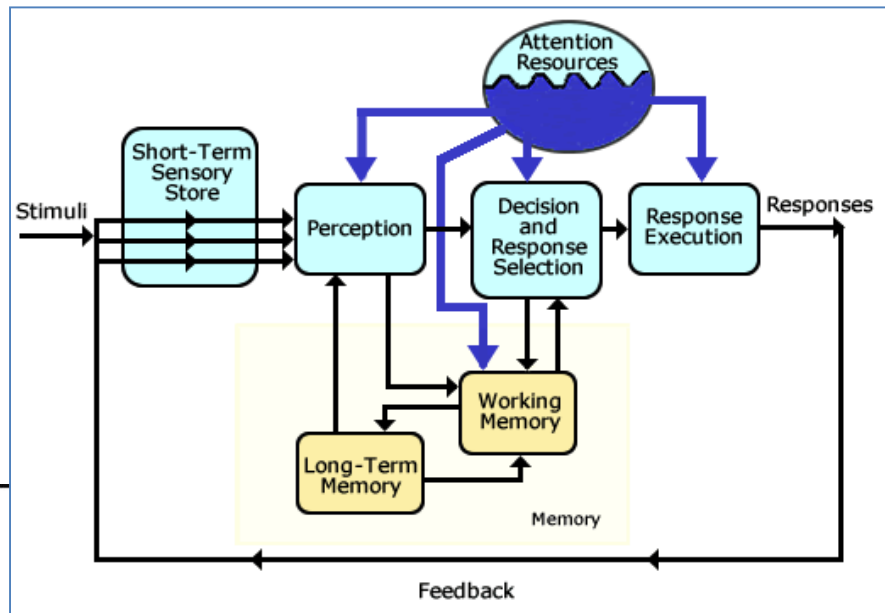
"Old-fashioned"

"Modern"

MIE542
Human Factors Integration (HFI)
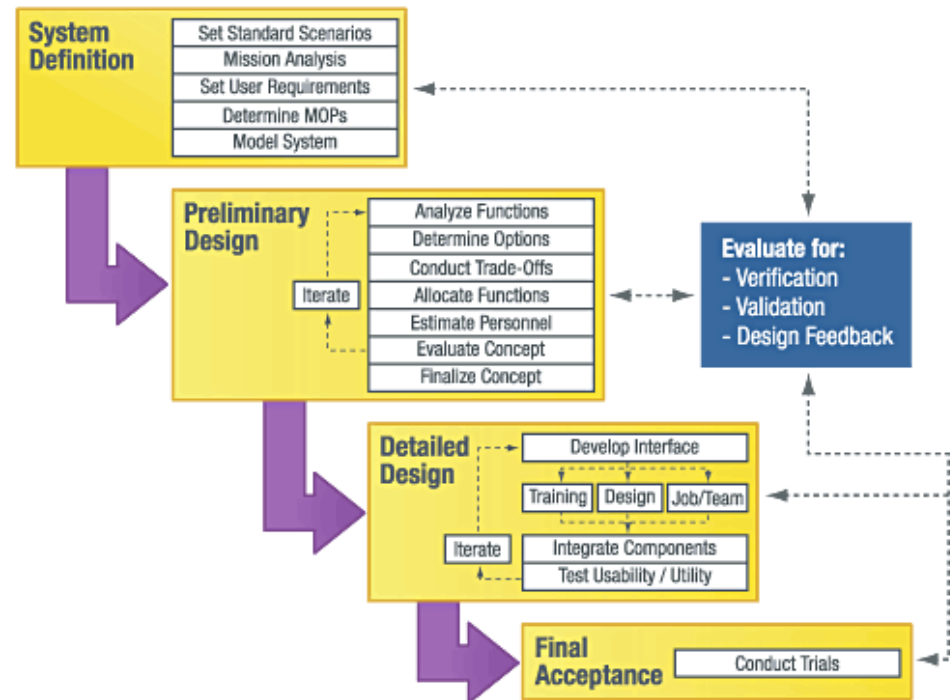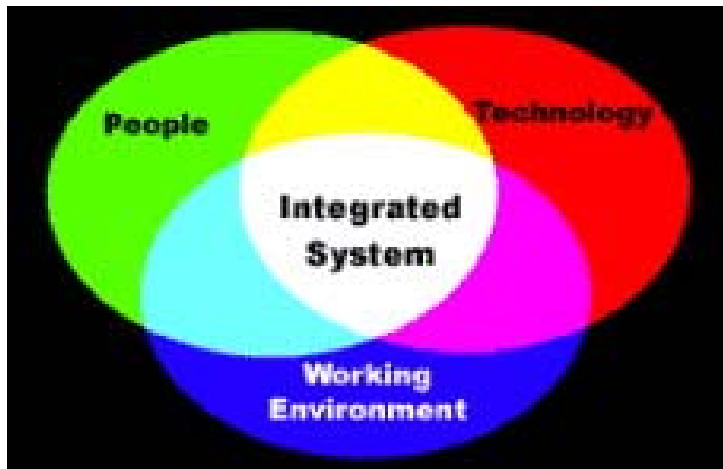
1. Integration of HF into engineering projects.
2. HFI tools, and HFI best practices.
3. Modelling, economics, and communication of HFI problems.
4. Examples of HFI, from energy, healthcare, military, software systems ..
5. Application of HFI theory and methods to design, including HFI problem specification, concept generation and selection.

