MODULE 4: DECISION-MAKING AND EVALUATION

CT ACADEMY | DATA ACTION LAB

10. EVIDENCE-INFORMED DECISION-MAKING

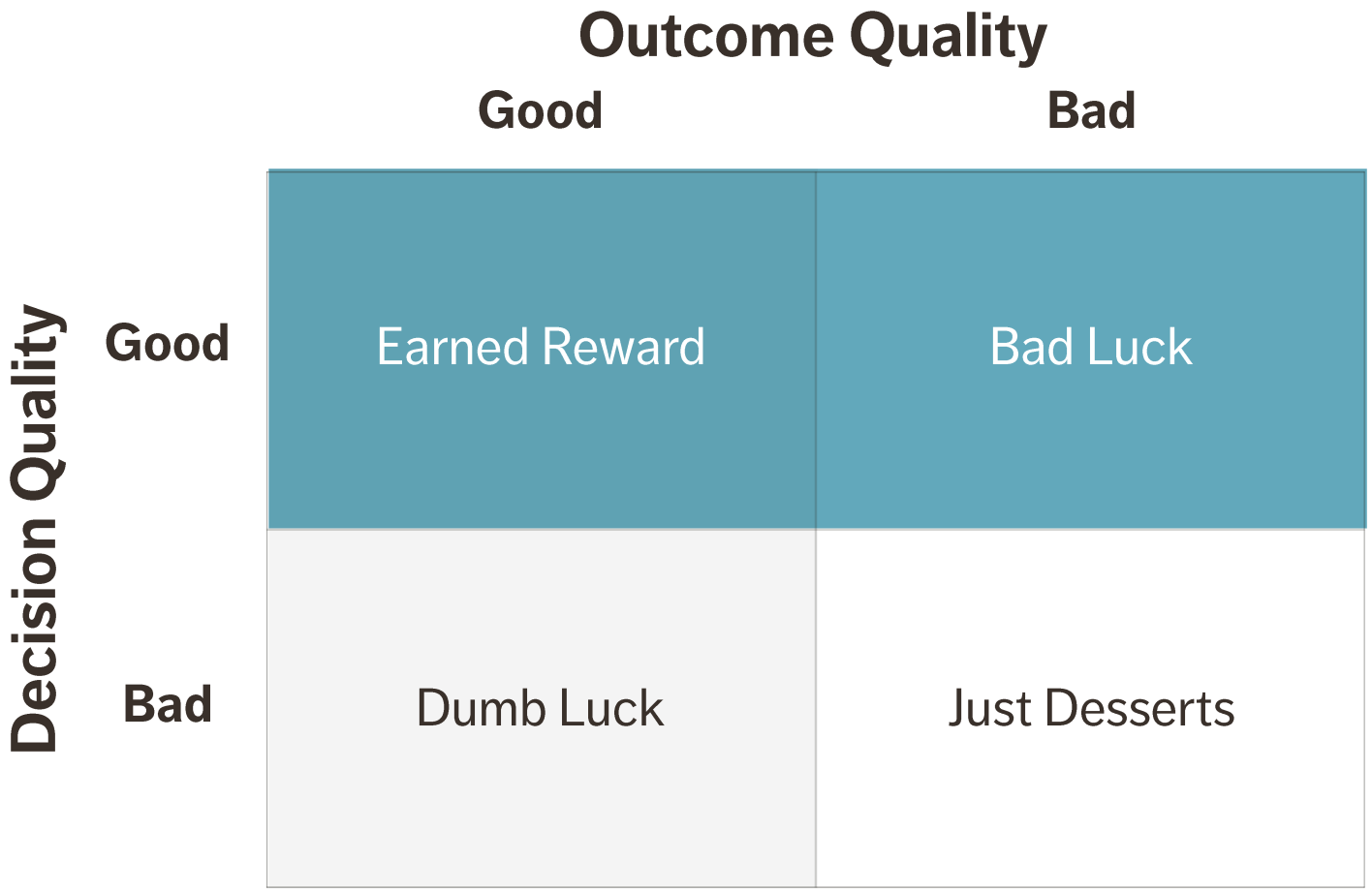
DECISION-MAKING AND EVALUATION

LIFE TURNS ON TWO THINGS

Luck
(outside your control)

Decisions
(within your control)

RESULTING



Poker players warn of "**resulting**": assessing the quality of a decision based **solely on its outcome**.

