...for better or worse, we two, for the time, were wedded... I saw that my own individuality was now merged... that my free will had received a mortal wound; and that another's misfortune or disaster might plunge me into death....I saw that here was a sort of interregnum in Providence; for its even-handed equity never could have sanctioned so gross an injustice. And yet still further pondering... I saw that this... was the precise situation of every mortal that breathes... If your banker breaks, you snap; if your apothecary by mistake sends you poison in your pills, you die.

Herman Meville, *Moby Dick*, 1851
Chap. 72, *"The Monkey Rope"*

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A model of patient safety

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- Safety is made and broken in *systems*, not individuals.
- Progress on safety begins with understanding *technical work.*
- Productive discussions of safety avoid confounding *failure* with *error.*
- Safety is *dynamic,* not static; it is constantly renegotiated.
- *Tradeoffs* are at the core of safety.

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Patient Safety Timeline

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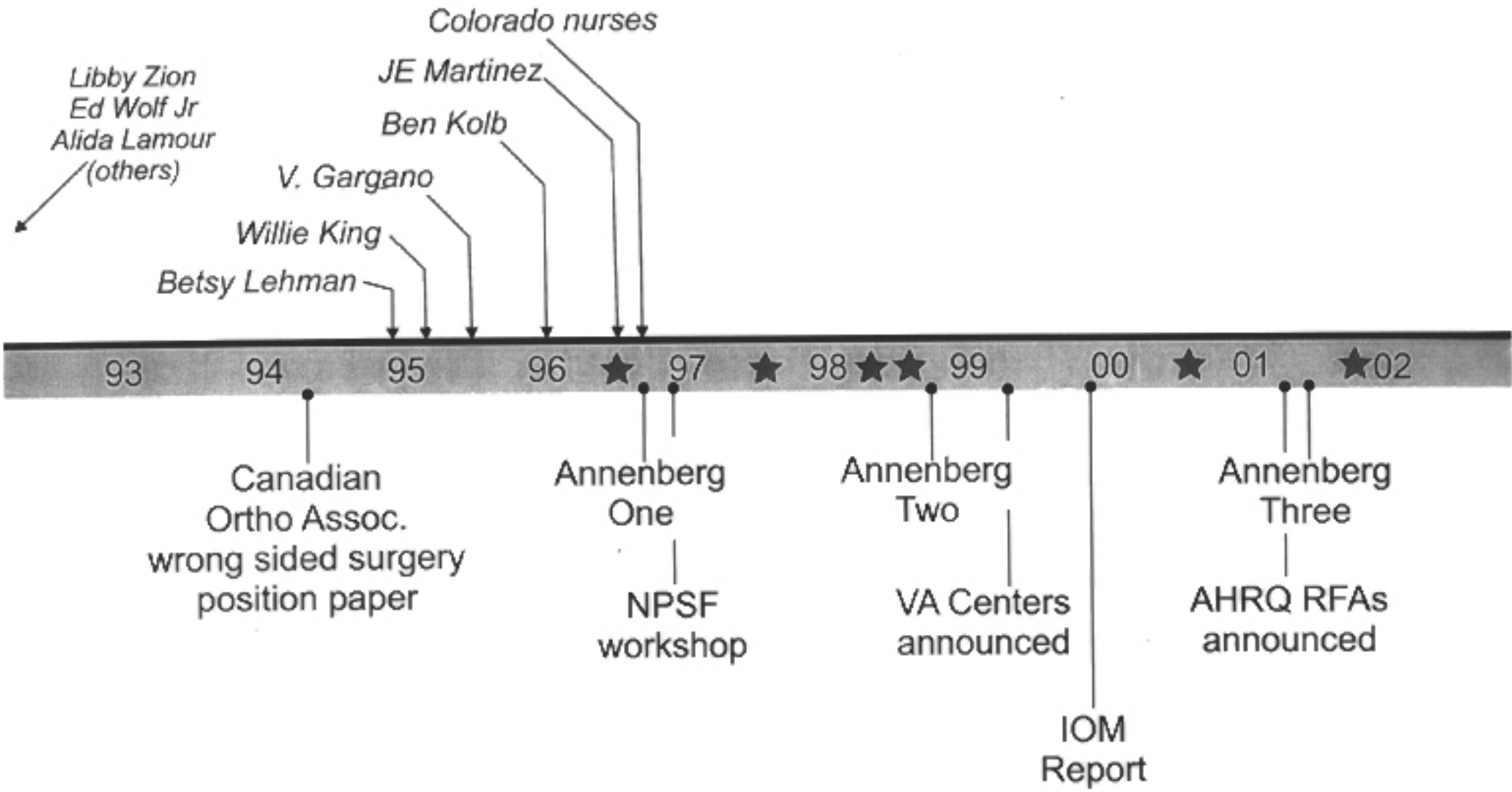

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How do insiders view failure?

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THE SYSTEM

Technology
Practitioners
Administration
Regulation

Practitioners

HUMAN ERROR

More motivation
More training
More technology
More sanctions

Technologists

HUMAN ERROR

More technology
More training
More sanctions

Administrators

HUMAN ERROR

More rules
More sanctions
More technology
More rules

Regulators

HUMAN ERROR

More sanctions
More rules
More certification

Human error by practitioners →

Blame and train
Automate people out of the system
More policies and procedures
More rules, regs
More (stiffer) sanctions

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How do other interested parties view failure?

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Professional organizations
Patient's rights organizations

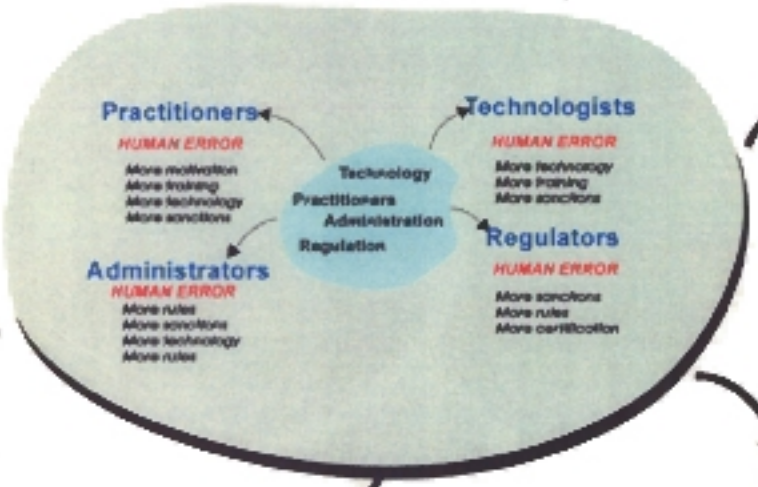
Status of members
Longevity of the org.

