



31st Annual **INCOSE**
international symposium
virtual event

July 17 - 22, 2021

Why Systems Engineers May Have an Edge When It Comes to Personal Resilience



What is Personal Resilience?

- The ability to adapt to and recover from adversity (Public Health Emergency, 2020)
- Involves planning and follow-through, problem solving, and managing emotions and impulses
- Is more than a skill – is an adaptation (National Resource Center on Domestic Violence, 2020) and a reflexive way of facing understanding the world (Coutu, 2017)
- Is innate but can be further developed



Why Care About Personal Resilience?

- Pandemic has resulted in unexpected disruptions to personal and professional lives
- Societal expectation of rapid responses in an uncertain environment has posed complex challenges to be overcome
- Personal resilience is key to overcoming these challenges

Common Characteristics of Personal Resilience (from Coutu, 2017)



- Acceptance of reality
- A belief, supported by strongly held values, that life is meaningful
- Ability to improvise

➤ All three are needed to be truly resilient

Spacey's (2017) Examples of Personal Resilience



- Big picture thinking
- Change agency
- Tolerance for ambiguity
- Unaffectedness

Elements of Big Picture Thinking (from Spacey, 2019)



- Systems thinking
- Foundational knowledge
- Design thinking
- Brainstorming
- Starting with first principles
- Root cause analysis
- Innovation and creativity
- Strategic or long-term thinking and using the “last moment possible” strategy for decision making
- Thinking globally, acting locally
- Avoiding unnecessary assumptions and constraints

Why the Assertion that Systems Engineers May Have an Edge?



- As described in the INCOSE Competency Framework, (Presland, Ed., 2018), Spacey's examples are characteristics that should be possessed by systems engineers (SEs)
- When acting as the “glue” between disciplines, SEs have to reconcile different issues and roles (Sheard, 1996)
- SEs act as change agents when introducing a systems approach to an organization or project team (Hahn, Hodges, Lombardo, and Kerman, 2020)

Mapping INCOSE Competencies to Spacey's Resilience Examples



Personal Resilience Traits		Systems Thinking	Foundational Knowledge	Design Thinking	Big Picture Thinking	Brainstorming	First Principles	Root Cause Analysis	Innovation and Creativity	Strategic Thinking and Last Moment Possible	Act Locally, Think Globally	Assumptions and Constraints	Change Agency	Tolerance for Ambiguity	Unaffectedness
Systems Thinking	X			X											
Lifecycles	X	X	X	X											
Capability Engineering															
General Engineering															
Critical Thinking		X	X	X	X			X	X	X			X	X	
Systems Modeling and Analysis															
Communications				X	X			X	X				X		
Ethics and Professionalism				X											
Technical Leadership				X	X			X	X				X		
Negotiation				X											
Team Dynamics				X	X			X	X				X		
Facilitation				X	X								X		
Emotional Intelligence				X									X		
Coaching and Mentoring															
Requirements Definition				X											
Systems Architecting				X											
Design for...				X											
Integration				X											
Interfaces				X											
Verification				X											
Validation				X											
Transition				X											
Operation and Support				X											
Planning				X											
Monitoring and Control															
Decision Management															
Concurrent Engineering															
Business and Enterprise															
Acquisition and Supply															
Information Management															
Configuration Management															
Risk and Opportunity Management				X	X	X							X		
Project Management				X	X	X							X		
Finance															
Logistics				X	X	X									
Quality								X						X	

