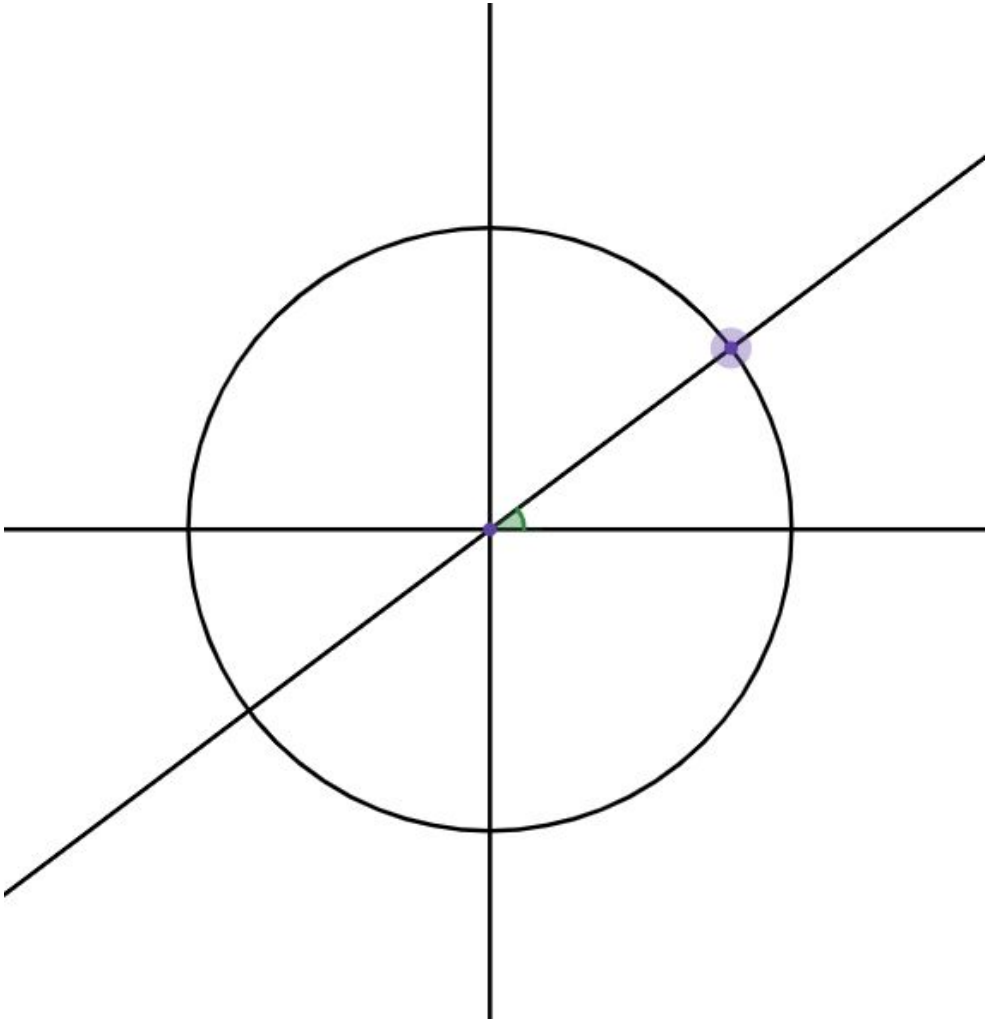
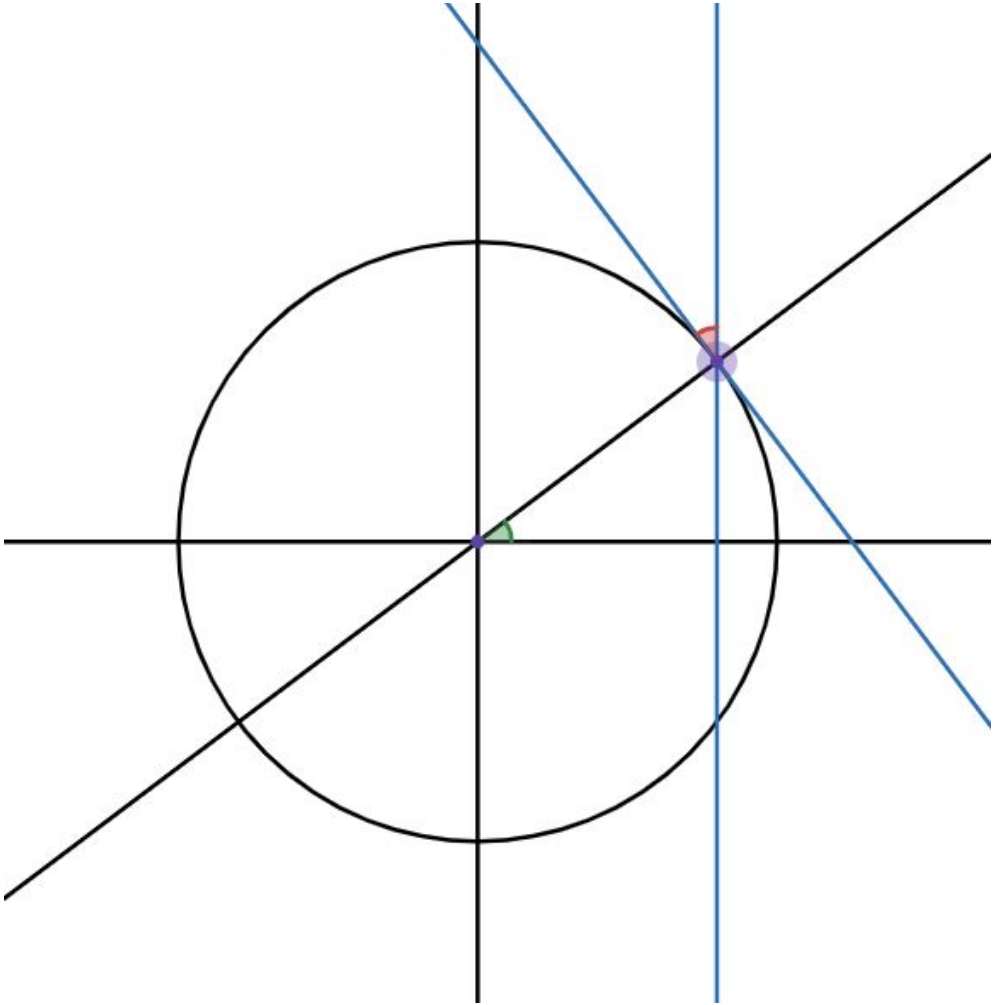
Abstraction & Idealization

