# Keeping the Human in the Loop

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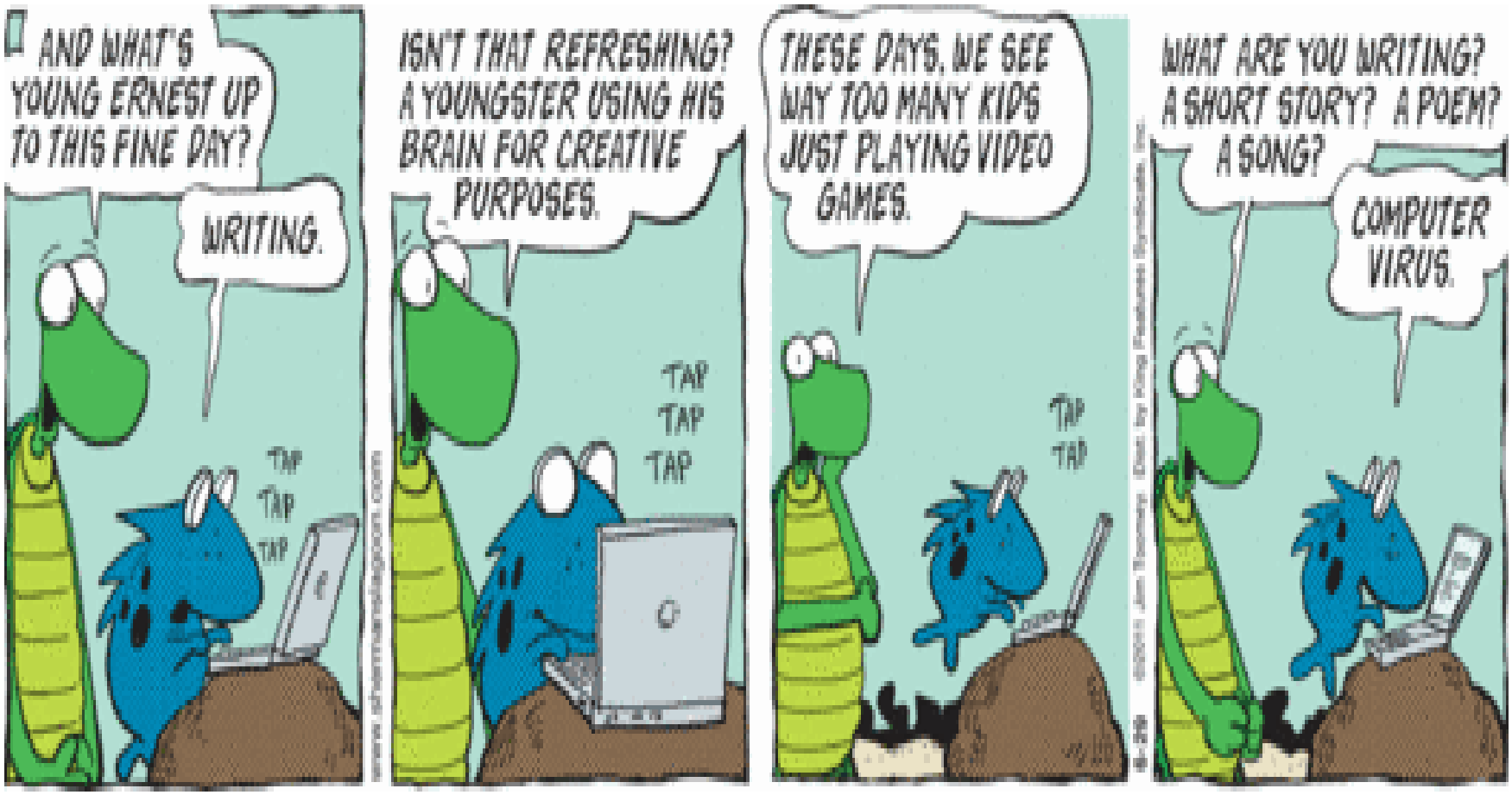
# How Do People Think About Computers?

# And What Are People Doing on Your Networks?



# Understanding the Human Perspective

- Example: Usability
- Example: Cognition
- Example: Risk perception
- What to do?

# Usability

Consider basic functionality:

# And Think About Context of Use

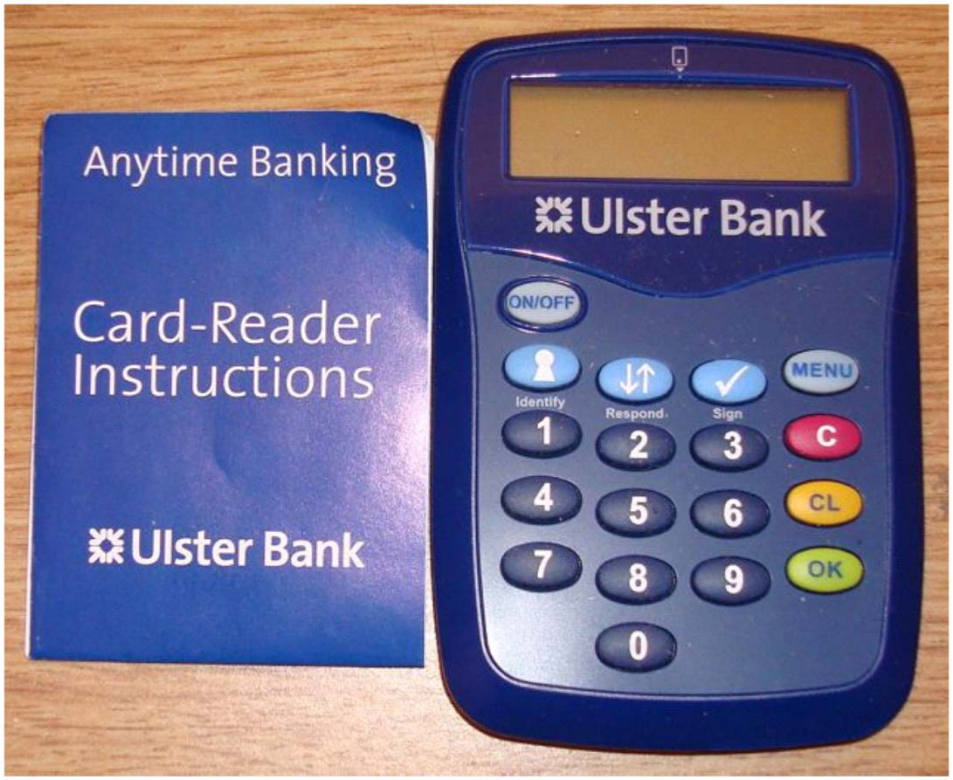
# Usability Example: Ulster Bank

When you open an account, the bank sends you four things:

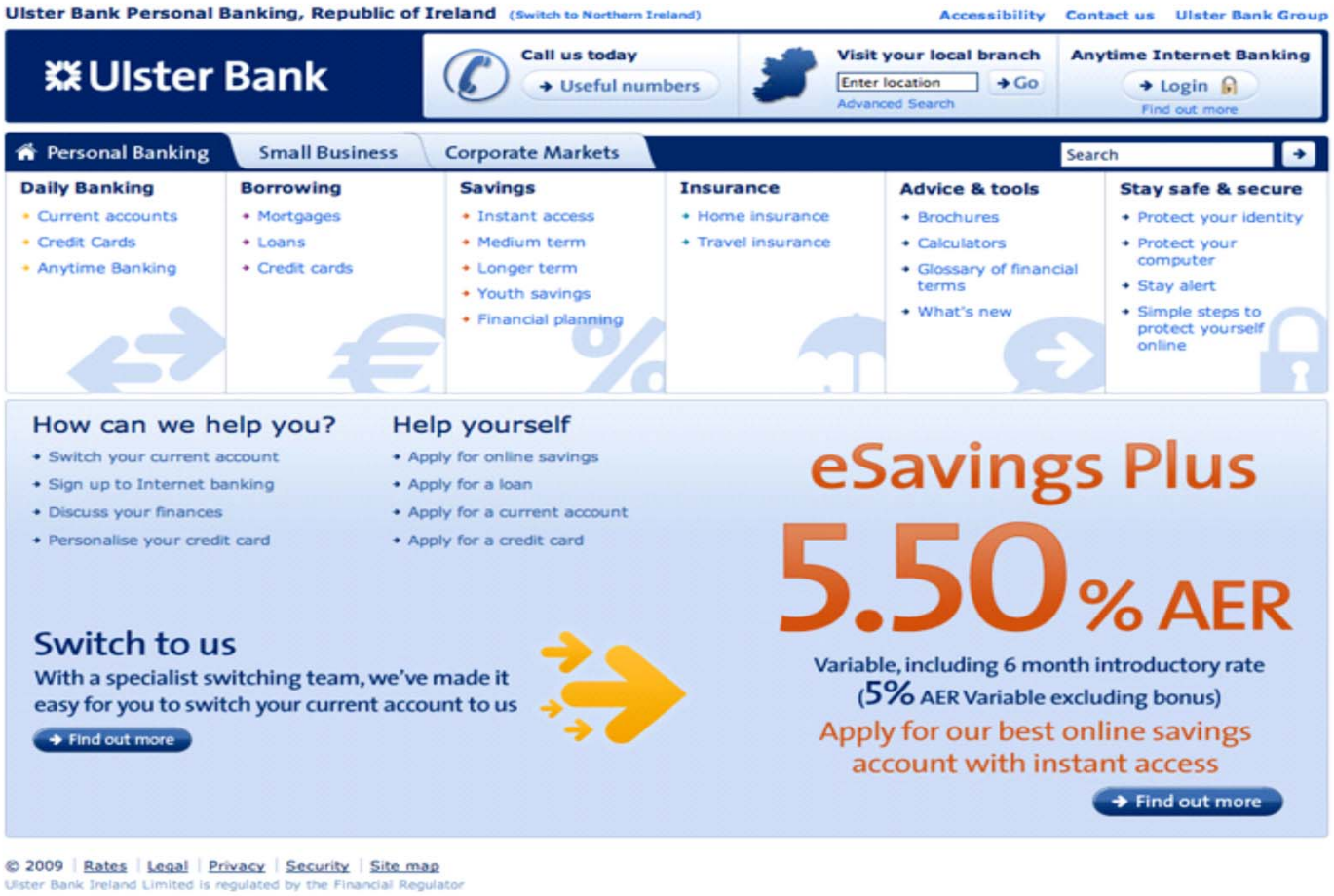
- A smartcard reader
- A separate letter with the actual smartcard
- A separate letter with a onetime PIN for the smartcard
- A separate letter with a onetime 10-digit activation code for the service

# So How Do You Establish an Account?

There are several steps. First get out the card-reader and instructions.



# Second Step: Go to the Online Site



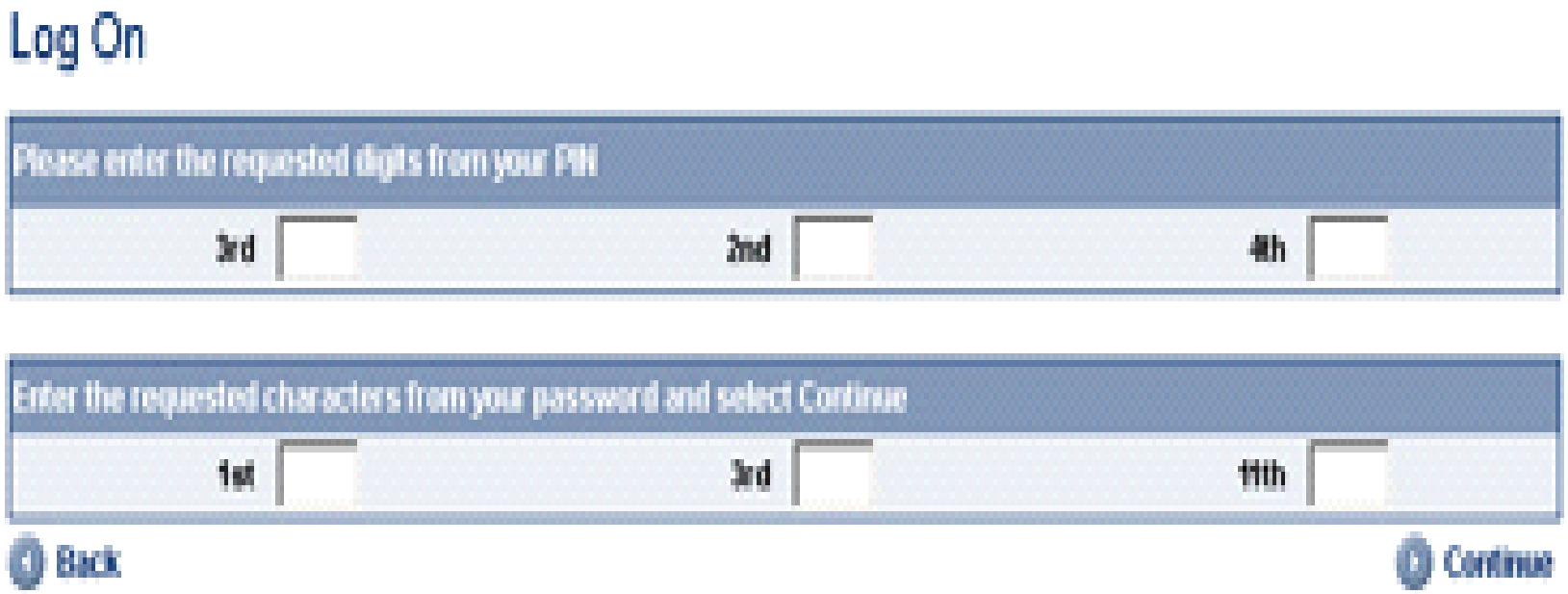
# Next Steps

- Change the PIN on the smartcard.
- Enter your customer number.
- Enter your user ID.

So far, so good.

# Enter Randomness

- Enter three digits from a different PIN.



