Estimating and Measuring Project Risk

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Agenda for Presentation

- My Background
- Understanding components of risk
  - Margin of Error
  - Confidence Intervals
- Application to entire lifecycle
- Risk in requirements phase
- Summary & Question

Clients

- Clients include Banking & Finance, Aerospace, Retailers, Animal Food, Telephony, Consulting Companies, Medical Research, Defense Contractors, Automotive, Universities, Government Agencies and others

- Some clients: MasterCard, Amadeus, Ralston Purina, Lockheed, Transamerica, DirecTV, Biologic, Accenture, Motorola, Nissan, others…

My Metrics

- Over 2 million frequent flyer miles
- Consulted on every continent except Antarctica
- Presented papers at conferences in USA, Europe, Middle East, Asia and Africa

Type of Work

- Productivity Assessments
- Benchmark Studies
- Estimating Models
- Mergers and Acquisitions
- Venture Capital and Initial Public Offerings
- Outsourcing Agreements
- Expert Testimony

Bottom Line

- Help organizations make money!

Learning from organizations
(ethology)

- Collect both quantitative and qualitative data
- Observe behaviors, customs, rituals, myths and ways of life
- Examine artifacts and physical evidence
- Build holistic picture of organization
- Trend the industry as a whole

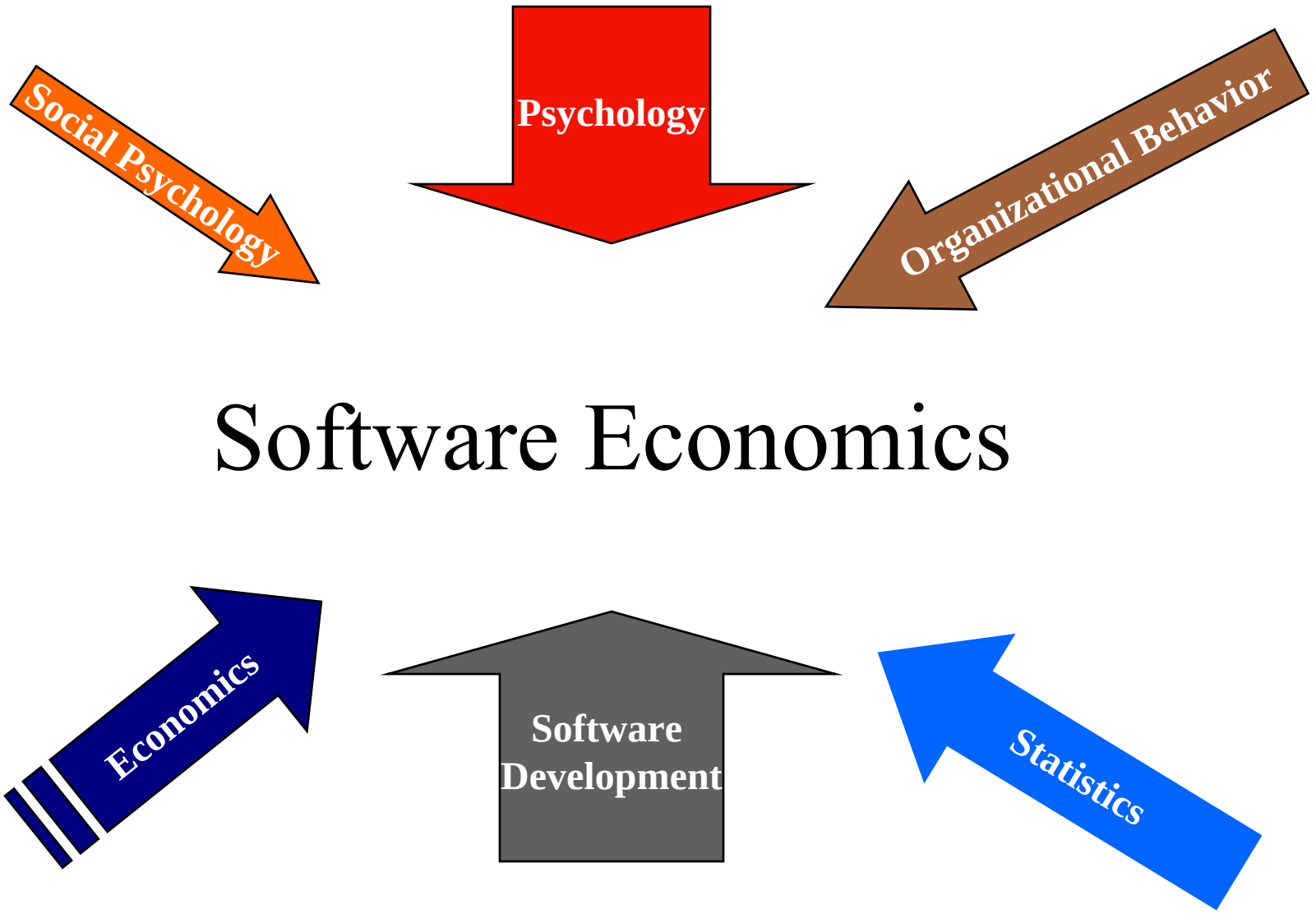
Research

- Dale Jorgenson, Harvard Business School
  - Historical Study of Productivity Rates for Software Development (1950 – present).
- Bureau of Economic Analysis
  - Methods of collecting and reporting software productivity rates based upon Function Points.
  - Measuring the IT Economy.
- Securities Exchange Commission

Adjunct Professor

(Avila University MBA Program & Psychology Department)

- Industrial Organization Psychology
- Managerial Economics
- Statistics
- Quantitative Analysis
- E-Commerce


Social Psychology
Psychology
Organizational Behavior
Software Economics
Economics
Software Development
Statistics

Available Software Titles

(business card titles)

- Software Philosopher
- Software Archaeologist
- Software Paleontologist
- Software Waste Management

There are lies, dammed lies and statistics.

