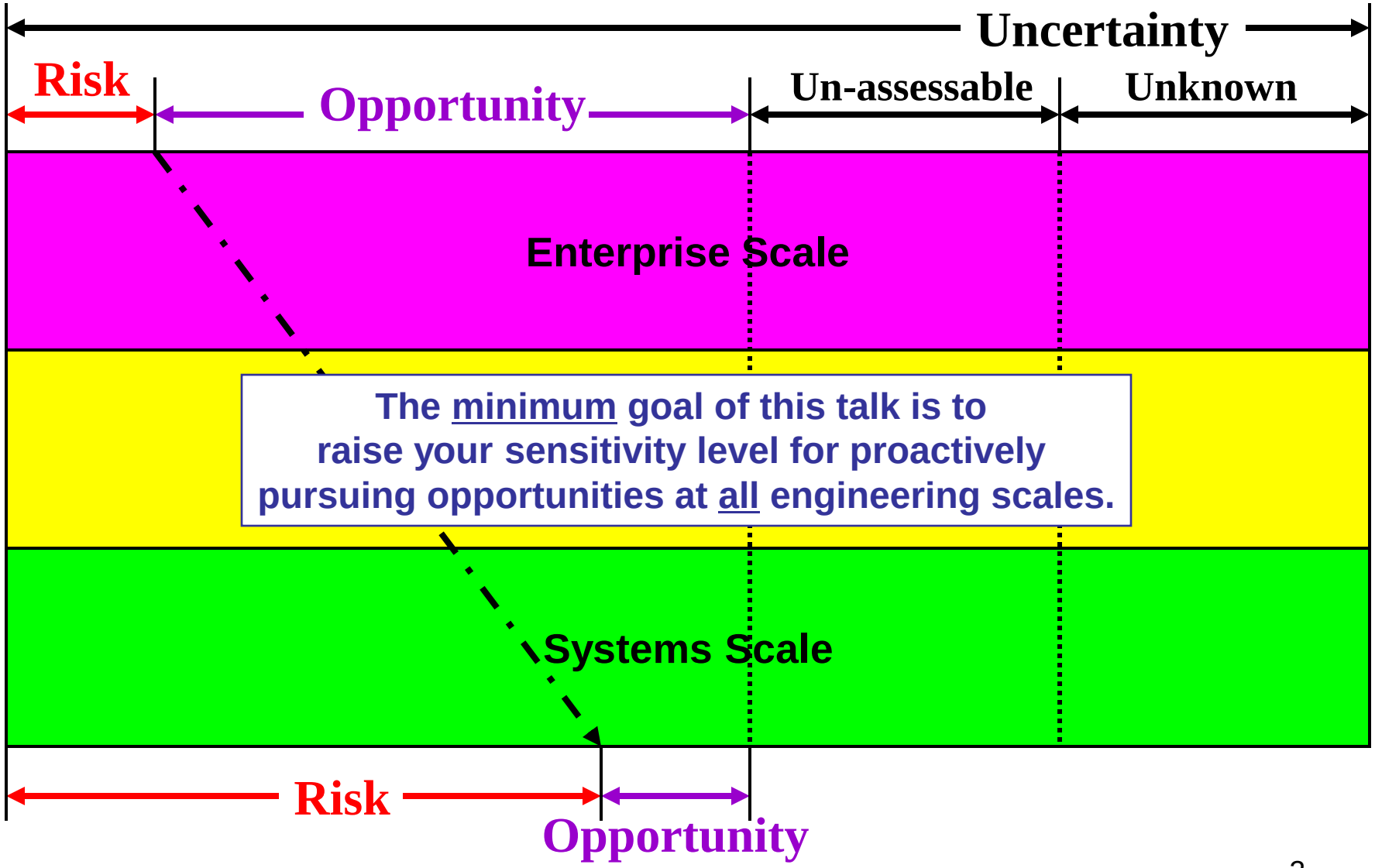
Enterprise Opportunity and Risk

B. E. White
The MITRE Corporation

11 July 2006

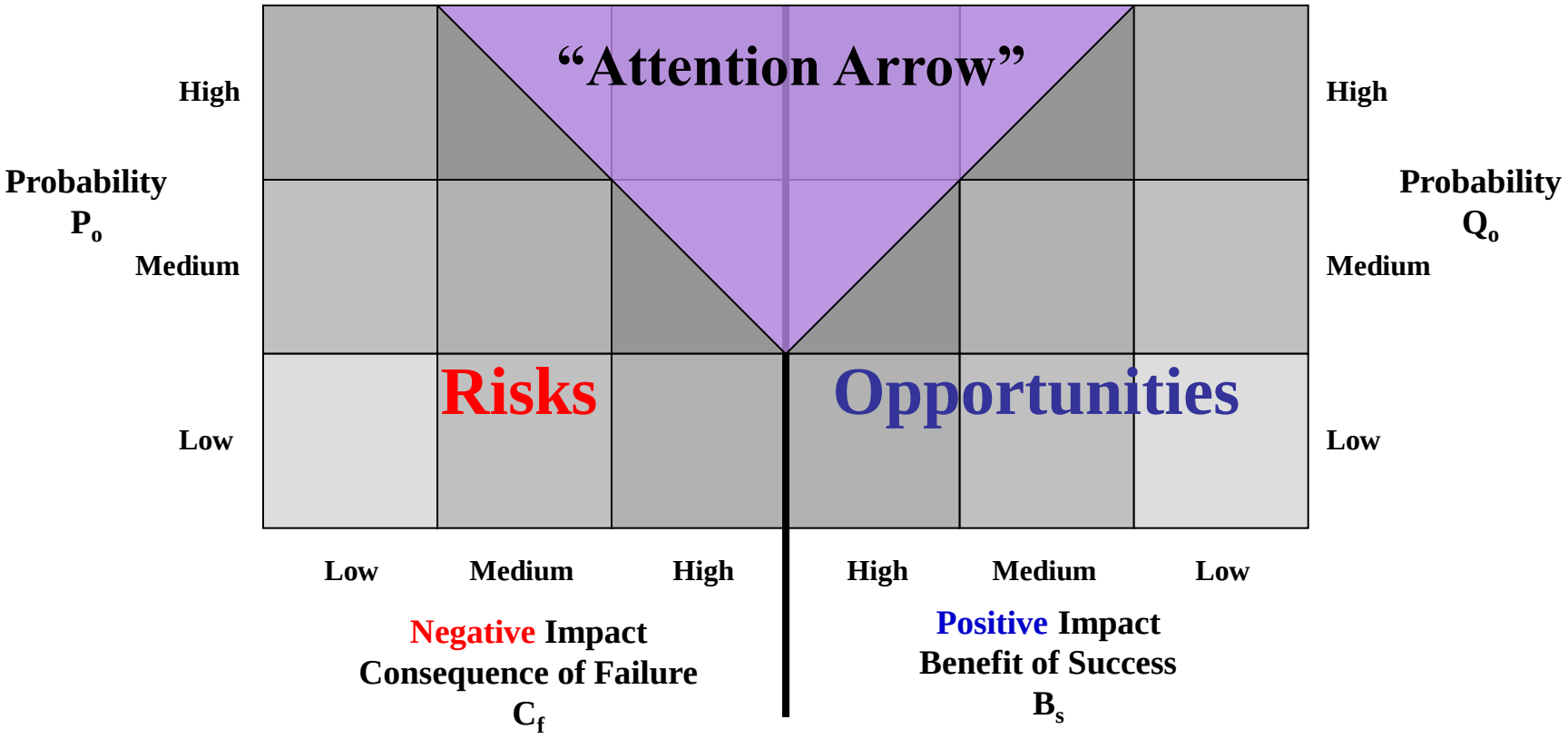
Public Release Case Number - 05-1262

Relative Importance of Opportunity



