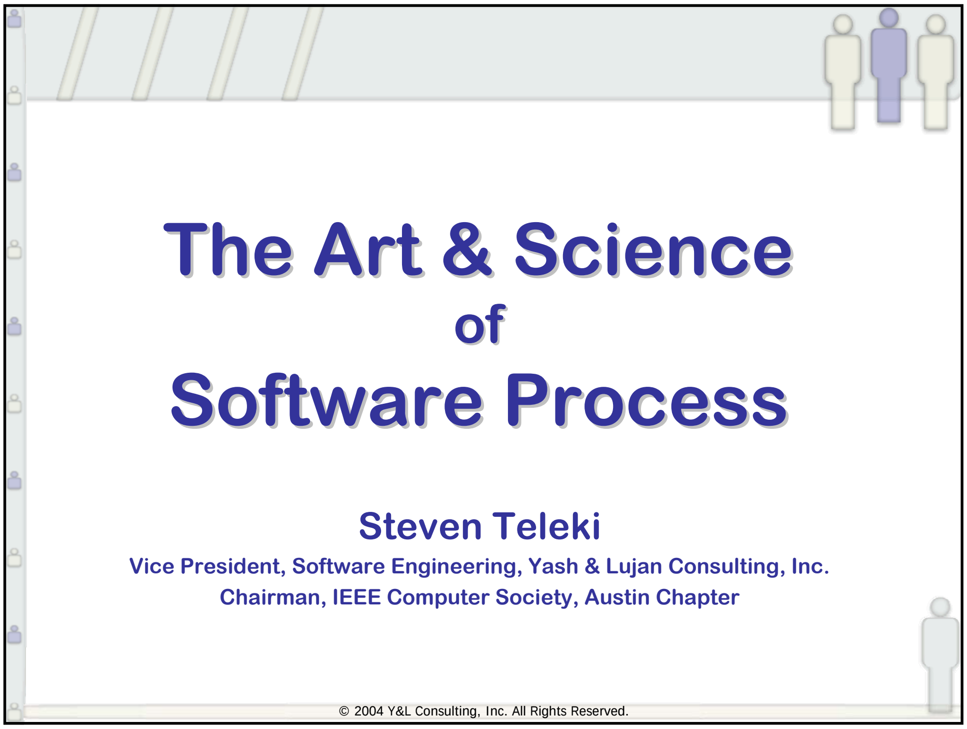
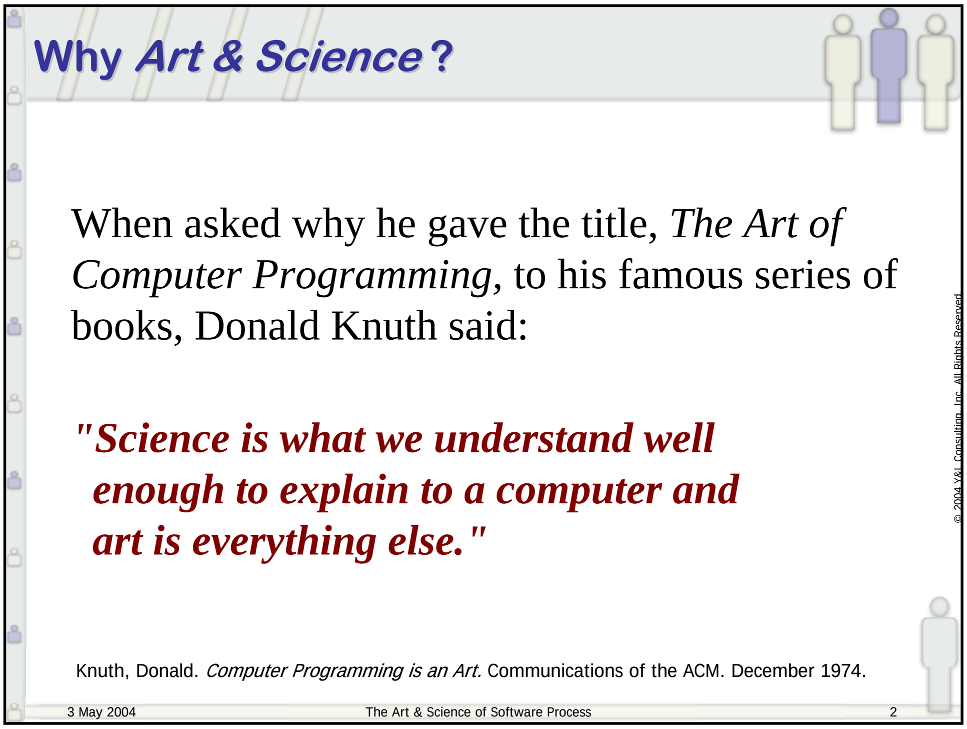


# The Art & Science of Software Process

**Steven Teleki**

Vice President, Software Engineering, Yash & Lujan Consulting, Inc.
Chairman, IEEE Computer Society, Austin Chapter

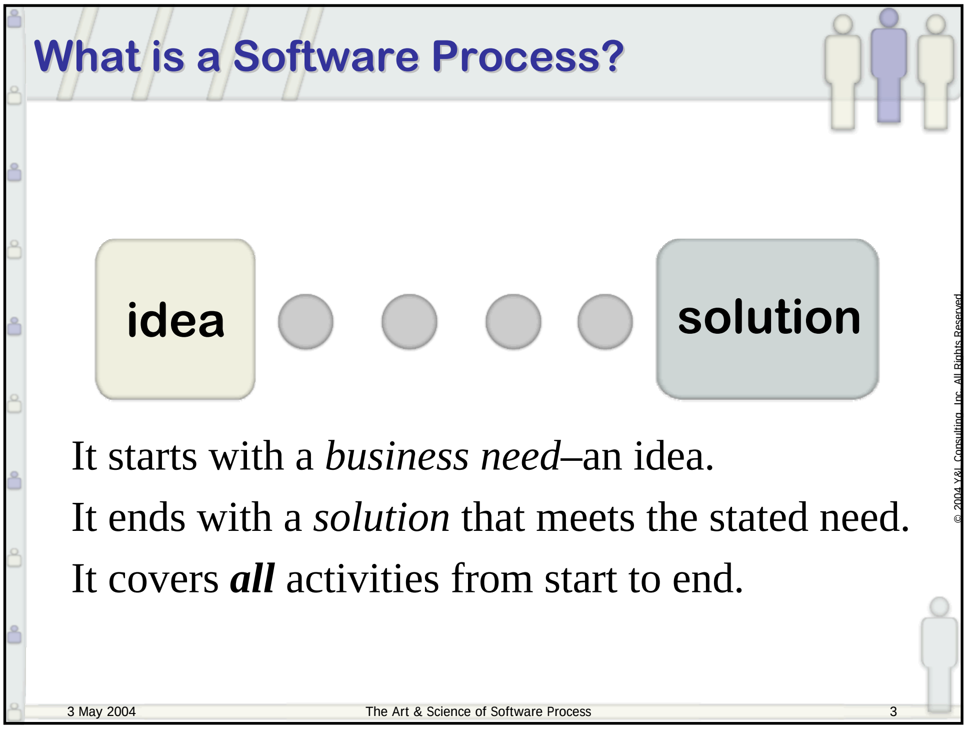


## Why *Art & Science*?

When asked why he gave the title, *The Art of Computer Programming*, to his famous series of books, Donald Knuth said:

***"Science is what we understand well enough to explain to a computer and art is everything else."***

Knuth, Donald. *Computer Programming is an Art.* Communications of the ACM. December 1974.



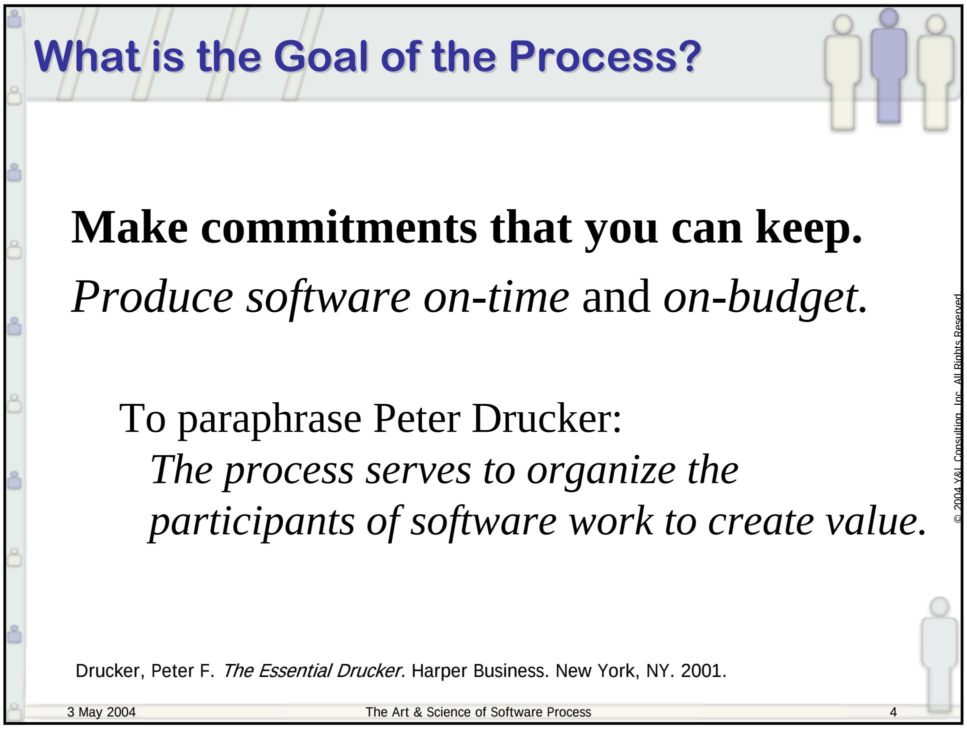
## What is a Software Process?

idea ● ● ● ● solution

It starts with a *business need*–an idea.

It ends with a *solution* that meets the stated need.

It covers ***all*** activities from start to end.



## What is the Goal of the Process?

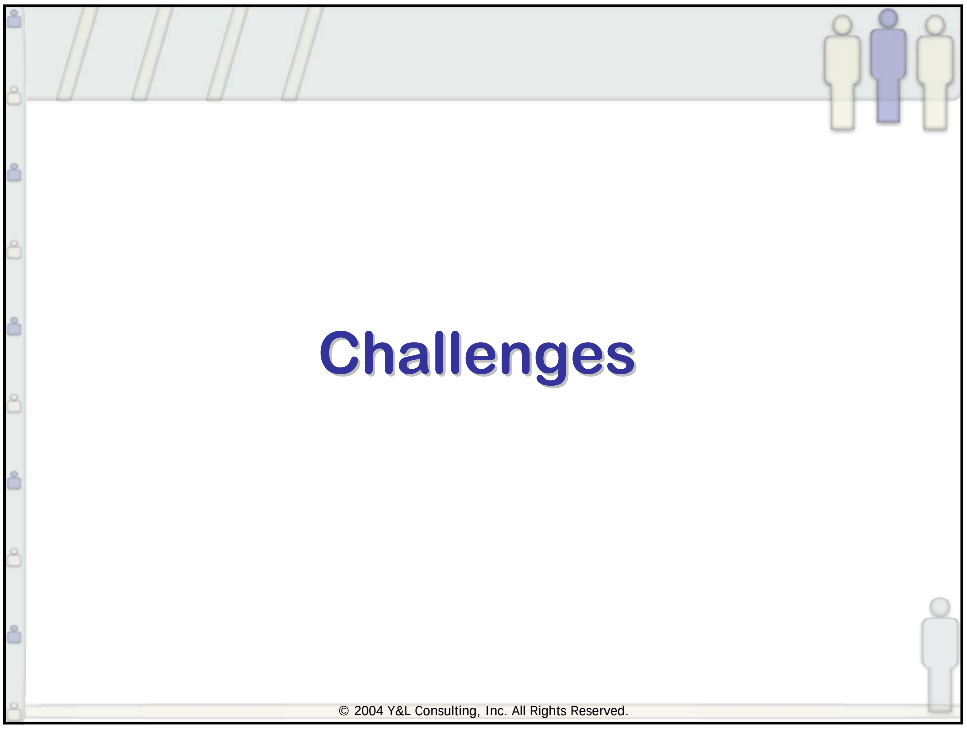
**Make commitments that you can keep.**

*Produce software on-time* and *on-budget.*

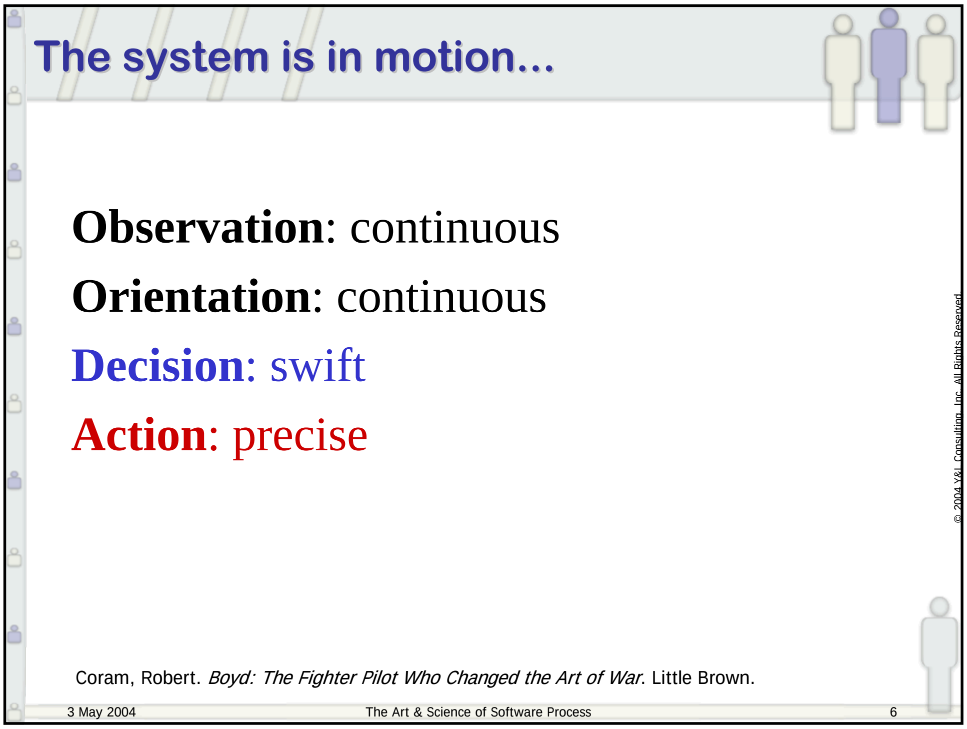
To paraphrase Peter Drucker:

> *The process serves to organize the participants of software work to create value.*

Drucker, Peter F. *The Essential Drucker.* Harper Business. New York, NY. 2001.



## Challenges



## The system is in motion…

**Observation**: continuous

**Orientation**: continuous

**Decision**: swift

**Action**: precise

Coram, Robert. *Boyd: The Fighter Pilot Who Changed the Art of War*. Little Brown.

