Learning from polls

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Learning From Polls

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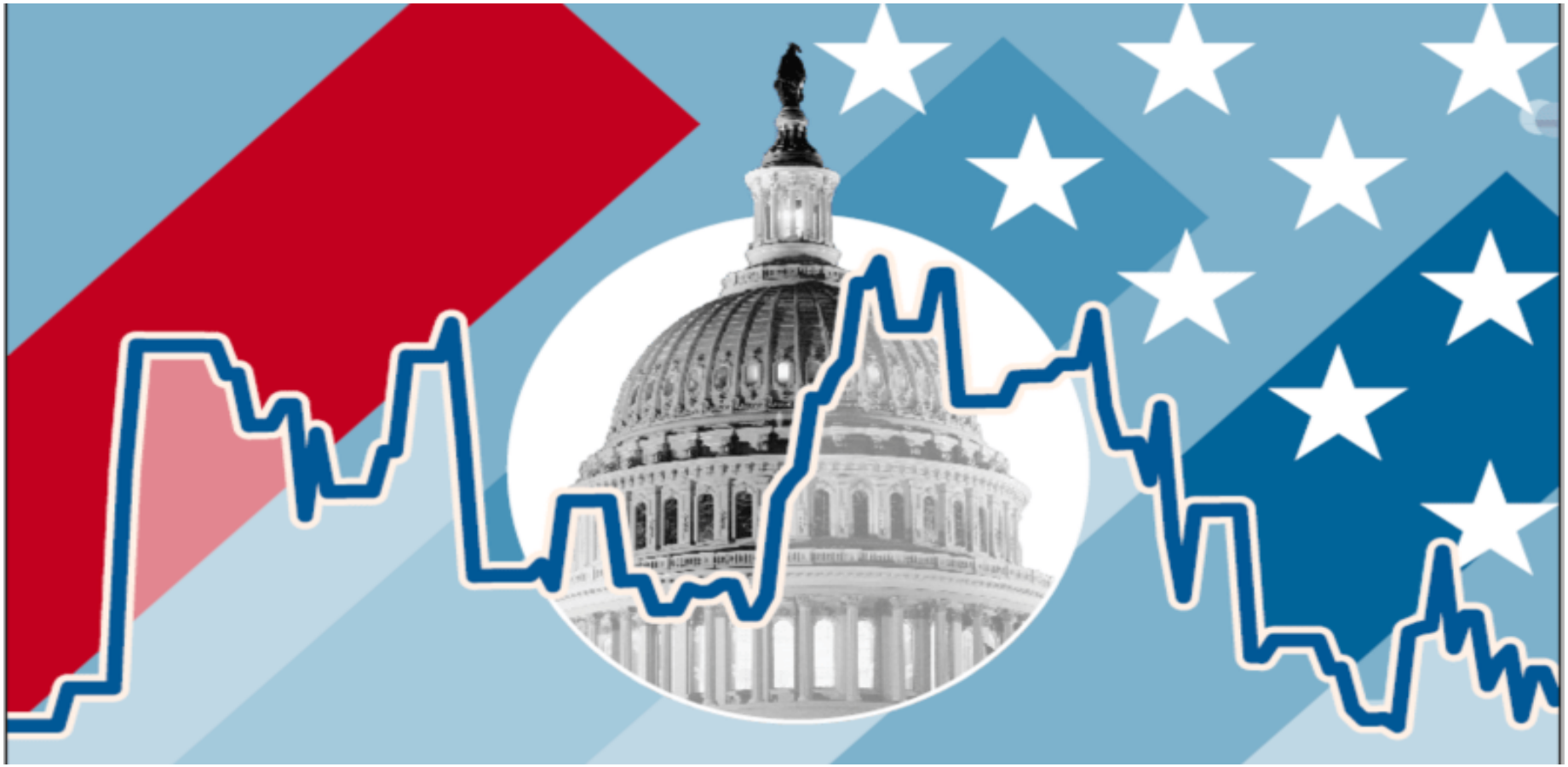
Election Polls in Democracy



Election Polls in Democracy

Research Question

How Do Citizens Learn From Polls?

Contribution

→ A Bayesian model of dynamic learning from polls.

