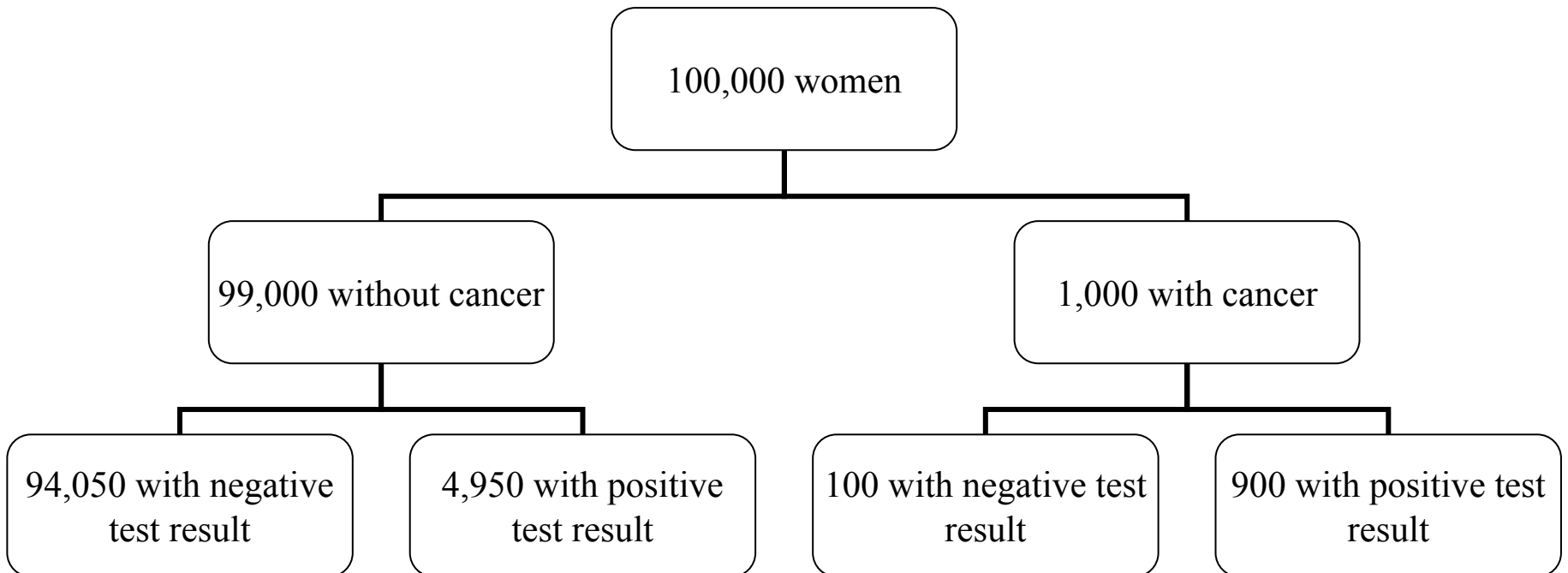


Experimental Economics

- **Bayesian Updating**
 - Introduction
 - Learning
 - Reinforcement learning
 - Winners curse
 - Origins of the winner's curse

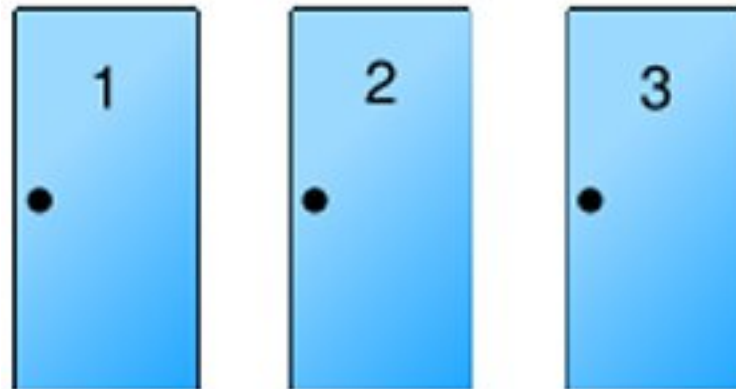
Non-Bayesians

- **Most individuals have difficulty doing Bayesian updating:**
 - 1% of women have breast cancer. 90% of women with breast cancer get a positive test result. 5% of women without breast cancer also get a positive test result. A woman had a positive test result, what is the probability that she has breast cancer?
 - Right answer: 15.38%