Social scientists

Social science
Good funding

Media

Good story
Conspiracy theory



Regulatory agencies

Big money
Huge liability
Political hot potato(e)

Equipment manufacturers

Huge market
Huge liability

Politicians

Big money
Potential media attention

Health system companies

Huge liability
Competitive edge

MORAL: *Everyone is a stakeholder*

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Sharp End and Blunt End

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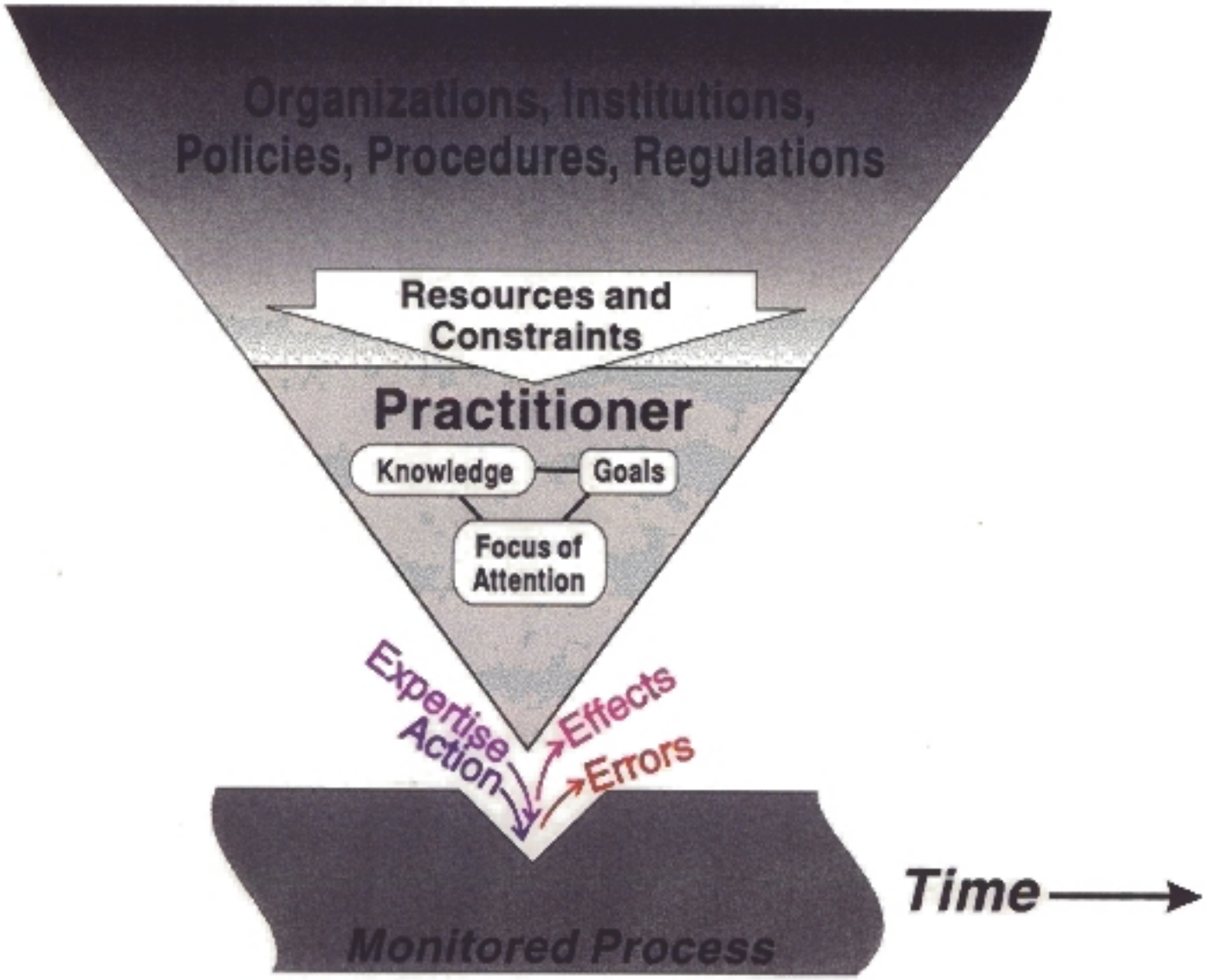

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Aftermath

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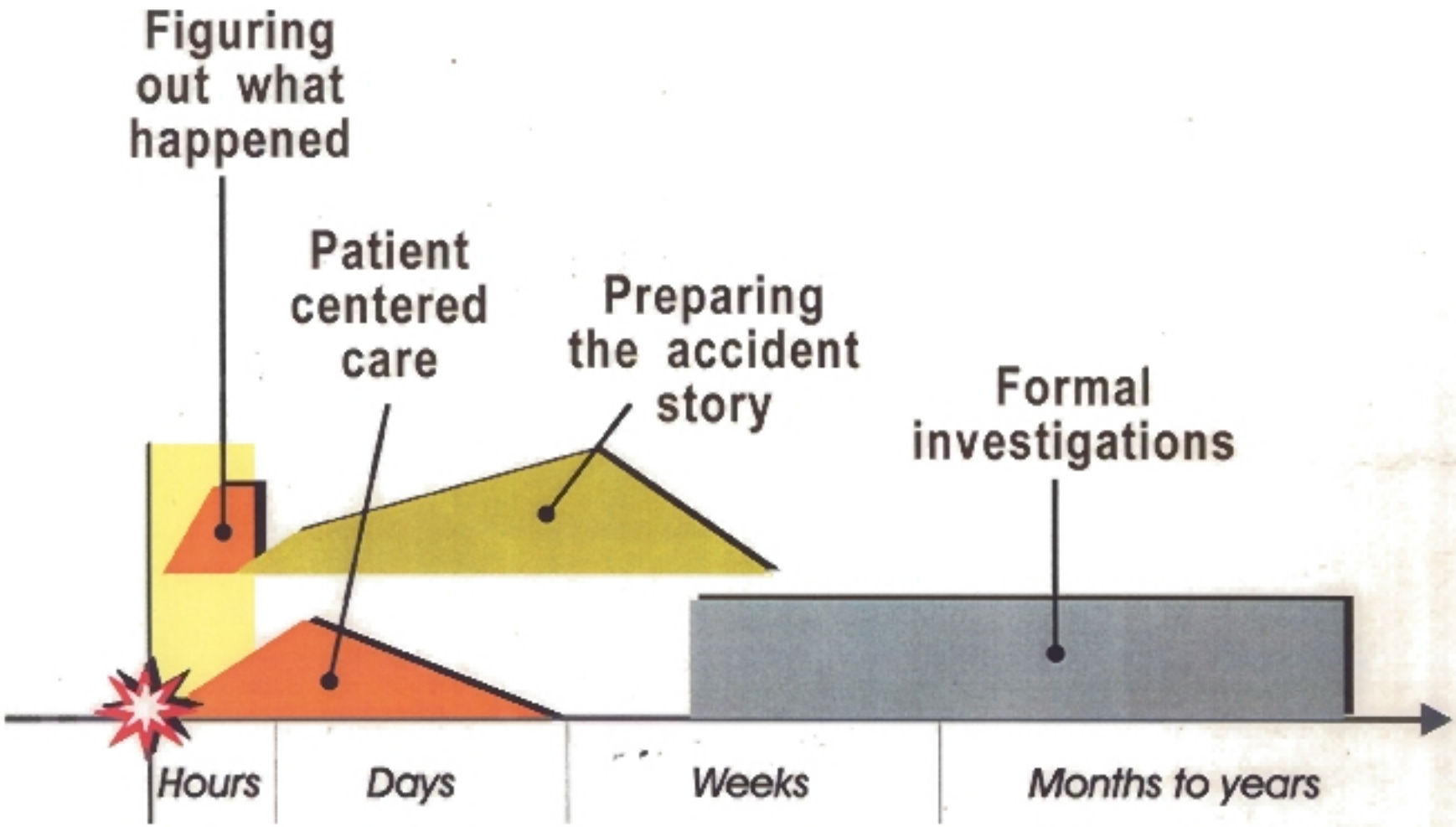

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CTL

- *Accidents appear...*

  ...astonishing.
  ...unique.
  ...preventable.