See Notes Page

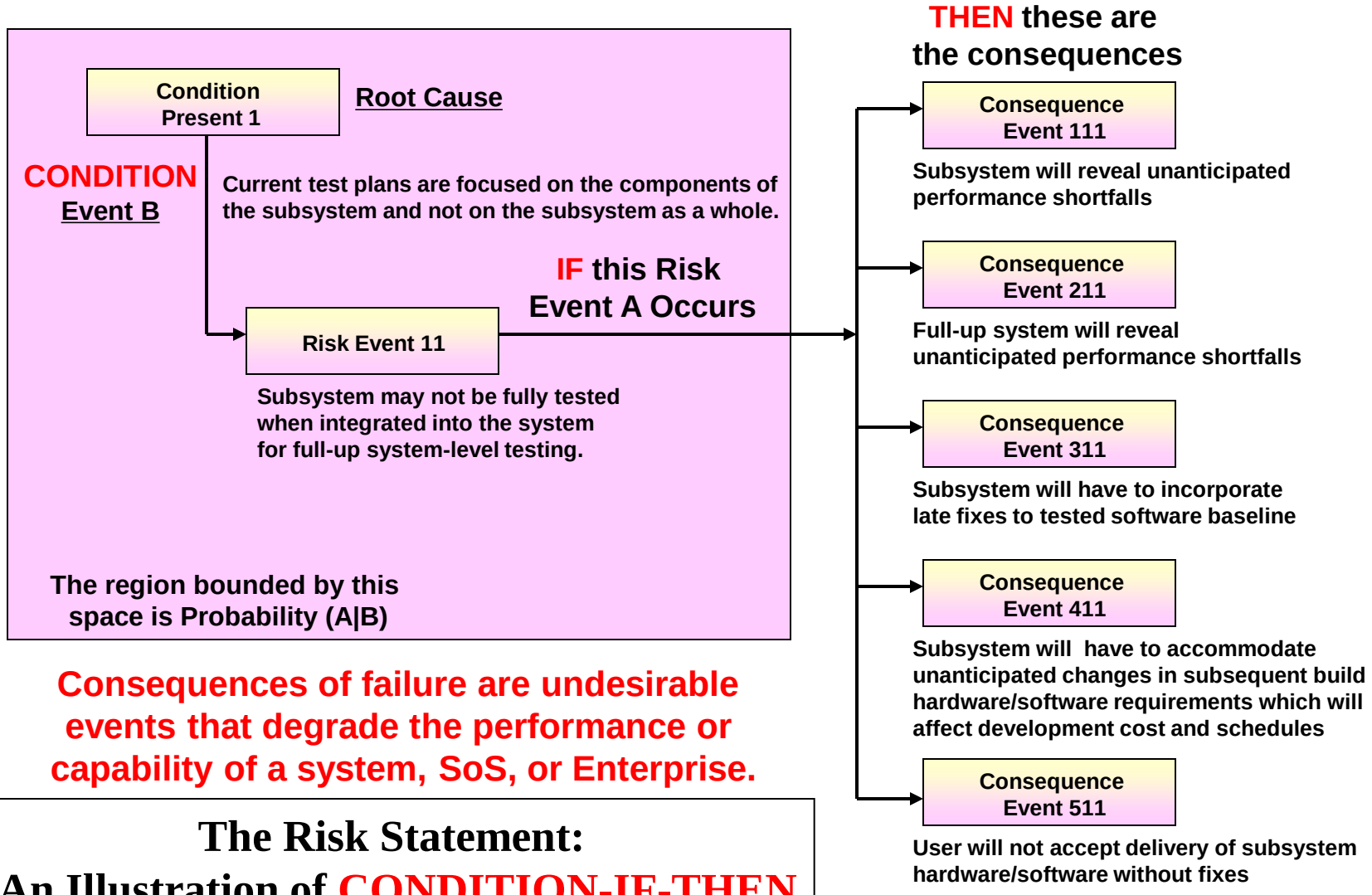
Risk/Opportunity Representation on Probability/Impact Grid



* After [Hillson, 2004], p. 126

See Notes Page

What Are Consequences of Failure?*



Consequences of failure are undesirable events that degrade the performance or capability of a system, SoS, or Enterprise.

The Risk Statement:
An Illustration of CONDITION-IF-THEN

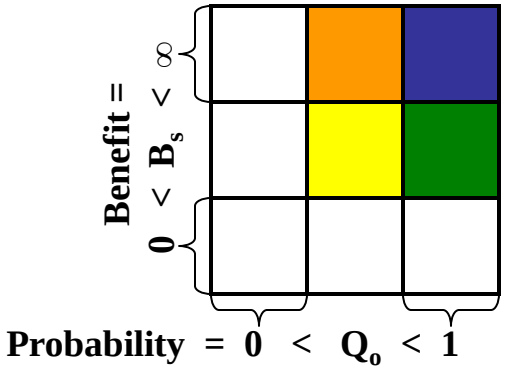
* [Garvey, 2005], p. 7

See Notes Page

What is Opportunity?

