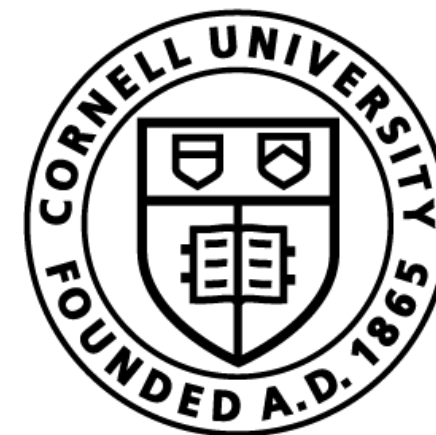


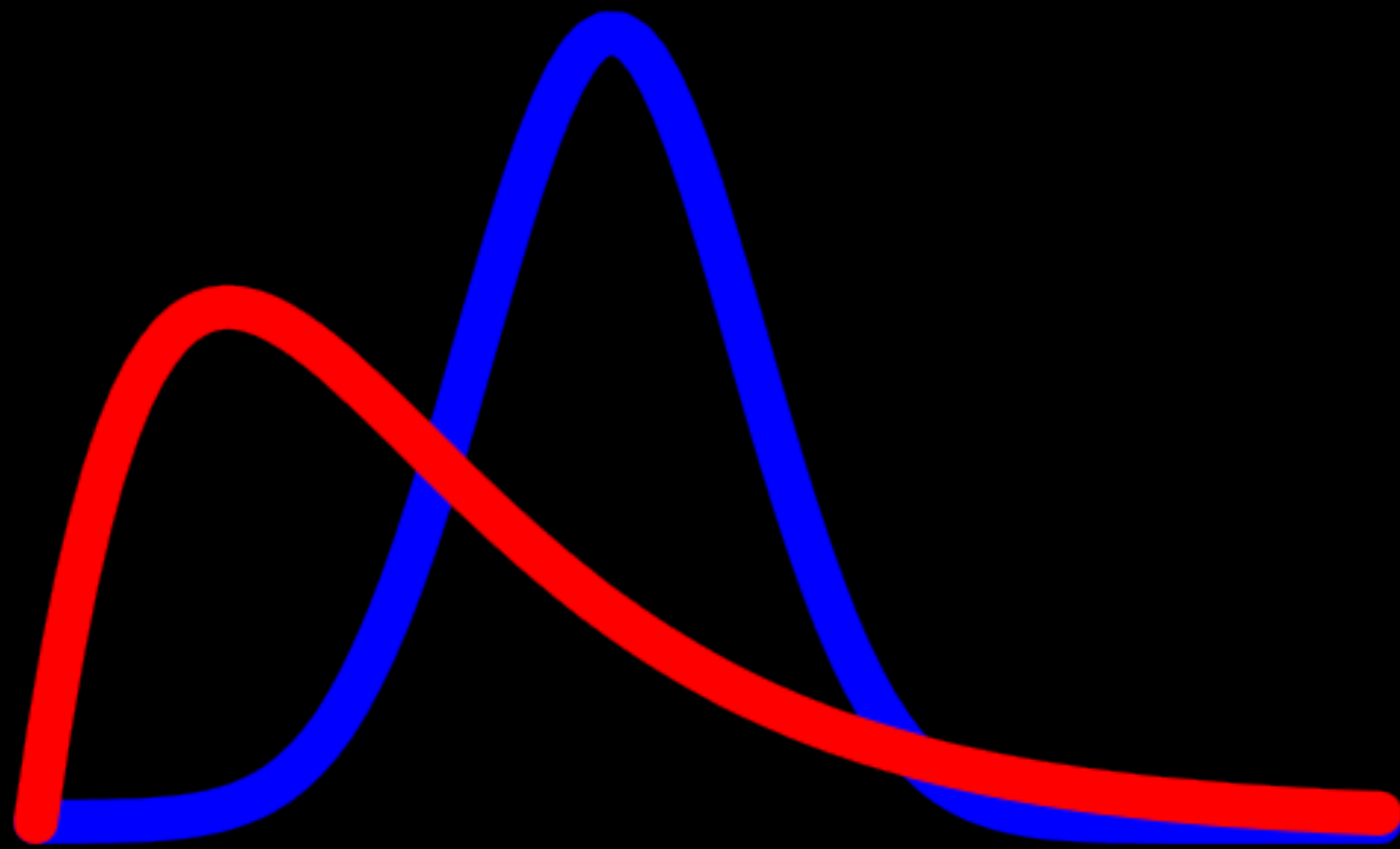
The Tale of Monty Hall & The Procrustes Problem

