MANAGING RISK

Leading Indicators for Project Management

Project Headlights

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Agenda

- Motivation
- “Headlights”
- Strategies for Leading Indicators
- Common Leading Indicators
- “Back-up Lights”
- Summary

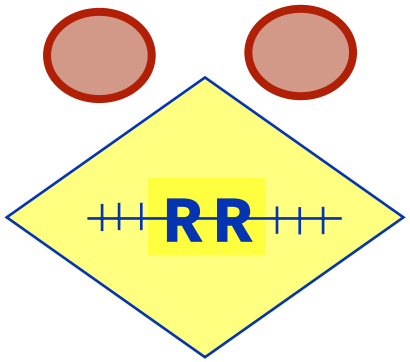
Motivation

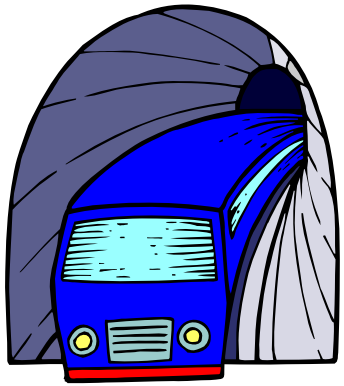
- The outcome of a project always involves uncertainty, especially if more than one dimension of performance is considered
- Measurement results often viewed as “snapshot in time”, implications of current conditions not understood
- Systematic view of measurement needed to anticipate and understand project performance, enables definition of “leading indicators” or “headlights”

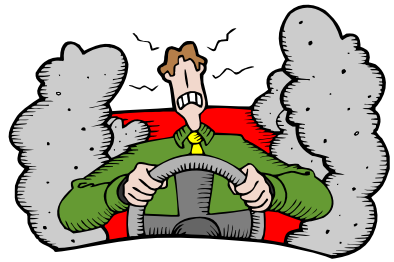
Measures and indicators

- No “measure” is intrinsically a leading indicator
- Leading Indicator = f (measure, time, interpretation)
- Not leading indicators:
  - Customer Satisfaction
  - Earned Value

Types of Indicators







Leading Indicators → **Current Indicators** → **Trailing Indicators**

“Headlights” (Leading Indicators)

- Under specific conditions, an individual measure or collection of measures may be predictive of future performance
- “Headlights” should be planned into the project – can be expensive to mount as an option
- No *generic* answer as to exactly what to measure for a *specific* project
- Many common measurement practices obscure the actual situation, providing “back-up lights” instead

Requirements for Leading Indicators

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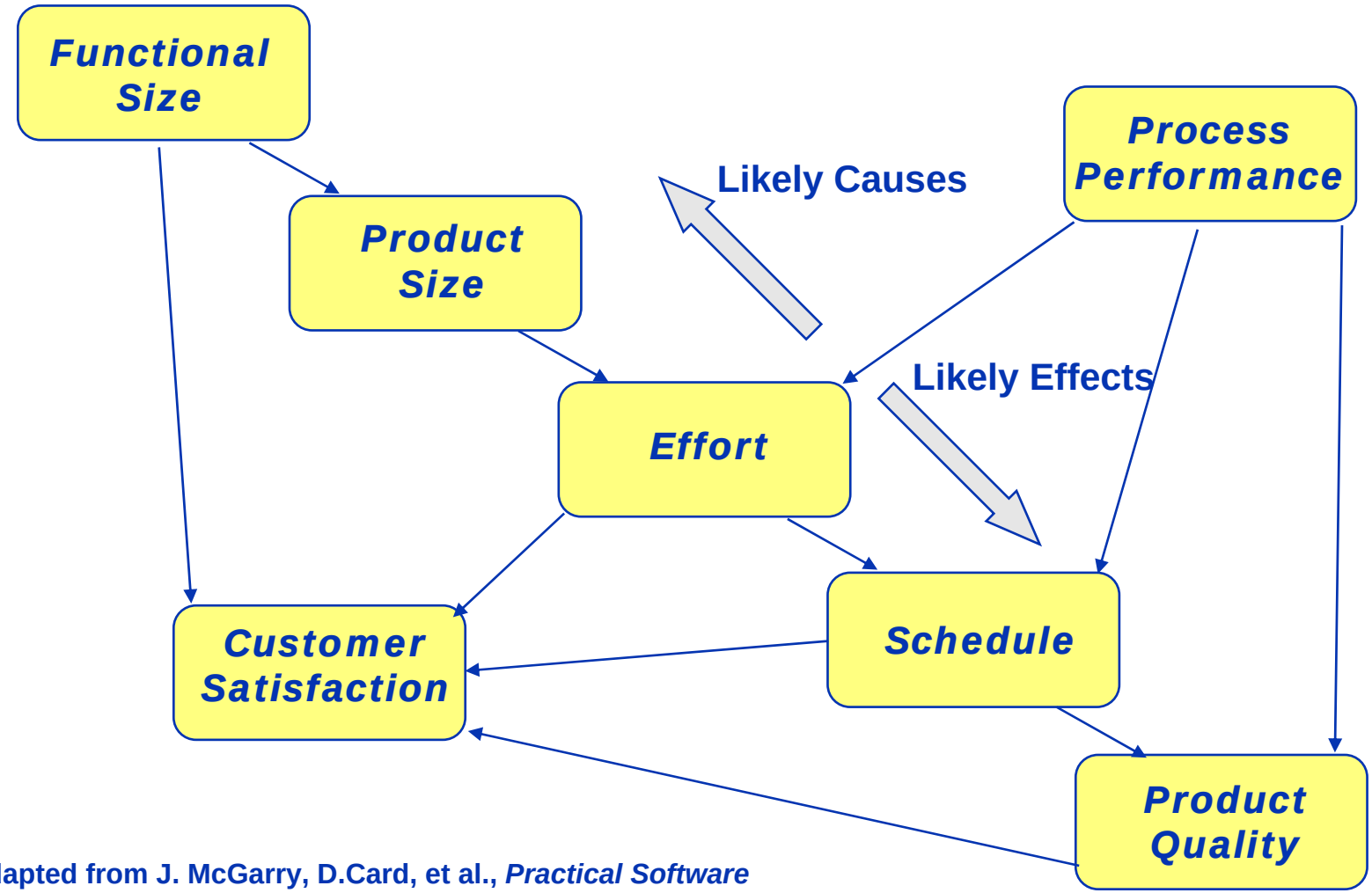
- Timely data collection and analysis
- Knowledge of what is important to success
- Measures with leading indicator properties (strategies)
- Interpretation and use of the measures as leading indicators

