

Changing Behavior:

The key to adoption of complex process technology

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My goals for this presentation

- 1) Present new or different approaches to technology transition
- 2) Challenge your current thinking (changing change agents is hard)
- 3) Describe what I see is working in the field (and my thoughts on why)
- 4) Focus on the potential benefits to you and your organization inherent in these approaches to change
- 5) Describe my reactions and internalization of the approaches



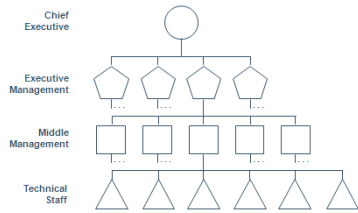
Topics

- Current SEI Change Management Approach
- What's Needed
- A New Approach
- Bandura Social Learning
- Bayesian Belief Networks

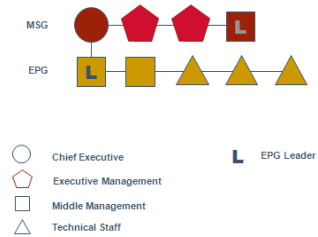


Comprehensive System Change Model (IDEAL)

Typical Organization Structure



Staffing the Process Infrastructure

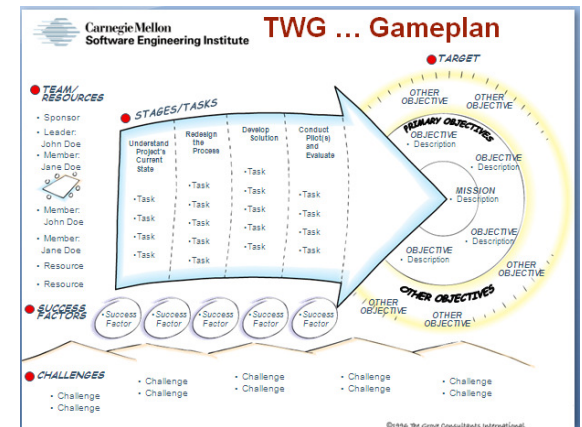


A Process Improvement Infrastructure

Core Teams are typically formed and given responsibilities and roles for managing, facilitating, and implementing a change effort from start to finish.

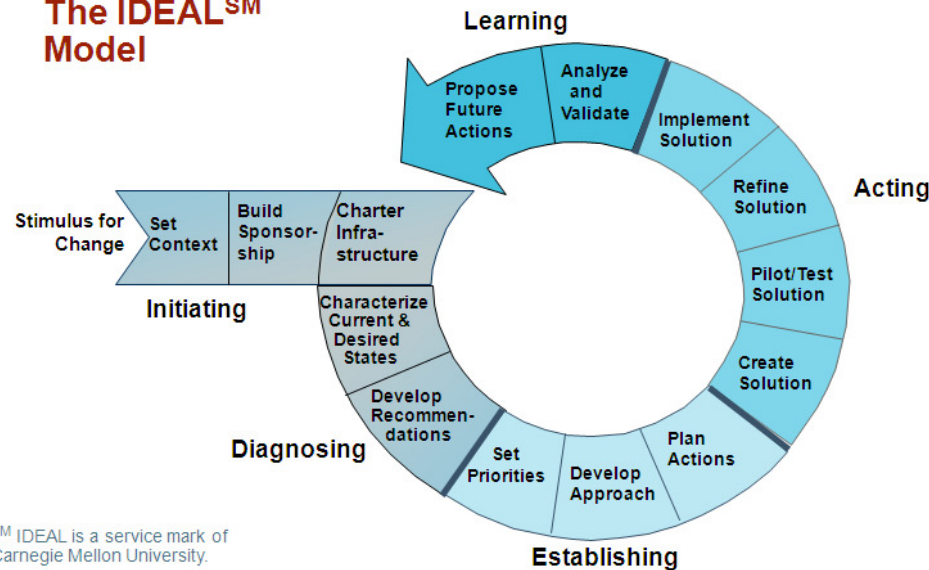


The Process Change Method



SEI IDEAL™ Model

The IDEALSM Model



Based on Org Change Principles:

Action Research

Socio-tech Systems

Plan Do Check Act

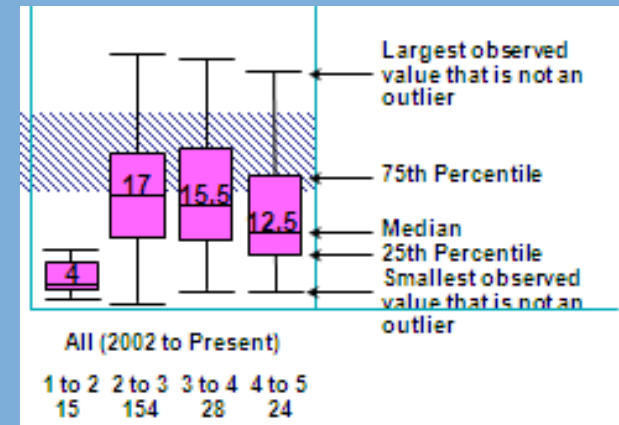
Cascading Sponsorship

Parallel learning Structures (SEPG)

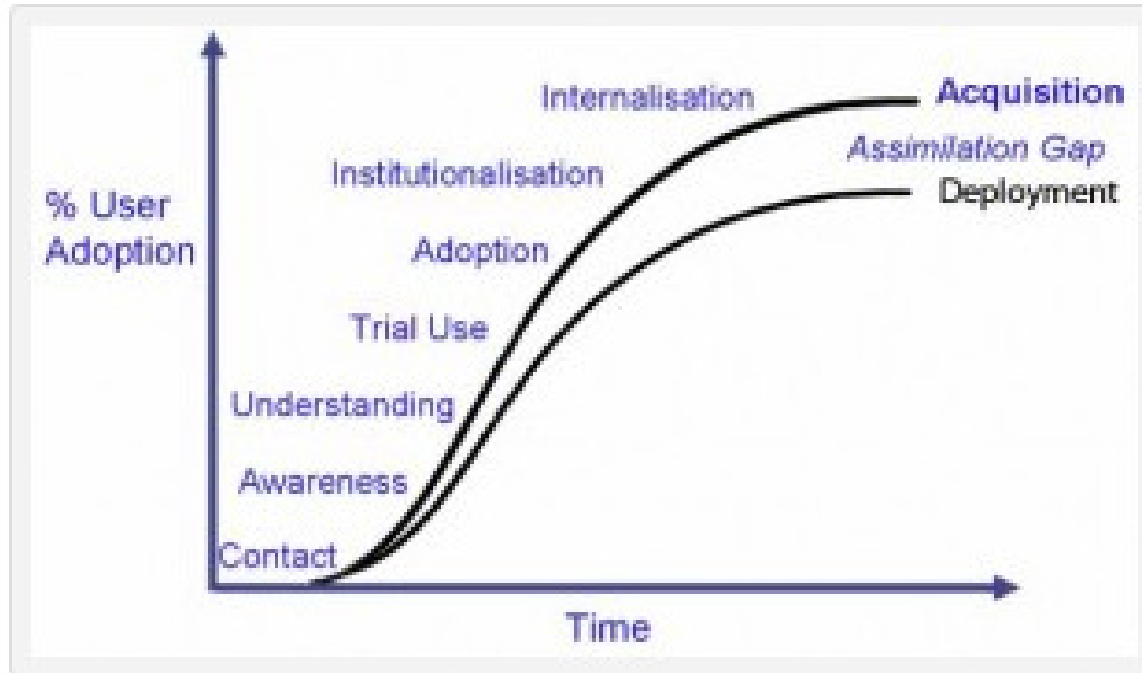
SM IDEAL is a service mark of Carnegie Mellon University.

My experience with using IDEAL:

- Takes too long (SEI time to move up)
- Costs too much
- Engineers don't embrace it
- Hard to sell Management Value Proposition



The assimilation gap is the gap between the objective and the deployment



Assimilation Gap

- 1) Implementation gap
- 2) Performance gap

Robert G. Fichman, Chris F. Kemerer, *"The Illusory Diffusion of Innovation : An Examination Of Assimilation Gaps"*, Working Paper Series No.746, Katz Graduate School of Business, University of Pittsburgh, November 1995.



Interested In ?