Learning

- **How about learning**
 - Can people learn to update correctly
- **The Monty Hall problem**
 - Three doors, 1 prize
 - Player chooses one door



Learning

- **How about learning**

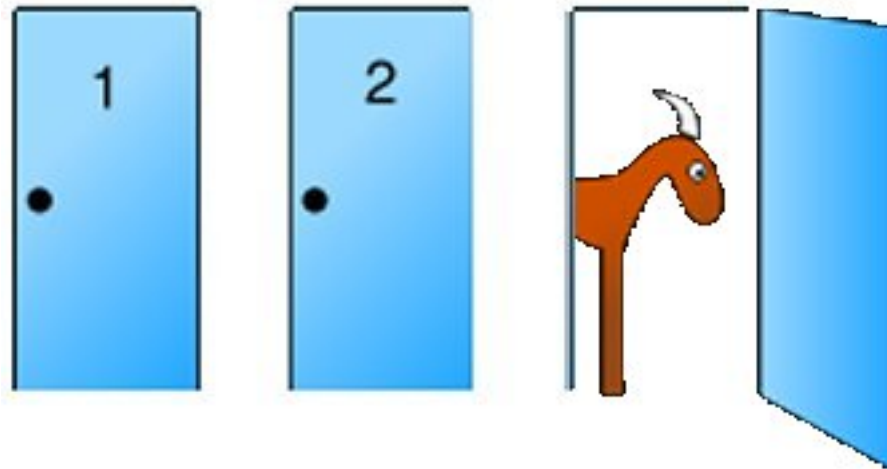
- Do people learn to update correctly with incentives

- **The Monty Hall problem**

- Three doors, 1 price
- Player chooses one door
- Host opens a door with no price
- Player has the opportunity to switch or not

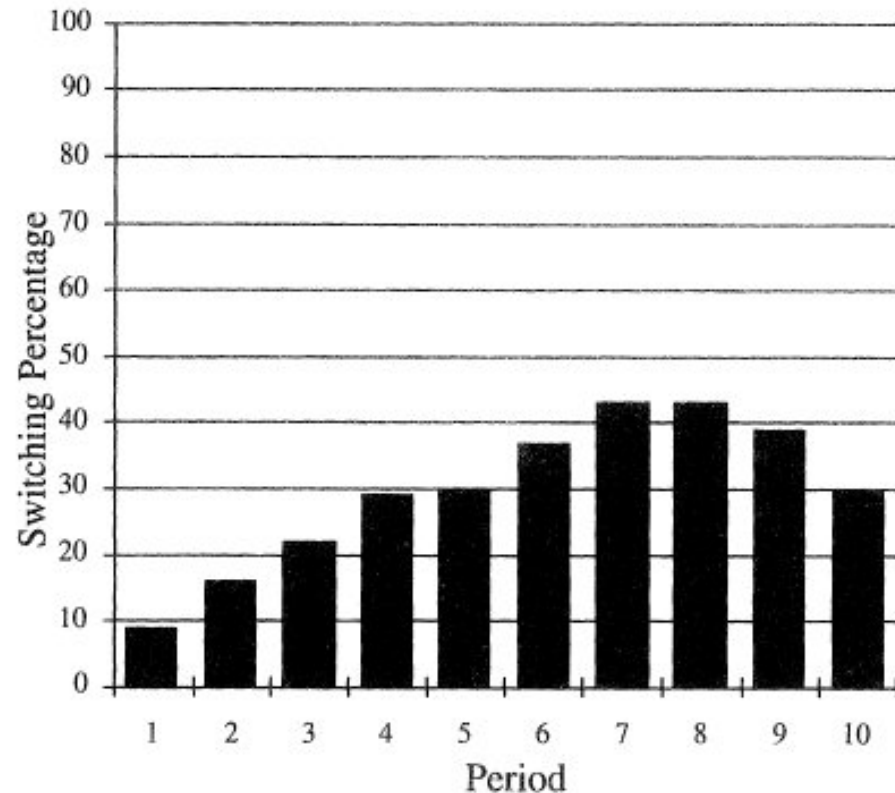
No switch: $P(\text{win}) = 1/3$

Switch: $P(\text{win}) = 2/3$



Learning

- **The Monty Hall problem** Friedman 1998
 - Experiment: part 1
 - Subjects play the Monty Hall game for 10 rounds
 - 104 subjects
 - Earn 40¢ if correct and 10¢ if wrong
 - Results
 - Only 28.5% switch
 - Increases with time but it never surpasses 50%