Projects are Systems

- Many interacting internal and external factors
- Influence of any individual factor varies over time
- Measure factors likely to affect the performance factor of interest, not just the performance factor directly
- Common tendency to avoid recognition of problems as opposed to searching for potential problems

Interactions Among Factors



Adapted from J. McGarry, D.Card, et al., *Practical Software Measurement*, Addison Wesley, 2002

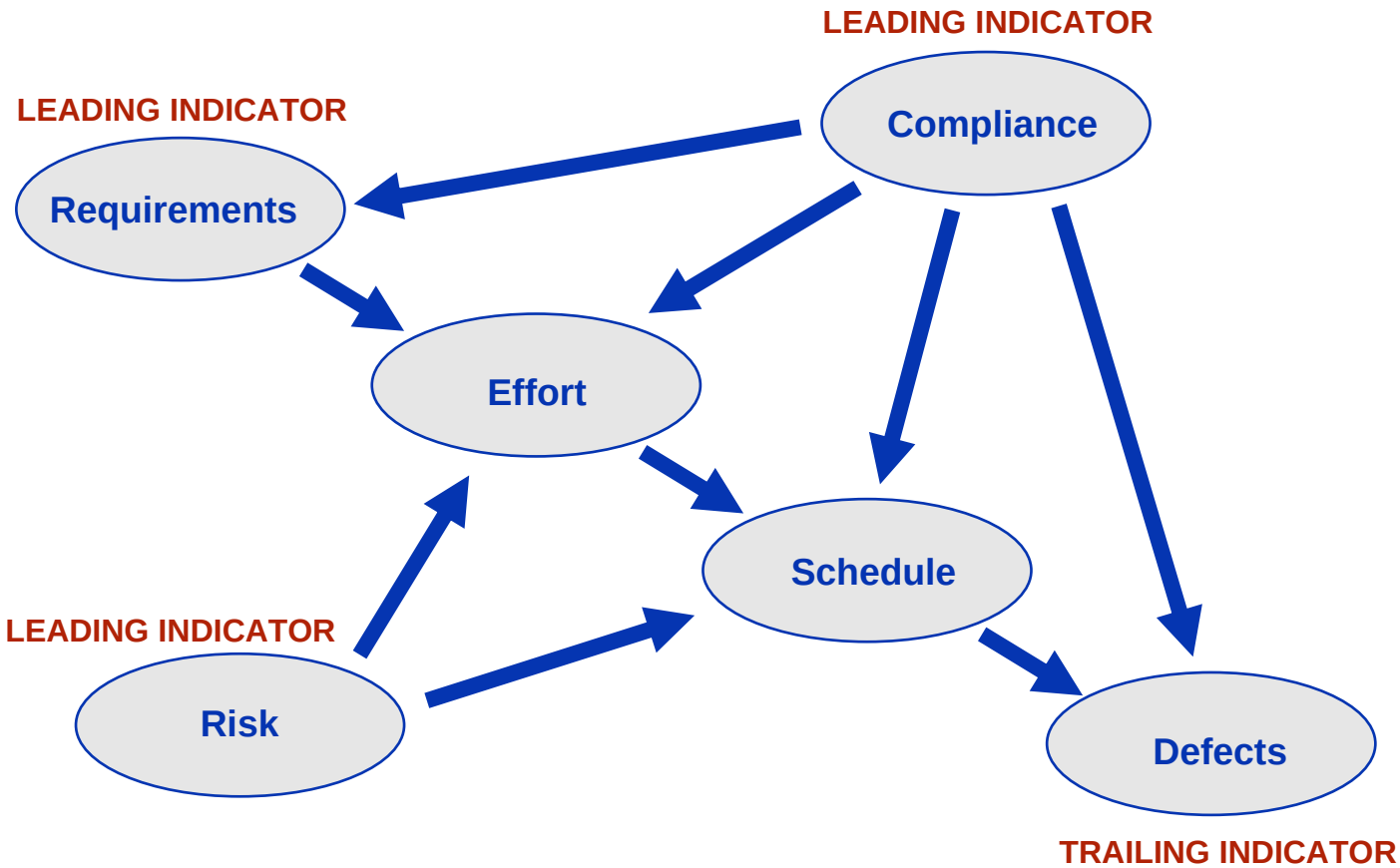
Strategies for Leading Indicators

- One measure predicts future values of another measure
- Values of a measure predict future values of the same measure
