Part One

Understanding human performance in complex systems

Dik Gregory and Paul Shanahan
How do people deal with limited resources?

People trade off.

Efficiency

Thoroughness
How do we decide what is ‘good enough’?

State
- fatigue
- stress
- personality
- mood
- health
- complacency

Understanding
- senses
- sense-making
- risk
- meaning
- memory
- emotions
- experience
- biases

Goals
- purposes
- plans
- procrastination
- expertise
- habits
- willpower
- values
- motivation
- needs

Fairness
- Belonging
- Social contact
- Autonomy
- Cooperation
How do we decide what is ‘good enough’?

**State**
- fatigue
- stress
- mood
- personality
- boredom
- complacency

**Understanding**
- senses
- sense-making
- biases
- risk
- meaning
- emotions
- knowledge

**Goals**
- purposes
- plans
- procrastination
- willpower
- expertise
- habits
- needs
- values
- motivation

**SUGAR**
- Efficiency
- Thoroughness
- Review
How do we synchronise our decisions with each other?

Teamworking

Language

Diversity

Leadership

Social pressure

Social capital

Trust
What’s different about complexity?

- Distributed control
- Tight connection
- Fundamental uncertainty
- Necessary performance variability
- Tendency for system ‘drift’
- No need for complication!
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Where does all this get us?

Premises

- Humans need to ‘complete the design’
- We do so by deciding what’s ‘good enough’
- ‘Good enough’ depends on our SUGAR mix
- Our SUGAR mix changes with each decision
Where does all this get us?

Conclusions
So, it would helpful to have tools which:

- Help individuals understand and resist **toxic** SUGAR mixes
- Warn organisations when things are **going wrong** systemically
Where can we find such tools?

Resilience engineering

What is resilience?
“the quality of a system that allows it to maintain its stability in the face of constant disruption”
How can we measure resilience?

Buffering
How can we measure resilience?

Flexibility
How can we measure resilience?
How can we measure resilience?

Tolerance
How can we measure resilience?

Discord
How can we measure resilience?

**Examples?**

- Discord
- Buffering
- Tolerance
- Margin

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In summary – four key points

- We can only view things based on our dynamically changing SUGAR mix.
- We ‘complete the design’ based on our current SUGAR mix – which determines ‘good enough’.
- We need to focus on resilience rather than human error.
- We need to develop resilience indicators to tell us when the system is becoming unsafe.
Being Human
in safety-critical organisations

by

Dik Gregory and Paul Shanahan

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Part Two

Practical steps towards resilience
Why do people often know about safety problems, but nobody does anything?

Some real-life examples of senior manager trade-offs gone wrong
Shuttle Explodes; All 7 Die on Board as Challenger Blows Up on Liftoff

Reagan Postpones Future Flights Pending a Probe

By MICHAEL SEILER and PETER H. KING
Times Staff Writers

KENNEDY SPACE CENTER, Fla.—The space shuttle Challenger exploded in a huge fireball less than two minutes after takeoff today, with all seven crew members—including New Hampshire teacher Sharon Christa McAuliffe—fear dead.

Airborne paramedics parachuted quickly into the calm waters off Cape Canaveral in a vain search for survivors.
Though there was no immediate announcement on the fate of the crew, all were believed dead.

The disaster—the worst in the history of America’s manned space program—came shortly after the Challenger blasted off on a cold Florida morning on the 25th shuttle
The blazing Zafira
Unnecessary baby deaths
Collapse of Barings Bank
Looking at your own trade offs

Task

- Take a few minutes to discuss a safety-related trade off you have made in the past.
- How were you influenced by your SUGAR mix at the time?
- Each come up with the three factors that most influenced your trade off.

Questions that may help

- How far did you have the knowledge and skills to solve the problem at the time - and why (not)?
- What were your goals at the time, how clear-cut were your priorities - and why (not)?
- How safe did you feel at the time - and why (not)?
- What sense of obligation did you feel at the time - to whom - and why (not)?
- How pressing did the problem seem at the time - and why (not)?
What can you do – now – to increase your organisation’s resilience?

Task

- Take a few minutes to brainstorm actions that could increase the resilience of your organisation

- Each come up with the three actions that you could realistically take to increase resilience

Possible considerations

- What’s the difference between management perception and operator experience of safety-critical work - & how do you know?

- How far does everyone work with shared priorities and values - & how do you know?

- How often do people report a safety issue and what happens when they do?

- How hard are people working to achieve their agreed objectives, how has this changed over time - & how do you know?

- What are the main sources of pressure on the people who work in your organisation, how well are they coping - & how do you know?

- How are your safety performance boundaries defined, how were they validated, where is everybody with respect to them - & how do you know?

- How often are people surprised by events, how well do they deal with them – & how do you know?
Final observations

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