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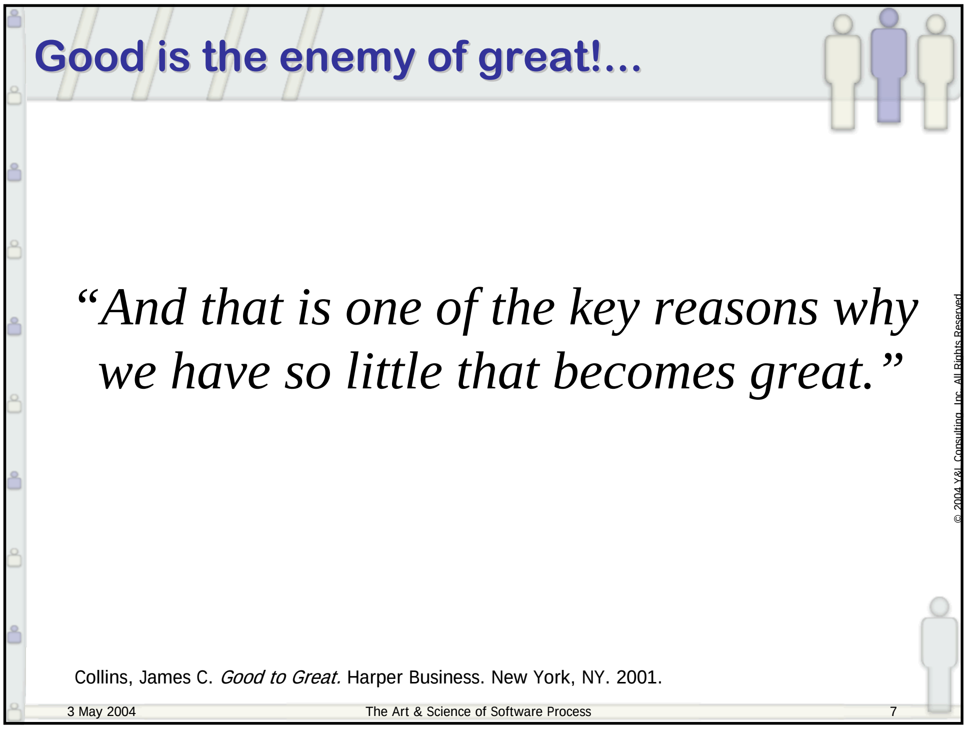
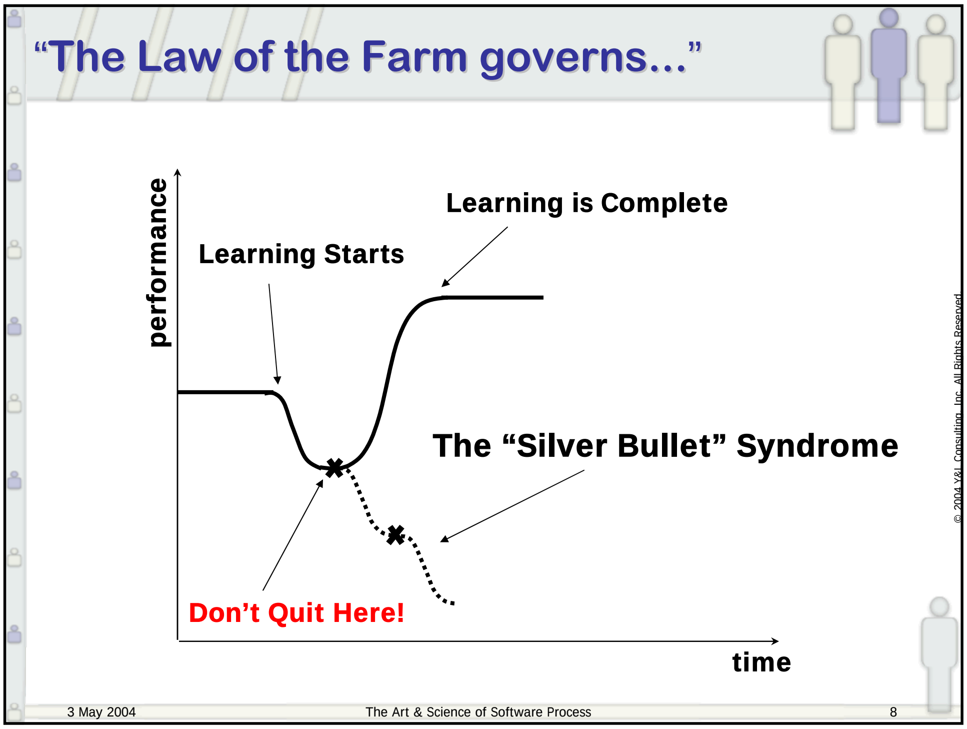


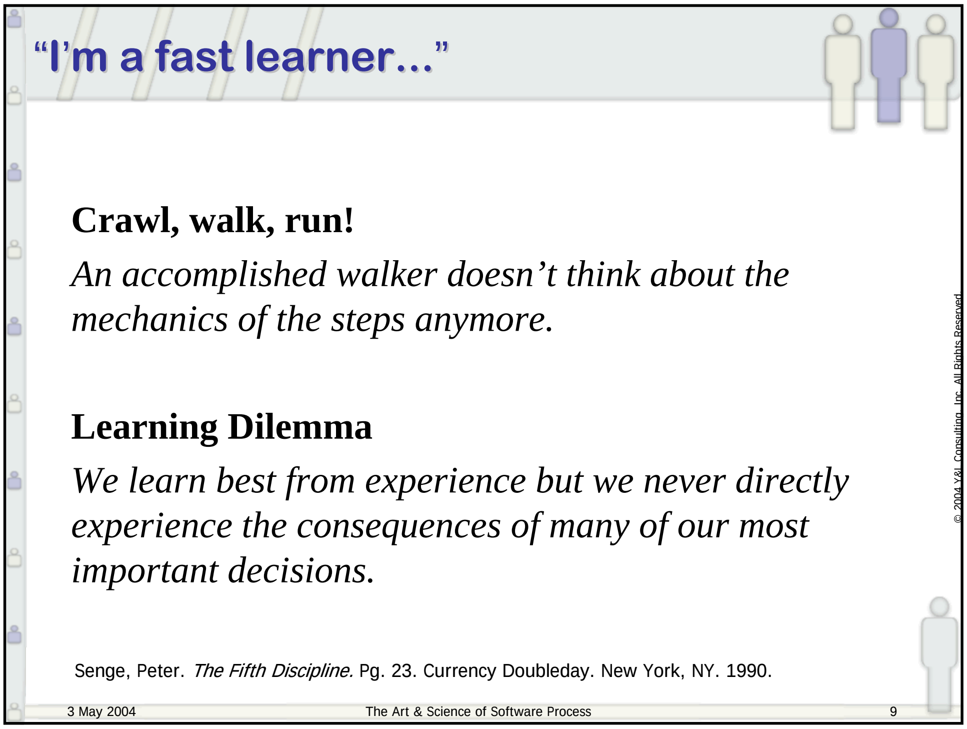
## Good is the enemy of great!...

> *“And that is one of the key reasons why we have so little that becomes great.”*

Collins, James C. *Good to Great.* Harper Business. New York, NY. 2001.



## “The Law of the Farm governs...”



## "I'm a fast learner…"

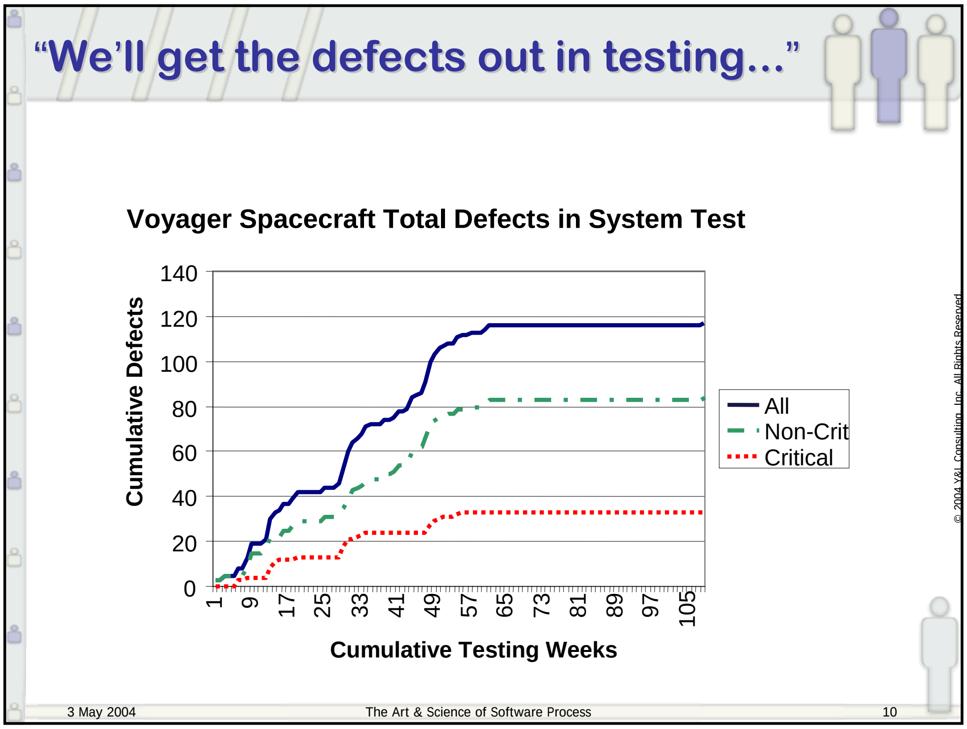
**Crawl, walk, run!**

*An accomplished walker doesn't think about the mechanics of the steps anymore.*

**Learning Dilemma**

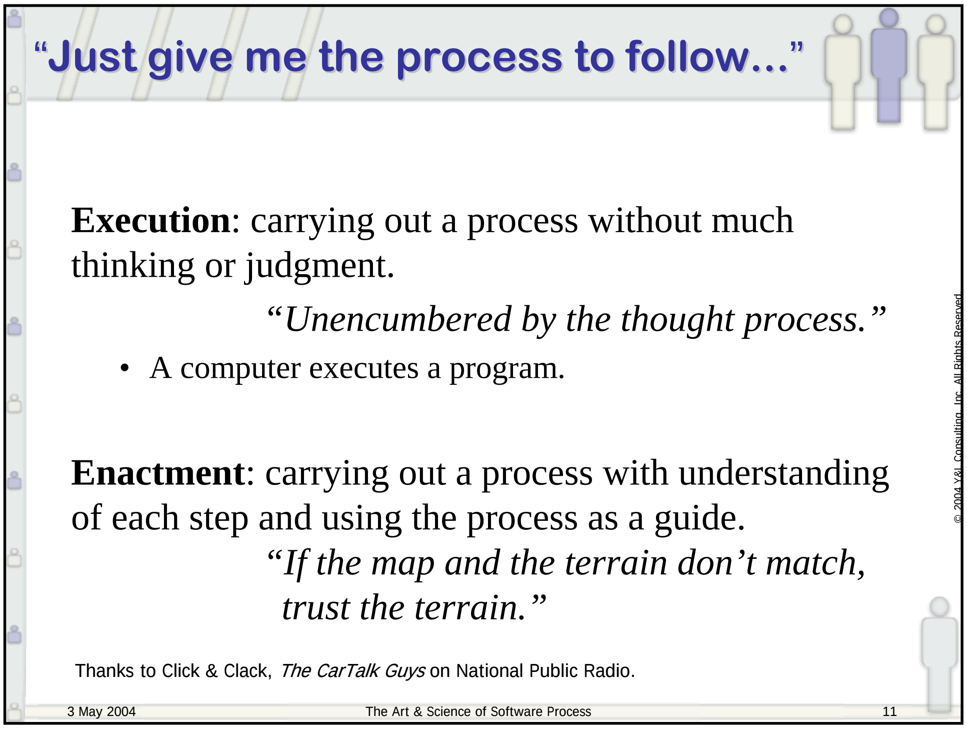
*We learn best from experience but we never directly experience the consequences of many of our most important decisions.*

Senge, Peter. *The Fifth Discipline.* Pg. 23. Currency Doubleday. New York, NY. 1990.



## "We'll get the defects out in testing…"

Voyager Spacecraft Total Defects in System Test



## “Just give me the process to follow…”

**Execution**: carrying out a process without much thinking or judgment.

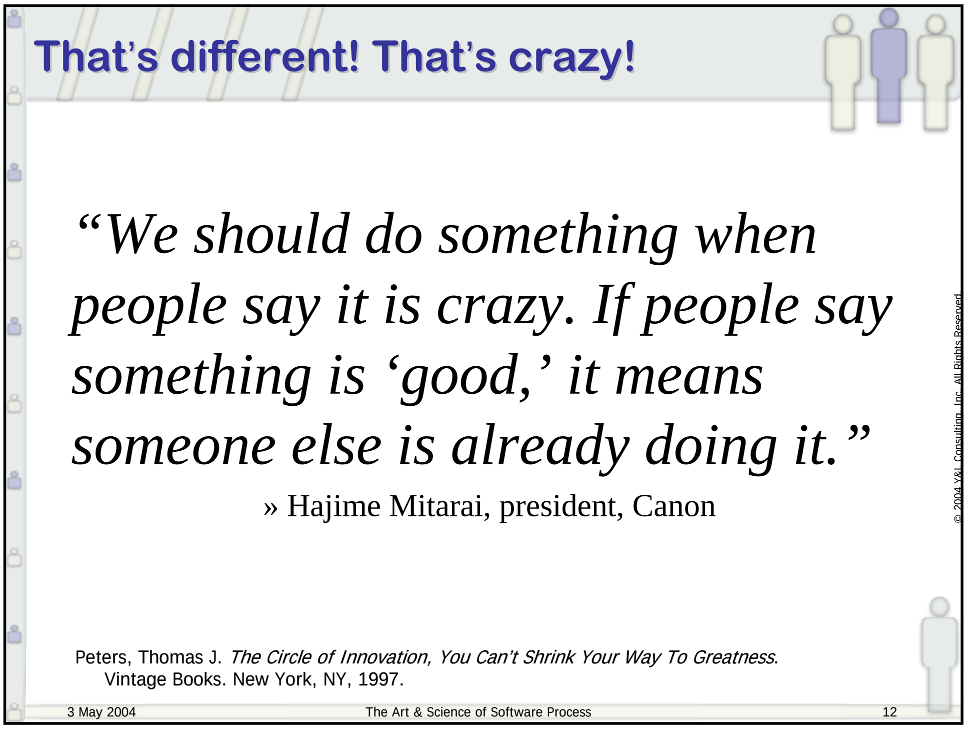
*“Unencumbered by the thought process.”*

- A computer executes a program.

**Enactment**: carrying out a process with understanding of each step and using the process as a guide.

*“If the map and the terrain don’t match, trust the terrain.”*

Thanks to Click & Clack, *The CarTalk Guys* on National Public Radio.