A streamlined transition approach that provides:

- Compelling Management Value Proposition
 - Predictable Costs
 - Creeping Commitment
 - Quick results with measurable ROI
- Concentrated and Focused process investments
- Accelerated Learning Environment
 - New Processes, New Experiences, New Data, New Beliefs, New Behaviors
- Rapid Predictable Organizational Adoption
- Continually Measurable Results

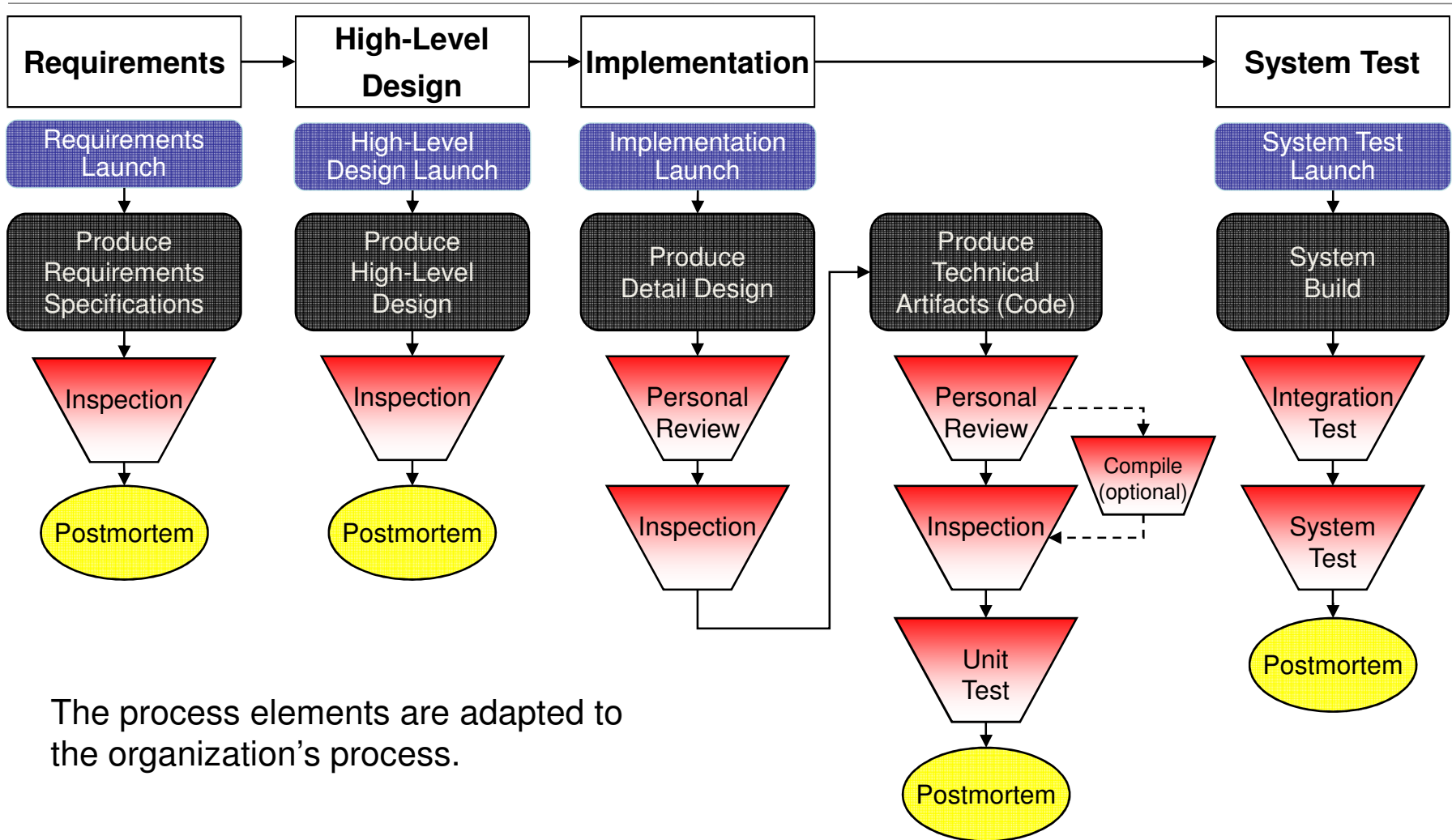


Major Differences in Approach to Transition

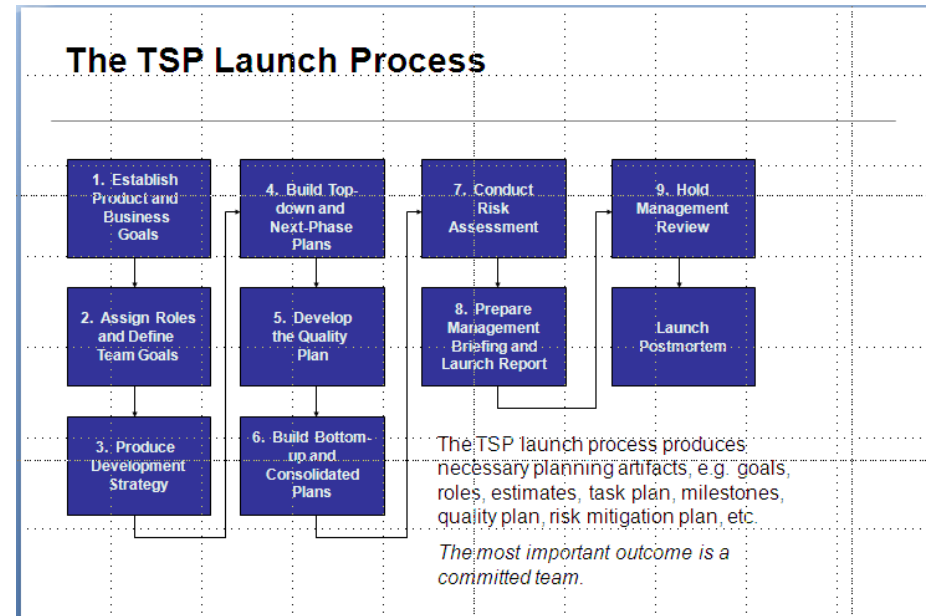
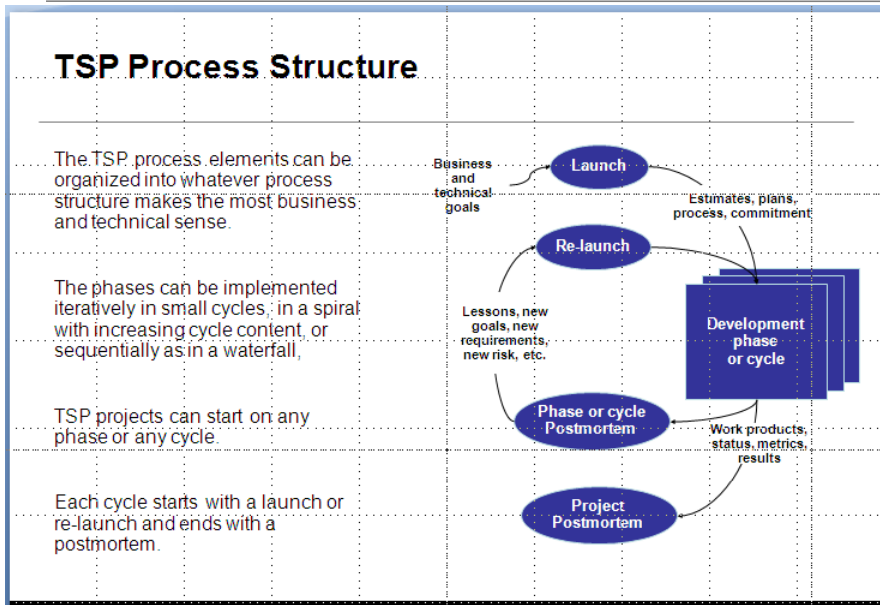
- Concentrated Process
 - Comprehensive Packaged Operational System of Integrated Processes
 - Proven Performance
 - Integrated Operational Measurement System (Individual level)
- Focused Implementation Strategy
 - Unit oriented (Project/Team)
 - JIT Concentrated 3 level Training
 - Accelerated Learning Laboratory
 - Effective Project/Team Launch Process
 - Coaching and continued support



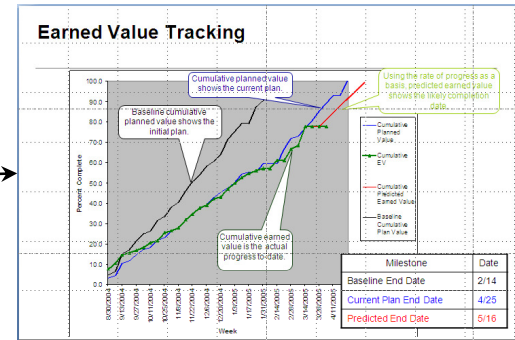
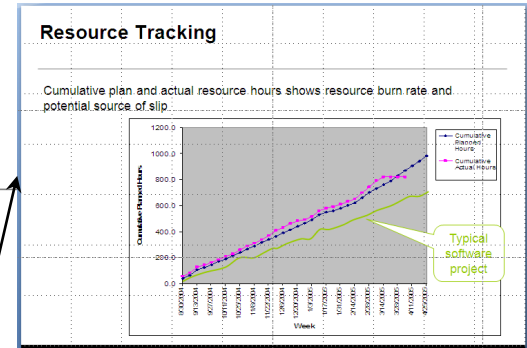
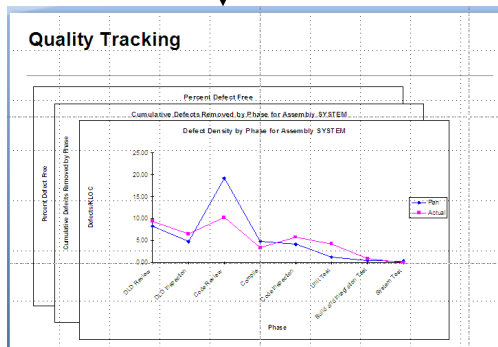
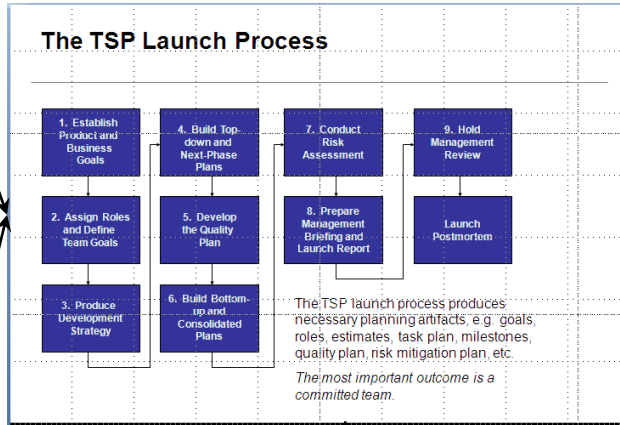
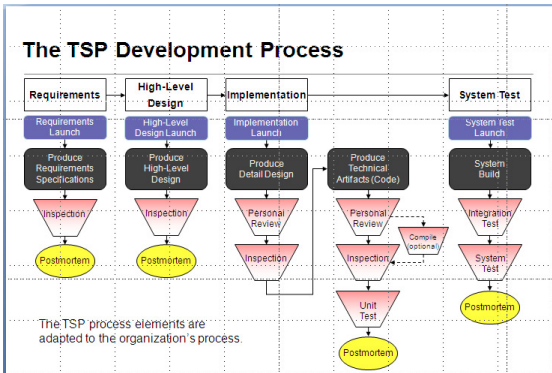
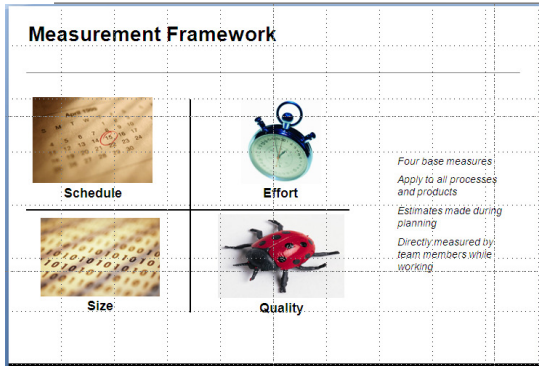
Comprehensive HP Development Process



