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Redefining Resiliency using Principles of Social Cognitive Theories to Address the Gap in Training and Assessing Resiliency for Air Carrier Operations

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Redefining Resiliency using Principles of Social Cognitive Theories to Address the Gap in Training and Assessing Resiliency for Air Carrier Operations

Patricia Bockelman, Jessica Cruit, Peter Hancock

UNIVERSITY OF CENTRAL FLORIDA

We need to talk.

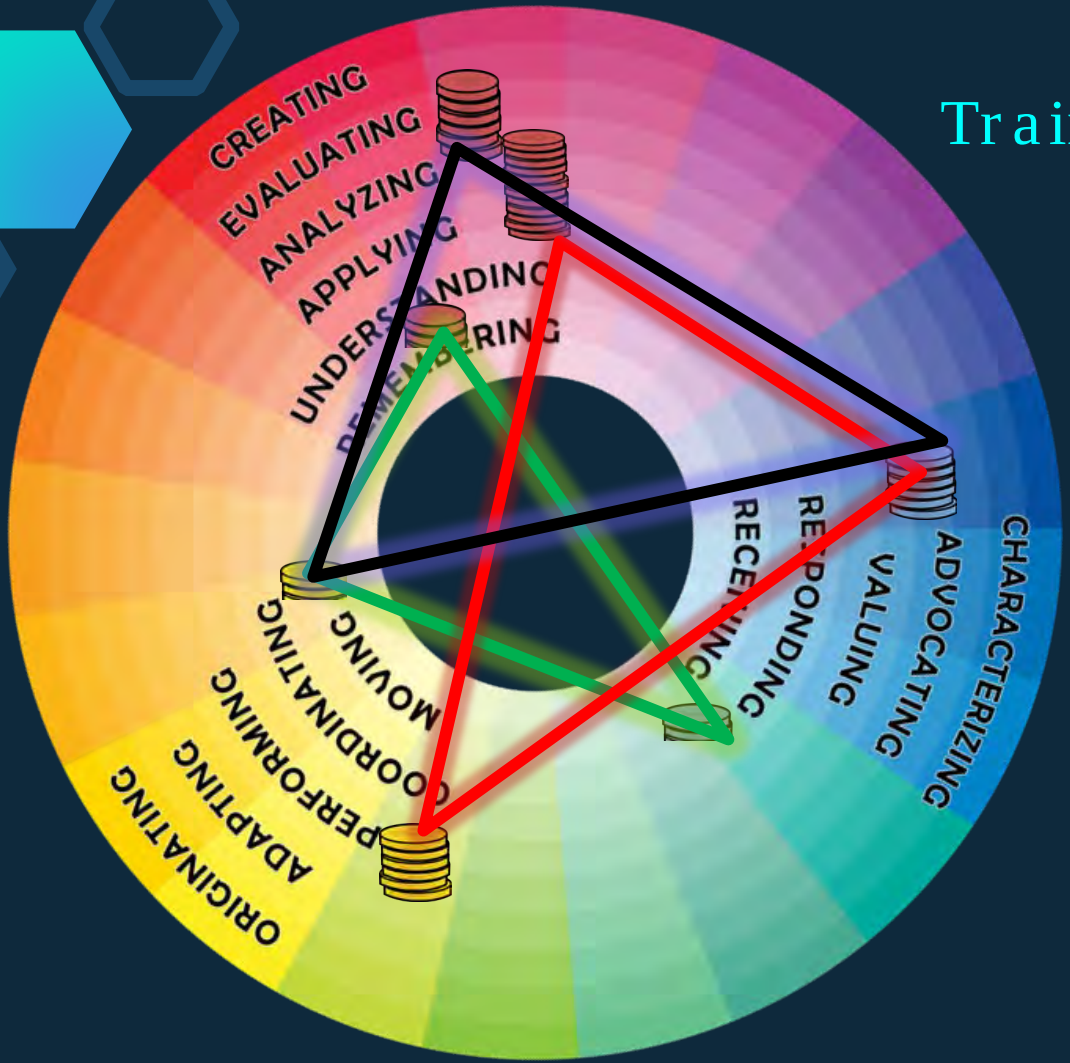
Hello!