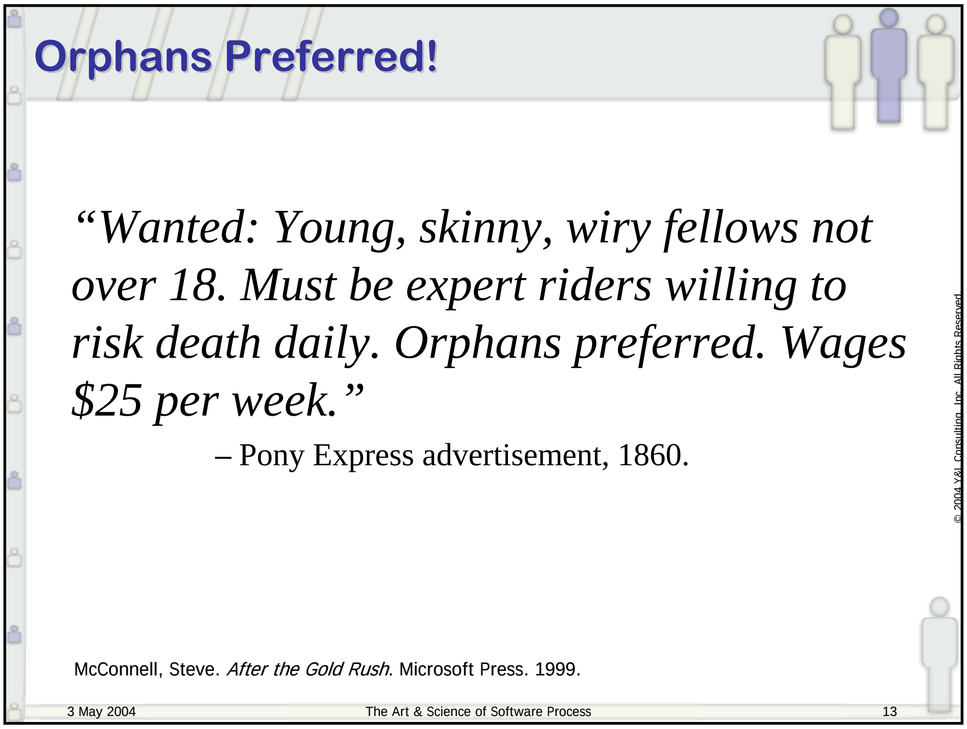


## That’s different! That’s crazy!

*“We should do something when people say it is crazy. If people say something is ‘good,’ it means someone else is already doing it.”*

» Hajime Mitarai, president, Canon

Peters, Thomas J. *The Circle of Innovation, You Can’t Shrink Your Way To Greatness.* Vintage Books. New York, NY, 1997.

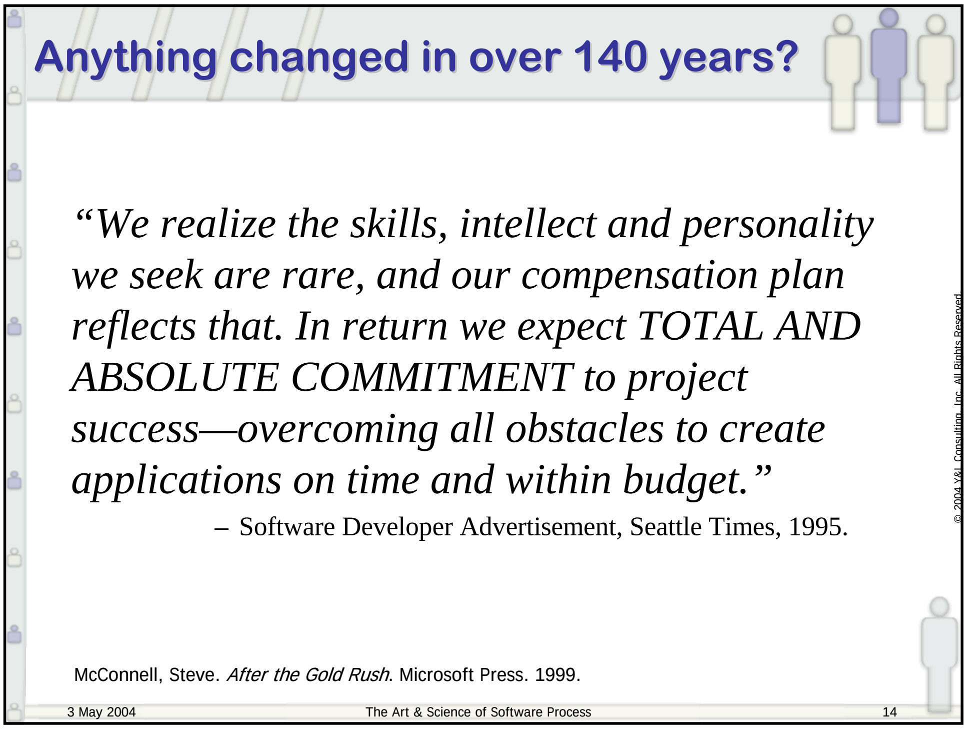


## Orphans Preferred!

*“Wanted: Young, skinny, wiry fellows not over 18. Must be expert riders willing to risk death daily. Orphans preferred. Wages $25 per week.”*

– Pony Express advertisement, 1860.

McConnell, Steve. *After the Gold Rush*. Microsoft Press. 1999.

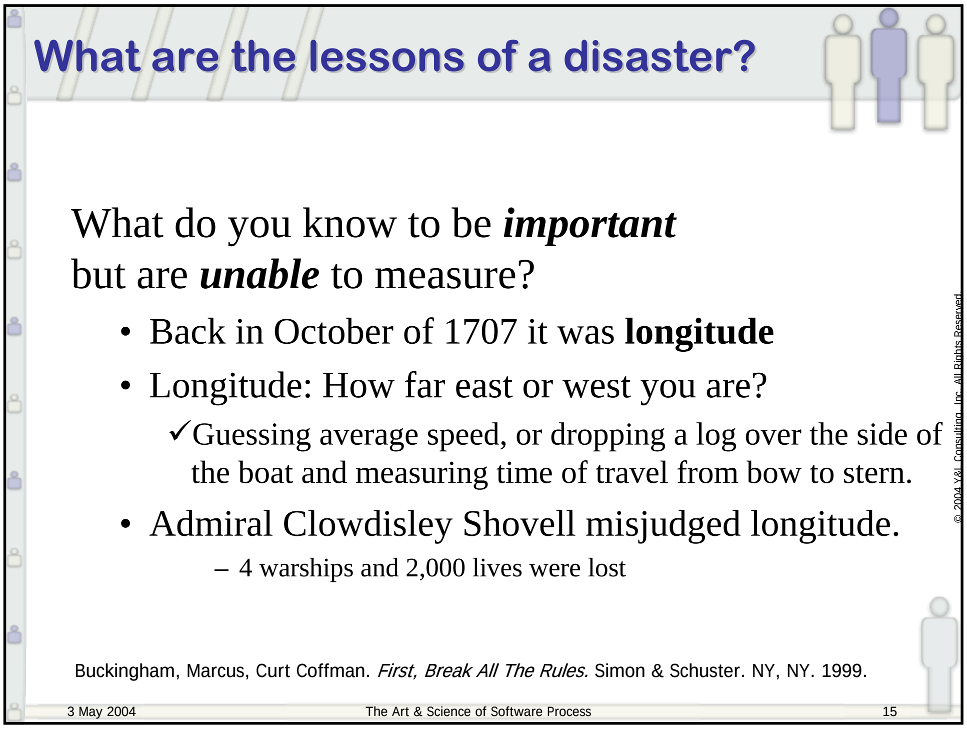


## Anything changed in over 140 years?

*“We realize the skills, intellect and personality we seek are rare, and our compensation plan reflects that. In return we expect TOTAL AND ABSOLUTE COMMITMENT to project success—overcoming all obstacles to create applications on time and within budget.”*

– Software Developer Advertisement, Seattle Times, 1995.

McConnell, Steve. *After the Gold Rush*. Microsoft Press. 1999.

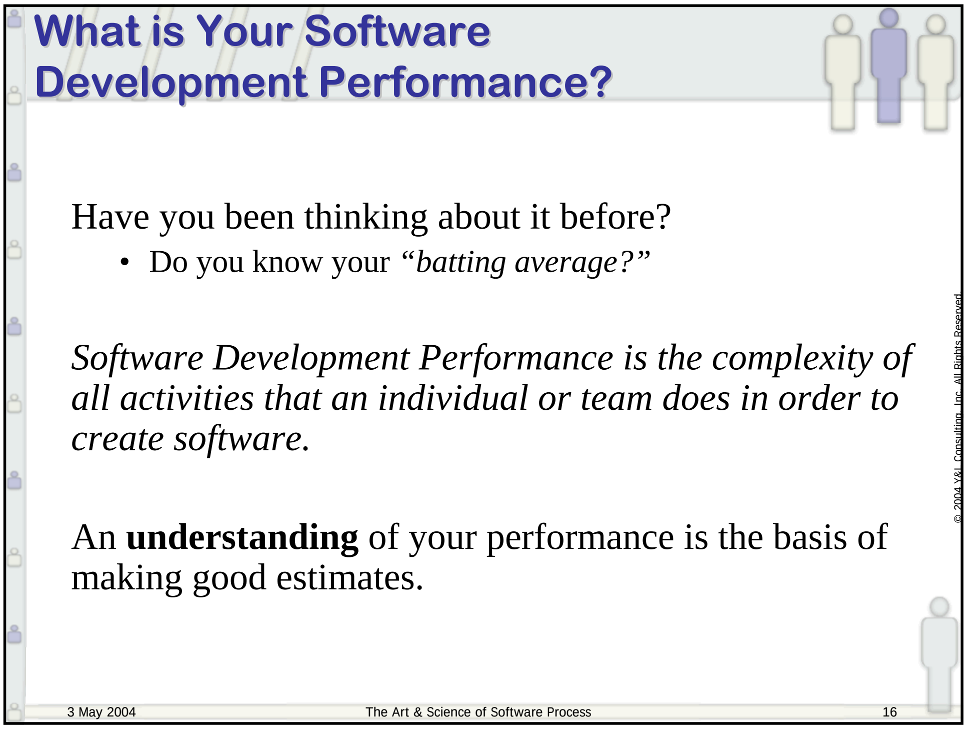


## What are the lessons of a disaster?

What do you know to be ***important*** but are ***unable*** to measure?

- Back in October of 1707 it was **longitude**
- Longitude: How far east or west you are?
  - ✓Guessing average speed, or dropping a log over the side of the boat and measuring time of travel from bow to stern.
- Admiral Clowdisley Shovell misjudged longitude.
  - – 4 warships and 2,000 lives were lost

Buckingham, Marcus, Curt Coffman. *First, Break All The Rules.* Simon & Schuster. NY, NY. 1999.



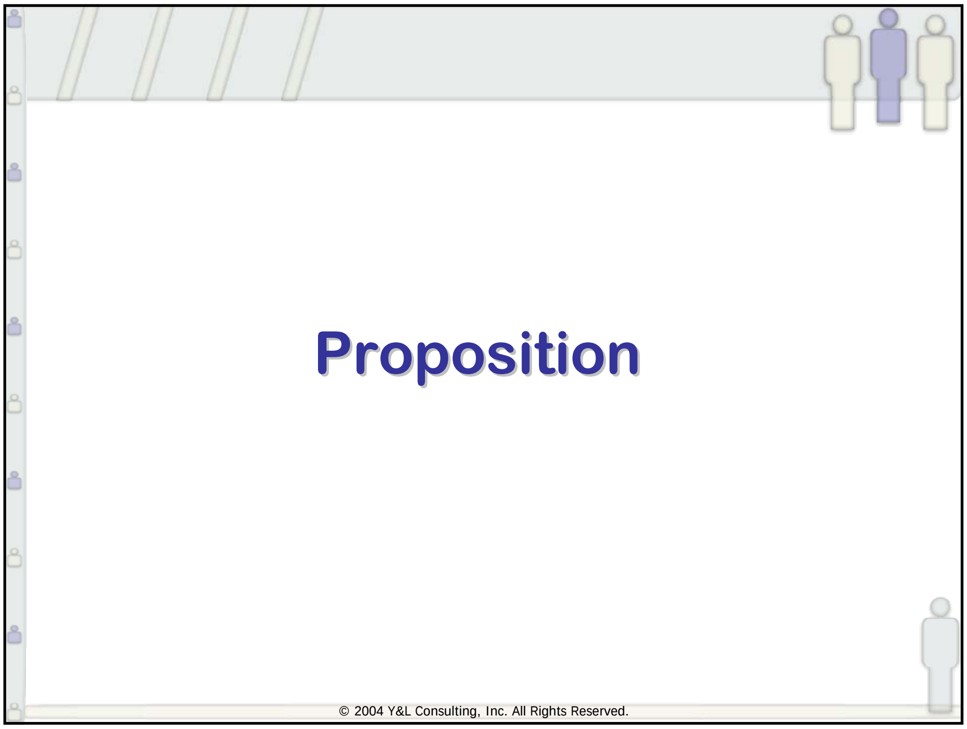
## What is Your Software Development Performance?

Have you been thinking about it before?

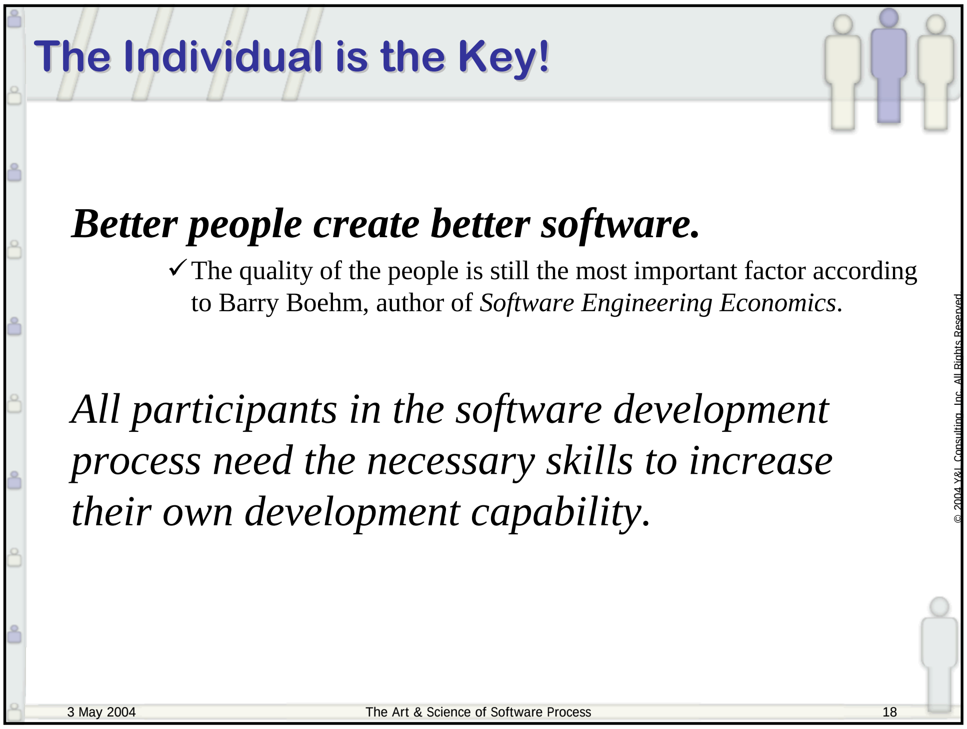
- Do you know your *"batting average?"*

*Software Development Performance is the complexity of all activities that an individual or team does in order to create software.*

An **understanding** of your performance is the basis of making good estimates.