2025 Embedded Ethics



Prove that if you point at the North Star with one hand, and at the Horizon with the other, the angle your arms make gives you your latitude on Earth.



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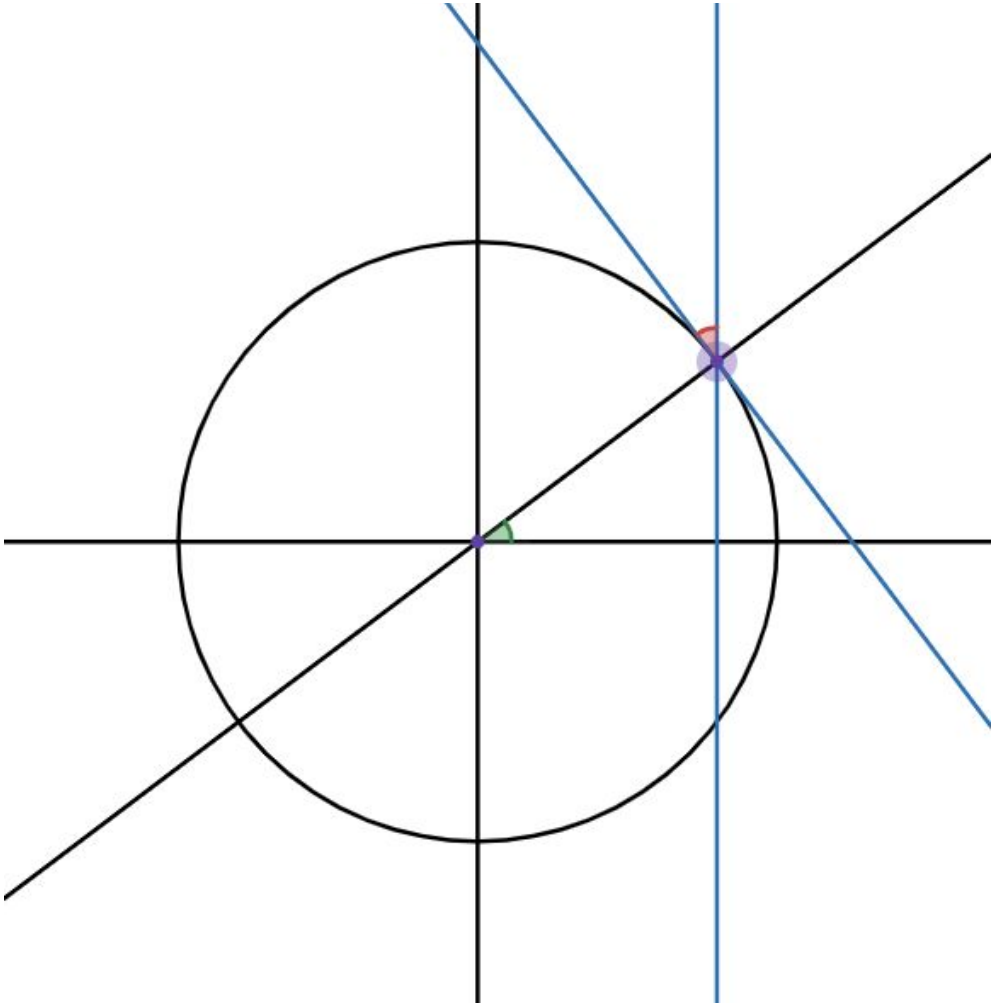

