Quality
from the
Quality Gurus

Steven Teleki
23 Sep 2011

Agenda

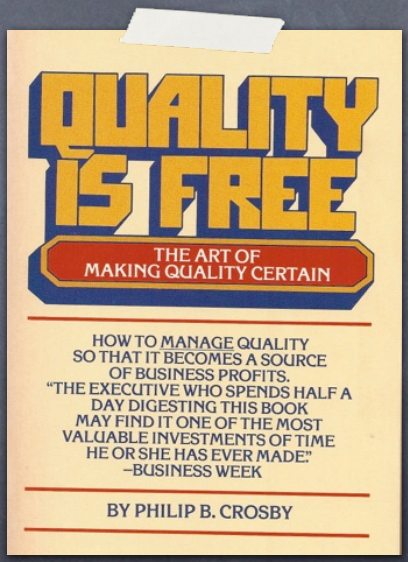
"To Achieve Quality There is No Substitute for Knowledge."
- W. Edwards Deming

Gurus:

- Philip Crosby
- W. Edwards Deming
- Joseph Juran
- Jeffrey Liker
- Peter Pande et. al.
- Jay Arthur
- Watts Humphrey
- Gerald Weinberg
- Karl Wiegers
- Ivar Jacobson et. al.

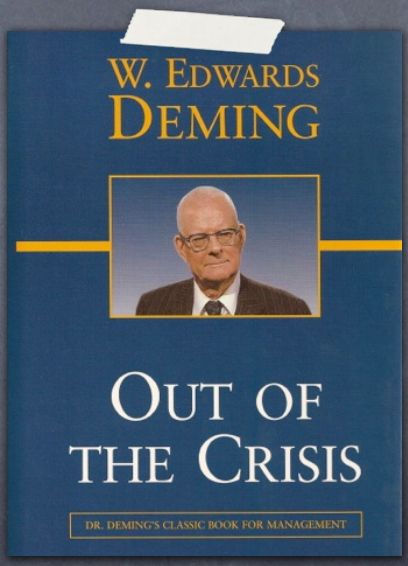
"Quality is conformance to requirements."

- Introduced the 5-stage Quality Maturity Grid
- Quality is measurable: $$$
- Cost of Quality: rework, scrap, warranty, returns, complaint handling, inspection and test



"Best efforts are not sufficient"

- Quality is perceived by the Customer
- How do you improve quality? By what method? Based on what theory?
- Deming's 14 Points for Management



"Everyone is Already Doing His Best"

Plan-Do-Check-Act (PDCA)

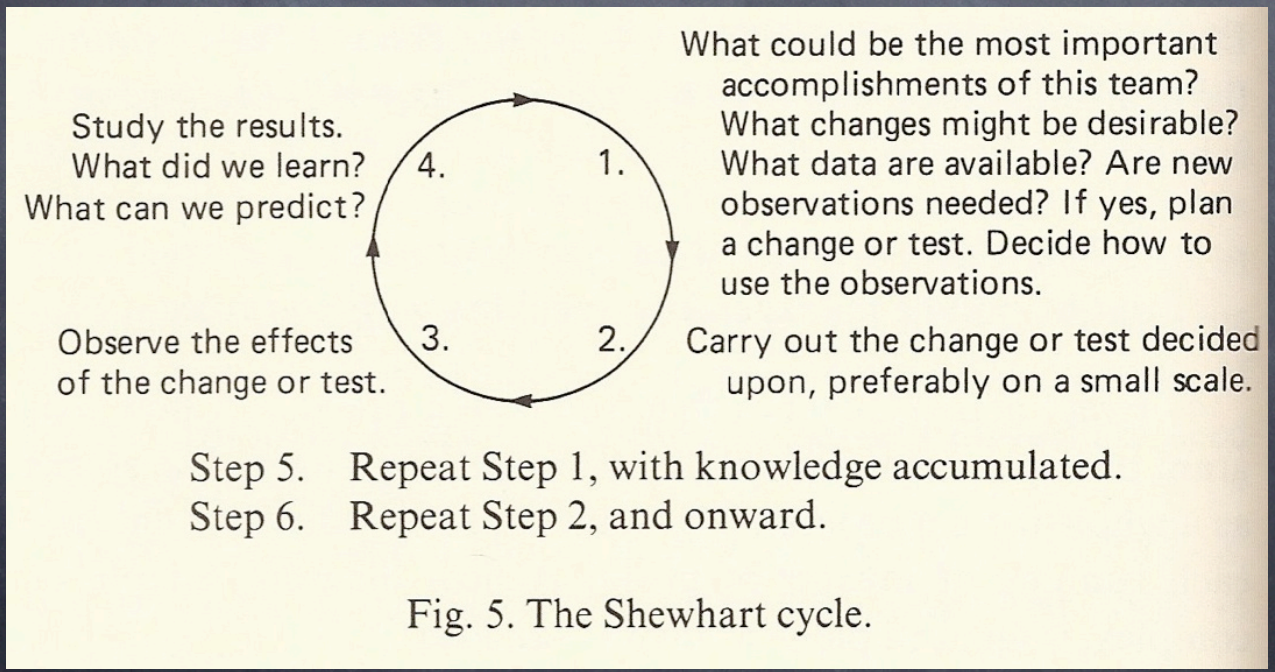
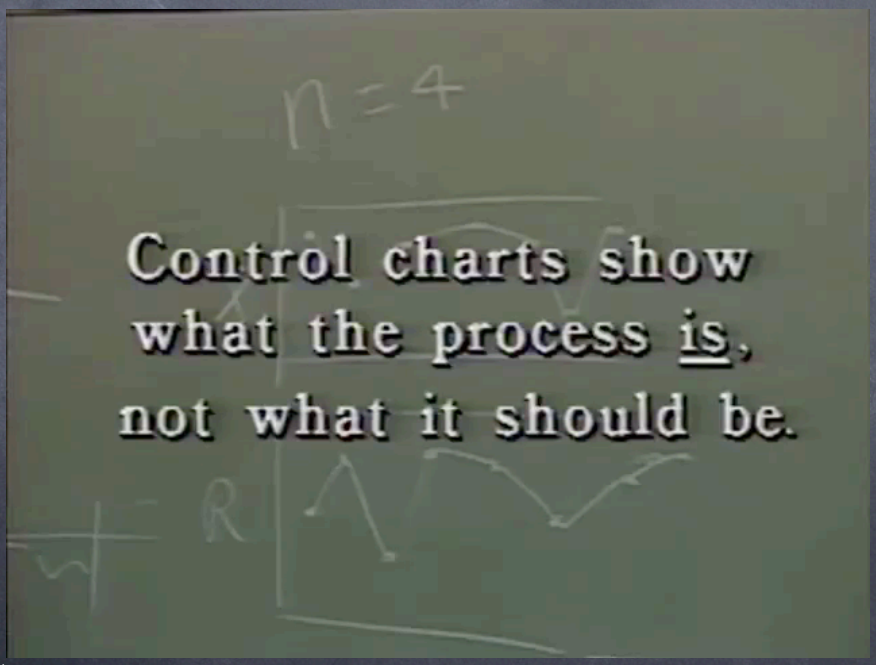