# Proposition

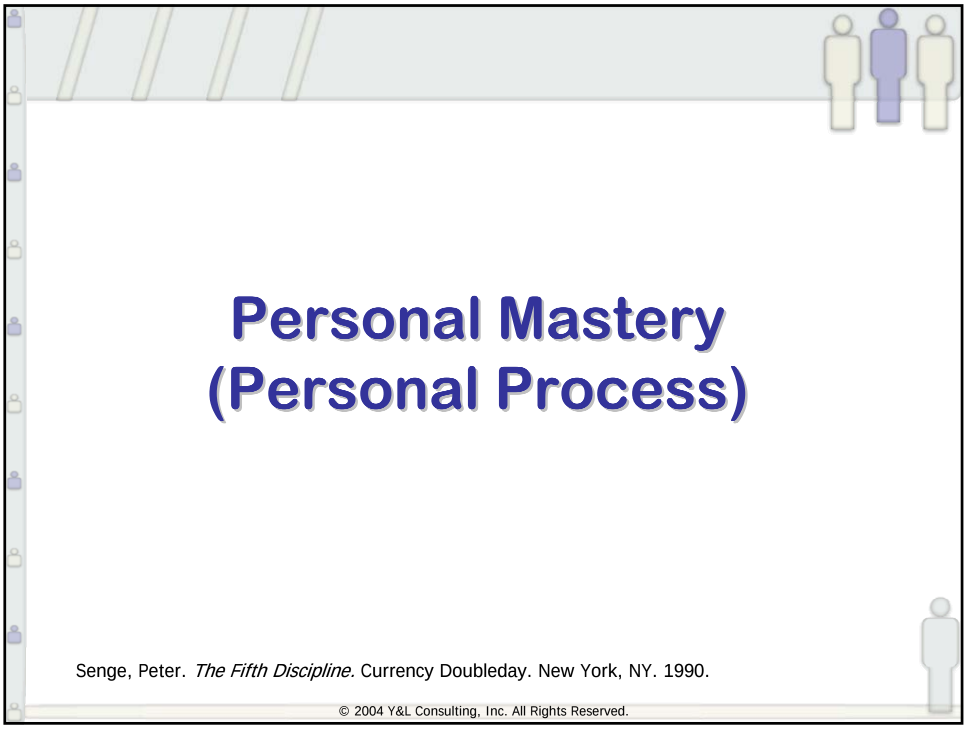


## The Individual is the Key!

***Better people create better software.***

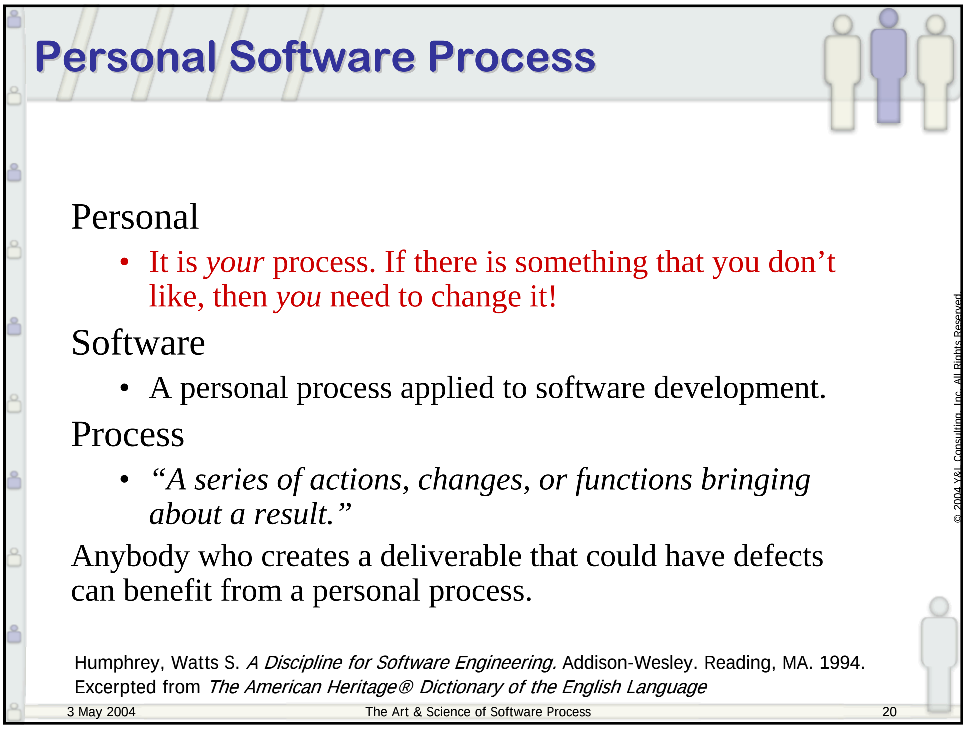
✓ The quality of the people is still the most important factor according to Barry Boehm, author of *Software Engineering Economics*.

*All participants in the software development process need the necessary skills to increase their own development capability.*



# Personal Mastery (Personal Process)

Senge, Peter. *The Fifth Discipline.* Currency Doubleday. New York, NY. 1990.



## Personal Software Process

Personal

- It is *your* process. If there is something that you don't like, then *you* need to change it!

Software

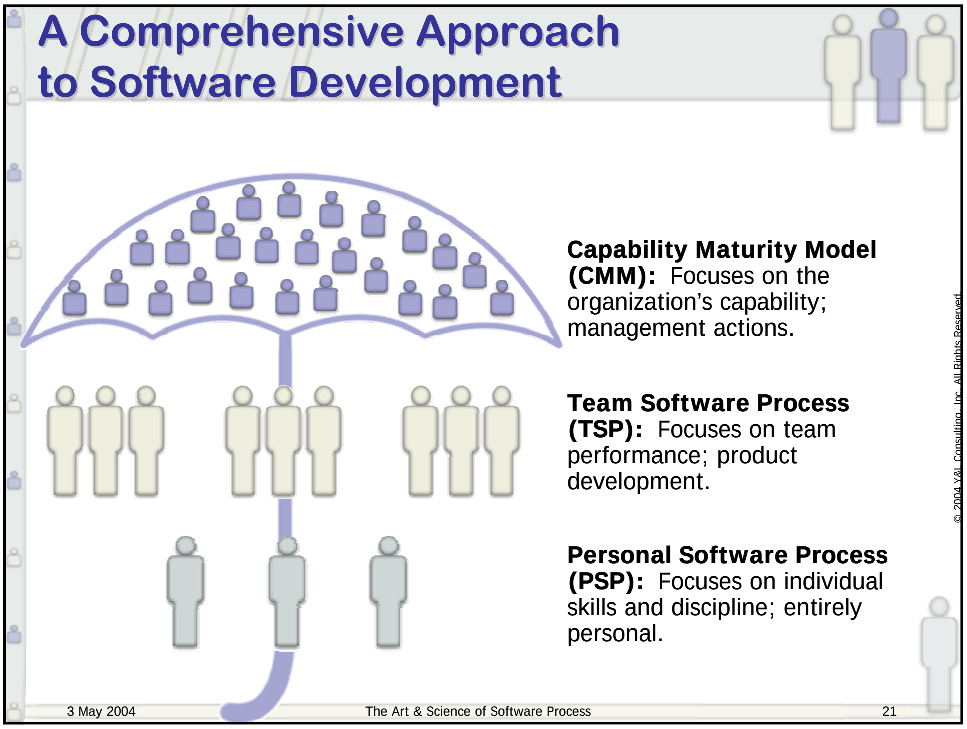
- A personal process applied to software development.

Process

- *"A series of actions, changes, or functions bringing about a result."*

Anybody who creates a deliverable that could have defects can benefit from a personal process.

Humphrey, Watts S. *A Discipline for Software Engineering.* Addison-Wesley. Reading, MA. 1994.
Excerpted from *The American Heritage® Dictionary of the English Language*

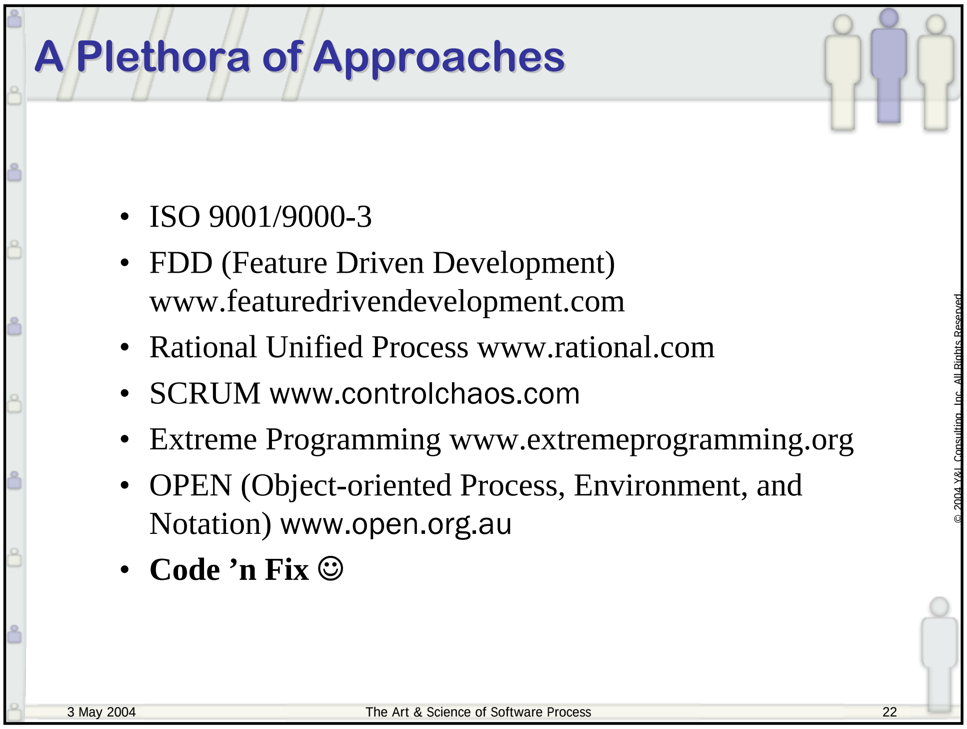


## A Comprehensive Approach to Software Development

**Capability Maturity Model (CMM):** Focuses on the organization's capability; management actions.

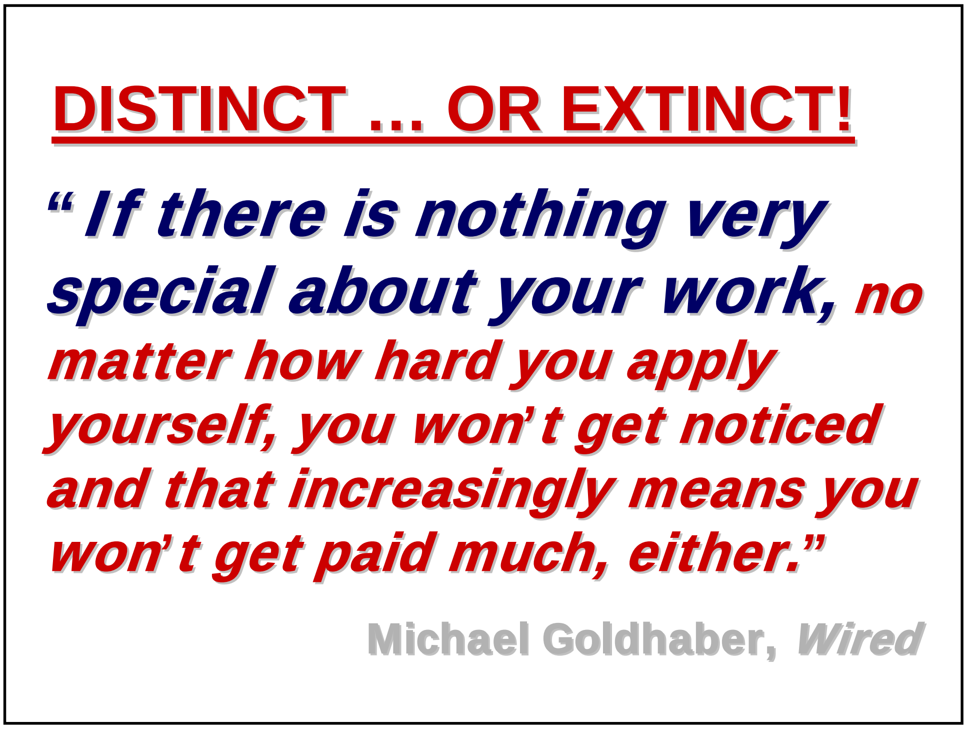
**Team Software Process (TSP):** Focuses on team performance; product development.