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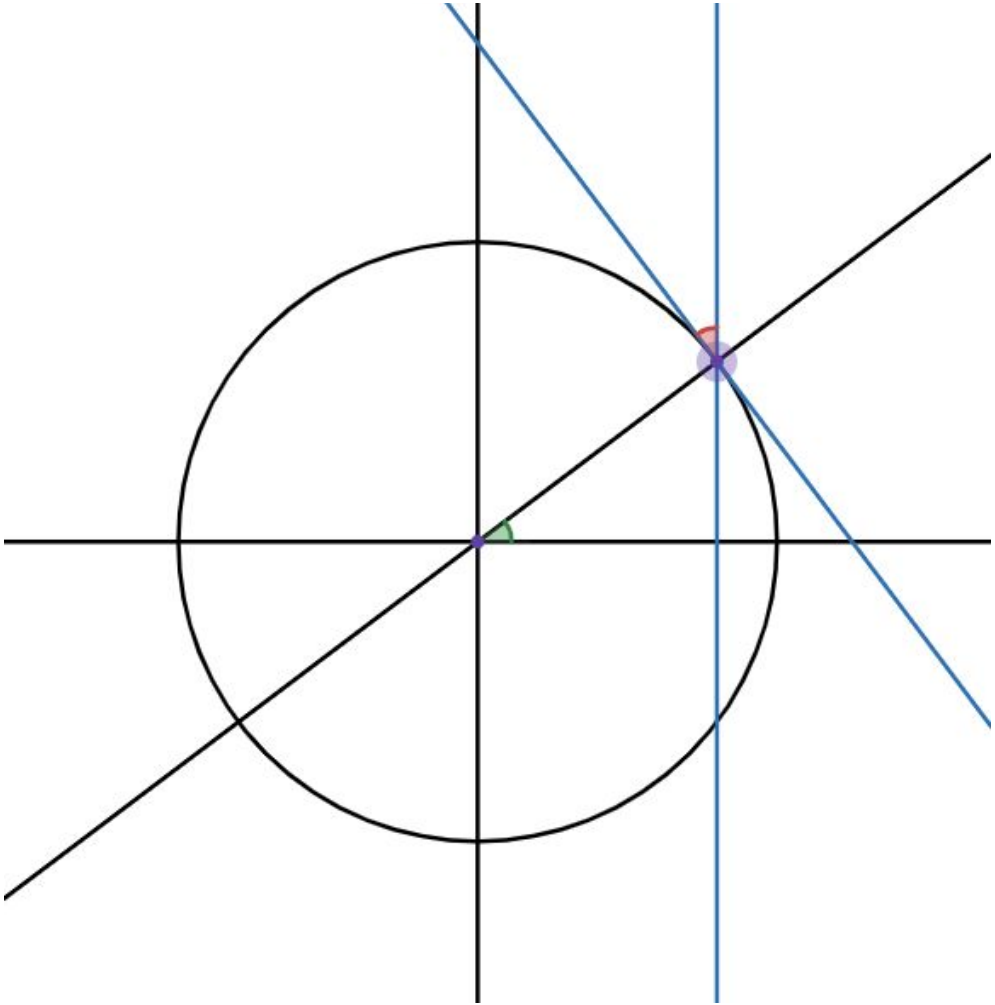

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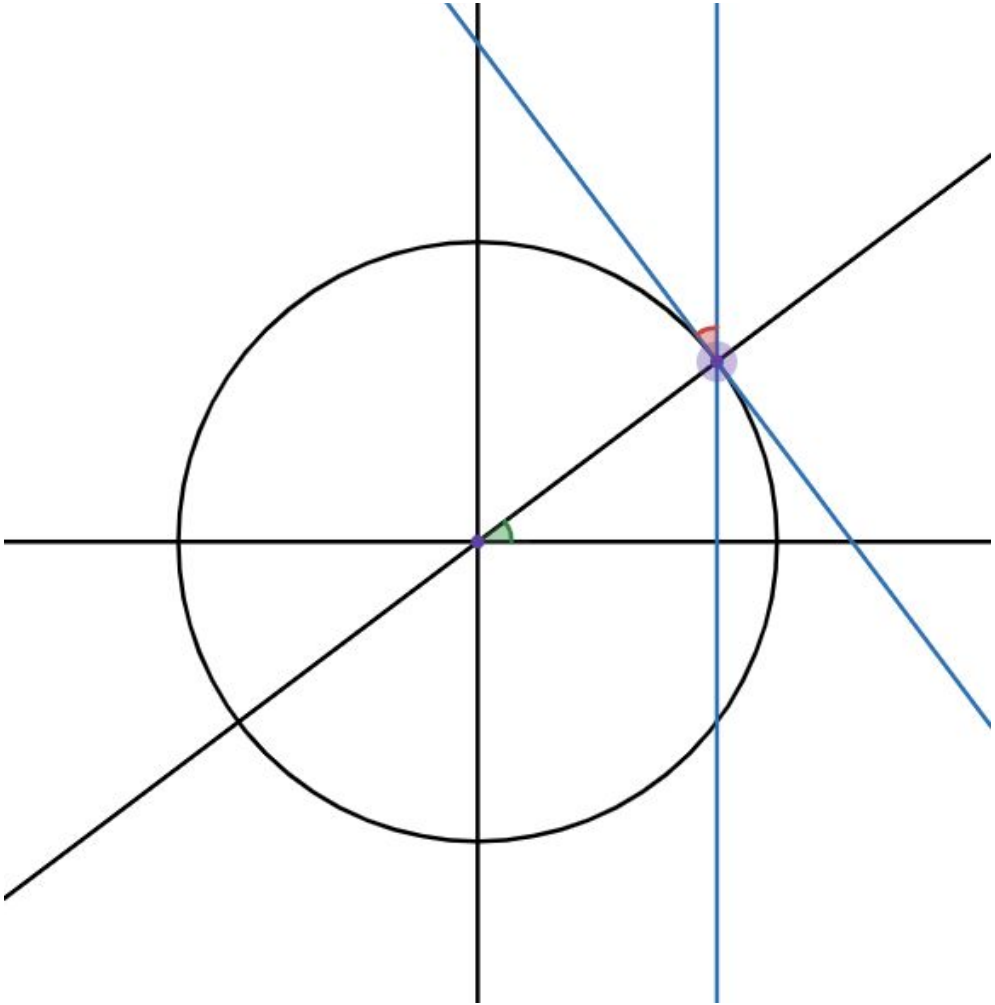