We are…

Patricia Bockelman

Jessica Cruit

Peter Hancock



Trainers want to know:

- What KSA combos lead to resilience?
- How does the demand ratio shift dynamically?
- Which items should be prioritized for my domain?

1

The way we talk

Influences the path we take

2

There are models

For shared common language

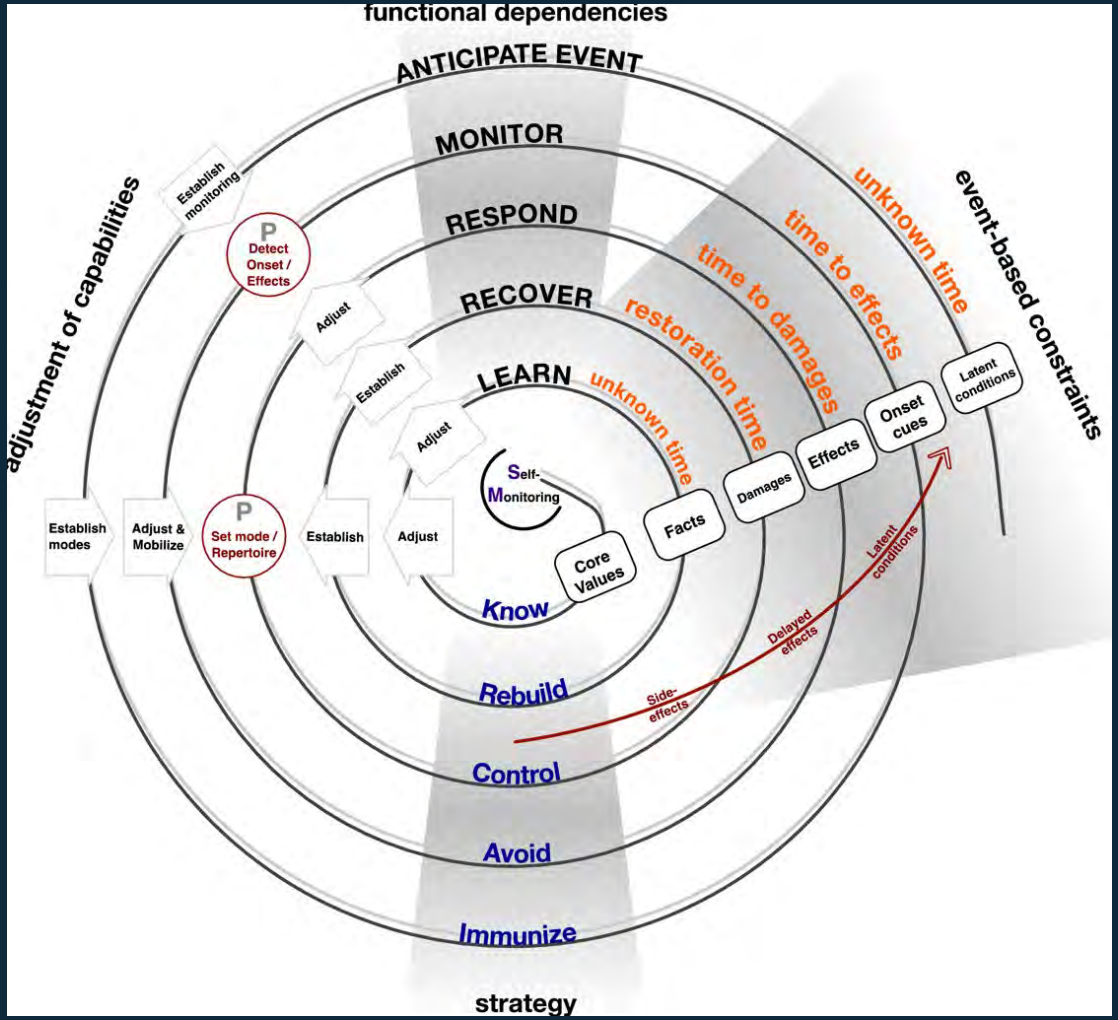
3

Training Implications

From piecing it together

Close Encounters of the 3rd Kind

Woods (2017) warns us…


functional dependencies
ANTICIPATE EVENT
MONITOR
RESPOND
RECOVER
LEARN
adjustment of capabilities
event-based constraints
strategy
Establish monitoring
P
Detect Onset / Effects
Adjust
Establish
Adjust
Establish modes
Adjust & Mobilize
P
Set mode / Repertoire
Establish
Adjust
Self-Monitoring
Core Values
Know
Rebuild
Control
Avoid
Immunize
unknown time
restoration time
time to damages
time to effects
unknown time
Facts
Damages
Effects
Onset cues
Latent conditions
Latent conditions
Delayed effects
Side-effects

Definition of Resilience	Source Domain
"Resilience (from *resilio*) a **leaping or skipping back**, a **rebounding**; a going from ones word. *Bac.* The French use *Resiliment* in the same sense."	Thomas Blount (1618)