- Human error is considered the *cause* of accidents 85% of the time in a variety of domains.
  - Aviation
  - Nuclear power
  - Telecom.
  - Chemicals
  - Power dist.
  - Medical practice
  - Shipping
  - Railroads

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Accident exemplars for complex system failure

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Nuclear power generation
- Three Mile Island
- Chernobyl

Commercial aviation
- Dryden Air Ontario

Shipping
- Herald of Free Enterprise
- Exxon Valdez

Telecommunications
- Telephone outage in New York
- Galaxy IV satellite failure

Space satellite
- Ariane explosion
- SOHO satellite outage

Surface transportation
- Chicago school bus *v.* train

Chemotherapy overdose
- Dana Farber (Betsy Lehman)
- University of Chicago

Symmetry problem
- Wrong leg amputation (Willie King)

Drug-drug interaction
- Meperidine - MAO inhibitor (Libby Zion)

Medication identification
- Lidocaine - epinephrine (Ben Kolb)
- High *v.* low conc. esmolol
- IV benzathine PCN (Colorado nurses)

Pharmacy operations
- Computer outage
- Automated distribution failures

Surgery operations
- Unneeded anesthetic

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After accident view of the causes of failure

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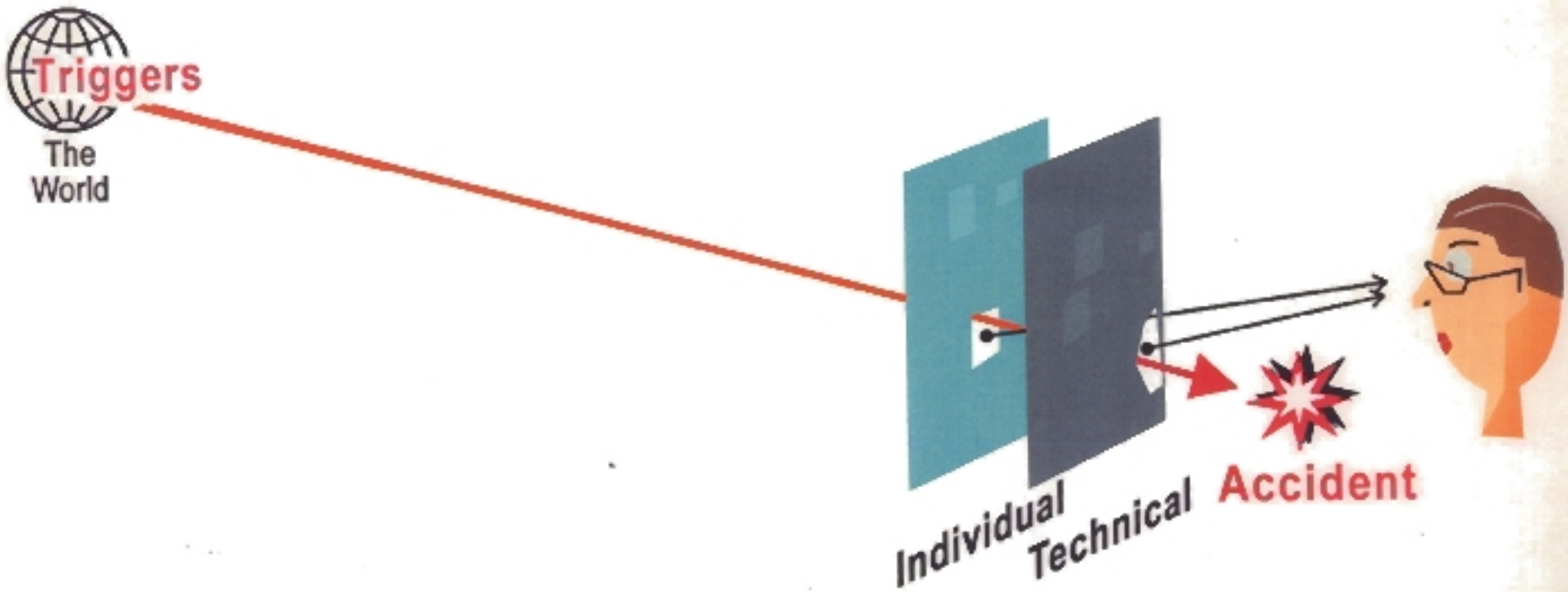

Modified from Reason, 1991

After accident view of the causes of failure

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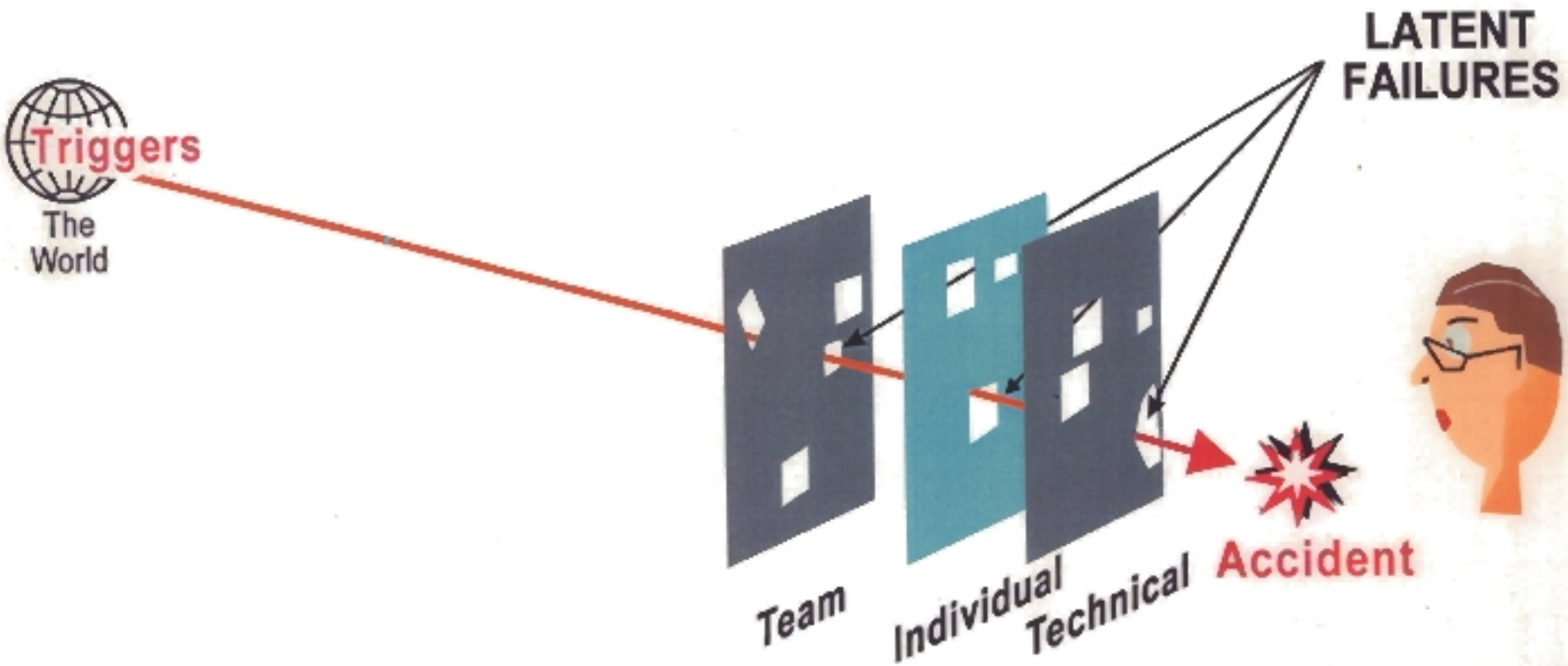

