Navigating the Unseen: Understanding Risk and Human Perception

Welcome to a journey through the complex world of risk perception. This presentation explores how humans evaluate and respond to risks in both personal and professional contexts, with special focus on industrial settings.

We'll examine psychological mechanisms, cognitive biases, and cultural factors that shape our understanding of risk, and provide practical strategies for improving risk management in engineering and safety fields.

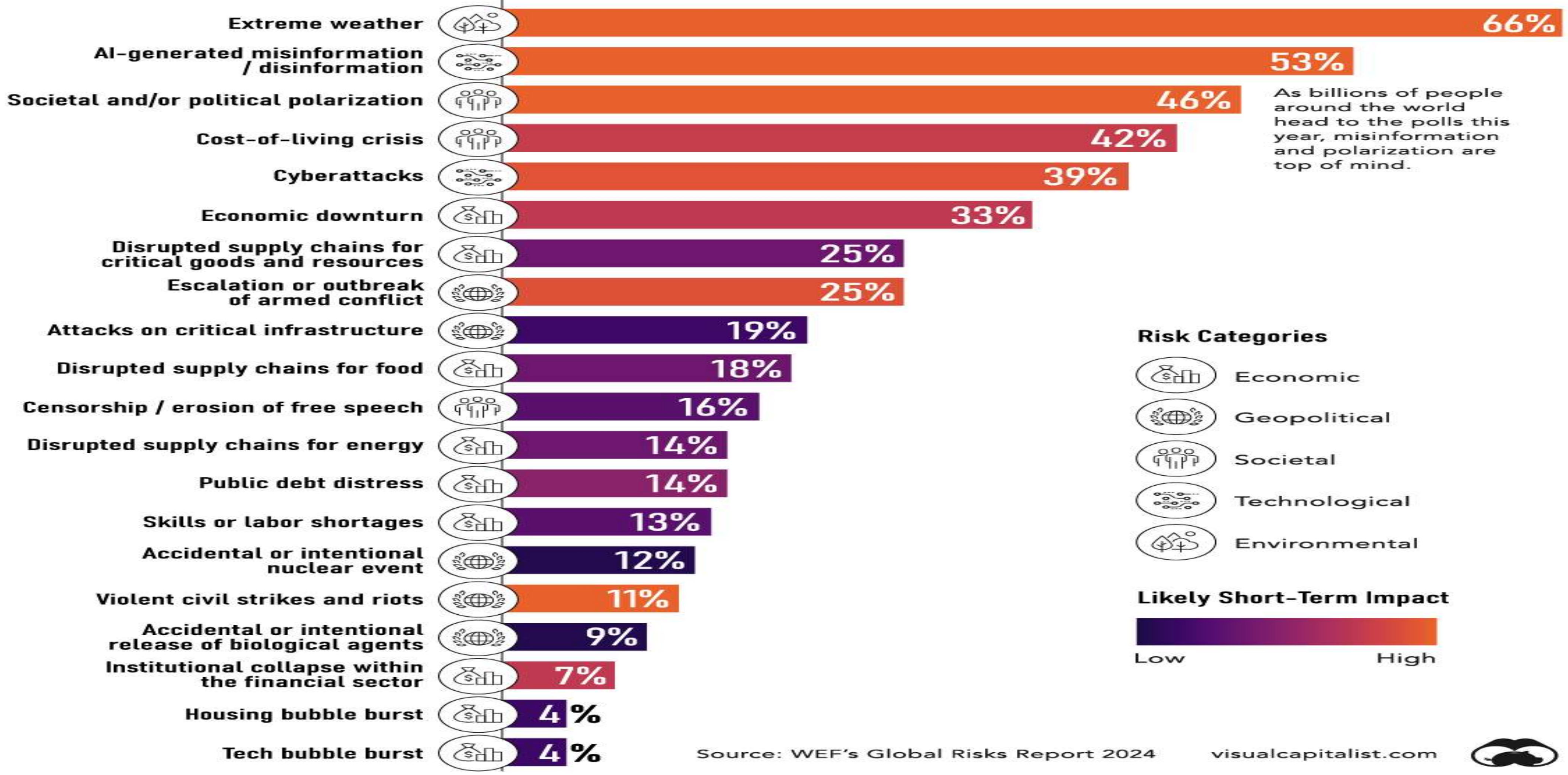
by Alessandro Nicotera


Iceland
Sweden
Norway
Finland
Estonia
Baltic Sea
Latvia
North Sea
Moscow
Москва
Denmark
Lithuania
Ireland
Poland
Belarus
Berlin
Germany
Prague
Ukraine
Slovakia
Austria
Moldova
Romania
Croatia
Serbia
Black Sea
Italy
Barcelona
Rome
Bulgaria
Georgia
Portugal
Spain
Istanbul
Azerbaijan
Tyrrhenian Sea
Greece
Turkey
Syria

THE TOP GLOBAL RISKS IN 2024

The World Economic Forum surveyed 1,490 leaders on the top global risks in 2024 and their potential scale of impact.

Q Please select up to five risks that you believe are most likely to present a material crisis on a global scale in 2024.