Sanjiban Choudhury

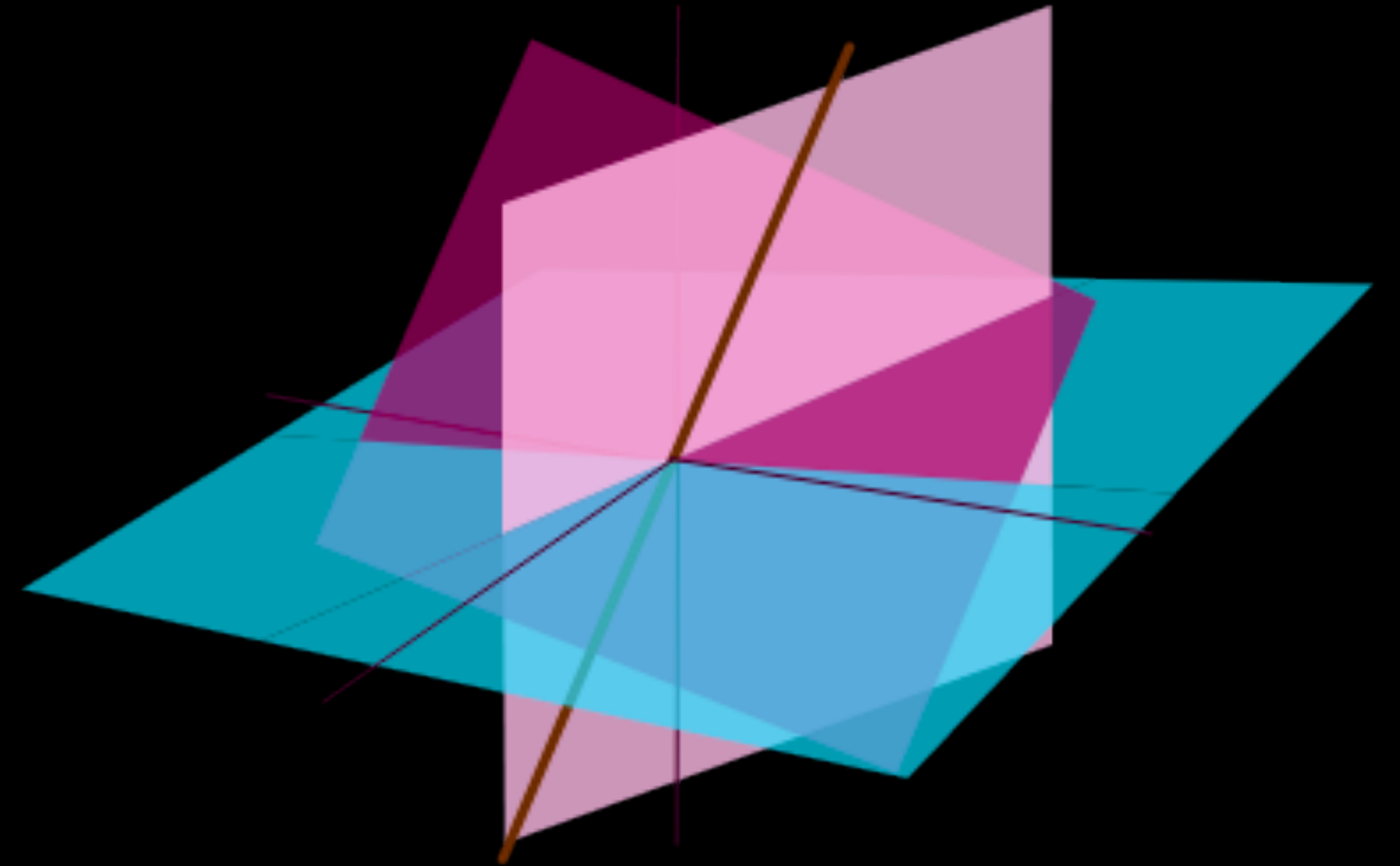


Cornell Bowers CIS
Computer Science

Foundations



Probabilistic Inference



Linear Algebra

Tale 1

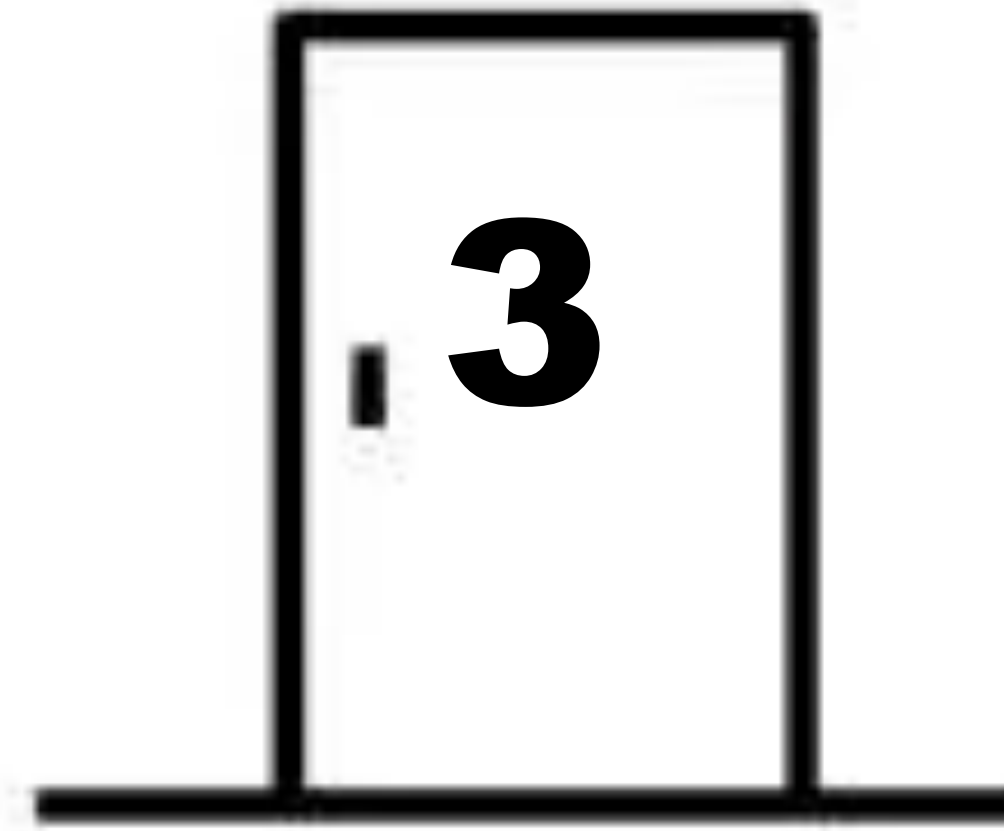
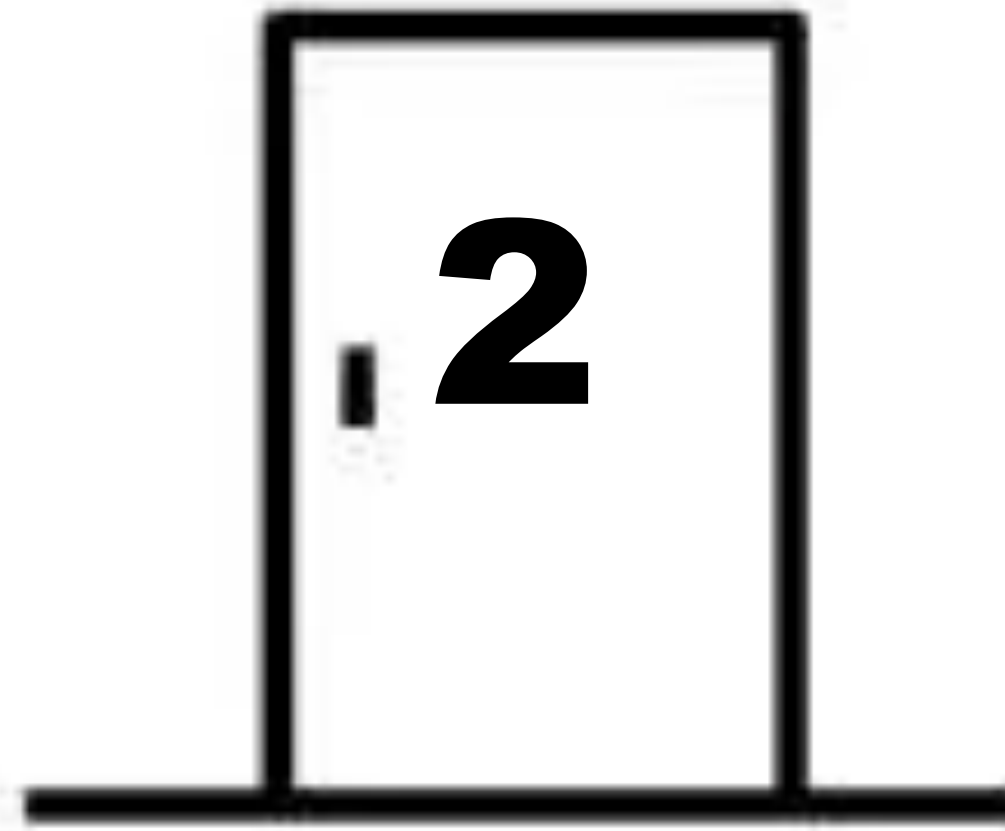
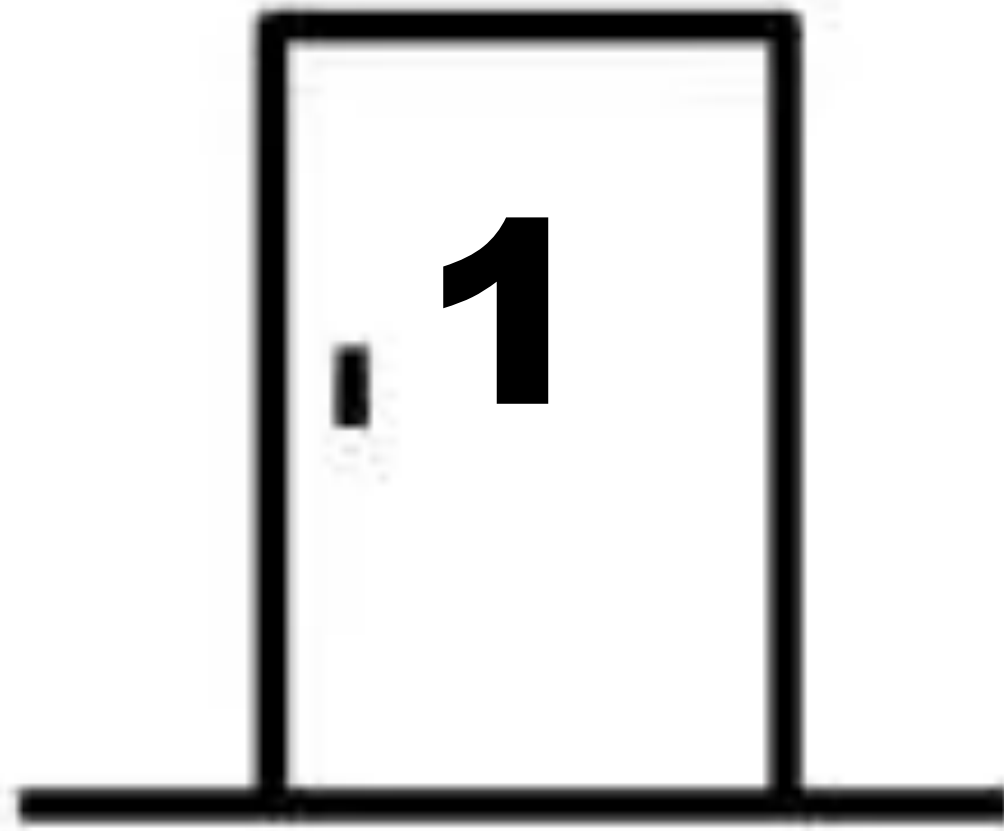


