MIT STAMP WORKSHOP 2026

The STPA “Aha” Moment Decoded:

What accelerates the mental-model shift needed to engineer a safer world - and what gates it.

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The “Aha!”

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Engineering a safer world starts in the mind...

That is also where progress can stall.

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First: A Mental Model Shift



- Required:
  - A Shift in Worldview
- Challenges:
  - Identity:
- Can Provoke:
  - Resistance rather than Curiosity

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No shared, evidence-based account of what triggers the shift.

- What, precisely, triggers the STPA/CAST "aha" moment?
- Do triggers converge across unrelated engineering domains?
- Are the ahas that convert *you* the same as those you use to convert *others*?
- Can the shift be accelerated deliberately, rather than left to chance?

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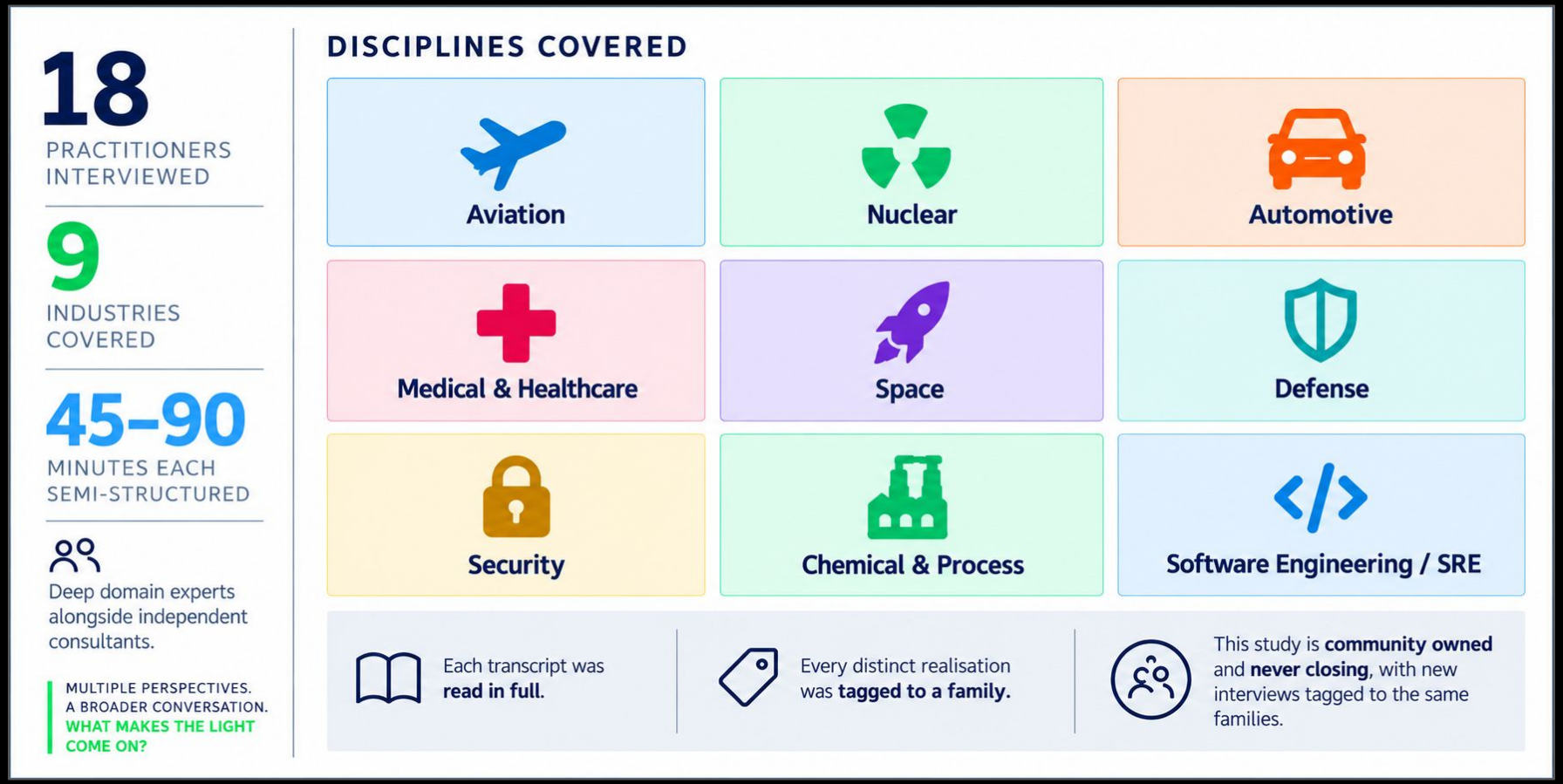
Cross-discipline field study