The ability of a system, community or society exposed to hazards to **resist, absorb, accommodate** to and **recover** from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.	Disaster and Risk Prevention (UNISDR, 2009, p. 24).
Resiliency as **a personal characteristic**. The ability to adapt to, and to **bounce back** from, unexpected events (an idea of effectively returning to baseline/equilibrium).	Matthews et al., 2017
Resiliency is **robustness**, which is the ability of the system to operate within its normal operating boundaries when it is perturbed	Gluck et al., 2012; Hoffman & Hancock, 2017
"…the regulatory formulations make clear that operational resilience is located at the level of pilot **mental processes (mental flexibility**) and **behavior (performance adaptation**). Second, that this operational resilience can be improved through training. *Third, there is an interesting use of normative language which is open to interpretation*."	Bergström, 2019

Semantic - linguistic Analysis

Q1

Can we discover patterns in the way “resilience” is used in language?

Q2

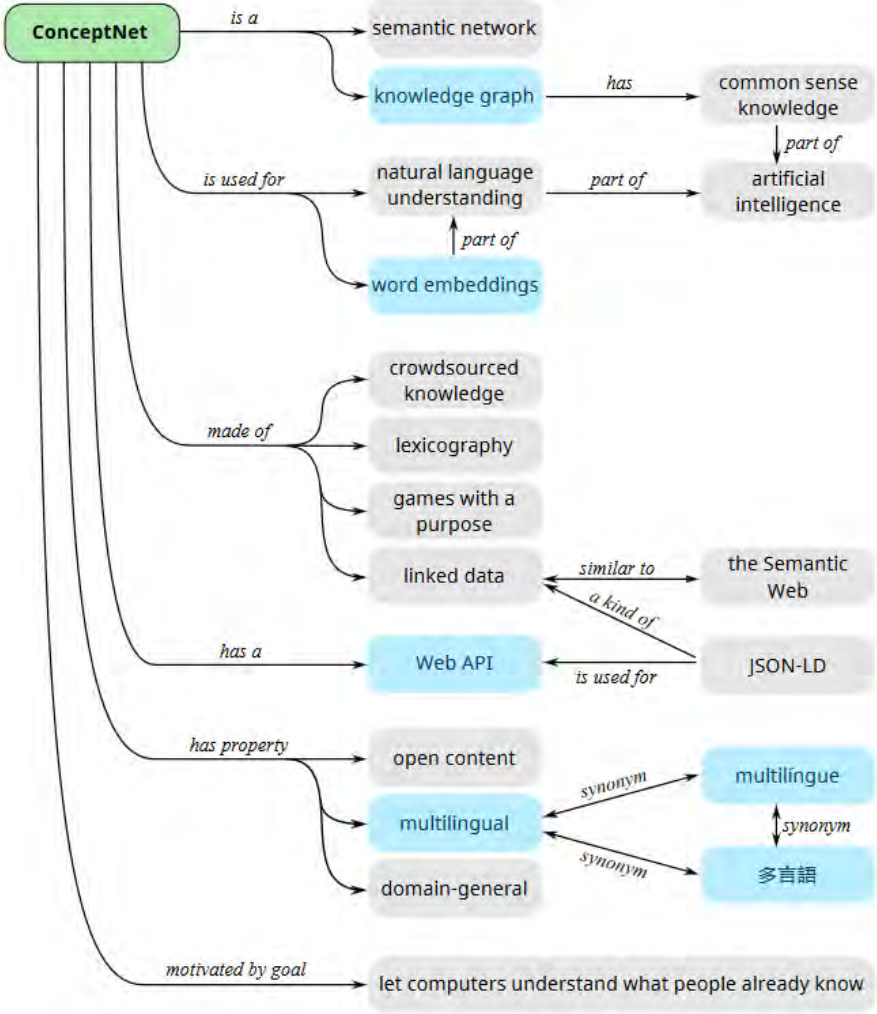
Will semantic clarification assist in a functional clarity of resilience constructs?