Mark Twain

Hannibal, Missouri

Statistics

- Probability is a numerical measure of the likelihood an event will occur.
- Probability can be used as a measure of the degree of uncertainty and risk

Professional Risk Takers

- Also known as *gamblers*
  - Calculate probability, odds and payouts
- Statistics was invented to measure risk

Consistency

- Dice, Cards, Slot Machines all are very consistent if played for along enough time.
- Casino's are 100 percent certain if you play long enough you are going lose.
- Game results appear as "lucky" or "random" if played in the short run.
- Consistency is the key for prediction and elimination of risk.

A Little Study & Statistics

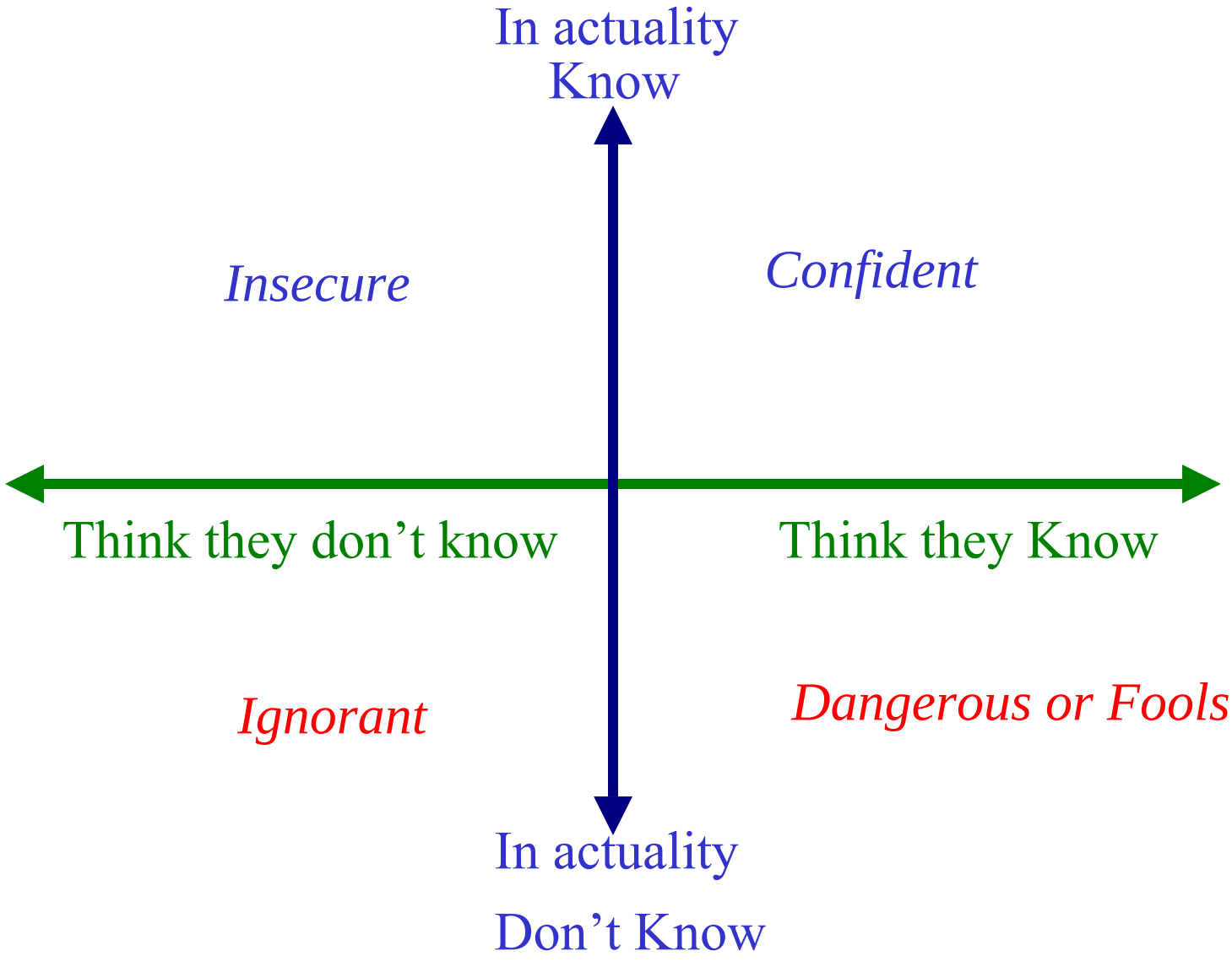
- Demonstrate luck has nothing to do with it.

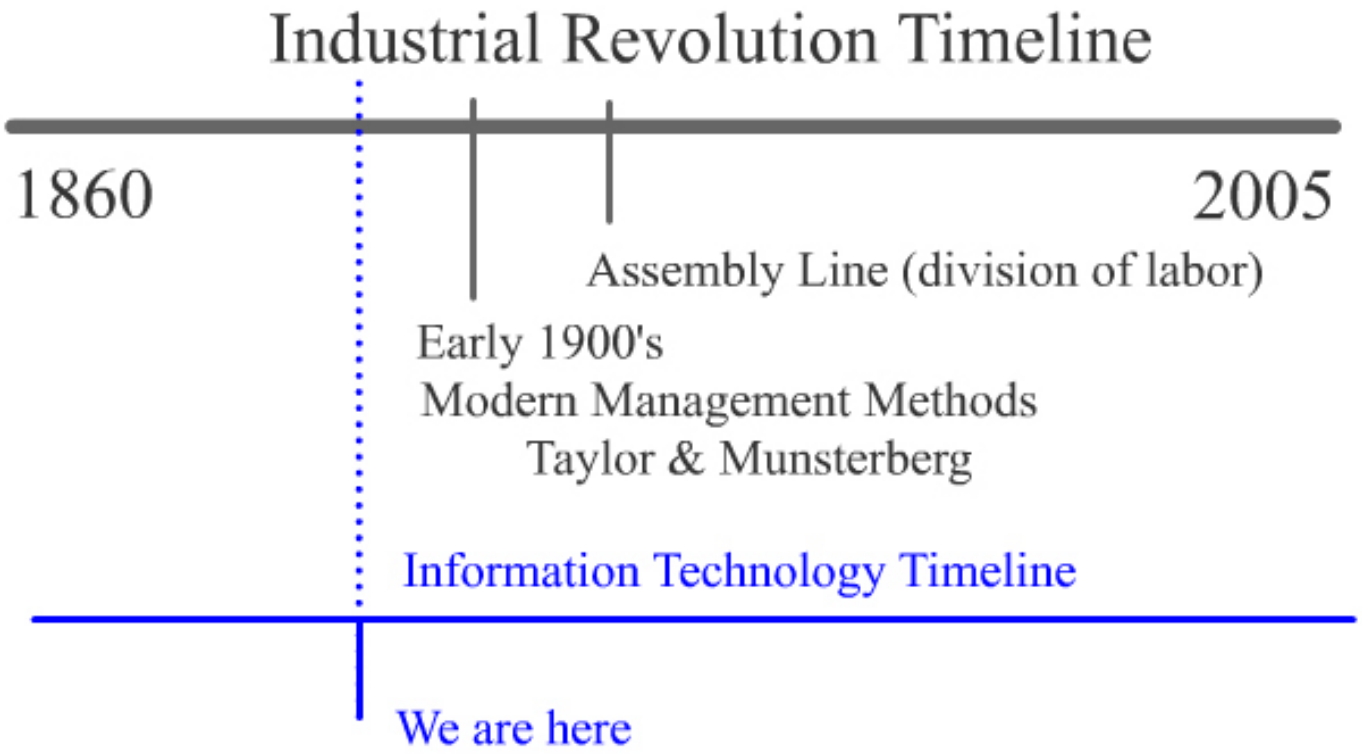
Estimate the Surface Area of a
A can of diet coke