Learning

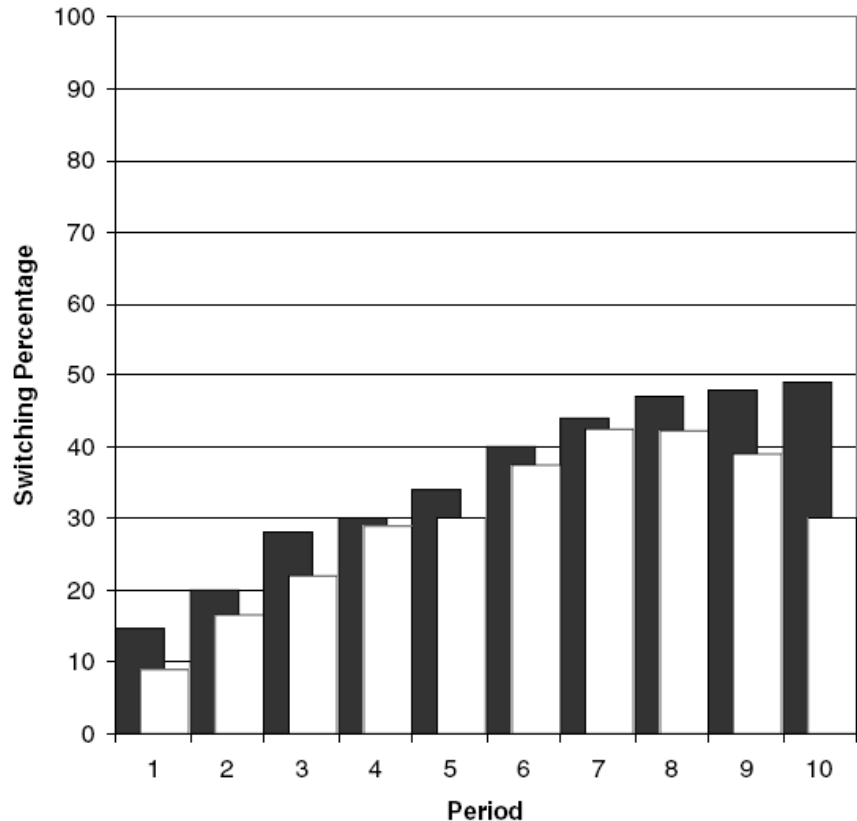
- **The Monty Hall problem** Friedman 1998
 - Experiment: part 2
 - Subjects play the Monty Hall game for 12-15 more rounds
 - 4 treatments
 - Intense: Earn 100¢ if correct and –50¢ if wrong
 - Track: Keep score for never-switch and always-switch strategies
 - Advice: Read advice in favor of switching and not switching
 - Compare: Receive summary statistics of all choices

| % Switching | Yes | No |
|--------------------|--------------|--------------|
| Intense | 43.9% | 48.7% |
| Track | 48.0% | 43.4% |
| Advice | 47.4% | 44.1% |
| Compare | 50.3% | 42.4% |