Fig. 5. The Shewhart cycle.

"The Process is Talking to You"



Control Charts

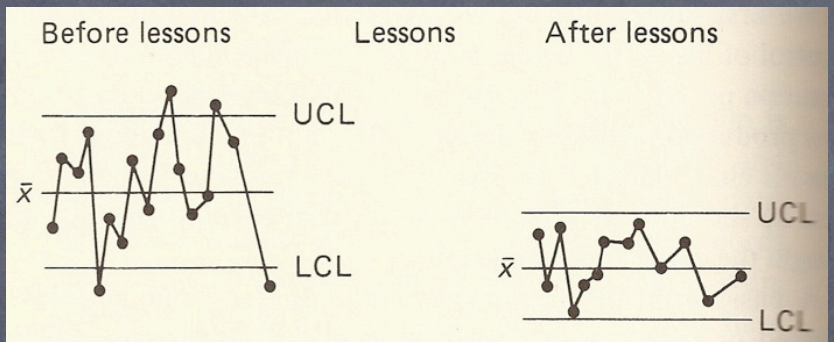
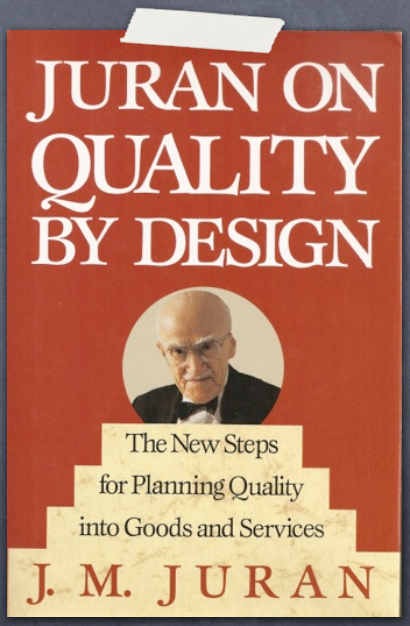


Fig. 17. Average weekly scores in golf for a beginner who took lessons before he reached a state of statistical control. Scores for four successive games constituted a sample of $n = 4$ for computation of $\bar{x}$ and R. The upper and lower control limits for $\bar{x}$ are calculated from the chart for ranges, not shown. From W. Edwards Deming, *Elementary Principles of the Statistical Control of Quality* (Union of Japanese Science and Engineering, Tokyo, 1950), p. 22. UCL and LCL mean upper control limit and lower control limit for $\bar{x}$.