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The Latent Failure Model of Complex System Failure

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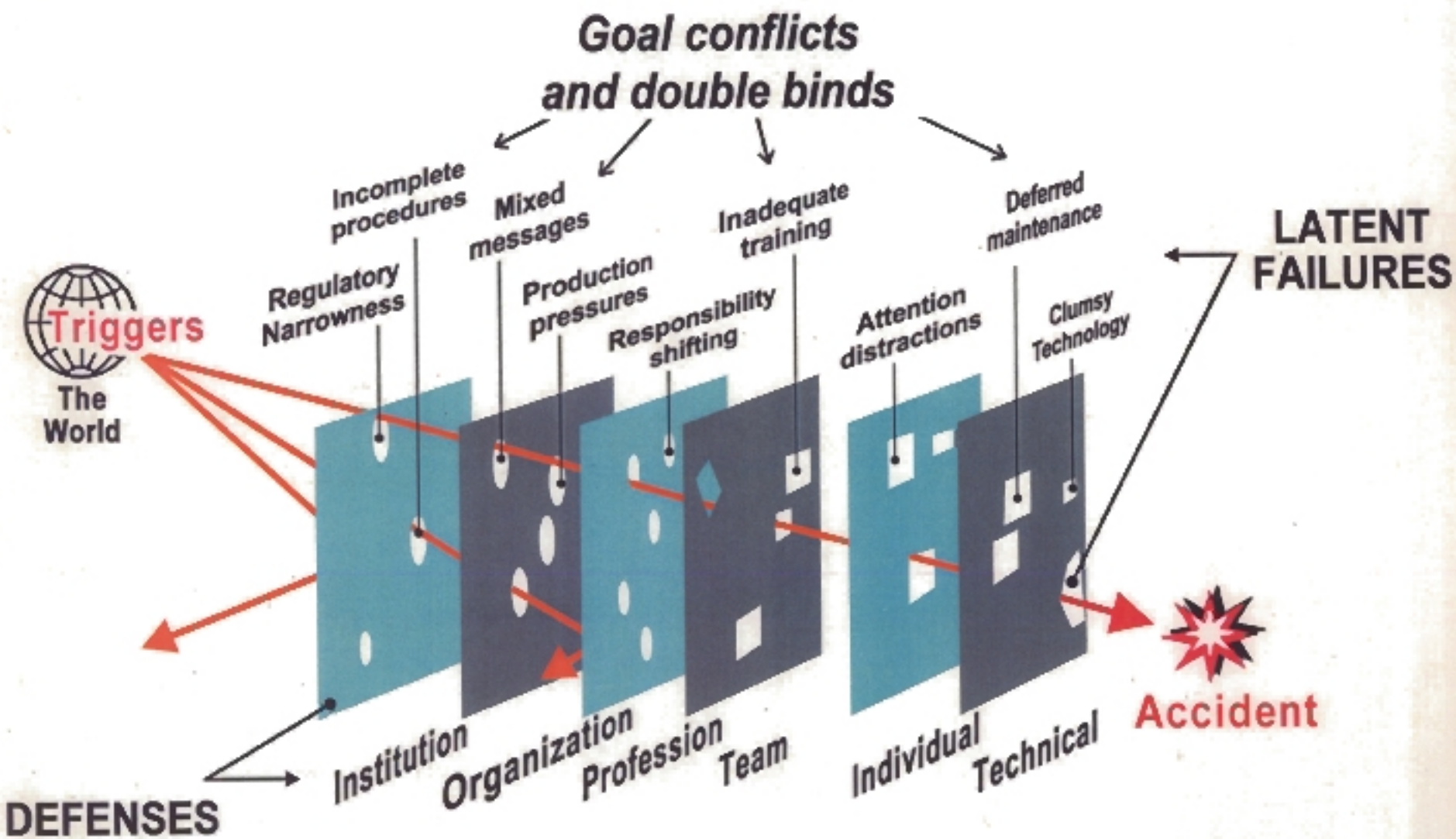

Modified by R I Cook, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999

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Fox Grove train vs. Bus crash

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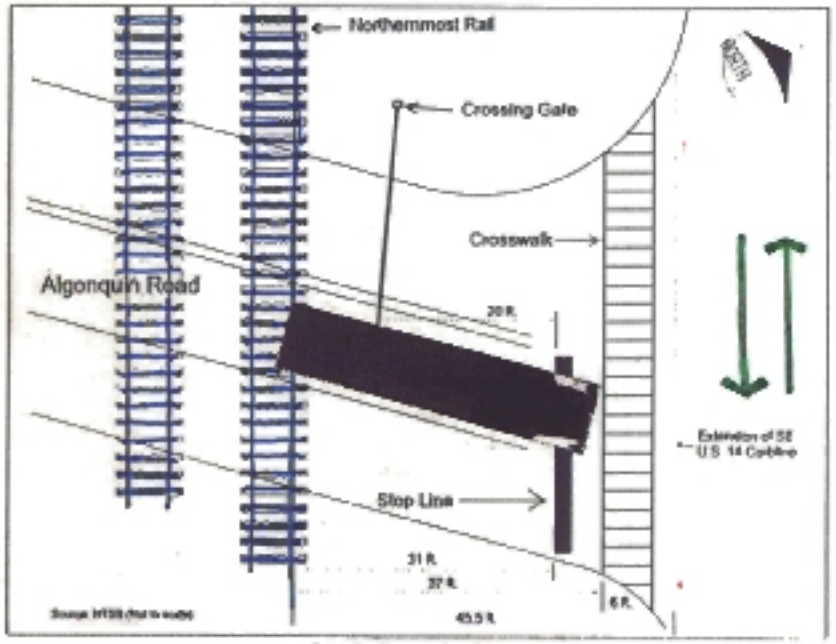

Popular view:

Inexperienced bus driver under stress or the effects of drugs failed to safely cross railroad tracks.