Learning

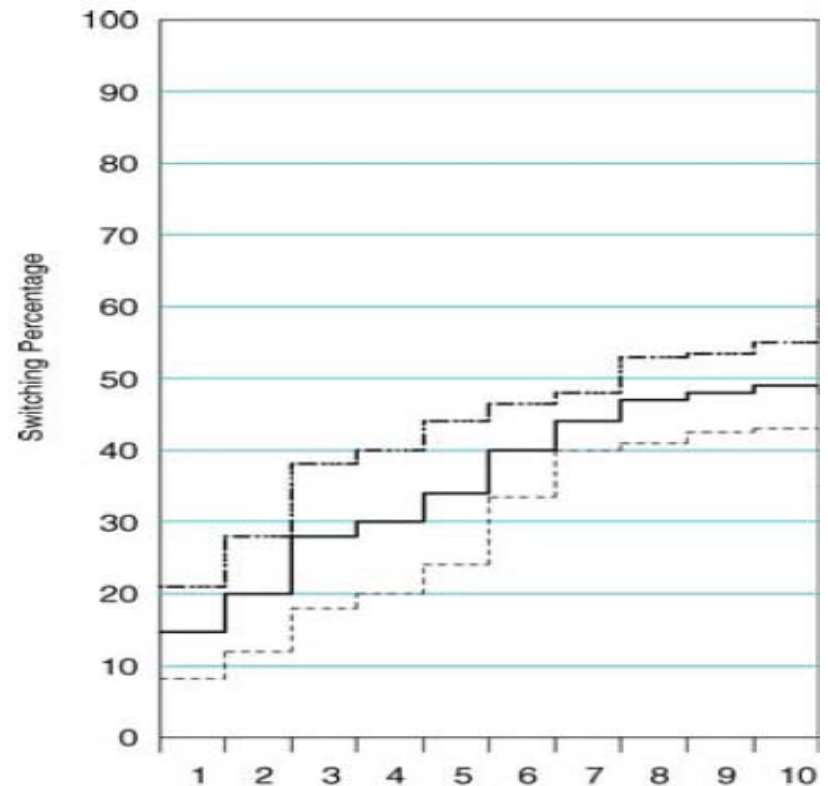
- **The Monty Hall problem** Palacios Huerta 2004
 - Experiment: part 1
 - Basically a replication of Friedman (1998)
 - Gathers more descriptive statistics

- Results
 - Only 35.1% switch
 - Increases with time but still does not surpass 50%



Learning

- **The Monty Hall problem** Palacios Huerta 2004
 - Experiment: part 1
 - Basically a replication of Friedman (1998)
 - Gathers more descriptive statistics
 - Results
 - Clear effect of “ability”
 - Seems like a level effect