The Juran Trilogy

- Quality Planning
  - Developing products and processes to meet customer's needs
- Quality Control
  - Evaluate, compare, improve
- Quality Improvement
  - Identify infrastructure, needs, projects, provide resources



The Juran Trilogy

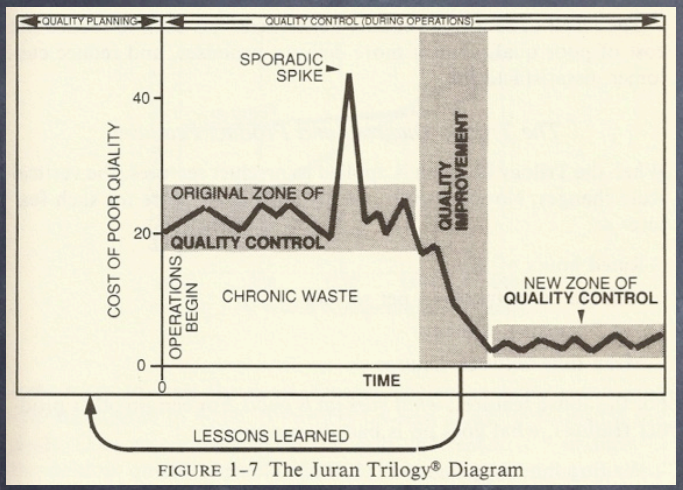


FIGURE 1-7 The Juran Trilogy® Diagram

Managing for Quality		
Quality Planning	*Quality Control*	*Quality Improvement*
Establish quality goals	Evaluate actual performance	Prove the need
Identify who are the customers	Compare actual performance to quality goals	Establish the infrastructure
Determine the needs of the customers	Act on the difference	Identify the improvement projects
Develop product features which respond to customers' needs		Establish project teams
Develop processes able to produce the product features		Provide the teams with resources, training, and motivation to: Diagnose the causes Stimulate remedies
Establish process controls; transfer the plans to the operating forces		Establish controls to hold the gains

FIGURE 1-6 The Three Universal Processes of Managing for Quality

Quality Culture @ Toyota

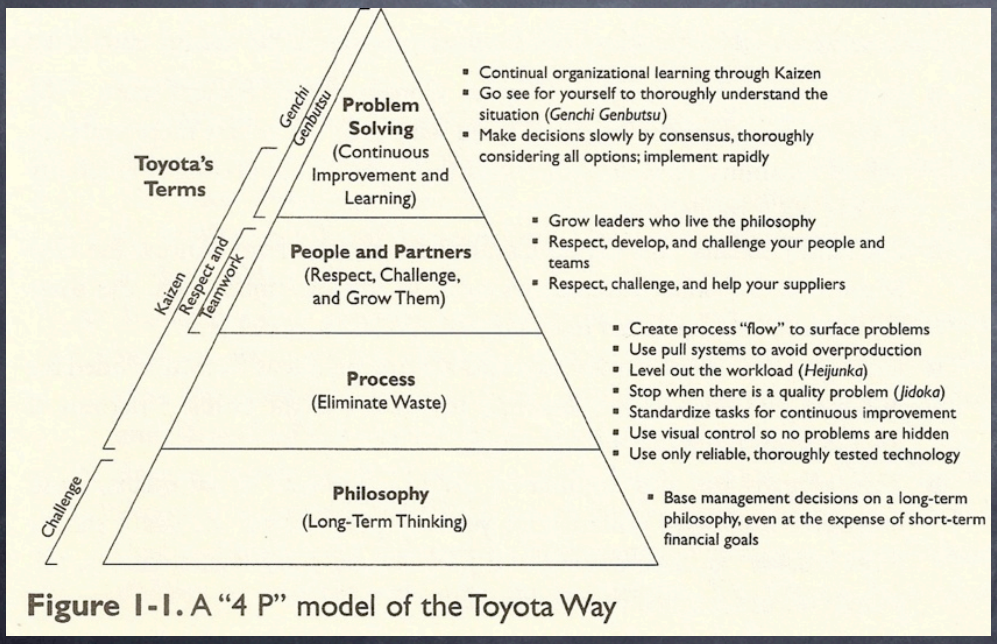
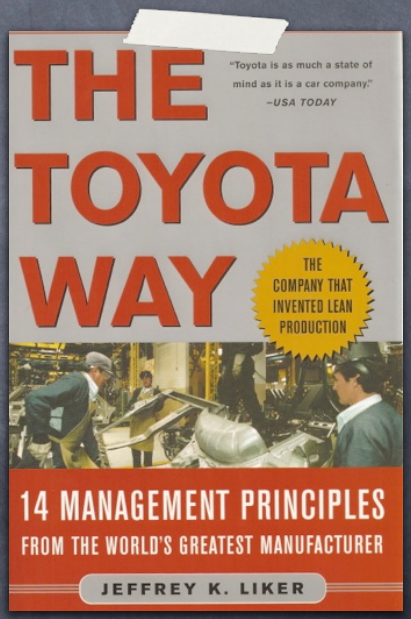


