CPS 196.2

Preference elicitation/ iterative mechanisms

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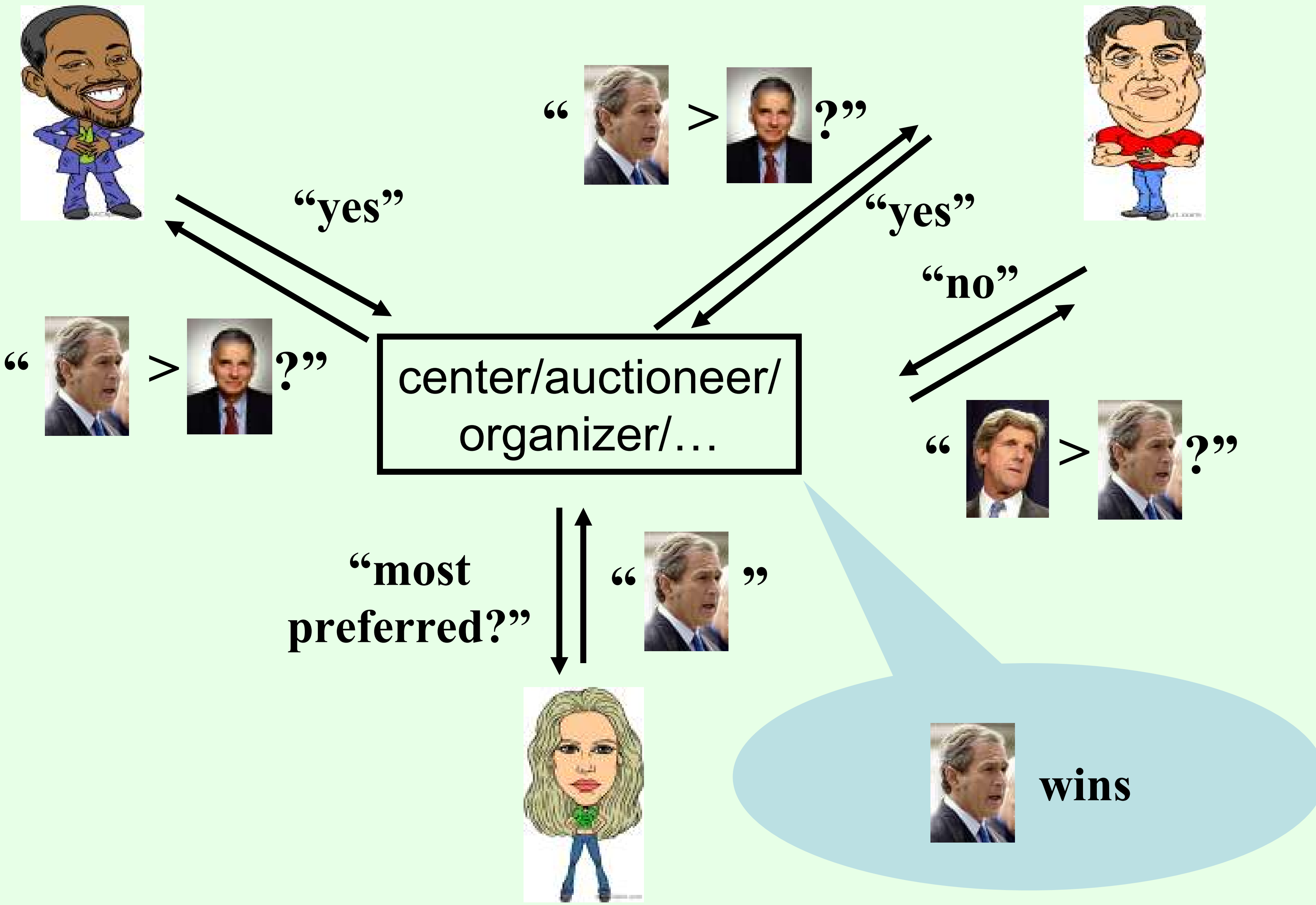
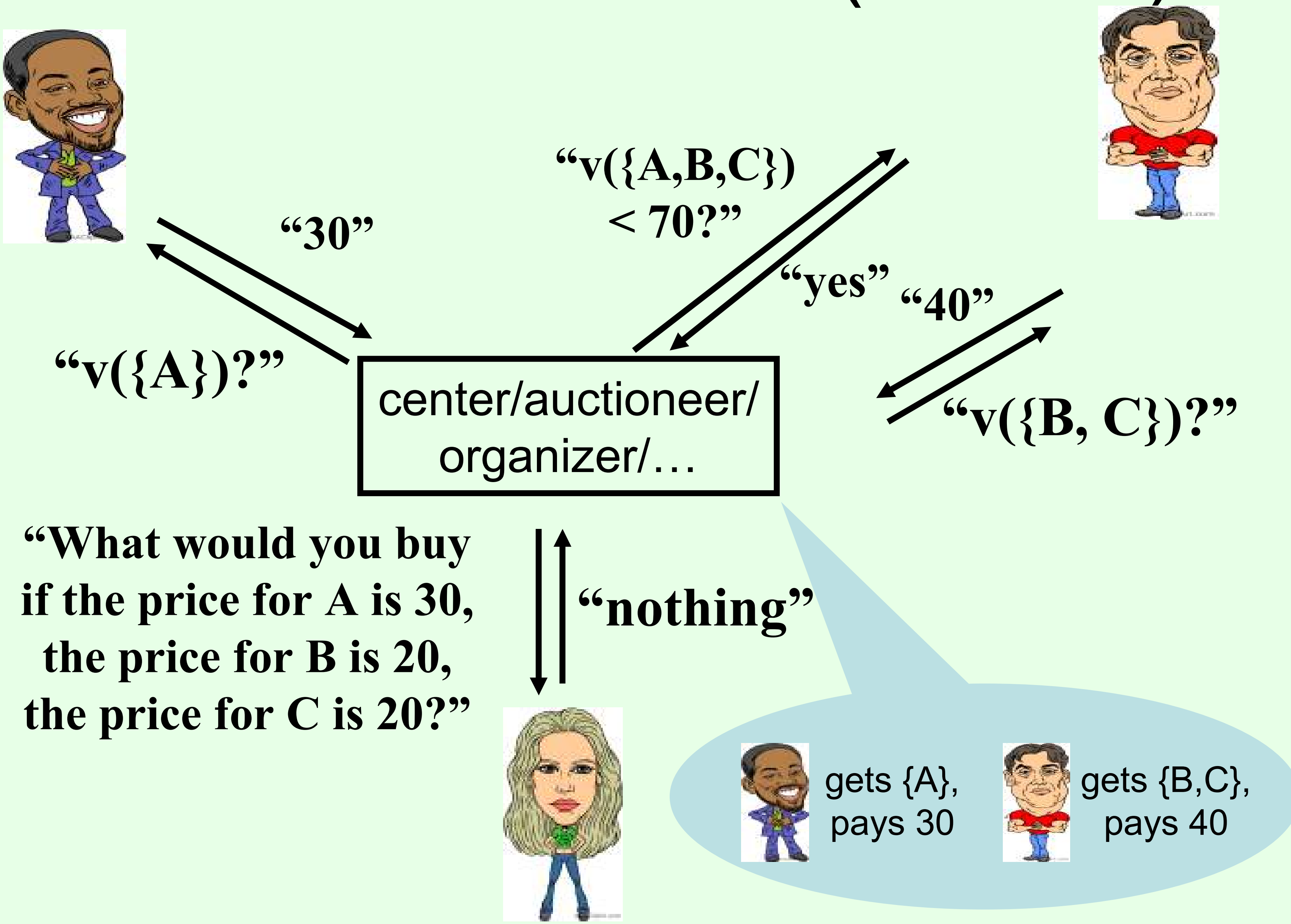
Preference elicitation (elections)



