From slides by Jason Hartline and Nicole Immorlica

Information cascades

**Cascade:** when people abandon their own information in favor of inferences based on earlier people’s actions

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**Guessing game**

**Experiment:**

There are three balls in this urn, either

- or

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**Guessing game**

**Experiment:** two urns equally likely

- This is called a blue urn.
- This is called a yellow urn.

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**Guessing game**

**Experiment:** When I call your name,

1. You (and only you) will see a random ball.
2. You must then guess if the urn is a blue urn or a yellow urn, and tell the class your guess.

If you guess correctly, you will earn one point.

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**What should the 1st student do?**

Guess that urn is same color as ball.
What should the 2nd student do?

1st guess was blue

What should the 2nd student do?

Guess that urn is same color as ball.

What should the 3rd student do?

1st and 2nd guesses were blue

Guess that urn is blue

no matter what she sees!

What should the nth student do?

First (n-1) guesses were blue

Let’s see why...

If the first two guesses are blue, everyone should guess blue.

First 2 students told the truth.

How likely is it that the urn is yellow given what you’ve seen and heard?
Strategy for urns

A player should guess yellow if,

$$Pr [ \text{yellow urn} | \text{what she saw and heard}] > \frac{1}{2}$$

and blue otherwise.

Analysis

From setup of experiment,

$$Pr [\bigcirc] = Pr [\bigotimes] = \frac{1}{2}$$

Analysis

From composition of urns,

$$Pr [\bigotimes | \bigcirc] = Pr [\bigotimes | \bigotimes] = \frac{2}{3}$$

Analysis

Suppose first student draws $\bigcirc$:

$$Pr [\bigotimes | \bigcirc] = \frac{Pr [\bigotimes | \bigotimes] \times Pr [\bigotimes]}{Pr [\bigotimes]}$$

Suppose first student draws $\bigotimes$:

$$Pr [\bigotimes | \bigotimes] = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$$

then he should guess yellow.
Analysis
Suppose second student draws $\bullet$ too:

$$\Pr [\begin{array}{ccc} \blacksquare \\ \bullet, \bullet \end{array}]$$

by a similar analysis, so she also guesses yellow.

Analysis
Suppose third student draws $\bullet$:

$$\Pr [\begin{array}{ccc} \blacksquare \\ \bullet, \bullet, \bullet \end{array}] = \frac{1}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{1}{2} = \frac{2}{3} > \frac{1}{2}$$
Analysis

The best strategy for the third student is to guess yellow no matter what he draws.

Information cascades

Staring up at the sky.

Fashions and fads

Self-reinforcing success of best-selling books.

Spread of technological choices by consumers

Information cascades

When:
1. People make decisions sequentially,
2. and observe actions of earlier people.

Information cascade: People abandon own info. in favor of inferences based on others’ actions.

Observations

1. Cascades are easy to start.

(every student makes same guess so long as first two students make same guess = draw same ball)
Observations

2. Cascades can lead to bad outcomes.

(given blue urn, chance of seeing yellow ball is 1/3, so first two students guess yellow with prob. $(1/3)^2 = 1/9$)