Figure 1-1. A "4 P" model of the Toyota Way



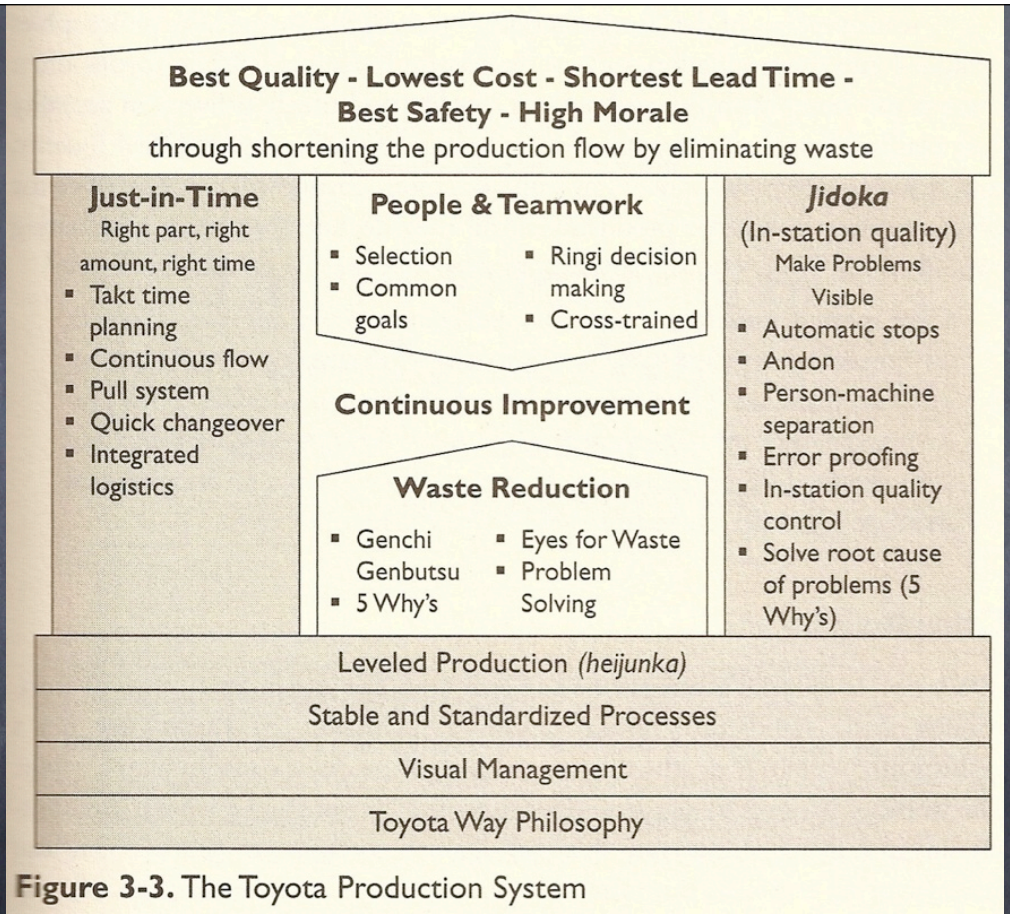
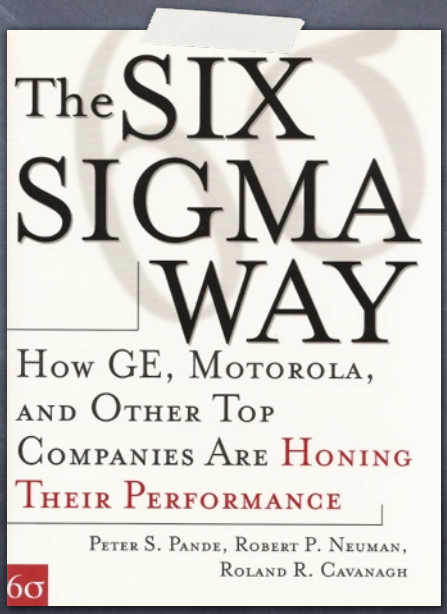