Q3

What training implications may be extracted from that clarification system?

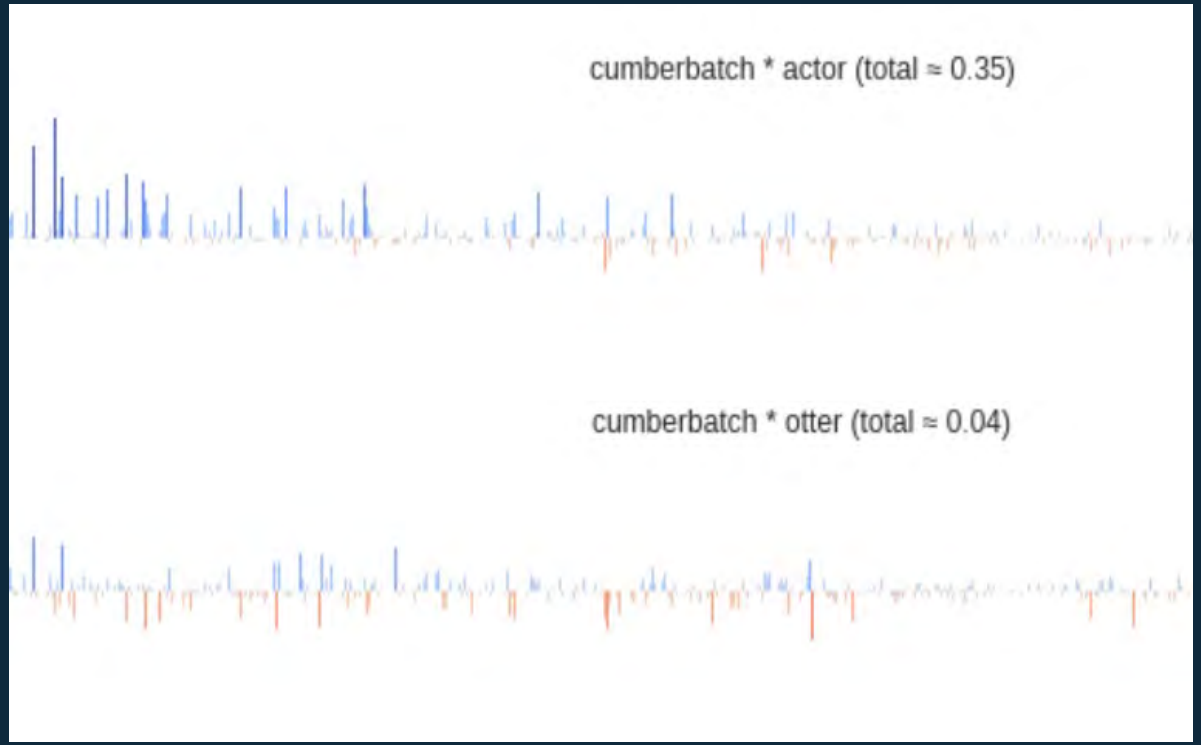
ConceptNet

Edges	Similarity weight	Anchor	Analysis source
spirited (a, wn)	— SimilarTo → Weight: 2.0	resilient (a, wn)	Source: Open Multilingual WordNet
elastic (a, wn)	— SimilarTo → Weight: 2.0	resilient (a, wn)	Source: Open Multilingual WordNet