- Opportunities are events or occurrences that assist a program in achieving its cost, schedule, or technical performance objectives.
- In the larger sense, explored opportunities can enhance or accomplish the entire mission.
- Opportunity also is associated with uncertainty and impact.
- There is a duality or parallelism to risk that can be applied.
- For an opportunity, let Q_o be the probability of occurrence, B_s, the benefit of success, and E_e, estimated enhancement.
- We can pose the simple formula:

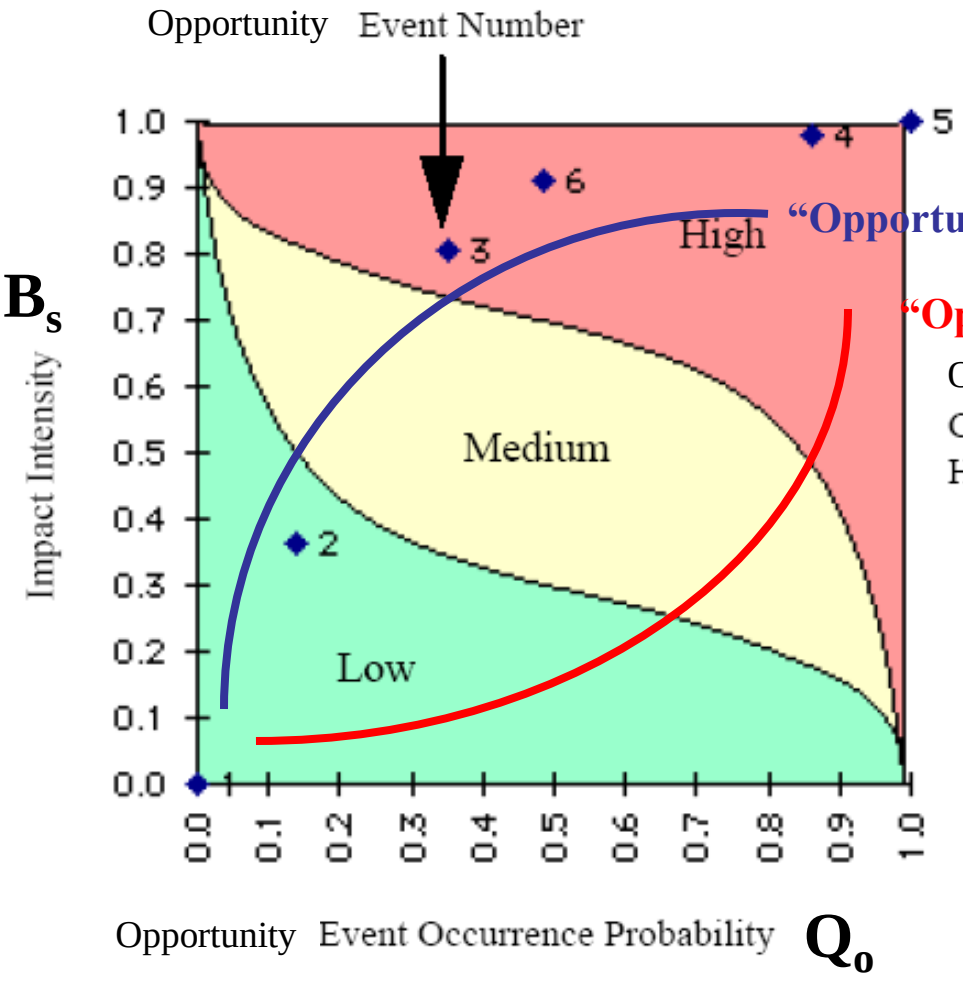
$$E_e = Q_o \times B_s$$ **[This is expected benefit!]**



Opportunity Assessment
$A_o = \{Q_o, B_s\}$
An interpretation:
- No Gain
- Worthwhile Pain
- Golden Opportunity
- Windfall
- Euphoria

See Notes Page

Opportunity Classification Example*



"Opportunity Averse" System Profile

"Opportunity Seeking" System Profile

Opportunity Classification Regions... High, Medium, Low

* After [Garvey, 2005], p. 8

See Notes Page

Thoughts About Opportunity and Risk Concerning TSE, SoS Engineering, and ESE or CSE

- Think about opportunity/risk with respect to a complex system's environment in addition to the system *per se*.
  - There may be many more opportunities in the system's environment.
  - The pursuit of these opportunities could reduce the system's "stress".
  - Environmental risks seem less important than the opportunities.
  - Enterprise-scale opportunity action and risk avoidance can be viewed with a philosophy of "nothing ventured, nothing gained".
  - Downside risk is about not incurring "damage" that might stifle the aforementioned opportunities.
- Compare and contrast TSE and CSE concepts.
  - A complex system (and enterprise) is "open".
  - This suggests a predisposition for opportunities.
  - One should "open" the system further to create more emergent behavior.
  - Be more aggressive with identifying, exploring, and developing opportunities than in TSE.