The Monty Hall Problem

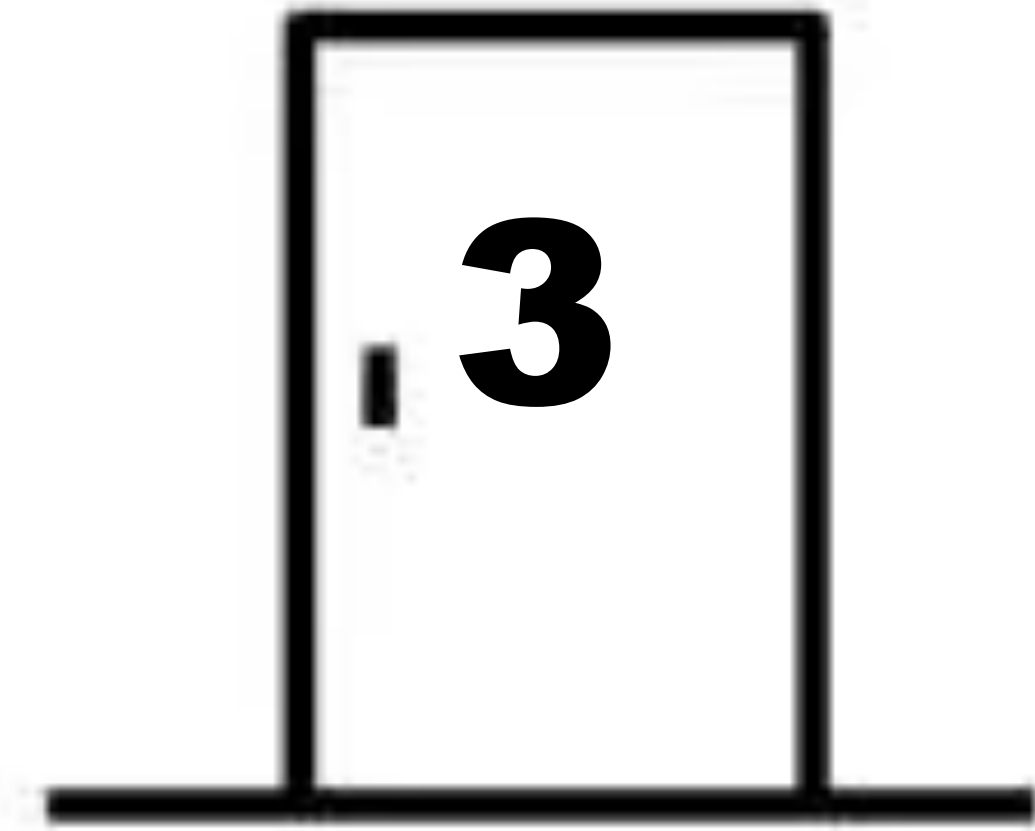
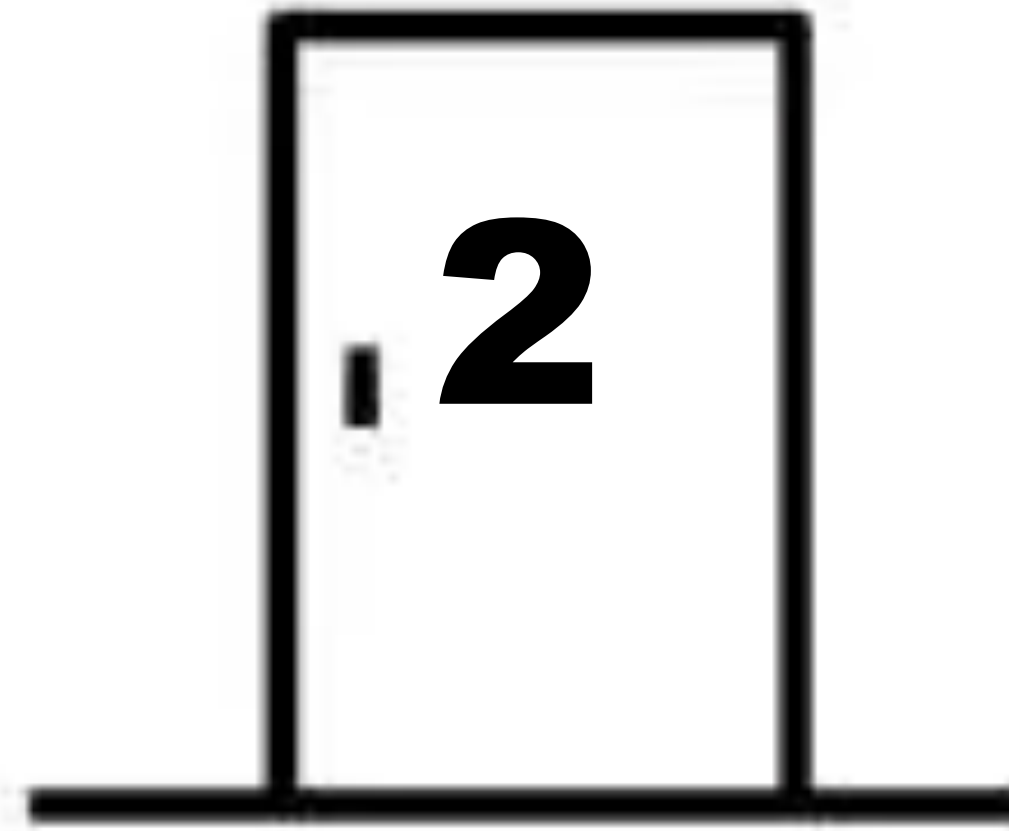
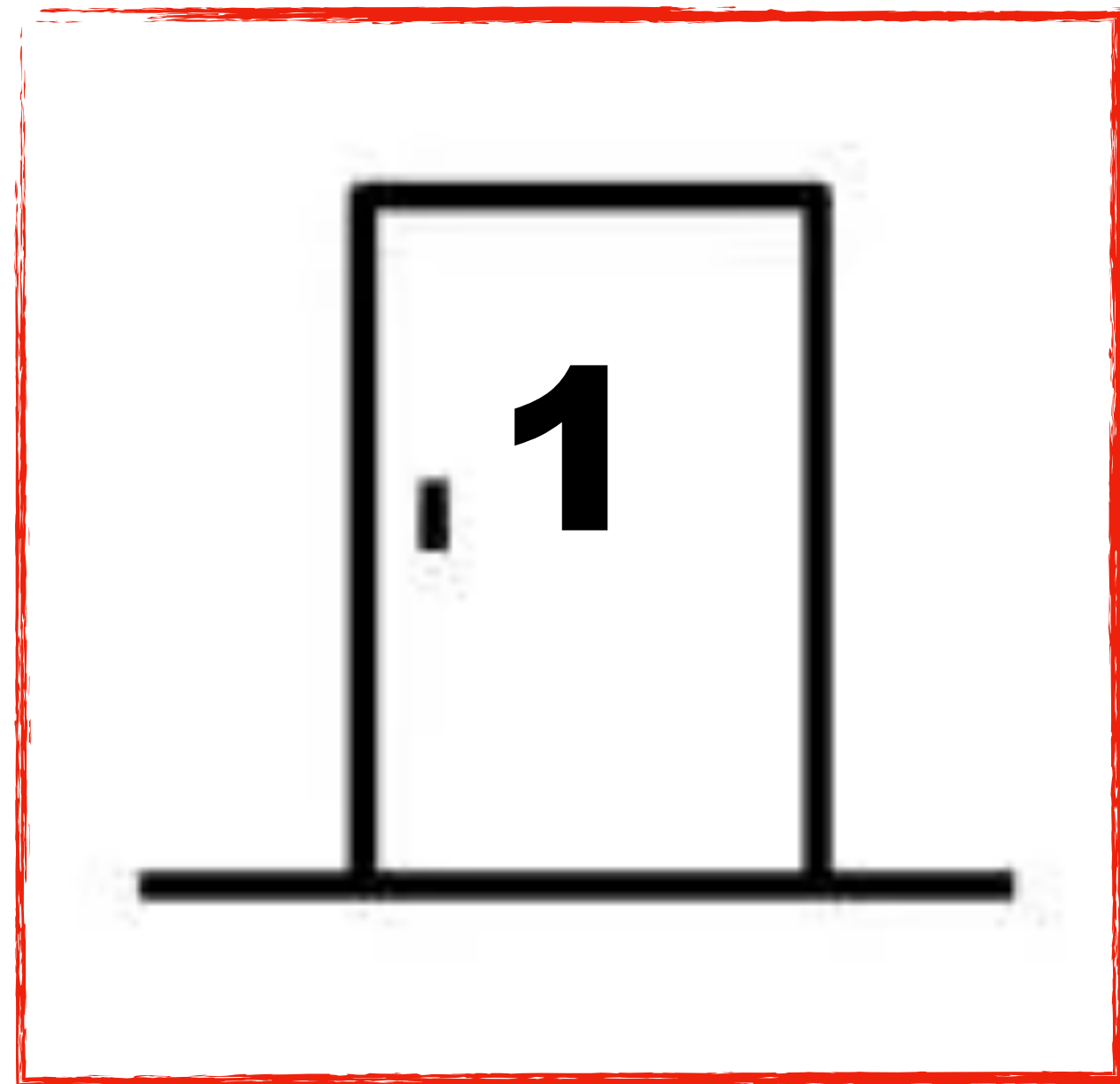




