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# Carrot and Stick: Eliciting Comparison Data and Beyond



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School of Engineering  
and Applied Sciences



# Data from agents

- Applications
  - LLMs' response (RLWH)

You  
Art nouveau

Which response do you prefer?  
Your choice will help make ChatGPT better.

Response 1

Art Nouveau is a decorative art and architecture style that emerged in the late 19th and early 20th centuries. Characterized by its use of long, sinuous, organic lines, Art Nouveau was a reaction against the academic art, eclecticism, and historicism of 19th-century architecture and design. It was inspired by natural forms and structures, particularly the curved lines of plants and flowers.

**Key features of Art Nouveau include:**

1. **Natural Forms:** Designs often mimic floral shapes, vines, and other botanical elements.
2. **Curvilinear Shapes:** Flowing, curvy lines are a hallmark, as opposed to the rigid, straight lines of earlier styles.
3. **Integration with Architecture:** Decorative elements are often integrated into architectural structures, including buildings, furniture, and decorative arts.

Response 2

Art Nouveau is an artistic movement that emerged in the late 19th and early 20th centuries, characterized by its intricate linear designs and flowing curves inspired by natural forms. It spanned various types of arts, including architecture, furniture, glassware, and illustration. The style is distinguished by its use of long, sinuous, organic lines and was a reaction against the academic art, eclecticism, and historicism of the 19th century.

**Key Characteristics of Art Nouveau:**

1. **Natural Forms and Structures:** This style often incorporates floral motifs, vines, and other plant-inspired elements. The lines are elegantly flowing and intertwined, suggesting motion and fluidity. This reflects Art Nouveau's philosophy of bringing nature into everyday life.
2. **Asymmetry:** Unlike the symmetrical forms

# Data from agents

- Applications
  - LLMs' response
  - Polling

## A chance to be an art curator

Penn's Arthur Ross Gallery to create exhibition based on public's picks.



The Arthur Ross Gallery is offering 125 artworks in the University of Pennsylvania's collection for the public to choose from in its first crowdsourced exhibit, "Citizen Salon."

# Data from agents

- Applications
  - LLMs' response
  - Polling



## Student Evaluations of Teaching - Fall 2020

### Legend Info

- ? indicates more information available.
- ★ indicates mandatory question.
- ! indicates invalid response.

## Student Evaluations of teaching for [C\$FN] [C\$LN]

Item 1 of 22	<b>Course requirements and expectations were clear</b>
	<input type="radio"/> Strongly Agree
	<input type="radio"/> Agree
	<input type="radio"/> Neutral
	<input type="radio"/> Disagree
	<input type="radio"/> Strongly Disagree
	<input type="radio"/> Not Applicable

# Data from agents

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- Applications
  - LLMs' response
  - Polling
  - Conference review



# Data from agents

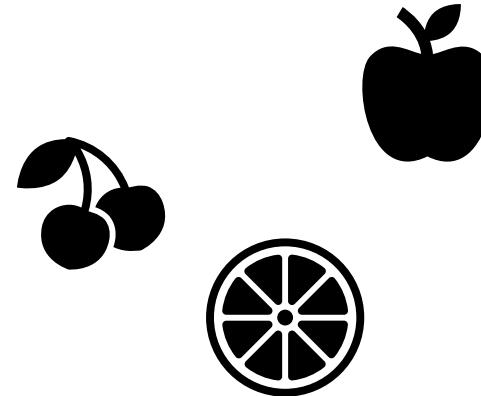
- Applications
  - LLMs' response
  - Polling
  - Conference review
- Challenges: how can we elicit truthful data?



# Eliciting Comparison Data [CFY24]

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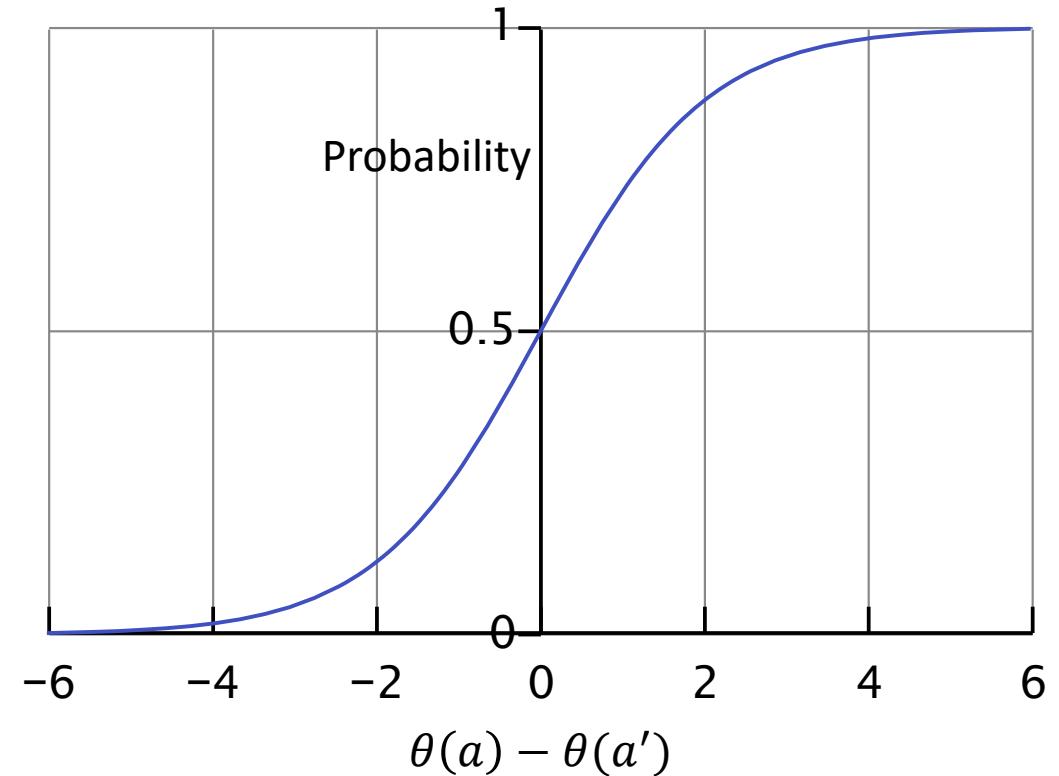
- Comparison data on items in  $A$ ?
  - LLMs' responses
  - Peer grading, and conference reviews



