Adaptive Software Development

Presented at OOPSLA 2000
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“Fire, fire, fire, fire, aim again, fire, fire, fire—there is no time for ‘ready’.”

-- Gary Hamel, Leading the Revolution

Ready, ready, ready, ready, aim, aim, aim... fire.

-- Traditional “heavy” project management & software development practices
The Path through the Quagmire of the Future

RADICAL INNOVATION
LIFECYCLE
COLLABORATION
HARNESSING CHANGE
Why Even Good Managers Fail

- Sustaining technology
  - 8” Disk Drives

- Disruptive technology
  - 5 1/4” Disk Drives

Time
Disruptive Practices

Current Practices

Disruptive Practices

Time

- CMM
- ISO
- PMBOK
- RUP

Current Users
Current Uses

New Users
New Uses

Lean Development
Adaptive Development
Extreme Programming
Crystal Methods
Critical Chain Proj. Mgt

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To rapidly complete large projects that are both research-like and mission-critical in a turbulent business and technology environment.

Exciting Features
Rapid delivery
High quality
High change
Why is this so hard?

It requires three traditionally incompatible behaviors from the same organization:

- Innovation
- Discipline
- Adaptability

Telecom development manager, “You can rant and rave all you want about software quality (or lack there of), but the marketing guys run the world and they want market share now...period, end of discussion. My job is to deliver on time on budget, with the ‘appropriate’ quality metrics.”
Radical Innovation

- Business Models, Products, Practices
- Incremental innovation--cutting costs by 15%
- Radical innovation--cutting costs by 90%
- e-Business should be about Radical Innovation
- e-Projects without Radical Innovation are just Projects

“Radical innovation is the competitive advantage for the new millenium.”

-- Gary Hamel, Leading the Revolution
Data from 210 projects, 1997-99, variety of industries:
- Schedule: 83 (40%) late by avg of 67%
- Cost: 30% over budget by 127%
- Project: 11 mths; Reqmts volatility- 22%
- 98 (47%) - couldn’t find original numbers

Data from QSM Associates: Michael Mah
Complex (extreme) Problems

- Complicated (increasing SIZE)
  - objects
  - people
  - connections

- Complex
  - innovation
  - speed
  - change
  - uncertainty

OPTIMIZATION vs. ADAPTATION
Disruptive and Innovative

- Extreme Programming - Kent Beck
- Crystal Method - Alistair Cockburn
- Lean Development - Bob Charette
- SCRUM - K. Schwaber, J. Sutherland
- Adaptive Software Dev - Jim Highsmith

“I predict that Kent Beck and his XP movement will be as much a symbol of our times as Watts Humphry and the CMM were a symbol of the eighties and early nineties.” - Tom DeMarco, Cutter Report on Light Methodologies
Core Principles of Light Methodologies

- Customer Value--Focus on results
- Tacit knowledge--Focus on individual skills
- Collaboration--Focus on innovation through group interaction
- Adaptation--Focus on exploration & harnessing change
- Minimalism--Focus on simplicity
Adaptive Software Development

- Disruptive Development Model
  - Adaptive Life Cycle
- Disruptive Science
  - Complex Adaptive Systems
- Disruptive Management
  - Leadership-Collaboration
Traditional Life Cycles

Waterfall

Evolutionary
The Adaptive Life Cycle

Speculate

Collaborate

Learn
Characteristics of Adaptive Cycles

- Mission-Directed
- Iterative (exploratory)
- Feature/Component-Driven
- Timeboxed
- Risk-Driven
- Change-Tolerant
“In an extreme environment, following a plan produces the product you intended, just not the product you need.”
Envision-Explore, not Plan-Do

● “Do It Right the First Time”
● Sends the wrong message
  - we can’t be uncertain
  - we can’t experiment
  - we can’t learn from mistakes
  - we can’t deviate from plan
● “Don’t worry about getting it right the first time, get it right the last time.”
The Adaptive Life Cycle

Adaptive Life Cycle

Project Initiation → Adaptive Cycle Planning → Concurrent Component Engineering → Quality Review → Final Q/A and Release

Speculate → Collaborate → Learn

Learning Loop

C1, C2, C3
Speculate: Initiation & Planning

Vision

Product Vision

Project Data Sheet

Adaptive Cycle Plan

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Cycle Objective Statement

Project Data Sheet

Cycle Delivery Dates

<table>
<thead>
<tr>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
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<td>1-Jun</td>
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Primary Features

- Order Entry: x  x
- Order Pricing: x
- Warehouse Picking: x  x
- Partial Order Ship: x
- Calculate Reorders: x
- System Interfaces: x
- Pricing Error Handling: x
- Security & Control: x

Technology Components

- Install Visual Basic: x
- Install Comm Lines: x

Support Components

- x

Client/Server Arch

- x

Develop Conversion Pln

- x

High-level Data Model

- x

Feature List

Conan Athletic Club:

- Ability to Statements:
  - Generate invoices
  - Generate monthly reports
  - Process customer requests
  - Process orders
  - Process return orders
  - Provide credit reporting
  - Provide customer information
  - Simplify guest management
  - Generate sales reports
  - Schedule basketball courts
  - Send messages to members

Risk Analysis

Conan Athletic Club:

- Ability to Statements:
  - Risk Area 1:
    - xkxjflxjflxjflj xdklflj xdklflj
  - Risk Area 2:
    - xkxjflxjflxjflj
  - Risk Area 3:
    - xkxjflxjflxjflj xdklflj xdklflj
Speculate-Collaborate-LEARN

People are Idiots!