- A measure tracks a basic constraint or limit to performance
- A measure captures risk or uncertainty

Three Common Leading Indicators

- Process Compliance – failure to follow the defined plan and process usually results in failure to meet budget, schedule, and quality objectives
- Requirements Volatility – uncertainty about the project objectives usually results in delays, rework, and inadequate testing
- Risk Exposure – project activities must reduce risk in order to reach a successful conclusion

Measurement Influences

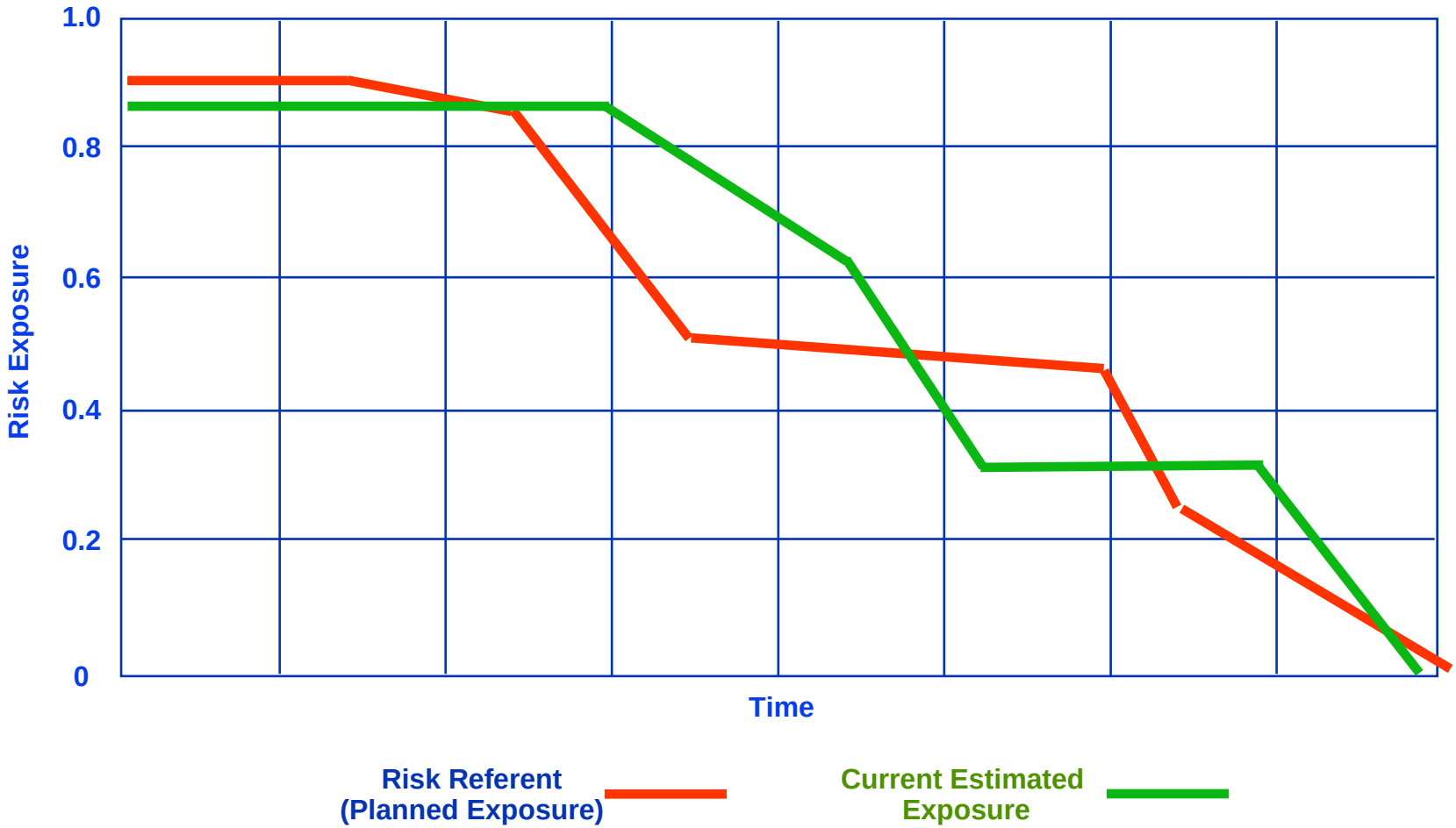


Unusual results in one dimension may predict problems in others!