Investigation findings:

16 different findings

29 different recommendations to 16 different bodies

An actual accident sequence

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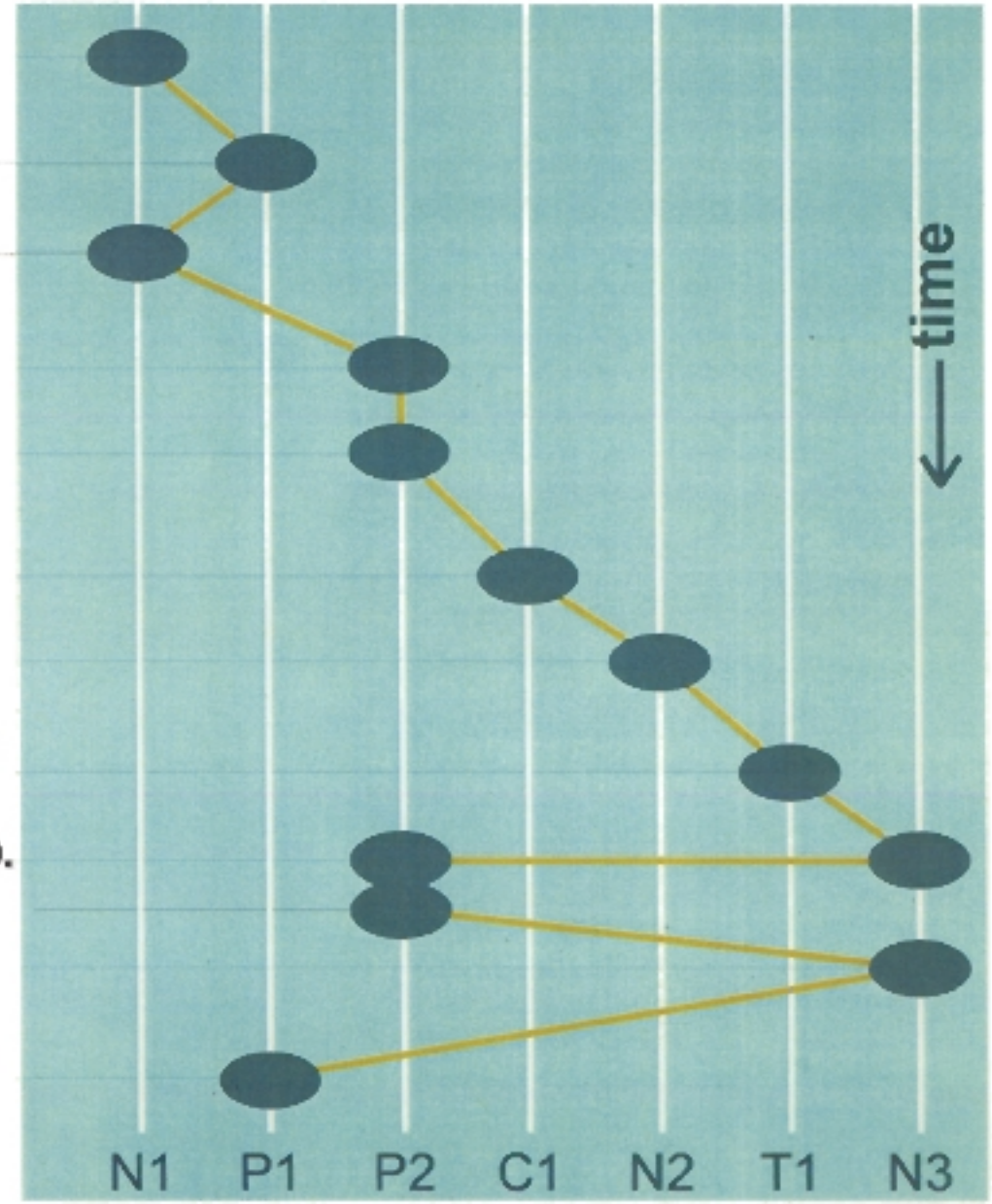
1. Usual OR desk nurse is ill; another nurse fills in.
2. Surgeon calls OR desk to cancel a scheduled procedure.
3. OR desk nurse notes cancelation on desk copy of OR schedule.
4. Anesthetist looks at master list and finds patient scheduled.
5. Anesthetist visits patient and writes preoperative orders.
6. Ward clerk checks OR schedule and patient's cart for operative permit.
7. Floor nurse prepares patient for procedure.
8. Transport person picks up patient and chart and transfers patient to OR.
9. Nurse and anesthetist check patient ID.
10. Anesthetist begins preparation.
11. Start time for case passes. OR nurse pages surgeon.
12. Surgeon comes to OR and states that case was canceled yesterday.



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HINDSIGHT BIAS

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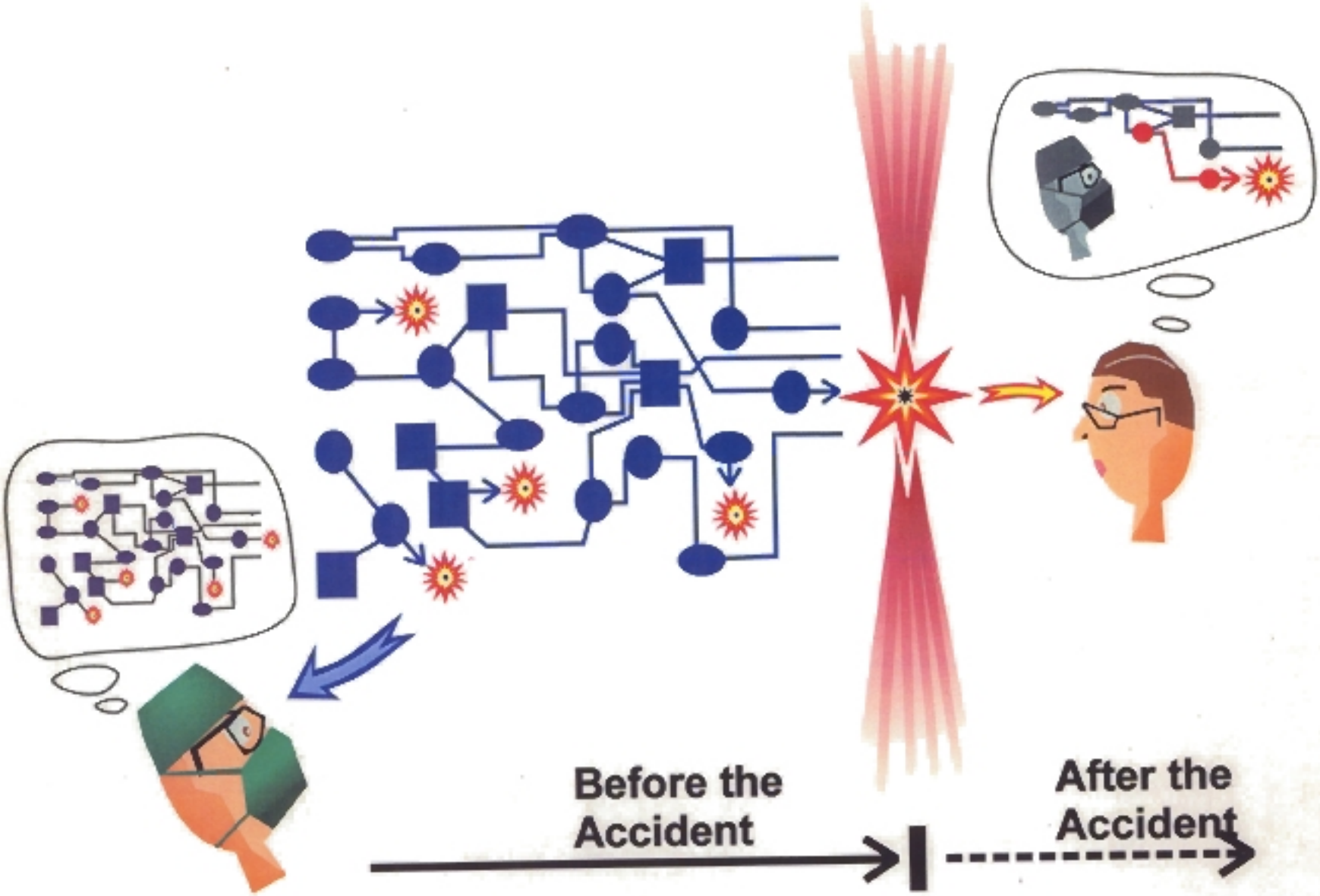

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Hindsight Bias

CtL

Hindsight ≠ Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty

Fischhoff 1975

Either a Medal or a Corporal: The Effects of Success and Failure on the Evaluation of Decision Making and Decision Makers

Lipshitz 1989

Effect of Outcome on Physician Judgements of the Appropriateness of Care

Caplan et al., 1991

If the end brings me out right, nothing that is said against me will amount to anything.