Effective Project/Team Launch Process



Operational Plans Implemented Processes



TSP Weekly Status Report

TSP Week Summary - Form WEEK

Name: _____ Date: 4/2/2003

Team: PSP Object _____

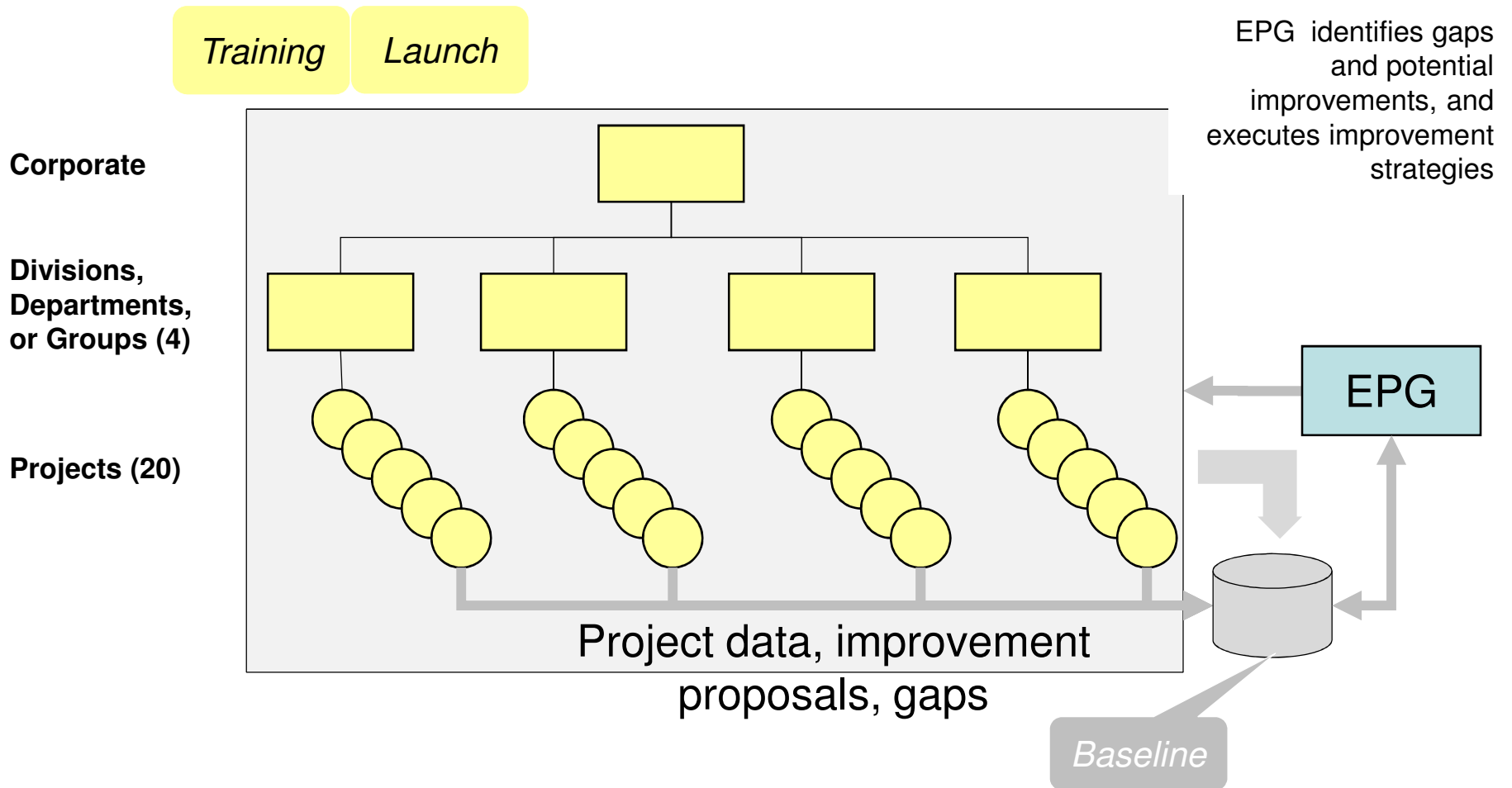
Status for Week: _____ Week Date: 3/30/03

Weekly Data	Plan	Actual	Actual vs Plan
Schedule hours for this week	155.0	88.0	-67.0
Schedule hours this cycle to date	1526.0	1034.0	-492.0
Earned value for this week	0.0	4.2	4.2
Earned value this cycle to date	75.0	161.3	86.3
To-date hours for tasks completed	1560.7	1468.1	-92.6
To-date average hours per week	121.3	109.3	-12.0

Assembly	Phase	Tasks Completed or Due	Resource	Task Plan	Task Actual	Plan vs. Actual	Planned	Plan vs. Actual
Main Form	CODENSP	Main Form Code Inspection	SA	1.6	2.4	0.8	10	0.83
DEMCO Delivery assn	UT	DEMCO Delivery assn (E-Change) UTR	SA	0.0	0.0	0.0	13	2.93
DEMCO Delivery assn	CODE	DEMCO Delivery assn (E-Change) UTR	SA	2.5	1.7	0.8	14	1.86
DEMCO Delivery assn	CS	DEMCO Delivery assn (E-Change) UTR	SA	3.0	1.7	1.3	14	2.28
DEMCO Delivery assn	COMPLETE	DEMCO Delivery assn (E-Change) UTR	SA	1.2	0.0	1.2	14	1.44
DEMCO Delivery assn	CODENSP	DEMCO Delivery assn (E-Change) UTR	SA	0.0	0.0	0.0	14	0.00
DEMCO Delivery assn	UT	DEMCO Delivery assn (E-Change) UTR	SA	0.0	0.0	0.0	14	0.00
Query Object	TCC	Query Object End Development	NS	0.0	0.0	0.0	14	0.00
Query Object	CODENSP	Query Object Code Inspection	NS	0.0	0.0	0.0	14	0.00
Query Object	UT	Query Object Code Inspection	NS	0.0	0.0	0.0	14	0.00



Focused Implementation: Building Organizational Capability Project-by-Project, Team-by-Team

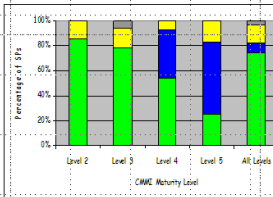


Does it work for Organizations?

TSP Implements CMMI -2

An organization using TSP has directly addressed or implemented most specific practices (SP).

- 85% of SPs at ML2
- 78% of SPs at ML3
- 54% of SPs at ML4
- 25% of SPs at ML5
- 80% of ML2 and ML3 SPs
- 75% of SPs through ML5



Most generic practices are also addressed.

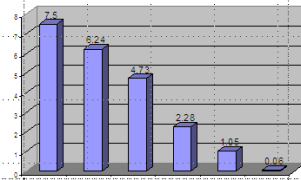
Based on a SCAMPI C of the latest version of TSP.

Reliable Products

An analysis of 20 projects in 13 organizations showed TSP teams averaged 0.06 defects per thousand lines of new or modified code.

Approximately 1/3 of these projects were defect-free.

These results are substantially better than those achieved in high maturity organizations.