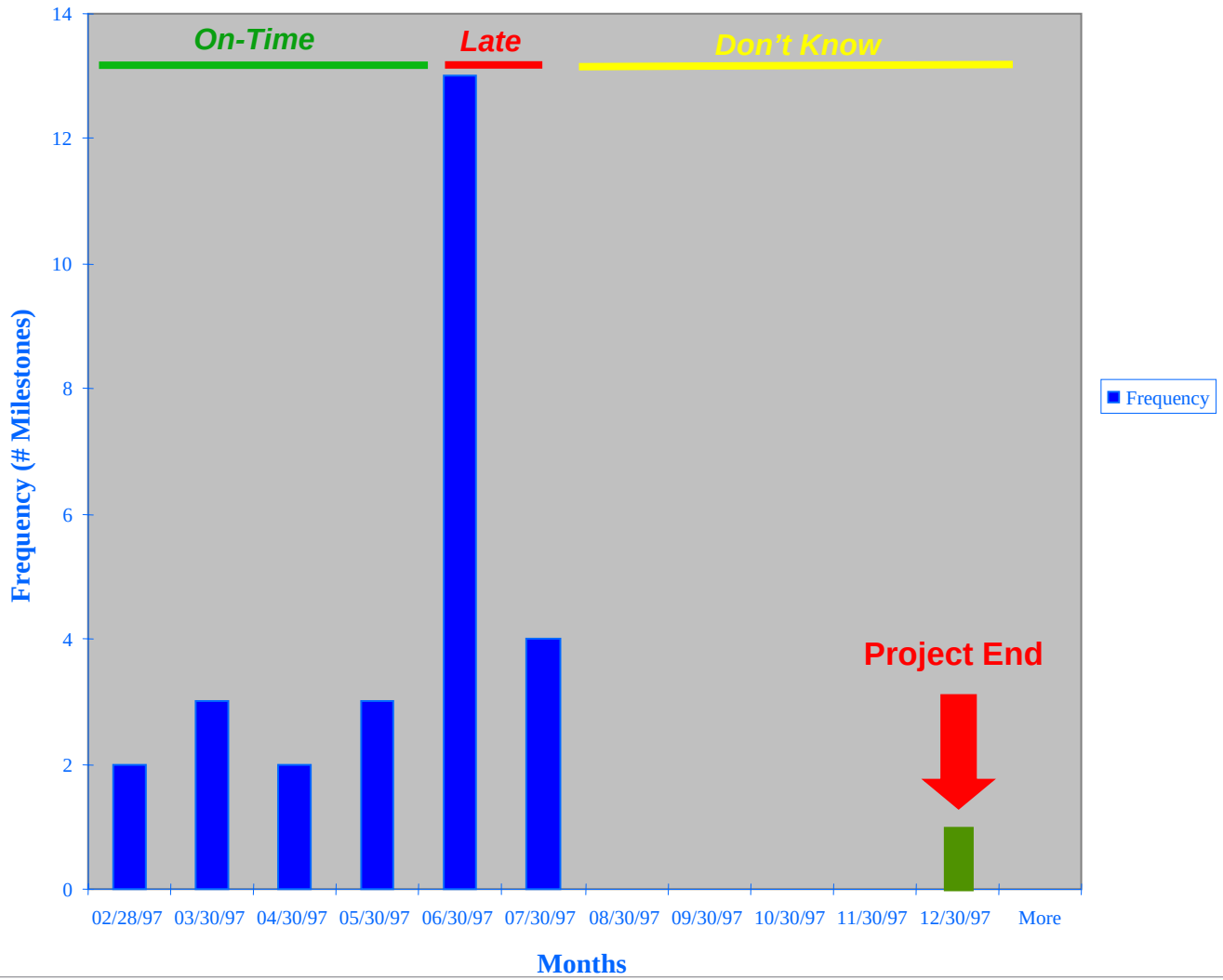
Quantification of Risk and Uncertainty

- Risk of undesirable events
- Lack of information
- Variability in performance

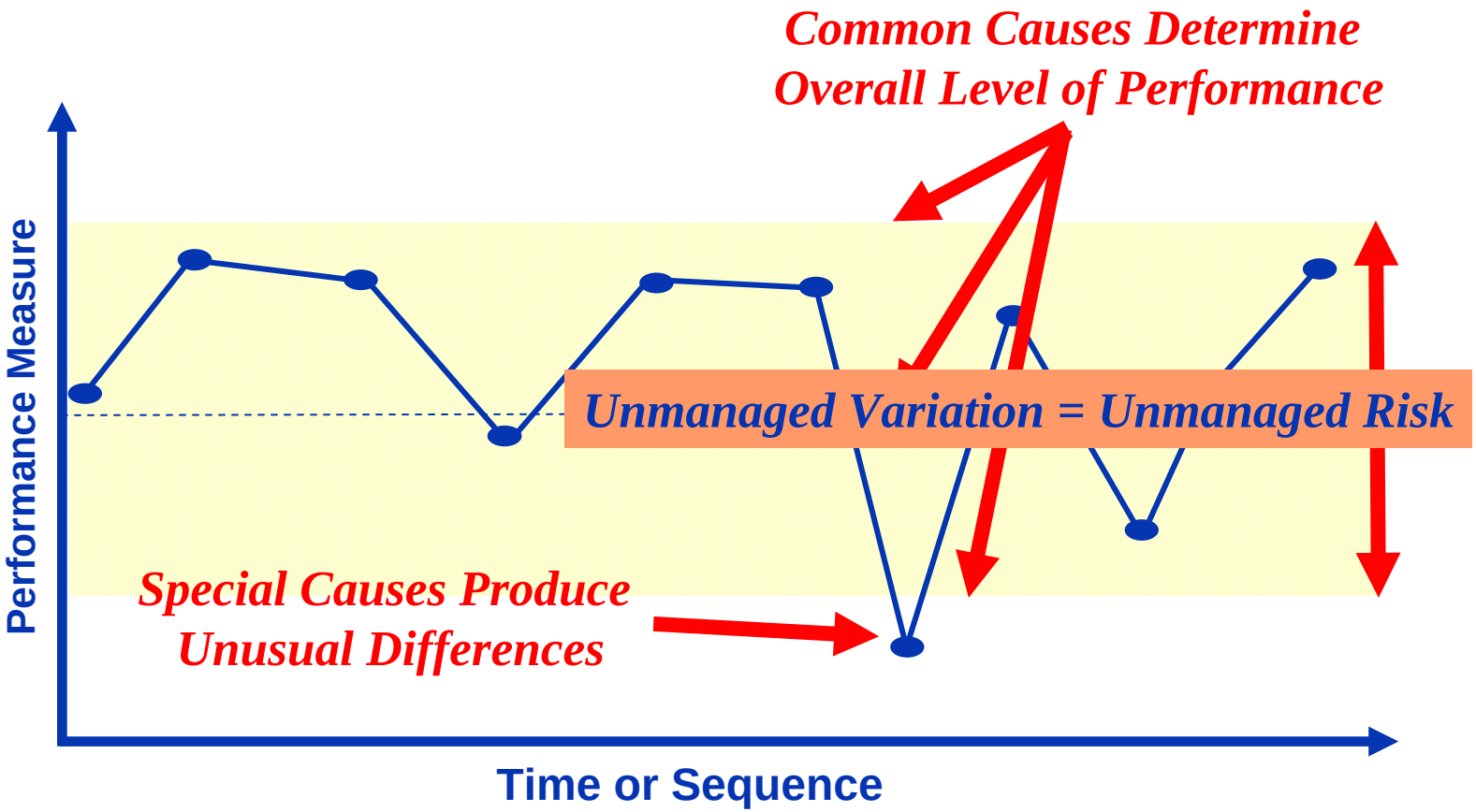
Risk Exposure



Planning Uncertainty into a Project



Variation in Performance



Process Variability