Ignore the facts…

- Seldom does Saul become Paul
- Temporal Provincials
  - People who are ignorant of history and proud of it.

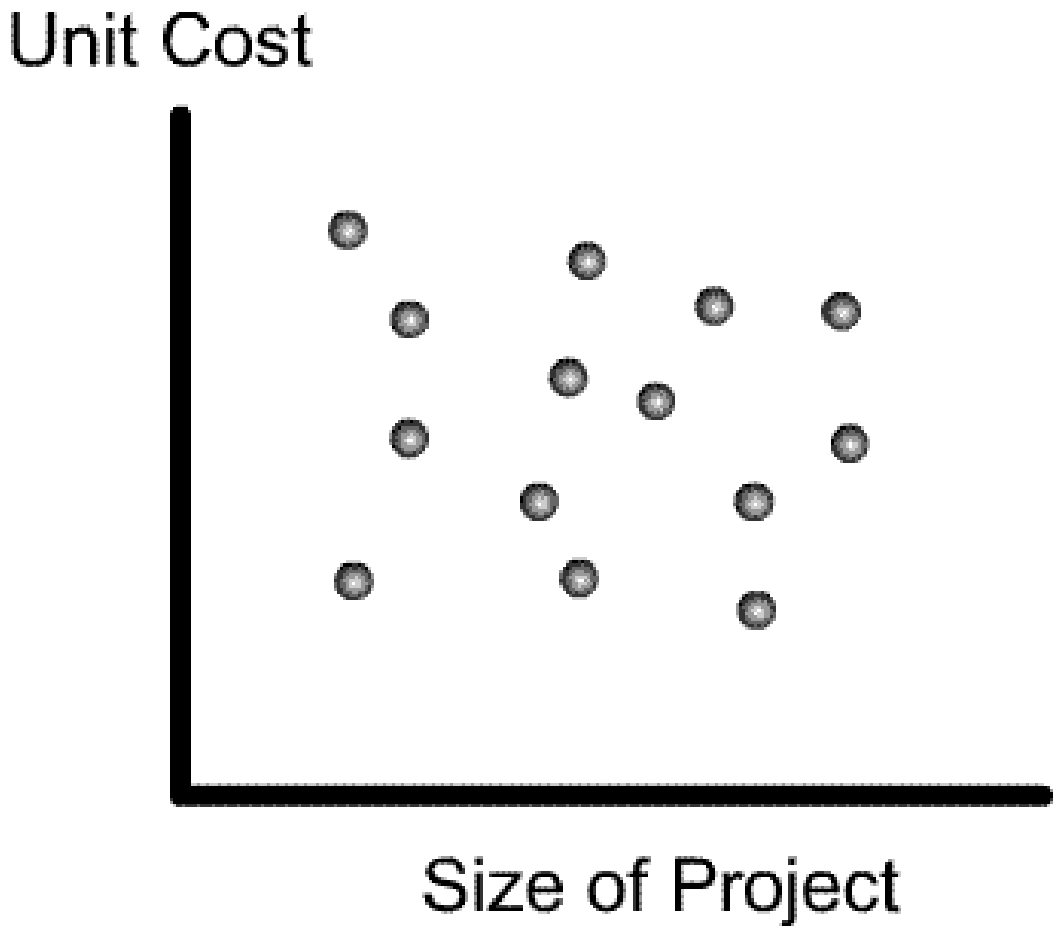
Unskilled & Unaware

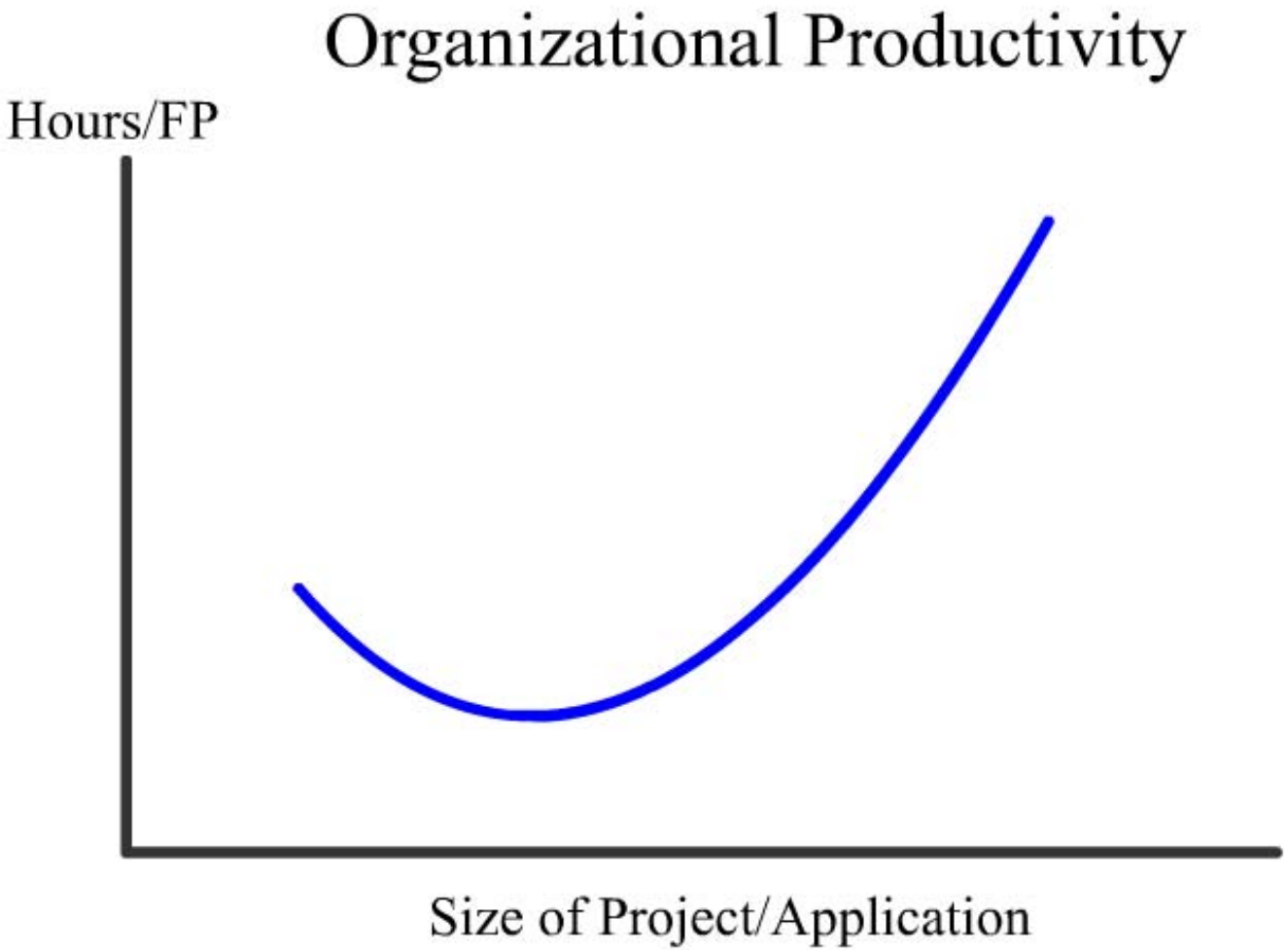