Figure 3-3. The Toyota Production System

PDCA -> DMAIC

Figure 2.8 The DMAIC Six Sigma improvement model

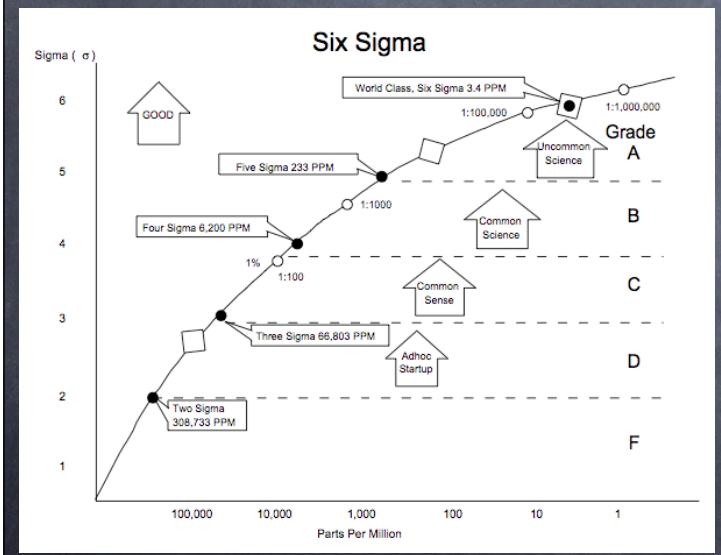


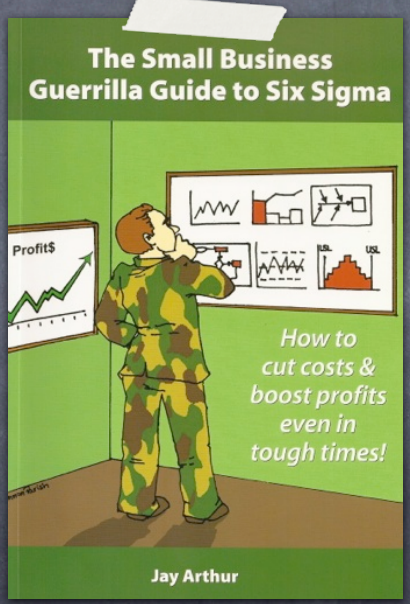
Six Sigma Improvement Processes

	Process Improvement	Process Design/ Redesign
1. Define	✓ Identify the problem ✓ Define requirements ✓ Set goal	✓ Identify specific or broad problems ✓ Define goal/change vision ✓ Clarify scope & customer requirements
2. Measure	✓ Validate problem/ process ✓ Refine problem/goal ✓ Measure key steps/ inputs	✓ Measure performance to requirements ✓ Gather process efficiency data
3. Analyze	✓ Develop causal hypotheses ✓ Identify "vital few" root causes ✓ Validate hypothesis	✓ Identify "best practices" ✓ Assess process design • value/non-value adding • bottlenecks/disconnects • alternate paths ✓ Refine requirements
4. Improve	✓ Develop ideas to remove root causes ✓ Test solutions ✓ Standardize solution/ measure results	✓ Design new process • challenge assumptions • apply creativity • workflow principles ✓ Implement new process, structures, systems
5. Control	✓ Establish standard measures to maintain performance ✓ Correct problems as needed	✓ Establish measures & reviews to maintain performance ✓ Correct problems as needed

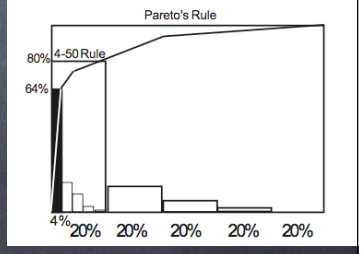
Figure 2.9 Overview of Process Improvement and Process Design/Redesign "paths" in DMAIC model

Start with the Problem that brings the Biggest Benefit



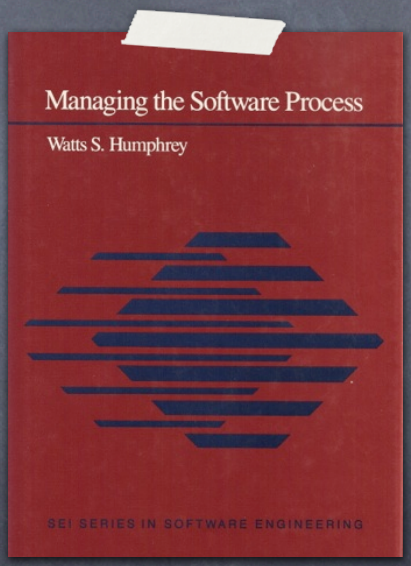


Sigma (σ)	Defects/Million
1	690,000
2	308,733
3	66,803
3.5 Average	
4	6,210
5	233
6	3.4

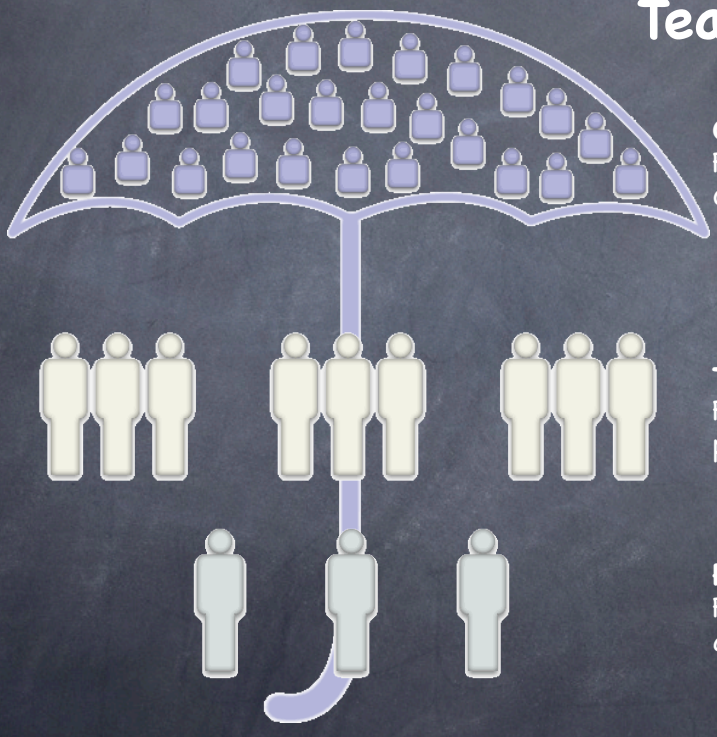


"Where are we, and where are we going?"