Source: CMU/SEI/2003-TR-014

Organizations Using TSP

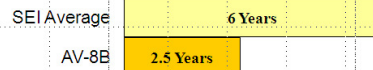
Advanced Information Services, Inc.	Knowledge Partner/QR Riv. Ltd.	SIAC Ingenieros de Software S.A. de C.V.
Centro De Investigacion En Matematicas	Kuwait Institute of Technology	SIACorp Technology
Cosmos International, Inc.	L.D. Electronics	Software Engineering Competence Center (SECC)
COMputing Technologies, Inc.	Logiplex	Software Park Thailand
Davis Systems	Motiv8, LLC	STP, Inc.
DEK International GmbH	National Aeronautics & Space Administration	TOVA INTEGRADORA S.A. de C.V.
Delaware Software, S.A. de C.V.	Next Process Institute Ltd.	TRV
Delivery Excellence	Planix/High Integrity Systems	Universidad Autonoma De Zacatecas
Grupo Empresarial Eisel, S.A. de C.V.	Process & Project Health Services	Universidad de Monterrey
Hansen Consulting	Process	Universidad Regionaria A.C.
Hitachi Software Engineering Co. Ltd.	PS&J Consulting - Software Six Sigma	University of Abu
Idea Entry Corp.	QuantBot	U.S. Air Force (CRSIP/STSC)
Intel/Worktop, Inc.	Sanda National Laboratories	U.S. Census Bureau
Instituto Tecnológico de Estudios Superiores de Monterrey	Science Applications International Corporation (SAIC)	U.S. Navy Air Support Command (NAVAIR)
Iti Esp S.A. de C.V.	Siemens AG	U.S. Naval Oceanographic Office (NAVO)
Kernel Technologies Group/S.A. de CV		

NAVAIR AV-8B TSP/CMMI Experience

AV-8B is a NAVAIR System Support Activity.

They integrate new features into the Marine Harrier aircraft.

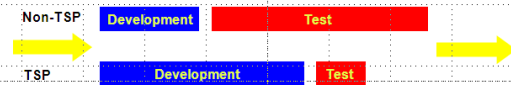
They used TSP to reduce the time to go from CMMI Level 1 to CMMI Level 4.



Productivity Improvement

From data on over 40 TSP teams, Intuit has found that:

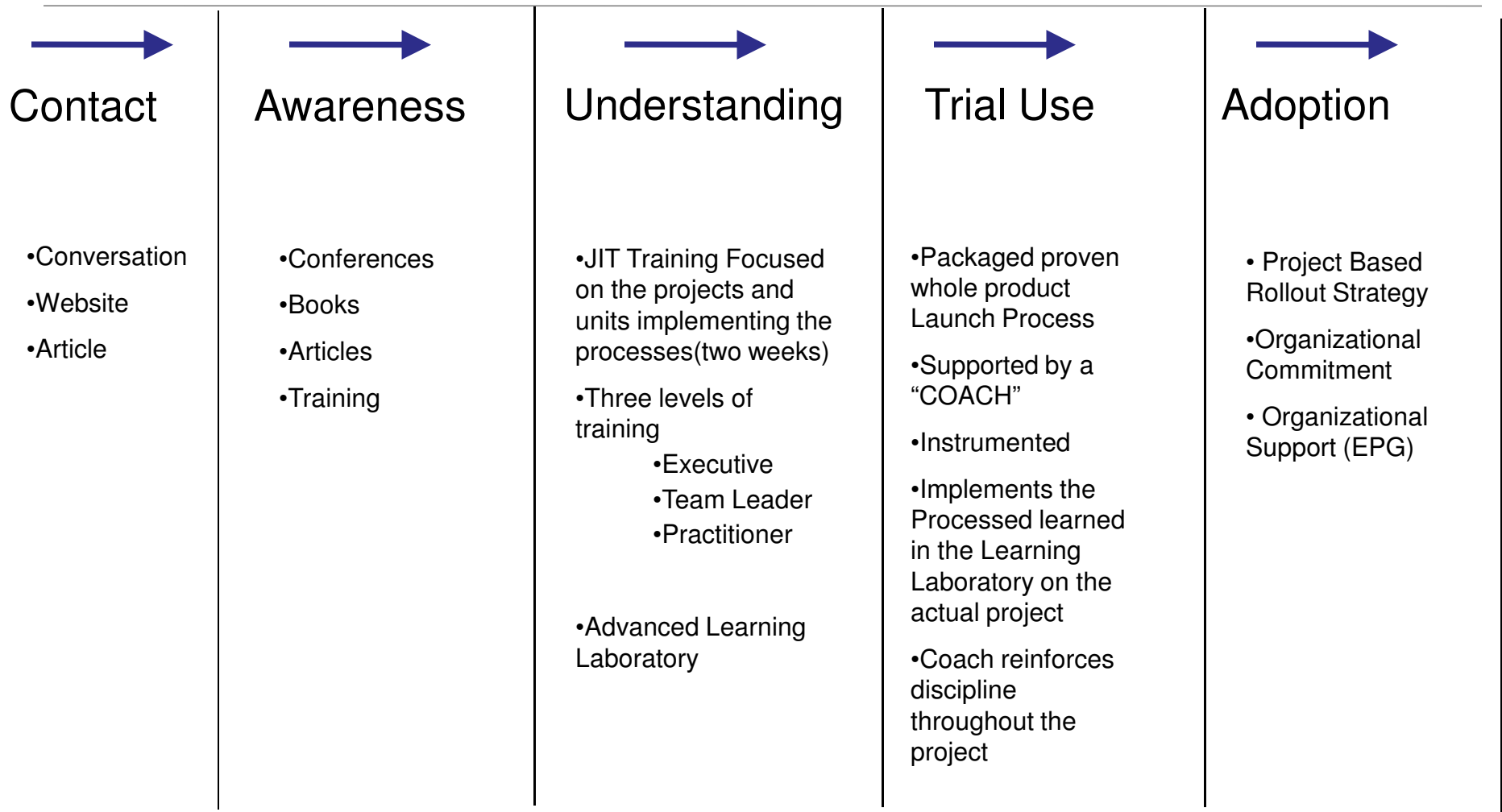
- post code-complete effort is 8% instead of 33% of the project
- for TSP projects, standard test times are cut from 4 months to 1 month or less.



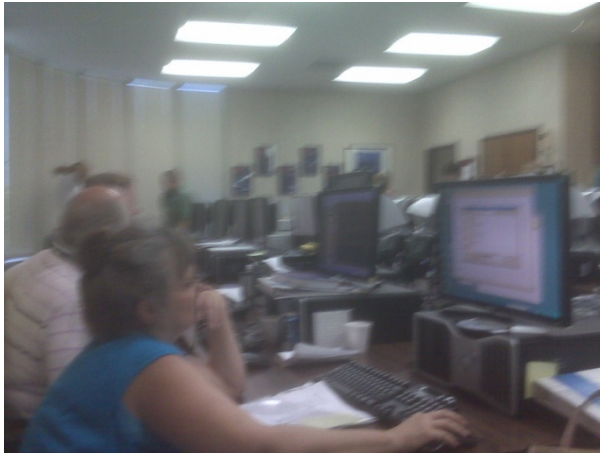
Organizations using TSP report productivity gains of 30% to 80% resulting in lower costs or more functionality in delivered software.



Individual Transition:



Advanced Learning Laboratory



Training ++

Process Simulation

Individual Instrumentation

Immersion Therapy

Self Discovery

Behavioral modification

Challenge current beliefs

Change Behavior

Change Behavior generates new results

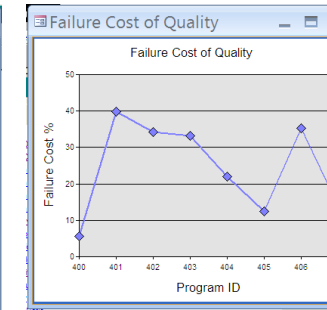
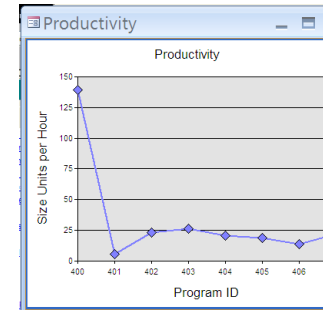
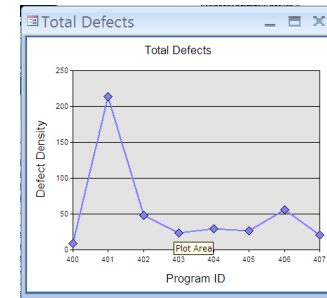
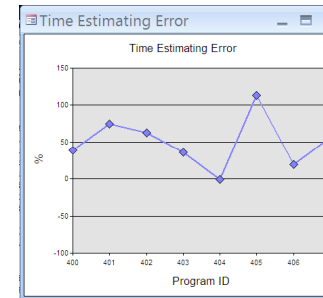
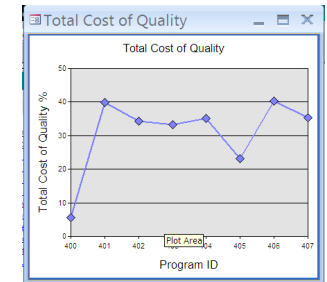
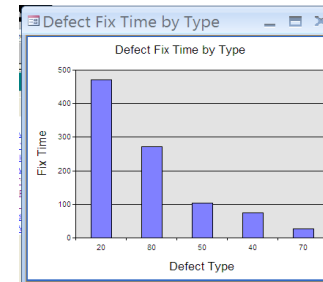
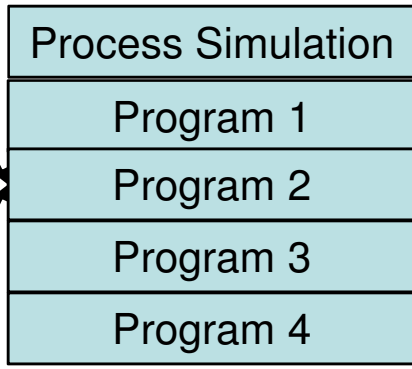
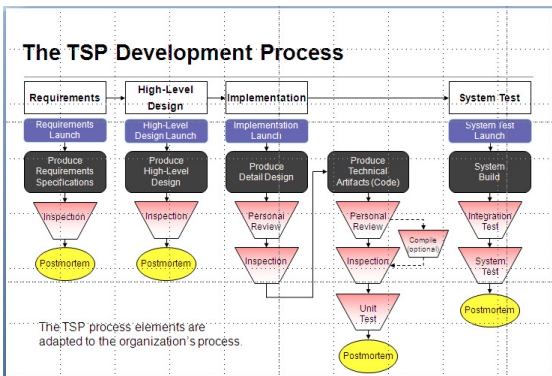
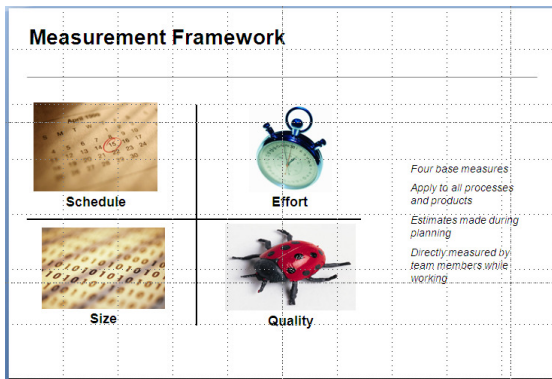