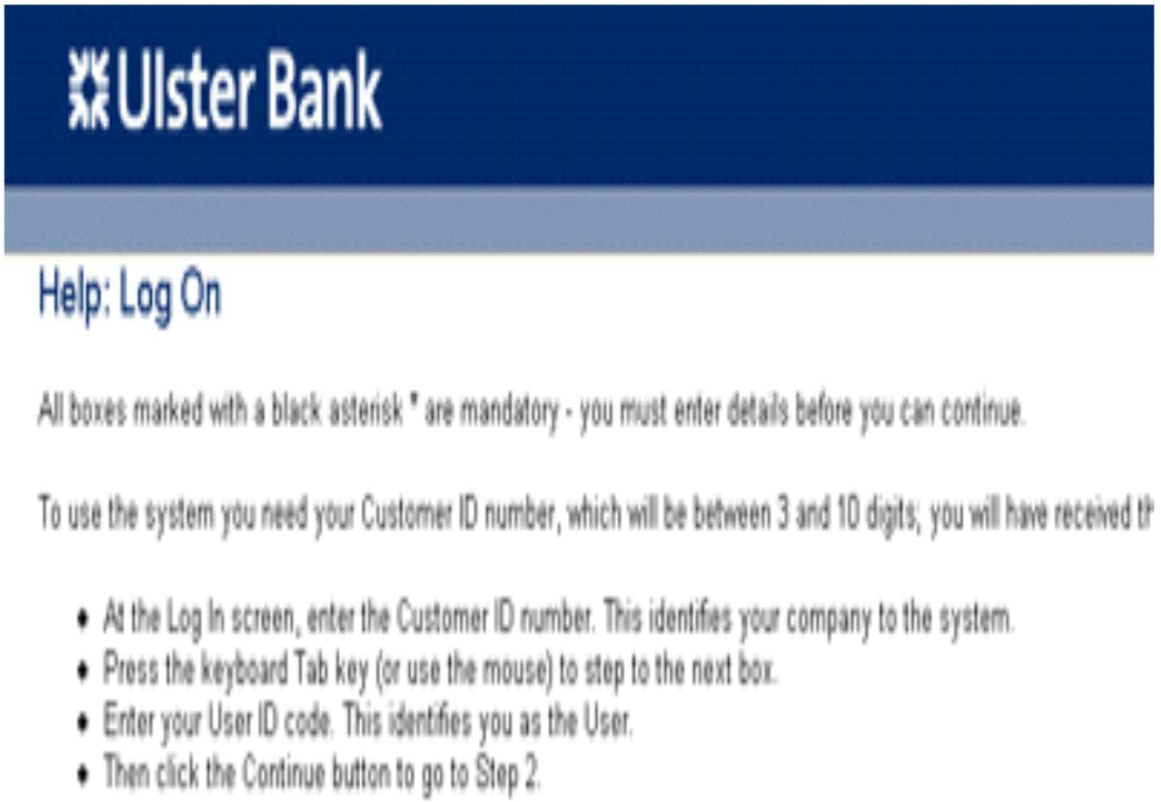

The first line asks for the third, second and fourth digits of your PIN, rather than the entire PIN; this sequence changes each time you log in.

# Even More Steps

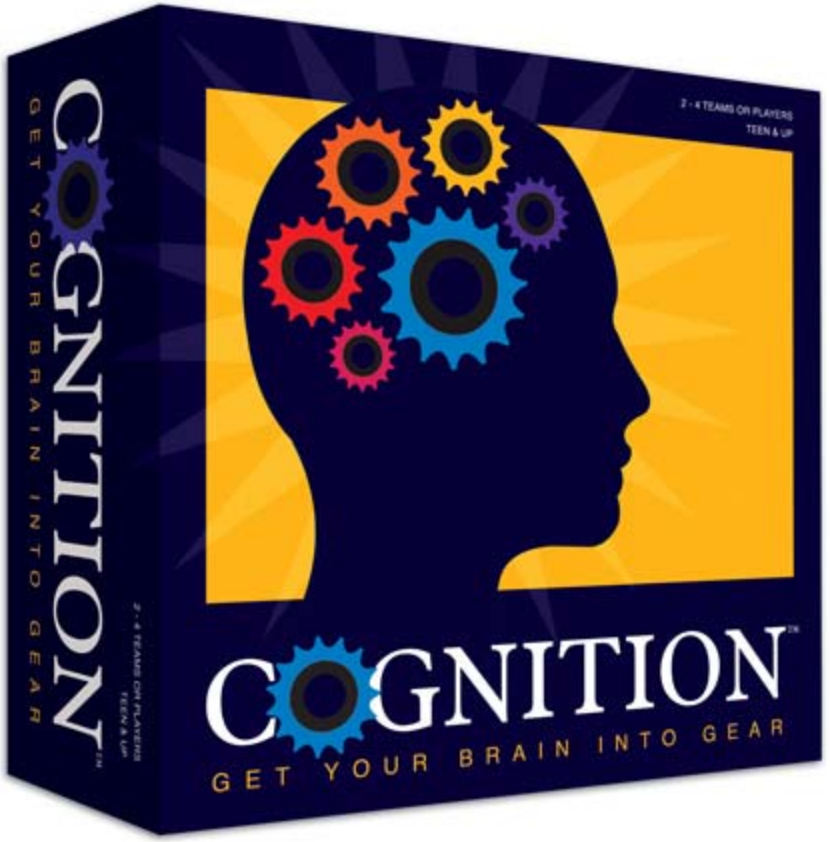
- Enter a new PIN.
- Enter a new password.
- Enter your activation code.

# Help!

There is a Help function, but it does not go into enough detail.



# Cognition


COGNITION
GET YOUR BRAIN INTO GEAR
2 - 4 TEAMS OR PLAYERS
TEEN & UP
COGNITION
GET YOUR BRAIN INTO GEAR

# We Can't Multi-Task

- Primary task vs. secondary task
  - Inattentional blindness
  - Rewards for primary task
- Information overload
  - George Miller: 7 +- 2
  - Intel no-email day
  - Gary Klein: Recognition-primed decision-making

# Scarcity Makes a Difference, Too (1 of 2)

Source: David Brooks, "The Unexamined Society," *NY Times*, 7 July 2011

- Financial scarcity: Consider Indian sugar farmers.
  - Before the harvest, scarcity. They have many daily decisions. The farmers do terribly on tests: lower IQs, more trouble controlling their attention, more short-sighted.
  - After the harvest, relative prosperity. Better test performance.

# Scarcity Makes a Difference, Too (2 of 2)

Source: David Brooks, "The Unexamined Society," *NY Times*, 7 July 2011

- Time scarcity: Consider Princeton students.
  - With time scarcity: They can play a timed game, and they were allowed to borrow time from future rounds. They did so, oblivious to the usurious rates the game organizers were charging.
  - Similar to behavior with payday lenders.
  - Possible relation to software quality? Perhaps need to get job done within time constraints makes people oblivious to the negative quality consequences.