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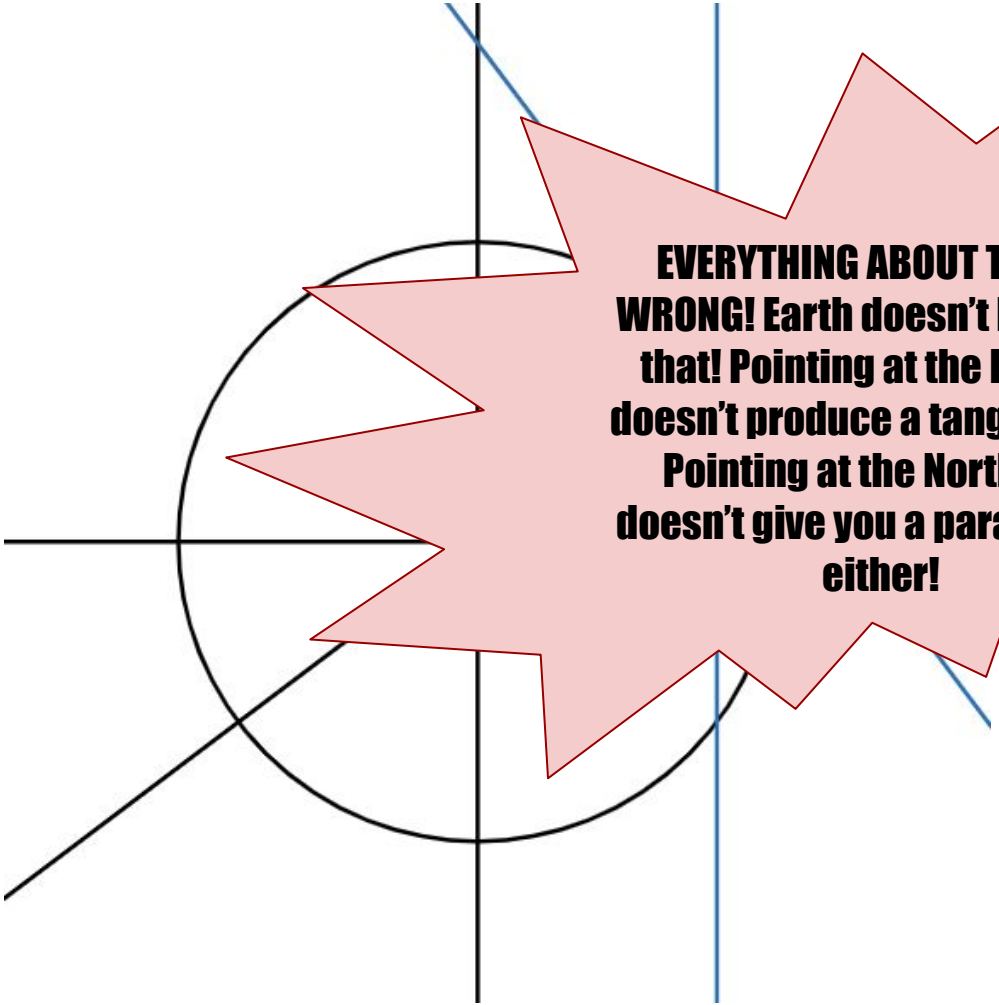

EVERYTHING ABOUT THIS IS WRONG! Earth doesn't look like that! Pointing at the Horizon doesn't produce a tangent line! Pointing at the North Star doesn't give you a parallel line either!