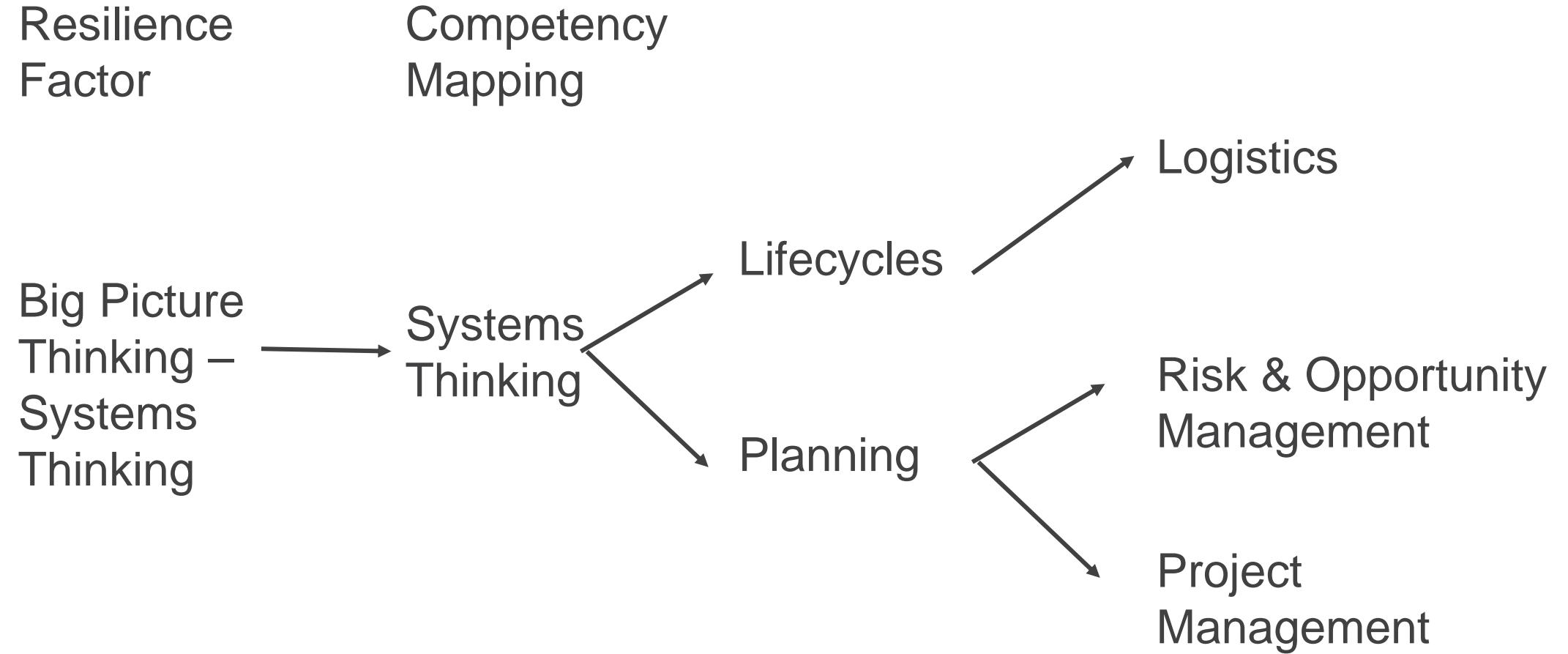


Approach Taken

- List and define each of the resilience factors and any sub-elements
- Describe the relationship to the SE competencies
- Provide additional details about the factors, including brief tips for developing in them



Big Picture Thinking – Systems Thinking





Big Picture Thinking – Foundational Knowledge

Resilience
Factor

Competency
Mapping

Big Picture
Thinking – → Technical → Critical
Foundational
Knowledge



Big Picture Thinking – Foundational Knowledge

Resilience
Factor

Big Picture
Thinking –
Foundational
Knowledge

Competency
Mapping

Requirements
System
Architecture
Design for...
Integration
Interfaces
Verification
Validation
Transition
Operations &
Support