# Eliciting Comparison Data [CFY24]

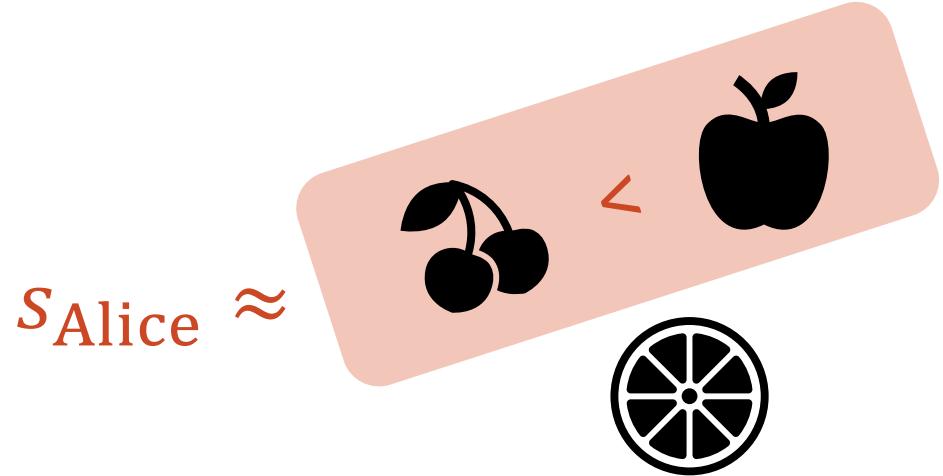
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- Comparison data on items in  $A$ ?
  - LLMs' responses
  - Peer grading, and conference reviews
- Statistical learning problem
  - Value  $\theta: A \rightarrow \mathbb{R}$
  - Each pair  $(a, a')$  with a noisy comparison  $\approx 1[\theta(a) > \theta(a')]$



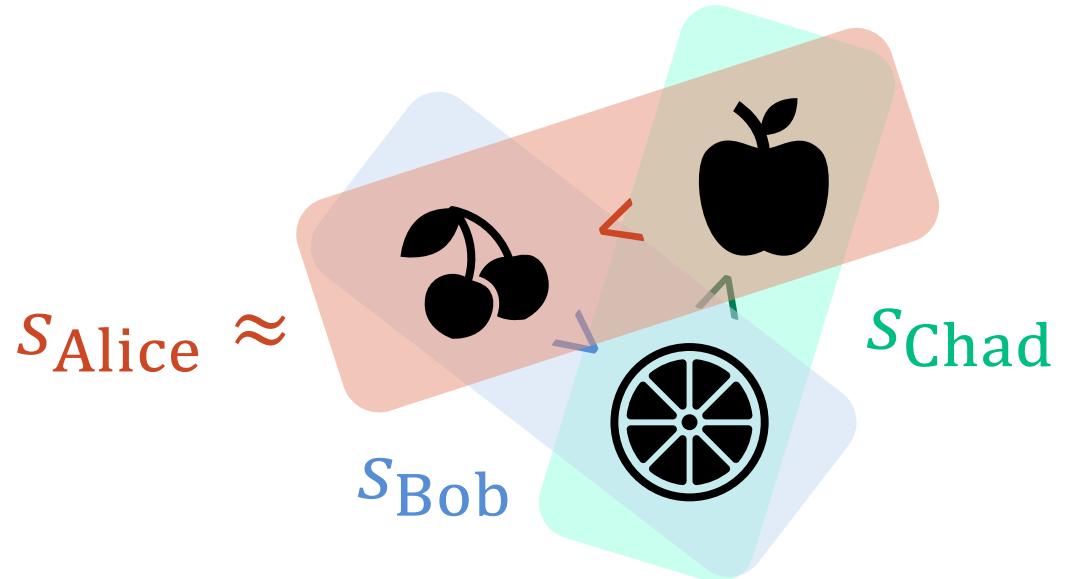
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  - Assign pairs to agents and use their reports