**Personal Software Process (PSP):** Focuses on individual skills and discipline; entirely personal.



## A Plethora of Approaches

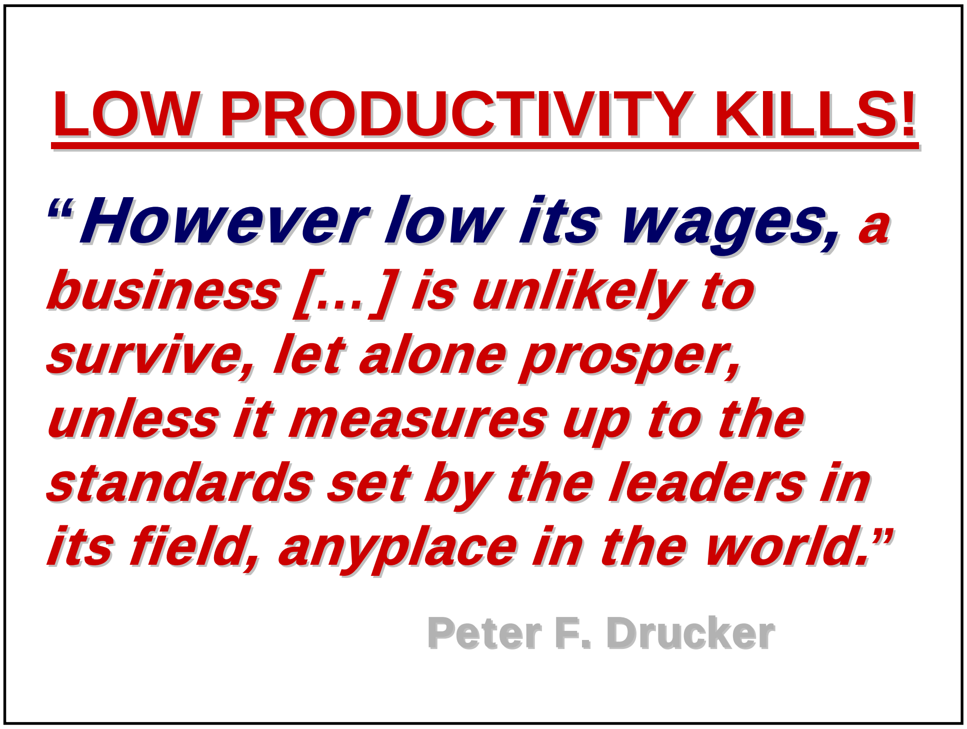
- ISO 9001/9000-3
- FDD (Feature Driven Development) www.featuredrivendevelopment.com
- Rational Unified Process www.rational.com
- SCRUM www.controlchaos.com
- Extreme Programming www.extremeprogramming.org
- OPEN (Object-oriented Process, Environment, and Notation) www.open.org.au
- **Code 'n Fix ☺**



## DISTINCT … OR EXTINCT!

*"If there is nothing very special about your work, no matter how hard you apply yourself, you won't get noticed and that increasingly means you won't get paid much, either."*

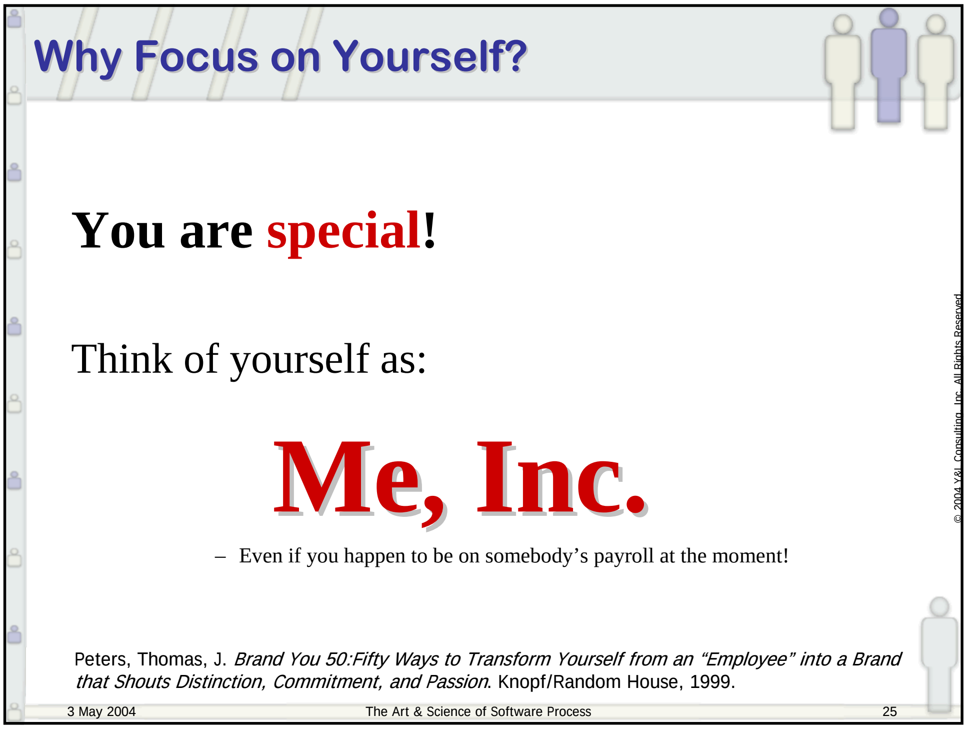
Michael Goldhaber, *Wired*



## LOW PRODUCTIVITY KILLS!

*"However low its wages, a business […] is unlikely to survive, let alone prosper, unless it measures up to the standards set by the leaders in its field, anyplace in the world."*

Peter F. Drucker



## Why Focus on Yourself?

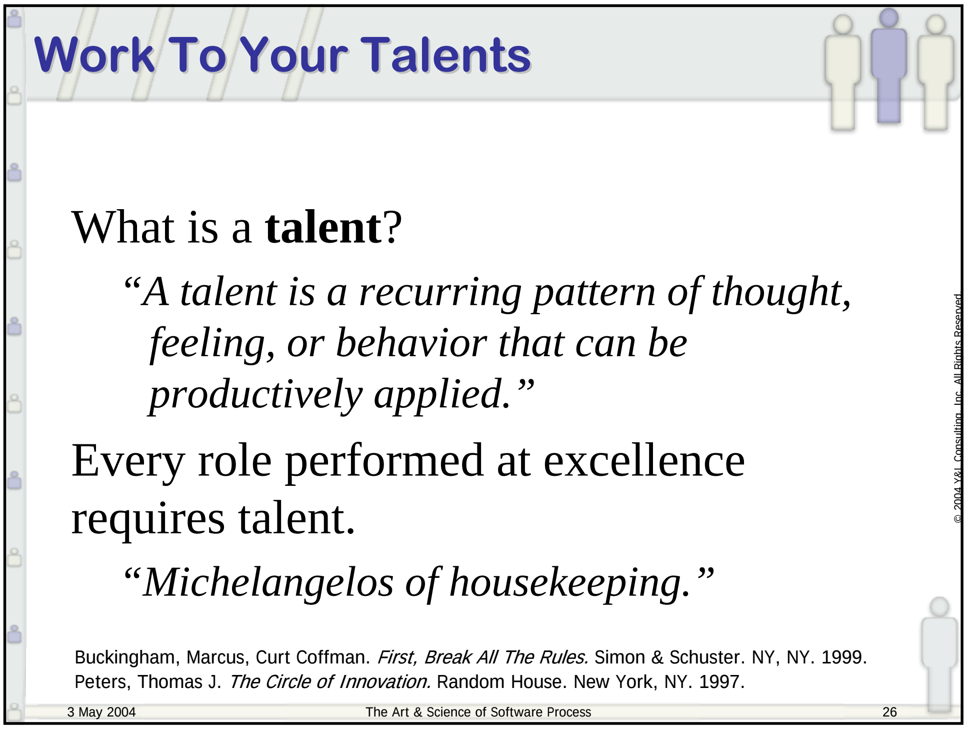
**You are special!**

Think of yourself as:

**Me, Inc.**

– Even if you happen to be on somebody's payroll at the moment!

Peters, Thomas, J. *Brand You 50:Fifty Ways to Transform Yourself from an "Employee" into a Brand that Shouts Distinction, Commitment, and Passion*. Knopf/Random House, 1999.



## Work To Your Talents

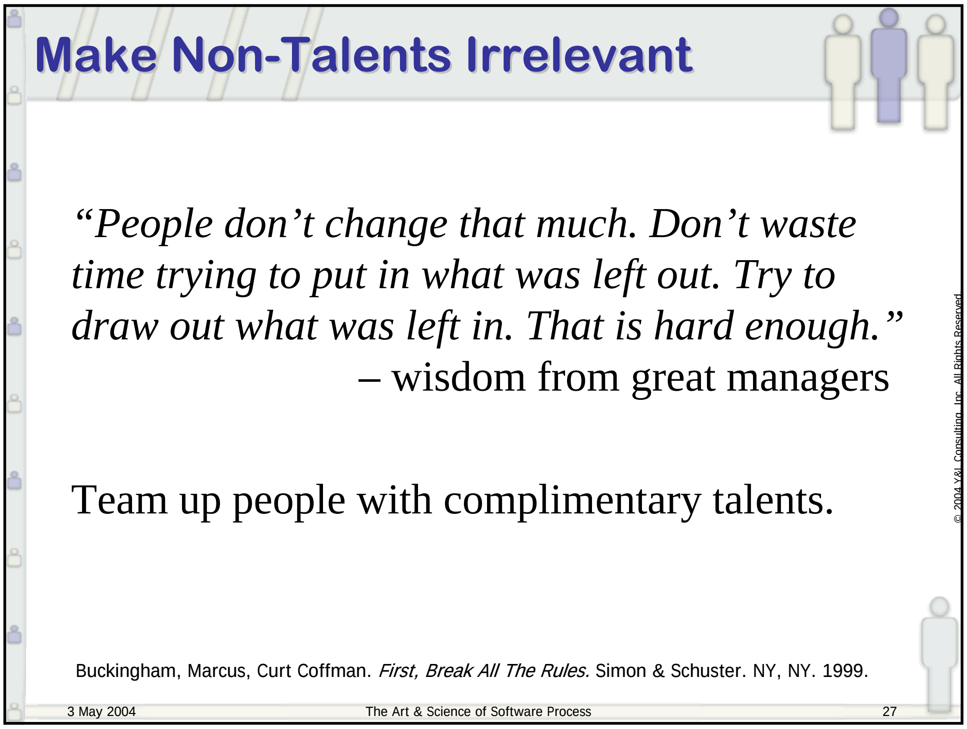
What is a **talent**?

> *"A talent is a recurring pattern of thought, feeling, or behavior that can be productively applied."*

Every role performed at excellence requires talent.

> *"Michelangelos of housekeeping."*

Buckingham, Marcus, Curt Coffman. *First, Break All The Rules.* Simon & Schuster. NY, NY. 1999.
Peters, Thomas J. *The Circle of Innovation.* Random House. New York, NY. 1997.



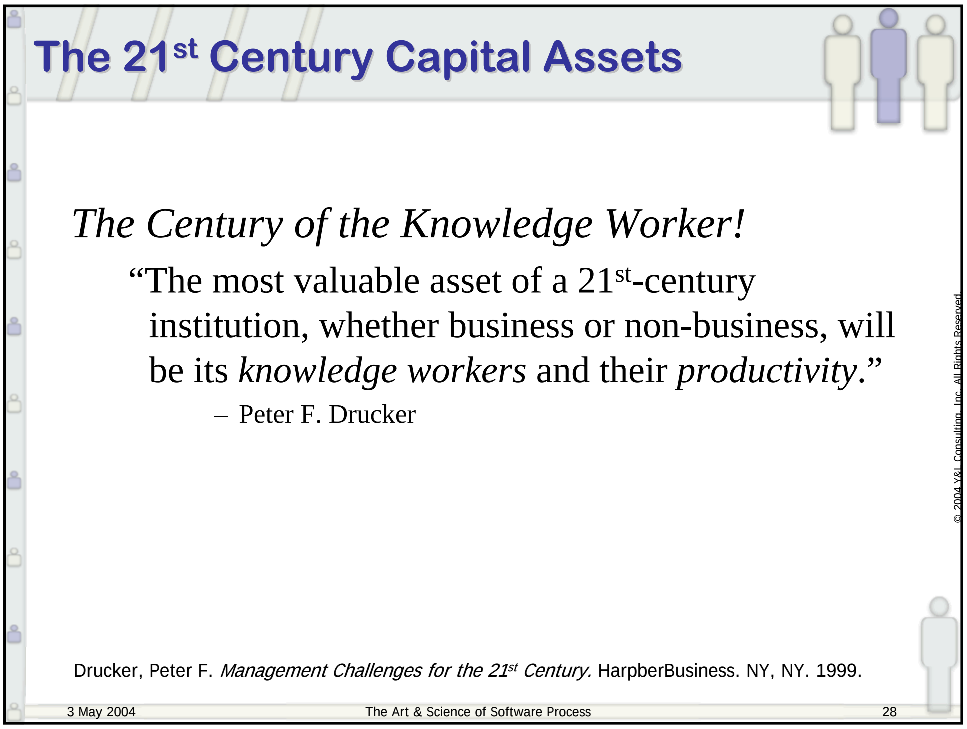
## Make Non-Talents Irrelevant

*"People don't change that much. Don't waste time trying to put in what was left out. Try to draw out what was left in. That is hard enough."*

– wisdom from great managers

Team up people with complimentary talents.

Buckingham, Marcus, Curt Coffman. *First, Break All The Rules.* Simon & Schuster. NY, NY. 1999.

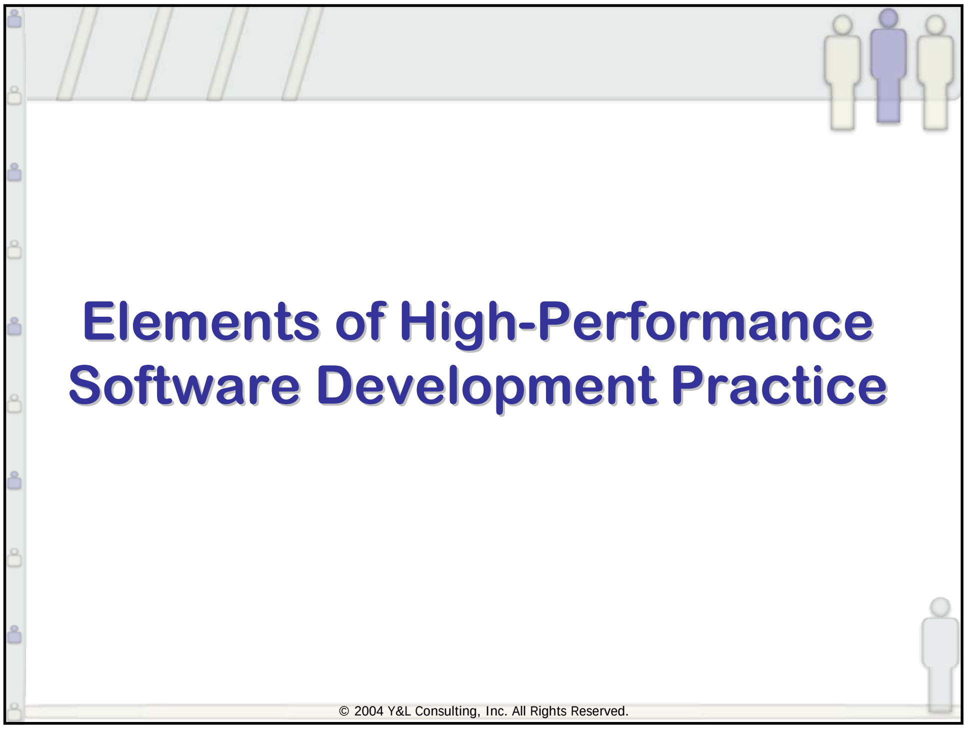


## The 21st Century Capital Assets

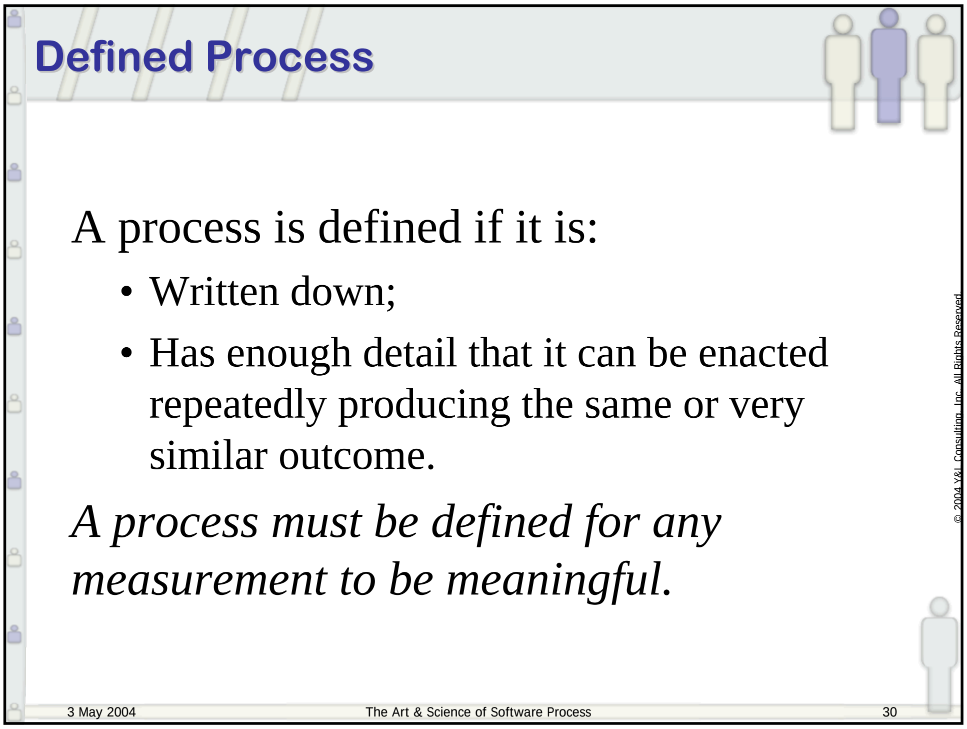
*The Century of the Knowledge Worker!*

> "The most valuable asset of a 21st-century institution, whether business or non-business, will be its *knowledge workers* and their *productivity*."
>
> – Peter F. Drucker

Drucker, Peter F. *Management Challenges for the 21st Century.* HarpberBusiness. NY, NY. 1999.