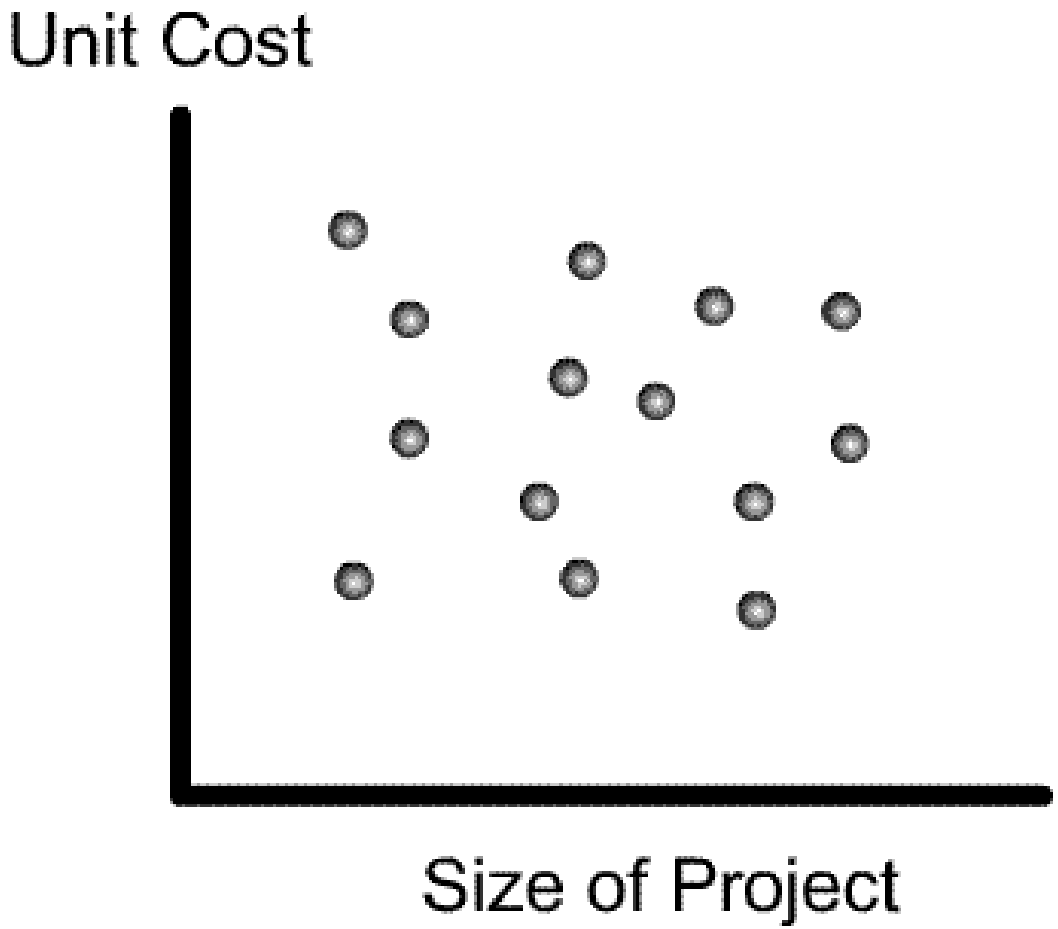

Industrial Revolution Timeline
1860
2005
Assembly Line (division of labor)
Early 1900's
Modern Management Methods
Taylor & Munsterberg
Information Technology Timeline
We are here