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# Data from strategic agents

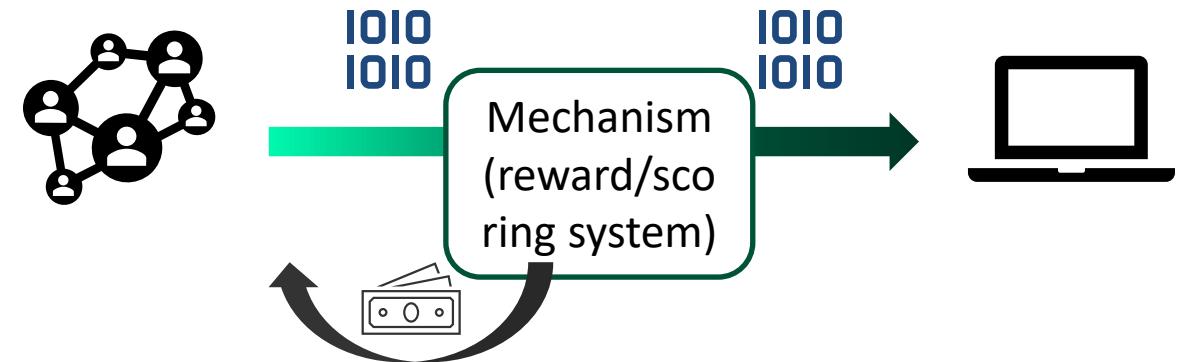
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- Comparison data on items  $A$ ?
- Statistical learning problem
  - Value  $\theta: A \rightarrow \mathbb{R}$
  - Each pair  $(a, a')$  with a noisy comparison  $\approx 1[\theta(a) > \theta(a')]$
  - Assign pairs to agents and use their **reports**



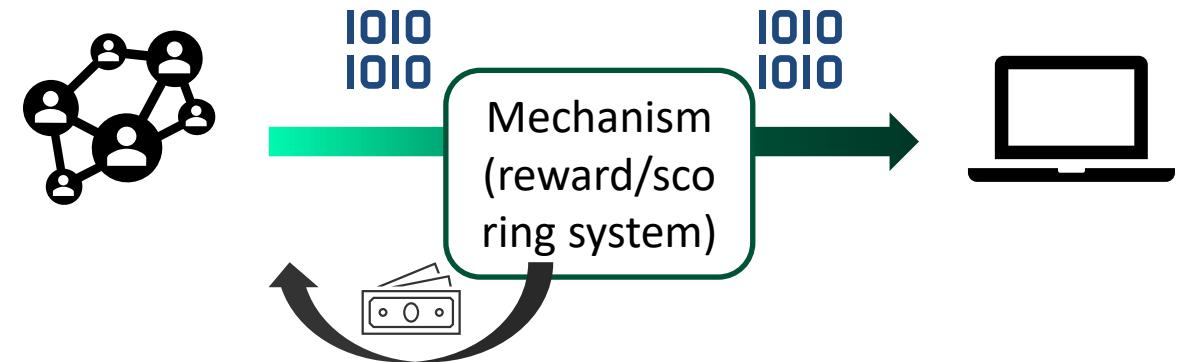
# Information elicitation

- Comparison data on items  $A$ ?
- Statistical learning problem
  - Value  $\theta: A \rightarrow \mathbb{R}$
  - Each pair  $(a, a')$  with a noisy comparison  $\approx 1[\theta(a) > \theta(a')]$
  - Assign pairs to agents and use their **truthful reports**



# Traditional Reward Methods

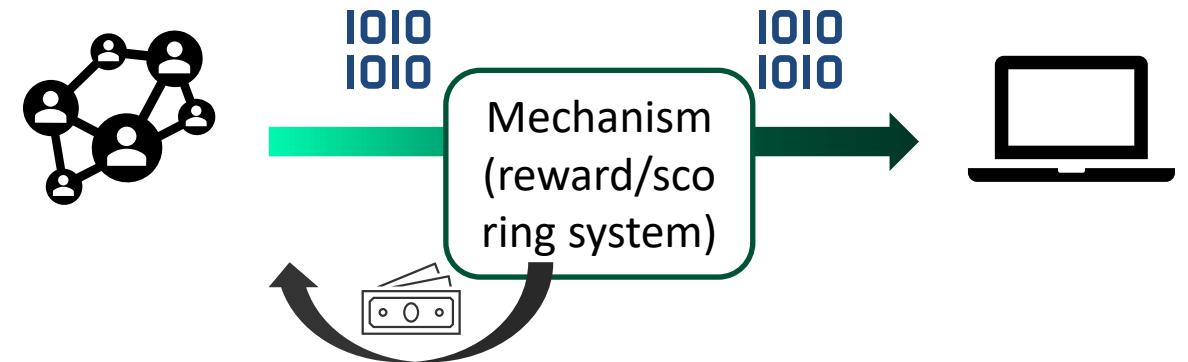
- Pay agents equally!