Process Simulation

Results from executing the Process

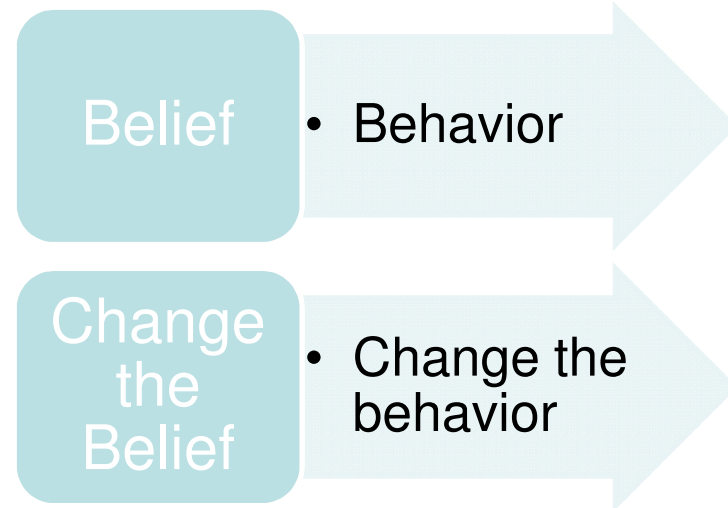
Executing the Processes

Product-Process-Planning Data



Belief Systems and Behavior

Belief drives behavior

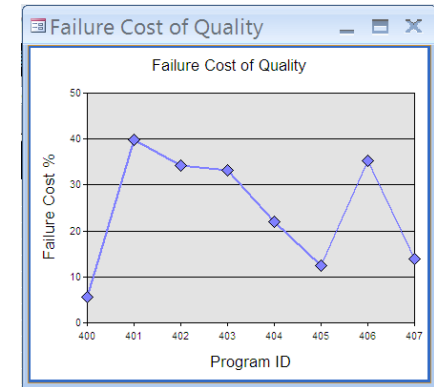
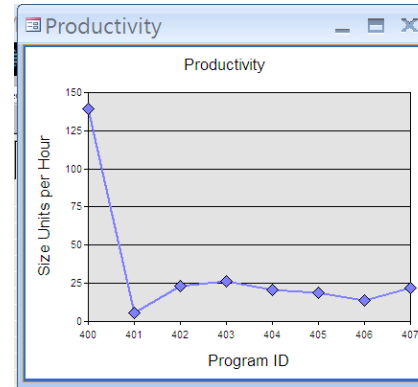
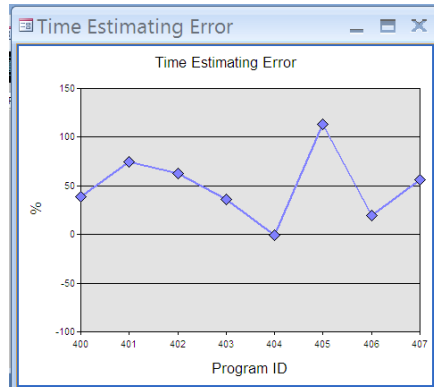
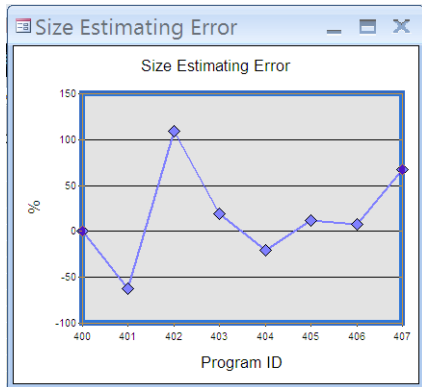


How to change a belief?

Show results inconsistent with the belief



My Beliefs-My Data-- My Journey

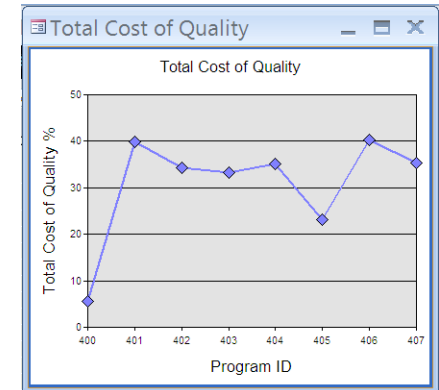


Think

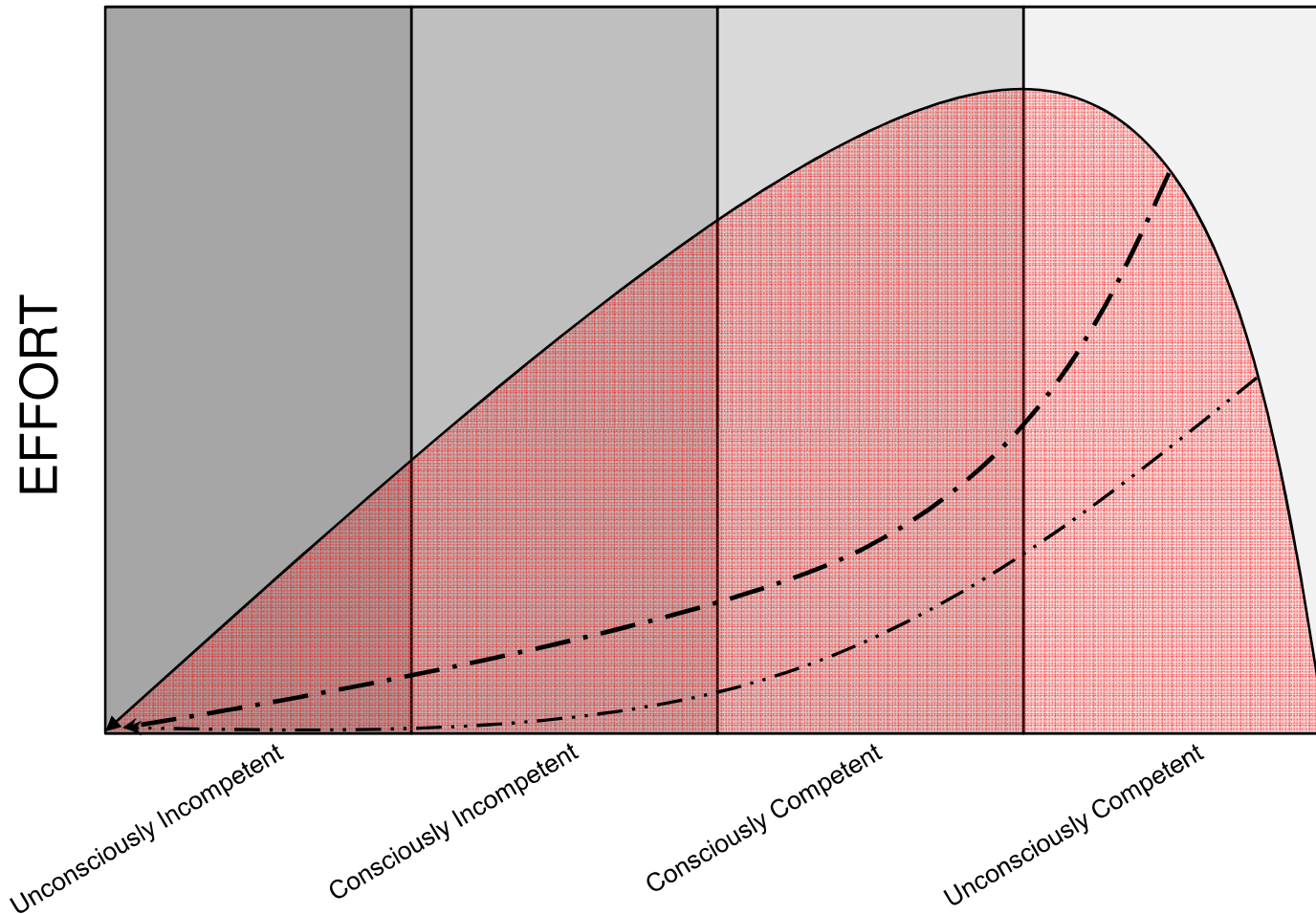
Change



Improve



Consciousness Model and Bandura Social Learning



Bayesian Belief networks

Bayesian Inference Model: Allow the use of prior knowledge.