# Is This Reasonable?

# Is This Information Overload?

# Too Much Information?

# Is This an Improvement?

# Is This Better?

# Add Other Cognition Effects to the Mix

- Based on experiences
  - Recency effect
  - Status quo bias
  - Recognition better than recollection
  - Interference
  - Identifiable victim effect
- Framing effects
- Confirmation bias
- Bystander effect

# Understand the Nature of Trust

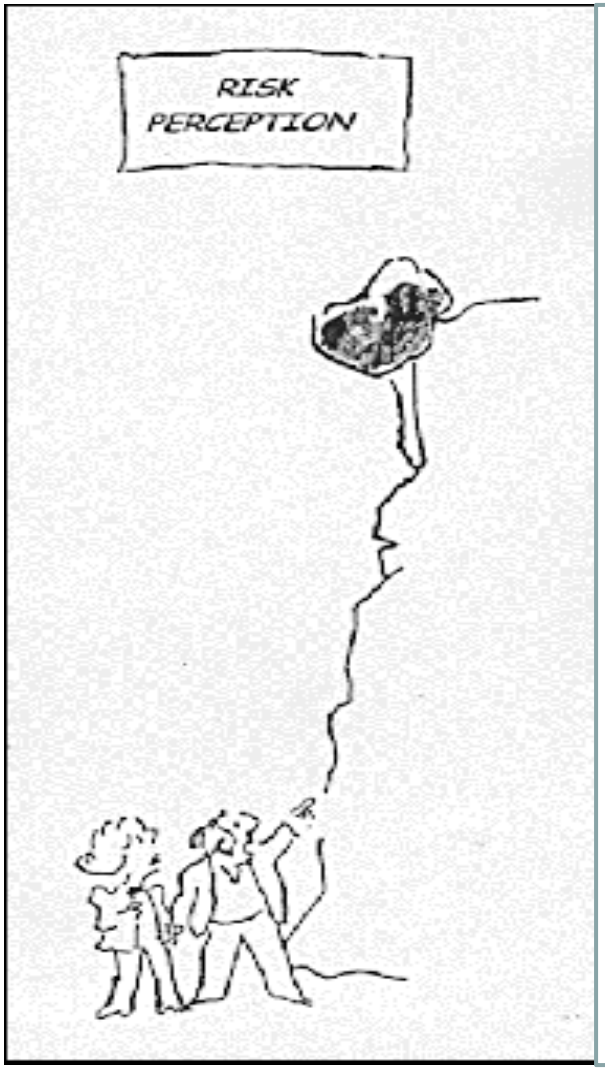
Example: Tenner (1991) describes how trust in technology leads to riskier behaviors

# Risk Perception

# Risk = Likelihood x Impact

- We must understand both in order to understand the risk.
- Only then can we compare two risks and make informed choices.

# Steps in Handling Risk



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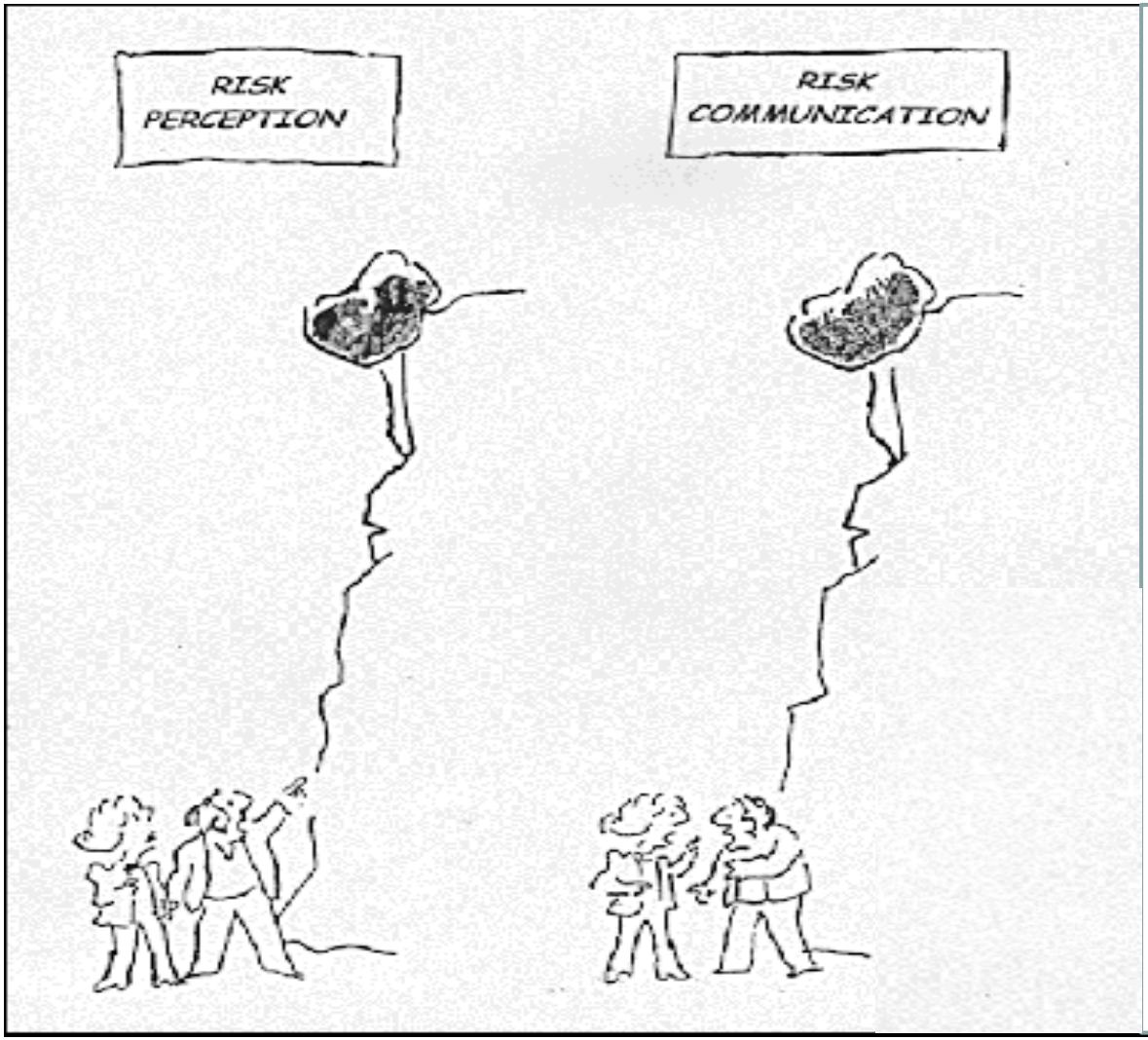