# Traditional Reward Methods

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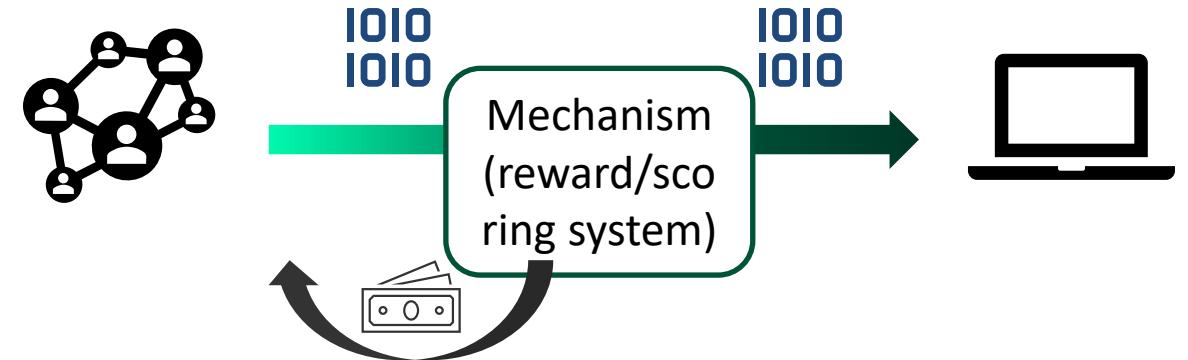
- Pay agents equally!
  - Provide random information without efforts



# Traditional Reward Methods

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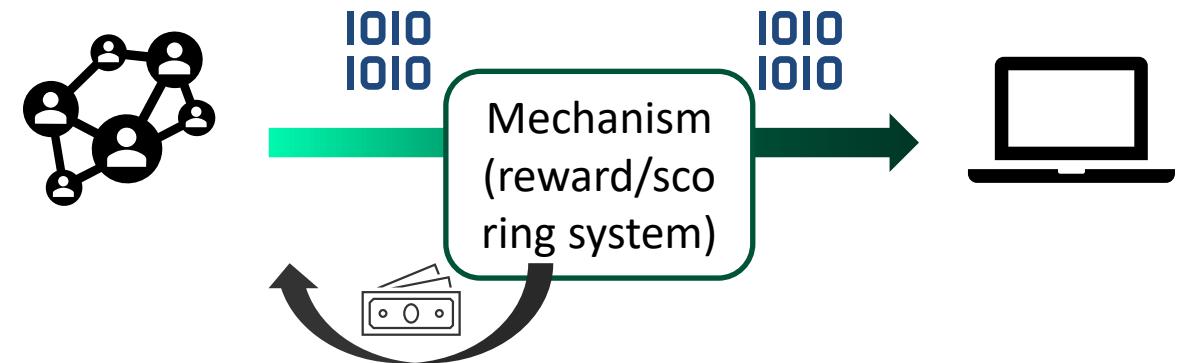
- Pay agents equally!
  - Provide random information without efforts
- Spot-check



# Traditional Reward Methods

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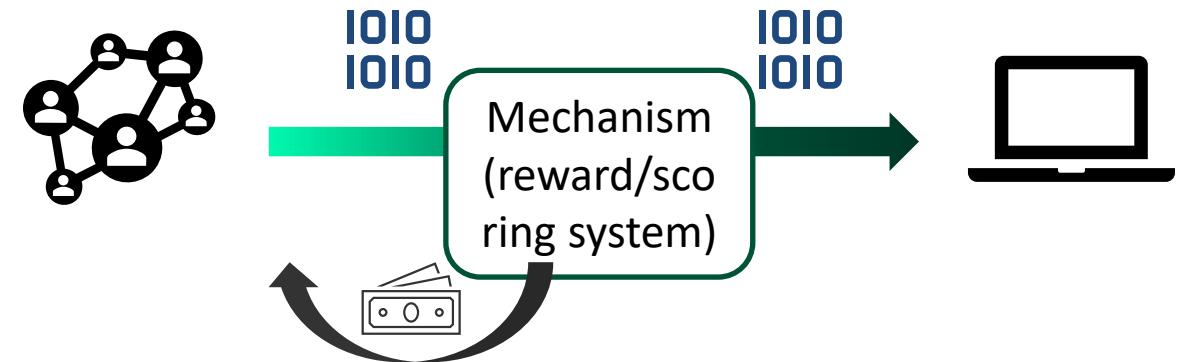
- Pay agents equally!
  - Provide random information without efforts
- Spot-check
  - Which response do you prefer?



# Traditional Reward Methods

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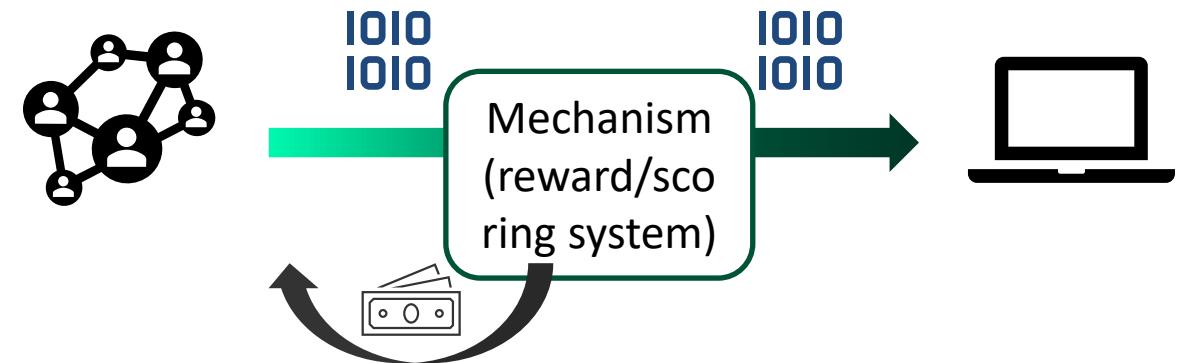
- Pay agents equally!
  - Provide random information without efforts
- Spot-check
  - Which response do you prefer?
- Majority vote