# Elements of High-Performance Software Development Practice

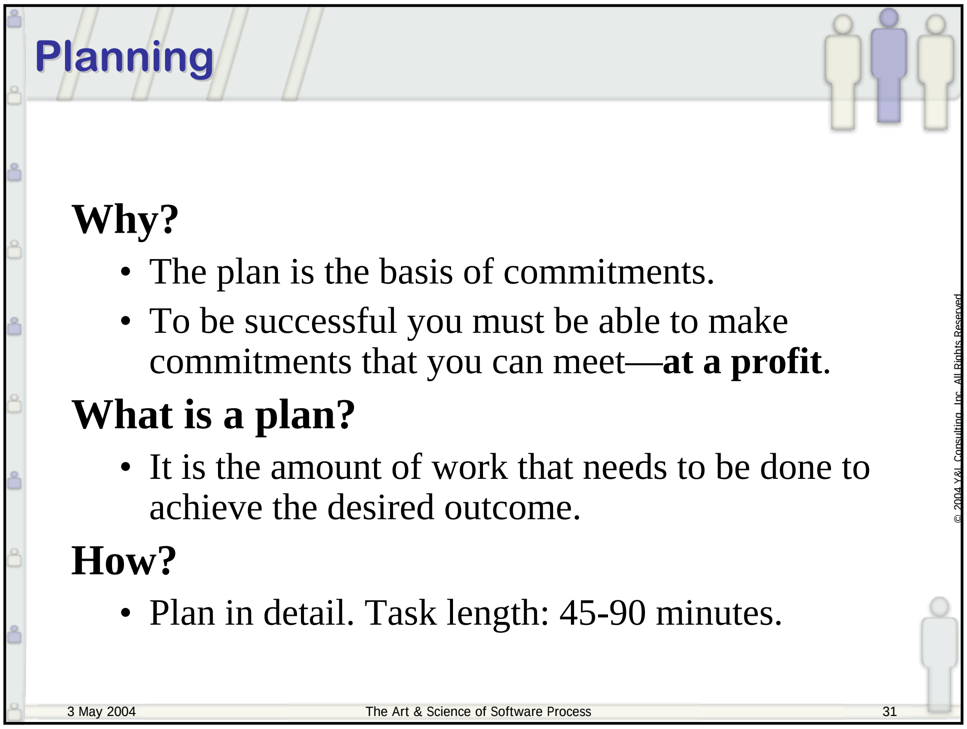


## Defined Process

A process is defined if it is:

- Written down;
- Has enough detail that it can be enacted repeatedly producing the same or very similar outcome.

*A process must be defined for any measurement to be meaningful.*



## Planning

**Why?**

- The plan is the basis of commitments.
- To be successful you must be able to make commitments that you can meet—**at a profit**.

**What is a plan?**

- It is the amount of work that needs to be done to achieve the desired outcome.

**How?**

- Plan in detail. Task length: 45-90 minutes.

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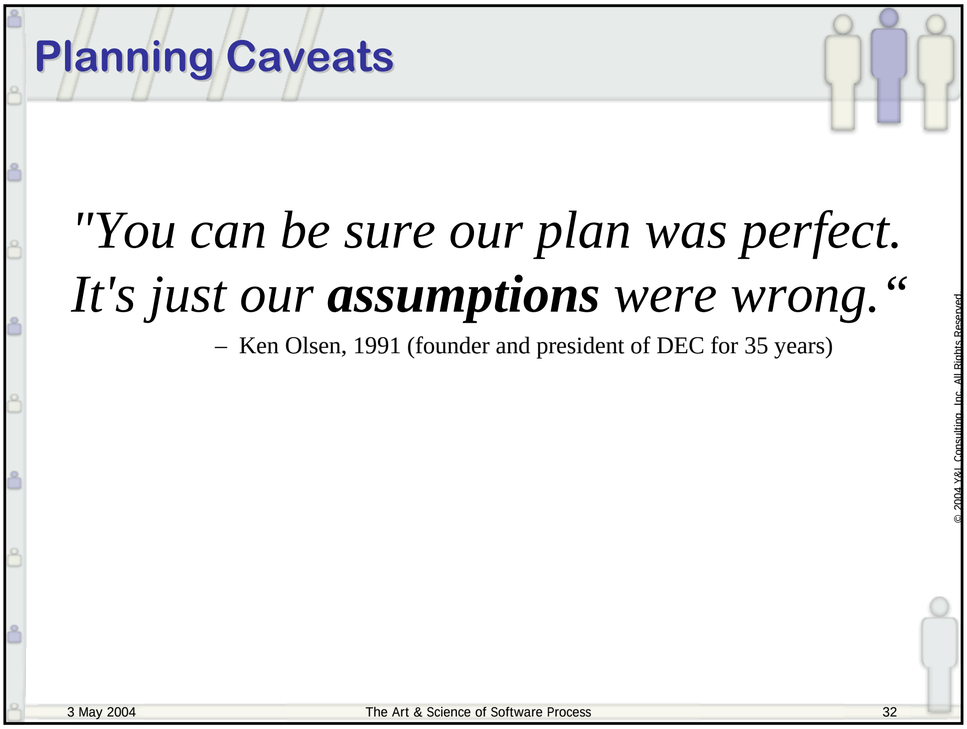

## Planning Caveats

*"You can be sure our plan was perfect. It's just our **assumptions** were wrong.“*

– Ken Olsen, 1991 (founder and president of DEC for 35 years)

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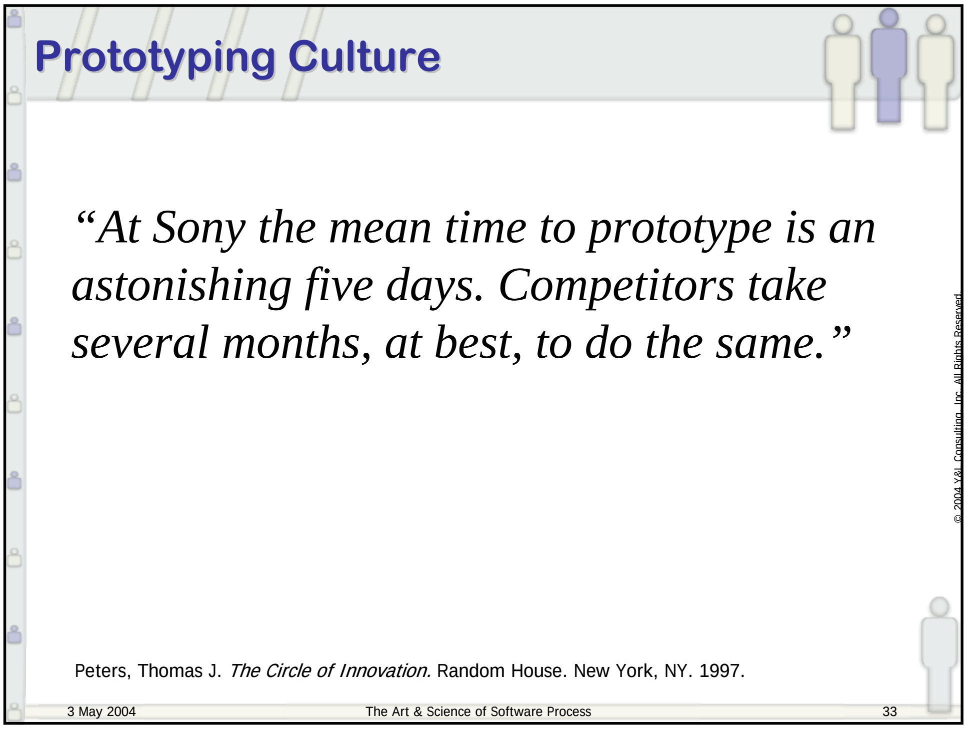
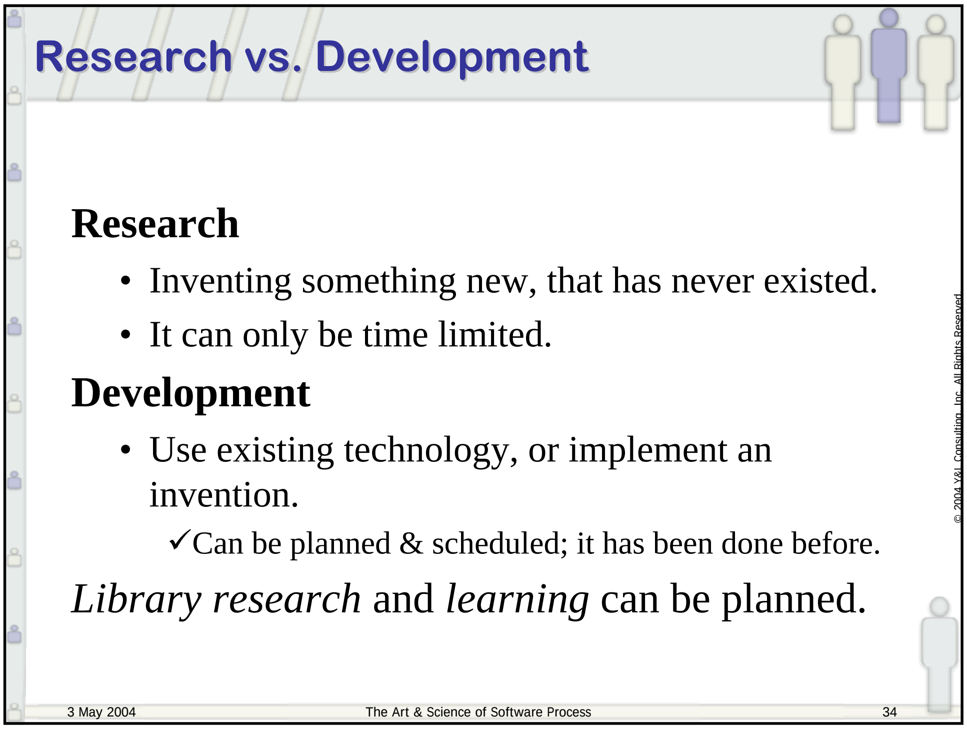


## Prototyping Culture

*“At Sony the mean time to prototype is an astonishing five days. Competitors take several months, at best, to do the same.”*

Peters, Thomas J. *The Circle of Innovation.* Random House. New York, NY. 1997.



## Research vs. Development

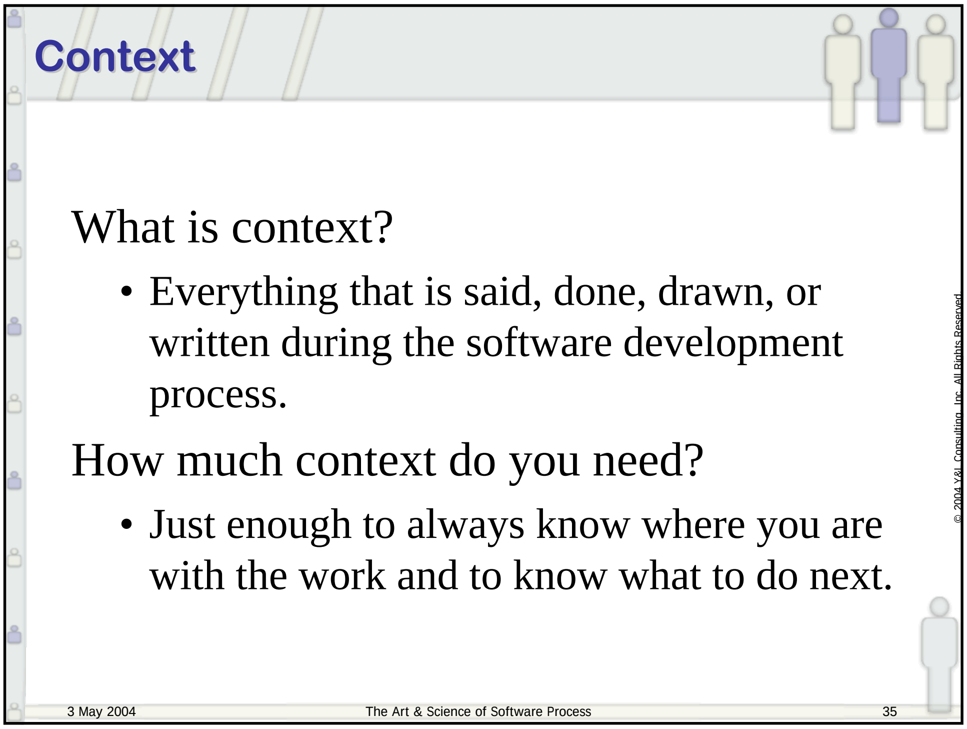
**Research**

- Inventing something new, that has never existed.
- It can only be time limited.

**Development**

- Use existing technology, or implement an invention.
  - ✓Can be planned & scheduled; it has been done before.

*Library research* and *learning* can be planned.



## Context

What is context?

- Everything that is said, done, drawn, or written during the software development process.

How much context do you need?

- Just enough to always know where you are with the work and to know what to do next.