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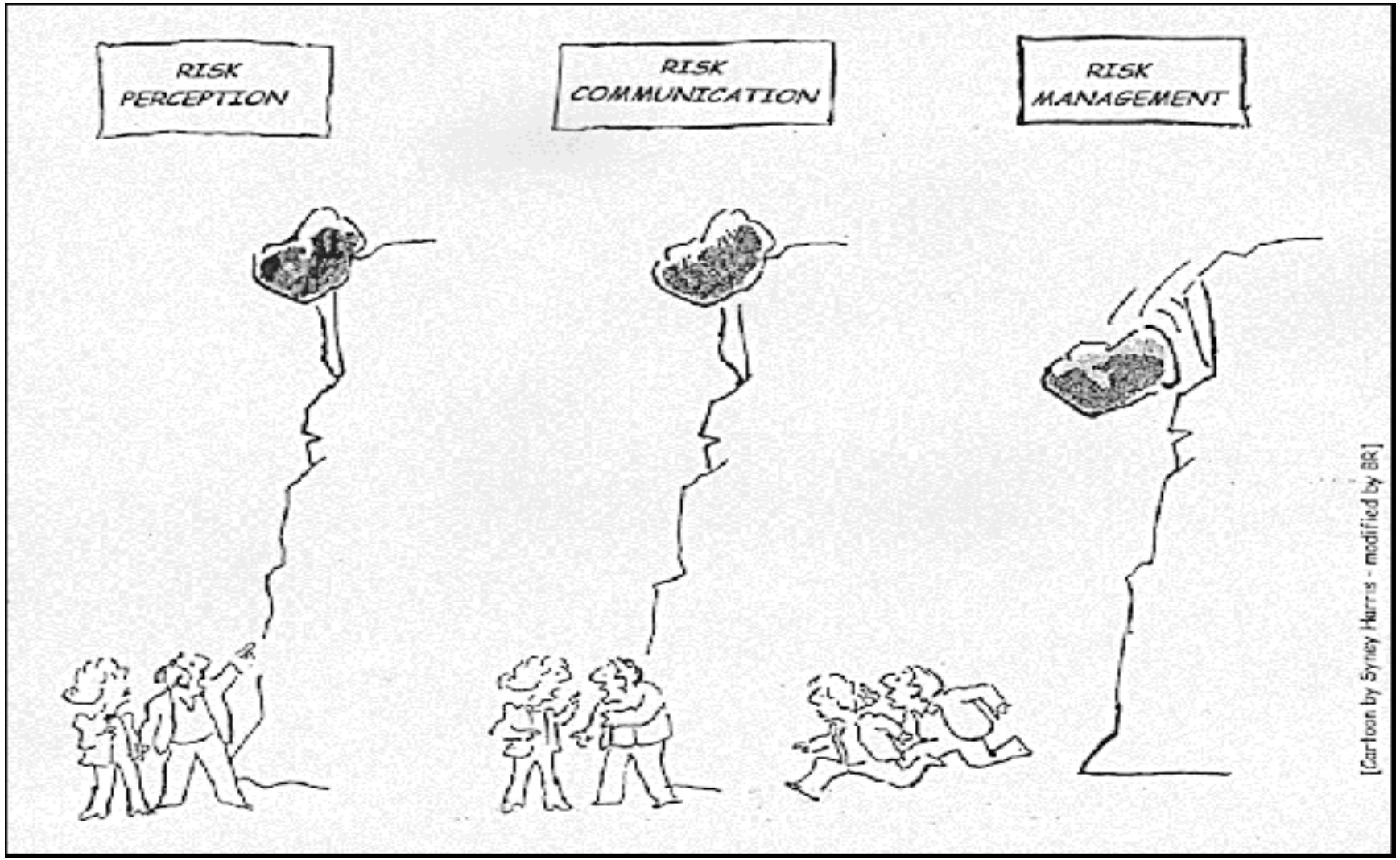
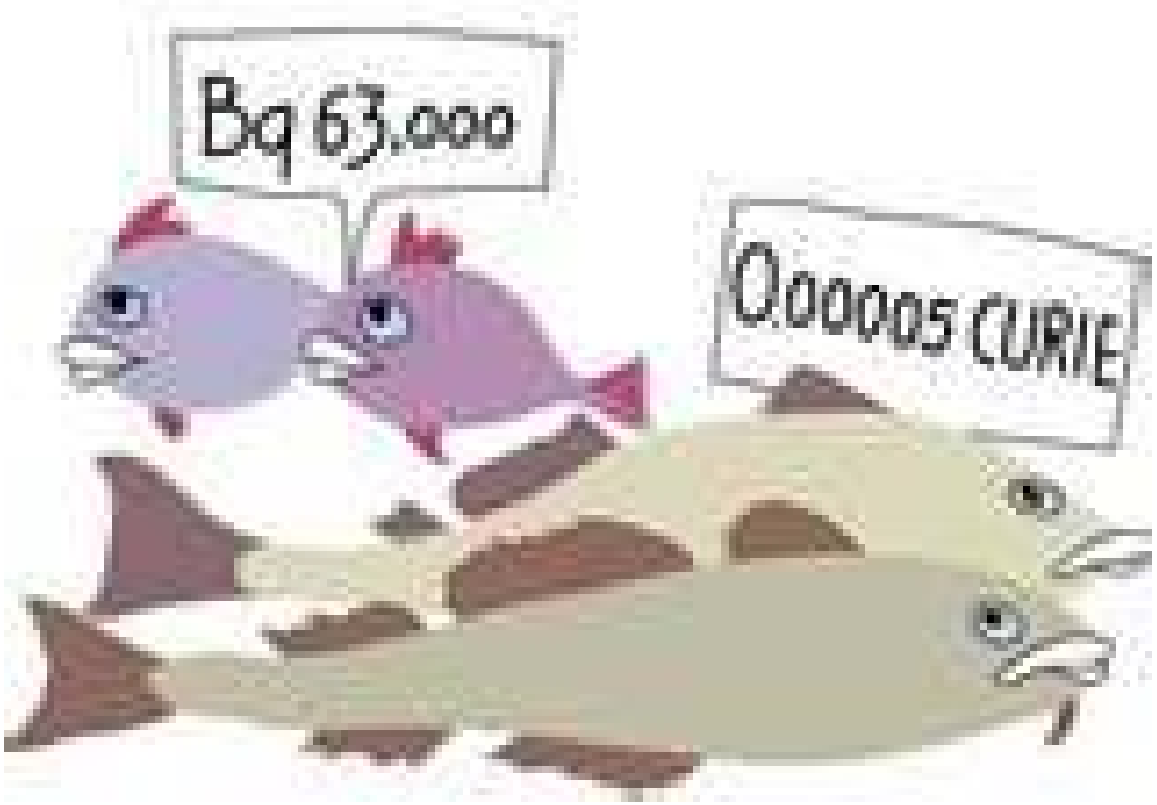


# Risk Perception

- When impact is high, we focus on it.
- When likelihood is very small, we focus on impact.



# How Often Does This Happen?

# The Black Swan Phenomenon

- Talib: Preparing for low-probability events with little data on prior occurrences
  - Japan's Sendai earthquake
  - Dependability example: AT&T phone outage
- What to do when resources are highly constrained?
  - Mitigation and remediation instead of prevention?

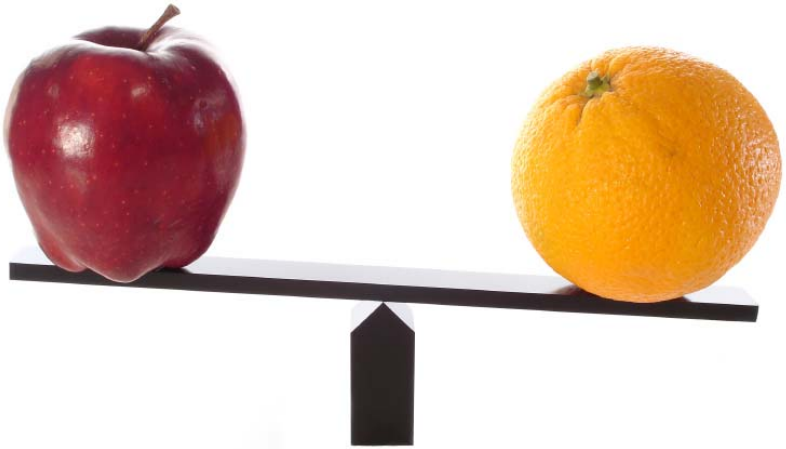
# Dread and Understanding

Two key factors influence how we perceive risk:

- Level of dread
- Level of understanding

Source: Slovic, Fischoff, Lichtenstein (1980)

# But What's the Right Way to Calculate and Compare Risks?

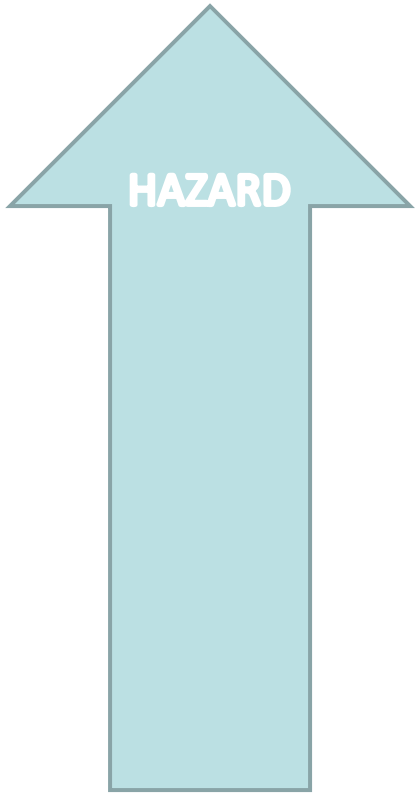


# How Should We Think About Risk?

Sandman (2007): Risk equals hazard plus outrage

- Hazard = how much harm is likely
- Outrage = how people are likely to react

So how do we use this to react to risks?

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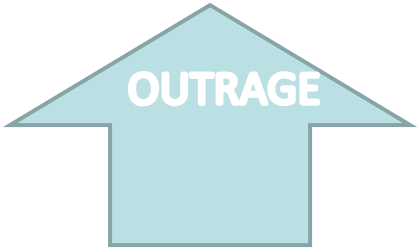


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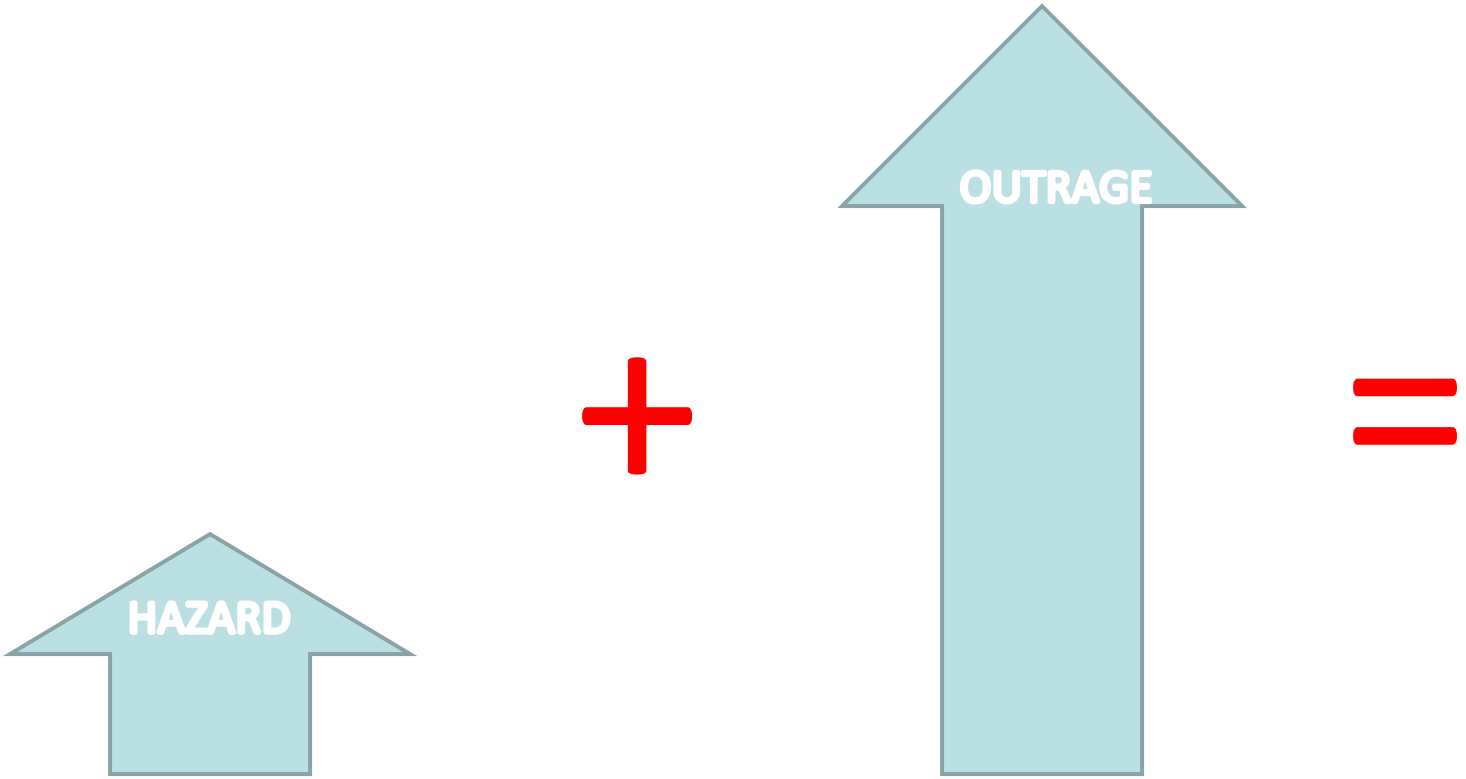
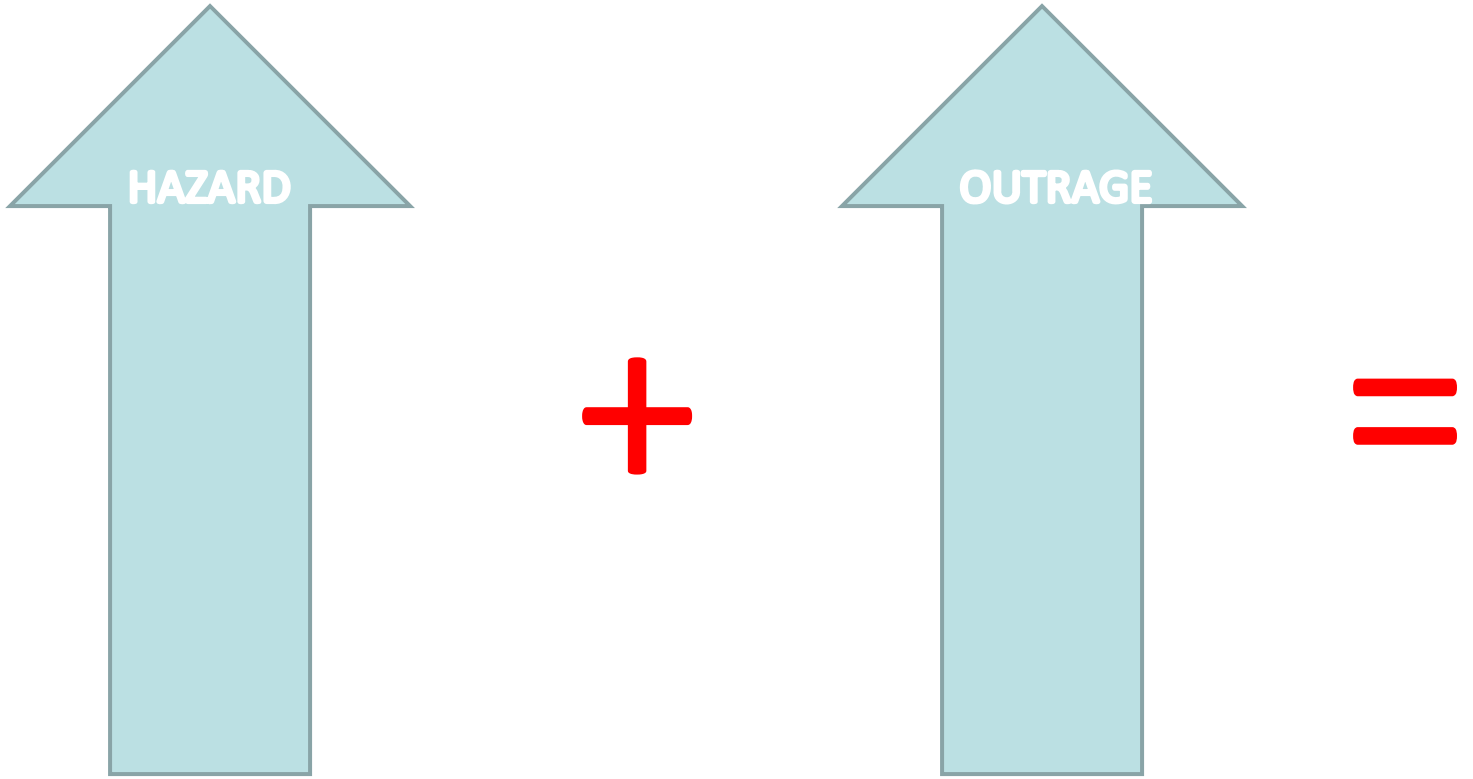
# Watch out!