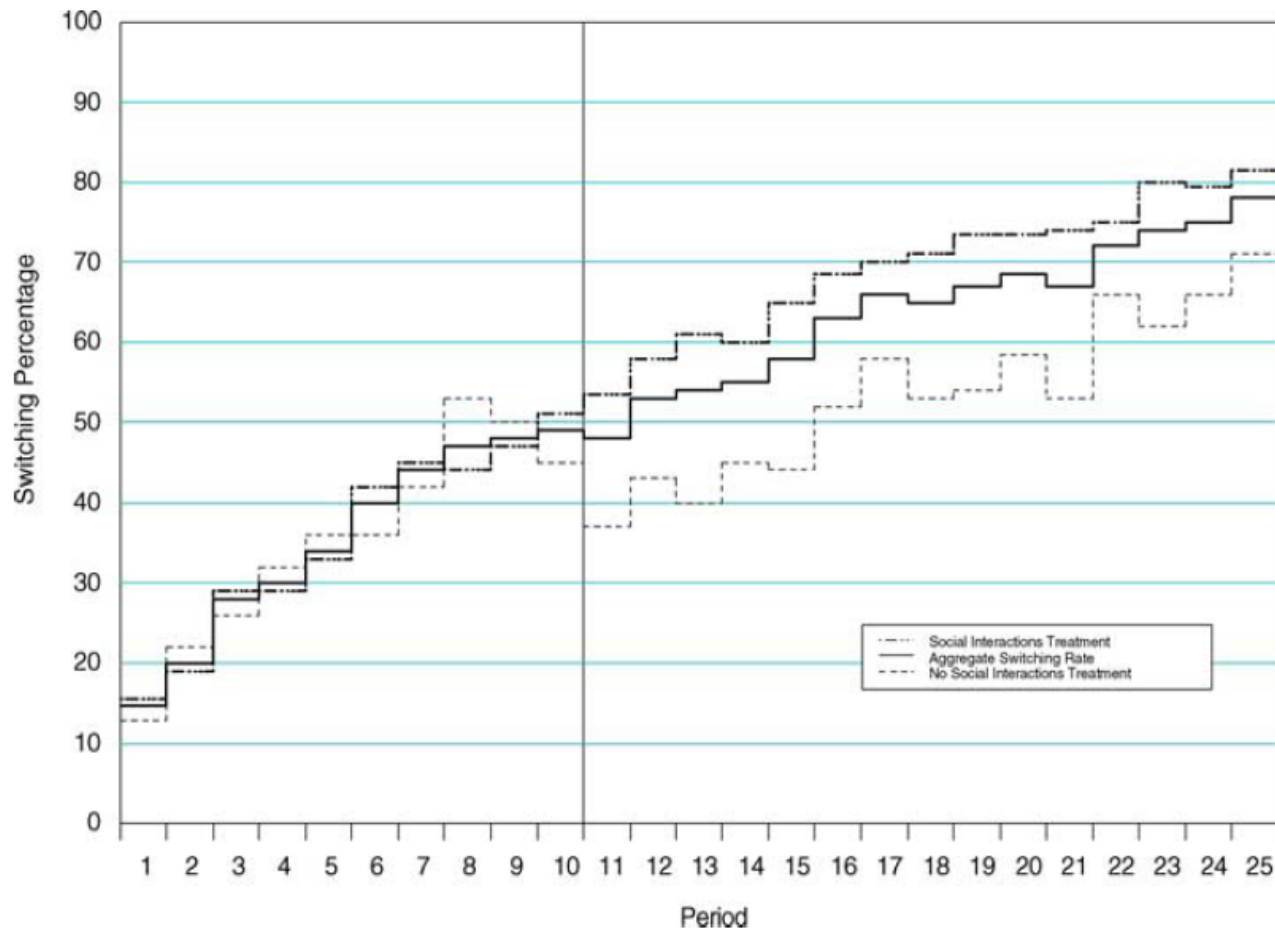
Learning

- **The Monty Hall problem** Palacios Huerta 2004
 - Experiment: part 2
 - Same as Friedman (1998)
 - Additional treatment variable: face to face communication in groups
 - Interaction effects:
 - Top ability and intense treatment
 - Bottom ability and group composition

| % Switching | Yes | No |
|---------------------------|--------------|--------------|
| Intense | 70.0% | 56.5% |
| Track | 66.7% | 61.2% |
| Advice | 65.9% | 62.5% |
| Compare | 70.4% | 58.4% |
| Social Interaction | 68.8% | 52.9% |

Learning

- **The Monty Hall problem** Palacios Huerta 2004
 - Experiment: part 2
 - Effect of social interaction:

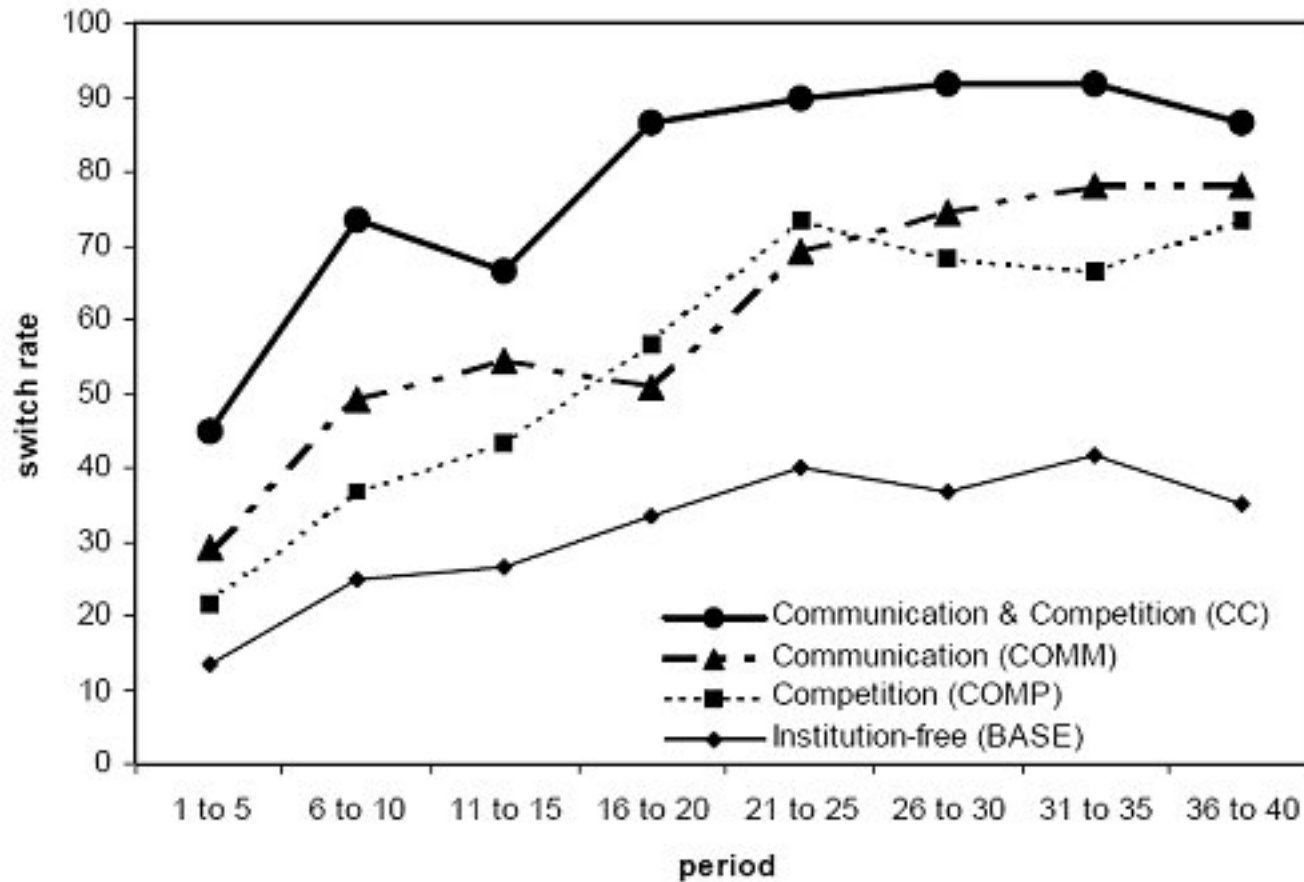


Learning

- **The Monty Hall problem** Slembeck & Tyran 2004
 - The role of institutions
 - 93 subjects play the Monty Hall game for 40 rounds
 - 4 treatments
 - Control: earn 10 points if correct and 0 points if wrong
 - Competition: higher relative points gives a better exchange rate
 - Communication: make decisions in groups of 3 (face-to-face)
 - Competition and communication: competing in groups of 3





Learning

- **The Monty Hall problem** Slembeck & Tyran 2004
 - The role of institutions



Reinforcement learning





- **When optimal choices feel wrong** Charness & Levin 2005
 - Bayesian updating or reinforcement learning
 - 165 subjects (106 in treatments 2 and 3)
 - 3 treatments: 2 with affective draws and 1 with non-affective draws

| | Left Urn | Right Urn |
|--------------------|--|---|
| UP ($p = 0.5$) |  |  |
| DOWN ($p = 0.5$) |  |  |

- The decision
 - 1st: Make a draw from the assigned urn
 - If you draw blue you win and if you draw red you lose
 - 2nd: Make a draw from left or from right urn
 - If you draw blue you win and if you draw red you lose

Reinforcement learning

- **When optimal choices feel wrong** Charness & Levin 2005
 - 1st draw is from the left
 - Blue: UP more likely → switch to right urn
 - Red: DOWN more likely → stay with left urn
 - 1st draw is from the right
 - Blue: UP for certain → stay with right urn
 - Red: DOWN for certain → switch to left urn

| | Left Urn | Right Urn |
|--------------------|--|---|
| UP ($p = 0.5$) |  |  |
| DOWN ($p = 0.5$) |  |  |

- Treatment 2: 1st draw pays
- Treatment 3: 1st draw does not pay

Reinforcement learning

- **When optimal choices feel wrong** Charness & Levin 2005
 - Results
 - Bayesian updating + reinforcement learning → low error rate
 - Bayesian updating – reinforcement learning → high error rate
 - Bayesian updating → middle error rate

| % Switching Errors | Good outcome | Bad outcome | Aggregate error |
|---|---------------------|--------------------|------------------------|
| Treatment 2 Start from Right | 12.9% | 3.9% | 8.1% |
| Treatment 2 Start from Left | 36.8% | 56.4% | 47.0% |
| Treatment 3 Start from Left | 13.5% | 42.4% | 28.2% |

Non-Bayesians

- **Do individuals learn to be Bayesian**
 - Maybe but ...
 - It depends on the learning environment
 - Competition and communication help a lot
 - Feedback helps if it reinforces the right choice

Experiments

- **Common value auction**
 - Instructions in z-Leaf
- **Acquire a company**
 - Instructions in z-Leaf