Measuring Consistency

- Variations in Productivity or Unit Cost
  - Hours Per Function Point
  - $ Per Function Point

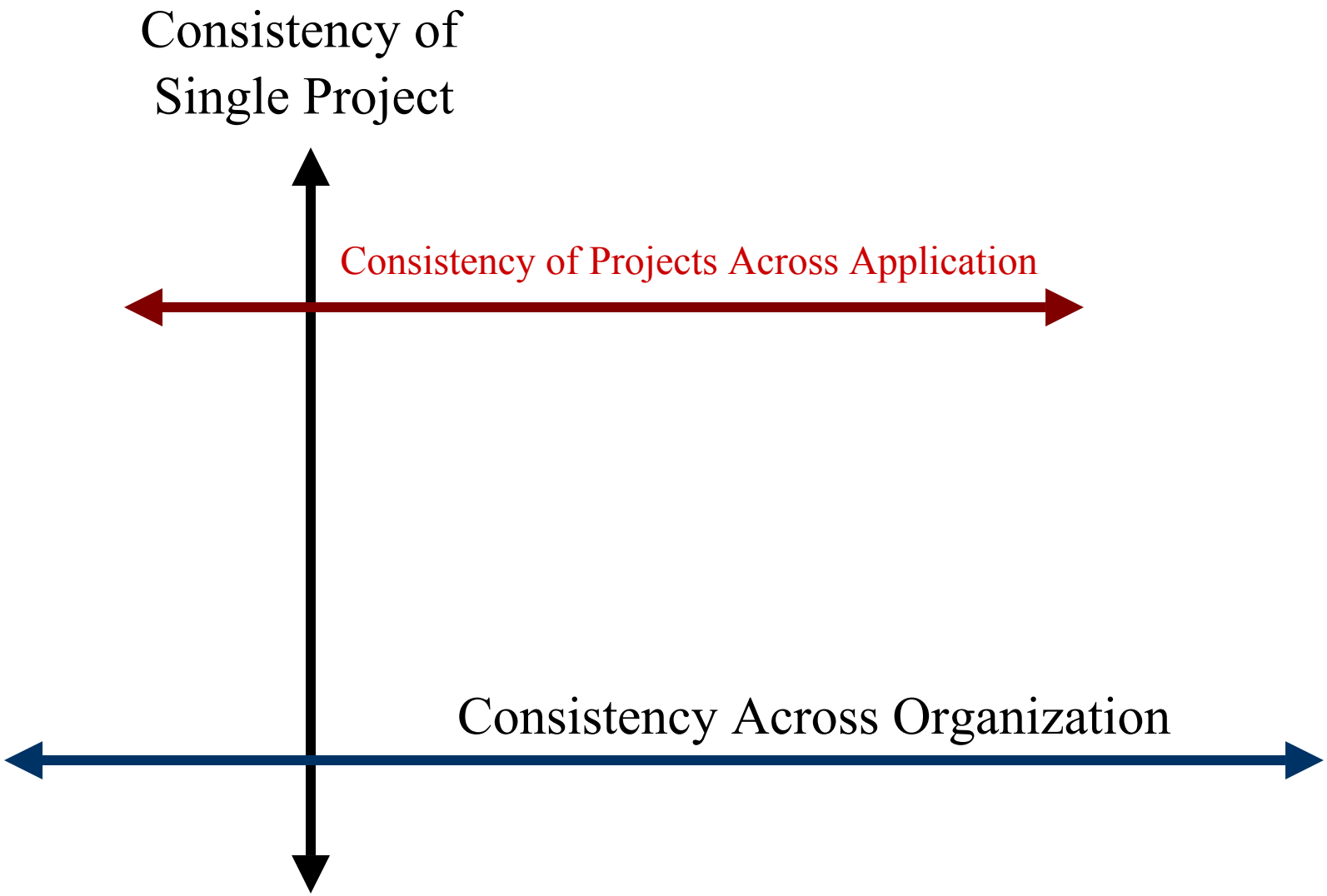

Unit Cost
Size of Project


Organizational Productivity
Hours/FP
Size of Project/Application


Unit Cost
Size of Project

Causes of Variation

- Projects are done inconsistent
- Projects are done differently every time
- Documentation is not similar within a project and especially between projects.


Consistency of
Single Project
Consistency of Projects Across Application
Consistency Across Organization

Measuring Consistency

- Select 12 or so projects (sample)
- Standard Deviation
- Average
- Use a tool like Microsoft Excel