# Traditional Reward Methods

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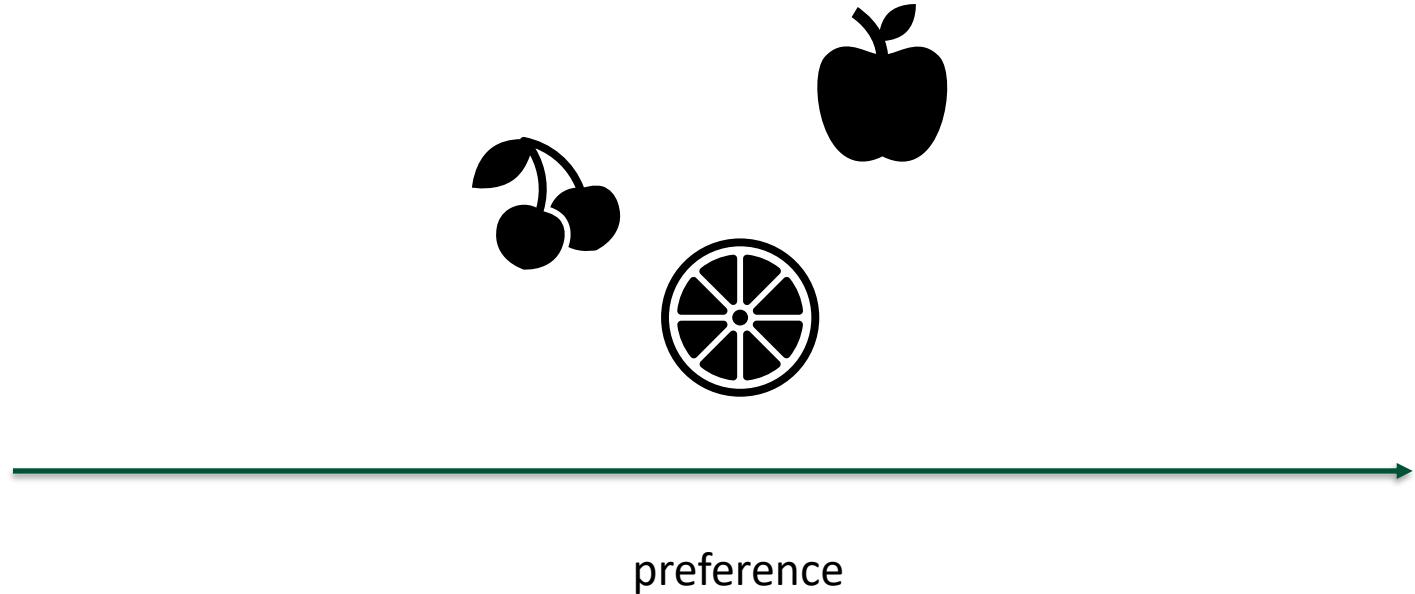
- Pay agents equally!
  - Provide random information without efforts
- Spot-check
  - Which response do you prefer?
- Majority vote
  - Different tasks for agents



# Peer Prediction

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- Idea: Comparison Are correlated
- Example:
  - Items: Apple, Orange, Cherry
  - Agents: Alice, Bob, and Chad

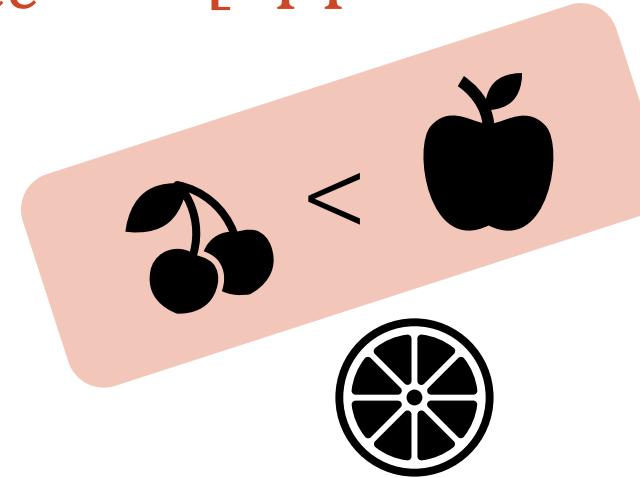


# Peer Prediction

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- Idea: Comparison Are correlated
- Example:
  - Items: Apple, Orange, Cherry
  - Agents: Alice, Bob, and Chad