Preference elicitation (auction)



Benefits

- Less communication needed
- Agents do not always need to determine all of their preferences
  - Only where their preferences matter

Elicitation algorithms

- Suppose agents always answer truthfully
- Some elicitation algorithms will always choose the same winner as (say) the STV (instant runoff) rule
  - Elicitation algorithm for STV
- Design elicitation algorithm to minimize queries for given rule
- What is a good elicitation algorithm for STV?
- What about Bucklin?

An elicitation algorithm for the Bucklin voting rule based on binary search

[Conitzer & Sandholm 05]

- Alternatives: A B C D E F G H

• Top 4?	{A B C D}	{A B F G}	{A C E H}
• Top 2?	{A D}	{B F}	{C H}
• Top 3?	{A C D}	{B F G}	{C E H}

Total communication is nm + nm/2 + nm/4 + … ≤ 2nm bits

(n number of voters, m number of candidates)

iBundle: an ascending CA [Parkes & Ungar 00]

- Each round, each bidder i faces separate price $p_i(S)$ for each bundle S
  - Note: different bidders may face different prices for the same bundle
  - Prices start at 0
- A bidder (is assumed to) bid $p_i(S)$ on the bundle(s) S that maximize(s) her utility given the current prices, i.e. that maximize(s) $v_i(S) - p_i(S)$ (straightforward bidding)
  - Bidder drops out if all bundles would give negative utility
- Winner determination problem is solved with these bids
- If some (active) bidder i did not win anything, that bidder's prices are increased by ε on each of the bundles that she bid on (and supersets thereof), and we go to the next round
- Otherwise, we terminate with this allocation & these prices

Lower bounds on communication

- Communication complexity theory can be used to show lower bounds
  - "Any elicitation algorithm for rule r requires communication of at least N bits (in the worst case)"
- Voting [Conitzer & Sandholm 05]
  - Bucklin requires at least on the order of nm bits
  - STV requires at least on the order of n log m bits
    - Natural algorithm uses on the order of $n(\log m)^2$ bits
- Combinatorial auction winner determination requires exponentially many bits [Nisan & Segal 06]
  - … unless only a limited set of valuation functions is allowed