ConceptNet
is a
semantic network
knowledge graph
has
common sense knowledge
part of
is used for
natural language understanding
part of
artificial intelligence
part of
word embeddings
crowdsourced knowledge
made of
lexicography
games with a purpose
linked data
similar to
the Semantic Web
a kind of
has a
Web API
is used for
JSON-LD
has property
open content
synonym
multilingue
multilingual
synonym
多言語
domain-general
motivated by goal
let computers understand what people already know

S: (n) resilience, **resiliency** (an occurrence of rebounding or springing back)
direct hypernym / *inherited hypernym* / *sister term*
derivationally related form
S: (n) resilience, **resiliency** (the physical property of a material that can return to its original shape or position after deformation that does not exceed its elastic limit)
direct hypernym / *inherited hypernym* / ***sister term***
S: (n) elasticity, snap (the tendency of a body to return to its original shape after it has been stretched or compressed) *"the waistband had lost its snap"*
S: (n) resilience, **resiliency** (the physical property of a material that can return to its original shape or position after deformation that does not exceed its elastic limit)
S: (n) bounce, bounciness (the quality of a substance that is able to rebound)
S: (n) give, spring, springiness (the elasticity of something that can be stretched and returns to its original length)
S: (n) stretch, stretchiness, stretchability (the capacity for being stretched)
S: (n) temper, toughness (the elasticity and hardness of a metal object; its ability to absorb considerable energy before cracking)
S: (n) elasticity of shear (the elasticity of a body that has been pulled out of shape by a shearing force)
derivationally related form
W: (adj) resilient [Related to: resilience, resiliency] (elastic; rebounds readily) *"clean bouncy hair"; "a lively tennis ball"; "as resilient as seasoned hickory"; "springy turf"*
W: (v) resile [Related to: resilience, resiliency] (return to the original position or state after being stretched or compressed) *"The rubber tubes resile"*

WordNet


cumberbatch * actor (total ≈ 0.35)
cumberbatch * otter (total ≈ 0.04)

WordNet Search - 3.1

- WordNet home page - Glossary - Help

Word to search for: spirited [Search WordNet]

Display Options: (Select option to change) [Change]

Key: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Display options for sense: (gloss) "an example sentence"

Verb

- S: (v) spirit, spirit up, inspirit (infuse with spirit) *"The company spirited him up"*

Adjective

- S: (adj) **spirited** (displaying animation, vigor, or liveliness)
- S: (adj) bouncing, bouncy, peppy, **spirited**, zippy (marked by lively action) *"a bouncing gait"; "bouncy tunes"; "the peppy and interesting talk"; "a spirited dance"*
- S: (adj) game, gamy, gamey, gritty, mettlesome, **spirited**, spunky (willing to face danger)
- S: (adj) enlivened, **spirited** (made lively or spirited) *"a meal enlivened by the music"; "a spirited debate"*

WordNet Search - 3.1

- WordNet home page - Glossary - Help

Word to search for: bouncy Search WordNet

Display Options: (Select option to change) Change

Key: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Display options for sense: (gloss) "an example sentence"

Adjective

- S: (adj) **bouncy**, live, lively, resilient, springy (elastic; rebounds readily) *"clean bouncy hair"; "a lively tennis ball"; "as resilient as seasoned hickory"; "springy turf"*
- S: (adj) bouncing, **bouncy**, peppy, spirited, zippy (marked by lively action) *"a bouncing gait"; "bouncy tunes"; "the peppy and interesting talk"; "a spirited dance"*

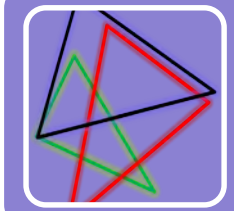
So, if it’s elastic…

- KSA combos lead to resilience

Identify the factors that make up specific resilient behaviors within context

Dynamic shifts in process

Identify the elements which constitute the processes of resilience



Customized prioritization

Identify the enabling conditions that elicit resilient behaviors

A different lens

Can social interaction constitute social cognition?