See Notes Page

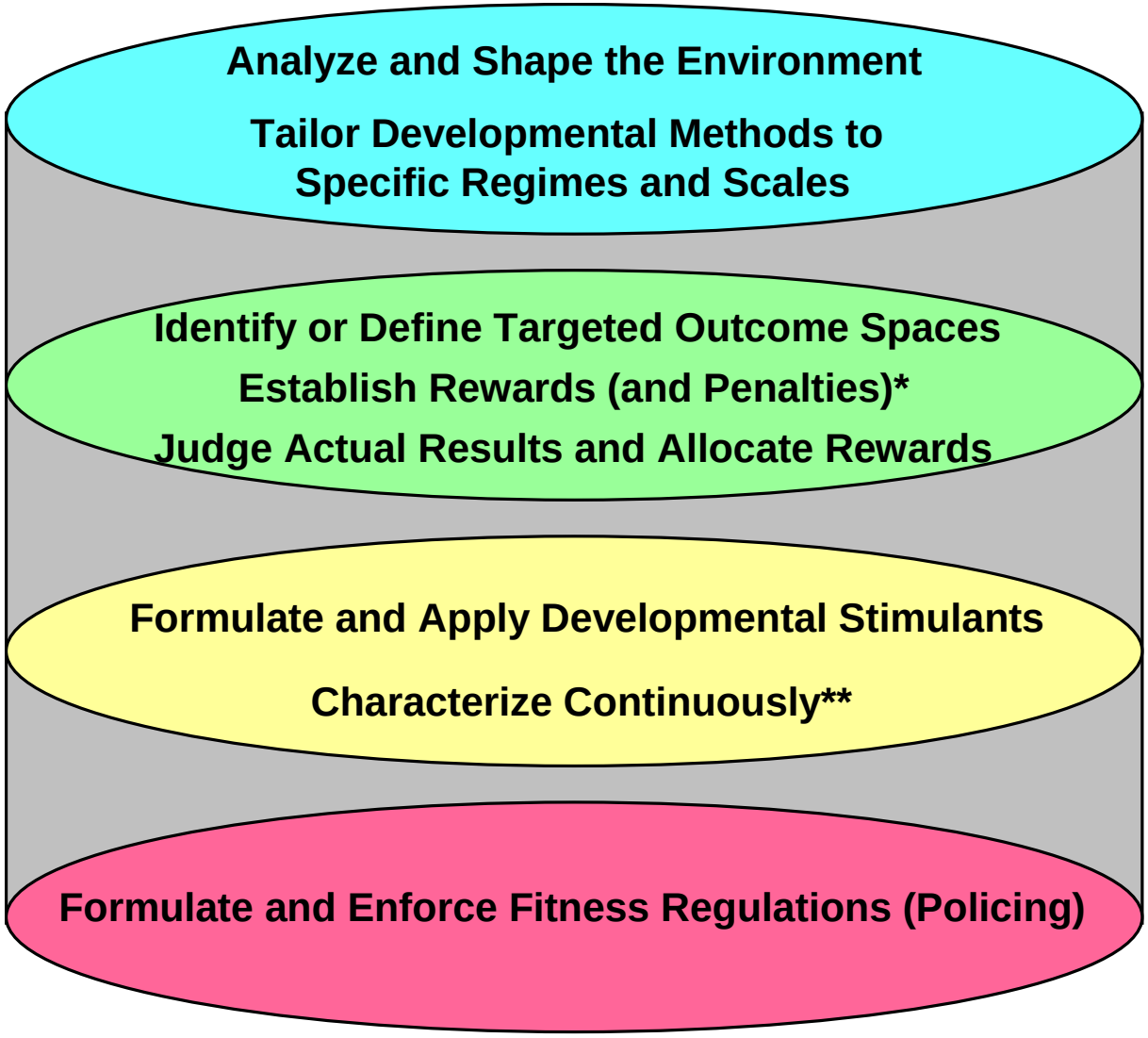
Thoughts About Opportunity and Risk Concerning TSE, SoS Engineering, and ESE or CSE (Concluded)

- Enterprise risks can be mitigated by creating a management process that has built-in abilities to
  - Quickly assess whether emergent behavior is desirable
  - Encourage desirable behavior
  - Discourage undesirable behavior
  - Encourage greater acceptance of risks
- Stevens: Messy frontier
  - *Political engineering (power, control…)*
  - *High risk, potentially high reward*
  - *Foster cooperative behavior*
- One may learn from researching what economists do about opportunity and risk at multi-scales of analysis, i.e., macroeconomics and microeconomics.*
- In summary
  - Opportunities for intervening in enterprise environments are great.
  - The greatest enterprise risk may be in allowing this process to atrophy.