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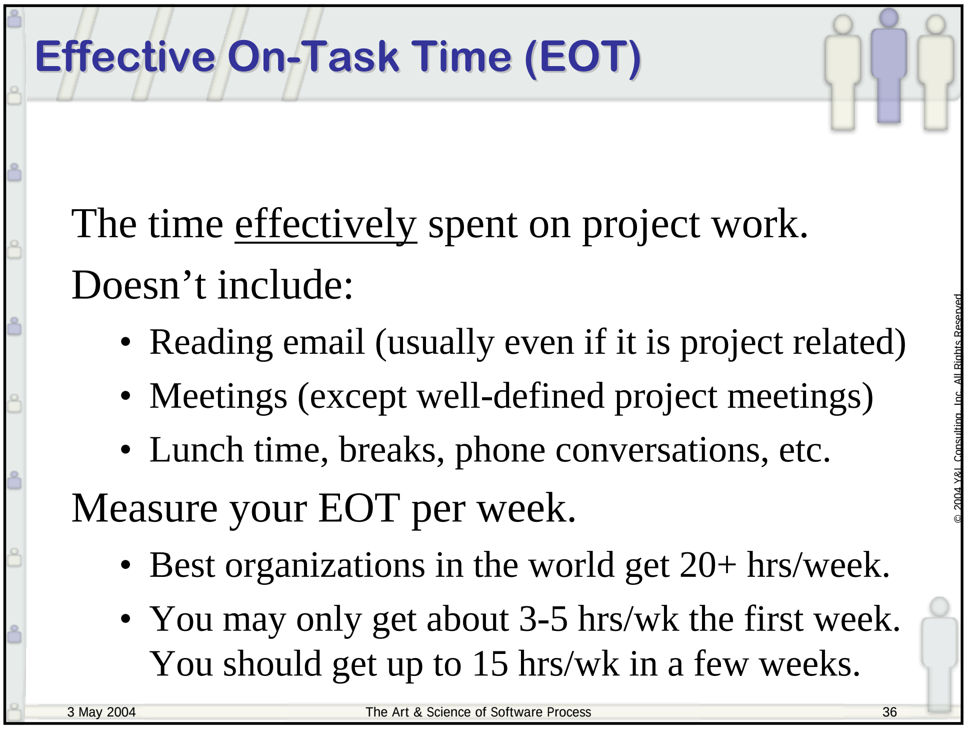

## Effective On-Task Time (EOT)

The time effectively spent on project work.

Doesn't include:

- Reading email (usually even if it is project related)
- Meetings (except well-defined project meetings)
- Lunch time, breaks, phone conversations, etc.

Measure your EOT per week.

- Best organizations in the world get 20+ hrs/week.
- You may only get about 3-5 hrs/wk the first week. You should get up to 15 hrs/wk in a few weeks.

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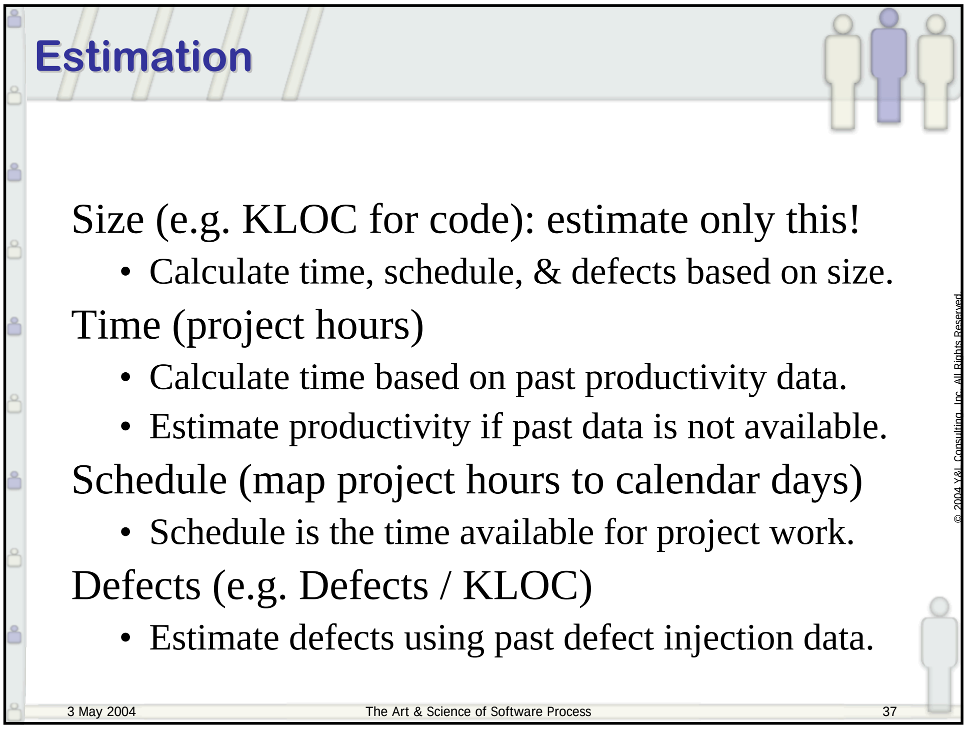


## Estimation

Size (e.g. KLOC for code): estimate only this!

- Calculate time, schedule, & defects based on size.

Time (project hours)

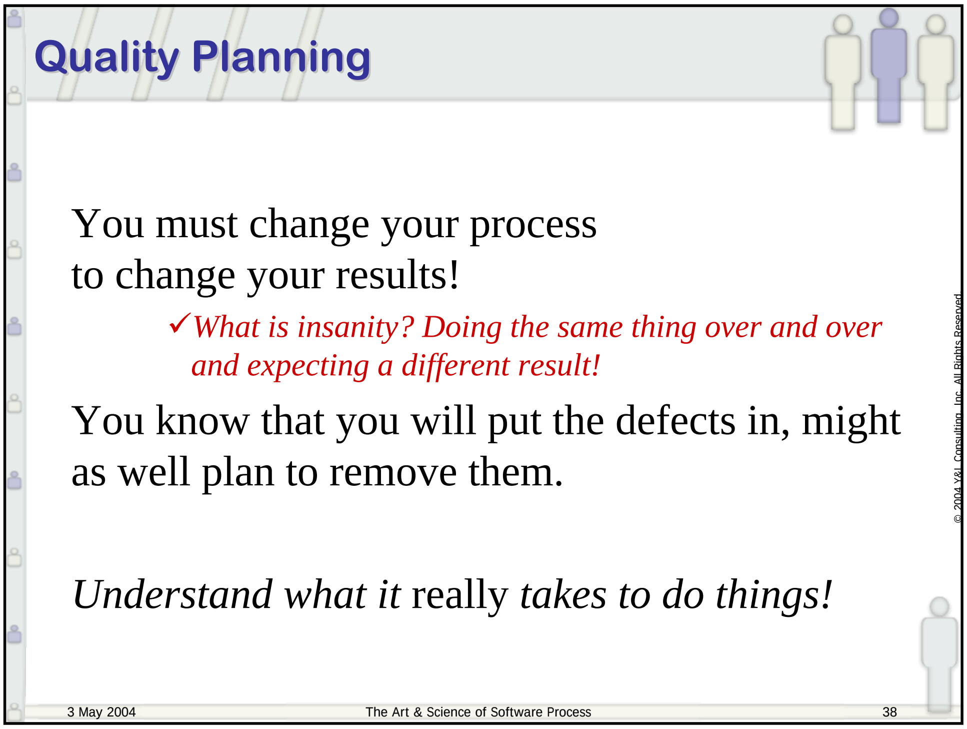
- Calculate time based on past productivity data.
- Estimate productivity if past data is not available.

Schedule (map project hours to calendar days)

- Schedule is the time available for project work.

Defects (e.g. Defects / KLOC)

- Estimate defects using past defect injection data.



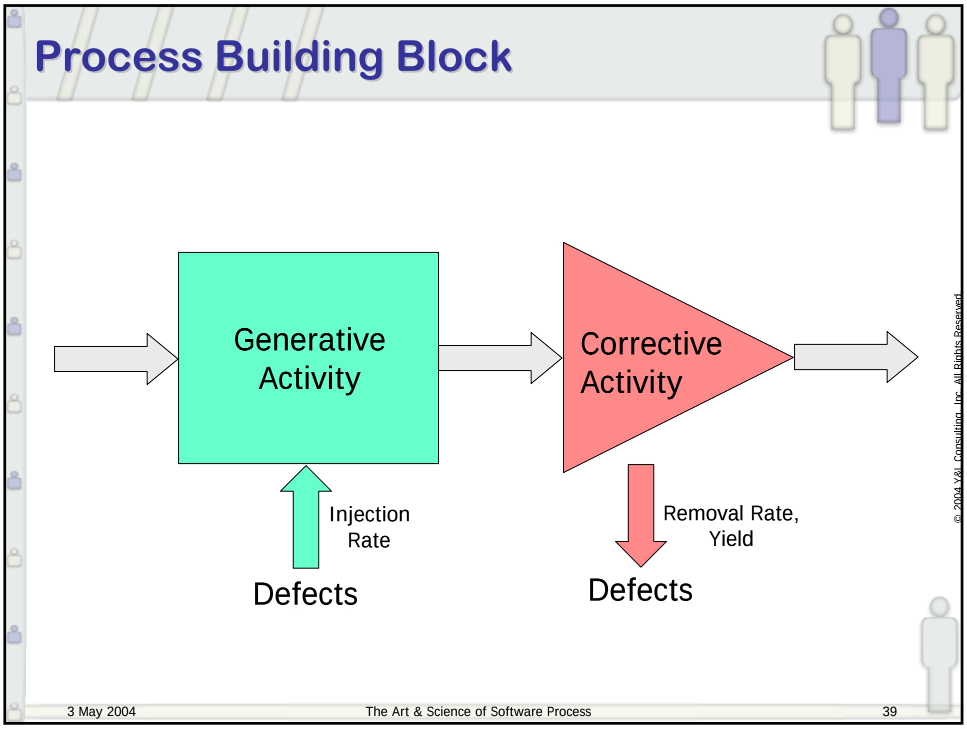
## Quality Planning

You must change your process
to change your results!

✓*What is insanity? Doing the same thing over and over and expecting a different result!*

You know that you will put the defects in, might as well plan to remove them.

*Understand what it* really *takes to do things!*



## Process Building Block

Generative Activity

Corrective Activity

Injection Rate

Defects

Removal Rate, Yield

Defects

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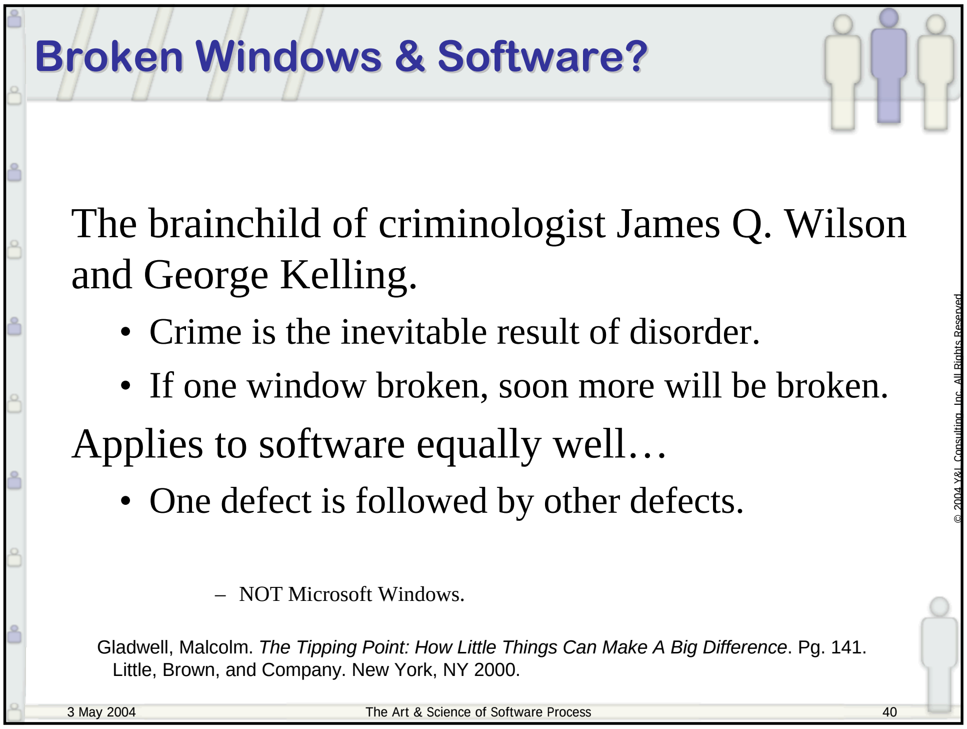


## Broken Windows & Software?

The brainchild of criminologist James Q. Wilson and George Kelling.

- Crime is the inevitable result of disorder.
- If one window broken, soon more will be broken.

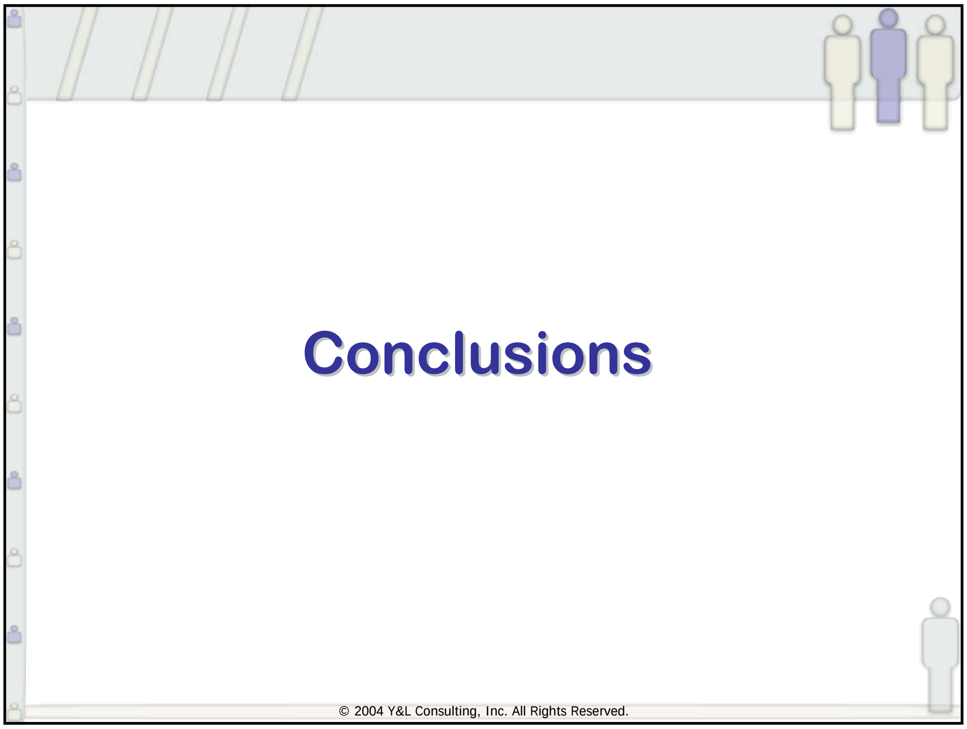
Applies to software equally well…

- One defect is followed by other defects.