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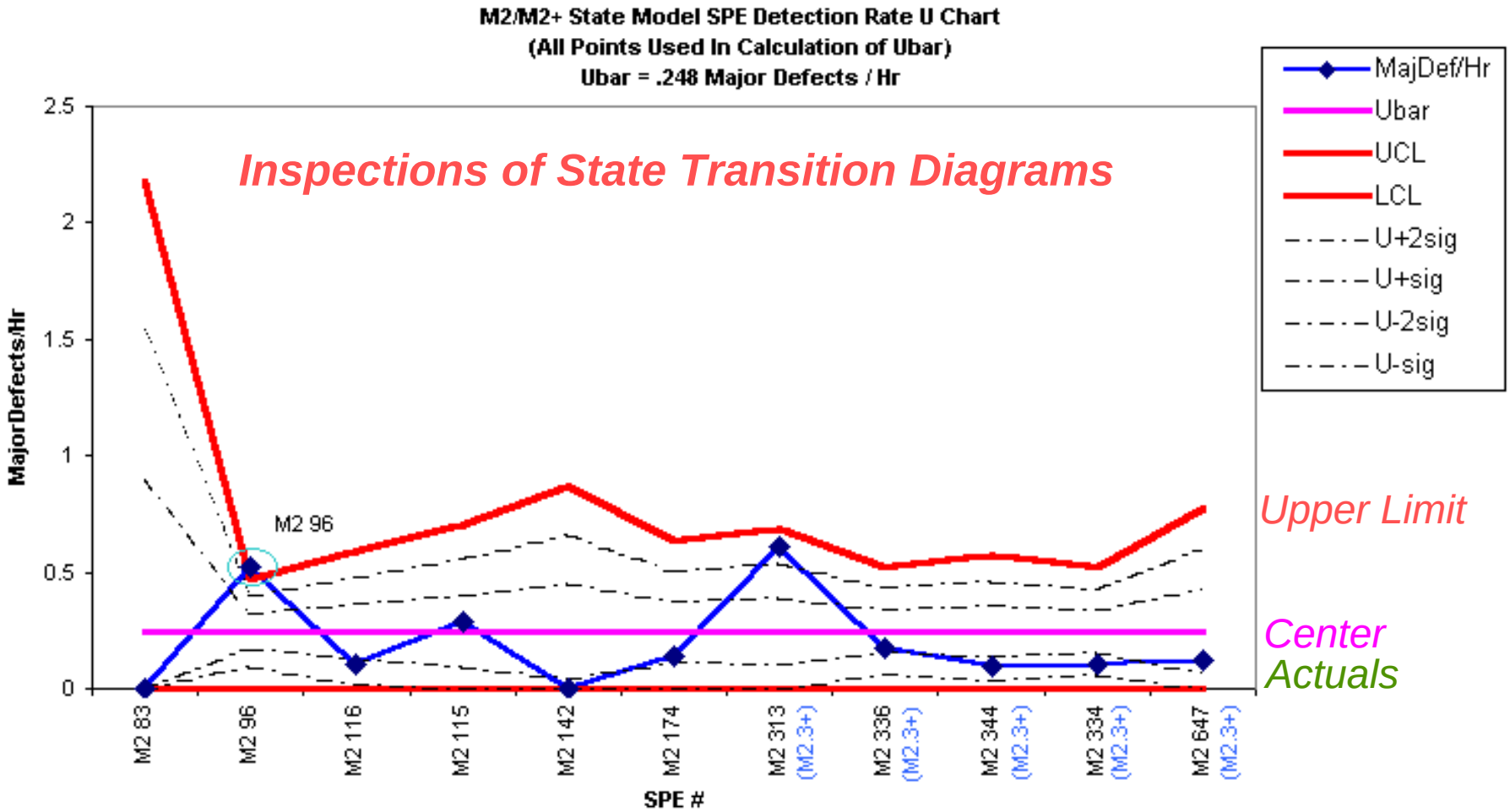

From D.Card, Controlling the Object-Oriented Design Process, *CNRC Conference on Quality Assurance of Object-Oriented Software*, February 2000

Longitudinal Predictions

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- Involves chains of activities (e.g., inspections) or