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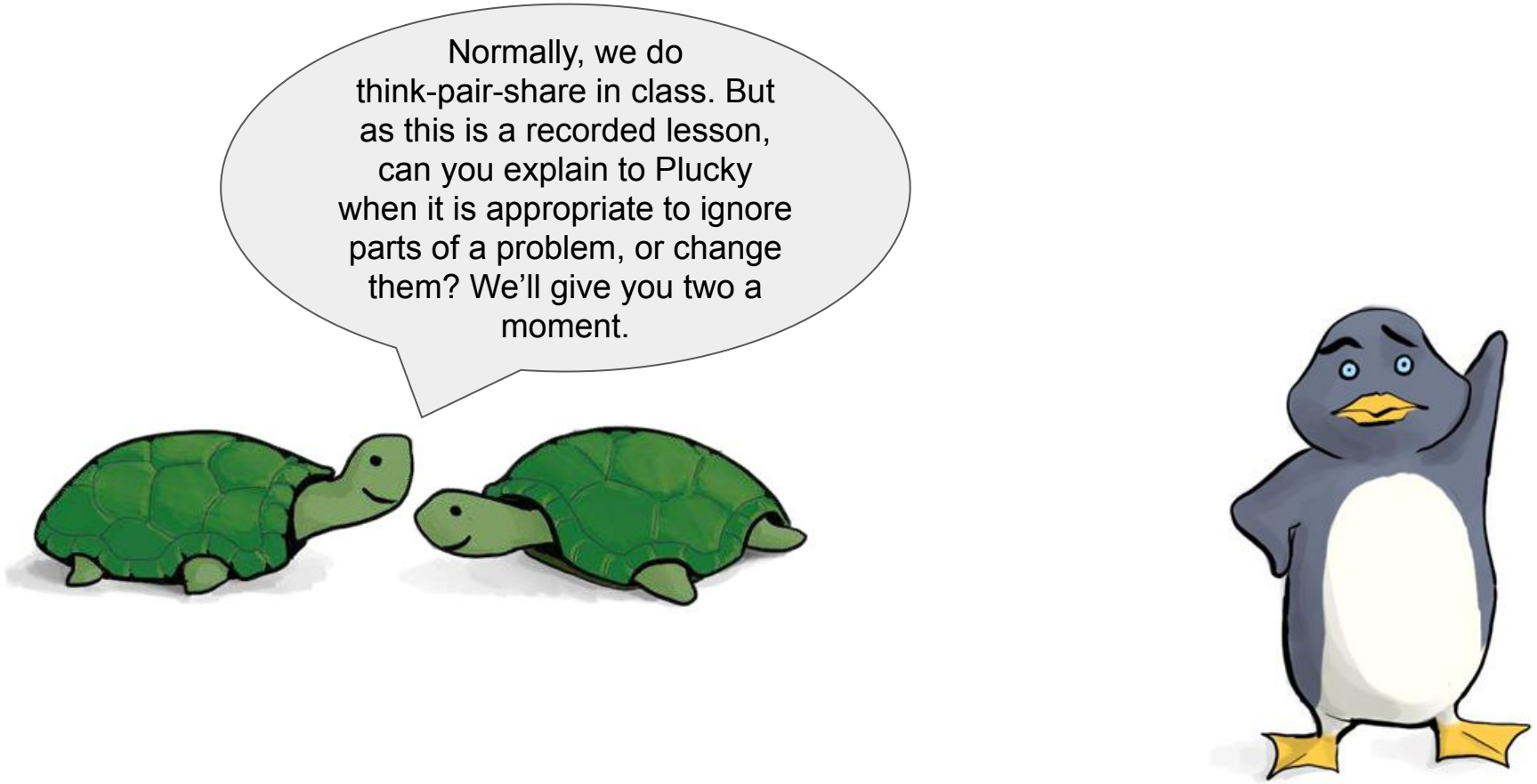
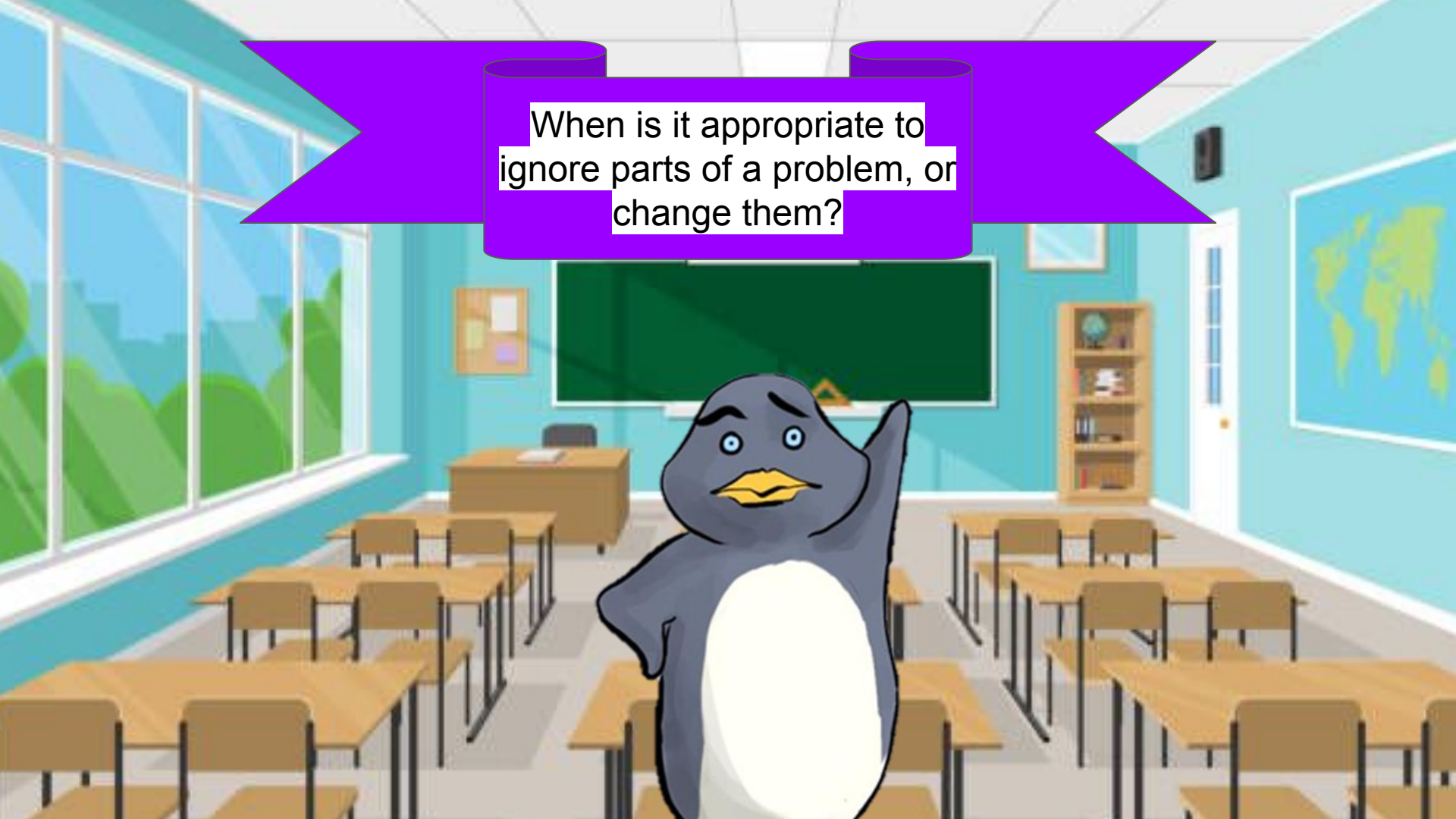

Normally, we do think-pair-share in class. But as this is a recorded lesson, can you explain to Plucky when it is appropriate to ignore parts of a problem, or change them? We'll give you two a moment.