* [Kuras, 2004]

See Notes Page

Regimen for Complex Systems Engineering (CSE)



* Relates explicitly to CSE Opportunities and Risks

** Relates explicitly to CSE Opportunities

See Notes Page

Opportunities and Risks in "Establish Rewards"

- Suppose a suitable outcome space has been identified.
- Autonomous agents will develop specific outcomes taking advantage of opportunities.
- There is risk in developing products that
  - May not become outcomes
  - Become less desirable outcomes
- These risks are either not rewarded or are rewarded less.
- Because a reward is granted to many outcomes, agents may pursue opportunities more aggressively than mitigating the risks of not achieving outcomes.
- Risk mitigation could be reduced to ordering outcomes according to rewards.
- This ordering might be pursued in conjunction with other autonomous agents because rewards are granted only to targeted populations of agents.
- The hypothesis that opportunities would be treated more aggressively than risks still needs validation.

See Notes Page

Opportunities in "Characterize Continuously"

- This CSE activity is the continual generation and refinement of complex-system characterizations. Continuous Characterization is crucial for autonomous agents to independently develop metrics to guide their local decision making to be congruent.
- The specific outcomes used as the basis for Judging should be characterized, as should the rationale that eventually explains the subsequent Judging decisions.
- Rewards (and perhaps Outcome Spaces) initially should be characterized with succinct "bumper-sticker" labels. The U.S. Army motivated a tremendous spurt forward with the visionary, "Own the Night".
- Pithiness encourages opportunities for inconsistencies in how Rewards (and Outcome Spaces) are interpreted. To the extent that consistency matters, however, a complex system will benefit from continually developing and espousing more detailed and complete characterizations.
- However, in complex-system evolution, characterizations cannot be too refined. New Outcome Spaces may need to be added to the characterizations, or their new possibilities will not be explored.

See Notes Page

Comparing TSE and SoS Risk Management*

	G	Y	R
Process	In a SoS, this action step requires a **similar** effort and scope as compared to a TSE environment	In a SoS, this action step requires a **modest increase** effort and scope as compared to a TSE environment	In a SoS, this action step requires a **significant increase** effort and scope as compared to a TSE environment
	or	**or**	**or**
Tools/ Constructs	In a SoS environment, **similar** tools and/or analytical constructs can be used with few (if any) modification as they are applied in a TSE environment.	In a SoS environment, tools and/or analytical constructs similar to those applied in TSE environments can be used; however, they require **modest changes to their designs or modest extensions to their underlying logic** to be properly applied in an SoS environment.	In a SoS environment, tools and/or analytical constructs similar to those applied in TSE environments can be used; however, they require **significant changes to their designs or significant extensions to their underlying logic** to be properly applied in an SoS environment. In some areas, new tools and/or analytical constructs may also be needed.