If the end brings me out wrong, ten angels swearing I was right will make no difference.

Abraham Lincoln, 1862

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Human Error

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Complex System Failure

Latent failures appear innocuous before accidents

There are many possible forms of failure.

Hindsight Bias

The pathway to the outcome seems to have been obvious.

HUMAN ERROR "CAUSED" THE ACCIDENT

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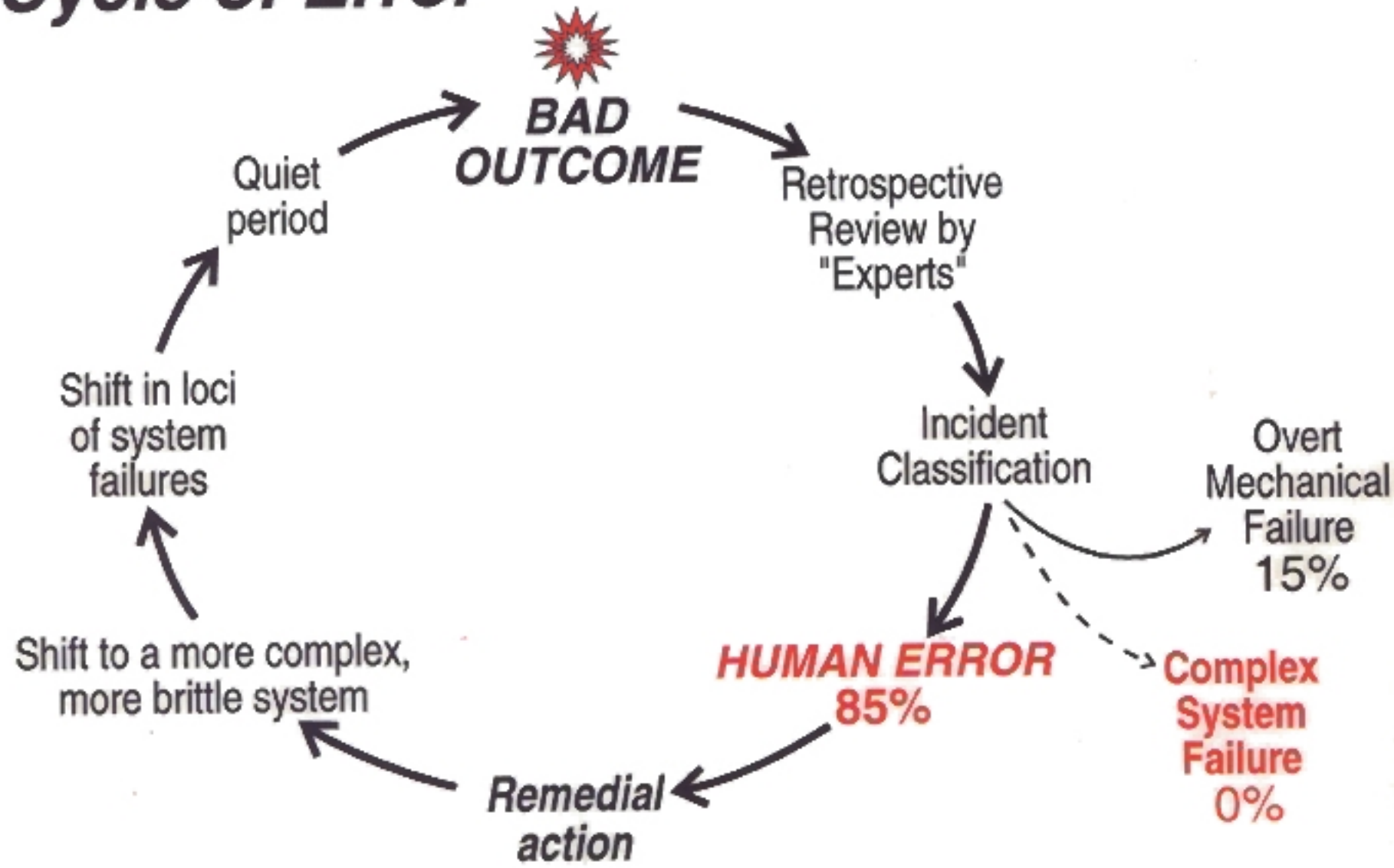
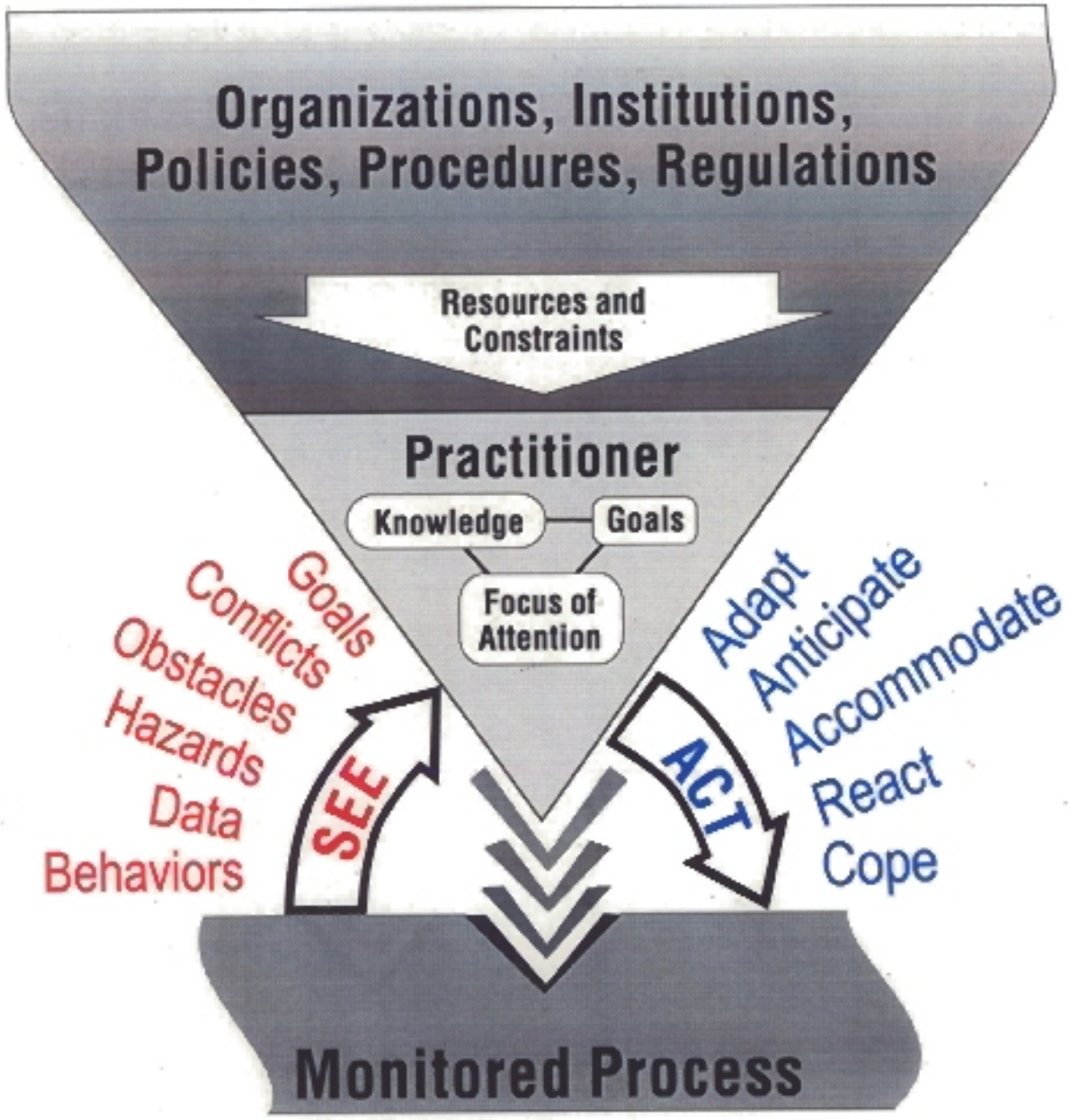
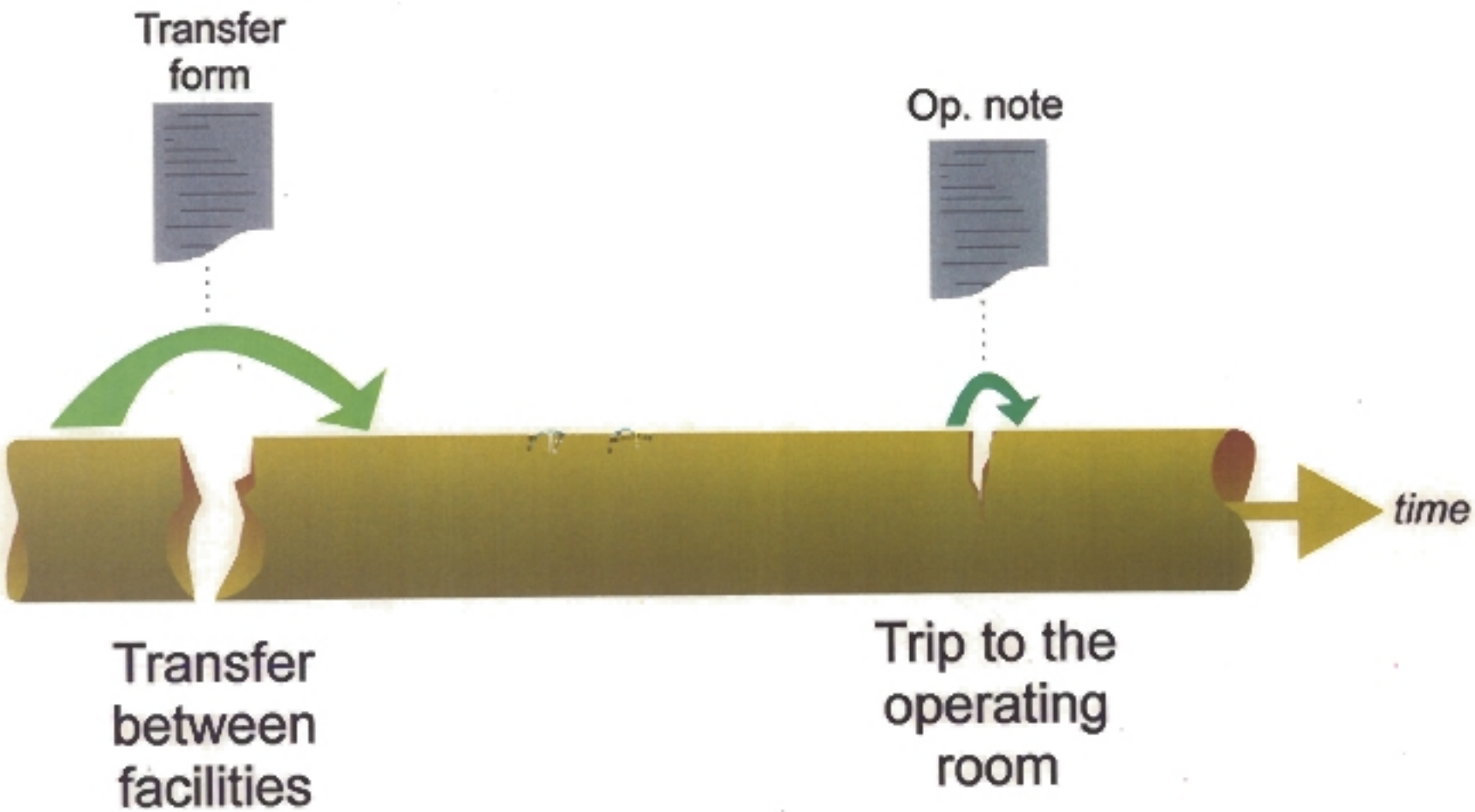
Cycle of Error