Winner's Curse

- **Common results for value auctions**
 - Winners curse: the winner of the auction overestimates the value of the good but does not underbid enough and ends up making a loss
- **Possible explanations for the winner's curse**
 - Utility of winning (risk seeking)
 - Wrong beliefs of other bidders' behavior
 - Cursed beliefs
 - k -level thinking
 - Non-Bayesian updating

Acquiring a company

- **The origin of the winner's curse** Charness & Levin 2009
 - Simplifying the winner's curse
 - A company is worth $x \in [0, 99]$ to an owner and $1.5x$ to a buyer
 - The buyer bids an amount y for the company
 - The owner accepts or rejects the bid
 - Optimal bid is 0!
 - Simplifying further (Treatment 1)
 - Automated owner who accepts if $y \geq x$ and rejects otherwise
 - Simplifying even further (Treatment 2)
 - A company is worth $x \in \{0, 99\}$ to an owner and $1.5x$ to a buyer
 - Simplifying completely (Treatment 3)
 - Choice of 4 lotteries:
A: $(0, 1)$ B: $(0, \frac{1}{2}; -33, \frac{1}{2})$ C: $(0, \frac{1}{2}; -66, \frac{1}{2})$ D: $(49.5, \frac{1}{2}; -99, \frac{1}{2})$

Acquiring a company

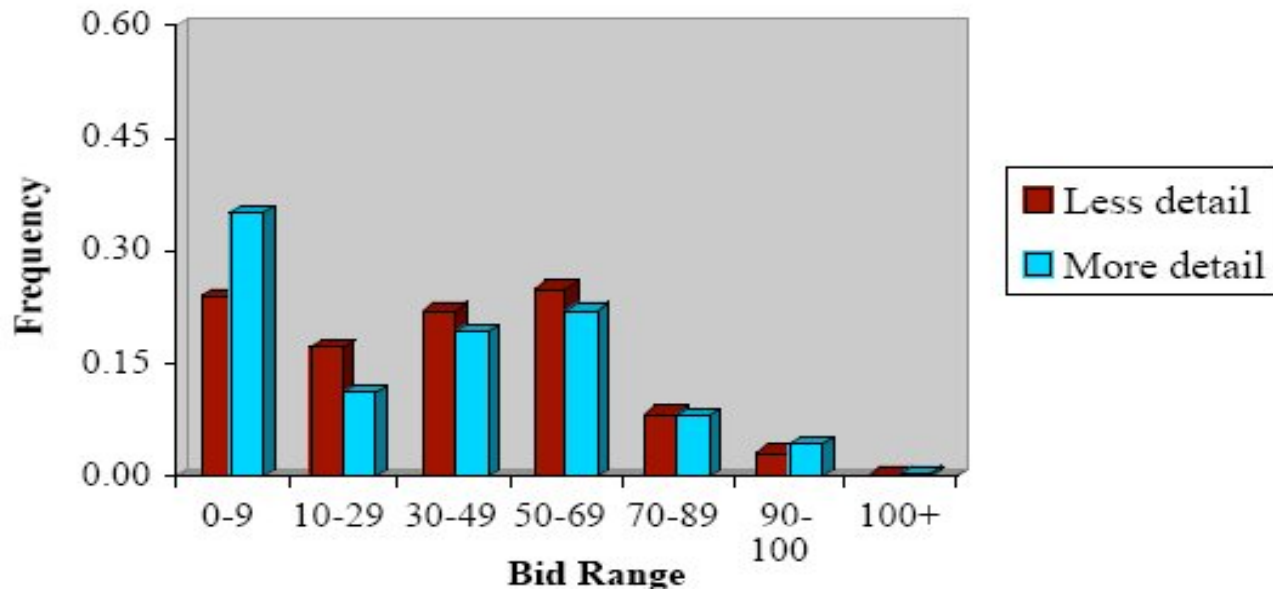
- **The origin of the winner's curse** Charness & Levin 2009
 - Design (2 parts with 30 periods)
 - Treatment 1 – Treatment 2 (normal instructions): 54 subjects
 - Treatment 2 – Treatment 1 (normal instructions): 48 subjects
 - Treatment 1 – Treatment 2 (detailed instructions): 38 subjects
 - Treatment 2 – Treatment 1 (detailed instructions): 33 subjects
 - Treatment 3: 46 subjects
 - Treatment 1s – Treatment 2s (normal instructions): 52 subjects
 - Treatment 1s – Treatment 2s (detailed instructions): 59 subjects
 - Treatment 2 – Treatment 1 – Treatment 2 – Treatment 1: 47 subjects
 - Treatment 3s: 40 subjects
 - Treatment 4: 57 subjects

