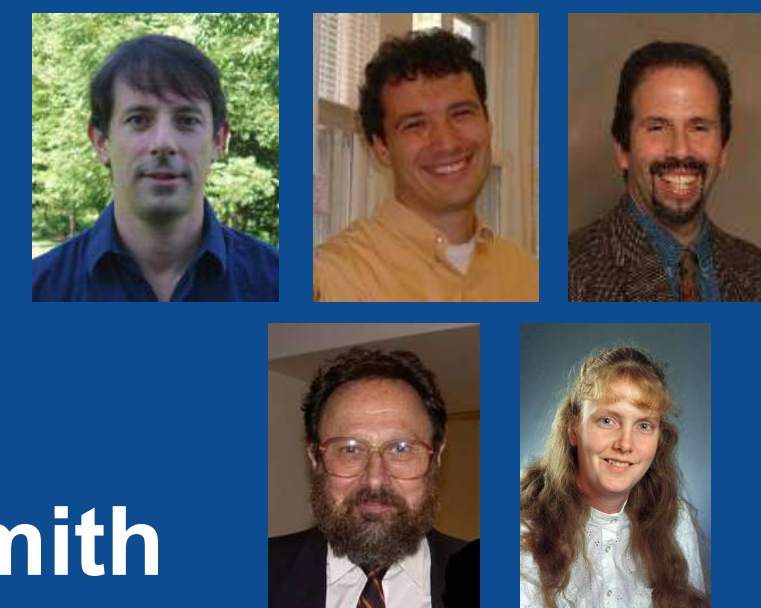


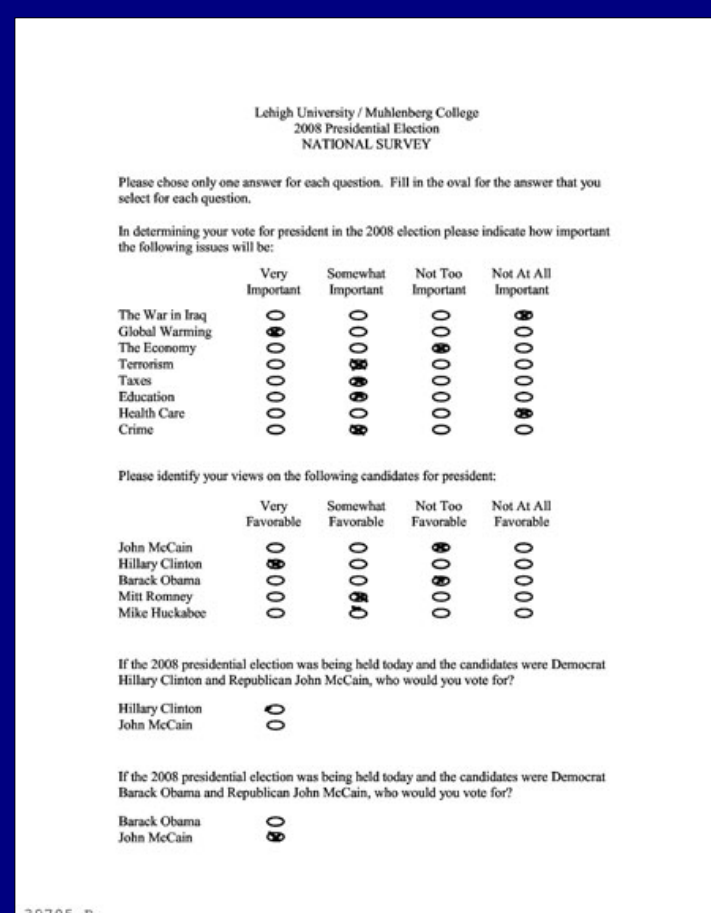
# Following the Paper Trail: Reliable Processing of Voting Records for Trustworthy Elections

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Paper, in the form of hand- or machine-marked ballots, can play a fundamental role in guaranteeing safe and secure elections. The processing of such records raises its own set of issues, however, which span broad technical and social boundaries. Our work is aimed at making paper less of a nuisance and more of an integral component in election systems.