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The Spectrum of Seven "Aha" Families

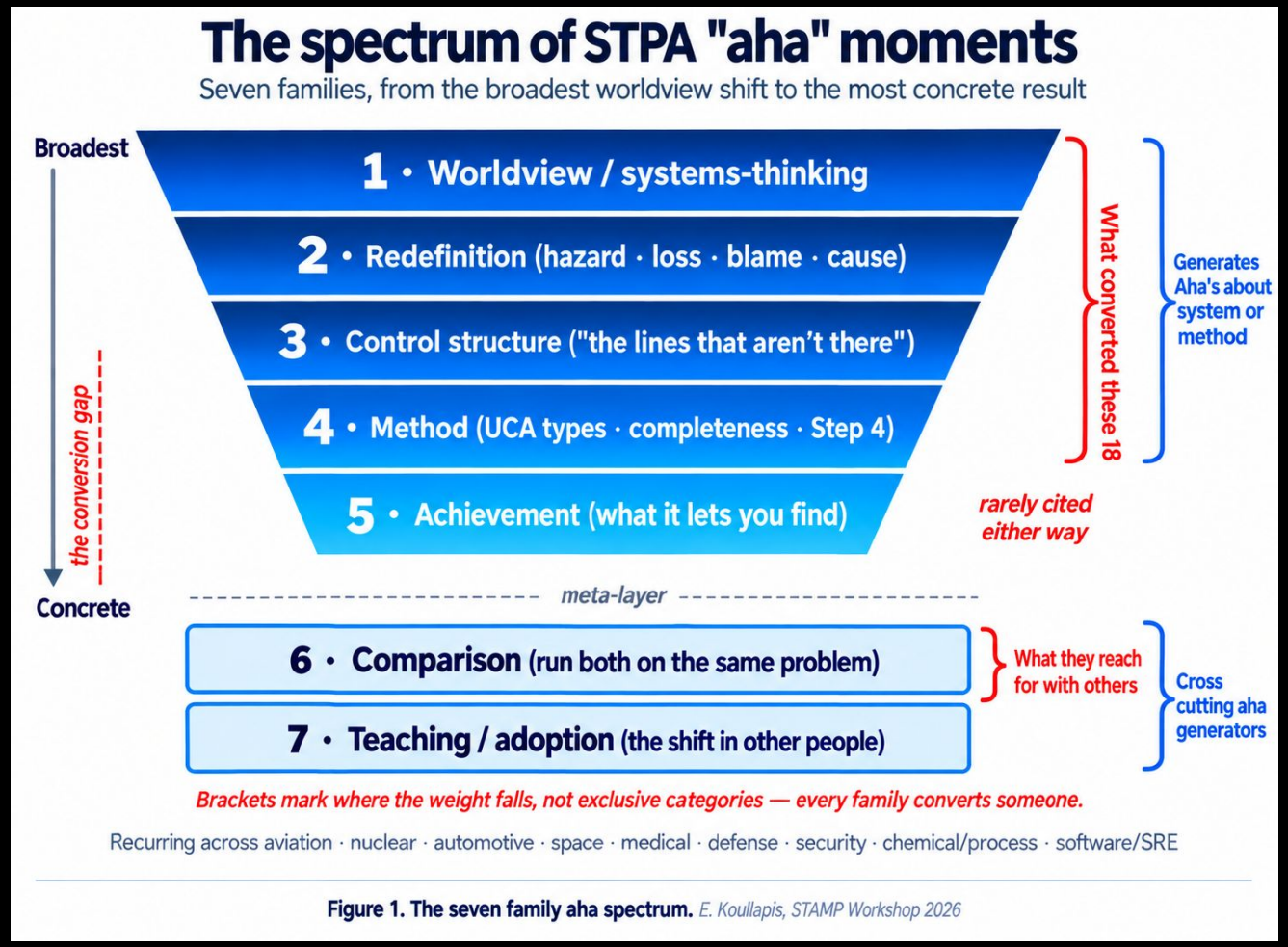

Figure 1. The seven family aha spectrum. *E. Koullapis, STAMP Workshop 2026*

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Family 1 - Worldview

A precondition for all other aha's

- **An old perspective stops being sufficient** — it can no longer explain or solve the problems being observed.