Acquiring a company

- **The origin of the winner's curse** Charness & Levin 2009
 - Treatment 17

| | First 30 Normal | Second 30 Normal | First 30 Detailed | Second 30 Detailed |
|--------------------|--------------------|---------------------|----------------------|-----------------------|
| Avg. Bid | 38.86 | 35.91 | 35.17 | 29.12 |
| % zero bids | 7.5% | 20.9% | 25.8% | 40.1% |

Bid Frequency in Treatment 1 (by instructions)

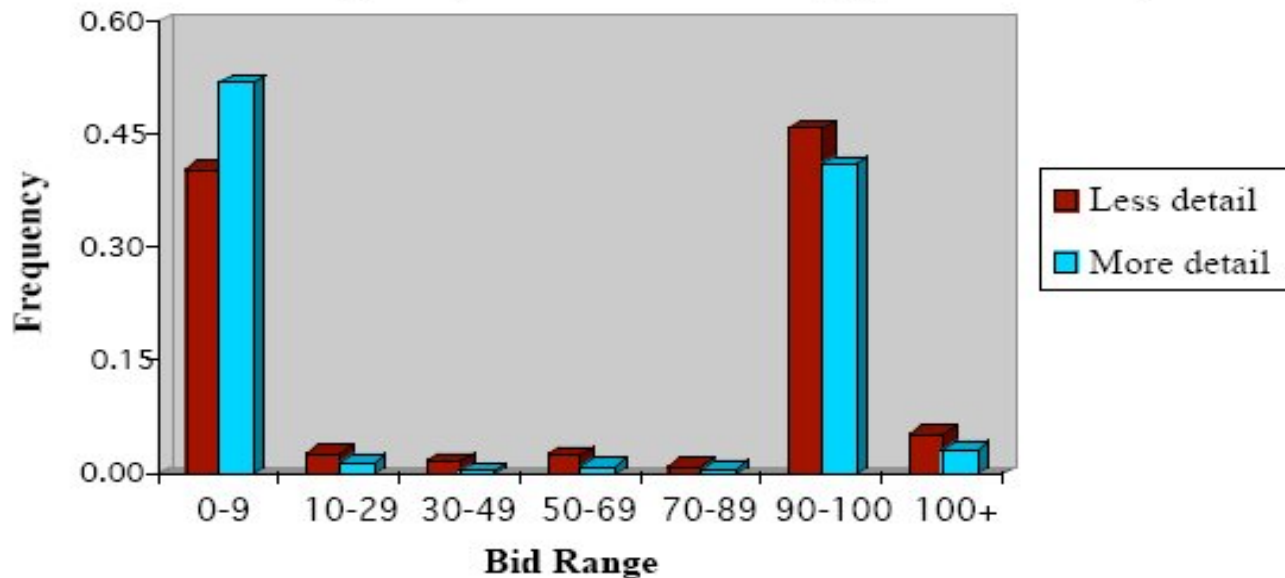


Acquiring a company

- **The origin of the winner's curse** Charness & Levin 2009
 - Treatment 2

| | First 30 Normal | Second 30 Normal | First 30 Detailed | Second 30 Detailed |
|--------------------|--------------------|---------------------|----------------------|-----------------------|
| Avg. Bid | 57.08 | 59.87 | 52.93 | 36.21 |
| % zero bids | 30.4% | 33.5% | 38.5% | 58.5% |

Bid Frequency in Treatment 2 (by instructions)



Acquiring a company

- **The origin of the winner's curse** Charness & Levin 2009

- Treatment 2

| | First 30 Normal | Second 30 Normal | First 30 Detailed | Second 30 Detailed |
|--------------------|----------------------------|-----------------------------|------------------------------|-------------------------------|
| Avg. Bid | 57.08 | 59.87 | 52.93 | 36.21 |
| % zero bids | 30.4% | 33.5% | 38.5% | 58.5% |

- Treatment 3

- % zero bids: 84.8%

- Summary

- Winner's curse persists in non-strategic environments
 - Individuals fail to properly update beliefs
 - Learning seems to be important here (instructions mattered)