When is it appropriate to ignore parts of a problem, or change them?

- **Abstraction** is when we omit details of the real-world situation.
- **Idealization** is when we deliberately change aspects of the real-world situation.

OK, I see how abstraction and idealization might be helpful, and sometimes necessary, but it seems dangerous! What if we abstract or idealize away something important?

Measurements vs. The World

Often the value that is feasible to measure is an imperfect proxy for the thing we would actually like to measure

Examples?

GDP (Gross Domestic Product)

- The GDP is the total value of all goods and services produced within a country
- GDP is “easy” (challenging but tractable) to measure
- What should be included that is left out? Is there anything included that should be left out?

GDP as a Measure of Economic Health

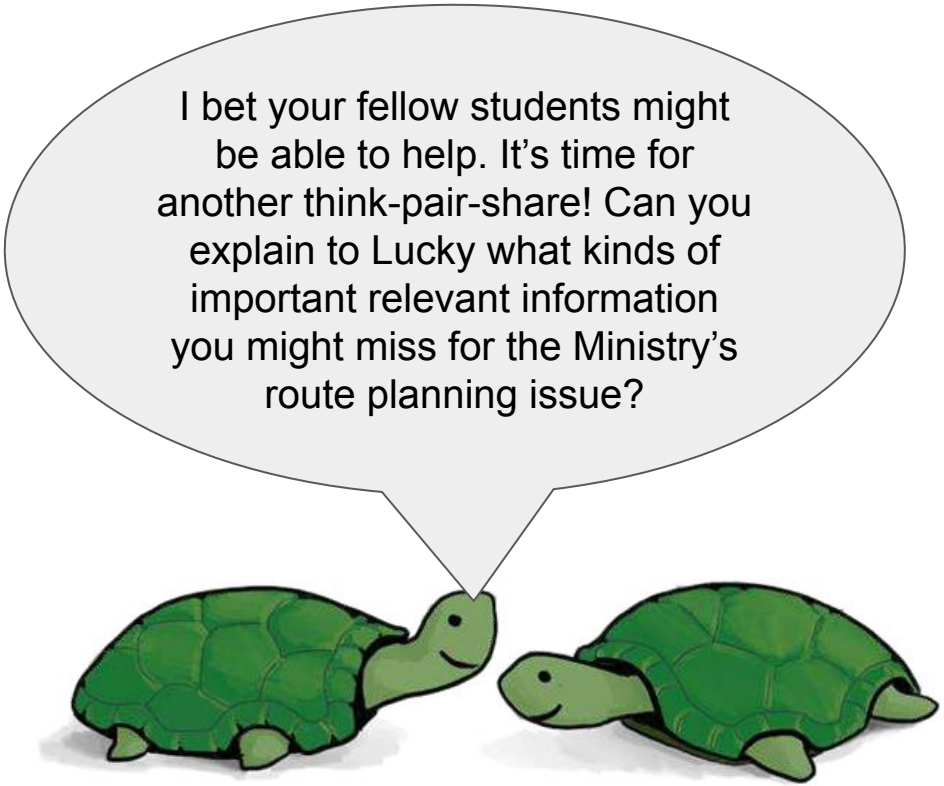
As a measurement, it has three kinds of problems:

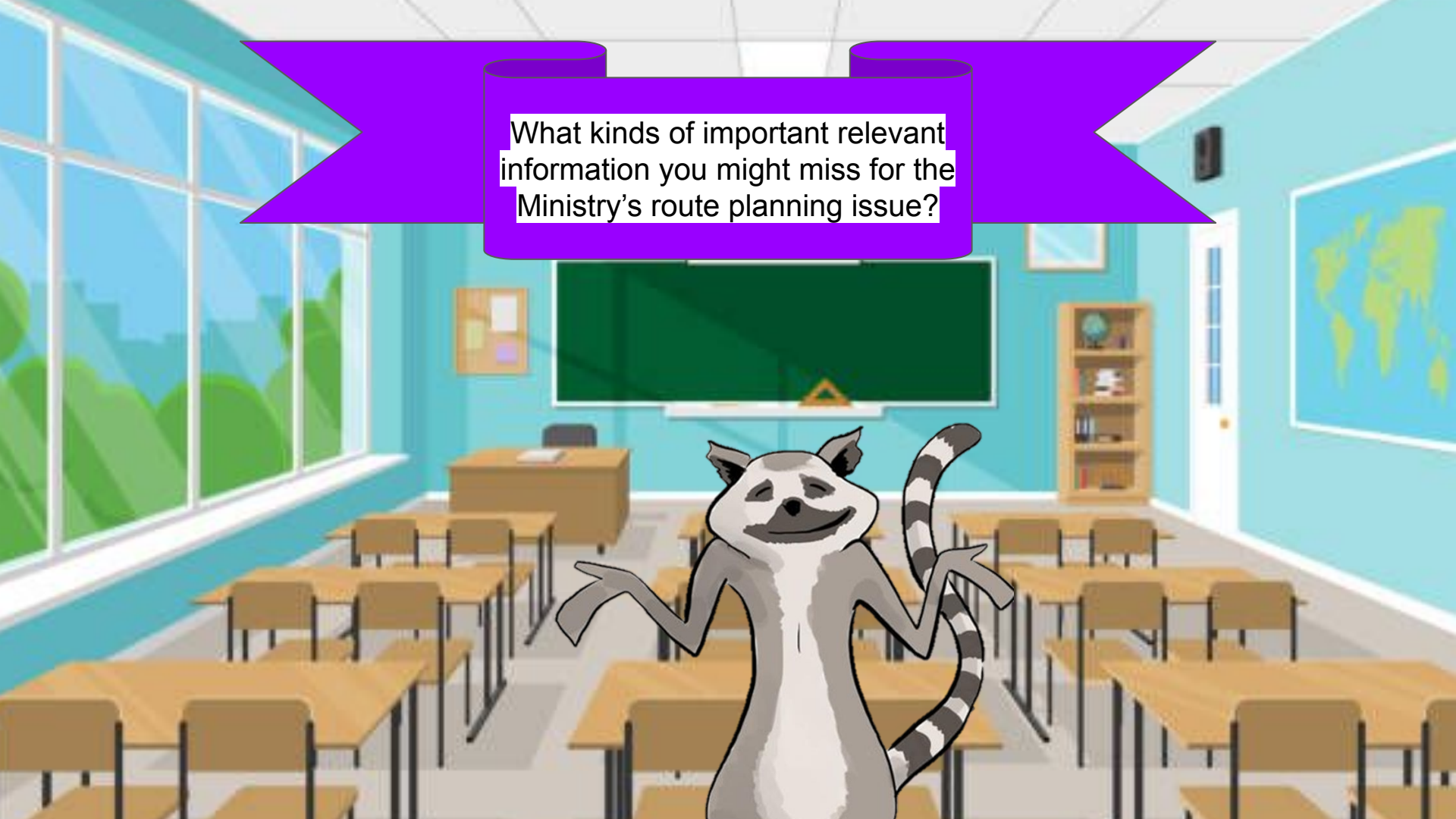
- Abstraction?
- Idealization?
- Imperfect proxy for the thing we really wanted to measure, which might have other values not capturedd