(DeJaegher, Di Paolo, Gallagher, 2010)

- F is a **contextual factor** if variations in F produce variation in X
- C is an **enabling condition** if the absence of C prevents X from occurring
- P is a **constitutive element** if P is part of the processes that produce X

Identified Resilient Performance Strategies Employed in Routine Aviation Contexts.

Capability	Strategy
Anticipate	Anticipate procedure limits
	Anticipate knowledge gaps
	Anticipate resource gaps
	Prepare alternate plan and identify conditions for triggering
Monitor	Monitor environment for cues that signal a change from normal operations
	Monitor environment for cues that signal need to adjust/deviate from current plan
	Monitor own internal state
Respond	Adjust current plan to accommodate others
	Adjust or deviate from current plan based on risk assessment
	Negotiate adjustment or deviation from current plan
	Defer adjusting or deviating from plan to collect more information
	Manage available resources
	Recruit additional resources
	Manage priorities
Learn	Leverage experience and learning to modify or deviate from plan
	Understand formal expectations
	Facilitate others' learning

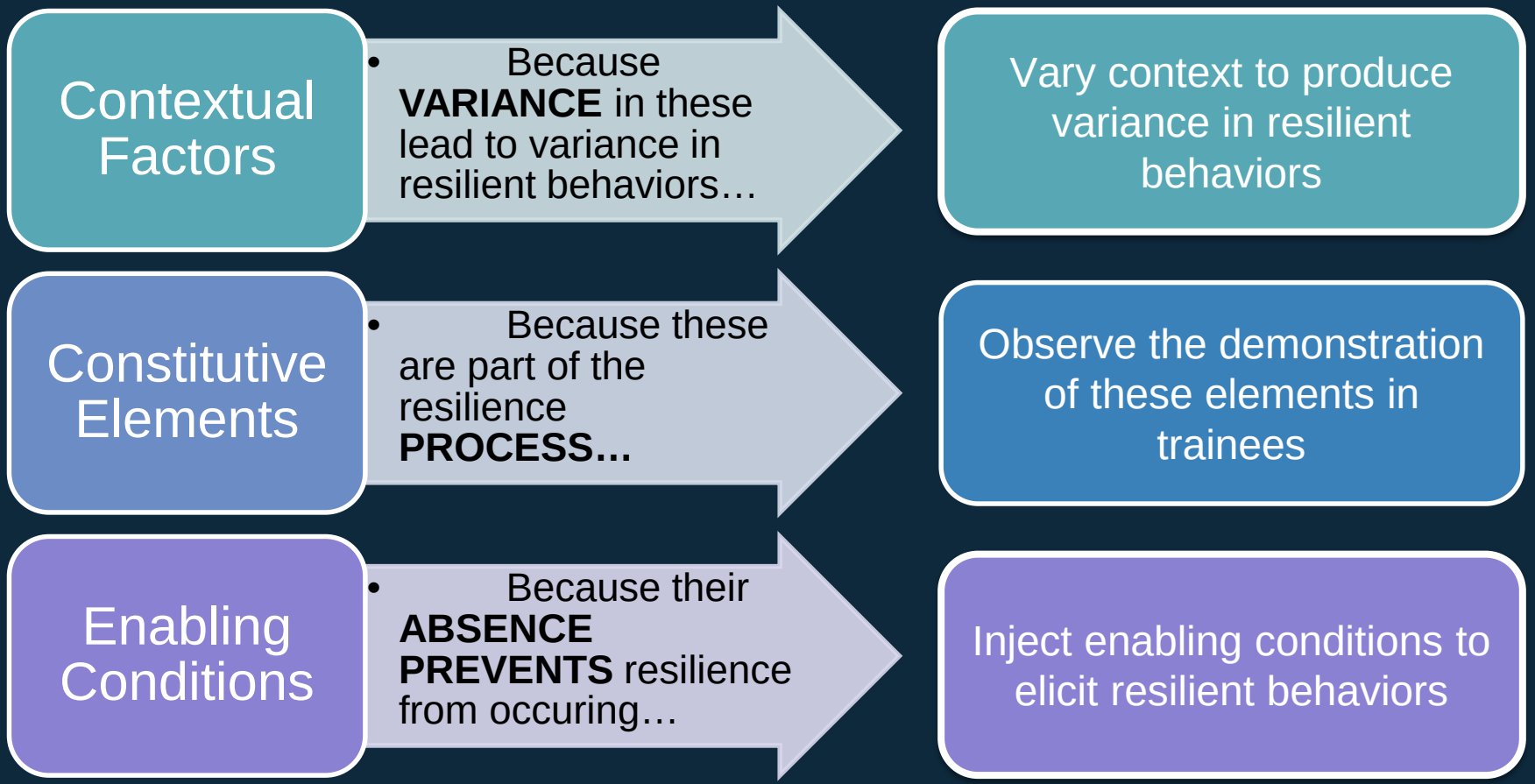
Hollbrook et al., 20019

	verb	object	Contextual Factors	Constitutive Elements	Enabling Conditions
Anticipate	anticipate	procedure (i.e. the limitations of the procedure)	Y	N	N
	prepare	plan	Y	U	N
Monitor	monitor	environment (for change)	Y	Y	Y
	monitor	self	Y	Y	Y
Respond	adjust	plan	Y	Y	N
	accommodate	solution	Y	Y	Y
	manage	resources	Y	Y	Y
	recruit	resources	Y	Y	N
Learn	leverage	experience	Y	Y	Y
	understand	expectations	Y	Y	Y
	facilitate	learning (others)	Y	N	N

-F is a contextual factor if variations in F produce variation in X

-C is an enabling condition if the absence of C prevents X from occurring

-P is a constitutive element if P is part of the processes that produce X