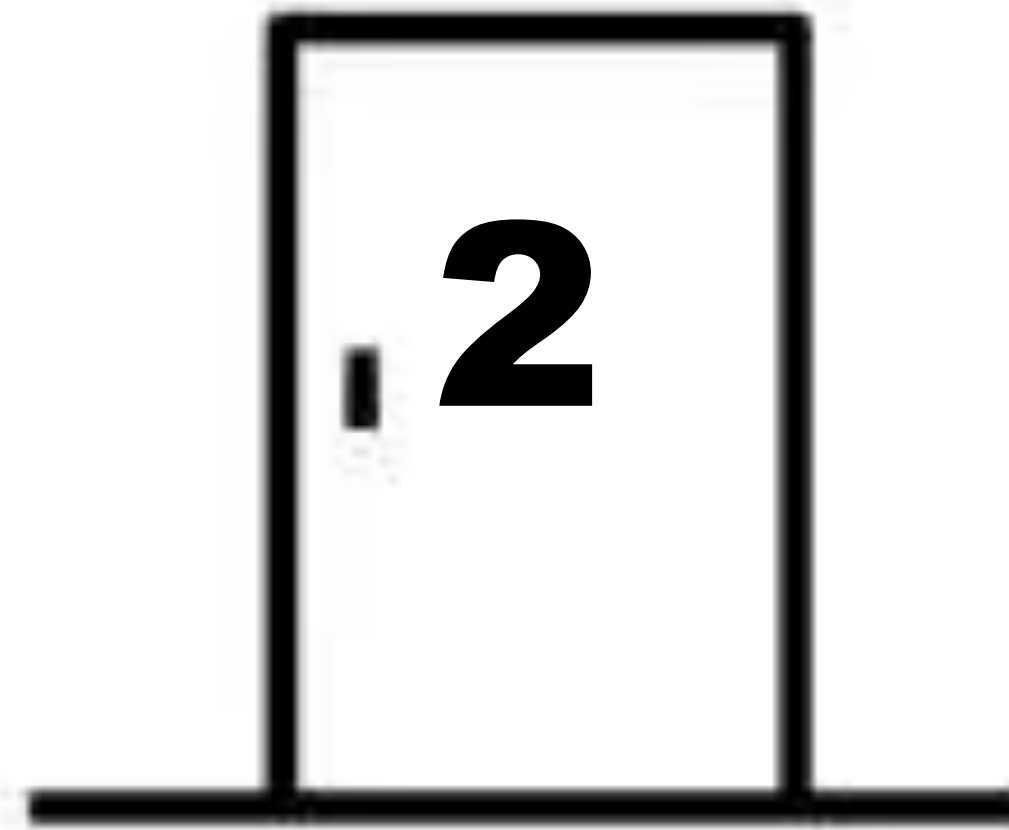
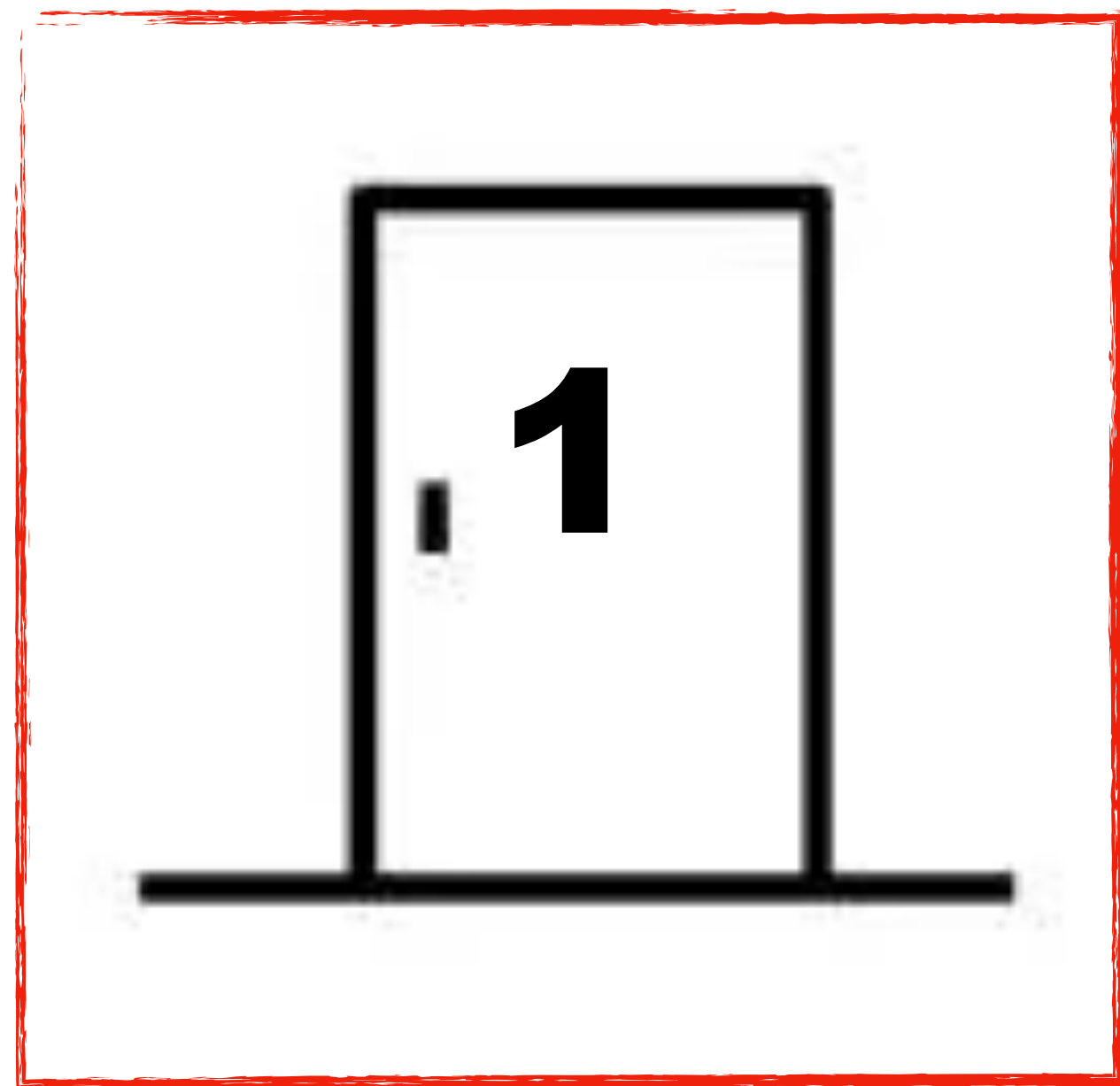
The Monty Hall Problem



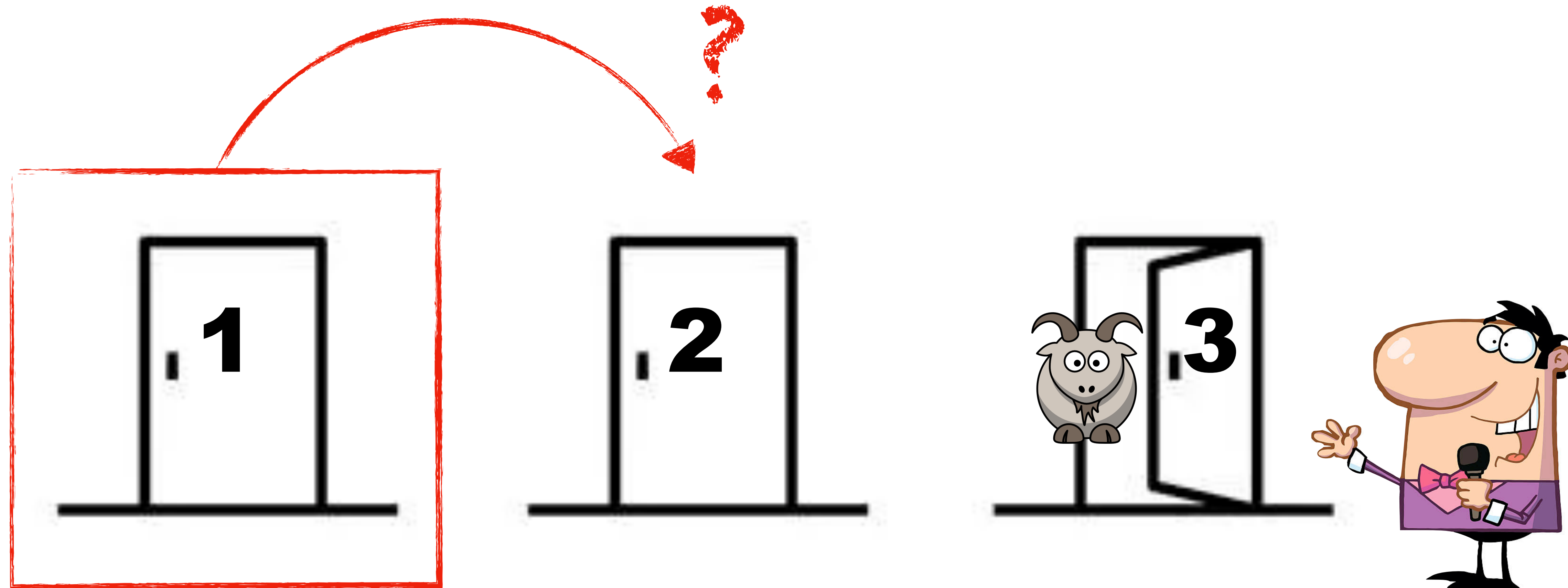
The Monty Hall Problem



The Monty Hall Problem



The Monty Hall Problem



Activity!

