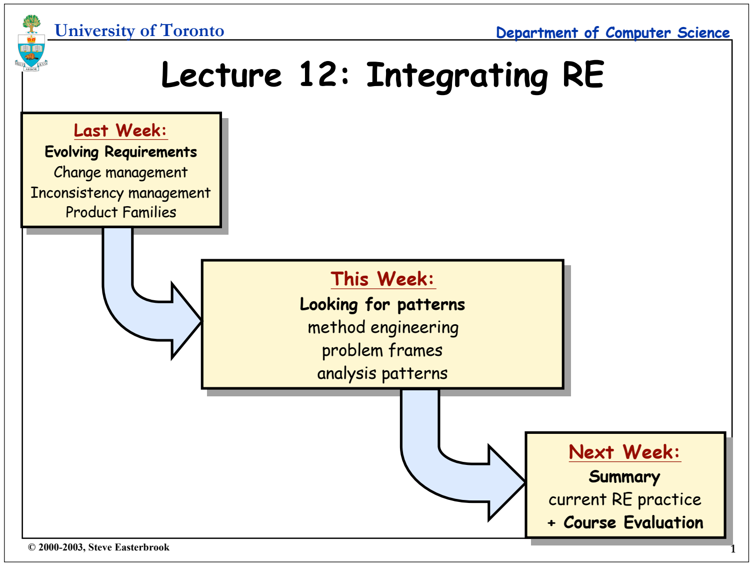
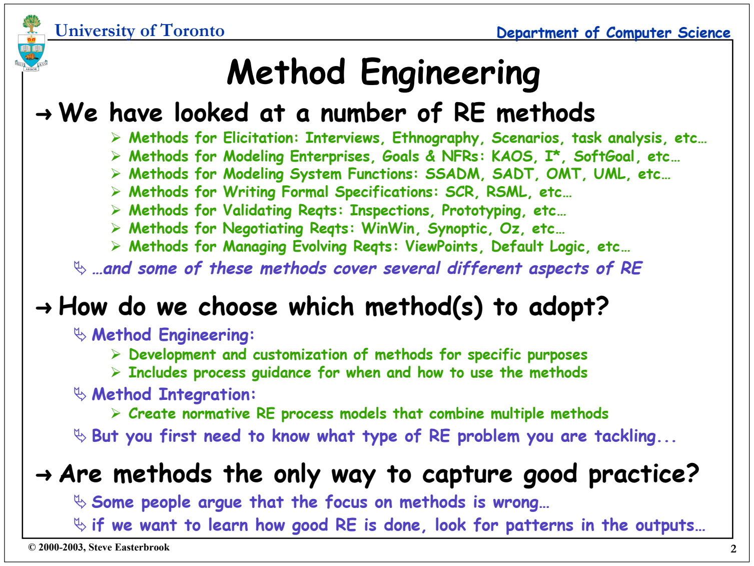


Lecture 12: Integrating RE

Last Week:
Evolving Requirements
Change management
Inconsistency management
Product Families

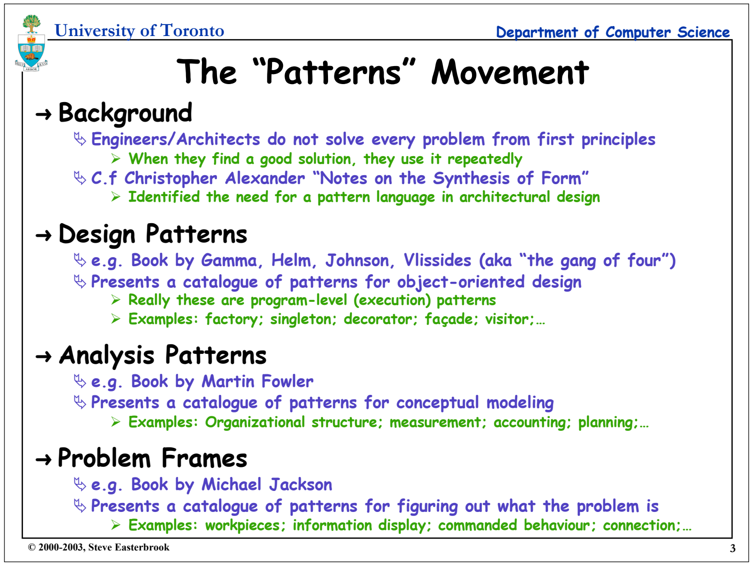
This Week:
Looking for patterns
method engineering
problem frames
analysis patterns