Create Confidence Intervals

$$\overline{x} \pm 1.96\left(\frac{\sigma}{\sqrt{n}}\right)$$

$\overline{X}$ is the mean or average

σ is the standard deviation

The sample size is *n*

1.96 is confidence at 95%

Large Margin of Error

$$1.96\left(\frac{\sigma}{\sqrt{n}}\right)$$

Large risk!
The wider the confidence interval
The less predictable

Example

- Average Hours Per Function = 8
- Standard Deviation is 4
- Sample size is 36

$$8 \pm 1.96\left(\frac{4}{\sqrt{36}}\right)$$

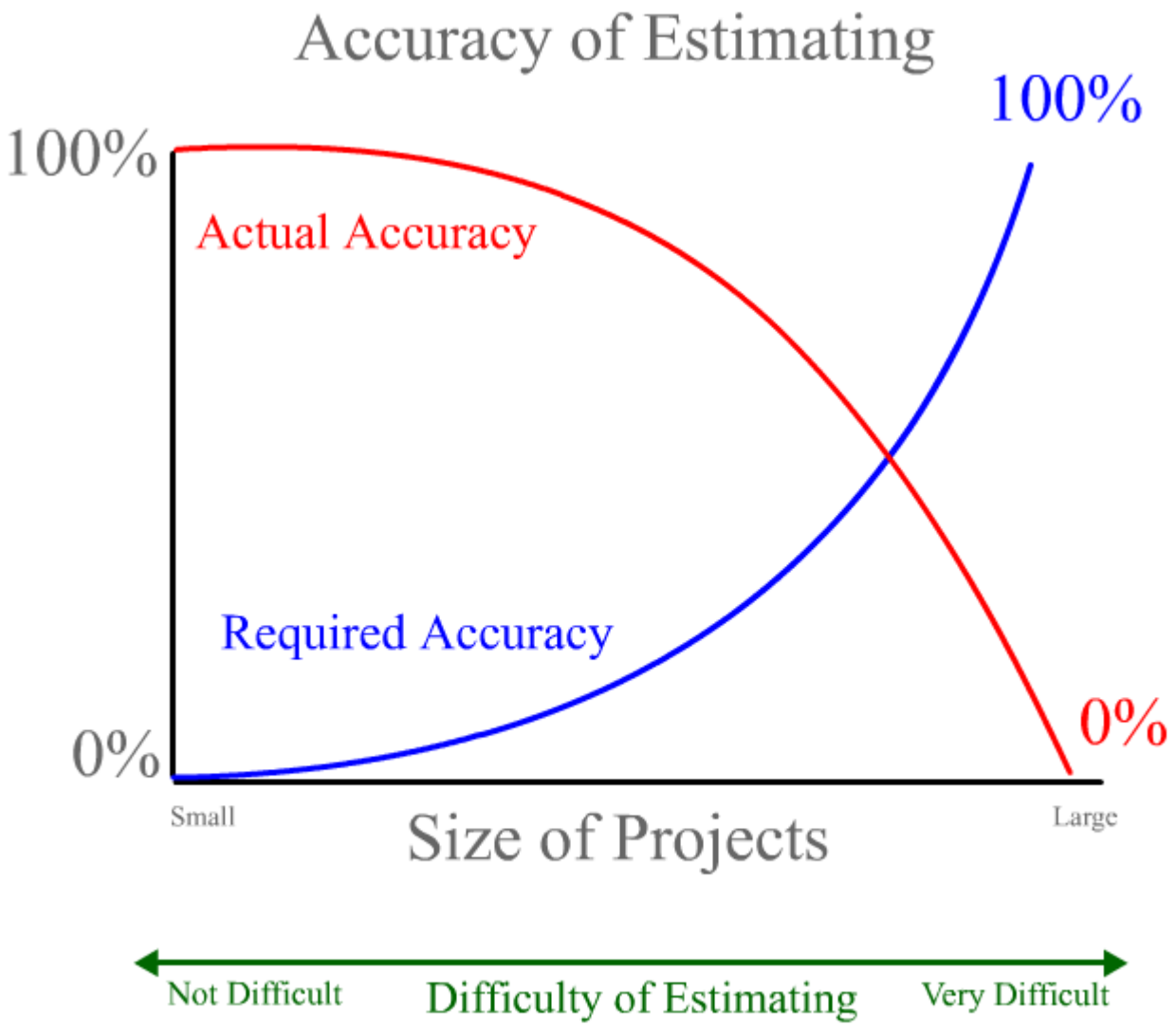
Works out to be…

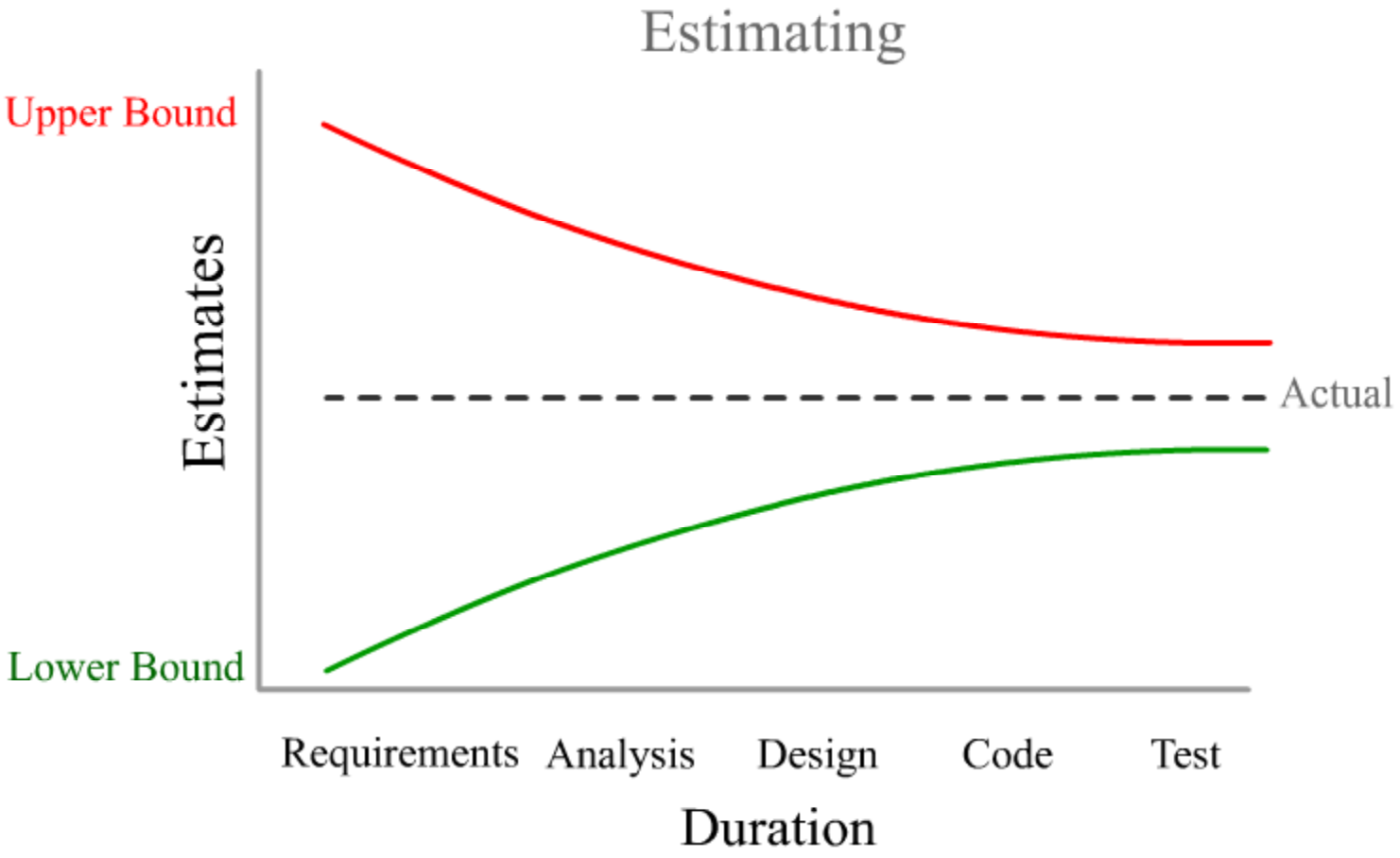
- 6.7 to 9.3 hours per function
- Mean of 8 hours per function