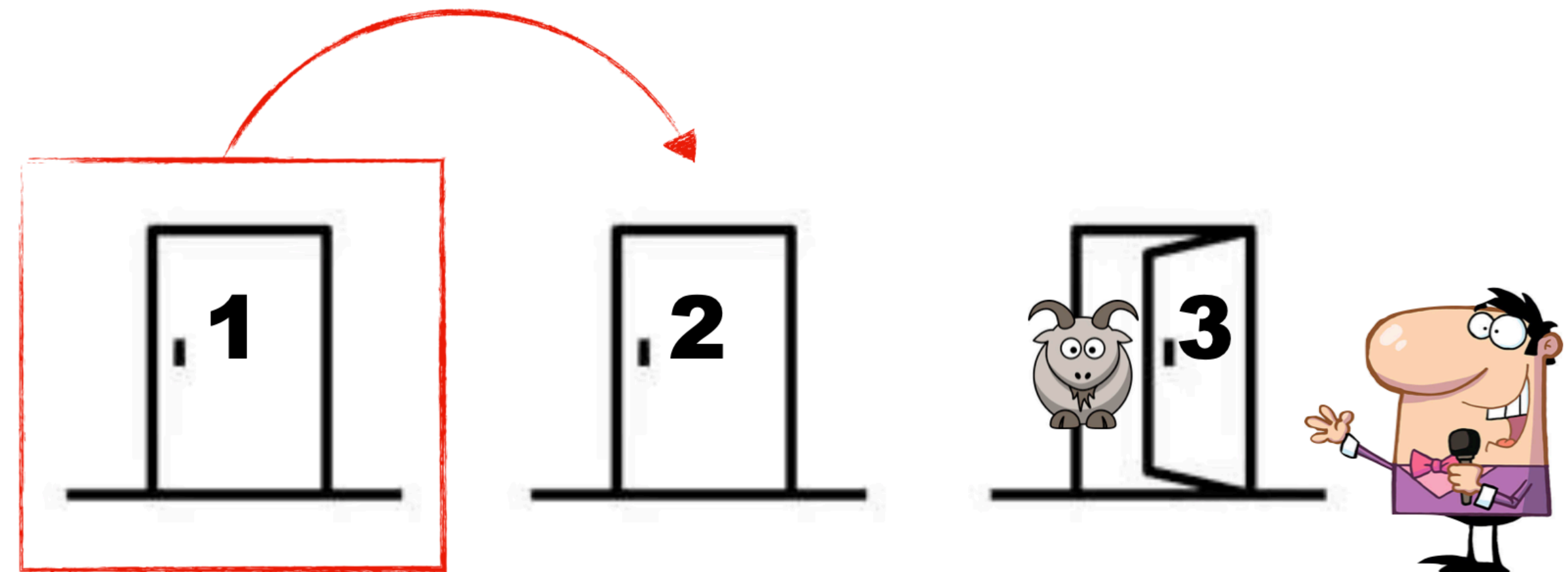


Think-Pair-Share

Think (30 sec): Will you stick with door 1? Or switch to door 2?
Justify your decision!

Pair: Find a partner

Share (45 sec): Partners exchange ideas



How is any of this related
to robotics?





Robots are
fundamentally
uncertain

Uncertainty in perception



Localizing object states as an inference problem



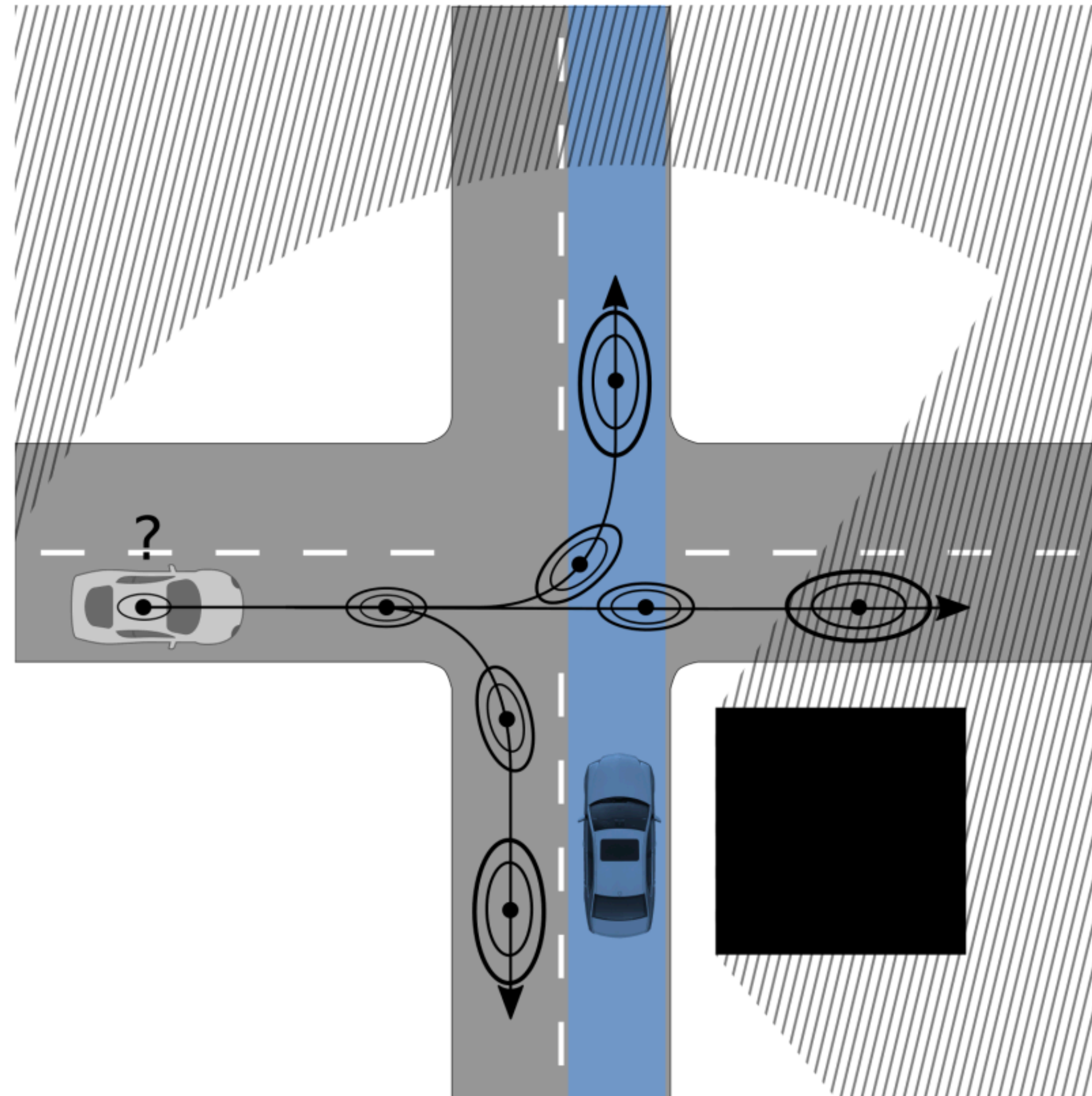
The Blindfolded Robot: A Bayesian Approach to Planning with Contact Feedback

An overview of experiments

Brad Saund, Sanjiban Choudhury, Siddhartha Srinivasa, Dmitry Berenson



Uncertainty in decision making



What did the robot do wrong?



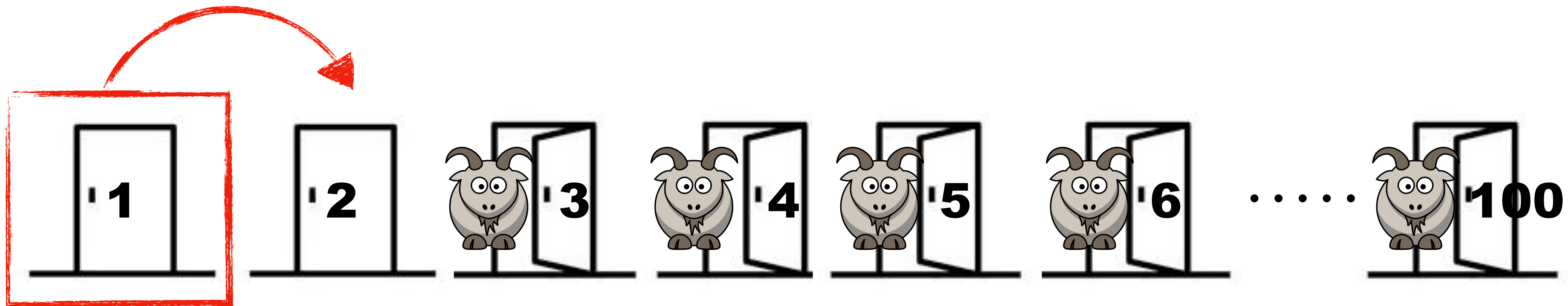
What did the robot do wrong?



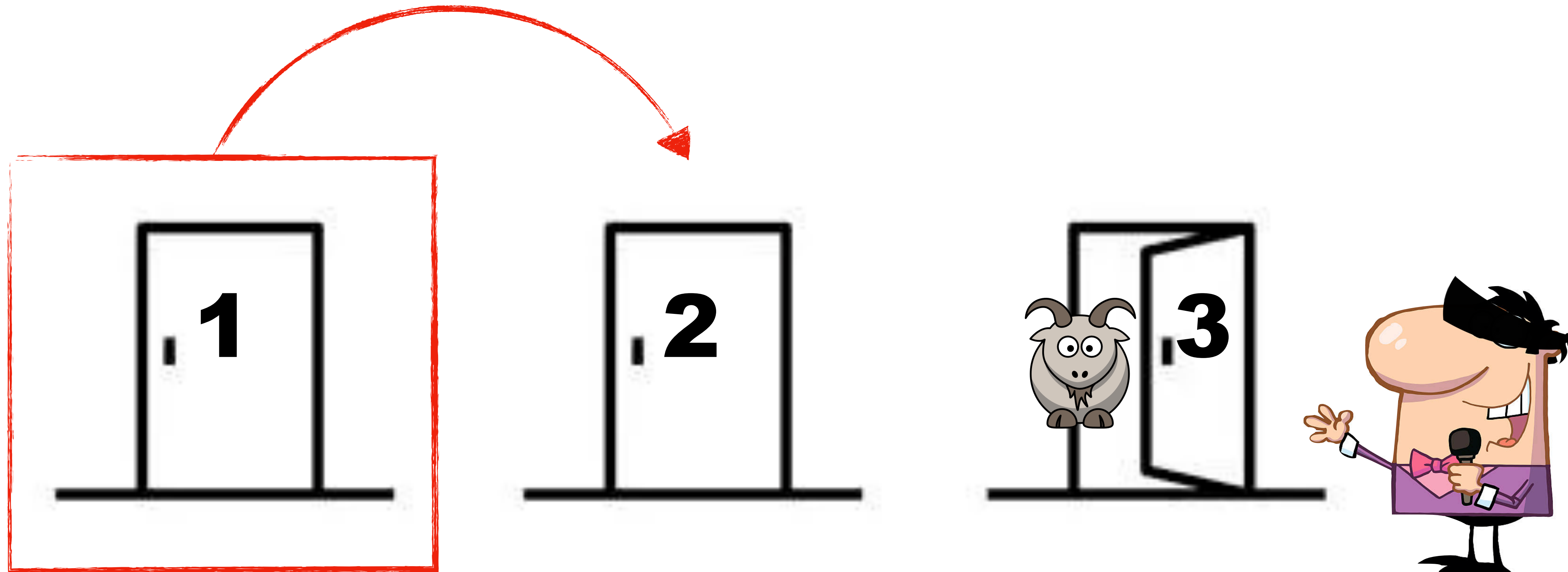
Back to the
problem



What if there are a 100 doors?