Source: WEF's Global Risks Report 2024 visualcapitalist.com


THE MOST IMPACTFUL GLOBAL
Short-Term & Long-Term Risks
The World Economic Forum surveyed over 900 experts on the most pressing global risks looking ahead.
SHORT TERM
2 YEARS
Technological
Environmental
Geopolitical
Societal
LONG TERM
10 YEARS
FAKE NEWS
1 Misinformation & Disinformation
2 Extreme Weather Events
3 State-based Armed Conflict
4 Societal Polarization
5 Cyber Espionage and Warfare
6 Pollution
7 Inequality
8 Involuntary Migration or Displacement
9 Geoeconomic Confrontation
10 Erosion of Human Rights and/or Civic Freedoms
1 Extreme Weather Events
2 Biodiversity Loss and Ecosystem Collapse
3 Critical Change to Earth Systems
4 Natural Resource Shortages
5 Misinformation and Disinformation
6 Adverse Outcomes of AI Technologies
7 Inequality
8 Societal Polarization
9 Cyber Espionage and Warfare
10 Pollution
Source: World Economic Forum Global Risks Report 2025
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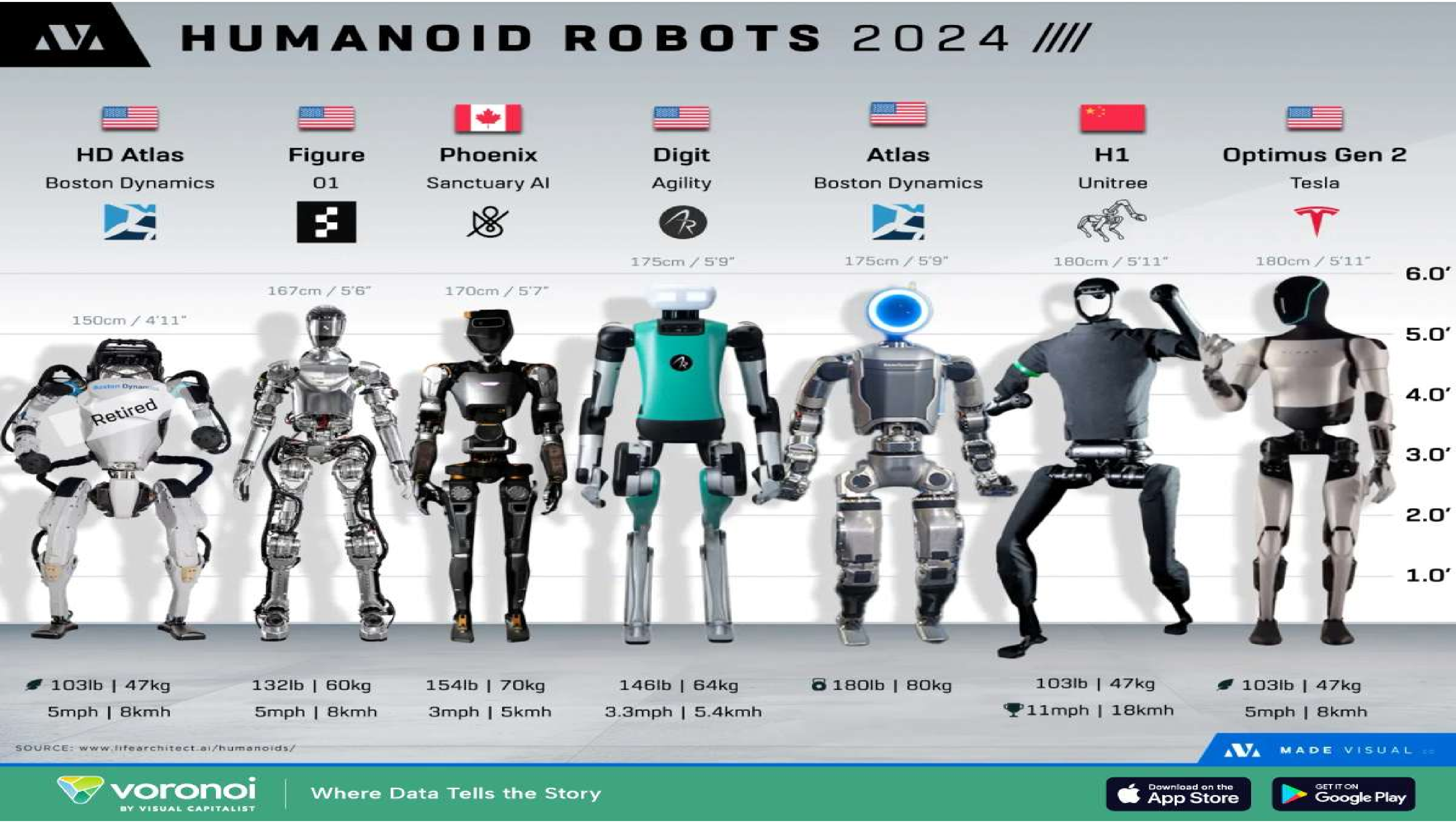
HUMANOID ROBOTS 2024
HD Atlas
Boston Dynamics
150cm / 4'11"
Retired
103lb | 47kg
5mph | 8kmh
Figure
01
167cm / 5'6"
132lb | 60kg
5mph | 8kmh
Phoenix
Sanctuary AI
170cm / 5'7"
154lb | 70kg
3mph | 5kmh
Digit
Agility
175cm / 5'9"
146lb | 64kg
3.3mph | 5.4kmh
Atlas
Boston Dynamics
175cm / 5'9"
180lb | 80kg
H1
Unitree
180cm / 5'11"
103lb | 47kg
11mph | 18kmh
Optimus Gen 2
Tesla
180cm / 5'11"
103lb | 47kg
5mph | 8kmh
6.0'
5.0'
4.0'
3.0'
2.0'
1.0'
SOURCE: www.lifearchitect.ai/humanoids/
MADE VISUAL
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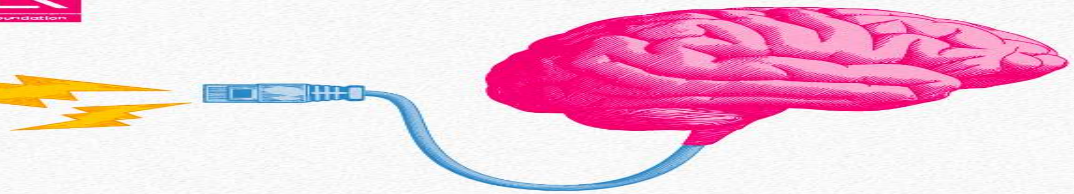
World Risk Poll | LR Foundation | Part 1

Will AI Help or Harm Us?

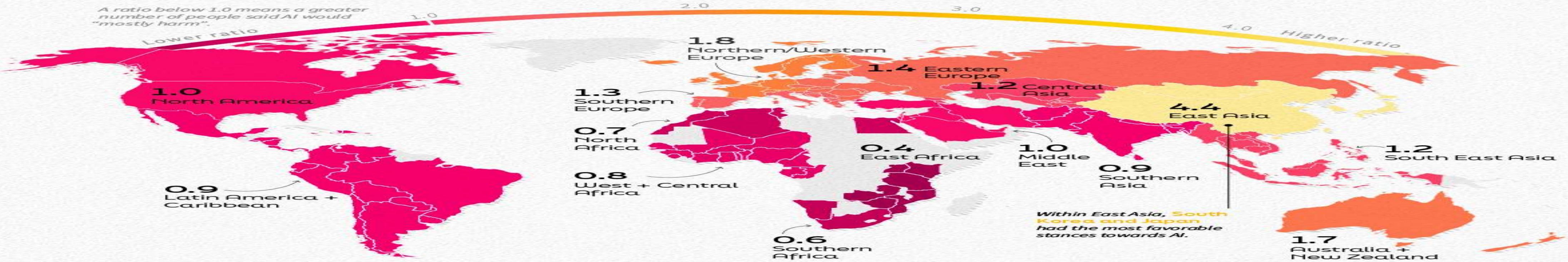
According to 121 Countries



Do you think artificial intelligence (AI) will mostly help or mostly harm people in your country in the next 20 years?

The world's opinion is divided.

Ratio of Those Who Said 'Mostly Help' to 'Mostly Harm' by Region



Source: Lloyd's Register Foundation World Risk Poll, 2021
Methodology: The ratio measures the regional sentiment towards AI of 125,000 people in 121 countries, polled in 2021. The higher the ratio, the more favorable stance the region has towards artificial intelligence.

Here's how responses varied slightly when other attitudes and life experiences were taken into account.

Percentage of Those Who Said AI Would 'Mostly Help' or 'Mostly Harm' by Their Experiences

Source: Lloyd's Register Foundation World Risk Poll, 2021
Due to rounding, percentages may sum to 100% ±1%.
Survey question: Do you think artificial intelligence will mostly HELP or mostly HARM people in this country in the next 20 years?
**Discrimination based on a person's nationality/ethnicity, skin color, sex, or disability.*

LR Foundation

Learn more about the risks faced by ordinary people around the globe.