Warn people who are insufficiently worried.



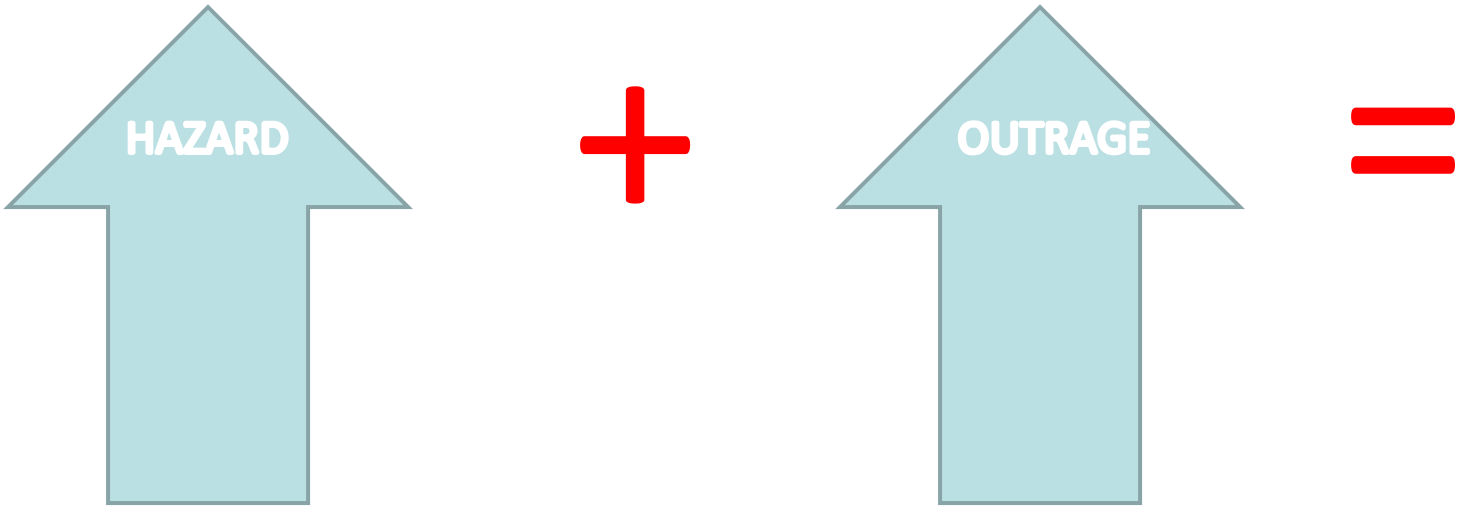

# Calm down

Reassure people who are upset.




# We'll get through this together

Crisis communication.




# What do you think?

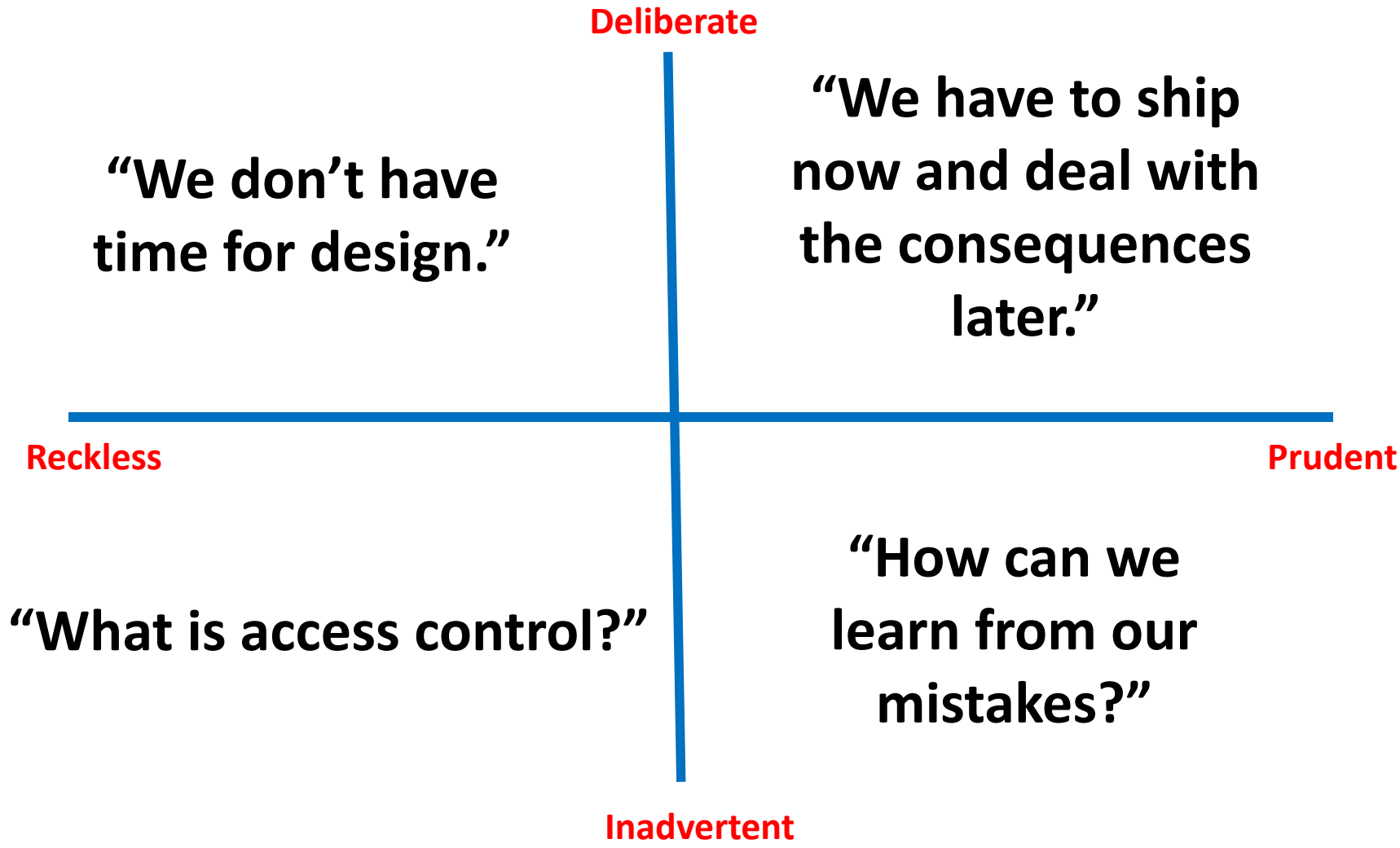
Discussion and deliberation.