Let $P(h|\xi)$ be a degree of belief in h given current state of information ξ .

New evidence \tilde{e} is presented.

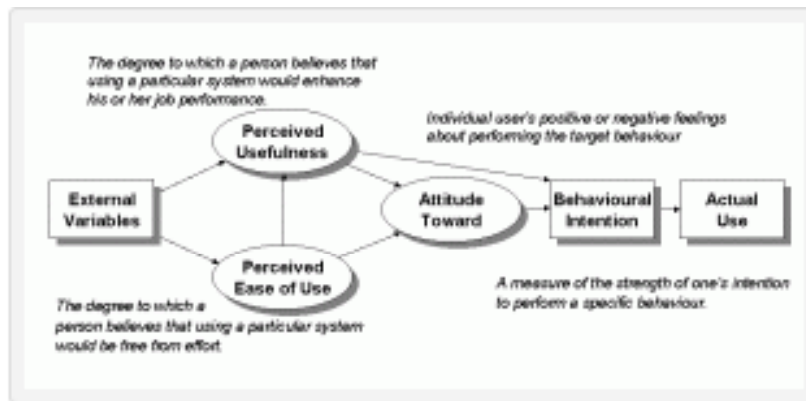
Update using Bayes's Theorem:

$$P(h | \tilde{e}, \xi) = \frac{P(h | \xi) P(\tilde{e} | h, \xi)}{P(\tilde{e} | \xi)}$$



Predicting Behavior based on Beliefs

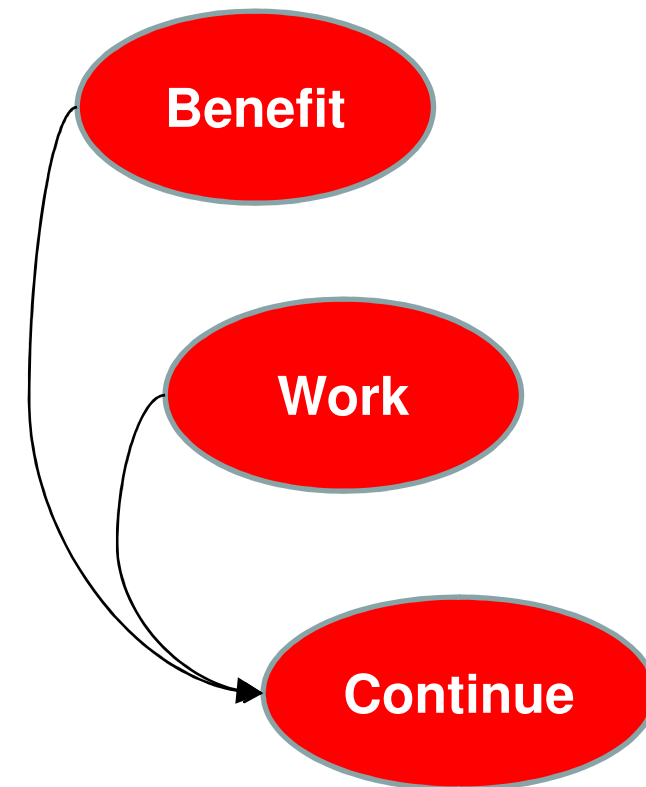
The Technology Acceptance Model is an information systems theory that models how users come to accept and use a technology



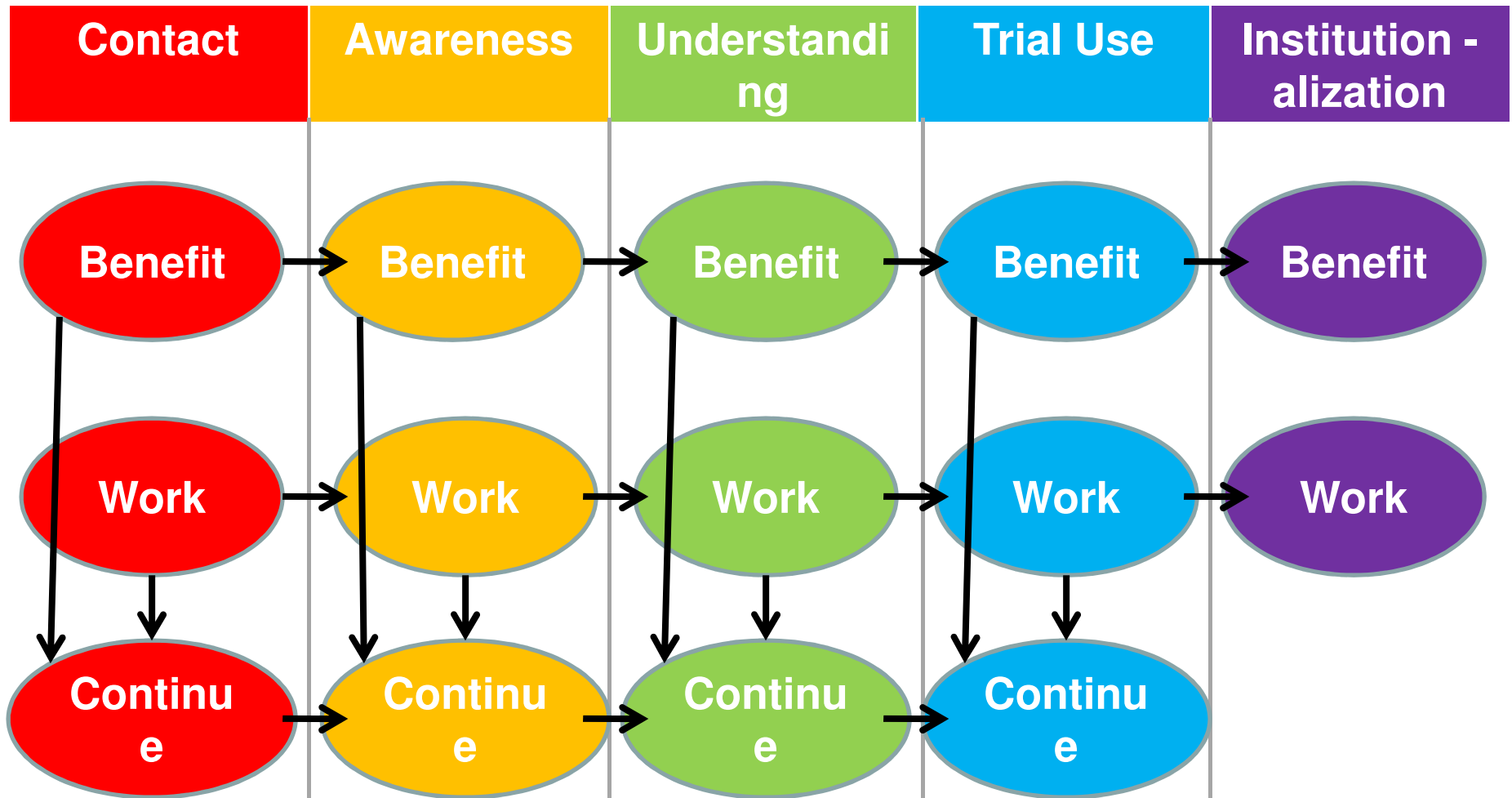
Bagozzi, R. P., Davis, F. D., & Warshaw, P. R. (1992). *Development and test of a theory of technological learning and usage. Human Relations*, 45(7), 660-686.