Problem: "resulting" makes us lack compassion for ourselves and for others.

Bad outcomes do not necessarily equate to **poor decision-making**.

Exercise: find examples for each quadrant.

EXERCISES

1. With 26 seconds left in the Super Bowl, the Seattle Seahawks were trailing the New England Patriots by 4 points. At 2nd & Goal, the Seahawks had the ball at the Pats' 1 yard line. The common wisdom in this situation is to hand the ball to the running back and let them try to punch through the defensive line. The Seahawks had two options:
    a) Run the ball (1 play). Risk: Fails to score and time runs out.
    b) Throw the ball instead, then run if necessary (2 plays). Risk: 2% chance of interception.

What play should the coach call? Why?

EXERCISES

2. In the Vanity Fair article "You Could Fit All the Voters Who Cost Clinton the Election in a Mid-Size Football Stadium", Tina Nguyen writes:

> "While nearly 138 million Americans voted in the presidential election, the stunning electoral victory of Donald Trump came down to upsets in just a handful of states that Hillary Clinton was expected to win. It has been cold comfort for Democrats that Clinton won the popular vote—at the last count, she was up by about 2.5 million votes, and climbing, as ballots continue to be counted. Even more distressing is the tiny margin by which Clinton lost Wisconsin, Michigan, and Pennsylvania—three states that were supposed to be her firewall in the Rust Belt, but that ultimately tipped the electoral college map decisively in Trump's favor.
>
> Trump's margin of victory in those three states? Just 79,316 votes.
>
> This latest number comes from Decision Desk's final tally of Pennsylvania's votes, where Trump won 2,961,875 votes to Clinton's 2,915,440, a difference of 46,435 votes. Add that to the official results out of Wisconsin, where Clinton lost by 22,177 votes, and Michigan, which she lost by 10,704 votes, and there you have it: 0.057 percent of total voters cost Clinton the presidency."

EXERCISES

"It is not entirely unusual for the electoral college to be lost by such a slim margin. In 2000, Al Gore lost Florida (and therefore the election) by 1,754 votes, triggering a painfully drawn out recount drama that only ended with a Supreme Court ruling. And in 2004, John Kerry lost to George W. Bush by losing Ohio by a little over 118,000 votes. But it is worth considering just how few voters ultimately set the country on its current, arguably terrifying course. The 79,316 people who voted for Trump in Wisconsin, Michigan, and Pennsylvania—all states that Democrats carried since 1992—is less than the entire student body of Penn State (97,494 students), or only slightly more than the number of people who attended Desert Trip, the Baby Boomer-friendly music festival colloquially known as "Oldchella." If you put all these voters in the Rose Bowl, there would be slightly over 13,000 seats left over.