Next Week:
Summary
current RE practice
+ Course Evaluation



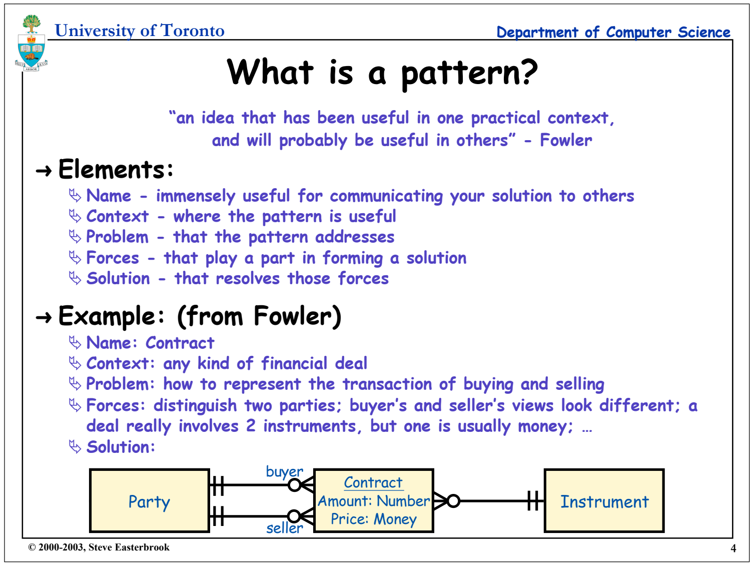
Method Engineering

- We have looked at a number of RE methods
  - Methods for Elicitation: Interviews, Ethnography, Scenarios, task analysis, etc…
  - Methods for Modeling Enterprises, Goals & NFRs: KAOS, I*, SoftGoal, etc…
  - Methods for Modeling System Functions: SSADM, SADT, OMT, UML, etc…
  - Methods for Writing Formal Specifications: SCR, RSML, etc…
  - Methods for Validating Reqts: Inspections, Prototyping, etc…
  - Methods for Negotiating Reqts: WinWin, Synoptic, Oz, etc…
  - Methods for Managing Evolving Reqts: ViewPoints, Default Logic, etc…
  - *…and some of these methods cover several different aspects of RE*
- How do we choose which method(s) to adopt?
  - Method Engineering:
    - Development and customization of methods for specific purposes
    - Includes process guidance for when and how to use the methods
  - Method Integration:
    - Create normative RE process models that combine multiple methods
  - But you first need to know what type of RE problem you are tackling...
- Are methods the only way to capture good practice?
  - Some people argue that the focus on methods is wrong…
  - if we want to learn how good RE is done, look for patterns in the outputs…



The "Patterns" Movement

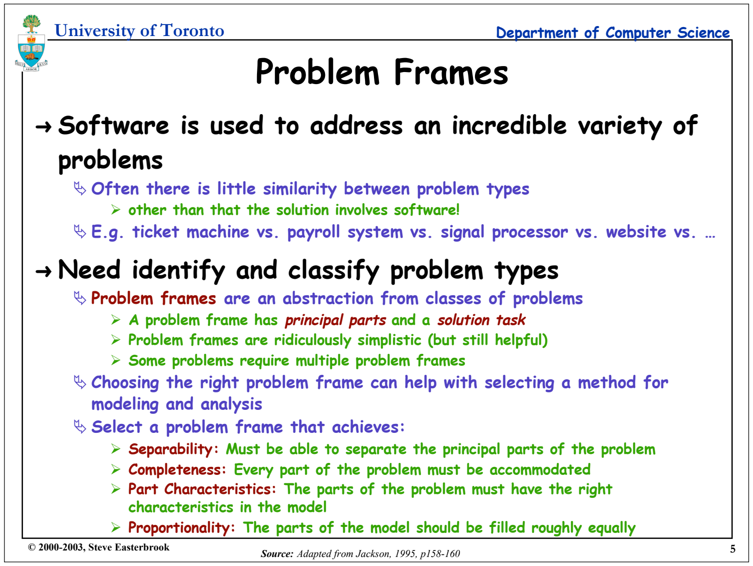
- Background
  - Engineers/Architects do not solve every problem from first principles
    - When they find a good solution, they use it repeatedly
  - C.f Christopher Alexander "Notes on the Synthesis of Form"
    - Identified the need for a pattern language in architectural design
- Design Patterns
  - e.g. Book by Gamma, Helm, Johnson, Vlissides (aka "the gang of four")
  - Presents a catalogue of patterns for object-oriented design
    - Really these are program-level (execution) patterns
    - Examples: factory; singleton; decorator; façade; visitor;…
- Analysis Patterns
  - e.g. Book by Martin Fowler
  - Presents a catalogue of patterns for conceptual modeling
    - Examples: Organizational structure; measurement; accounting; planning;…
- Problem Frames
  - e.g. Book by Michael Jackson
  - Presents a catalogue of patterns for figuring out what the problem is
    - Examples: workpieces; information display; commanded behaviour; connection;…



What is a pattern?