Planning

Lifecycles

Logistics

Risk & Opportunity
Management

Project
Management



Big Picture Thinking – Design Thinking

Resilience
Factor

Competency
Mapping

Big Picture
Thinking –
Design
Thinking

Systems
Thinking

Planning

Critical
Thinking

Technical
Competencies

Professional
Competencies

Lifecycles

Logistics

Risk & Opportunity
Management

Project
Management



Big Picture Thinking – Design Thinking

Resilience
Factor

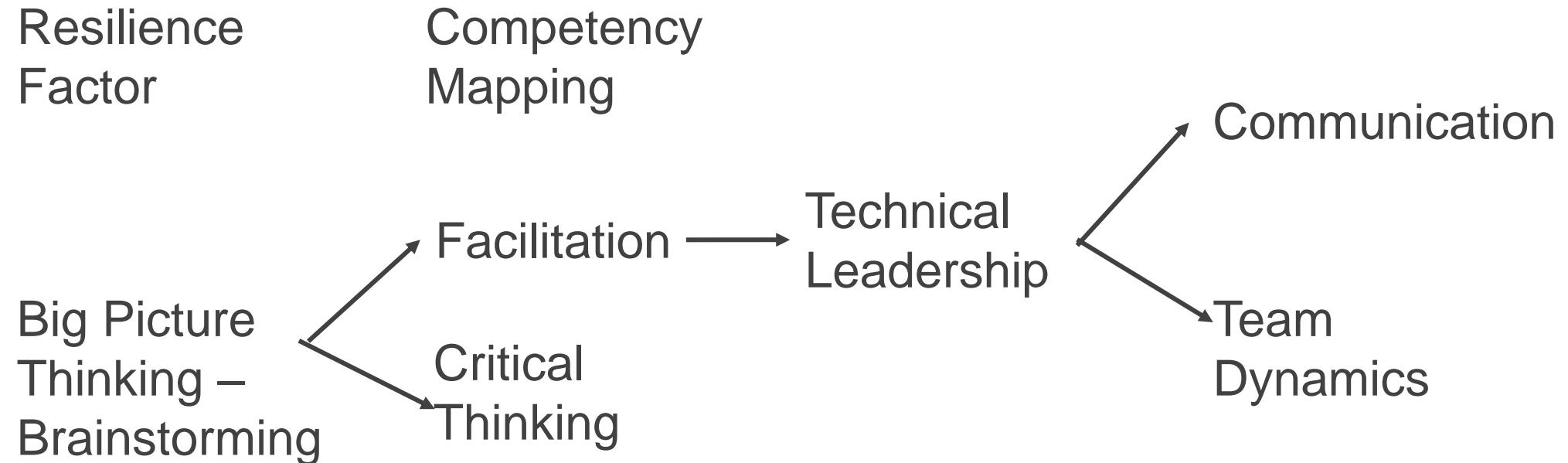
Competency
Mapping

Big Picture
Thinking –
Design
Thinking





Big Picture Thinking – Brainstorming



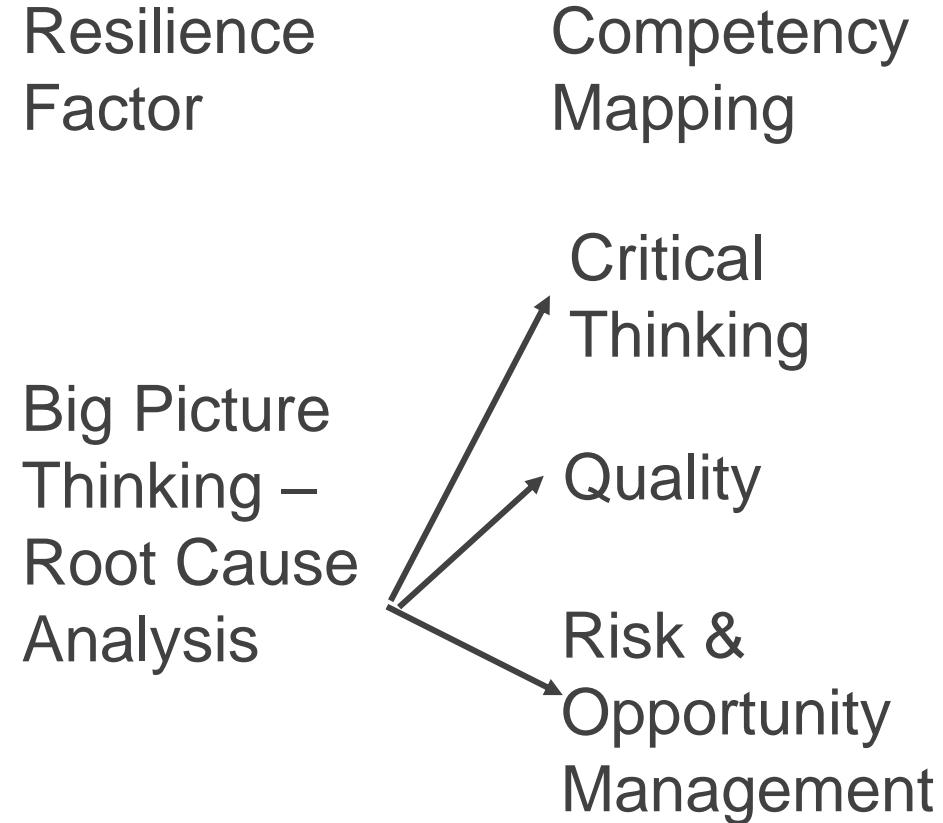


Big Picture Thinking – First Principles

- SE's first principles are embodied in the General Engineering Competency



Big Picture Thinking – Root Cause Analysis





Big Picture Thinking – Innovation and Creativity

Resilience
Factor

Competency
Mapping

Big Picture