- **A new insight expands an existing belief** — revealing there is more to the world/system than first understood.

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Worldview

- **An old perspective stops being sufficient** — it can no longer explain or solve the problems being observed.

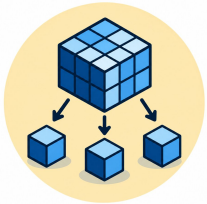
"We grow up in a linear world"



'Our education reinforces linear, component focused views.'



'We learn to understand complexity through decomposition'



'We assume good components mean they system will be good'



"Systems thinking requires us to unlearn that mental model''



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Worldview

An old perspective stops being sufficient — it can no longer explain or solve the problems being observed.

> *"They did everything they were supposed to do — yet still ended up with an unsafe aircraft in the sky. That made me look twice at STAMP."*

> *"There was always something missing. Every accident report I looked at — including those I helped write — felt incomplete."*

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Worldview

- **A new insight expands an existing belief** — revealing there is more to the world/system than first understood.
    - “Systems theory as ‘a law of the universe’ that explains complex software, human operations, and organisations alike.” Dr J.P Thomas
    - The single most repeated theme in this study:
        - “I was always a systems thinker; I just lacked the language.”

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Worldview alone is not sufficient

Knowledge is not the same as insight and intuition

> *“You can be a systems thinker and still not get STPA.”*

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Family 2 · Redefinition

The words stop meaning what they used to

Hazard · Loss · Safety · Blame · Cause

The Non-Failure Accident

"*You can have a system that works exactly as intended, no failures, and it still kills everyone.*"

No component fails and the outcome is still catastrophic.

Real-World Examples:

- Mars Lander: A leg-lock fooled a touchdown sensor into early shutdown.
- The Nimrod: Passed formal certification yet remained un-airworthy.

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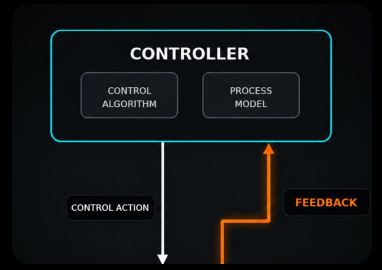
Family 3 · Control Structure

The lines that aren’t there



The 'Aha!' Generator

Personal Discovery

A personal aha generator — revealing unseen control lines and implicit feedback mechanisms.

*“a novice grasps the system from the control structure **without** domain experts”*

Collective Alignment

A collective aha generator — bridging stakeholders who perceive the system from vastly different angles.

Shared Perspectives

“Two boxes and two arrows — the keystone to everything.”

“The control structure gives different perspectives a shared map.”

“Put the map between people — and they start to see each other differently.”

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Family 4 · Method

The structured “Aha” entry point

Step 1: The Underrated Lever

“Often, it's kind of just skipped through... people think they know it, but they just don't.”

— medical devices & critical software

Step 4: The Converter

“Step 4 — oh, it's good.”

“You can't do this with any credibility without bringing subject-matter experts into the room. And you can't bring them in separately.”

Key Realization: You have to do STPA to get the AHA — it is the step that cannot be done at a desk.

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Family 5 - Achievement

What it lets you find

Foresight & Impact

The Crystal Ball Effect

STPA’s unique ability to provide foresight and reveal hidden system dynamics before they surface in production.

Executive Value

Delivers key "Aha!" moments directly to the sponsors of STPA initiatives to demonstrate clear ROI.

Cross-Family Discovery

"Aha!" insights in this family continuously map back to higher-level system architecture families.

“We surfaced scenarios the team hadn’t seen in ten years of certification — the whole team went, ‘Wow.’”

“Found what the design team never considered.”

“You think you have the evidence — CAST shows you where else to look.”