- Formally define quantities of interest: Rate of adaption, perceived precision of the poll

→ Results from a experimental study

- Respondents update strongly to new poll results
- Respondents perceive polls twice as uncertain as sampling error
- Prior beliefs vanish over time

→ Application of experimental design to Partisan bias.

- Polls mediate initial partisan conformation bias over time

Beliefs and Change

- Bayesian Learning Model

$$\begin{aligned} p_i(\theta_t|y_t) &\propto p_i(y_t|\theta_t)p_i(\theta_t) \\ \mu_{it} &= \mathbb{E}[p_i(\theta_t|y_t)] \end{aligned}$$

- Rate of Adaption δ_{it}

$$\mu_{it} = \mu_{it-1} + \delta_{it}(y_t - \mu_{it-1})$$

- Subjective standard deviation of the poll

$$SD_i[y_t] = \sqrt{\mathbb{VAR}[p_i(y_t|\theta_t)]}.$$

Learning Model 1

Binomial Likelihood of poll outcome $(y_t \rho N_t)$, where ρ perceived sample size scale factor:

$$p(y_t \rho N_t | \theta_t) = \binom{\rho N_t}{y_t \rho N_t} \theta_t^{y_t \rho N_t} (1 - \theta_t)^{\rho N_t - y_t \rho N_t}$$

Beliefs (based on last posterior) are beta distributed and carry over depending on d:

$$p_i(\theta_t) = p_i(\theta_{t-1} | y_{t-1})^d,$$

If $d = 0$, prior is uniform.
If $d = 1$, prior in t is identical to posterior in $t - 1$.

Learning Model 2

$$p_i(\theta_t|y_t) = \frac{\Gamma(\alpha_{it}+\beta_{it})}{\Gamma(\alpha_{it})\Gamma(\beta_{it})}\theta_t^{\alpha_{it}-1}(1-\theta_t)^{\beta_{it}-1}$$

whereas beta-distributed beliefs are conjugate and yield:

$$\begin{aligned}\alpha_{it} &= d\alpha_{it-1} + y_t\rho N_t \\ \beta_{it} &= d\beta_{it-1} + (1-y_t)\rho N_t\end{aligned}$$

Interesting quantities

- Rate of Adaption depends on d and ρ

$$\delta_{it} = \frac{(y_t\alpha_{it-1} + y_t\beta_{it-1} - \alpha_{it-1})\rho N_t}{(y_t\alpha_{it-1} + y_t\beta_{it-1} - \alpha_{it-1})(d(\alpha_{it-1} + \beta_{it-1}) + \rho N_t)}. \quad (1)$$

  - If $d = 0 \rightarrow \delta_{it} = 1$
  - If $\rho N_t = 0 \rightarrow \delta_{it} = 0$

- Subjective standard deviation of the poll depends on ρ

$$SD[y_t] = \frac{1}{\sqrt{\rho}}\sqrt{\frac{y_t(1-y_t)}{N}} \quad (2)$$

Experiment: Overview

- Instill prior belief.

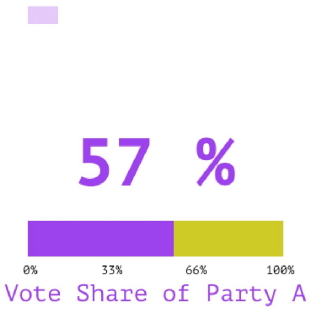
  $\rightarrow$ Elicit belief.
- Show poll 1.

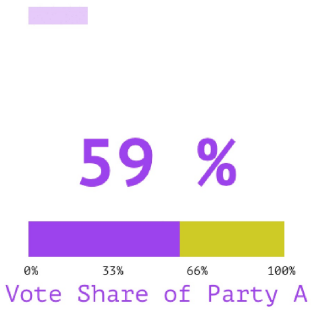
  $\rightarrow$ Elicit belief.
- Show poll 2.

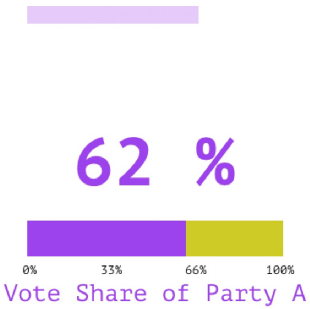
  $\rightarrow$ Elicit belief.
- Show poll 3.