Route Planning Measurement Case Study

- Bogotá's Ministry of Transport wanted to measure average speeds on a road in order to do better route planning
- They set up two Bluetooth sensors spaced apart on a roadway. By picking up cell phone identifiers, Bluetooth sensors can determine the average speed of the vehicle containing that cell phone.

What’s the harm? You already told us that sometimes a little hand waving is necessary. Even good! This bluetooth thing sounds good enough.

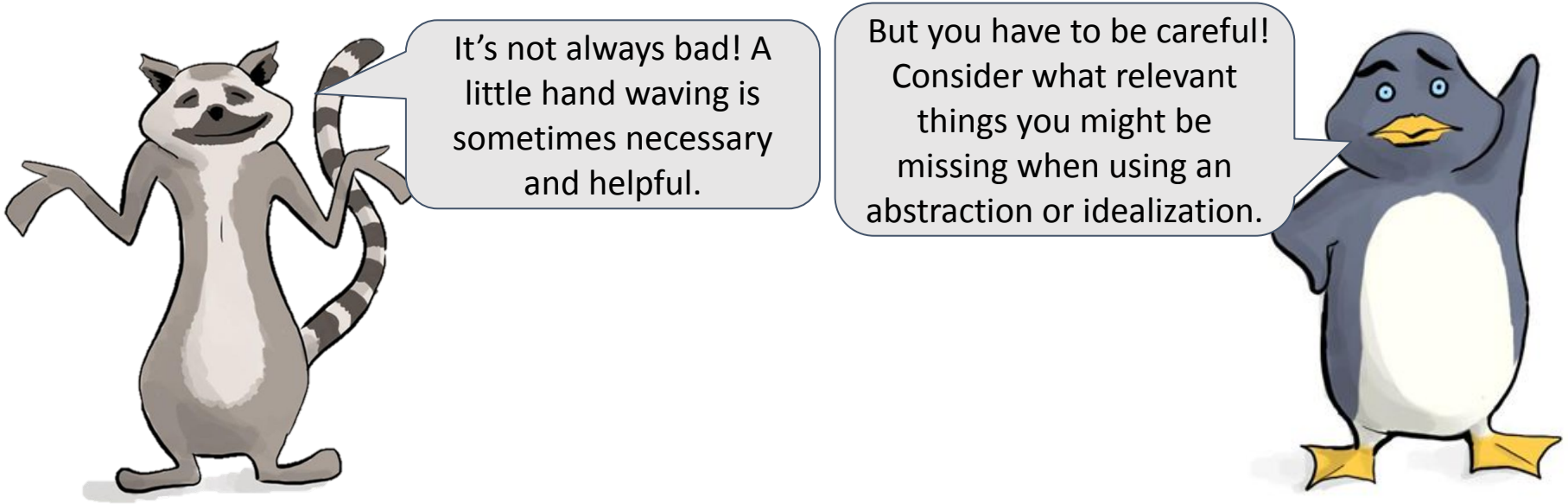

I bet your fellow students might be able to help. It’s time for another think-pair-share! Can you explain to Lucky what kinds of important relevant information you might miss for the Ministry’s route planning issue?


What kinds of important relevant information you might miss for the Ministry’s route planning issue?

Route Planning Measurement Case Study

- Low-tech transport?
- Types of vehicles?
- Capacity? Multiple devices?