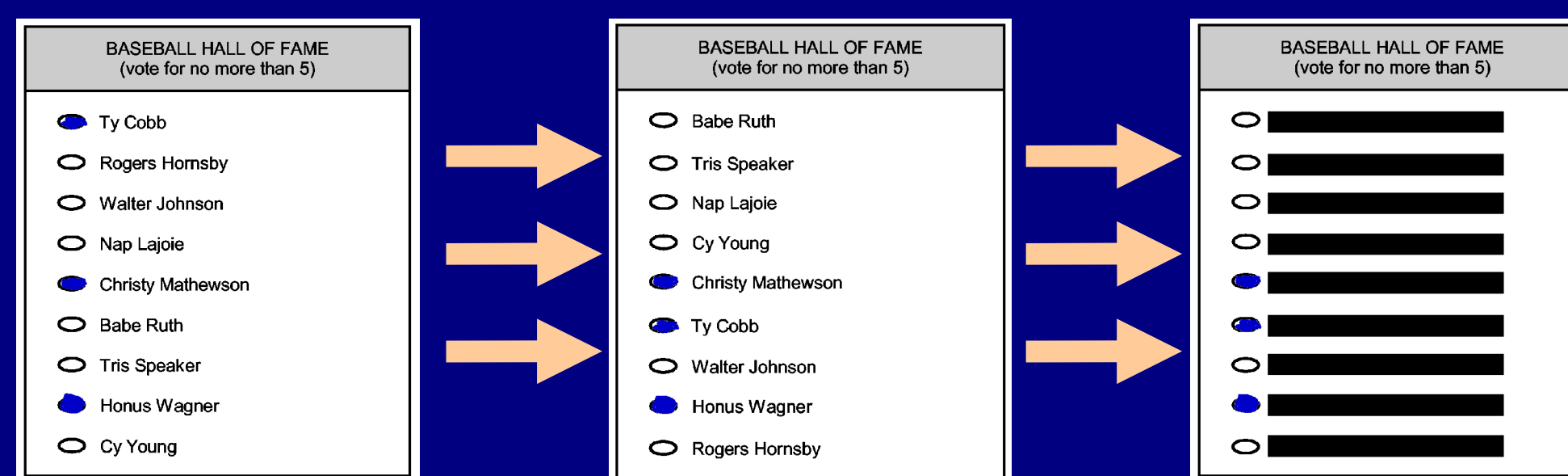
## User Studies



Simulated Lehigh-Muhlenberg 2008 Presidential Election survey. Synthesized using markings that are randomly chosen, placed, and distorted (some intentionally "marginal").

- Study human bias in hand recounts.
- Identify factors that affect voter trust.