"an idea that has been useful in one practical context,
and will probably be useful in others" - Fowler

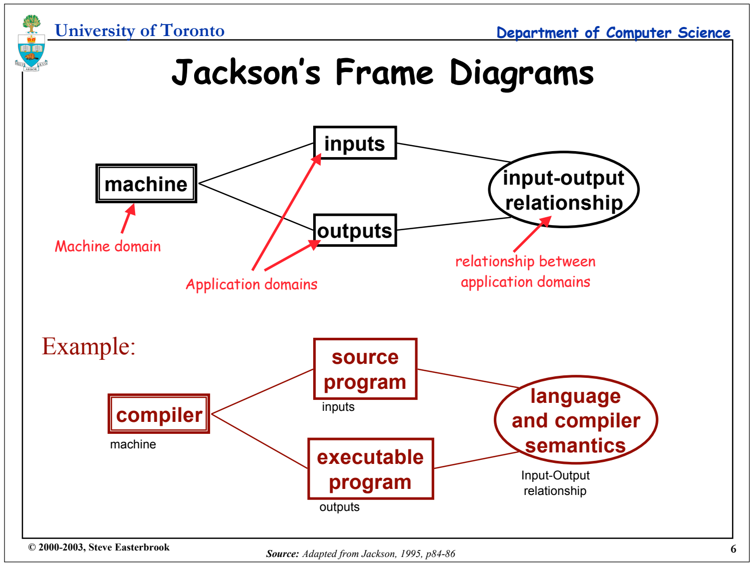
- Elements:
  - Name - immensely useful for communicating your solution to others
  - Context - where the pattern is useful
  - Problem - that the pattern addresses
  - Forces - that play a part in forming a solution
  - Solution - that resolves those forces
- Example: (from Fowler)
  - Name: Contract
  - Context: any kind of financial deal
  - Problem: how to represent the transaction of buying and selling
  - Forces: distinguish two parties; buyer's and seller's views look different; a deal really involves 2 instruments, but one is usually money; …
  - Solution:



Problem Frames

- Software is used to address an incredible variety of problems
  - Often there is little similarity between problem types
    - other than that the solution involves software!
  - E.g. ticket machine vs. payroll system vs. signal processor vs. website vs. …
- Need identify and classify problem types
  - Problem frames are an abstraction from classes of problems
    - A problem frame has *principal parts* and a *solution task*
    - Problem frames are ridiculously simplistic (but still helpful)
    - Some problems require multiple problem frames
  - Choosing the right problem frame can help with selecting a method for modeling and analysis
  - Select a problem frame that achieves:
    - Separability: Must be able to separate the principal parts of the problem
    - Completeness: Every part of the problem must be accommodated
    - Part Characteristics: The parts of the problem must have the right characteristics in the model
    - Proportionality: The parts of the model should be filled roughly equally

Source: *Adapted from Jackson, 1995, p158-160*



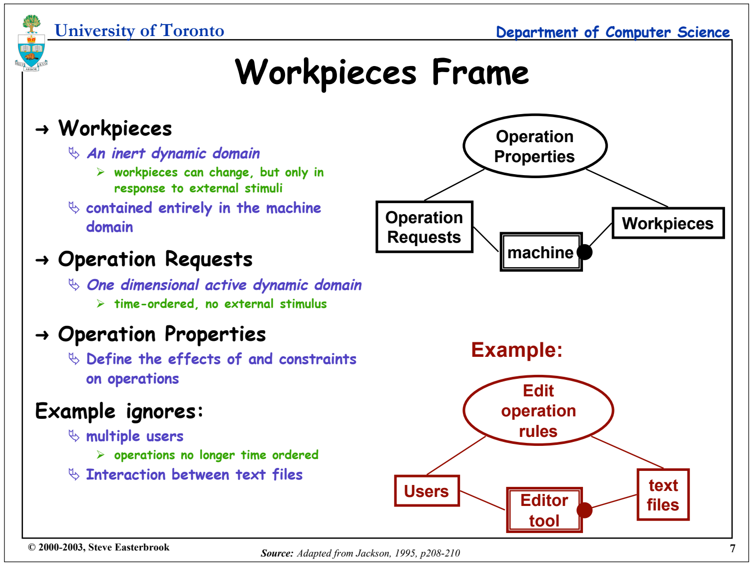
Jackson's Frame Diagrams

machine
inputs
outputs
input-output relationship
Machine domain
Application domains
relationship between application domains