continuing activities (e.g., requirements changes) that span the product life-cycle
- Values of performance factor in one activity relate to subsequent activities
- May be described analytically, empirically, or simulated

Example Defect Profile

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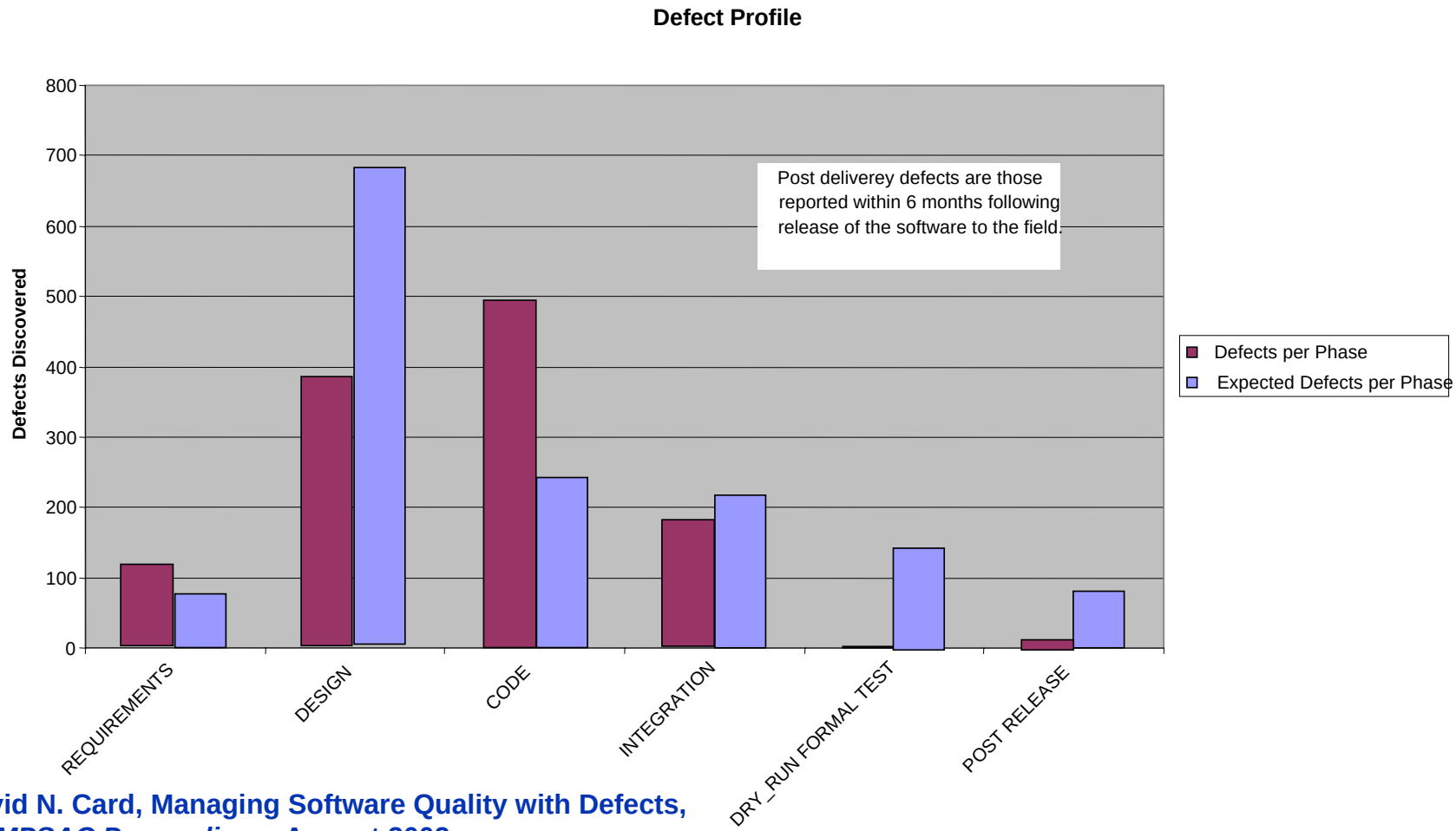