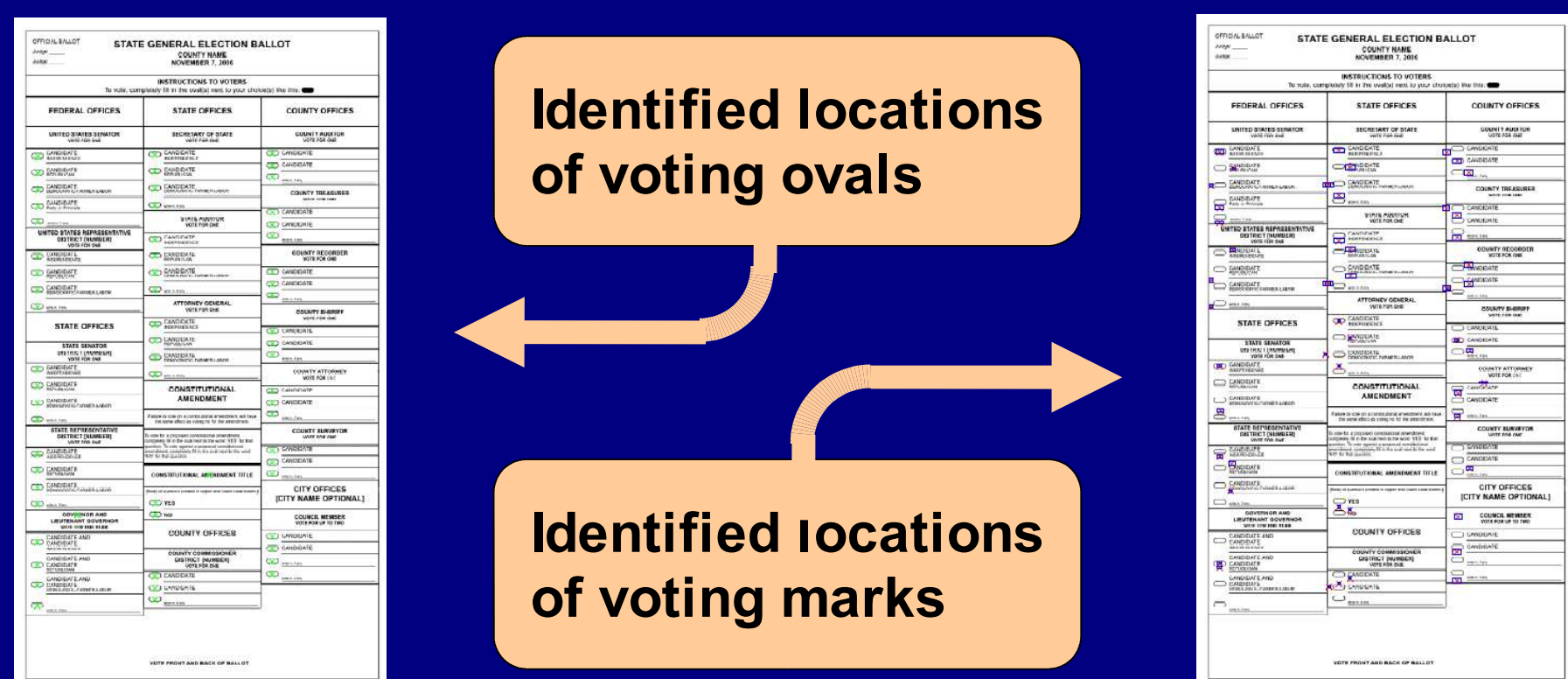
## "Blind" Auditing



*shuffle*      *redact*

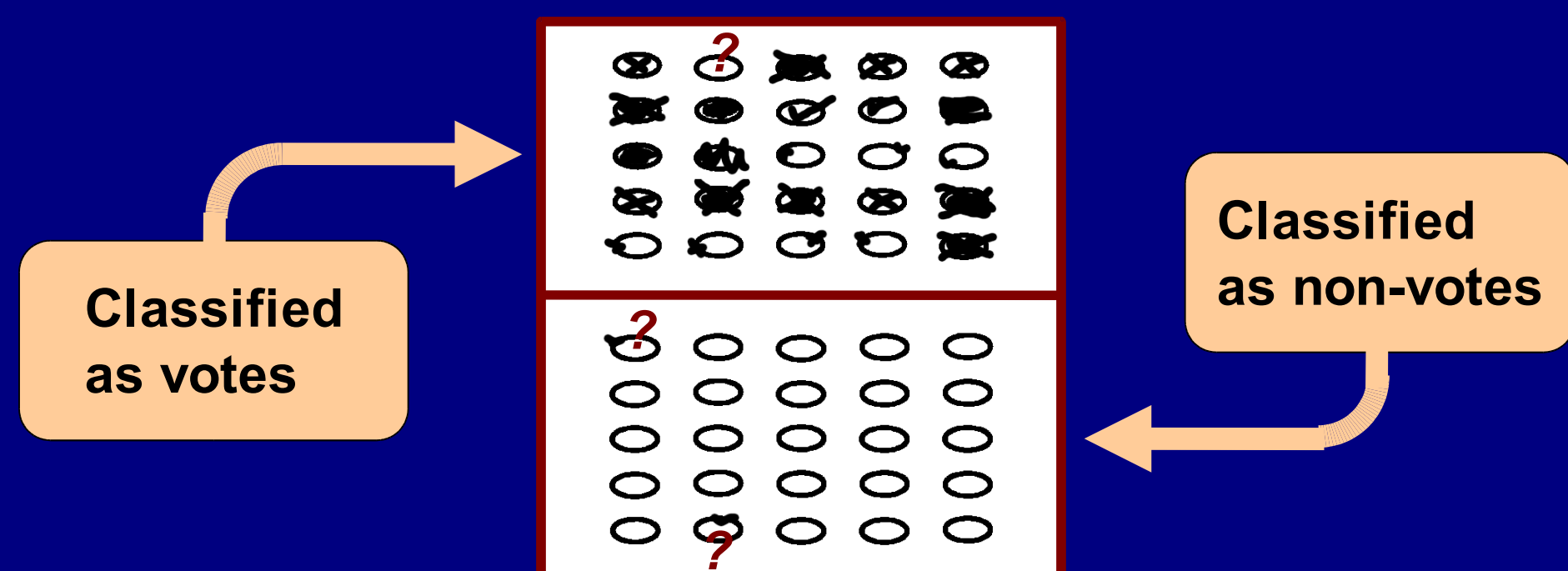
- Bias-free method for semi-automating hand recounts of op-scan ballots.