Figure 9 (edited). Three Color Comparative Assessment Scheme

* [Garvey, 2005], p. 12

See Notes Page

Comparing TSE, and SoS and ESE Opportunity Management

SoS Opportunity Management		Enterprise Opportunity Management	
Assessment	**Action Steps and Substeps**	**Assessment**	**Action Steps and Substeps**
Yellow	Step 1 Prepare	Red	Step 1 Prepare
Y: Action 1	Commit Resources	R: Action 1	Commit Resources
Y: Action 2	Form the Team	R: Action 2	Form the Team
Y: Action 3	Know the Mission	R: Action 3	Know the Mission
R: Action 4	Think Opportunities	Y: Action 4	Think Opportunities
Yellow	Step 2 Identify the Opportunities	Yellow	Step 2 Identify the Opportunities
Y: Action 1	Establish Team	R: Action 1	Establish Team
Y: Action 2	Develop Understanding	R: Action 2	Develop Understanding
Y: Action 3	Identify Opportunities	Y: Action 3	Identify Opportunities
G: Action 4	Classify Opportunities	G: Action 4	Classify Opportunities
G: Action 5	Write Opportunity Statements	G: Action 5	Write Opportunity Statements
R: Action 6	Correlate Related Opportunities	Y: Action 6	Correlate Related Opportunities
Yellow	Step 3 Assess and Prioritize Opportunities	Red	Step 3 Assess and Prioritize Opportunities
Y: Action 1	Impact Assessment	R: Action 1	Impact Assessment
G: Action 2	Probability Assessment	Y: Action 2	Probability Assessment
R: Action 3	Timeframe Assessment	R: Action 3	Timeframe Assessment
Y: Action 4	Reassess Opportunities	R: Action 4	Reassess Opportunities
Y: Action 5	Rank Opportunities	R: Action 5	Rank Opportunities
G: Action 6	Coarse Sort; Identify Handling Bands	Y: Action 6	Coarse Sort; Identify Handling Bands
Green	Step 4 Decide on Handling Options	Yellow	Step 4 Decide on Handling Options
G: Action 1	Identify Options within Each Opportunity Band	Y: Action 1	Identify Options within Each Opportunity Band
G: Action 2	Easy Opportunities	Y: Action 2	Easy Opportunities
Y: Action 3	Hard Opportunities	R: Action 3	Hard Opportunities
Y: Action 4	Assign OPRsG	R: Action 4	Assign OPRsG
G: Action 5	Update Opportunity Database	G: Action 5	Update Opportunity Database
Yellow	Step 5 Establish Handling Plans	Red	Step 5 Establish Handling Plans
Y: Action 1	Develop Plans and Estimates	R: Action 1	Develop Plans and Estimates
R: Action 2	Review and Approve	R: Action 2	Review and Approve
Y: Action 3	Fund, Direct, Integrate	R: Action 3	Fund, Direct, Integrate
Yellow	Step 6 Implement Opportunity Handling	Red	Step 6 Implement Opportunity Handling
Y: Action 1	Finalize Opportunity Management Plan	R: Action 1	Finalize Opportunity Management Plan
Y: Action 2	Provide Mechanisms to Monitor	Y: Action 2	Provide Mechanisms to Monitor
Y: Action 3	Implement Handling Plans	R: Action 3	Implement Handling Plans
Y: Action 4	Monitor Progress	Y: Action 4	Monitor Progress
Green	Step 7 Monitor Handling Plans	Yellow	Step 7 Monitor Handling Plans
G: Action 1	Periodically Review Handling Plans	Y: Action 1	Periodically Review Handling Plans
Y: Action 2	Modify or Stop, If Required	R: Action 2	Modify or Stop, If Required
G: Action 3	Retire Opportunities	Y: Action 3	Retire Opportunities

G = green
Y = yellow
R = red

See Notes Page

Concluding Remarks

- The greatest enterprise risk may be in not pursuing enterprise opportunities.
- There is duality
  - In treating risks and opportunities
  - Between systems and enterprises
- Opportunity (as well as risk) management is a "team sport".
  - But ESE is the "big leagues" for opportunity management.
- Keep in mind there are unknowns and unknowables.
- Opportunities in ESE abound!
- Qualitative assessments of opportunity management
  - Tend to be more difficult for enterprises than for SoS or systems
  - Could easily change after learning more about ESE
- Our principal hypothesis: In ESE, be aggressive with opportunity and accepting of risk.
  - This is just the opposite of what seems to be the case in TSE!
  - Nevertheless, validation from actual case studies should be sought.