- Introduced the 5-level Software Development Capability Maturity Model



Humphrey's Work Ties Together Organization, Team, and Individual



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

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

Personal Software Process (PSP):
Focuses on individual talents, capabilities, and performance; entirely personal.

What is Quality?

What is Software Quality?

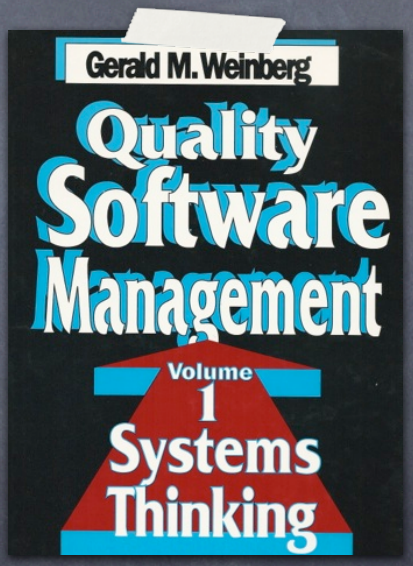
Basic definition
- meeting the users' needs
- needs, not wants
- true functional needs are often unknowable

There is a hierarchy of needs
- do the required tasks
- meet performance requirements
- be usable and convenient
- be economical and timely
- be dependable and reliable

"When you are not absolutely certain, you are probably wrong"

Applying Systems Theory to Software Development

- "Quality is not the same thing as absence of errors, but the presence of many errors can destroy any other measure of quality in a product."



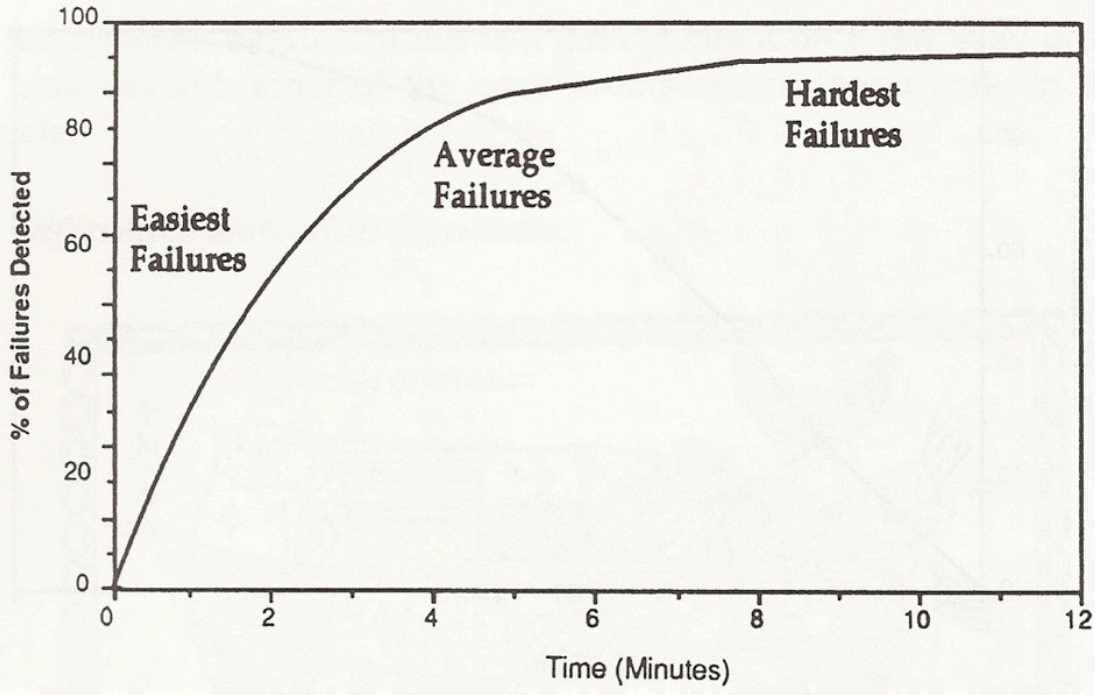


Figure 13–3. The Failure Detection Curve is a tautology because the failures that are hardest to find are found last. That's what "hardest to find" means.

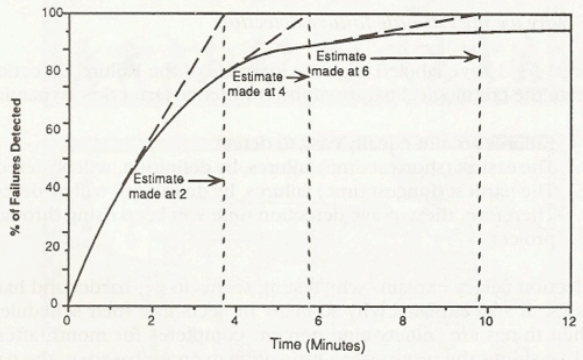


Figure 13–4. At each moment in the detection process, estimators tend to use a linear projection of their most current experience.