Contextual Factors
Because **VARIANCE** in these lead to variance in resilient behaviors…
Vary context to produce variance in resilient behaviors
Constitutive Elements
Because these are part of the resilience **PROCESS…**
Observe the demonstration of these elements in trainees
Enabling Conditions
Because their **ABSENCE PREVENTS** resilience from occuring…
Inject enabling conditions to elicit resilient behaviors

Recommendations

Acknowledgements

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1. Woods, D. D. (2017). Essential characteristics of resilience. In *Resilience engineering* (pp. 21-34). CRC Press.
2. Lundberg, J., & Johansson, B. J. (2019). Resilience is not a silver bullet–Harnessing resilience as core values and resource contexts in a double adaptive process. *Reliability Engineering & System Safety* , *188*, 110-117.
3. De Jaegher, H., Di Paolo, E., & Gallagher, S. (2010). Can social interaction constitute social cognition?. *Trends in cognitive sciences* , *14*(10), 441-447.
4. Bergström, J. (2019). The Discursive Effects of Safety Science. *Safety Science Research: Evolution, Challenges and New Directions* , p173.
5. Speer, R., Chin, J., & Havasi, C. (2017, February). Conceptnet 5.5: An open multilingual graph of general knowledge. In *Thirty-First AAAI Conference on Artificial Intelligence* . http://conceptnet5.media.mit.edu/
6. Princeton University (2010). "About WordNet." WordNet. Princeton University. https://wordnet.princeton.edu/
7. Holbrook, J., Prinzell III, L. J., Stewart, M. J., Smith, B. E., & Matthews, B. L. (2019). Resilience and Safety for In-Time Monitoring, Prediction, and Mitigation of Emergent Risks in Commercial Aviation. In *38th International Symposium on Aviation Psychology* (p. 109).

Thanks!

Any questions?

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