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Family 6 - Comparison

Run both on the same problem

- Side-by-side analysis can be the most effective converter
  - Comparison makes limitations visible
  - What one method misses can create the aha
- Experience the difference — don’t just explain it
- Same accident. Different methods. Different findings.
  - Most powerful when applied to an accident they personally investigated

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Family 7 - Teaching & Adoption

Core Objective: Using the Aha Families to Enable the Shift in Others

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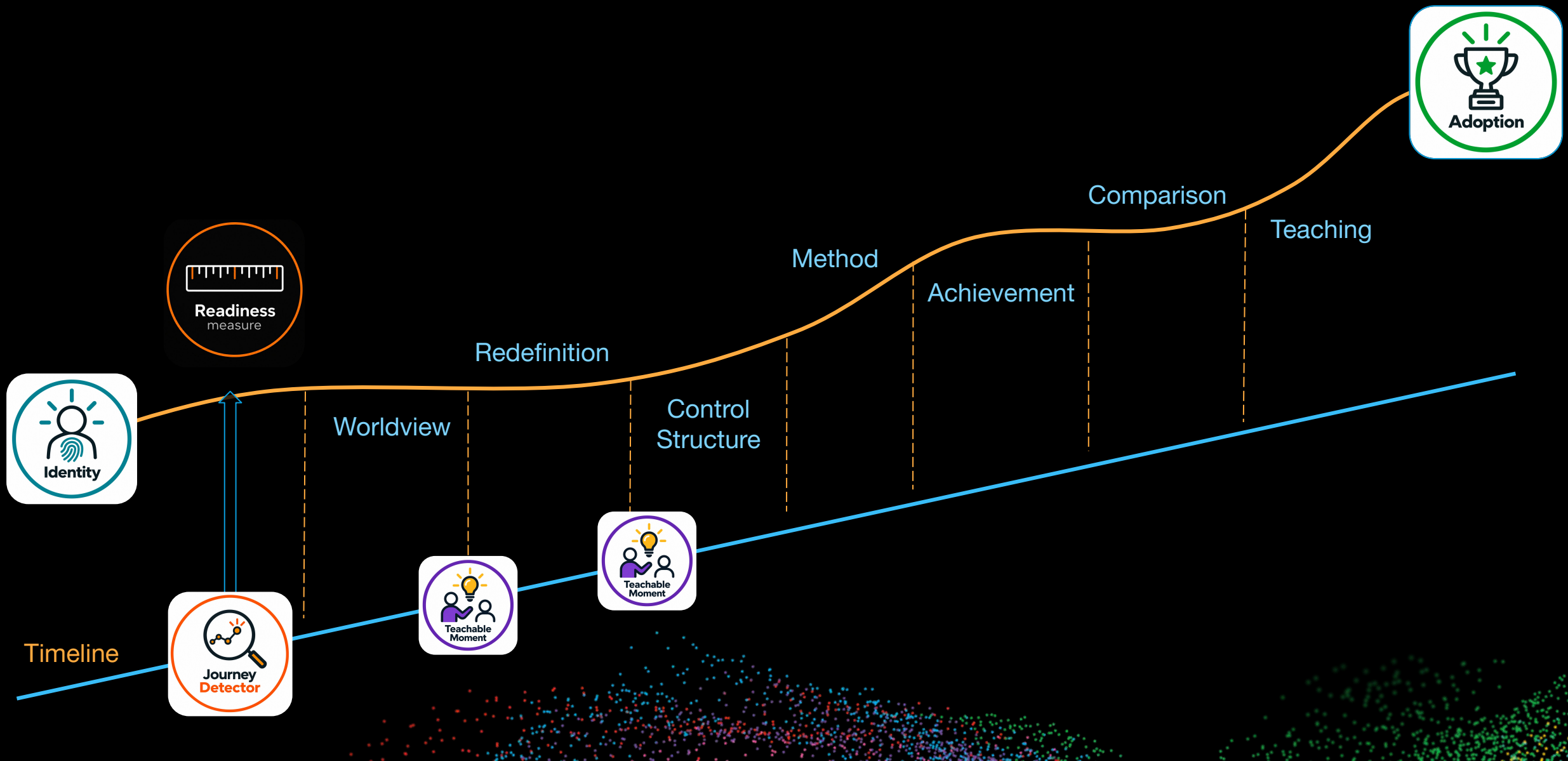
The Conversion Curve