Download the free report here >>>

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Odds of Death
These are the lifetime odds of dying from an accidental injury in the U.S., as of 2020.
Lifetime odds were estimated by dividing the one-year odds of dying by the life expectancy of a person born in 2020 (77 years).
Bubble size = ratio as % chance
101 : 1
Motor vehicle accident
292,000,000 : 1
Winning the Powerball jackpot
42,915 Americans died in car crashes in 2021.
798 : 1
Complications of medical and surgical care
1,606 : 1
Alcohol poisoning
1,825 : 1
Accidental building fire
2,745 : 1
Choking on food
5,882 : 1
Drowning in swimming pool
6,368 : 1
Sunstroke
7,998 : 1
Accidental firearm discharge
10,386 : 1
Drowning (other than pool)
11,756 : 1
Airplane accident
57,825 : 1
Bee or wasp sting
69,016 : 1
Dog attack
138,849 : 1
Lightning strike
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Source: National Safety Council, NHTSA, Powerball
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"The quest for certainty is the greatest obstacle to becoming an expert in risk."

— Gerd Gigerenzer

1. Paradox of Flying vs. Driving

Common belief: Driving is safer than flying.
Reality: Car accidents cause far more fatalities each year than airplane crashes, but the anxiety related to flying is much more common due to the dramatic nature of plane accidents and intense media coverage, which amplifies the *availability heuristic*

2. Paradox of the Illusion of Control

Common belief: The more experience you have, the fewer risks you face.
Reality: Experts often underestimate the risks in their own field due to overconfidence in their skills, known as *expertise blindness* and *technical overconfidence*, which can lead to catastrophic mistakes

3. Paradox of Confirmation Bias

Common belief: More information leads to better decisions.
Reality: People often seek only information that confirms what they already believe, ignoring critical data that contradicts their initial assumptions, thereby worsening their risk assessments

4. Paradox of Emotion vs. Rationality

Common belief: Rational decisions are always better than emotional ones.
Reality: In some cases, instinctive, emotionally driven reactions can be more accurate than purely rational evaluations, especially in contexts where past experience plays a key role in recognizing danger signals

5. Paradox of Professional Overconfidence

Common belief: Experienced professionals make fewer mistakes.
Reality: Paradoxically, experienced professionals can be more vulnerable to risk assessment errors because their expertise makes them ignore weak signals or unlikely events

6. Paradox of Familiarity and Risk

Common belief: Familiar things are safer.
Reality: We often underestimate the risks associated with everyday activities like driving or using common machinery, while overestimating the dangers of rare but spectacular events

7. Paradox of Perceived Safety

Common belief: Advanced technology is always safer.
Reality: Advanced technologies like artificial intelligence can introduce new, hard-to-identify risks, creating a false sense of security

8. Paradox of Fear and Risk

Common belief: Being afraid of something means it is more dangerous.
Reality: Our fears often do not correspond to the actual probability of danger, as in the case of terrorism versus heart disease, the latter being far more deadly every year

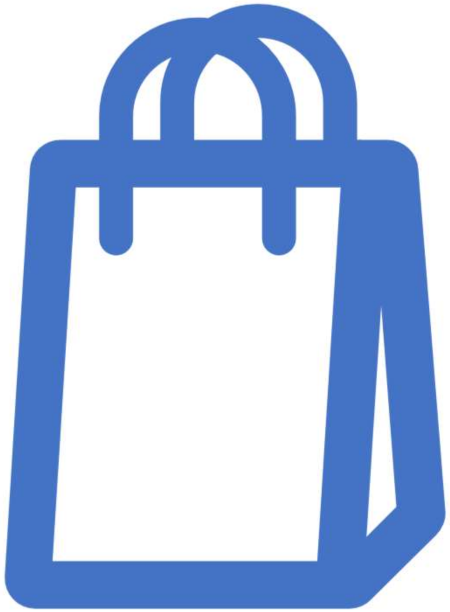
9. Paradox of Tunnel Vision

Common belief: Focusing on a problem reduces risk.
Reality: Excessive focus on a single aspect can lead to ignoring larger or more probable risks, as demonstrated in industrial accidents where attention is often limited to immediate dangers and not the root causes

10. Paradox of Technological Progress

Common belief: Technology always reduces risk.
Reality: While some technologies reduce risks, others introduce new and often more complex risks, creating invisible vulnerabilities and dangerous dependencies

If you had to use a bag to carry your groceries home, would you choose a paper bag or a plastic one? And why?



Producing a paper bag requires three times more water than producing a plastic bag. Paper production generates 70% more air pollution than plastic production. It also takes 91% more energy to recycle a kilogram of paper compared to a kilogram of plastic.

Introduction: The Importance of Understanding Risk

Complexity & Uncertainty

In today's rapidly evolving world, understanding risk has become more crucial than ever before.

Technological Advancement

AI, climate change, and global interconnectedness create new vulnerabilities requiring sophisticated risk management.

Human Vulnerability

Our intuitive understanding of risk often conflicts with scientific frameworks, creating dangerous gaps.

The Psychology of Risk Assessment

Primitive Processing

Instant threat evaluation occurs before conscious thought, sometimes leading to risk misconceptions.

Dual-Processing

Risk assessment combines immediate emotional reactions with deliberate analytical evaluation.

Threat Evaluation

Controllability, familiarity, and potential impact influence how we perceive different risks.

Emotional Response

The amygdala processes threats before our rational mind analyzes the situation.

Abstract vs. Concrete Threats

Concrete Threats

- Immediate physical dangers
- Easily recognized by our senses
- Trigger automatic responses
- Our brains evolved to handle these

Abstract Threats

- Climate change impacts
- Financial market fluctuations
- Cybersecurity vulnerabilities
- Harder for our brains to evaluate

How might this cognitive challenge affect your professional risk assessments? Consider areas where abstract threats may be underestimated in your field.

Memory and Risk Perception

12x

Overestimation

People typically overestimate dramatic but rare risks (like terrorism) by as much as twelve times