Organizations, Institutions,
Policies, Procedures, Regulations
Resources and
Constraints
Practitioner
Knowledge
Goals
Focus of
Attention
Goals
Conflicts
Obstacles
Hazards
Data
Behaviors
SEE
ACT
Adapt
Anticipate
Accommodate
React
Cope
Monitored Process

GAPS in the continuity of care



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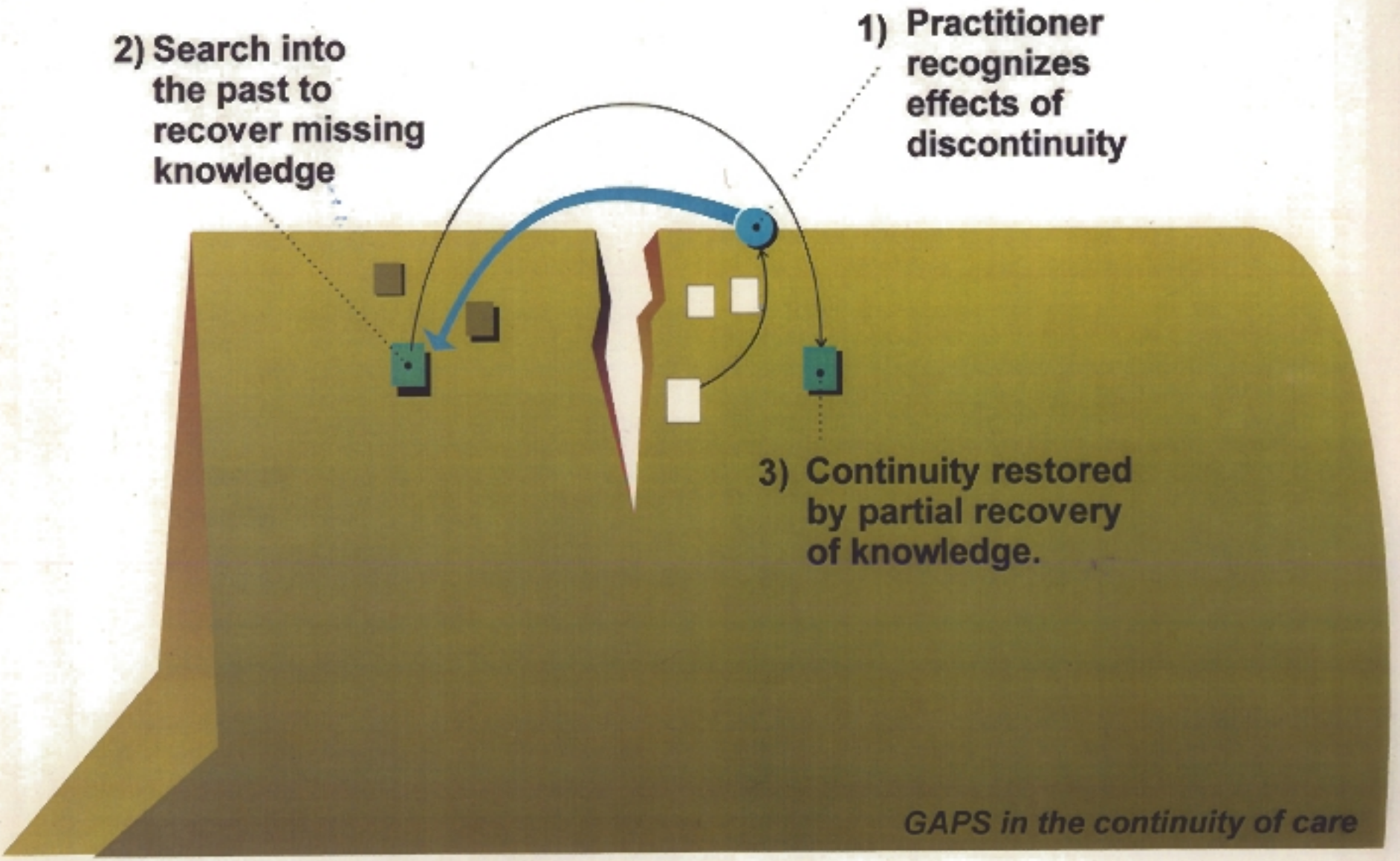
Recovering from prior GAP



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Future understandings

- **Resilience**
- **Risk dynamics**
- **Productive collaborations**
- **Safety a value not a goal**

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Making Safety

Cognitive technologies Laboratory

- **Safety is made and broken in systems, not individuals.**
  Successful systems....
  ...support detection an recovery from incipient failures.
  ...support learning about interactions at all levels.

- **Progress in safety begins with understanding technical work**
  Success and failure flow from the same sources.
  The key is to learn what makes problems difficult.

- **Productive discussions of safety avoid confounding *failure* with *error.***

- **Safety is dynamic not static; it is constantly renegotiated.**
  Treating safety as sacred threatens safety.
  Adding complexity makes safety harder to achieve.
  The most important safety issues are those of the future.

- **Tradeoffs are at the core of safety.**

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The Latent Failure Model of Complex System Failure

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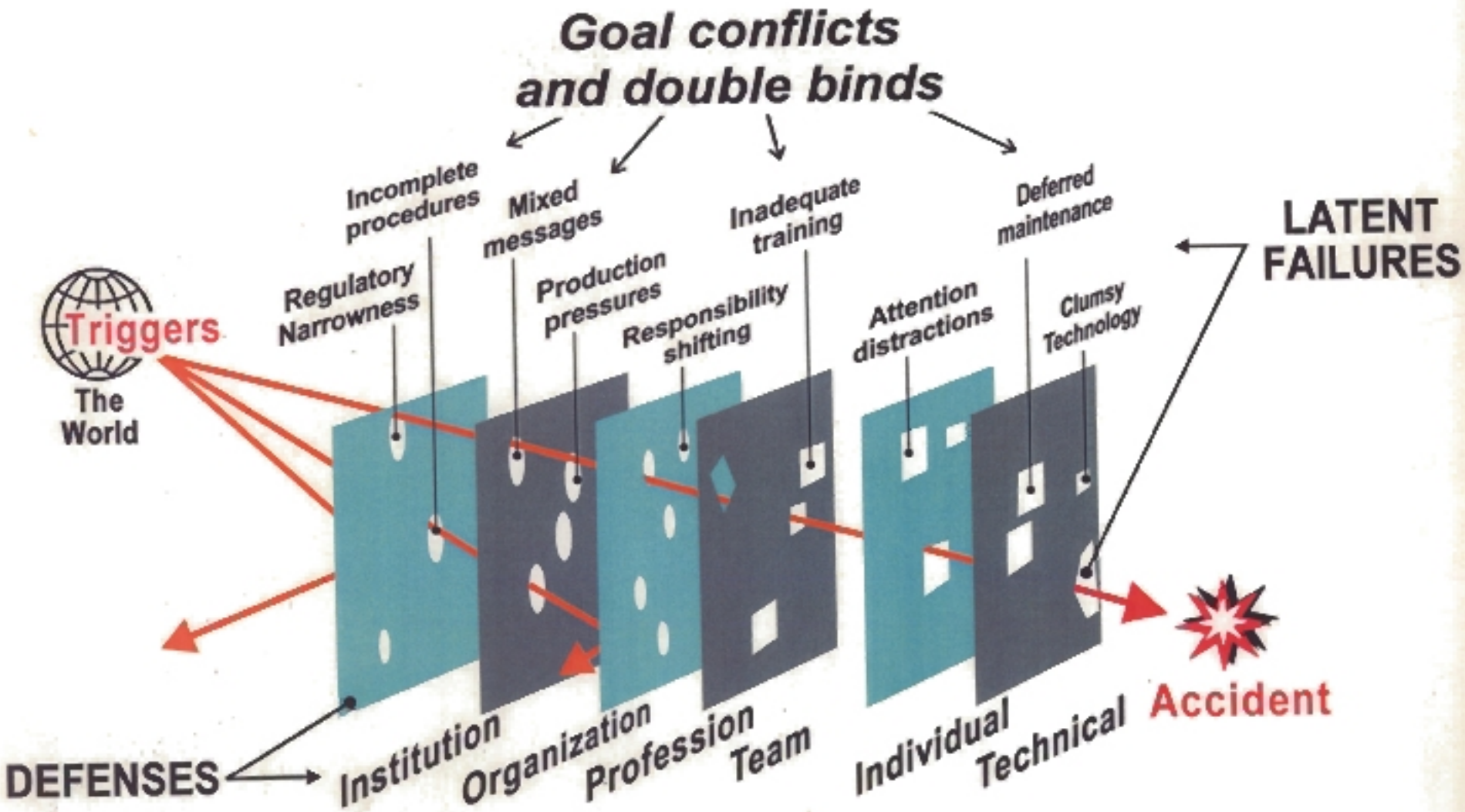

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