Thinking –
Innovation &
Creativity

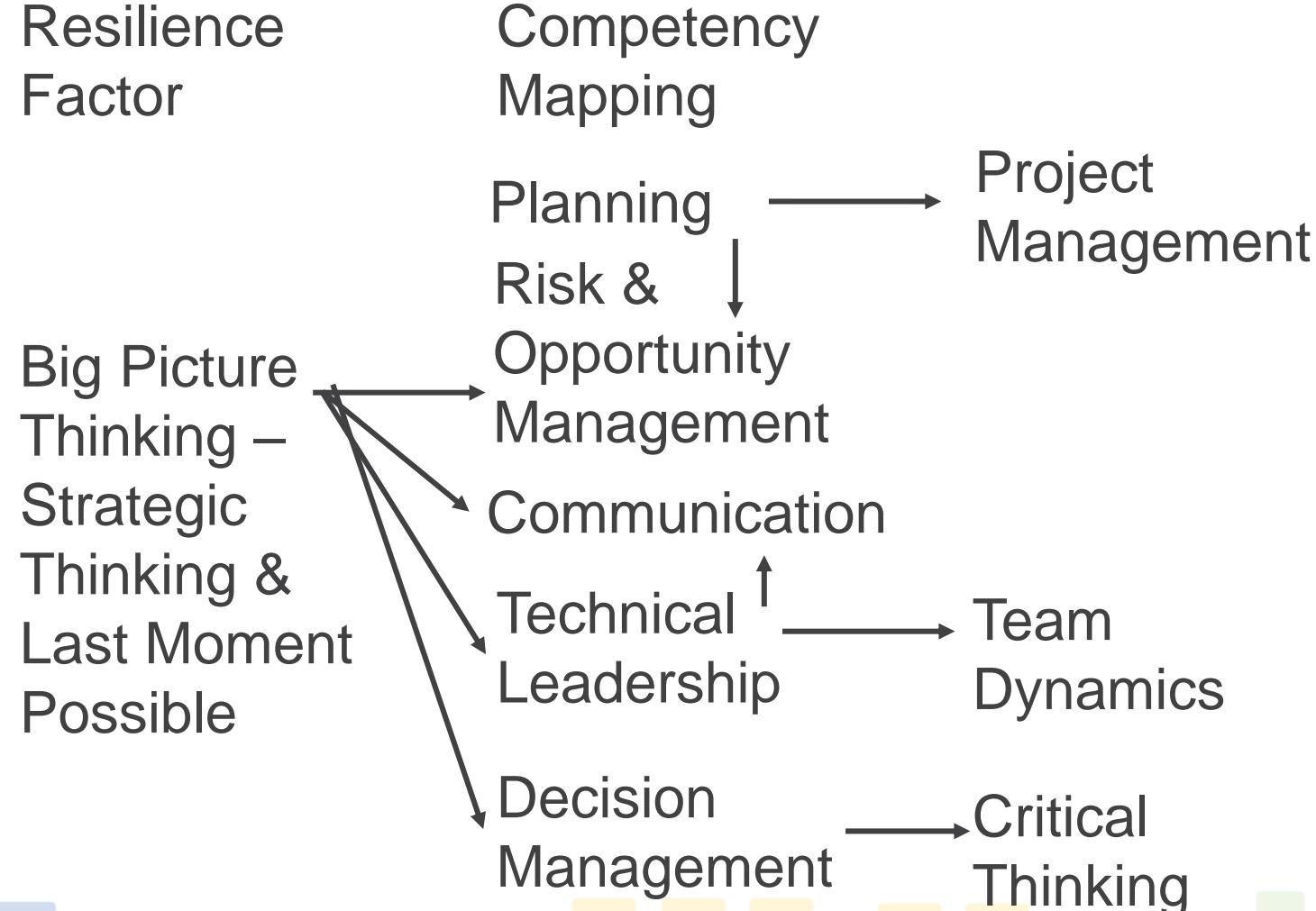
Critical
Thinking

Technical
Leadership

Communication

Team
Dynamics

Big Picture Thinking – Strategic Thinking and “Last Moment Possible”



Big Picture Thinking – Think Globally, Act Locally



Resilience Factor

Competency Mapping

Big Picture Thinking – Think Globally, Act Locally

Lifecycles

Design for...

Planning

Risk & Opportunity Management

Project Management

Big Picture Thinking – Assumptions and Constraints



- SEs deal with assumptions and constraints as they execute the Requirements Definition Competency



Change Agency

Resilience
Factor

Competency
Mapping

Change
Agency

Capability
Engineering

Transition

Planning

Professional
Competencies

Decision

Management

Business &
Enterprise

Risk &
Opportunity
Management

Critical
Thinking



Tolerance for Ambiguity

Resilience
Factor