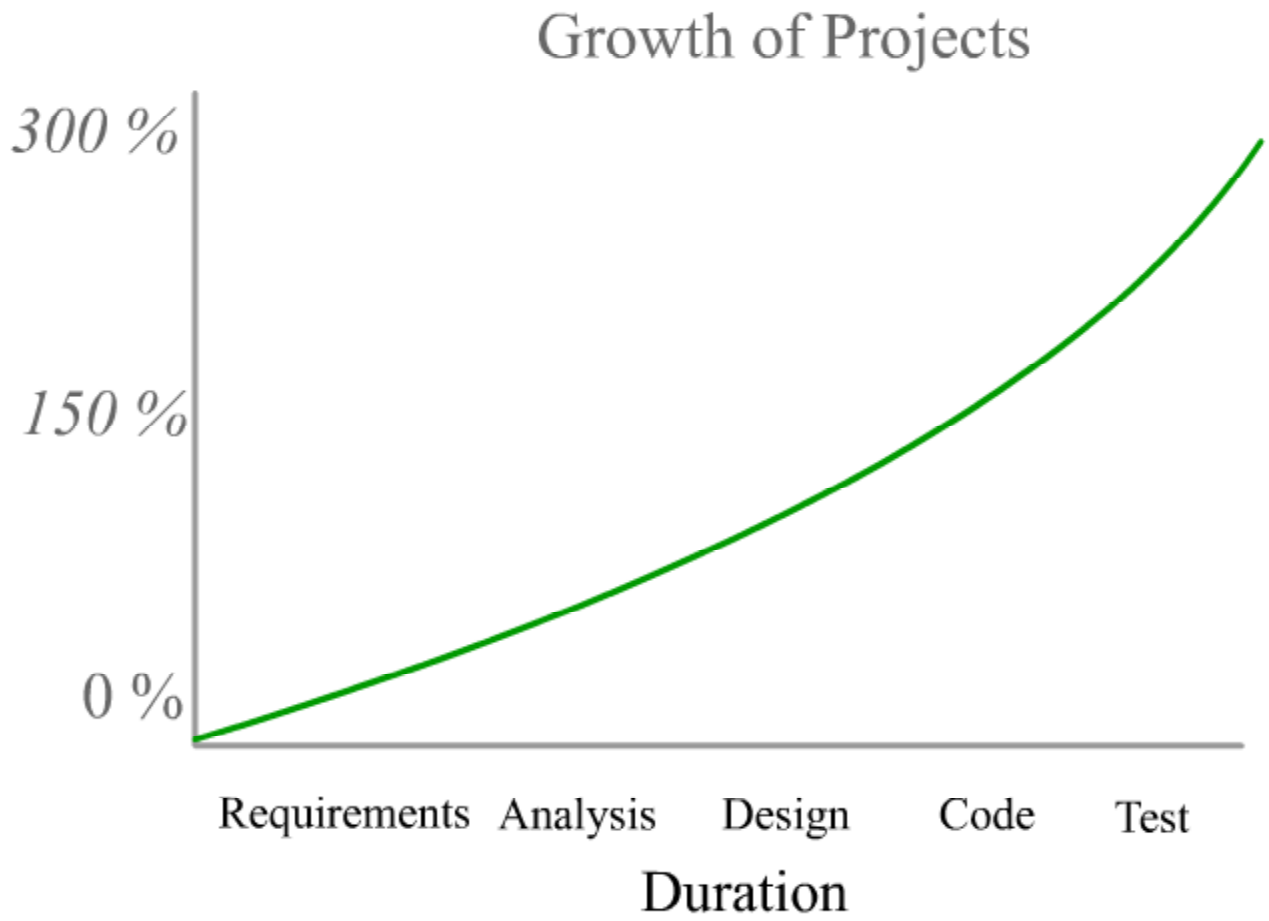
- This is your estimating interval also!
  - Based upon past performance.
- If interval is too wide, the you need to do projects consistently.

Estimate

- New project is 100 function points
  - Estimate is between 670 hours to 930 hours.
  - Just 100 times lower and upper bounds


Accuracy of Estimating
100%
100%
Actual Accuracy
Required Accuracy
0%
0%
Small
Large
Size of Projects
Not Difficult
Difficulty of Estimating
Very Difficult


Estimating
Upper Bound
Estimates
Actual
Lower Bound
Requirements
Analysis
Design
Code
Test
Duration


Growth of Projects
300 %
150 %
0 %
Requirements
Analysis
Design
Code
Test
Duration