What if Monty is blindfolded?



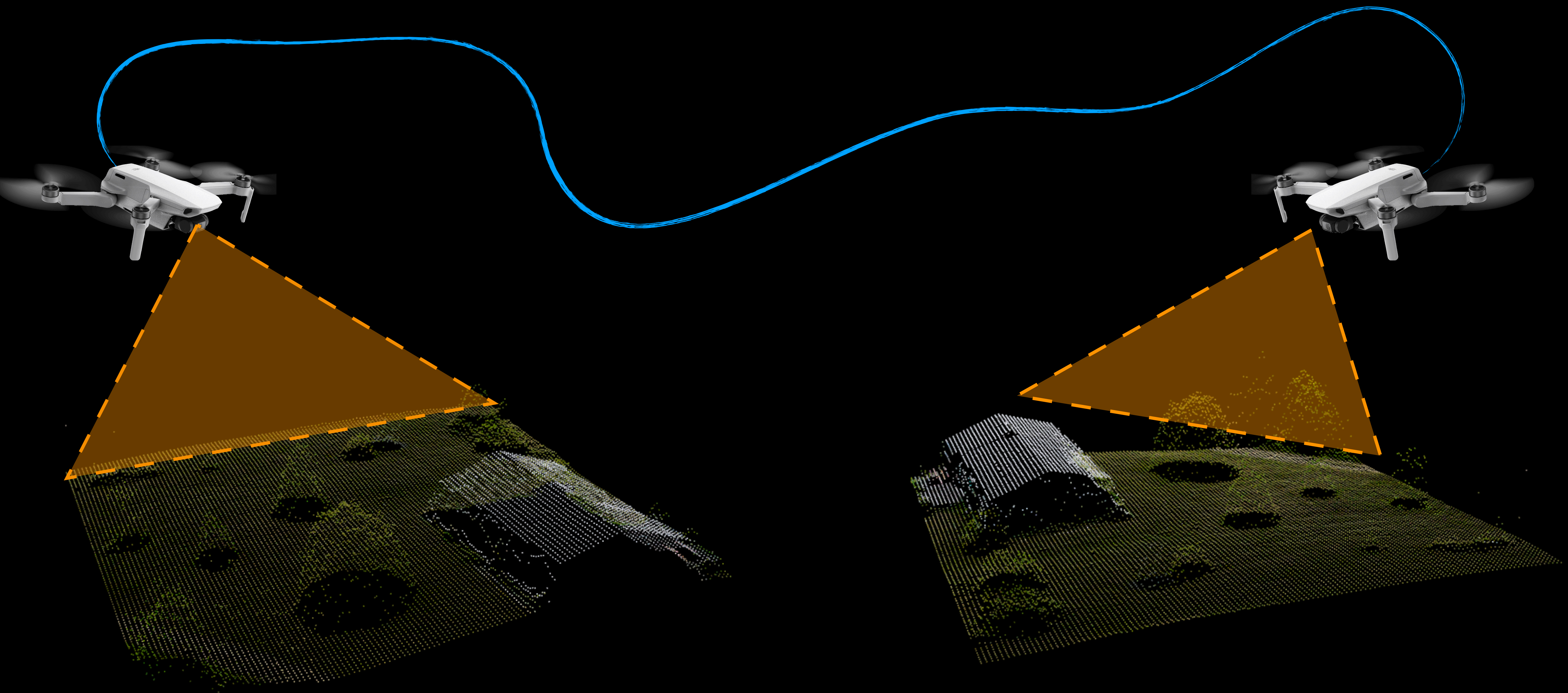
Tale 2



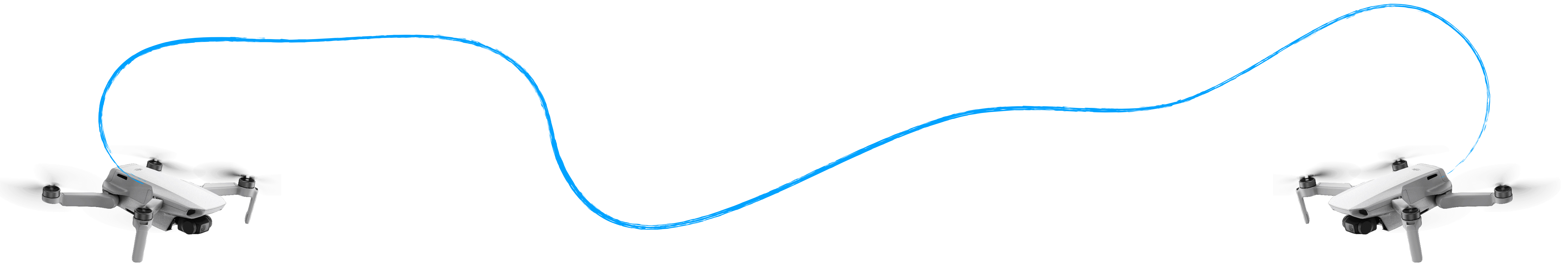
Procrustes Problem



Rotation? Translation?



Rotation? ~~Translation?~~



x_1, y_1

x_2, y_2

x_4, y_4

x_3, y_3

x'_1, y'_1

x'_4, y'_4

x'_2, y'_2

x'_3, y'_3

Activity!