Example:

compiler
machine
source program
inputs
executable program
outputs
language and compiler semantics
Input-Output relationship

Source: *Adapted from Jackson, 1995, p84-86*



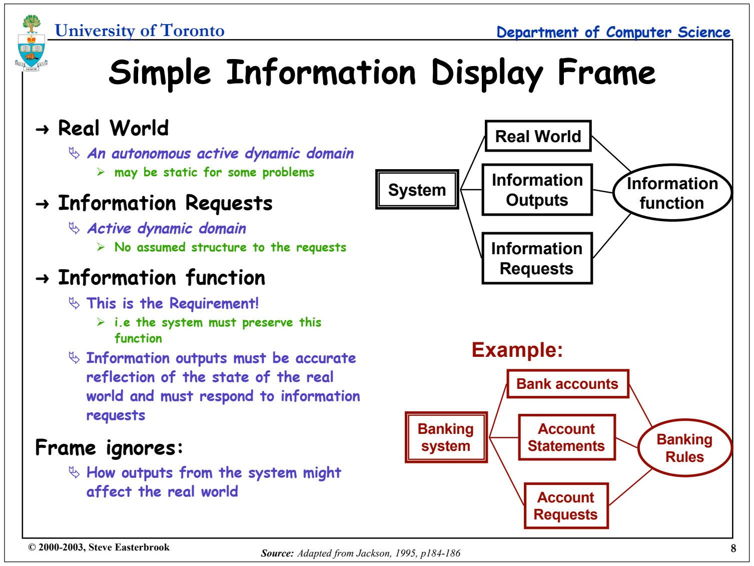
Workpieces Frame

- Workpieces
  - *An inert dynamic domain*
    - workpieces can change, but only in response to external stimuli
  - contained entirely in the machine domain
- Operation Requests
  - *One dimensional active dynamic domain*
    - time-ordered, no external stimulus
- Operation Properties
  - Define the effects of and constraints on operations

Example ignores:
- multiple users
  - operations no longer time ordered
- Interaction between text files

Example:

Source: *Adapted from Jackson, 1995, p208-210*



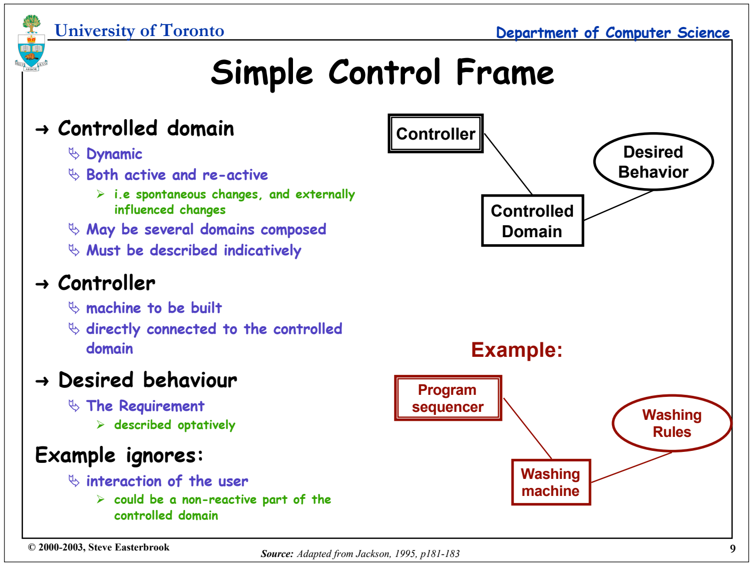
Simple Information Display Frame

- Real World
  - *An autonomous active dynamic domain*
    - may be static for some problems
- Information Requests
  - *Active dynamic domain*
    - No assumed structure to the requests
- Information function
  - This is the Requirement!
    - i.e the system must preserve this function
  - Information outputs must be accurate reflection of the state of the real world and must respond to information requests