# Bottom Line: We Need to Integrate Human Nature in Decision-making

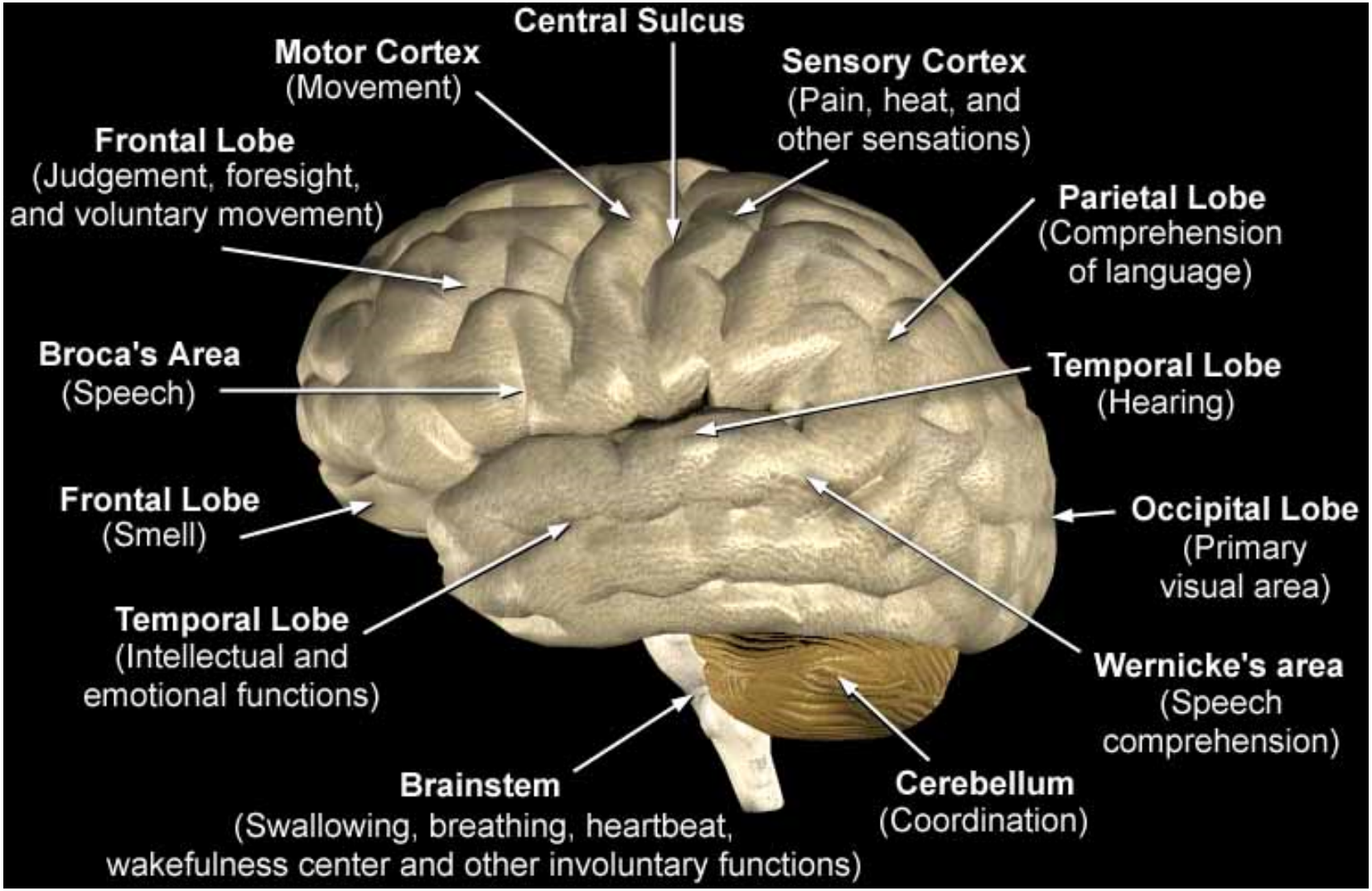
# What Should We Do?

# First, Examine Your Current Approach

(Source: Gunnar Peterson)



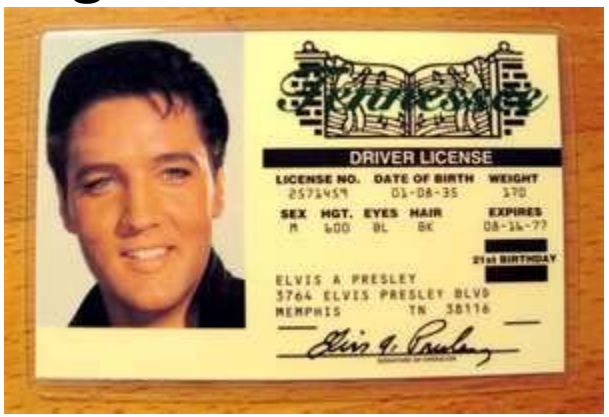
# Next, Pay Attention to This



# Example: Opt-in vs. Opt-out

Agreeing to organ donation during drivers' license registration:

- In Germany and the US: opt-in
  - Result? About 14% of drivers are organ donors
- In Poland and France: opt-out
  - Result? About 90% of drivers are organ donors



# Account for Human Variation

# Especially Novice, Master, Expert

# Account for Cognitive Load

# And Have Realistic Expectations

# What to Do? (1 of 2)

- Requirements
  - Include significant user-sensible, testable requirements that reflect how people perceive and react
- Design
  - User-centered design that can be prototyped and evaluated
- Testing
  - Simulations
  - Tests in real situations with variety of users: novices, masters, experts

# What to Do? (2 of 2)

- Evolution
  - Look at trouble tickets, other evidence of use and consequences, and redesign according to what you learn.
- Include behavioral scientists on development, evaluation and maintenance teams
  - Or at least train your developers to be sensitive to human perception and action.

# For More Information (1 of 2)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# For More Information (2 of 2)


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