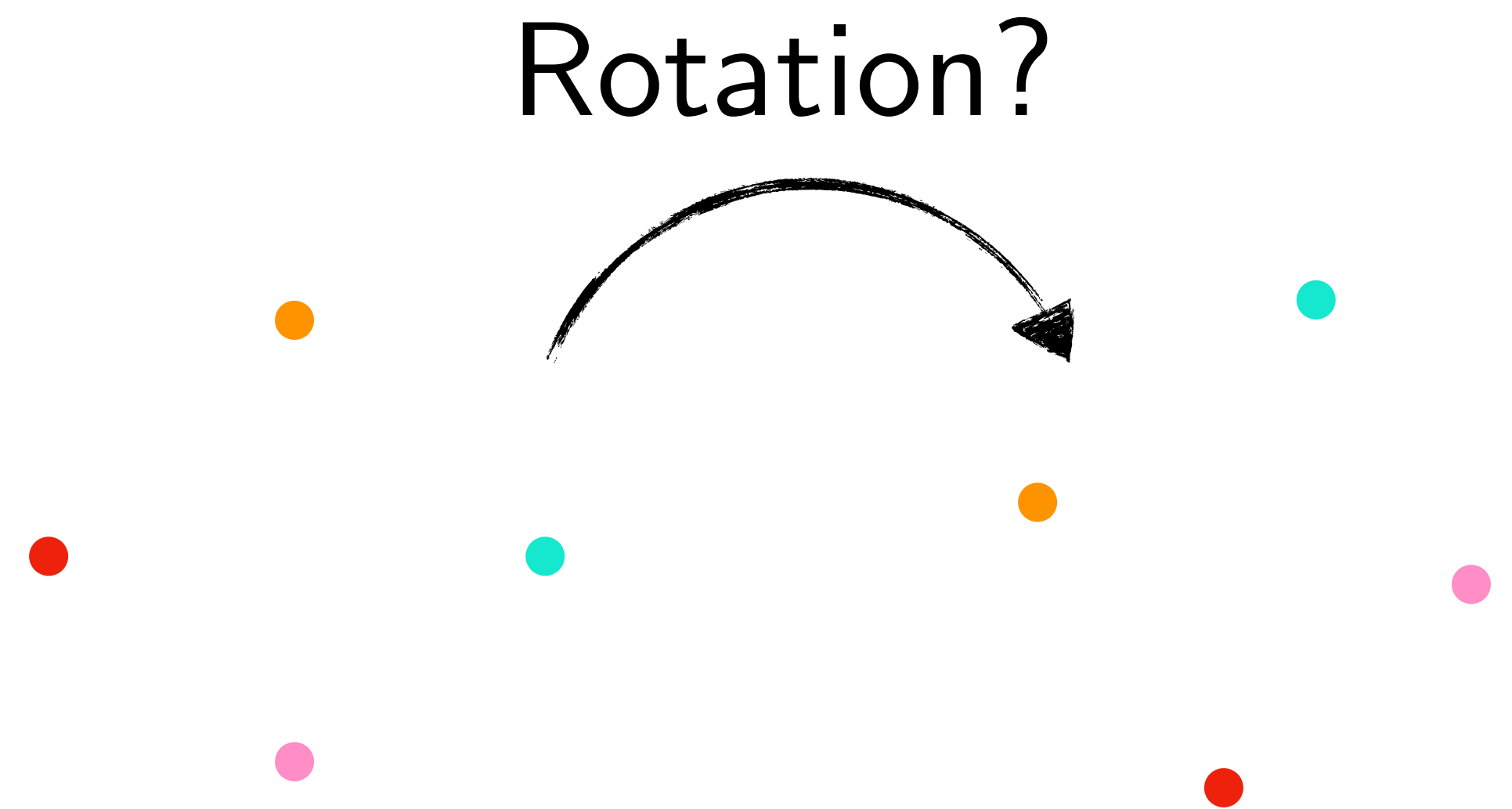


Think-Pair-Share

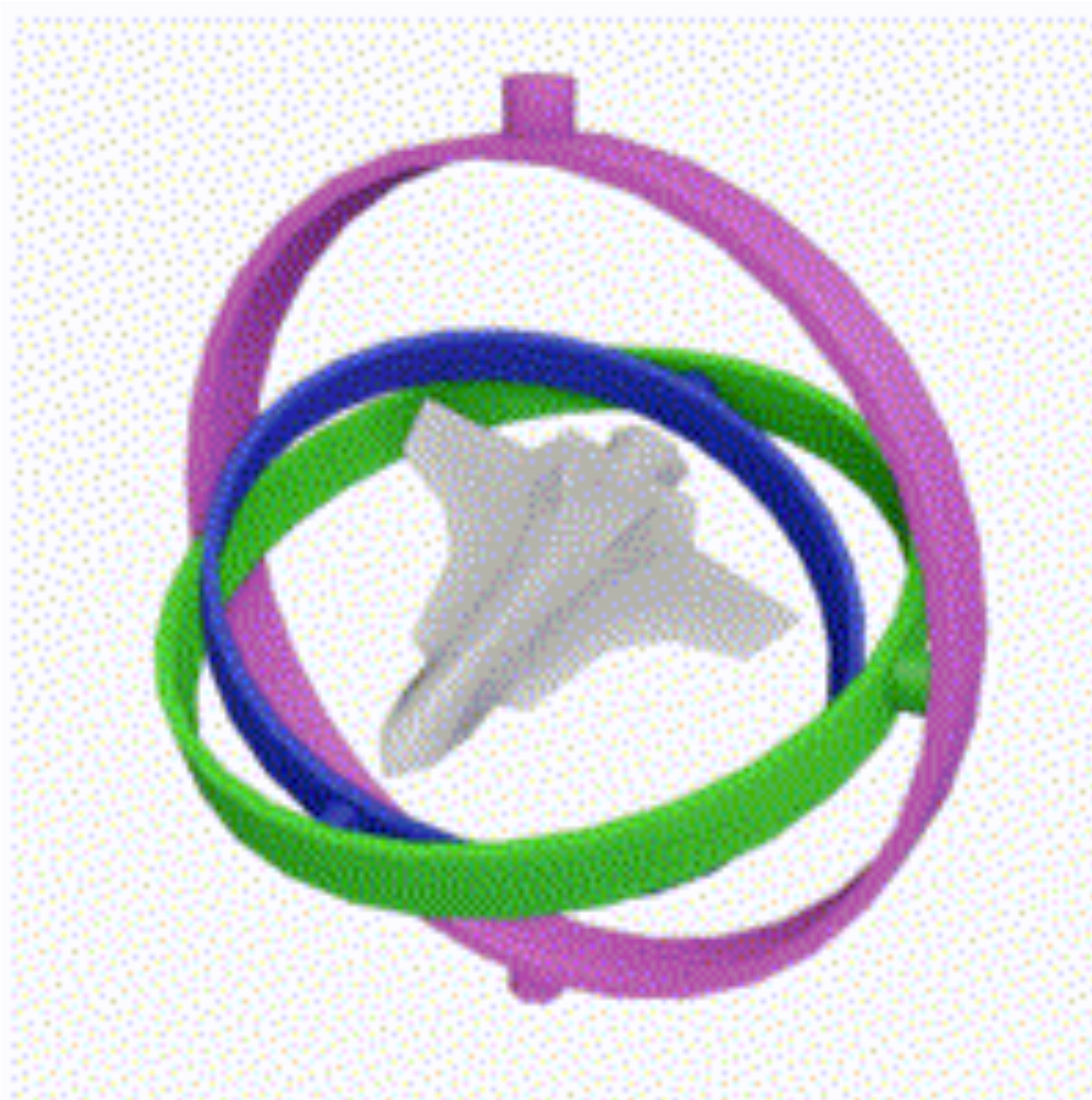
Think (30 sec): How can we solve for the unknown rotation?

Pair: Find a partner

Share (45 sec): Partners exchange ideas



Gimbal Lock!



Gimbal locked airplane.
When the pitch (green) and yaw (magenta) gimbals become aligned, changes to roll (blue) and yaw apply the same rotation to the airplane.

A real problem in Apollo 13!

How is any of this related
to robotics?