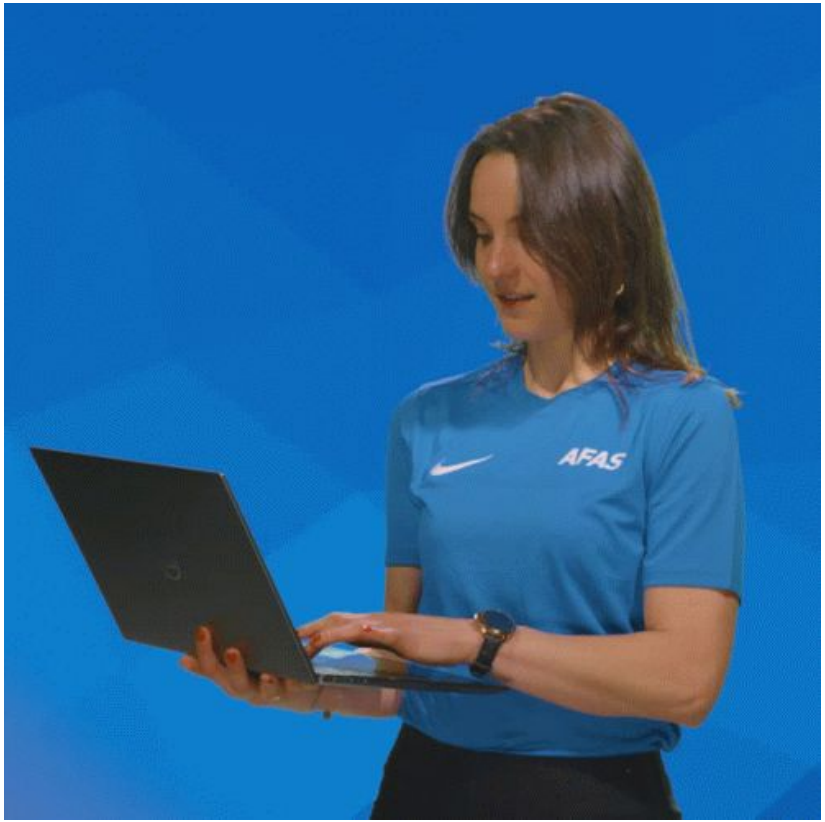
Abstraction and Idealization can happen in the process of formalizing a problem. A common problem spot is deciding how to measure features of a problem.



Who is included and excluded in problem formalization?

- Idealization can both include things we should exclude, and exclude things we should include
- Problematic simplification can appear even before we attempt to formulate a solution, it can appear in the data we use to detect problems in the first place

Inclusion from Data



Risks of Inclusion:

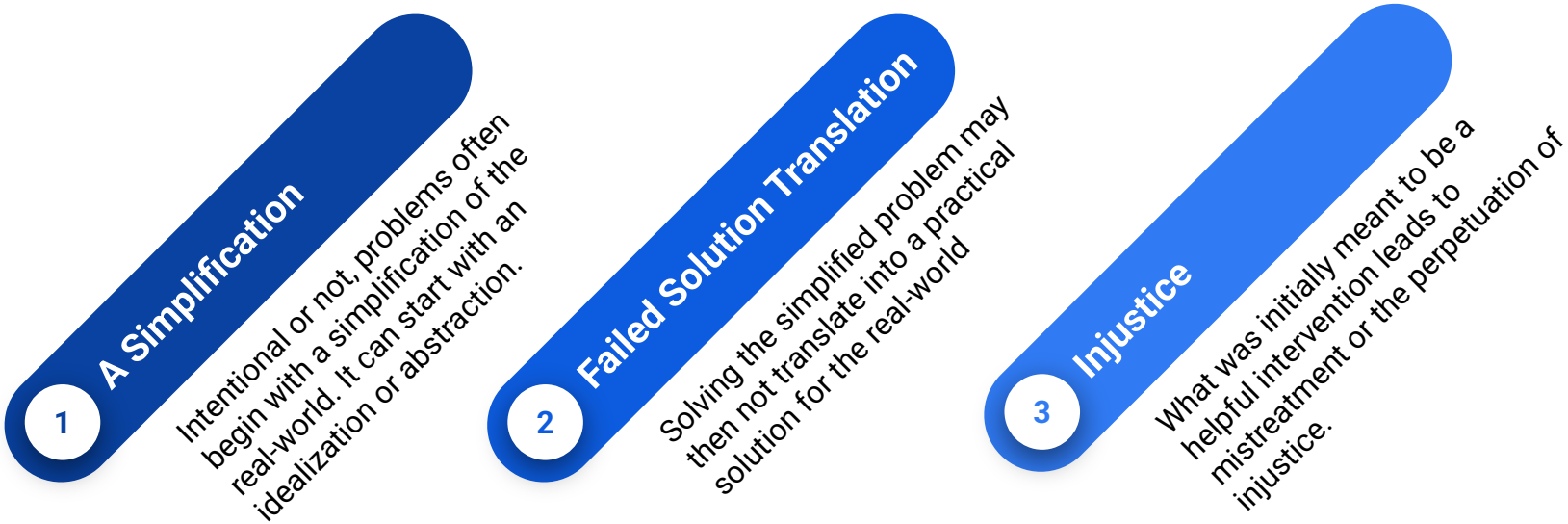
- Violation of privacy
- Data scraped without consent
- Risks to Fourth Amendment rights (self-incrimination)
- Risks to other civil liberties
- Misinterpretation of data

Exclusion from Data

Risks of Exclusion:

- Data does not describe you
- Your needs not measured/accounted for
- Voice less heard in politics
- Excluded from marketplaces/commerce
- State might take action to make you more “legible”

Case Study: Sex Categorization and Airport Security Scanners


1
A Simplification
Intentional or not, problems often begin with a simplification of the real-world. It can start with an idealization or abstraction.
2
Failed Solution Translation
Solving the simplified problem may then not translate into a practical solution for the real-world
3
Injustice
What was initially meant to be a helpful intervention leads to mistreatment or the perpetuation of injustice.