Where are HF practitioners working?

- Health Care / Medical Informatics
- Software
- Aviation / Space
- Process Control
- Manufacturing
- Telecommunications
- Military (Research & Practice)
- Research & development
- Private Consulting
- Forensics
- University
- ……

Graduate Studies for Human Factors

*insert some points about research/graduate studies and what career paths that may lead to (can segway talk about your own research here and where your past students have went on to work (academic vs non-academic)

Operations Research (OR)

Professor Michael Carter
www.mie.utoronto.ca/faculty/carter

Operations Research (OR)

- ~~What is operations research?~~
- What ISN'T operations research?

Operations Research

- OR is everywhere!
- And so are OR careers

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Operations Research Areas

Supply Chain

Operations Research Areas

Vehicle routing

Operations Research Areas

Finance

Operations Research Areas

Military

Operations Research Areas

Healthcare

OR Core Courses

Second Year

- **MIE250:** Fundamentals of Object Oriented Programming
- **MIE262:** Operational Research I: Deterministic OR
- **MIE263:** Operations Research II: Stochastic OR

Third Year

- **MIE360:** Systems Modelling and Simulation
- **MIE335:** Algorithms & Numerical Methods
- **MIE363:** Resource and Production Modelling
- **MIE364:** Methods of Quality Control and Improvement

OR Technical Electives

Third Year

- **MIE365:** Operational Research III: Advanced OR
- **MIE354:** Business Process Engineering
- **MIE469:** Reliability and Maintainability Engineering
- **MIE367:** Cases in Operational Research

Fourth Year

- **MIE562:** Scheduling
- **MIE566:** Decision Analysis
- **MIE561:** Healthcare Systems
- **MIE465:** Analytics in Action****
- **MIE498H/Y:** Research Thesis*

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Careers in Operations Research

*insert a few points about different careers here

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Graduate Studies for Operations Research

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Who Employs Indy's?

Canadian Tire Corporation

Hudson Bay Company

Wal-mart

Loblaw Companies Ltd.

Kraft Canada

Unilever Canada

CIBC

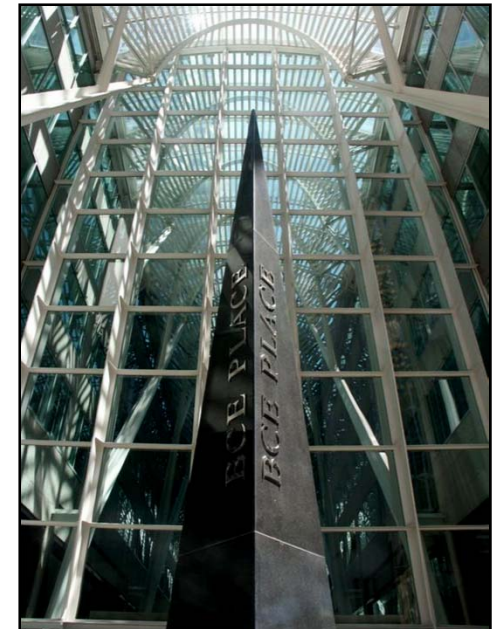**Deloitte & Touche**

Bain and Co.

Environment Canada

Research In Motion

Rogers Cable

Atomic Energy Canada Ltd.

University Health Network

Beyond the Classroom

MIE Students are some of the most involved in Engineering!

Sample of clubs our students are involved with:

- Institute for Industrial Engineers
- Engineers Without Borders
- Volunteer Consulting Association
- National Business and Technology Conference