40%

Underestimation

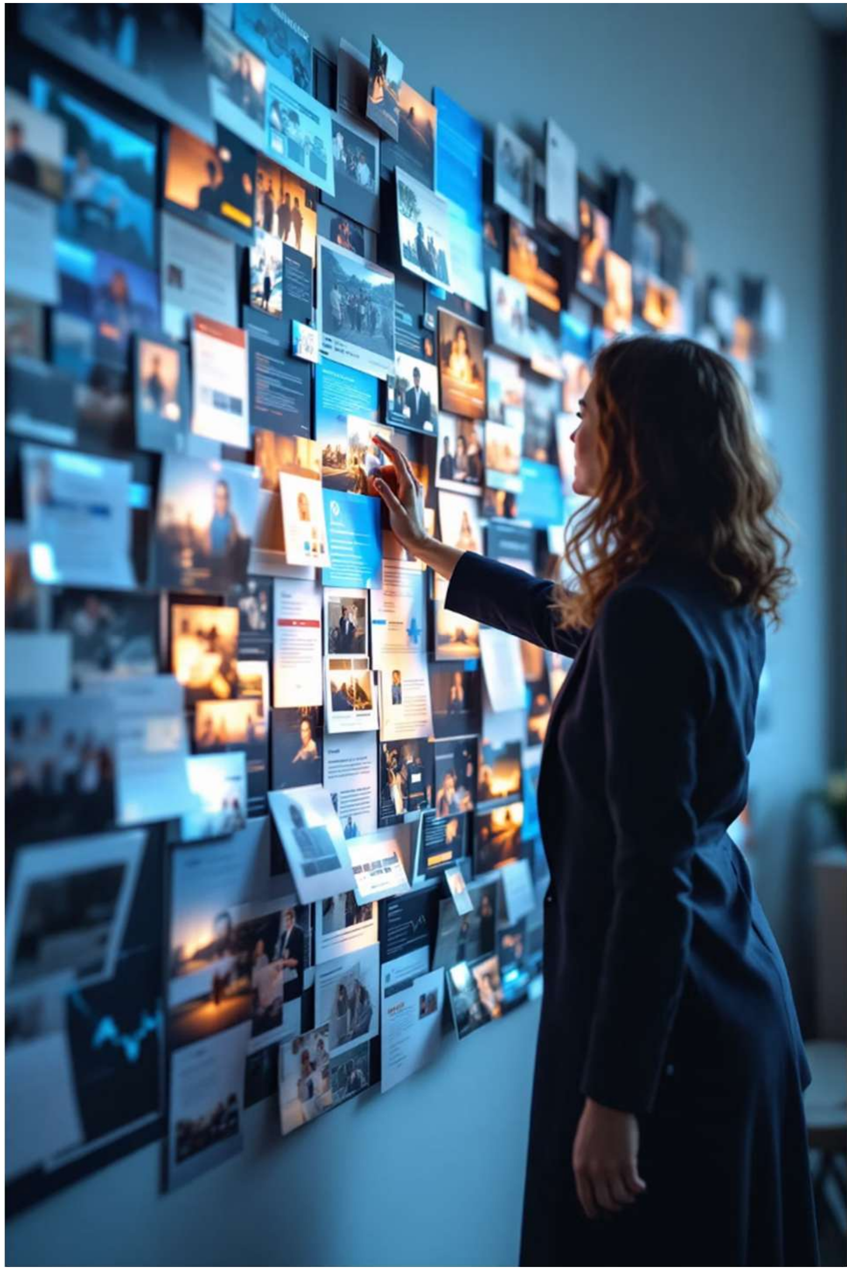
Common but less dramatic risks (like heart disease) are underestimated by approximately 40 percent

73%

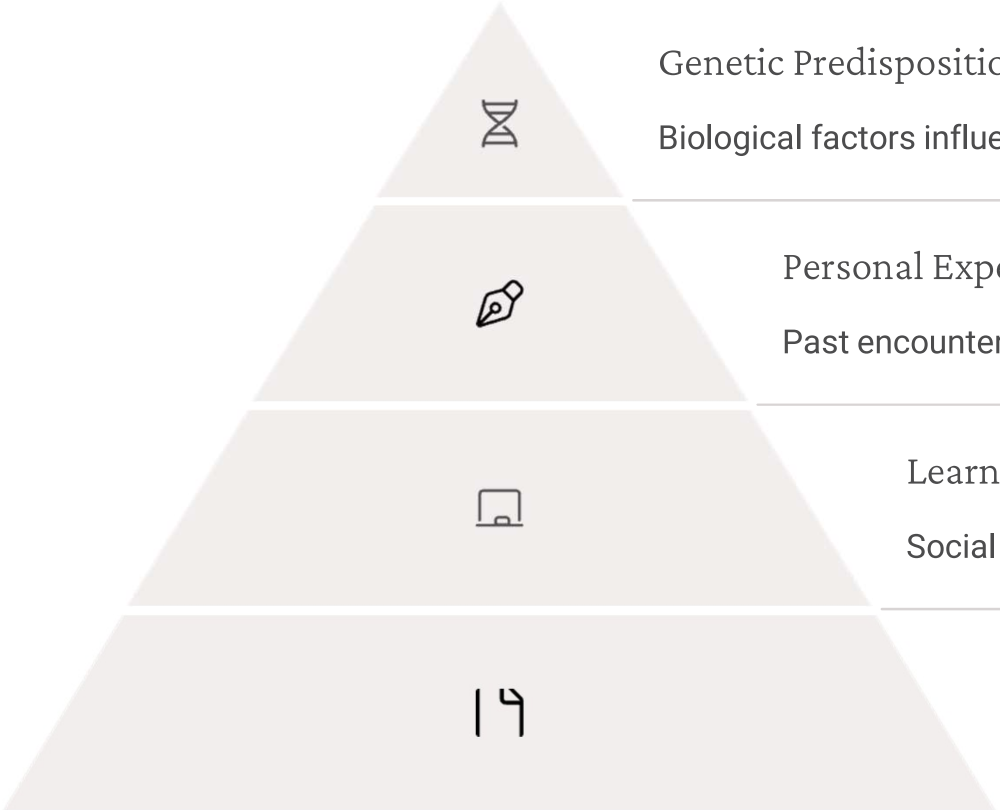
Memory Influence

Of risk assessments are significantly influenced by ease of recall rather than actual probability

How might this affect safety assessments in your organization? Consider how memorable events might distort risk evaluations in your field.



Individual Differences in Risk Perception



Genetic Predisposition

Biological factors influencing risk tolerance

Personal Experience

Past encounters shaping risk evaluation

Learned Behavior

Social and educational influences

Personality Traits

Inherent characteristics affecting approach

Question: How might understanding these individual differences help you create more effective safety training programs?

Cultural Influences on Risk Perception

Cultural Values

Fundamental beliefs acting as filters for processing potential threats

Collective Behavior

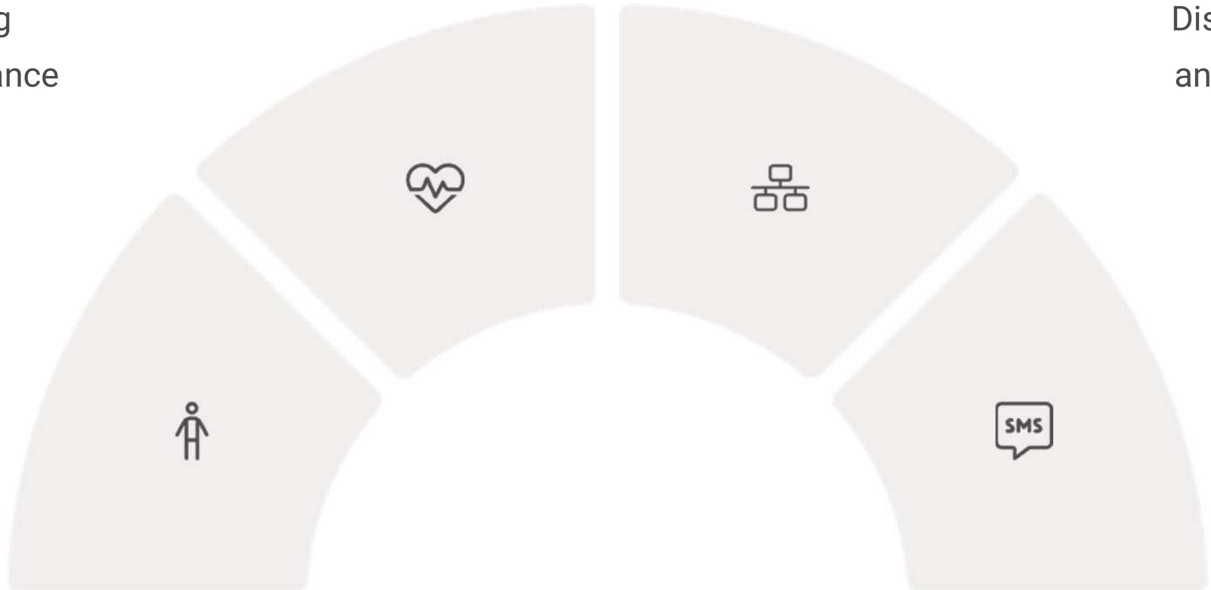
Social learning through community networks and cultural institutions

Social Norms

Unwritten rules guiding behavior and risk acceptance within societies

Communication Styles

Distinct ways of discussing and addressing risk across cultures



Media and Risk Perception

Information Sources

Varying levels of trust in different media

Amplification Effect

How media coverage can magnify perceived risks

Selective Exposure

People seek information confirming existing beliefs

Question: How does media coverage influence risk perception in your industry? Consider how certain risks get amplified while others receive minimal attention.