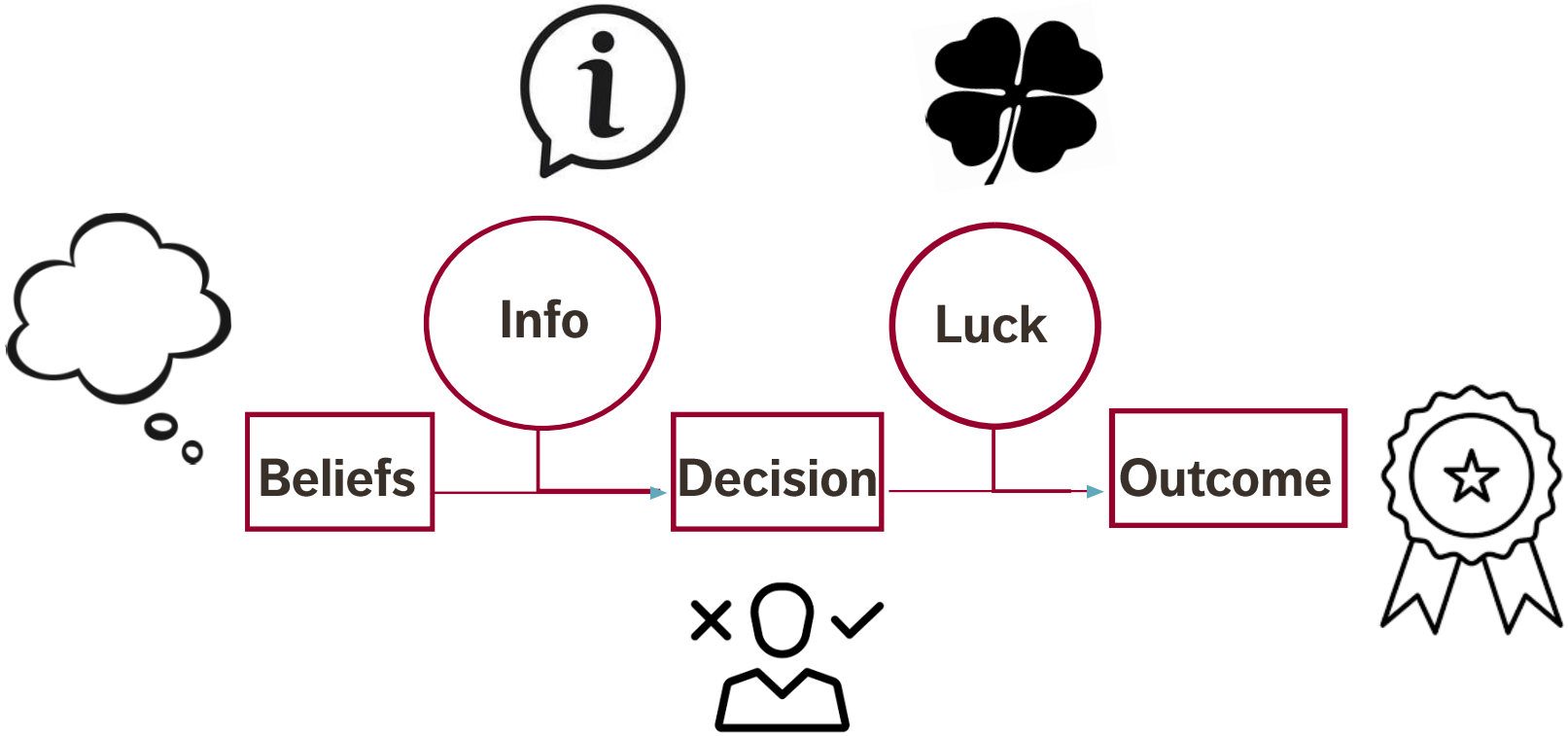
There are more people living in Nampa, Idaho, a city you have never heard of.

To put things in even more painful perspective, Green Party candidate Jill Stein won about 130,000 votes in those three states. Libertarian candidate Gary Johnson won about 422,000.

But perhaps the most painful data point for Clinton is this: the Democratic nominee for president never made a single campaign stop during the general election, and largely neglected Pennsylvania and Michigan, too, while Trump canvassed all three states relentlessly. His furious, last-minute blitz throughout the Rust Belt to win white, working-class voters, combined with the lack of resources Clinton invested, essentially handed their combined 46 electoral votes to Trump. Instead, Clinton spent the last few weeks of her campaign expending resources in places like Arizona and Texas—states which went for Trump by huge margins."

So was it bad luck, or a mistake? Why?

LUCK AND INFORMATION



EXERCISE

Revisit the last two questions in light of the Luck and Information slide.

WHAT IS ANALYSIS IN THE GOC?

Drawing conclusions?

Gathering and presenting evidence (pivot tables)?

Providing options?

Providing opinions/hypotheses/beliefs/recommendations?

Pushing your agendas?

CRITICAL THINKING

Critical thinking (supported by analysis, reasoning, inference) is important.

Using **rigor** and **methods:** also important.

This is not a course on logic, BUT...

ultimately reasoning activities are all about getting at the (a?) **truth** – having enough true facts at your fingertips to keep you from making bad decisions.