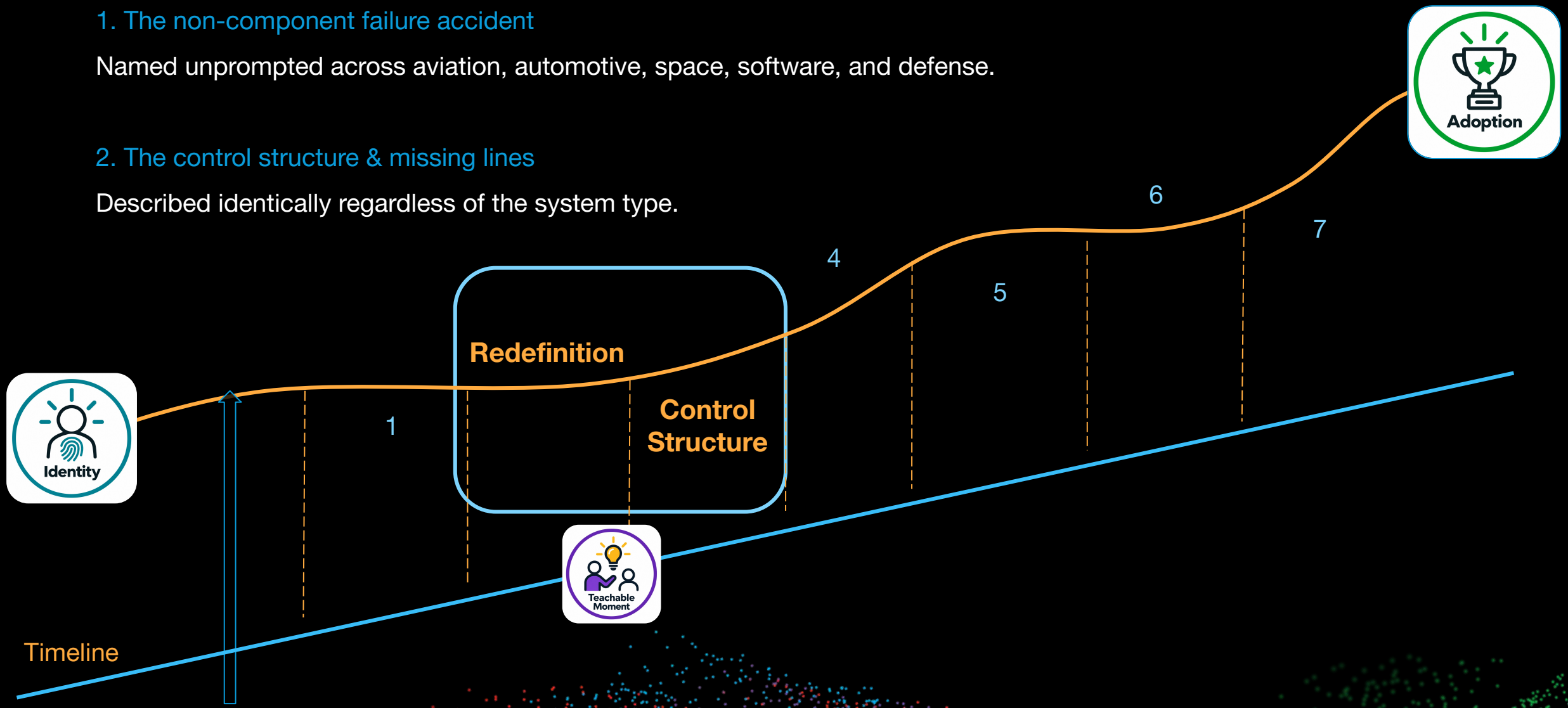
The Two Most Convergent "Aha" Moments

1. The non-component failure accident

Named unprompted across aviation, automotive, space, software, and defense.