42

Industry Guidelines

- For projects less than 1,000 function points
  2 – 15 hours per function point

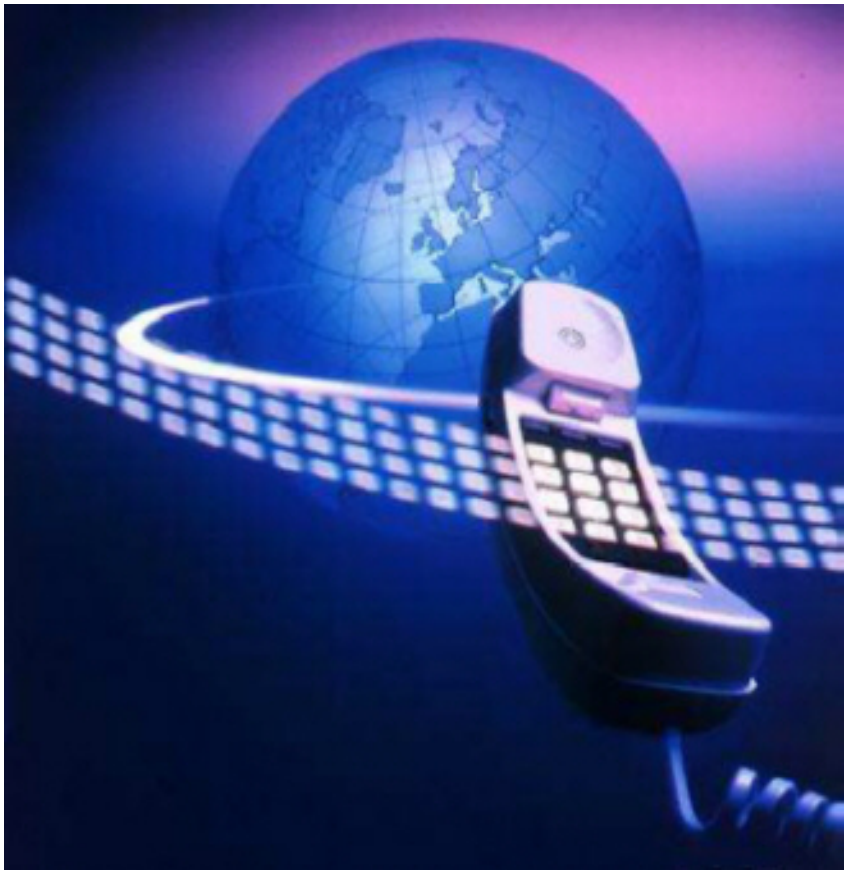
- Projects between 1,000 – 5,000 function points
  8 – 35 hours per function point

- For projects larger than 5,000 function points
  15 – 60 hours per function point

Review

- Sample several projects
- Calculate Hours Per Function Point
- Calculate Standard Deviation
- Calculate Confidence Intervals
- Oui La! Estimating model.

A different perspective



Consistency in Requirements

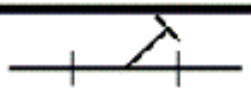
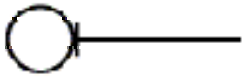
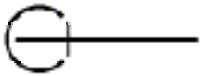
- In consistent requirements leads to
  - Missed requirements
  - Incomplete requirements
  - Requirement which can’t be measured
  - Requirements which can’t be tested.
- In consistent requirements is risky business

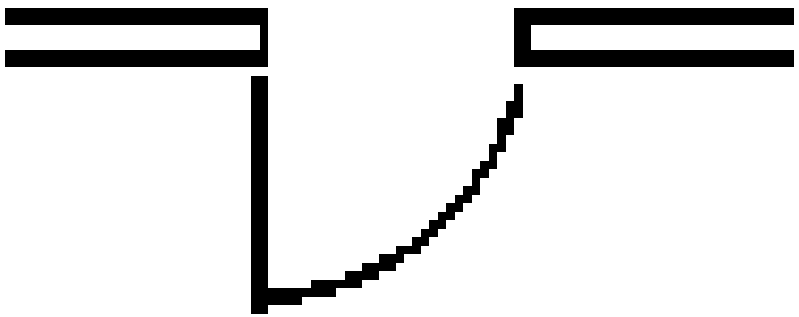
Example

- Examined a single Requirements/Design document
- Within a single document used 5 different verbs
  - **Get**, Find, Fetch, Retrieve, Query all meaning the same thing
  - **Get** alone would have been just fine.

Example for a Client

- Examined 3 projects
- Used 68 verbs to describe a few actions
  - Delete 3 different verbs
  - Add 15 different verbs
  - Change 17 different verbs
  - Inquiry 14 different verbs
  - Output 19 different verbs
- Verbs used inconsistently and redundantly.

 WATER METER	COLD WATER
HOT WATER	VENT LINE
SANITARY WASTE	G GAS PIPE
 GATE VALVE	 WATER HEATER SHUT OFF
 WATER CLOSET	 LAVATORY
 WATER HEATER	 DISHWASHER
 CLOTHES WASHER	 FLOOR DRAIN
 CLEAN OUT	 VENT THRU ROOF
 90° ELBOW	 PIPE TURNS UP
 PIPE TURNS DOWN	 TEE
 UNION	 CAP



No Glossary!

- Inconsistent Requirements
- No acceptance criteria
- High Risk of
    - Project Growth
    - Missed Requirements
    - Misunderstood Requirements
    - Requirements which cannot be measured.

Requirements Standards

- **Get** describes the action of retrieving information from a data base
  - Using another verb to describe this same action would be considered a defect.
    - Determine the frequency of using another verb such as retrieve or fetch.
    - Determine the number of verbs used to describe the same exact action.

Requirement Standards
(Glossary)

- Improved productivity (upto about 8 fold).
- Consistent and Predictable
- Less Risk

Most IT Organizations

- Fabricate estimates

Confidence Intervals

- Requirements 8% to 22%
- Analysis 7% to 11%
- Design 7% to 11%
- Code 25% and 35%
- Testing 28% to 55%
- Implementation 1% to 5%

Relationship

- Those companies who spend the highest percent of time in requirements have the highest productivity rates.
- Spend the least amount of time testing.

Productivity v. Quality

- A direct relationship between productivity and quality.
- Those organizations with high productivity rates also have high quality.

Measuring Risk

- The key to understanding risk is measuring consistency.
- The less consistent the less predictable.

Productivity

- It is difficult (maybe impossible) to reduce productivity by reducing cost.
    - Cost / FP
- In fact, for each $1 reduction in cost increases cost/fp by about $1.18
- Trying to improve productivity by reducing cost has the opposite effect.

Now What

- You don’t have any unit cost figures?
- You still can calculate intervals on phases and/or tasks.

Questions

(don’t worry be happy!)

- I’ll give you my phone number
  - 816.739.4058
- David@SoftwareMetrics.Com
- SoftwareMetrics.Com
  - More information than you will ever need on FPA.