SYSTEM OPTIONS

System 1: automatic decisions (“gut-feeling”)

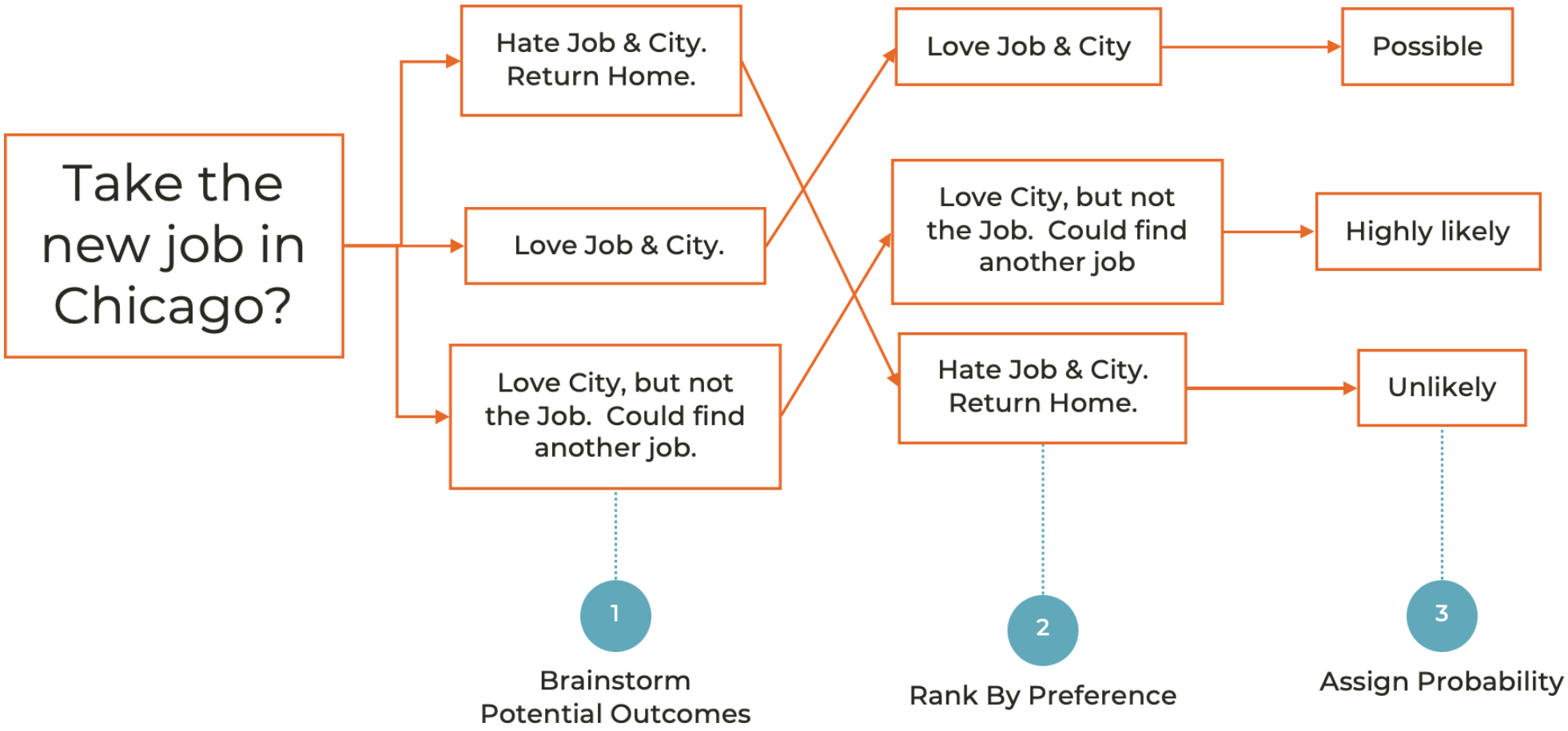
System 2: scientific method (“controlled environment”)

But also…

System 2: everything else (i.e., your job)

We need to use all reasoning types, with emphasis on what is **plausibly** true.