“The greatest risk we face is overestimating our own understanding.”
Learning Comes in Two Flavors

- Learning about THINGS
  - C++, JAVA

- Learning about OURSELVES
  - Mental Models

“Mental Models are the images, and assumptions which we carry in our minds of ourselves, and every aspect of the world. … and all of these mental maps, by definition, are flawed in some way.” --Peter Senge
Learning Practices

Customer, product, team
- Customer Focus Groups
- Peer Reviews
- Postmortems
- After Action Reports
- Communities of Practice
- Pair Programming (XP)
Speculate-COLLABORATE-Learn

<table>
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“The act of collaboration is an act of shared creation and/or discovery.”
Michael Schrage, *No More Teams*
Command-Control

Leadership-Collaboration

Command Control is too slow:
  Can’t process information fast enough
  Can’t make decisions fast enough
“Simple, clear purpose and principles give rise to complex, intelligent behavior.”

“Complex rules and regulations give rise to simple, stupid behavior.”
Leadership-Collaboration

- Establish a Vision and Purpose
- Define acceptable boundary conditions
- Encourage innovation and collaboration
- Share Power (decision making)
  - Leader enables teams
  - Teams enable leaders
- Macro-management, not micro-management
Complex Adaptive Systems
- Independent Agents
- Self-organizing
- Emergent
Why is this science important?

“Thinking of businesses as complex adaptive systems is one of the most important ideas of the decade. It is about sense making.”

- Tom Petzinger, Wall Street Journal
The Zone of Creative Adaptability

Poised at the Edge

Innovation, creativity, effective decisions, emerge at the “Edge of Chaos,” a narrow band perched between order and chaos.

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Inertia and Adaptability

To adapt quickly, inertia needs to be kept low.
Harnessing Change

Flea

I am in control!

The magnitude of change
Harnessing Change

- Change is a competitive advantage
- "Rework" is a virtue
- Lighter beats Heavier
Dealing with Uncertainty

Anticipation: Presumptive planning, Overcaution

“Rework” does not mean a broken process. Rework is how we deal with change.
Rework: Friend or Foe

- Change can arise from
  - #1 Broken Practice
  - #2 Turbulent Environment

- Strategies
  - #1 Fix the practice—eliminate rework
  - #2 Get better at “rework”

- XP Strategy
  - Simplicity
  - Continuous Testing
*Xenopus laevis* is a unique resource for two critical vertebrate biological areas: early embryonic development and cell biology. In the former, *X. laevis* has led the way in establishing the mechanisms of early fate decisions, patterning of the basic body plan, and organogenesis. Contributions in cell biology and biochemistry include seminal work on chromosome replication, chromatin and nuclear assembly, cell cycle components, cytoskeletal elements, and signaling pathways.

-- National Institute of Health Xenopus Initiative
Light vs. Heavy Methods

- Documentation is not Understanding (tacit)
  - One Study of Typical Requirements Documents: 15% Complete, 7% Correct, Not cost effective to increase
    (Source: Elemer Magaziner)

- Formality is not Discipline

- Process is not Skill
“We believe it is time for firms to shift their attention to the more human aspects--from access to attention, from velocity to viscosity, from documents to discussions.”

-- Thomas Davenport & Laurence Prusak, Working Knowledge: How Organizations Manage What They Know

- Attention-Use
- Viscosity-Richness
Traditional Light/Heavy Debate

Traditional View:
1 dimensional balance

Light        Heavy
Optimizing

Process, Documentation, Formality
Modern Light/Heavy Debate

![Diagram showing the relationship between Light and Heavy methodologies]

- Typical Light Methodology
- Typical Heavy Methodology

Optimizing Process, Documentation, Formality
What to do next

- Analyze the complexity of your projects
- Examine your organization’s culture
- Understand principles of Light Methods
- Improve performance by evolving your own “methodology” based on balancing:
  - Your problem, Your culture, Light Practices

Remember, methodology is a framework for thinking, not a prescription for action.
There is no Unified Thinking Tool.
“Our businesses are only as successful as our ideas. If our ideas are out of date, the behaviors they drive will be out of date.”

-- Howard Sherman & Ron Schultz, Open Boundaries: Creating Business Innovation Through Complexity.
Why Light Methods?

Radical Innovation

“Companies fail to create the future not because they fail to predict it but because they fail to imagine it.”
--Gary Hamel, *Leading the Revolution*

Community

“People, and Relationships, are the new bottom line of business, not simply for humanistic reasons, but as a way to promote adaptability and business success.”
-- Roger Lewin and Birute Regine, *The Soul at Work: Embracing Complexity Science for Business Success*