Time Orientation and Risk

Short-Term Focus

Some cultures prioritize immediate risks and consequences.

- Quarterly business results
- Immediate safety hazards
- Visible, tangible threats

Long-Term Perspective

Other societies emphasize distant future risks.

- Climate change impacts
- Infrastructure deterioration
- Systemic, gradual risks

How does your organization balance short-term and long-term risk considerations? Consider the implications for resource allocation and planning.

Evolution of Risk Understanding

1

Ancient Beginnings

Primitive societies developed basic methods intertwined with religious beliefs.

2

Medieval Advances

Maritime trade led to sophisticated risk-sharing and early insurance concepts.

3

Industrial Revolution

New manufacturing processes created novel risk categories requiring better safety protocols.

4

Modern Era

Computational capabilities enabled sophisticated statistical analysis and risk modeling.

Paradigm Shifts in Risk Theory

The Nuclear Age

Introduced entirely new categories of risk consideration, forcing reevaluation of catastrophic events.

Quantitative Risk Assessment

Transformed risk from intuitive process to quantitative discipline through probabilistic approaches.

Behavioral Approaches

Revealed complex interplay between human perception and technical risk assessment methodologies.

Globalization Impact

Created need for consistent approaches across different cultural and regulatory environments.

Measuring Risk Perception

Psychometric Paradigm

Multidimensional scaling techniques mapping risk perceptions across attributes like controllability and severity.

Assessment Tools

Questionnaires utilizing Likert scales to quantify qualitative judgments about various risks.

Data Analysis

Multivariate analysis identifying patterns and correlations between different risk perception factors.

Calibration

Comparing subjective assessments against objective risk data to identify systematic biases.

Digital Tools for Risk Perception Measurement

Mobile Applications

Enable real-time monitoring of risk perceptions across large populations.

Web Platforms

Capture nuanced aspects of risk evaluation through interactive elements.

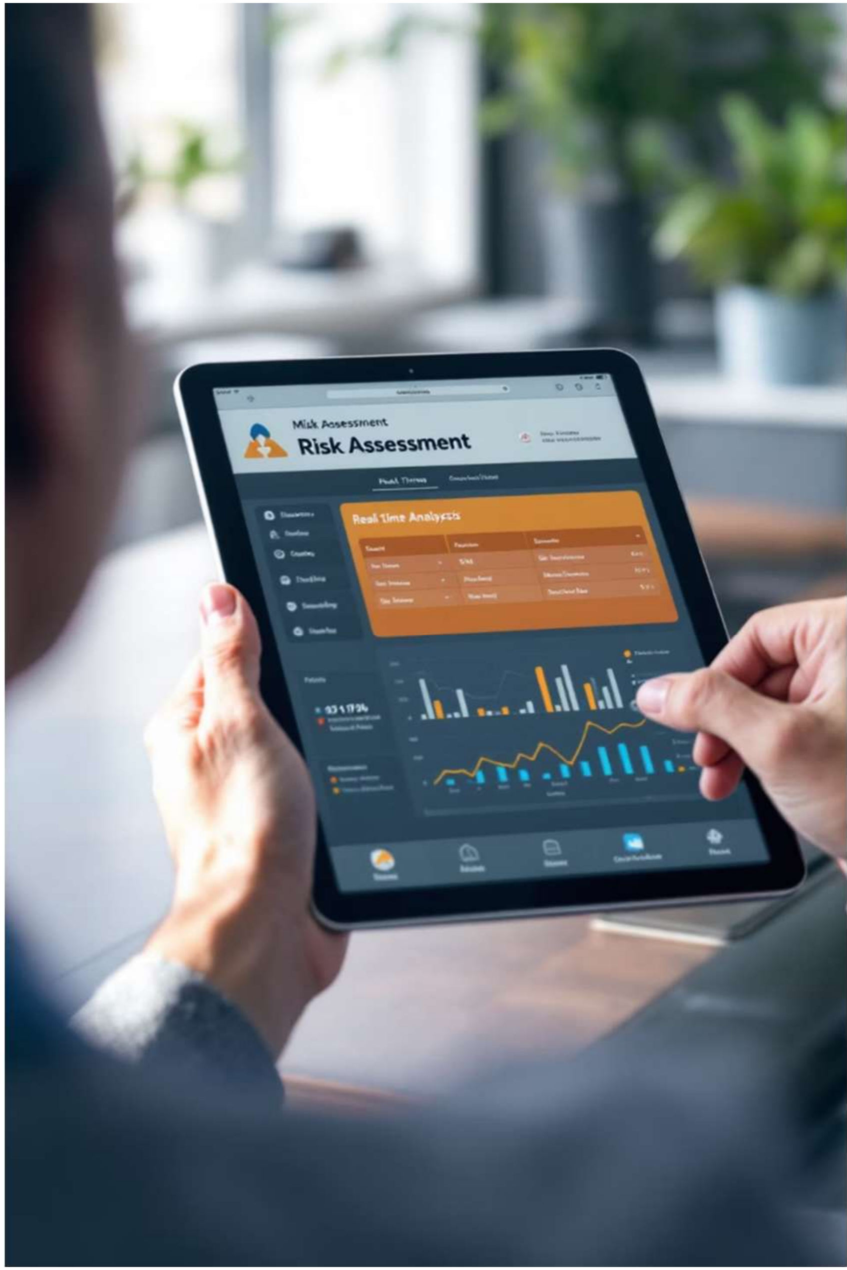
Big Data Analytics

Process large-scale risk perception data to identify patterns and trends.