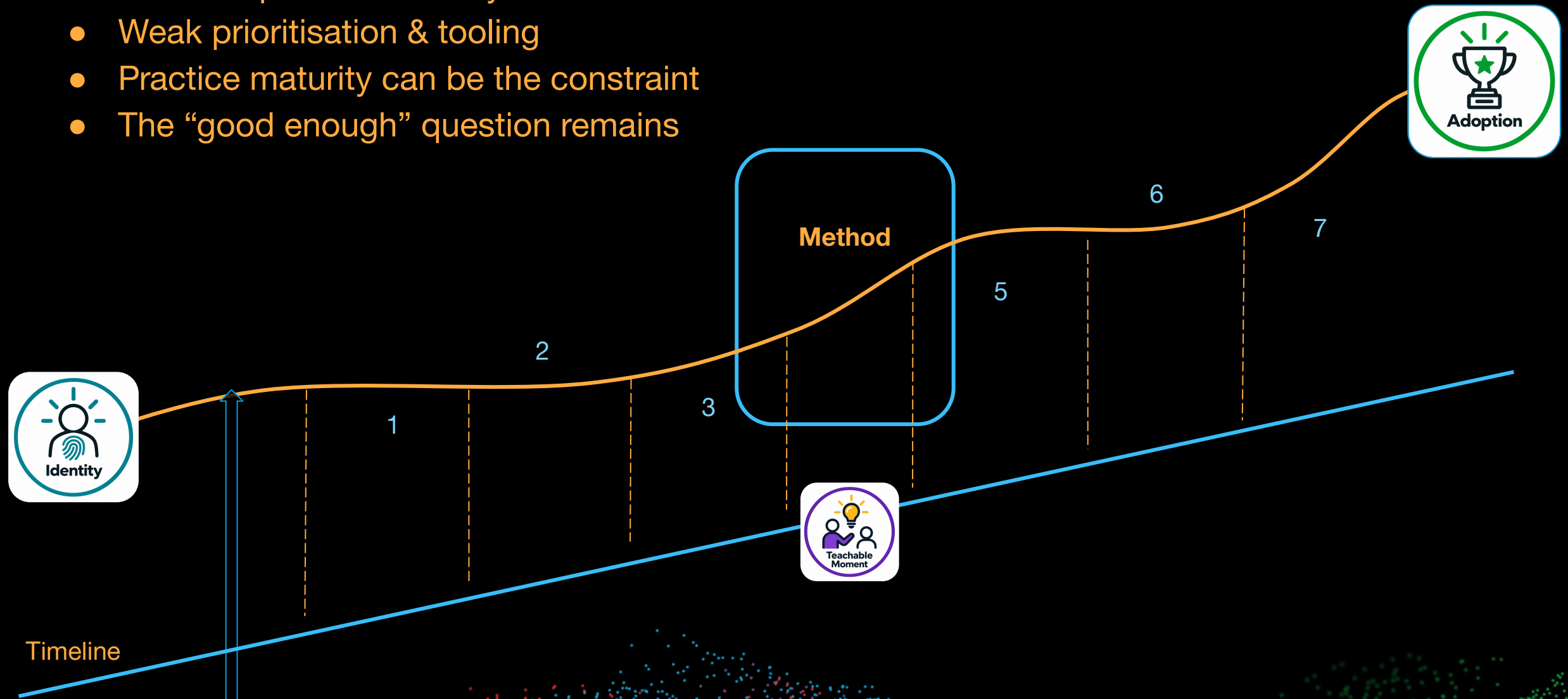
2. The control structure & missing lines

Described identically regardless of the system type.



Method - Teaching moment

- Rigidity for fast-moving software & AI
- Can collapse into triviality at scale
- Weak prioritisation & tooling
- Practice maturity can be the constraint
- The “good enough” question remains



Adoption Lessons

01

Rescue those who want rescuing

02

You don't have to climb Everest

03

A converted leader is not enough

04

Go to them

05

Mission before education

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Acceleration Tips?



01

Readiness screen

identify when someone is open to the shift

02

Teaching playbook

practical drills and examples that trigger the aha

03

Adoption playbook

make the shift stick through targeting, rollout and ownership

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Insights for Meditation



There is no one "the aha." There are seven — and two are near-universal

Respect Identity & measure readiness and teachability

To accelerate you need teaching & adoption strategy

The limits are real — and naming them builds credibility

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Teach for the click.
Don’t wait for it

The patterns converge strongly enough across 9 disciplines

Strategically use the 7 aha families to achieve our mission:

Engineering a Safer World!

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Engineering a safer world requires an ongoing effort

Human insights on STPA ‘Aha’ moments are priceless.

COMMUNITY VISION

This is a community-owned study that does not need to close

- Create and share a database of collected insights
- Develop strategies for addressing the challenges to achieving insight.

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Thank you to the ‘Aha’ moment study group!



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Invitation!

Help us sharpen the signal

Linkedin - Eloïse Koullapis

Whitepaper - STPA Aha Moments

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