David N. Card, Managing Software Quality with Defects, *COMPSAC Proceedings*, August 2002

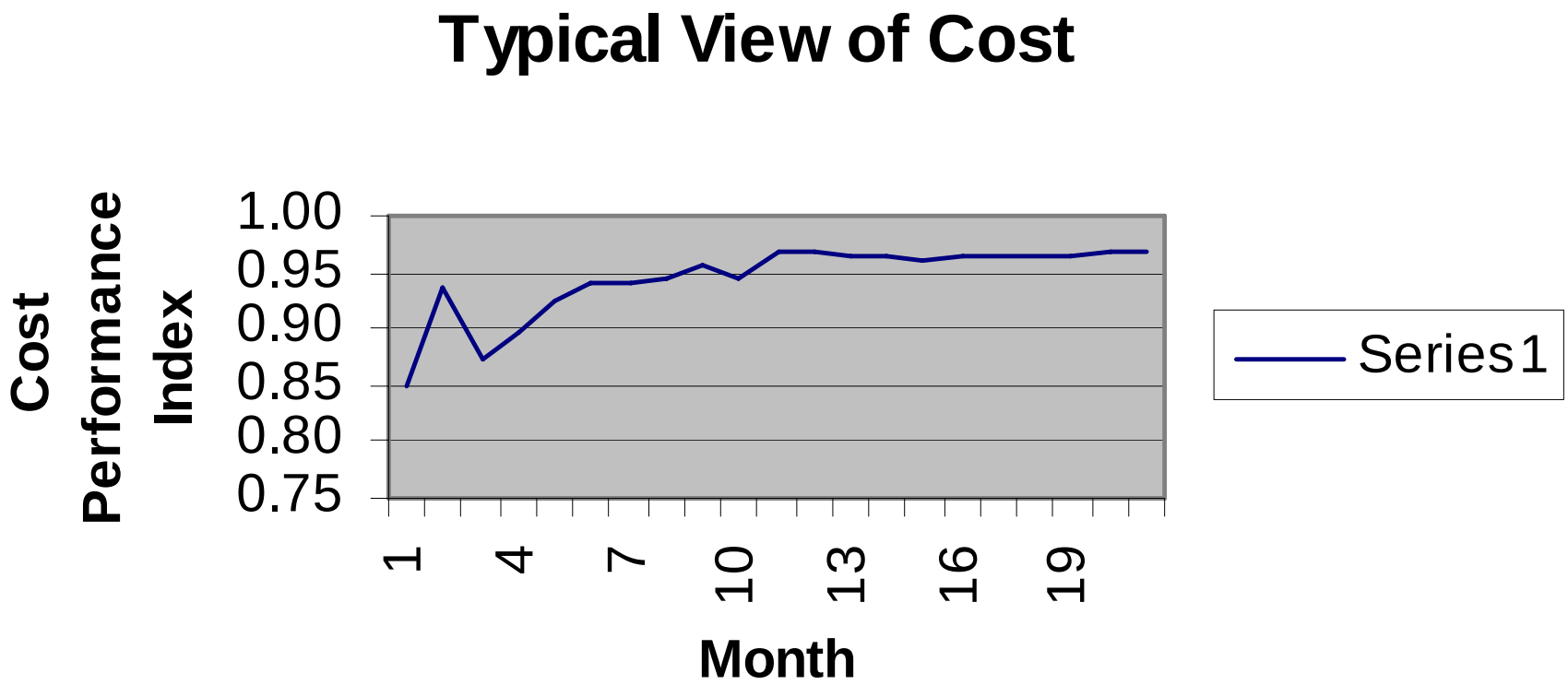
Potential Constraints

- Staff Availability
- Annual Budget
- Specialized Facilities

Common “Back-up Lights”

