EVIDENCE-INFORMED DECISION-MAKING

HOW WE REASON

data-action-lab.com

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, THEN 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.

data-action-lab.com

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."

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

data-action-lab.com

Formal Reasoning Techniques

There are four general reasoning strategies:

1. deducing new facts from existing facts (deductive reasoning)

2. generalizing from examples (inductive reasoning)

3. reasoning to the best explanation (abductive reasoning)

4. 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.

There are other more specialized approaches such as scientific method, statistical reasoning and mathematical / computer modeling.

HOW WE REASON

Formal Reasoning Techniques

Deductive

- General Principle: All birds have feathers

- Premise: A robin is a bird

- Conclusion: A robin has feathers

This conclusion **must** be true if the premises are true

Plausible

- Premise 1: The grass is wet

- Premise 2: It often rains at night in this area

- Conclusion: It probably rained last night

The conclusion is **plausible**, but not guaranteed – maybe a sprinkler caused it

When we made decisions, do we typically use deductive or plausible reasoning?

HOW WE REASON

Formal Reasoning Techniques

For completeness here are more examples for each of the reasoning categories:

1. Deductive reasoning (applies general rules to reach a certain conclusion)
   Example: All mammals breathe air. A whale is a mammal. Therefore, a whale breathes air.

2. Inductive reasoning (draws general conclusions from specific observations)
   Example: Every swan I've seen is white. Therefore, all swans are probably white.

3. Abductive reasoning (chooses the most likely explanation from incomplete evidence).
   Example: The window is broken and there's a baseball on the floor. The most likely explanation is that the baseball broke the window.

4. Analogical reasoning (uses similarities between two situations to infer something about one of them).
   Example: The human brain is like a computer — since computers can store information, so can the brain.

EVIDENCE-INFORMED DECISION-MAKING

HOW WE REASON