Competency
Mapping

Tolerance
for
Ambiguity

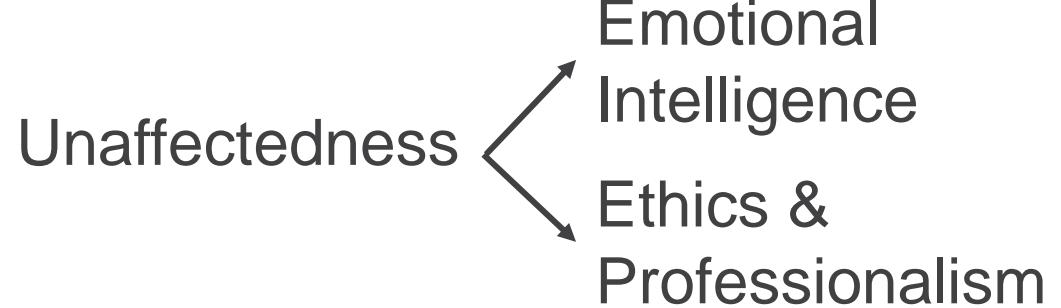




Unaffectedness

Resilience
Factor

Competency
Mapping





Observations and Conclusions

- 30 of the 36 SE competencies are related to Spacey's resilience factors
 - Core and Professional Competencies heavily engaged
 - Technical Competencies serve as foundational knowledge
 - SE Management Competencies useful in dealing with ambiguity
- Supports the assertion that SEs could have an edge regarding personal resilience



Observations and Conclusions

- Personal resilience taps into the SE competencies both directly and through interrelationships among the competencies



Observations and Conclusions

- Developing oneself in the SE competencies should further the development of personal resilience, enabling the ability to overcome adversity



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