Robots
fundamentally
reason about 3D
relationships

3D Surface Reconstruction



Planning + Controls

Optimization with over **50 objectives** at **500 iterations/sec**



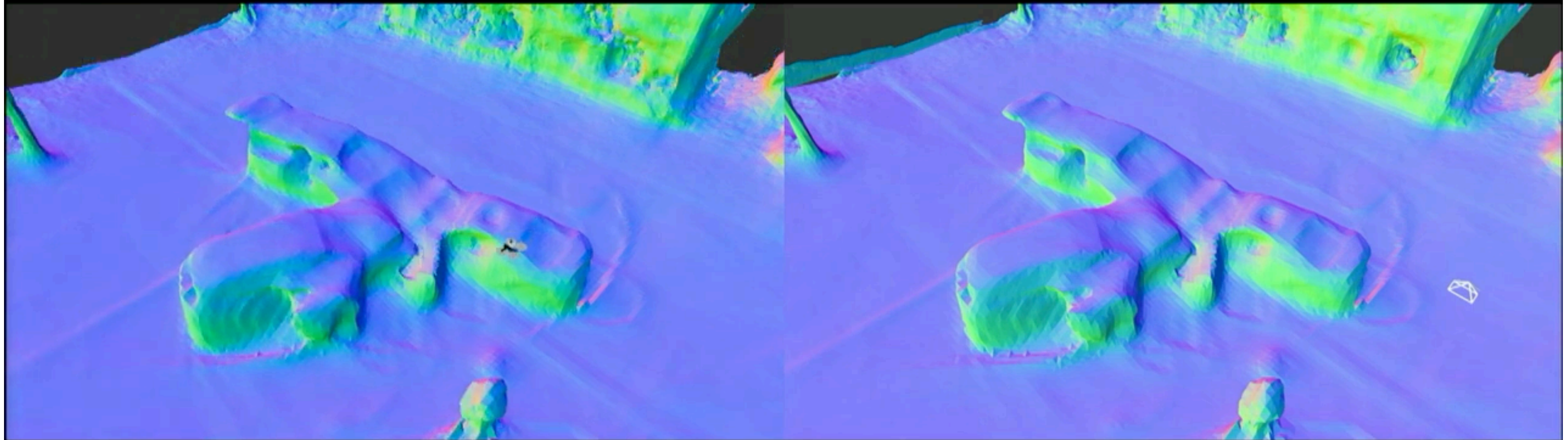
3D Surface Reconstruction



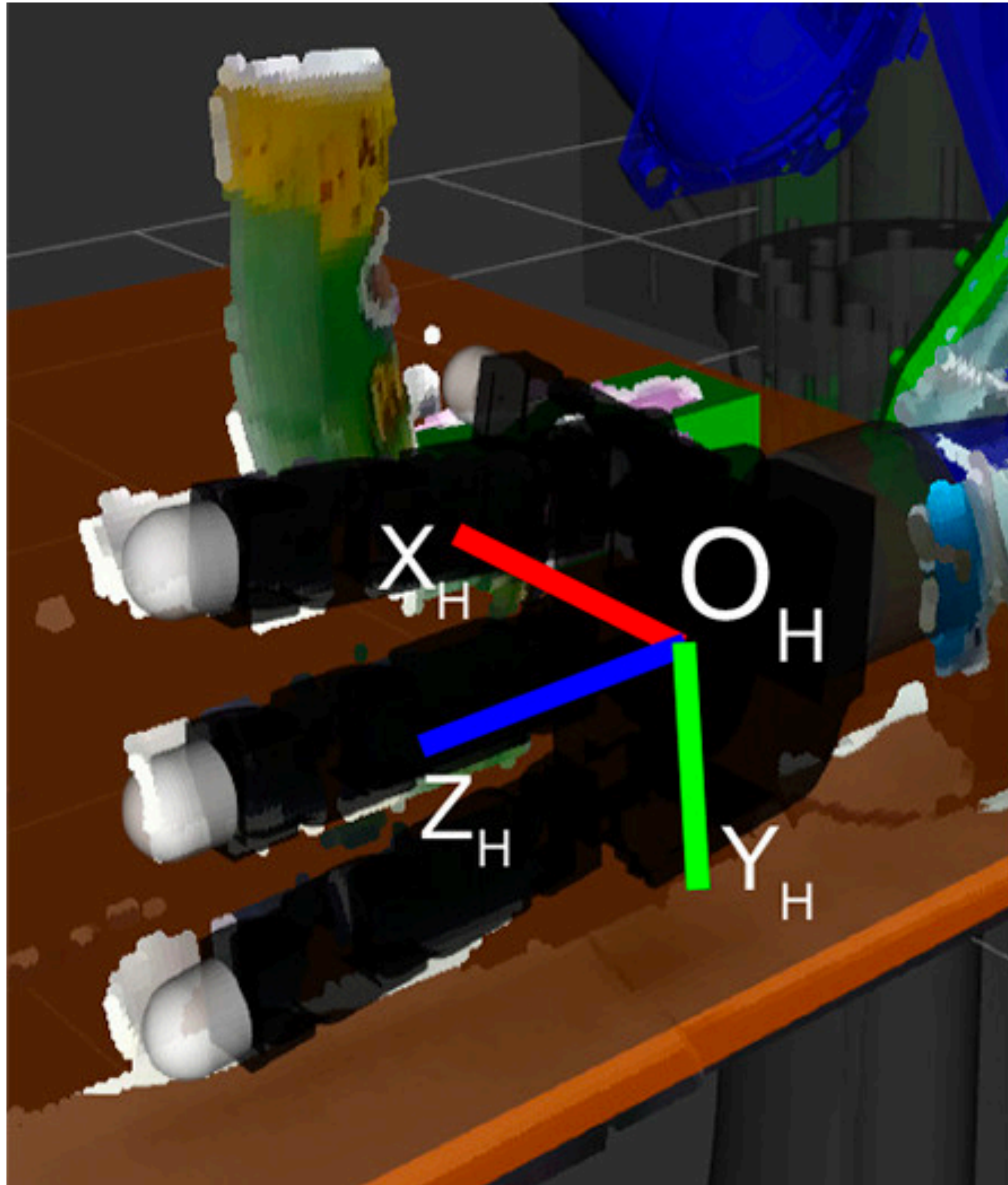
3D Scan Workflow

Explore

Capture

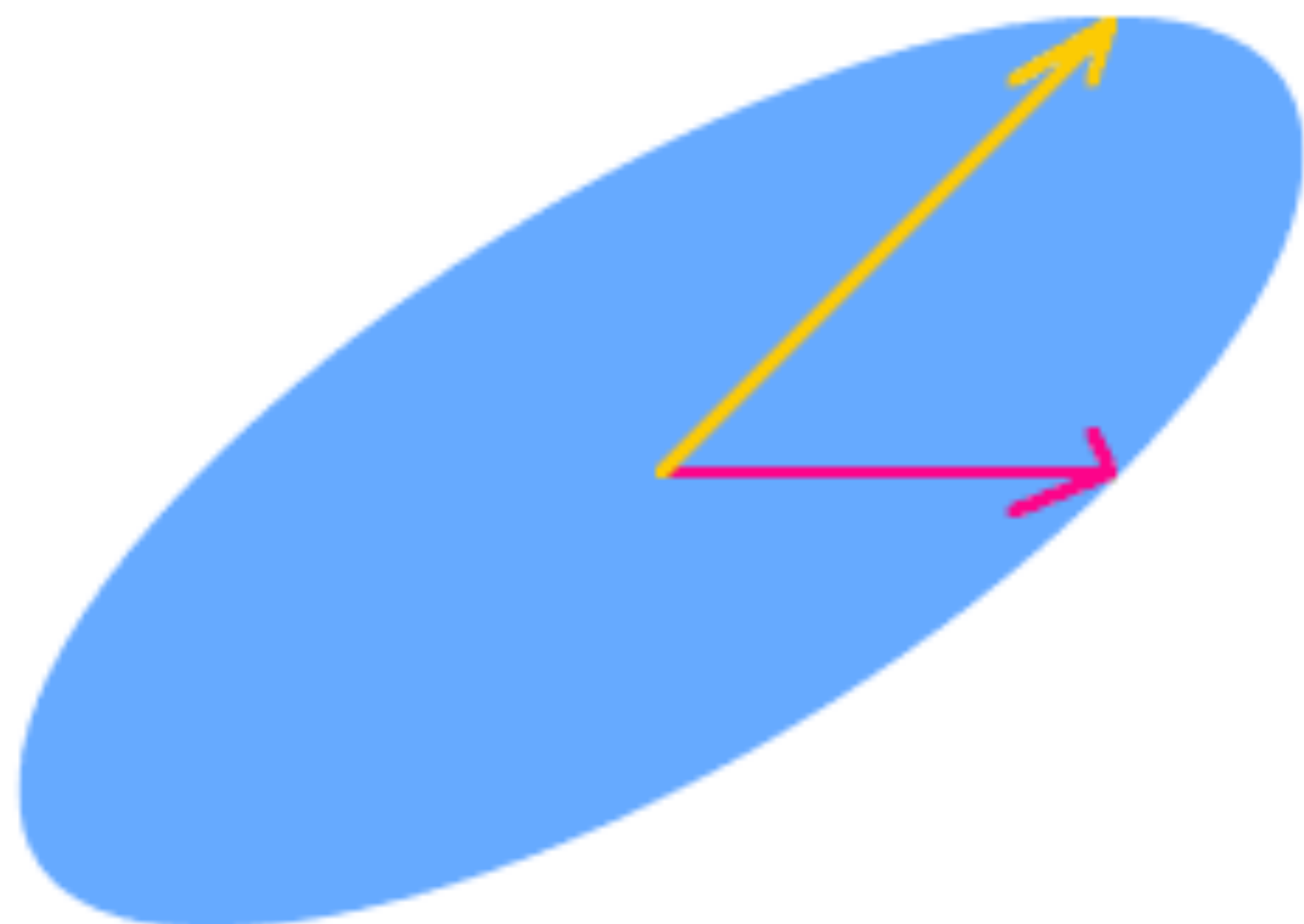


3D Grasp Pose Estimation



Back to the
problem

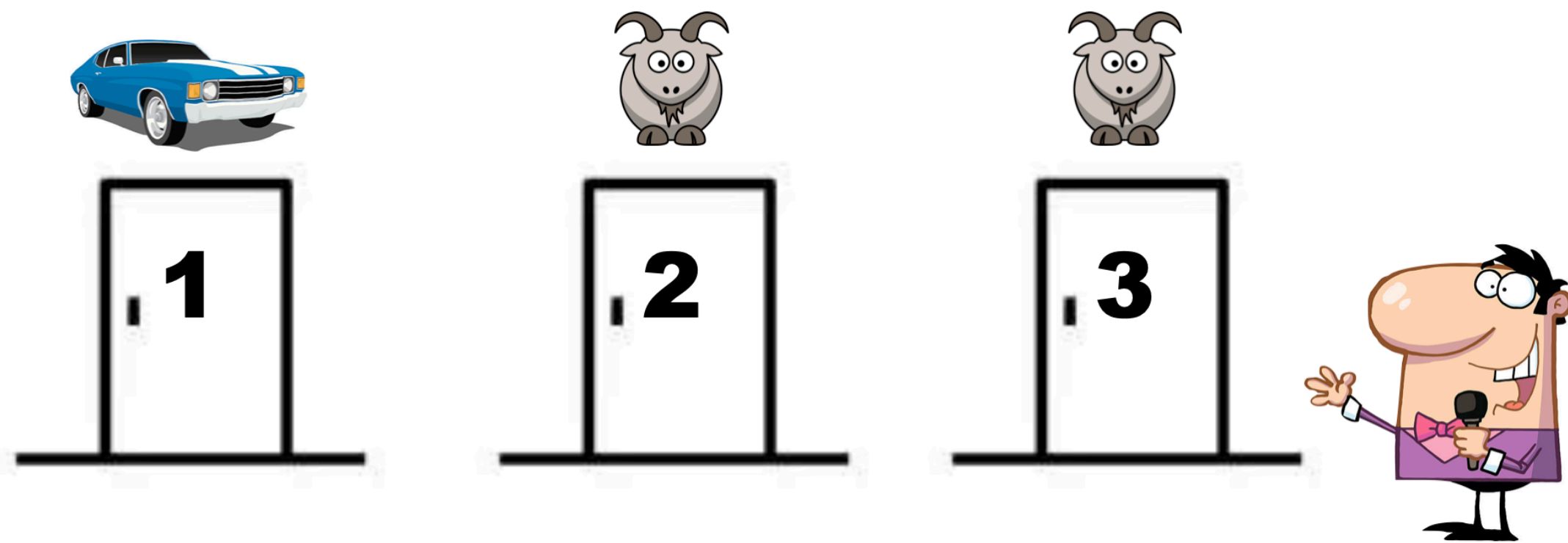




$$M = \begin{bmatrix} M_{1,1} & M_{1,2} \\ M_{2,1} & M_{2,2} \end{bmatrix}$$

tl;dr

The Monty Hall Problem



The Procrustes Problem