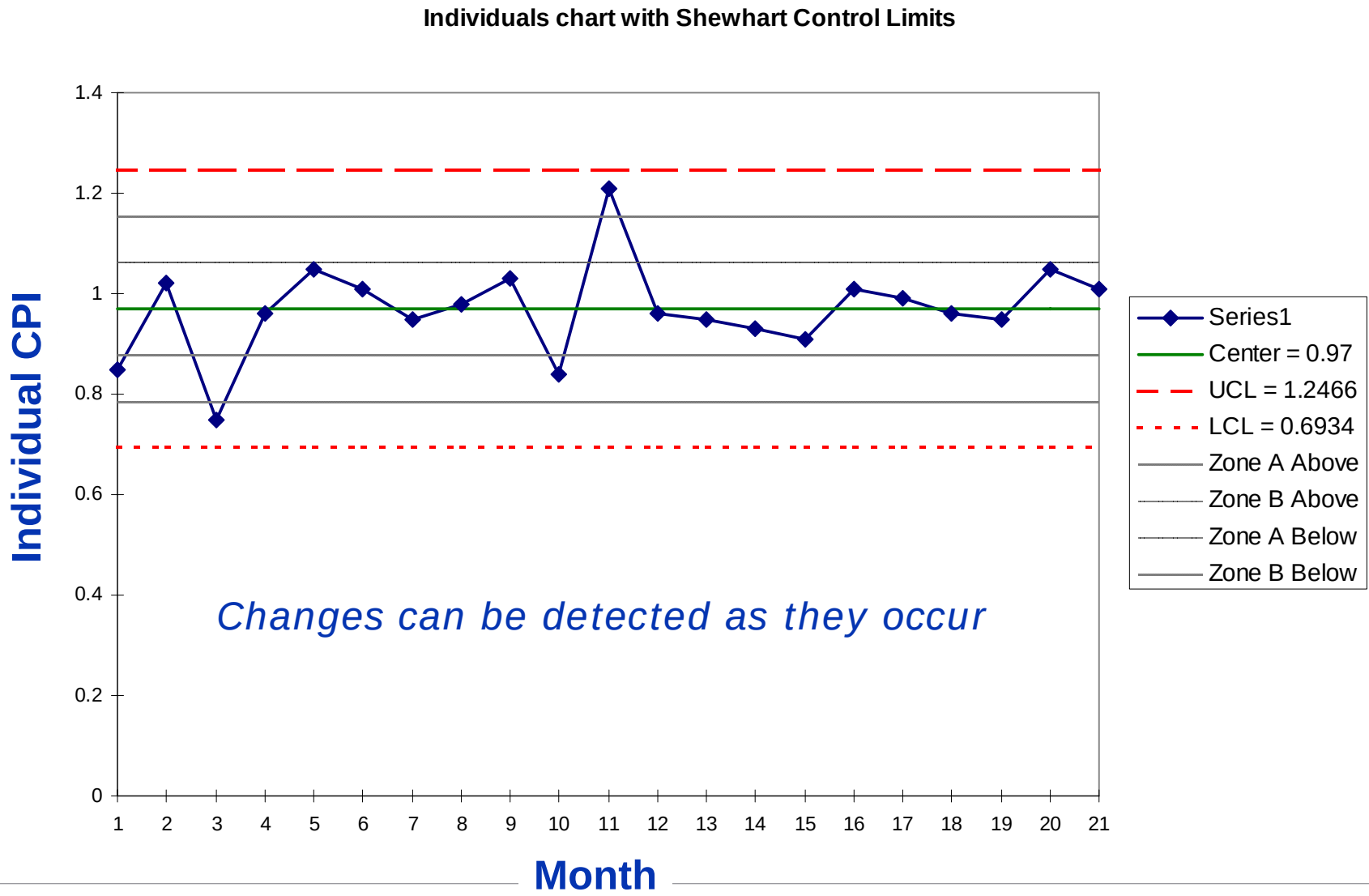
- Cumulative measures
- Percentages
- Focus on a single factor
- Ambiguous and inconsistent measurement definitions

Cumulative View



Cost Performance Index = $\frac{\text{Sum to date of Budgeted Cost of Work Performed}}{\text{Sum to date of Actual Cost of Work Performed}}$

Individual View



Process Performance Models

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- All effective PPMs are leading indicators
- Not all leading indicators are valid PPMs

Summary

- Consider the project as a system
- Plan “Headlight” measures into the project
- Avoid measurement practices that obscure the situation
- Ensure that measures are well-defined
- Remember “leading” is relative
- Don’t forget about constraints and risks
- Get managers to think in terms of leading indicators