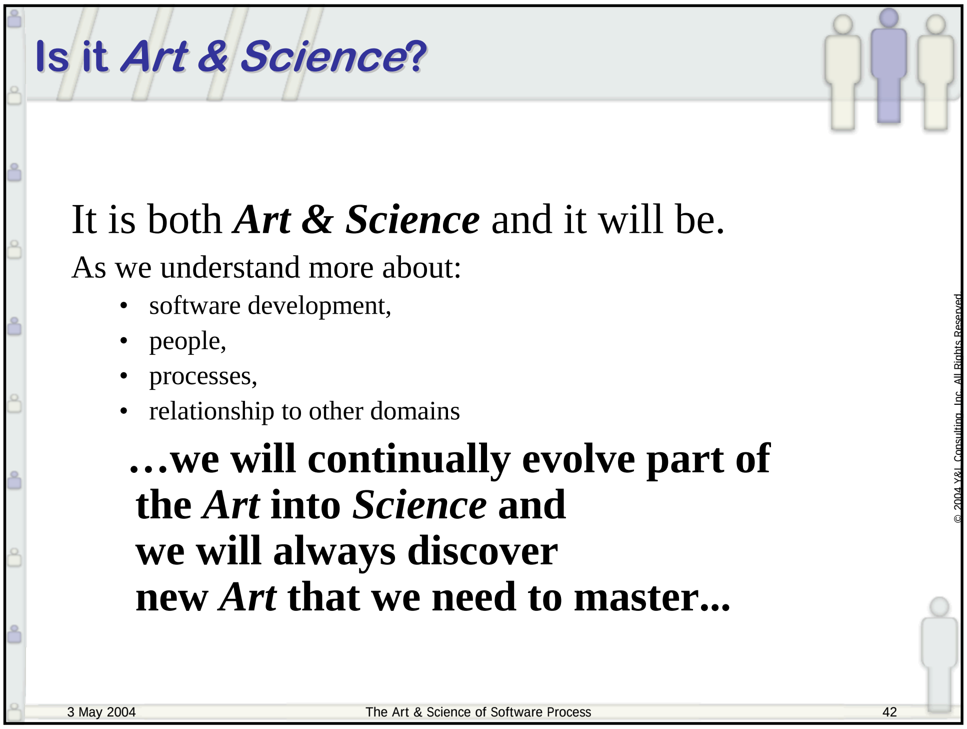
– NOT Microsoft Windows.

Gladwell, Malcolm. *The Tipping Point: How Little Things Can Make A Big Difference*. Pg. 141. Little, Brown, and Company. New York, NY 2000.

3 May 2004 The Art & Science of Software Process 40



## Conclusions



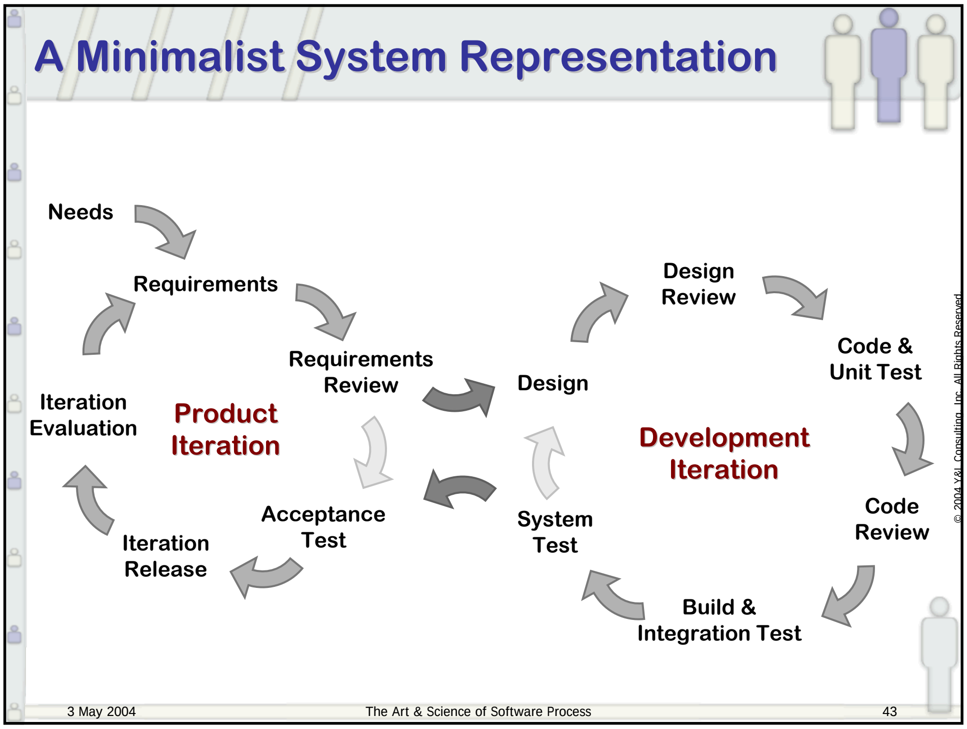
## Is it *Art & Science*?

It is both ***Art & Science*** and it will be.

As we understand more about:

- software development,
- people,
- processes,
- relationship to other domains

**…we will continually evolve part of the *Art* into *Science* and**
**we will always discover**
**new *Art* that we need to master...**



## A Minimalist System Representation

Needs

Requirements

Requirements Review

Design

Design Review

Code & Unit Test

Code Review

Build & Integration Test

System Test

Acceptance Test

Iteration Release

Iteration Evaluation

Product Iteration

Development Iteration

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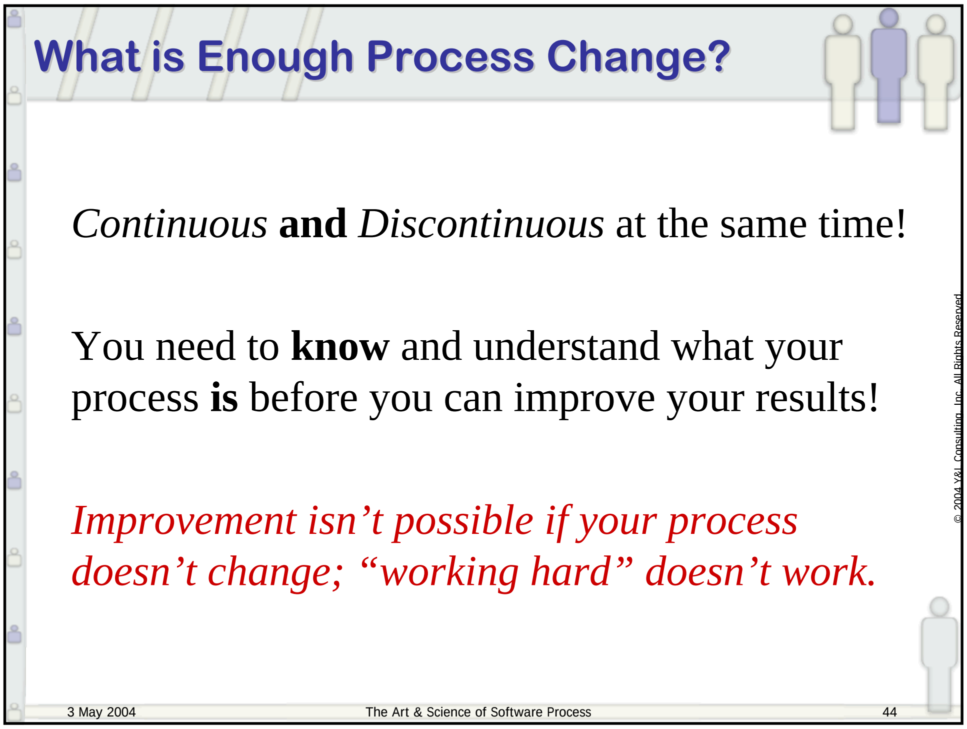

## What is Enough Process Change?

*Continuous* **and** *Discontinuous* at the same time!

You need to **know** and understand what your process **is** before you can improve your results!

*Improvement isn’t possible if your process doesn’t change; “working hard” doesn’t work.*

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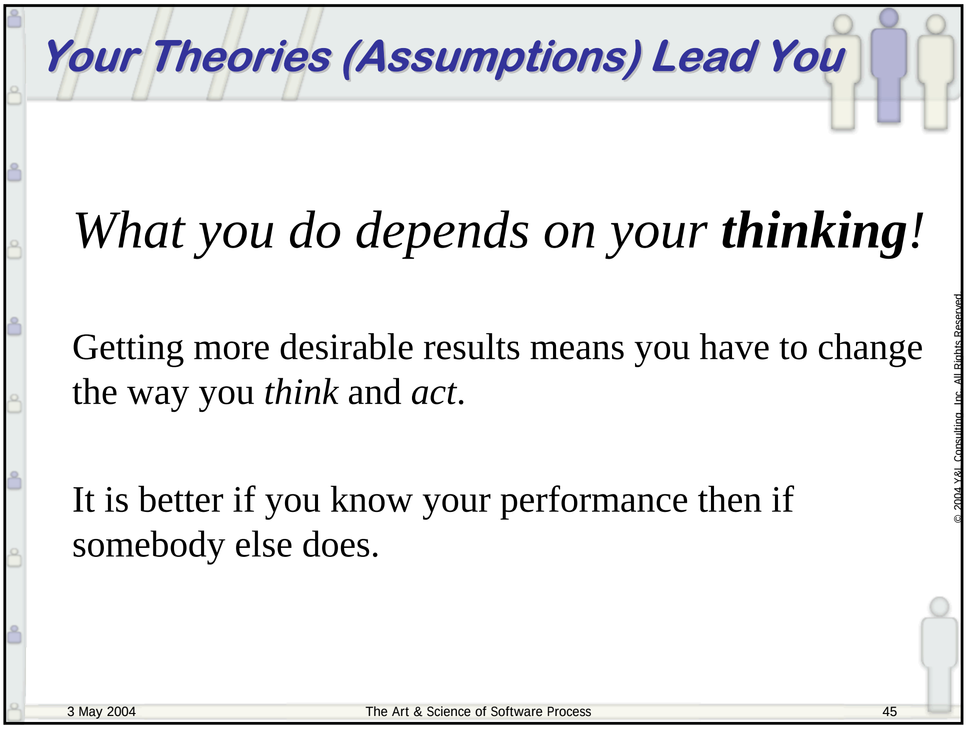
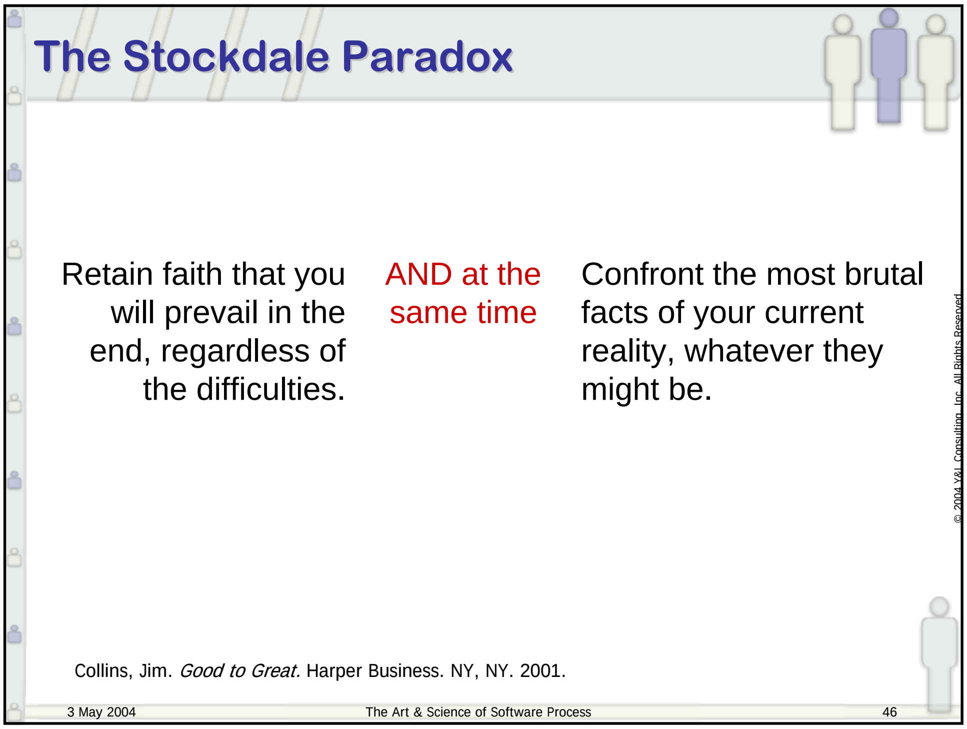


## *Your Theories (Assumptions) Lead You*

*What you do depends on your* ***thinking****!*

Getting more desirable results means you have to change the way you *think* and *act*.

It is better if you know your performance then if somebody else does.



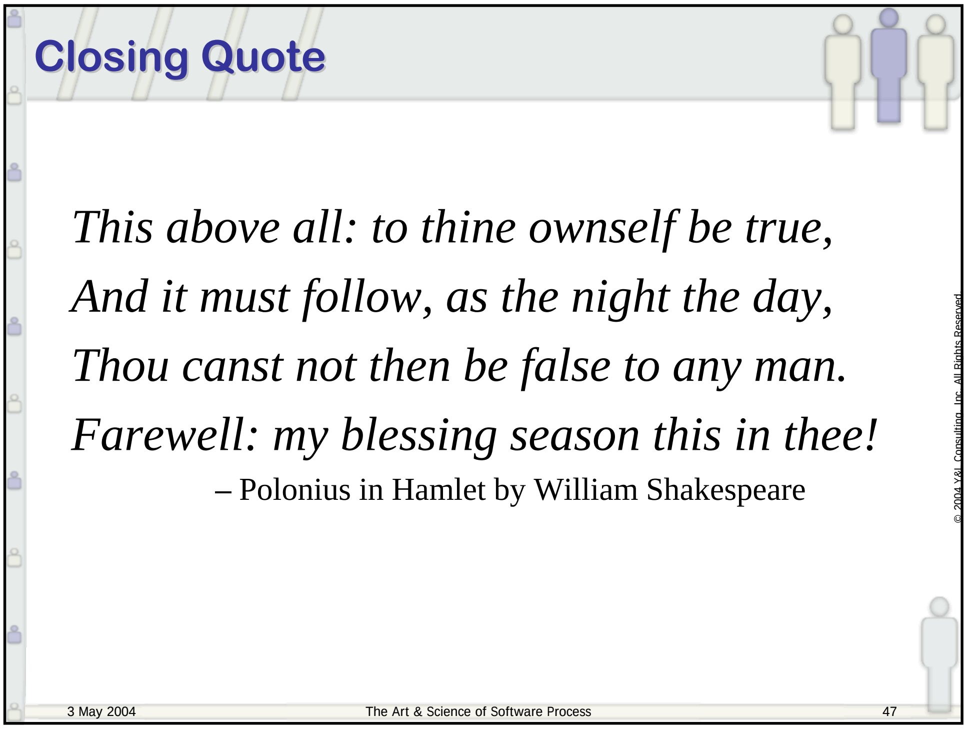
## The Stockdale Paradox

Retain faith that you will prevail in the end, regardless of the difficulties.

AND at the same time

Confront the most brutal facts of your current reality, whatever they might be.

Collins, Jim. *Good to Great.* Harper Business. NY, NY. 2001.



## Closing Quote

*This above all: to thine ownself be true,*
*And it must follow, as the night the day,*
*Thou canst not then be false to any man.*
*Farewell: my blessing season this in thee!*

– Polonius in Hamlet by William Shakespeare

## Thank You!

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For a software development reading list please visit:
**http://pseng.net/reading/**