ANNIE DUKE'S GUIDE TO DECISIONS



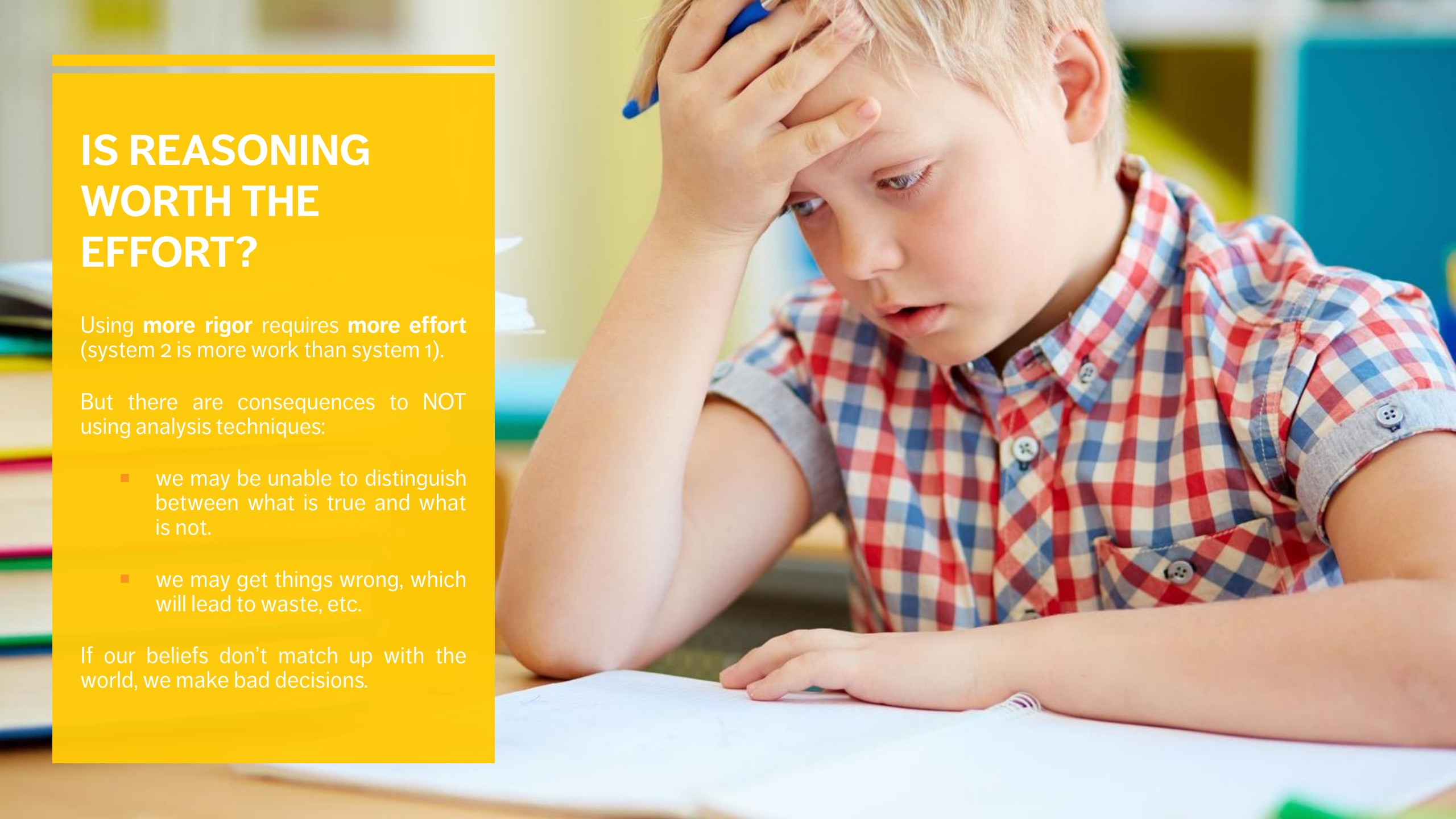
IS REASONING WORTH THE EFFORT?

Using **more rigor** requires **more effort** (system 2 is more work than system 1).

But there are consequences to NOT using analysis techniques:

- we may be unable to distinguish between what is true and what is not.
- we may get things wrong, which will lead to waste, etc.

If our beliefs don't match up with the world, we make bad decisions.



EXERCISE

A port-mortem can help us learn the causes of a bad outcome, with one tiny limitation: the patient is already dead.