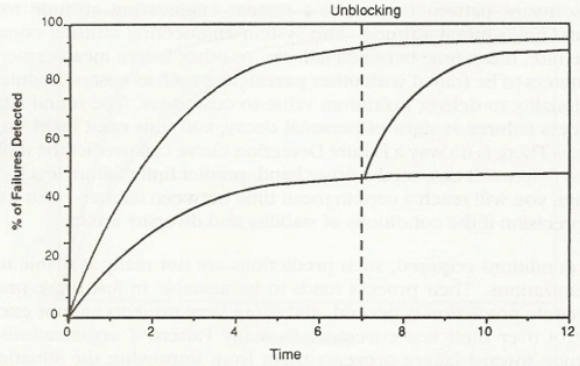


Figure 13–6. The Failure Detection Curve in a blocking fault situation does not follow the expected upper curve, but follows the lower curve that is the sum of two curves, one of which only begins to rise after access to certain failures is unblocked.

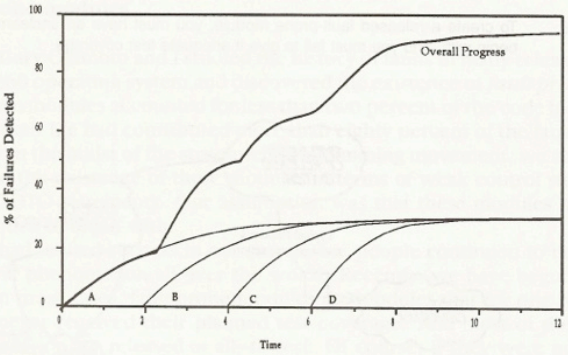


Figure 13–10. With an orderly sequence of modules introduced into test and uniform cleanliness of modules, overall progress in failure detection can be used to estimate test completion.

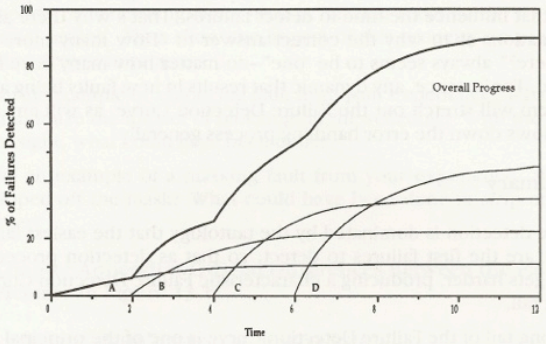


Figure 13–11. When management decisions mean that late modules are likely to be fault-prone modules, the Failure Detection Curve is likely to be stretched out much worse than it could be, leading to seriously optimistic estimates of failure detection progress.

21

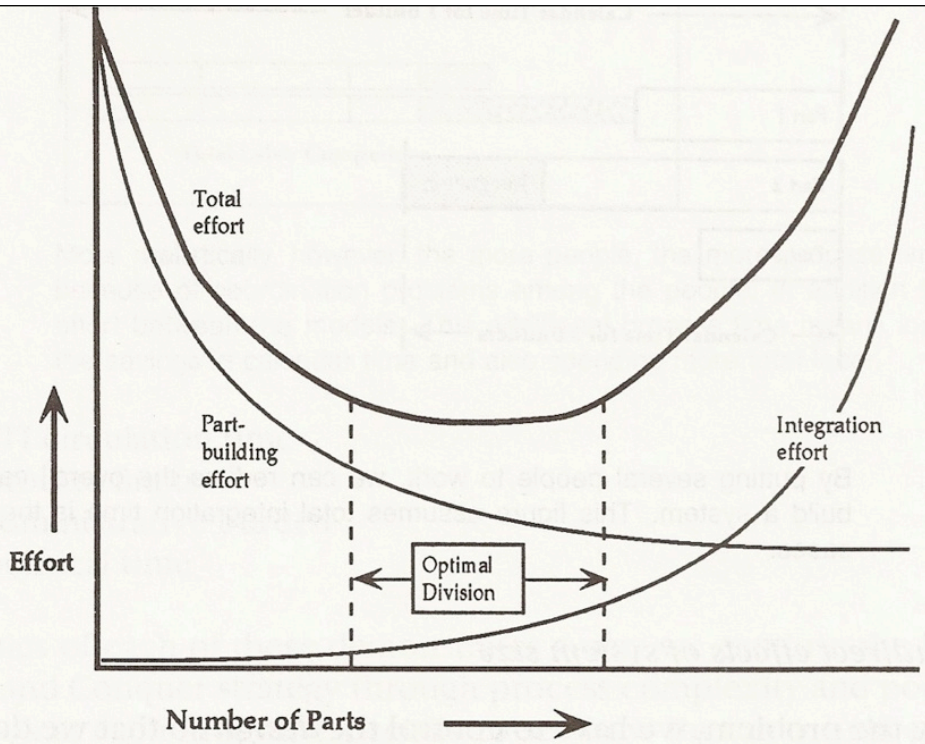


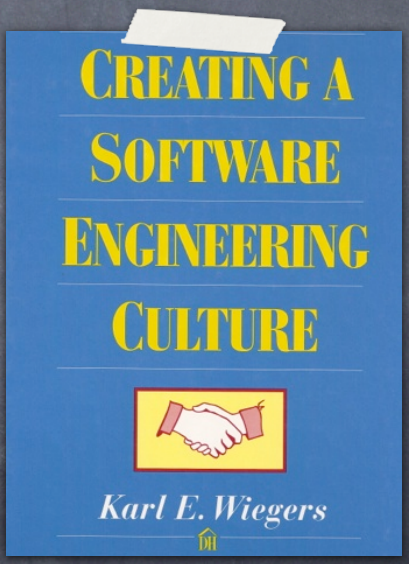
Figure 14–4. The more parts we divide the system into, the more linear the labor of each part becomes. On the other hand, the more parts, the more integration effort grows nonlinearly. Eventually, there would be so many small parts that the integration effort would be greater than the building effort.