Frame ignores:
- How outputs from the system might affect the real world

Example:

Source: *Adapted from Jackson, 1995, p184-186*



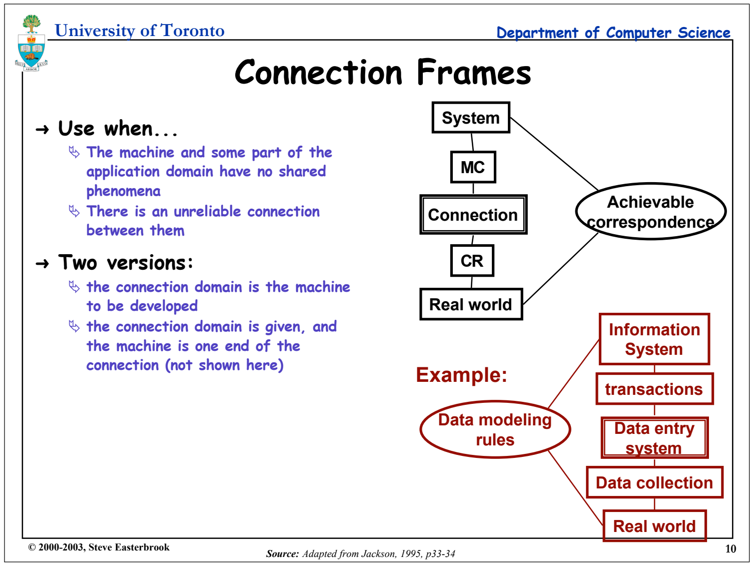
Simple Control Frame

- Controlled domain
  - Dynamic
  - Both active and re-active
    - i.e spontaneous changes, and externally influenced changes
  - May be several domains composed
  - Must be described indicatively
- Controller
  - machine to be built
  - directly connected to the controlled domain
- Desired behaviour
  - The Requirement
    - described optatively

Example ignores:

- interaction of the user
  - could be a non-reactive part of the controlled domain

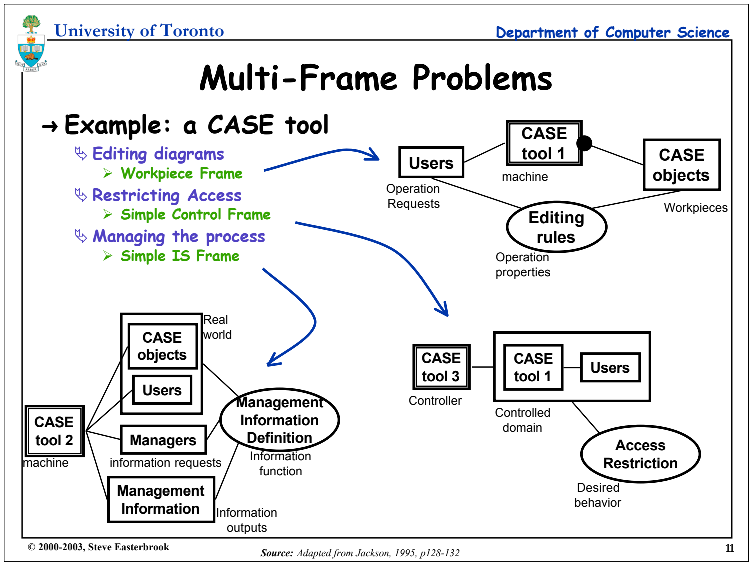
Source: Adapted from Jackson, 1995, p181-183



Connection Frames

- Use when...
  - The machine and some part of the application domain have no shared phenomena
  - There is an unreliable connection between them
- Two versions:
  - the connection domain is the machine to be developed
  - the connection domain is given, and the machine is one end of the connection (not shown here)

Source: Adapted from Jackson, 1995, p33-34



Multi-Frame Problems

- Example: a CASE tool
  - Editing diagrams
    - Workpiece Frame
  - Restricting Access
    - Simple Control Frame
  - Managing the process
    - Simple IS Frame

Users
Operation Requests
CASE tool 1
machine
CASE objects
Workpieces
Editing rules
Operation properties
CASE objects
Real world
Users
CASE tool 2
machine
Managers
information requests
Management Information Definition
Information function
Management Information
Information outputs
CASE tool 3
Controller
CASE tool 1
Users
Controlled domain
Access Restriction
Desired behavior

Source: Adapted from Jackson, 1995, p128-132