In a **pre-mortem**, we imagine ourselves at some time in the future, having **failed to achieve a goal**, and looking back at how we arrived at that destination – it is an autopsy **before** the patient dies. With **backcasting**, we instead imagine that things worked out.

In general, we conduct a pre-mortem/backcasting exercise by first identifying the goal to achieve, or the decision being considered, then picking a timeline for achieving that goal, and finally imagining that it is the day after the deadline, at which point we are looking back at the process.

We then try to give 5 reasons "within our control" and 5 reasons "outside of our control" for why things failed (pre-mortem) or for why they succeeded (backcasting).

After these exercises, we might modify our decision based on the new insights, increasing the chance of good things happening and reducing the chance of bad things happening; in effect, we are looking for ways to mitigate the impact of bad luck (flood insurance works along those lines).

Conduct premortem/backcasting for a new youth mental health initiative. Assume that your department has created an app which aims to improve the mental health of Canadian teenagers. It is now two years from today and you are looking back on the app's launch.

ETHICAL DECISION-MAKING

Ethical research groups have identified different approaches to ethical decision making. The simplest being the **Blanchard-Peale framework** which is summarized as:

1. is it legal?
2. is it fair?
3. how does it make me feel?

Other approaches: **Markkula Centre framework** (utilitarianism, rights approach, fairness, common good approach, virtue approach), **issue-contingent model** (recognize issue, make judgement, establish moral intent, engage in behaviour).

The key concept is that decision-making for the organization must first be analyzed – however decisions are made, guidance is provided to help decision makers if issues must be addressed.

ANALYTICS: ANALYSIS PARALYSIS

We may need to make a decision with **less than complete** information. What is the risk of **not deciding** vs. the risk of making a less-than-perfect decision?

Analysis paralysis is caused by overthinking a situation and worrying about the outcome at the expense of decision-making. It is **perfectionism**, taken to an extreme (not good).

“It doesn’t matter in which direction you choose to move when under a mortar attack, just so long as you move. Decisions are never final for the simple fact that change is never absolute. Rather, change is ongoing. To stay competitive and progress at the rate of change requires adaptive decisions that can be iterated and improved upon on the fly.” [Jeff Boss, Forbes]

ANALYTICS: AVOIDING ANALYSIS PARALYSIS

WHAT IS YOUR ANALYSIS GOAL?

Do you want to:

- carry out actions based on **what is in your data**?
- gain a deeper understanding of something **specific**? (specific individual(s)? specific group(s)?)
- come to **general** conclusions that extend beyond the specific?

Local vs. Global

Here vs. Everywhere

Past/Present vs. Future

Situational Awareness vs. Contingency Planning

TYPICAL SEQUENCE OF REASONING

1. Start with premises: knowledge/assumed true beliefs

2. Carry out reasoning

3. Reach conclusions: new knowledge/potentially true beliefs

This approach can also be used to generate a **logical argument**

YOU ALREADY DO THIS, INFORMALLY

Suppose I pause at the top of a set of stairs with an armful of stuff. What argument might be playing out **unconsciously**...?

- IF I have too many things in my hands, THEN I can't hold on to the railing going down the stairs
- IF I don't hold onto the railing, THEN I might stumble
- IF I stumble, tTHEN I might drop my stuff to stop myself falling down the stairs
- IF I drop my stuff, THEN some of it might break
- IF my stuff breaks, THEN then I'll be sad

CONCLUSION: I currently have too many things in my hands.

YOU ALREADY DO THIS, INFORMALLY

How do we act on such a conclusion?

- Because I have too many things in my hands, I might drop them on the stairs and break some of them.
- This would make me sad :(
- Instead, I could choose to make two trips so I can hold on to the railing.
- If I make two trips instead of one, this doesn't mean I won't drop something and break it, but it does increase my confidence that I won't drop something.

Decision and Action: "I will split the load into two parts and make two trips." or "Nah, that's not likely to happen; I'll tough it out and make one trip."

REASONING VULNERABILITIES

Conspiracy theories **mindset:** individuals jumping to invalid conclusions because they cannot reason and/or recognize bad evidence.

Is it **plausible** that there are microchips in the COVID vaccine? How would you gauge the degree of plausibility?