## Mark Characterization



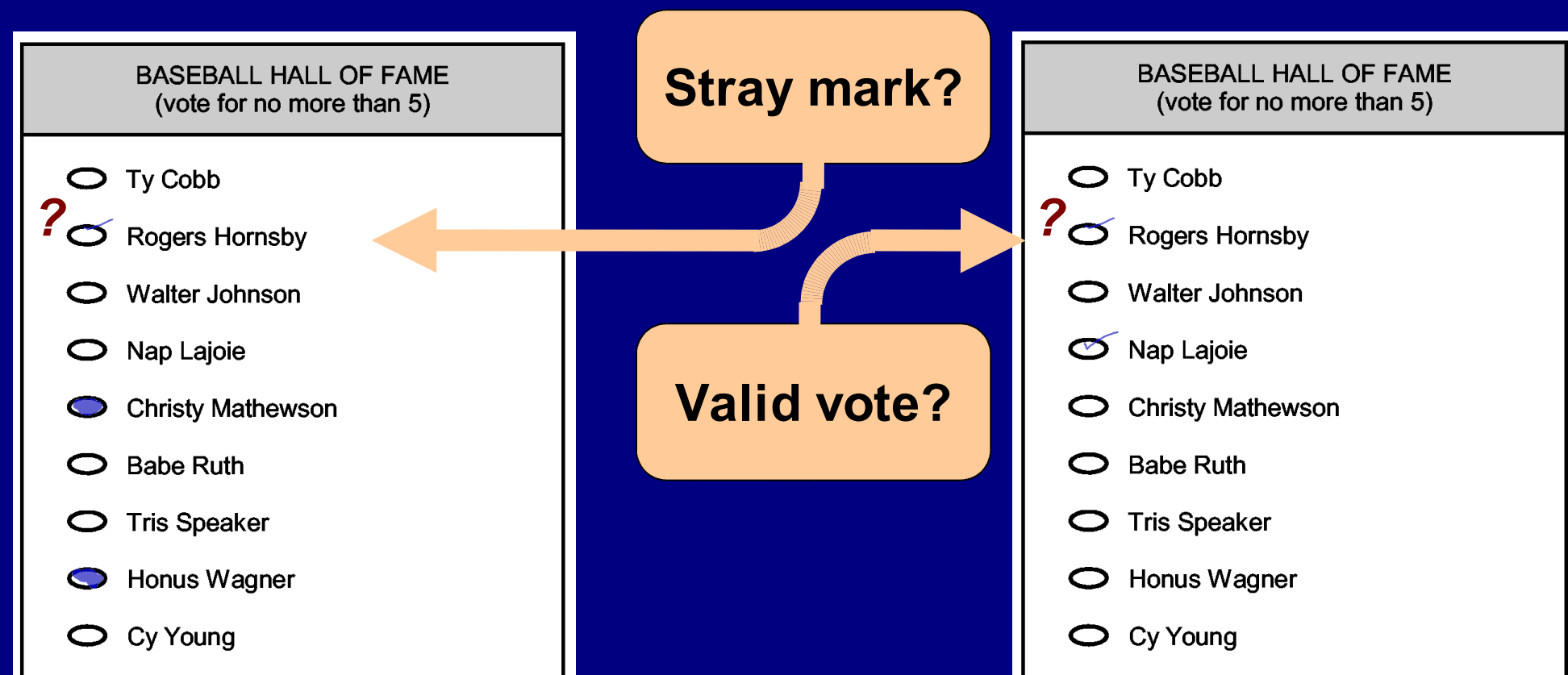
- Ballot mark characterization for consistent op-scan specification, testing, and certification.

## Homogeneous Class Display



- Marks grouped as "vote" or "non-vote" based on software classification.
- Makes it easier to identify anomalous results by quick inspection.

## Whole Ballot Recognition



- Voter intent is better modeled by evaluating all marks on same ballot together (context-sensitivity).

Any marking is potentially a valid vote. We are analyzing how mark shapes, sizes, and intensities inform the ability of automated systems to locate and identify marks as votes.

Creation of a public database of ballots (marked, classified, ground-truthed) is an essential part of our infrastructure effort.

**FROM A LEGAL STANDPOINT, VOTER INTENT IS KEY!**