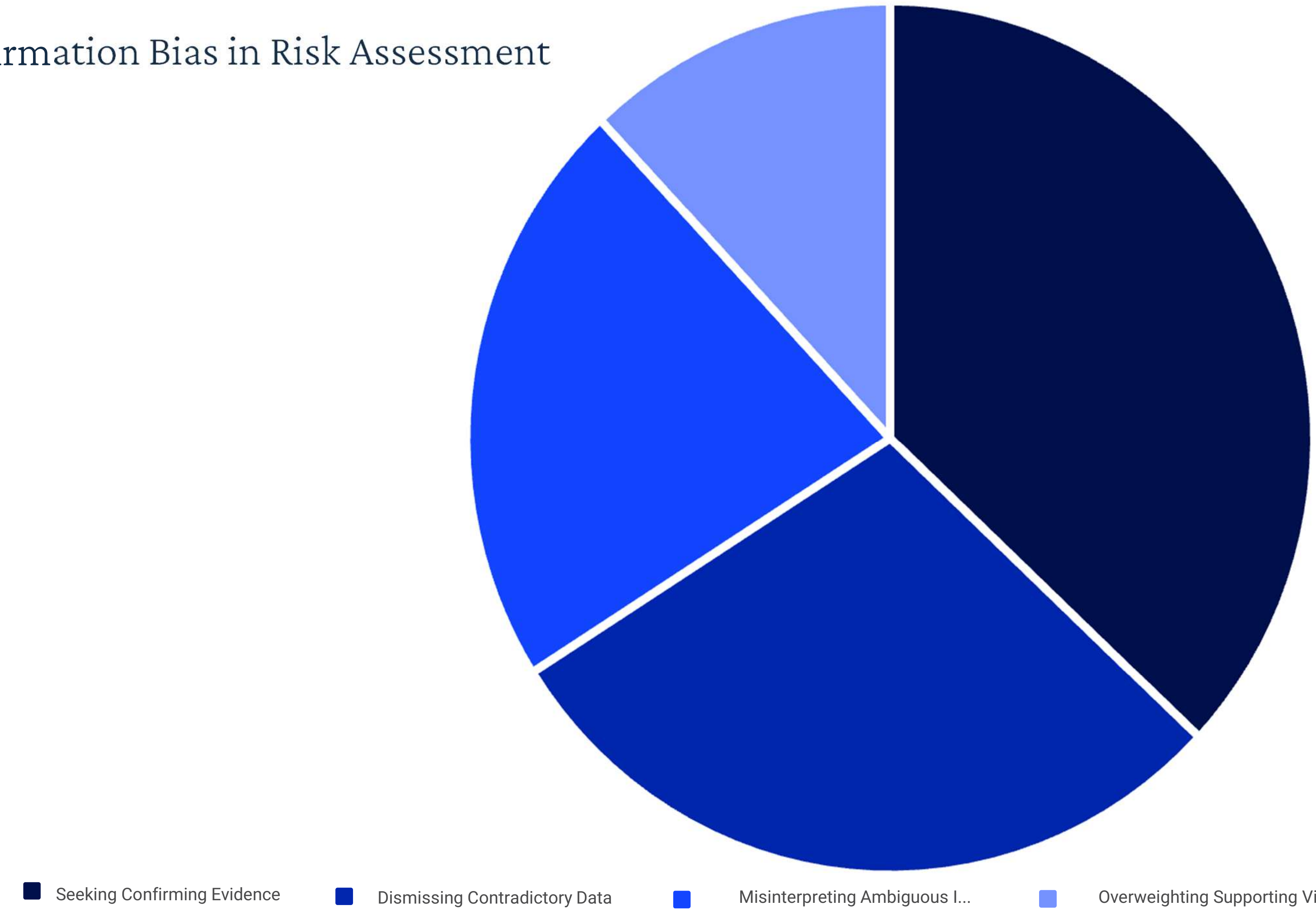
Visualization Tools

Transform complex risk data into intuitive, actionable insights.

Question: How might these digital tools improve risk perception measurement in your field?



Confirmation Bias in Risk Assessment



The Availability Heuristic

Definition

The availability heuristic leads us to judge event likelihood based on how easily we can recall similar instances.

Recent or emotionally charged events become more accessible in memory, potentially distorting risk assessment.

Real-World Example

After a widely publicized airplane accident, people often overestimate air travel dangers despite statistical evidence of safety.

This mental shortcut, while evolutionary useful, can lead to significant misjudgments in modern risk contexts.

Question: How might the availability heuristic affect safety assessments in your organization?

Overconfidence Effect

Overestimation

Exaggerating our abilities and performance capabilities

Overplacement

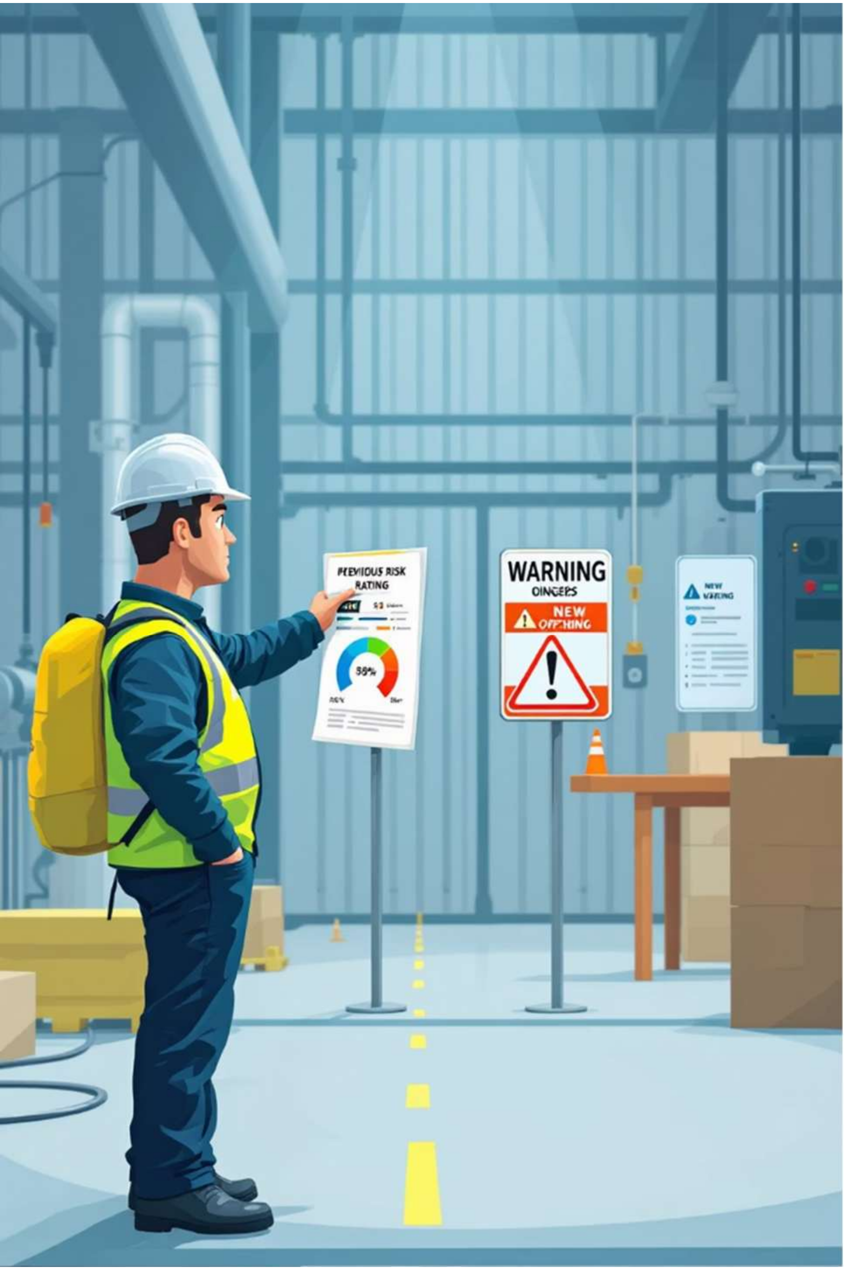
Ranking ourselves too highly relative to others

Overprecision

Excessive certainty in the accuracy of our beliefs

In risk assessment, overconfidence is particularly dangerous when professionals overestimate their ability to control or prevent risks.

Engineers might believe they've considered all possible failure modes, leading to incomplete risk analyses.