Thought exercise: you are given a stable of deductive logicians and a stable of debaters to help you make decisions. Which would you chose? Is any of them of use to you?

PLAUSIBLE REASONING

Consider the following scenario [Jaynes, 2003]:

- you are walking down a deserted street at night;
- you hear a security alarm, look across the street, and see a store with a broken window, and
- someone wearing a mask crawls out of the broken window with a bag full of smart phones.

What might a system 1 conclusion be?

What might a system 2 conclusion be?

PLAUSIBLE REASONING

Say we concluded that the person crawling out of the store is stealing merchandise from the store. How do we come to that conclusion? It **cannot** come from a logical deduction based on evidence.

Indeed,

- the person crawling out of the store **could** have been its owner who,
- upon returning from a costume party, realized that they had misplaced their keys
- just as a passing truck was throwing a brick in the store window,
- triggering the security alarm, after which
- the owner then went into the store to retrieve items before they could be stolen,
- which is when you happened unto the scene.

The original conclusion is not **deductive**, but it is at least **plausible**.

DEDUCTIVE VS. PLAUSIBLE REASONING

Plausible reasoning:

If A is true, then B is more plausible

B is true

A is more plausible

If "the person is a thief" (A is true), we would not be surprised to "see them crawling out of the store with a bag of phones" (B is plausible).

We do "see them crawling out of the store with a bag of phones" (B is true).

Thus, we would not be surprised if "the person were a thief" (A is more plausible).

EXERCISE

Are the following arguments plausible? What are their flaws? Could they be improved?

1. COVID vaccinations lead to increased hospitalizations as half of the hospitalizations were vaccinated.
2. Turning the Large Hadron Collider on was a mistake because either it destroys the Earth or it does not; a 50% chance is way too risky.
3. We know that the Earth is not flat because none of the other planets we know are flat.
4. You should not vote in the next election because one vote never makes a difference.
5. The solution to reduce congestion is to reduce the number of lanes because with fewer lanes, people will seek alternative modes of transportation.
6. Airport security measures are proportionate to the risk because it's ok to wait a few hours if it means that my plane won't be hijacked.

SUPPLEMENTAL MATERIAL

10. EVIDENCE-INFORMED DECISION-MAKING

FORMAL RIGOROUS REASONING

Mathematicians and philosophers developed **formal methods** to bring **rigour** to informal reasoning – we can think of these as reasoning tools.

Using these tools increase our chances that we will **end up with true statements**, in which we can feel confident (if not always 100% so).

Without rigor, we can succumb to **biased reasoning**, which prevents us from reaching **true conclusions** or **justified conclusions**.

FORMAL REASONING TECHNIQUES

INDUCTIVE, PLAUSIBLE, DEDUCTIVE, ABDUCTIVE, ANALOGICAL REASONING

FURTHER SPECIALIZED TECHNIQUES: SCIENTIFIC METHOD, STATISTICAL REASONING, MATHEMATICAL AND COMPUTER MODELLING

EVIDENCE-BASED ANALYSIS, WHICH MAY BE MORE-OR-LESS TECHNICAL

FORMAL REASONING TECHNIQUES

Reasoning strategies:

- deducing new facts from existing facts (**deductive** reasoning)
- generalizing from examples (**inductive** reasoning)
- reasoning to the best explanation (**abductive** reasoning)
- using analogies and models (**analogical** reasoning)

These last three techniques are examples of **plausible reasoning** – you are not guaranteed to reach the truth, but you are increasing your level of certainty.