22

Quality is Embedded in the Culture of the Organization

Table 11.1.
Some Components of the Cost of Quality for Software.

Category	Examples
Defect Prevention	• Effort devoted to understanding the root causes of defects • Process improvement activities • Quality assurance efforts • Quality training and tools
Quality Appraisal	• Inspection to find defects • Testing to find defects • Measuring the quality of the product
Product Failure	• Reproducing and diagnosing the failure • Rework (fixing the defect, rebuilding the product, reinspecting it, retesting it, reinstalling it) • Engineering and requirements changes • Warranty repair or replacement • A support function to help customers with products that are defective or difficult to use • Program redesign • Programs, documents, or entire applications that are abandoned, or scrapped and rebuilt



Iterative & Incremental

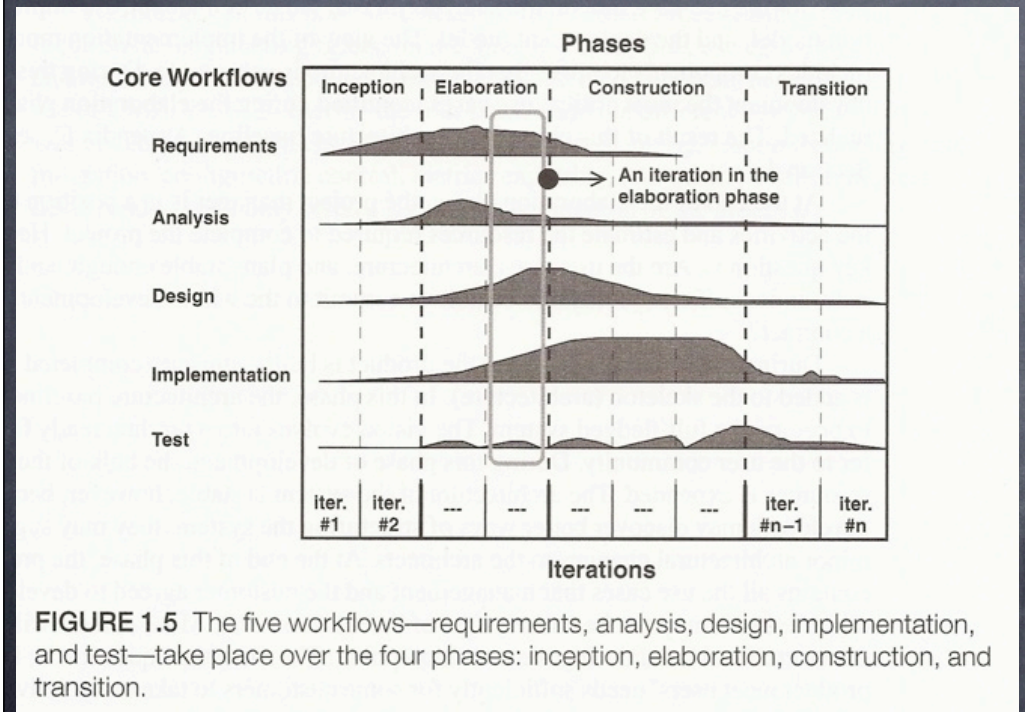
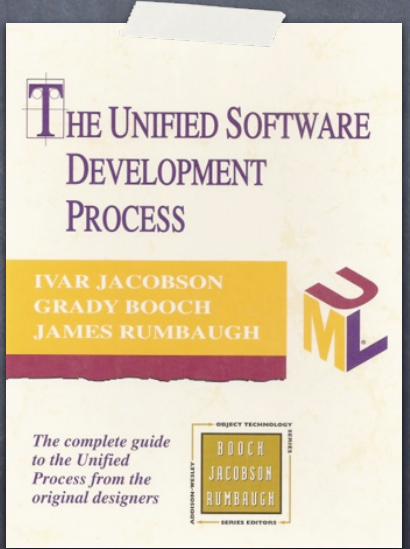


FIGURE 1.5 The five workflows—requirements, analysis, design, implementation, and test—take place over the four phases: inception, elaboration, construction, and transition.



Conclusion

"If I have seen a little further it is by standing on the shoulders of giants."
- Sir Isaac Newton

Your Letters and Comments are Welcome!

- Steven Teleki: steve@teleki.net
- Visit: http://steven.teleki.net/
  - Software Development Reading List
  - Slides from past talks