See Notes Page

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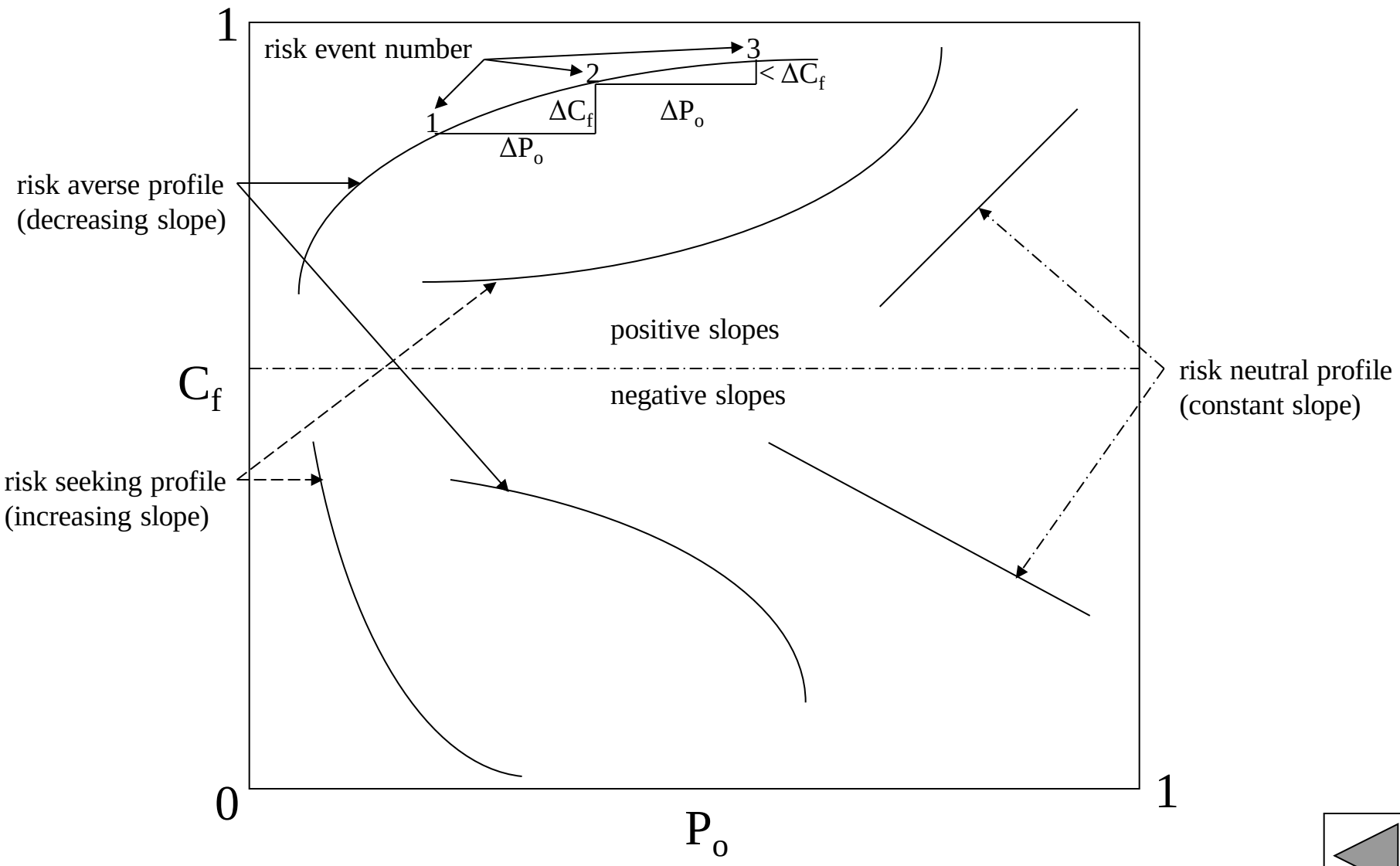
Back Up Charts

Example System Profiles



See Notes Page

What Can One Do to Engineer a Complex Systems Environment?*

- Analyze and shape the environment: Guide the complex-system's self-directed development. This depends on the nature of the system and its environment. No portion of the environment can be directly controlled in a persistent fashion.
- Tailor developmental methods to specific regimes and scales: Any complex-system operates in multiple regimes and at multiple scales. The operational regime is directly associated with the purposes or mission of the whole system. The developmental regime and it is associated with changes in the system. These two regimes cannot be sufficiently isolated for a complex-system.
- Identify or define targeted outcome spaces: Outcome spaces are large sets of possible partial outcomes at specific scales and in specific regimes. The complex-system itself will choose the exact combinations of partial outcomes that it realizes.
- Establish rewards (and penalties): Establish rewards (and penalties) that are intended to influence the behavior of individual (but not specific) autonomous agents at one or more scales and regimes to influence agent outcomes.

* [Kuras-White, 2006]

See Notes Page

What Can One Do to Engineer a Complex Systems Environment?* (Concluded)

- Judge actual results and allocate rewards: Consider and judge the actual outcomes in many or all of the regimes and scales in terms of targeted outcome spaces. Then allocate rewards to the most responsible agents, whether they were pursuing those rewards or not. Do this in ways that preserve or even increase the opportunity for more new results.
- Formulate and apply developmental stimulants: Use methods that increase the number of, or the intensity and persistence of, interactions among autonomous agents. Specific forms of this method depend on the phase of the developmental cycle of a capability that is being addressed.
- Characterize continuously: Aim at gathering information at multiple scales and in multiple regimes pertinent to Outcome Spaces and making it available to the autonomous agents.
- Formulate and enforce fitness regulations (policing): For example, initiate procedures aimed at detecting and screening changes so that fitness is maintained; that monitor characteristic periods; and that inhibit or negate changes that increase characteristic periods.

* [Kuras-White, 2006]

See Notes Page