Simplified Acceptance Model based on Beliefs

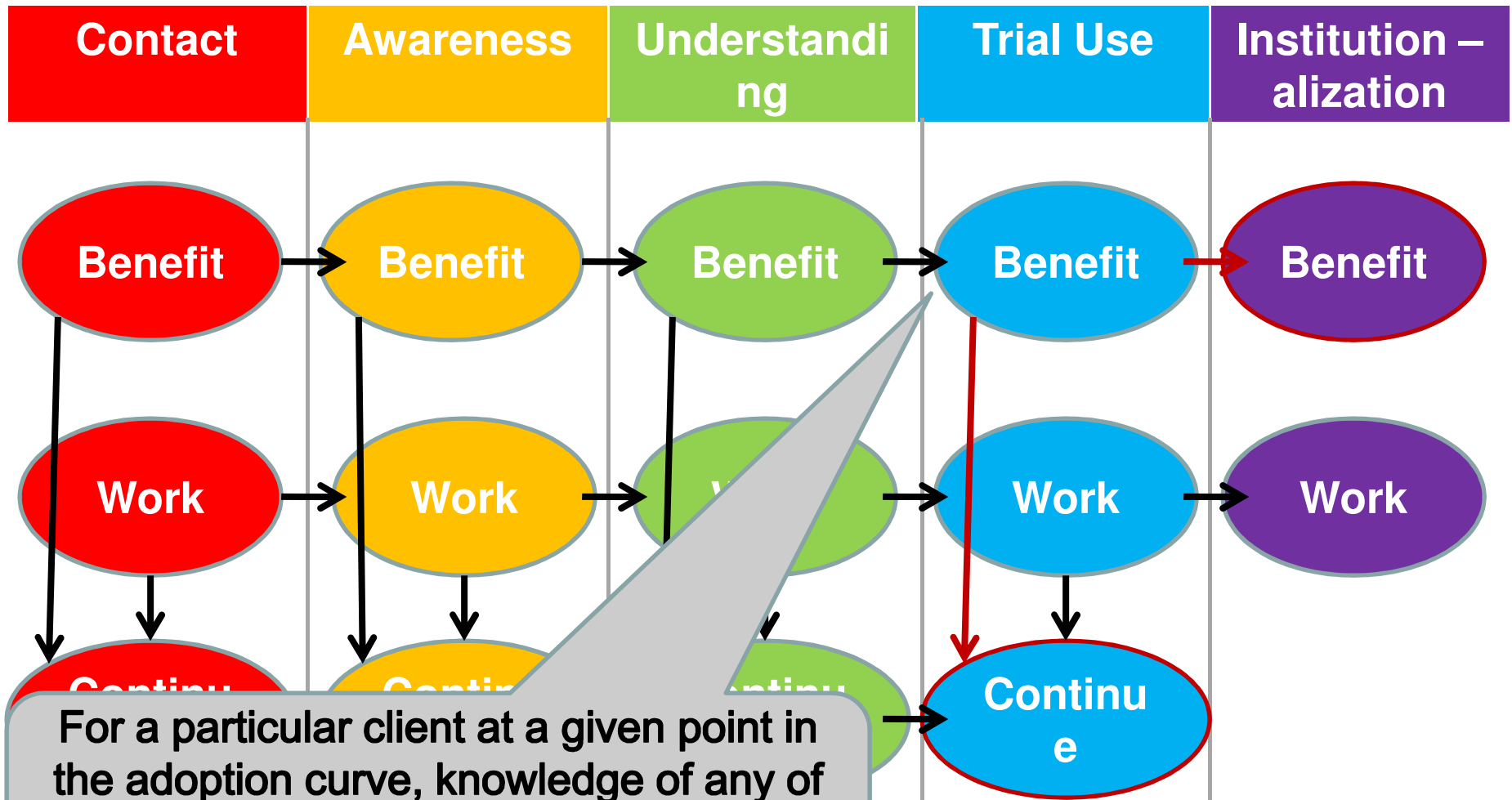
Repeated for Contact, Awareness, Understanding, Trial use and Institutionalization



Concept of a BBN Model

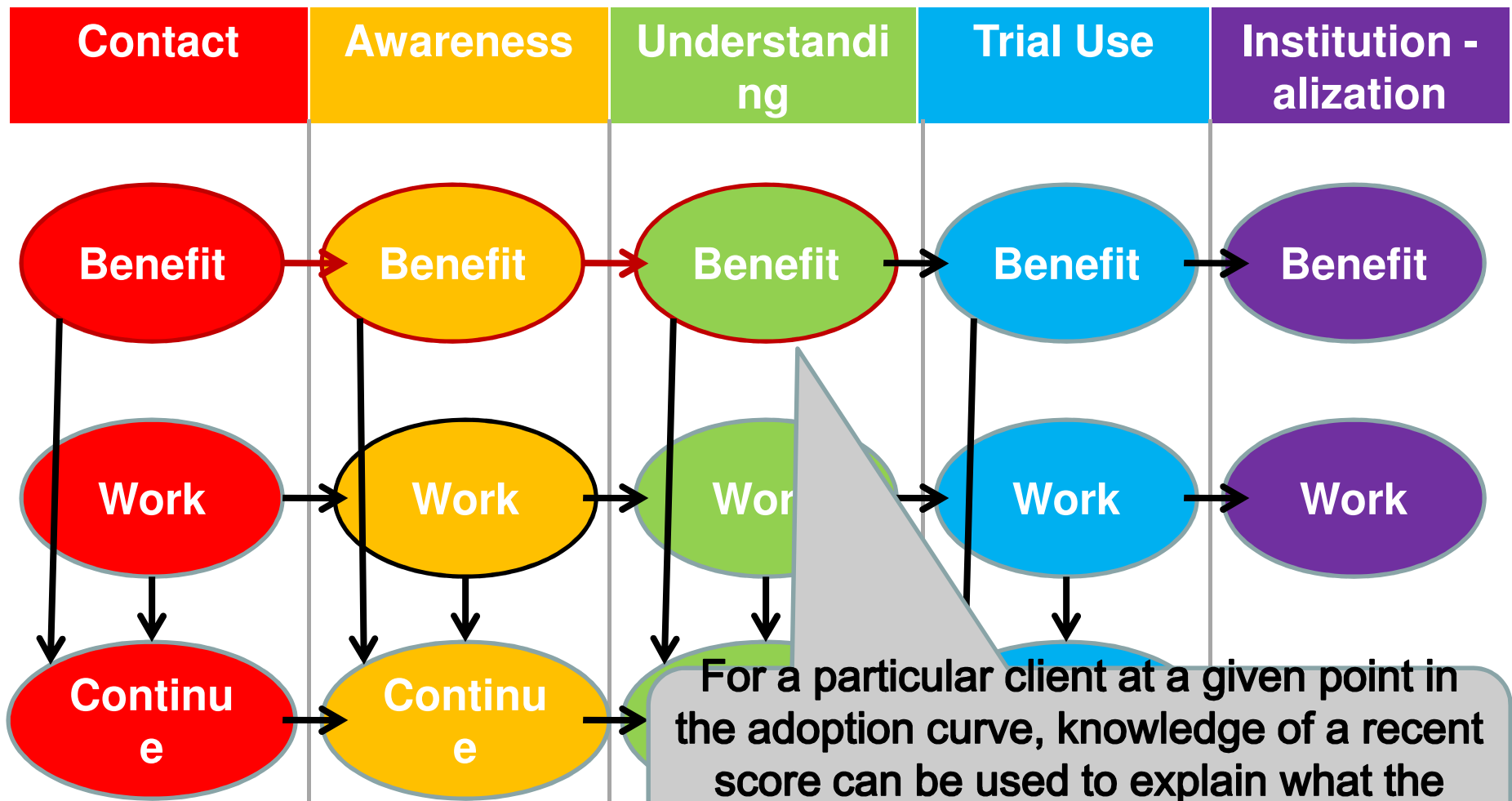


Using BBN Model to Predict Future



For a particular client at a given point in the adoption curve, knowledge of any of the past or present scores can be used to predict the future scores!

Using BBN Model to Explain Past



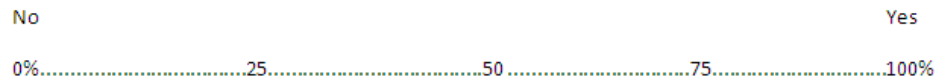
Transition Survey

Awareness:

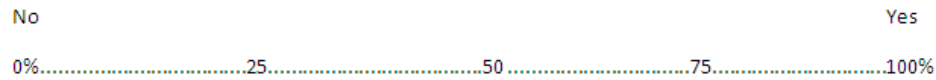
Activity: Executive Seminar/ Team lead training

Page | 3

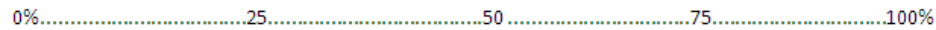
PSP will benefit me/my organization:



PSP/TSP will work for me/ my organization



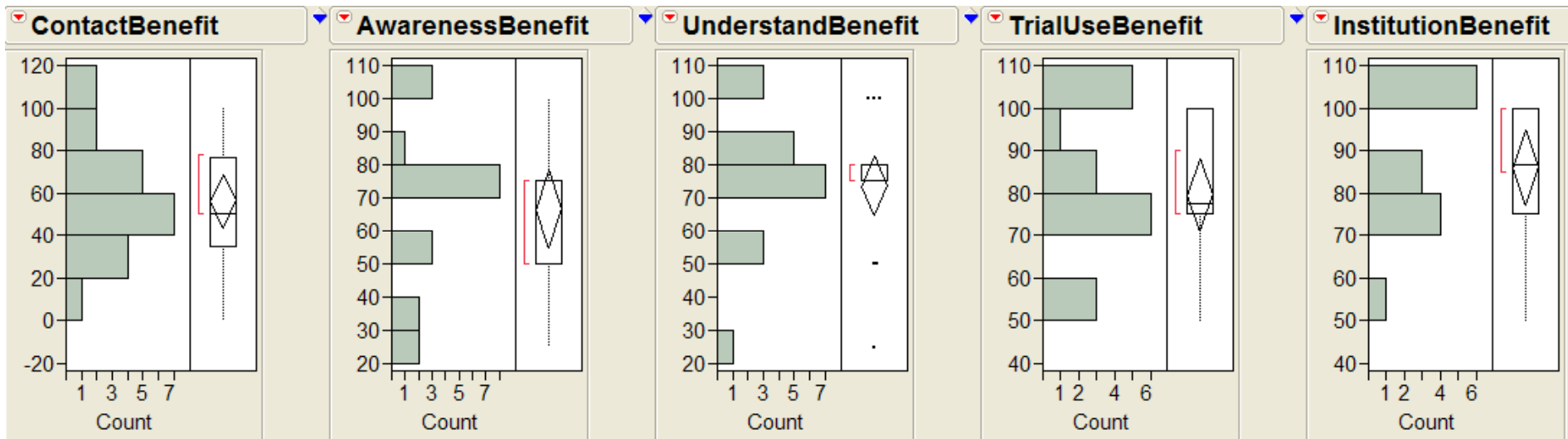
(For Partners) What percentage of clients continue on to understanding



Comments:



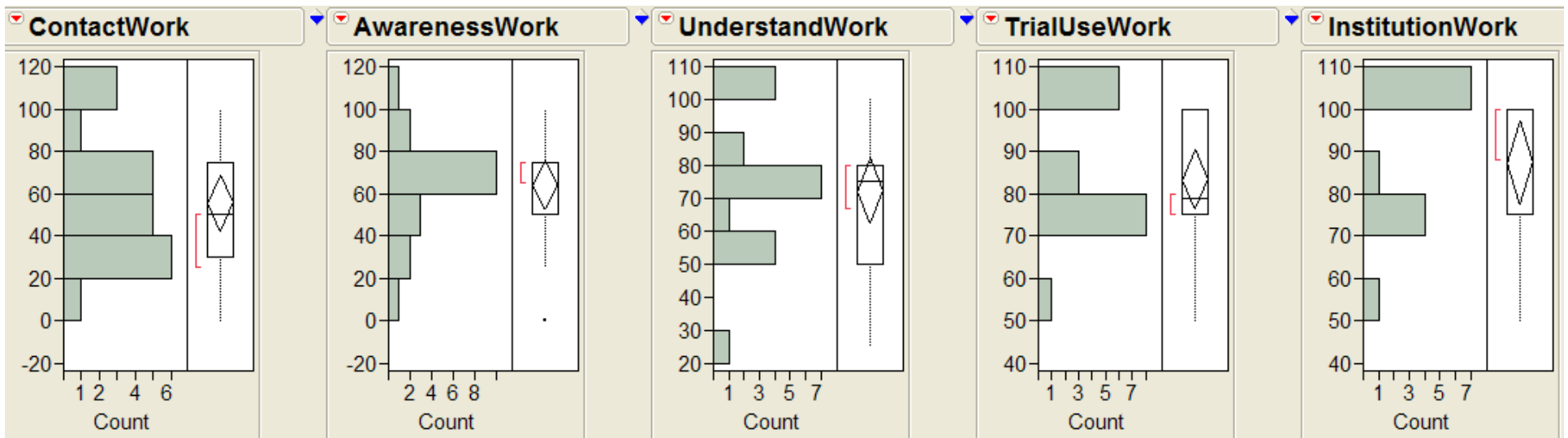
Changing Benefit Profile



This distribution of the Benefit score is noticeably moving up across the adoption phases



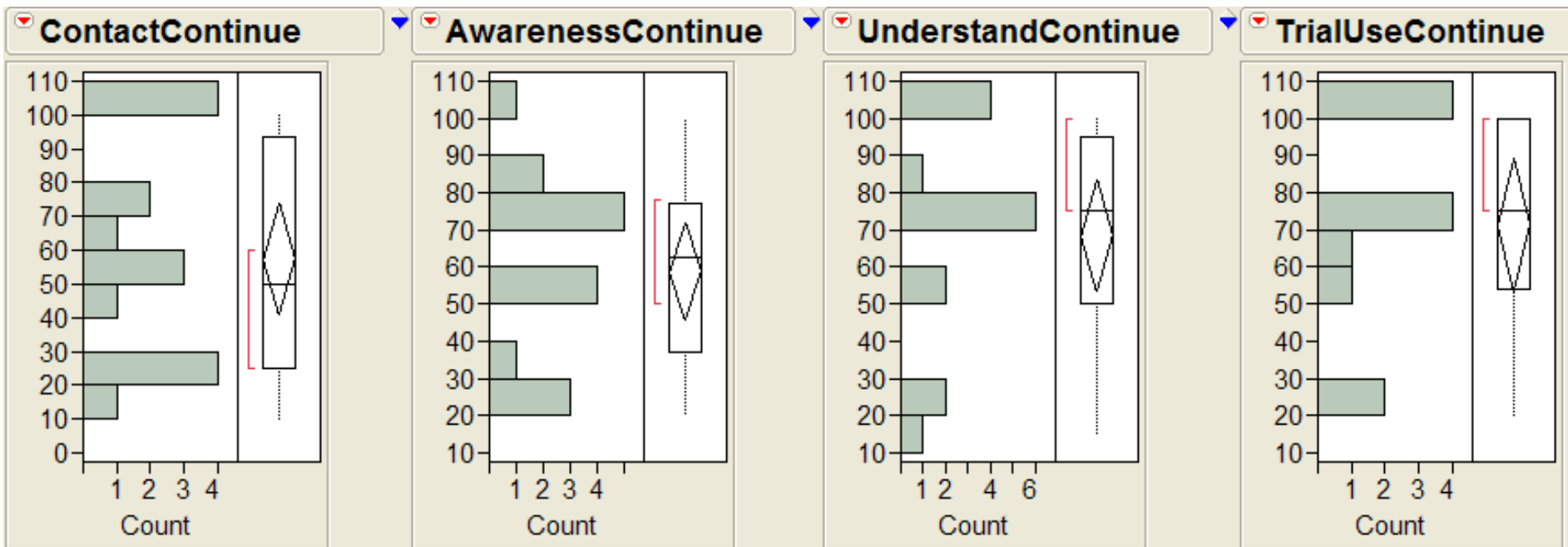
Changing Work Profile



This distribution of the Work score is noticeably moving up across the adoption phases



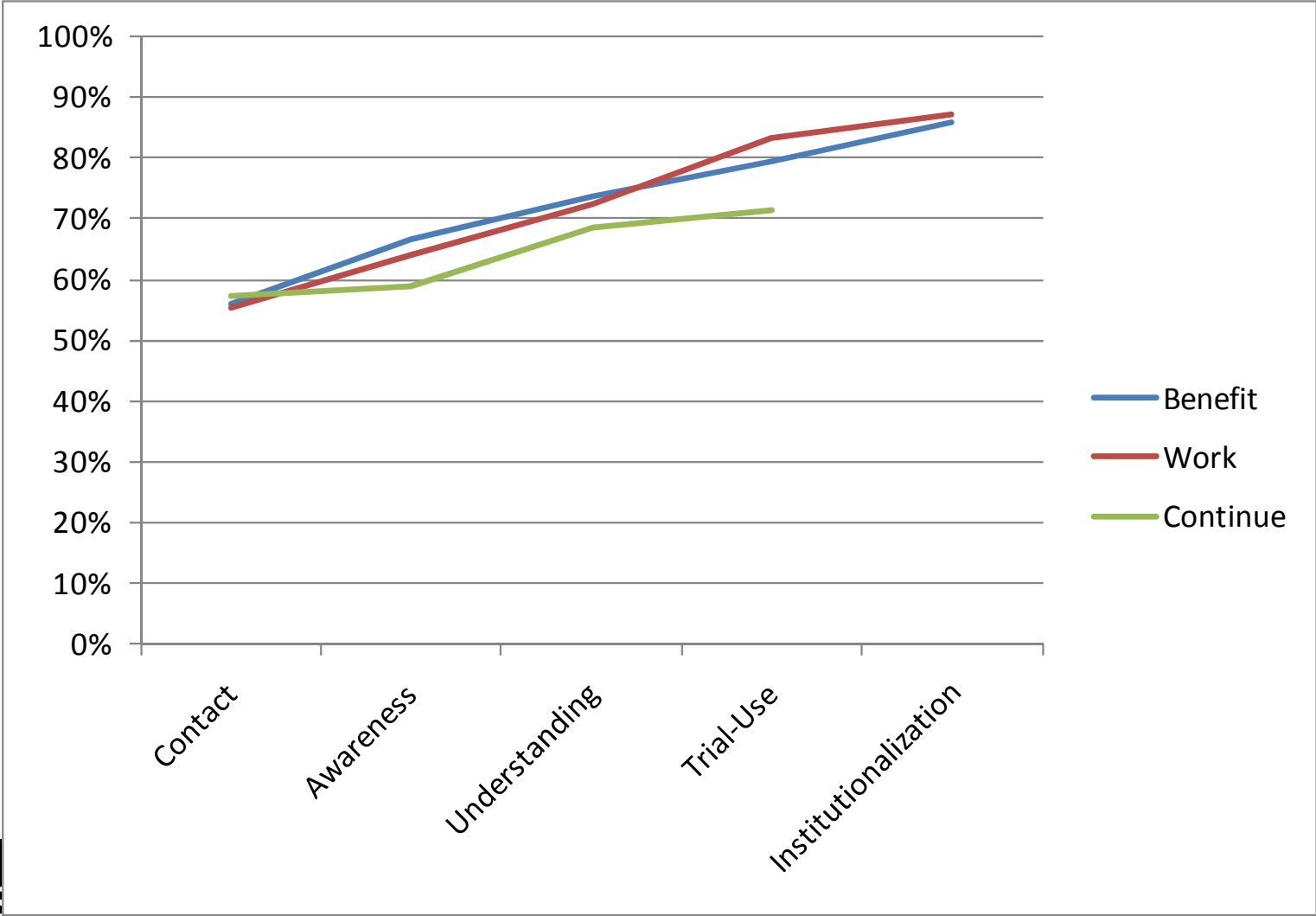
Changing Continue Profile



This distribution of the Continue score is noticeably moving up across the adoption phases



Overall Trend of Average Responses



Some Initial Linear Models

$$\text{Contact-Continue-Score} = 4.3 + 0.85 * \text{Contact-Work-Score}$$

(Adj-Rsquare = 48%)

Understand-Behavior
Awareness

(Adj-Rsquare = 48%)

Although we prefer adjusted Rsquare values in the 80%+ range, these single factor prediction models show promise.

Remember, Adj-Rsquare is the amount of behavior of the outcome explained by the modeling factor



Questions?



Software Engineering Institute

Carnegie Mellon



Software Engineering Institute

Carnegie Mellon

Changing Behavior

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