TYPICAL ANALYSIS ACTIVITIES

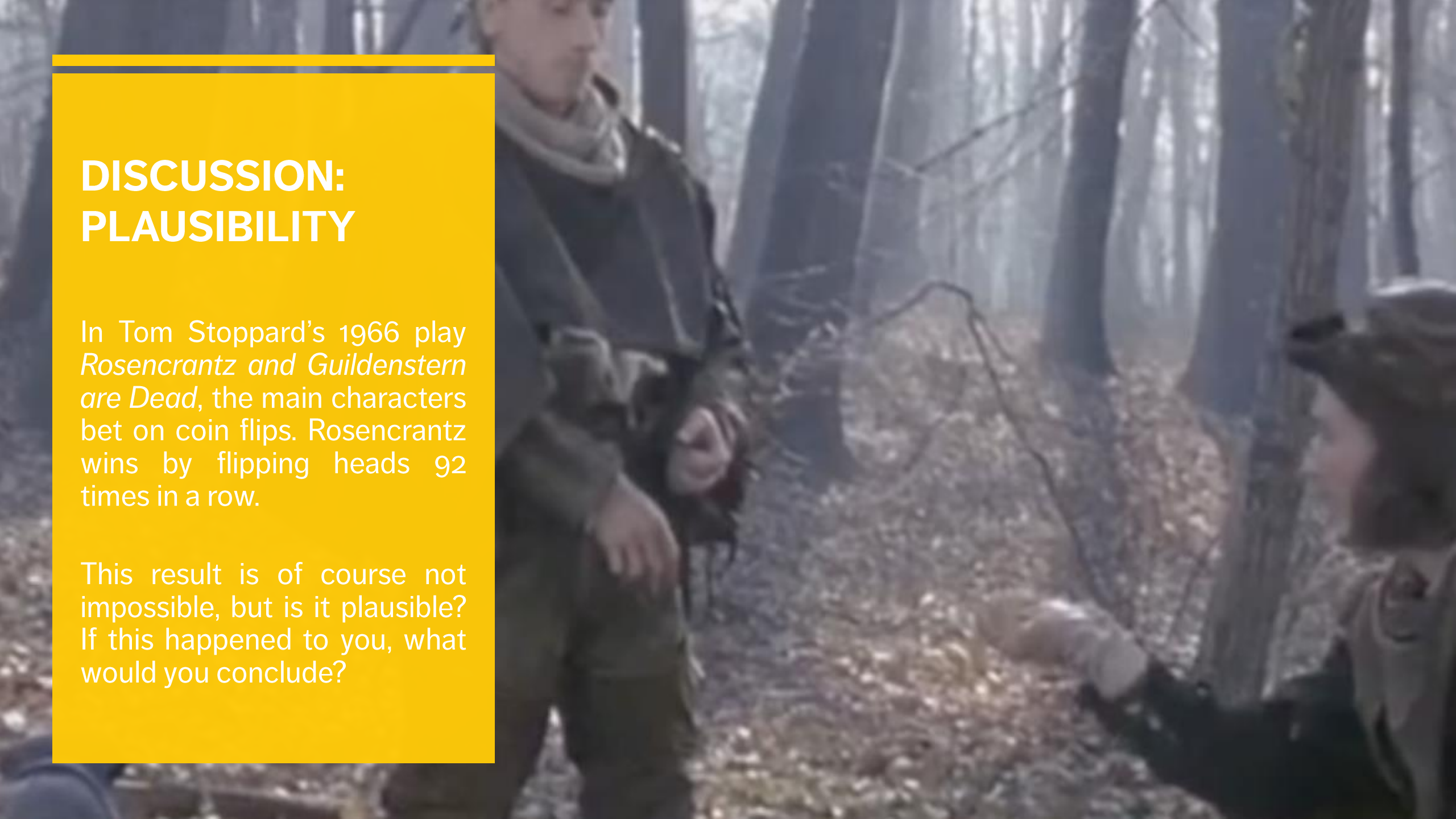
Analysis is an activity done *to* something.

We analyze the **situation** or the **problem:**

- Gathering facts and evidence
- Summarizing the facts
- Reviewing and evaluating facts
- Combining facts
- Generating new statements or hypotheses
- Breaking down concepts into simpler concepts

Common theme: facts!

- Building up more complex concepts from simpler concepts
- Defining concepts
- Using reasoning to derive new facts
- Determining if statements are true (facts) or false
- Determining how confident we are about a statement being true or false



DISCUSSION: PLAUSIBILITY

In Tom Stoppard's 1966 play *Rosencrantz and Guildenstern are Dead*, the main characters bet on coin flips. Rosencrantz wins by flipping heads 92 times in a row.

This result is of course not impossible, but is it plausible? If this happened to you, what would you conclude?

BUILD RELATIONSHIPS WITH STAKEHOLDERS