$$s_{\text{Alice}} = 1[\text{apple} > \text{cherry}]$$

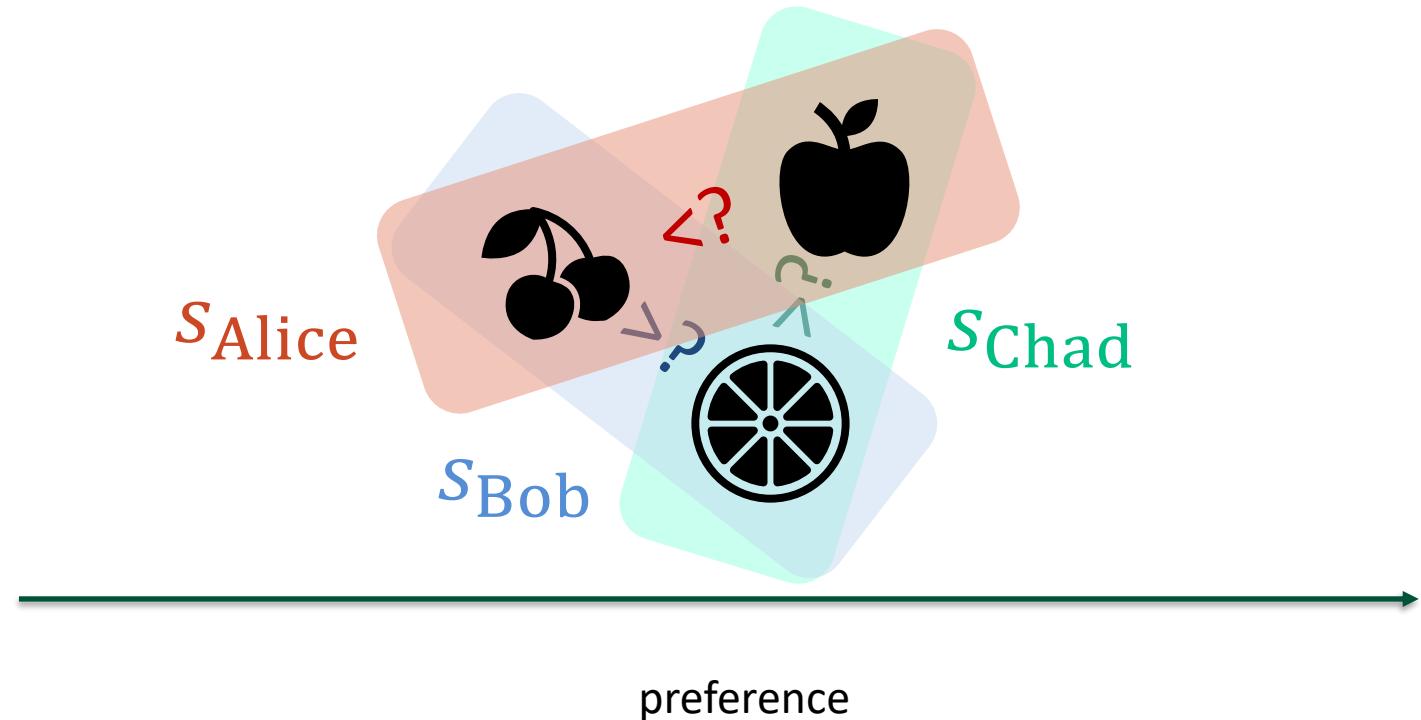


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preference

# Peer Prediction

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# Peer Prediction

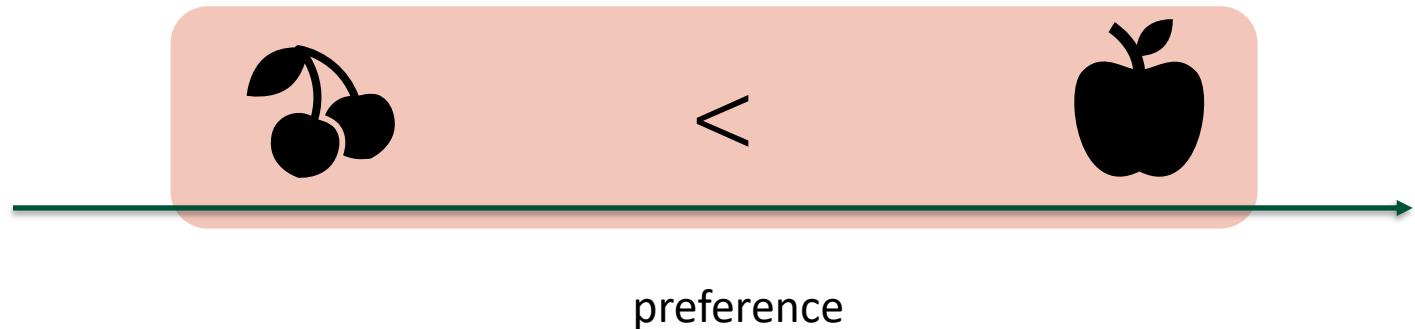
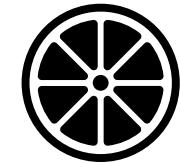
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- Idea: Comparison Are correlated
- Example:

- Items: Apple, Orange, Cherry
- Agents: Alice, Bob, and Chad
- If Alice believes **Apple>Cherry**,

$$S_A = 1$$

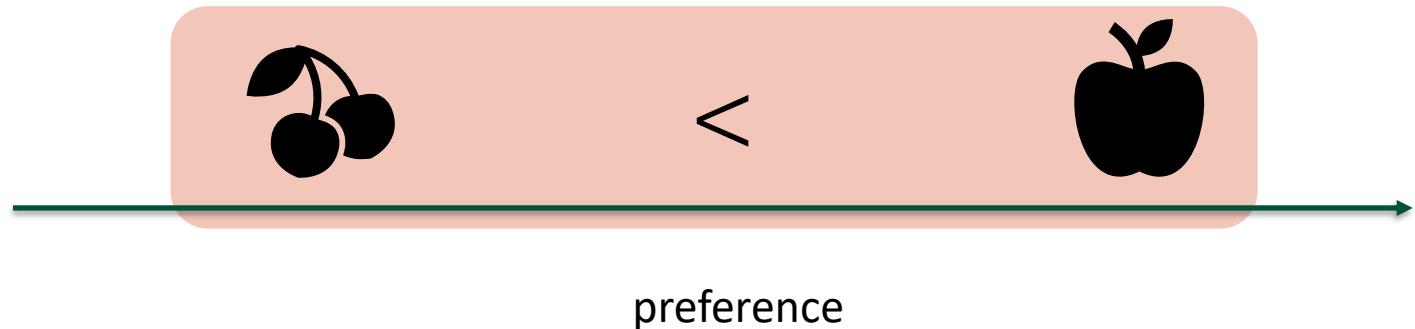
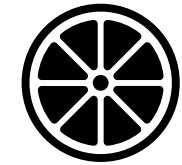
- a) Orange>Cherry
- b) Orange>Apple



# Peer Prediction

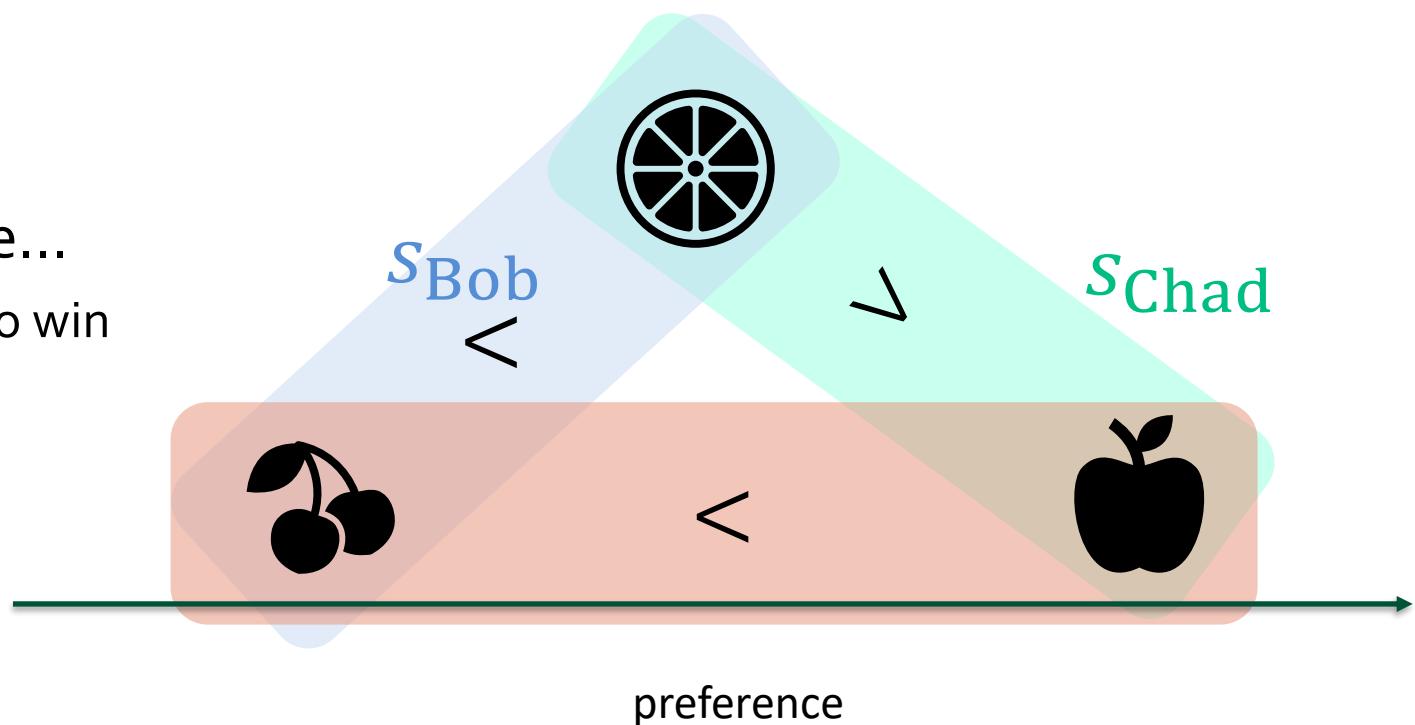
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- Idea: Comparison Are correlated
- Example:
  - Items: Apple, Orange, Cherry
  - Agents: Alice, Bob, and Chad
  - If Alice believes Cherry < Apple...
    - **Transitivity:** Apple more likely to win Orange than Cherry does.