Anchoring Bias in Risk Evaluation

Initial Exposure

First piece of information or estimate disproportionately influences final assessment.

Insufficient Adjustment

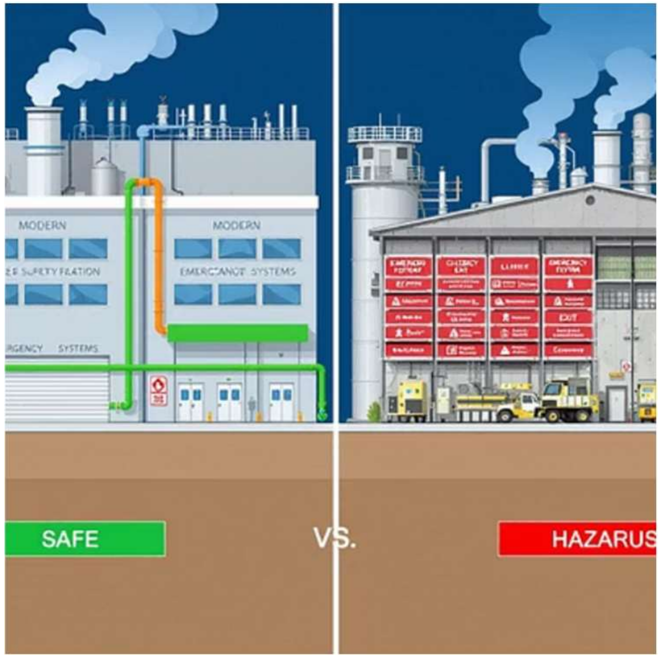
New information fails to adequately shift assessment away from initial anchor.

Persistent Effect

Even when aware of bias, professionals still demonstrate significant anchoring.

Question: How might previous safety ratings influence new assessments in your field? What processes could help overcome this bias?

Representativeness Bias



Representativeness bias leads people to make judgments based on stereotypical patterns rather than probability.

Safety managers might underestimate risks in a new facility because it resembles a previously successful operation, overlooking crucial differences in personnel, equipment, or conditions.

Fear and Risk Evaluation

Fear Response

- Activates amygdala in brain
- Can sharpen or distort perception
- Increases estimation of negative outcomes
- Evolved as protective mechanism

Professional Impact

- May lead to excessive caution
- Can cause overestimation of dramatic risks
- Sometimes appropriate as warning signal
- Requires conscious management

Question: How might fear responses influence risk assessments in high-stress engineering situations?

Anxiety and Risk Assessment

Persistent Worry

Creates heightened state of risk awareness

Threat Scanning

Constantly looking for potential dangers

Probability Distortion

Overestimation of negative outcomes

Risk Avoidance

May lead to overly cautious decisions

Unlike the immediate response of fear, anxiety creates a persistent state that can both enhance and impair judgment.

Emotional Regulation in Risk Assessment

Balanced Evaluation

Well-developed emotional regulation allows acknowledging feelings while maintaining analytical thinking.

Emotional Awareness

Recognizing emotional states as they occur helps prevent them from unduly influencing assessments.

Regulation Techniques

Specific strategies like cognitive reappraisal help maintain objectivity during risk evaluation.

Skill Development

Emotional regulation can be improved through training and deliberate practice.

Intuitive Judgment in Risk Assessment

Benefits

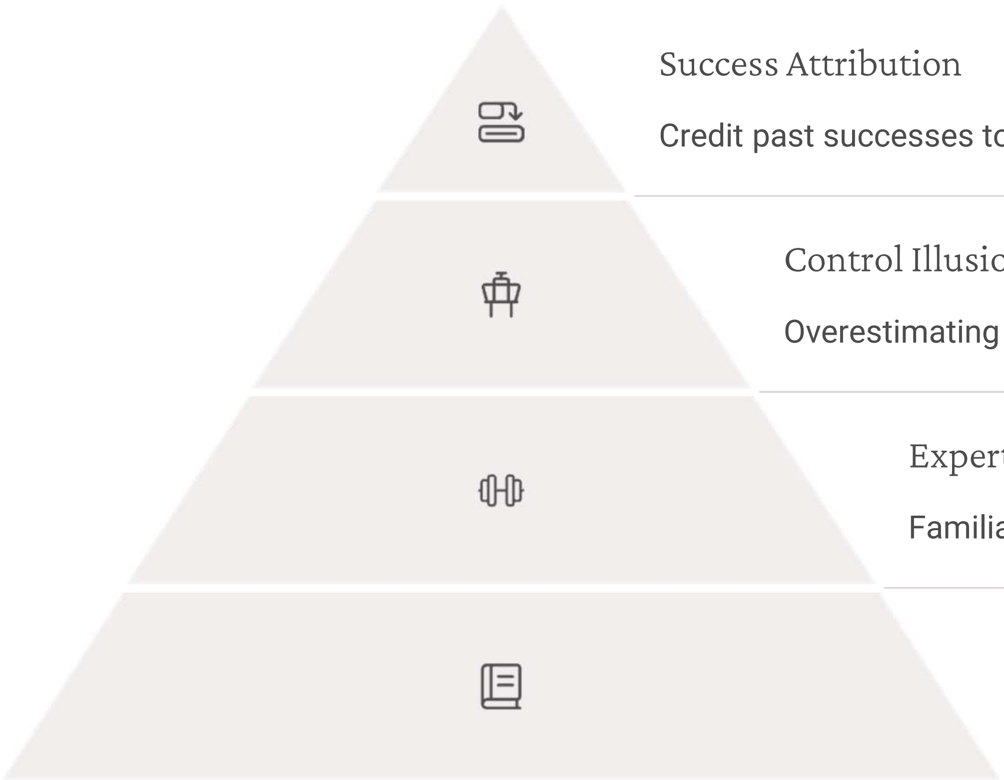
- Rapid assessment capability
- Integrates unconscious knowledge
- Valuable when information is limited
- Draws on accumulated experience

Limitations

- Vulnerable to cognitive biases
- Reliability varies by domain
- Difficult to articulate reasoning
- May overlook novel factors

Question: When should professionals rely on intuitive judgment in risk assessment, and when is a more analytical approach needed?

Technical Overconfidence in Engineering



Success Attribution

Credit past successes to skill rather than luck

Control Illusion

Overestimating ability to prevent failures

Expertise Blindness

Familiarity creating dangerous blind spots

Knowledge Gaps

Unknown unknowns beyond technical expertise

Engineers, having successfully solved numerous technical challenges, may develop an inflated sense of their ability to control system behaviors.

Professional Assumptions in Engineering

Standardized Education

Similar training creates shared mental models

Industry Experience

Common practices reinforced through careers

Collective Blind Spots

Shared assumptions creating systemic vulnerabilities

While common foundations provide valuable frameworks, they can create collective blind spots when engineers automatically apply familiar solutions without considering alternatives.

Engineering Mindset Limitations

Quantitative Focus

Engineers often prioritize numerical data and technical specifications over qualitative information.

- Mathematical precision
- Statistical analysis
- Measurable parameters

Overlooked Factors

This focus can lead to undervaluing crucial "soft" data that reveals important risk factors.

- Operator feedback
- User experience
- Organizational factors
- Human behavior patterns

Question: How might your organization better integrate qualitative insights into risk assessment?