# Peer Prediction

- Idea: Comparison Are correlated
- Example:
  - Items: Apple, Orange, Cherry
  - Agents: Alice, Bob, and Chad
  - If Alice believes Cherry < Apple...
    - **Transitivity:** Apple more likely to win Orange than Cherry does.
    - Agree with Bob's than Chad's

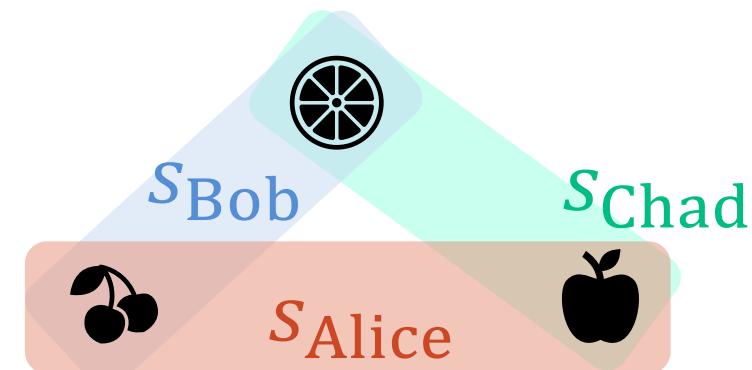


# Bonus penalty mechanism for comparisons

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- If the agent's signals satisfy **strongly stochastic transitivity**,
- BPP mechanism pays Alice

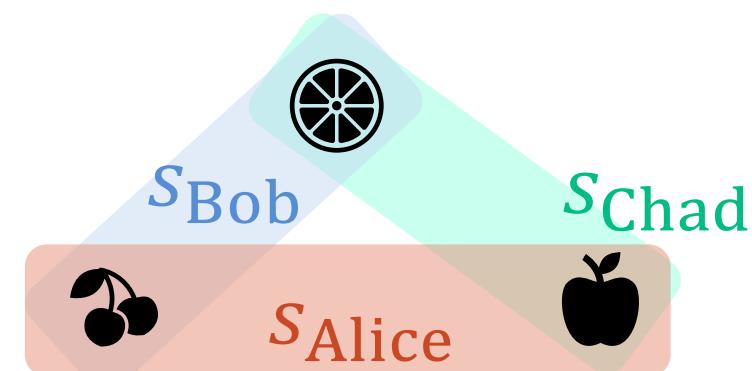
$$\begin{cases} 1 & \text{if agree with Bob and disagree with Chad} \\ -1 & \text{if agree with Chad and disagree with Bob} \\ 0 & \text{otherwise} \end{cases}$$



# Bonus penalty mechanism for comparisons

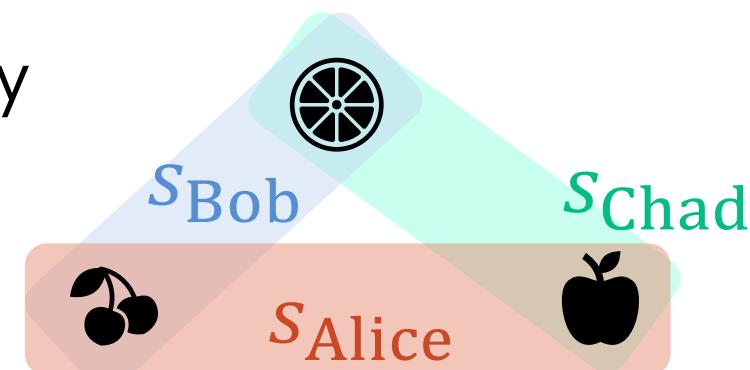
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- If the agent's signals satisfy **strongly stochastic transitivity**,
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$$\begin{cases} 1 & \text{if agree with Bob and disagree with Chad} \\ -1 & \text{if agree with Chad and disagree with Bob} \\ 0 & \text{otherwise} \end{cases}$$
  - Alice wants to tell the truth when Bob and Chad are truthful.



# Bonus penalty mechanism for comparisons

- If the agent's signals satisfy **strongly stochastic transitivity**,
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$$\begin{cases} 1 & \text{if agree with Bob and disagree with Chad} \\ -1 & \text{if agree with Chad and disagree with Bob} \\ 0 & \text{otherwise} \end{cases}$$
  - Alice wants to tell the truth when Bob and Chad are truthful.
  - Alice gets zero payment when all report randomly



# Bonus penalty mechanism for networked data

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- If the agent's signals satisfy homophily
- BPP mechanism pays Alice
$$\begin{cases} 1 & \text{if agree with a friend and disagree with a stranger} \\ -1 & \text{if agree with a stranger and disagree with a friend} \\ 0 & \text{otherwise} \end{cases}$$
  - Alice wants to tell the truth when everyone is truthful.
  - Alice gets zero payment when all report randomly