Specialized Knowledge Gaps

Electrical Engineering

Power systems and control circuits

Chemical Engineering

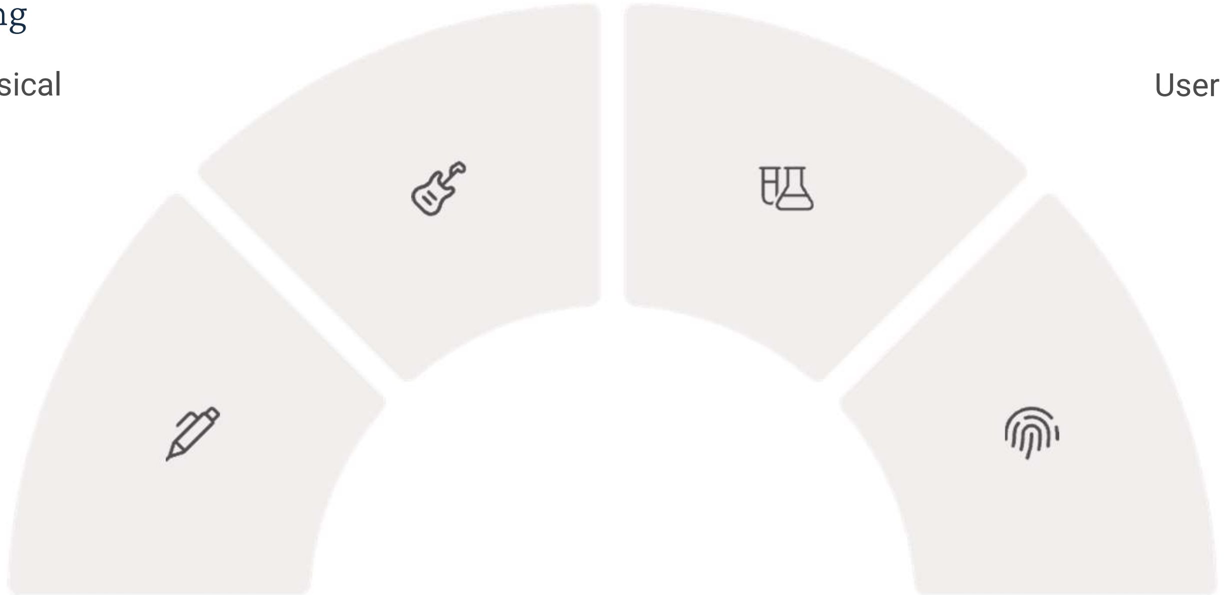
Material interactions and reactions

Mechanical Engineering

Structural integrity and physical systems

Human Factors

User interaction and ergonomics



Engineers develop deep expertise in specific domains while potentially overlooking interdisciplinary factors that could affect system safety.

Structured Debiasing Approaches

Pre-mortem Analysis

Imagine potential failure scenarios before they occur to counteract optimism bias.

Structured Questioning

Challenge assumptions with protocols: What evidence contradicts our view? What alternatives exist?

Competing Hypotheses

Evaluate multiple explanations simultaneously rather than confirming one preferred solution.

Devil's Advocate

Formally assign someone to challenge the prevailing view to prevent groupthink.

Cognitive Restructuring for Risk Assessment

1

Recognize Automatic Patterns

Identify habitual thought processes and assumptions in risk evaluation.

?

Challenge Assumptions

Actively question the basis for risk judgments and perceived patterns.

Seek Balanced Evidence

Look for information both supporting and contradicting initial risk assessment.

4

Develop Alternative View

Create more balanced, evidence-based risk evaluations.

System Safety Engineering

Risk Assessment Matrices

Standardized frameworks for evaluating probability and severity

2

Safety Protocols

Comprehensive procedures balancing safety and efficiency

Failure Modes Analysis

Systematic examination of potential component failures

4

Preventive Measures

Hierarchy of controls following elimination-to-PPE sequence

Redundancy and Fail-Safe Systems

Multiple Protection Layers

Critical systems designed with redundant safeguards to prevent single-point failures.

Backup Power Systems

Secondary power sources ensure continuous operation of safety-critical components.

Redundant Control Circuits

Multiple control pathways maintain system integrity even when primary circuits fail.

Emergency Shutdown Systems

Automatic activation when dangerous conditions are detected, with manual override capability.

Human Factors in Industrial Safety

Physical Ergonomics

Designing workstations, tools, and equipment to accommodate human biomechanical limitations.

- Comfortable reach zones
- Properly positioned controls
- Minimized physical strain

Cognitive Ergonomics

Addressing mental workload, decision-making requirements, and information processing demands.

- Intuitive interfaces
- Clear warning systems
- Manageable information load
- Decision support tools

Workplace Psychology and Safety

1

Motivation

Intrinsic and extrinsic drivers of safety behavior

2

Job Satisfaction

Correlation with safety compliance and vigilance

Organizational Support

Perceived backing for safety-oriented decisions

Production Pressure

Conflicting priorities affecting safety choices

When employees feel valued and supported, they are more likely to follow safety procedures and report potential hazards.

Emergency Response Planning

1

Crisis Preparation

Comprehensive risk assessment identifying potential emergency scenarios

Command Structure

Clear hierarchy following Incident Command System model

Communication Protocols

Redundant systems for internal and external notification

Evacuation Procedures

Multiple routes and assembly points considering environmental factors

Risk Communication in Industry

Tailored Communication

Messages designed for specific stakeholder needs from shop floor to executive suite.

Structured Safety Briefings

Regular meetings using SHARP method: Situation, Hazards, Actions, Resources, Problems.

Two-Way Dialogue

Feedback mechanisms ensuring messages are understood and actionable.

Visual Communication

Hazard maps, signage, and infographics transcending language barriers.

Bhopal Disaster: A Case Study (1984 – 25.000 deaths)

Technical Failure

Water contamination in methyl isocyanate storage tank

Maintenance Issues

Inadequate procedures and reduced safety systems

Cost-Cutting

Gradual erosion of safety margins through budget reductions

Insufficient Training

Operators not prepared for emergency response

Nuclear Accident of Three Mile Island (1979): Human Factors Failure

Event Sequence

- Equipment malfunctions initiated event
- Operators misinterpreted indicators
- Alarm systems overwhelmed staff
- Control room design contributed to confusion
- Partial core meltdown resulted

Human Factors Lessons

- Information overload during crisis
- Inadequate control room ergonomics
- Poor alarm prioritization
- Insufficient simulator training
- Complex procedures hindered response

Challenger Disaster (1986-7 deaths): Organizational Failure

31°F

Launch Temperature

Far below O-ring safety threshold

73s

Flight Duration

Before catastrophic failure occurred

7

Warning Attempts

By engineers concerned about O-ring performance

The Challenger disaster demonstrates how organizational culture and decision-making processes can override technical concerns. Management dismissed engineering warnings about O-ring performance in cold temperatures.

Key Takeaways: Navigating the Unseen

1

Understand Psychological Factors

Recognize how cognitive biases and emotional responses affect risk perception.

2

Consider Cultural Context

Acknowledge how cultural differences influence risk evaluation and communication.

Balance Technical and Human Factors

Integrate engineering solutions with psychological and organizational considerations.

Learn From History

Study both failures and successes to build more resilient safety systems.

Take Action

Implement structured debiasing techniques and comprehensive safety frameworks.