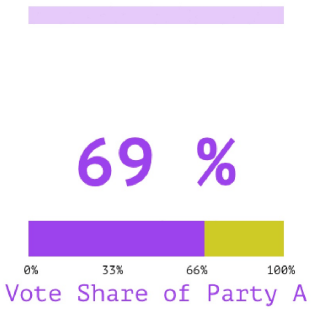
  $\rightarrow$ Elicit belief.

Setting Prior









Measuring Beliefs

Table: Manski Prior Elicitation

Question	Response
What is the most likely vote share of party A? Please give your response in percentage points.	b_i^m
What do you think is a likely range of the vote share that party A will receive? Please indicate the lower bound in percentage points.	b_i^l
Now, please indicate the upper bound in percentage points.	b_i^u
What is the probability that party A will get a vote share of less than b_i^l percent?	p_i^l
What is the probability that party A will get a vote share of more than b_i^u percent?	p_i^u

Poll Results

: Poll 1 : Poll 2 : Poll 3

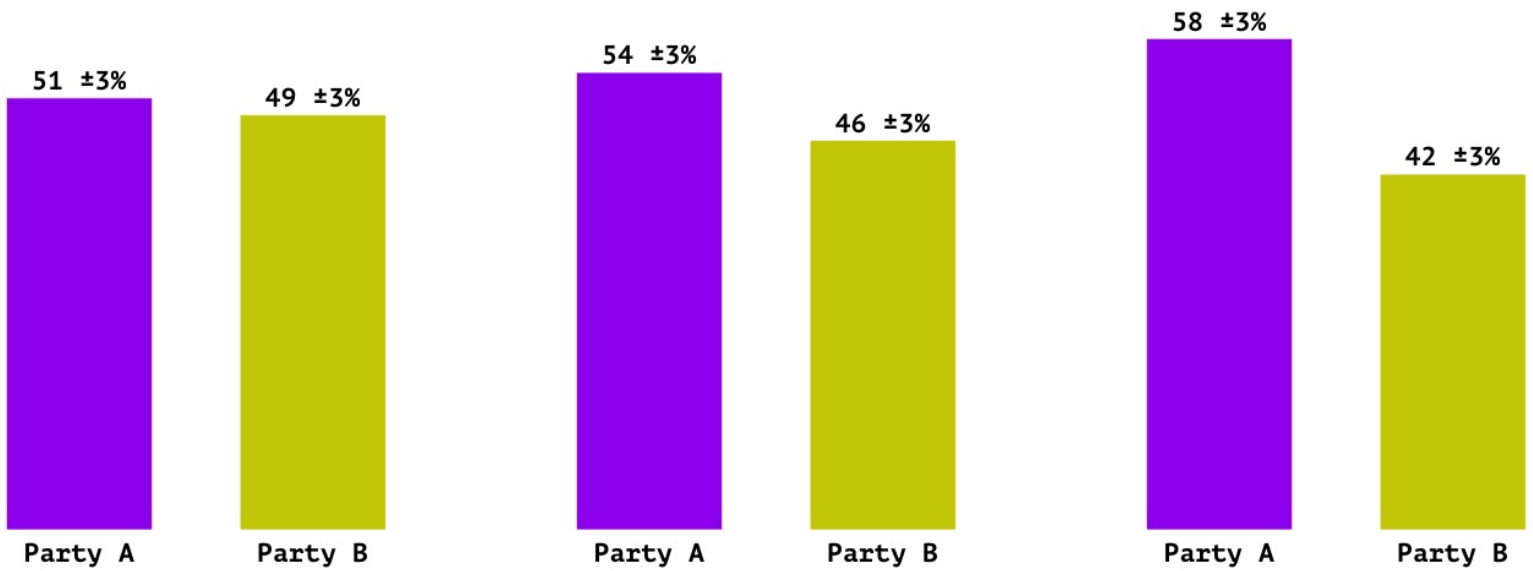


Figure: Screenshot the three possible information treatments. Respondents are presented with one plot with polling information in each round.

Descriptive Results Pilot Study

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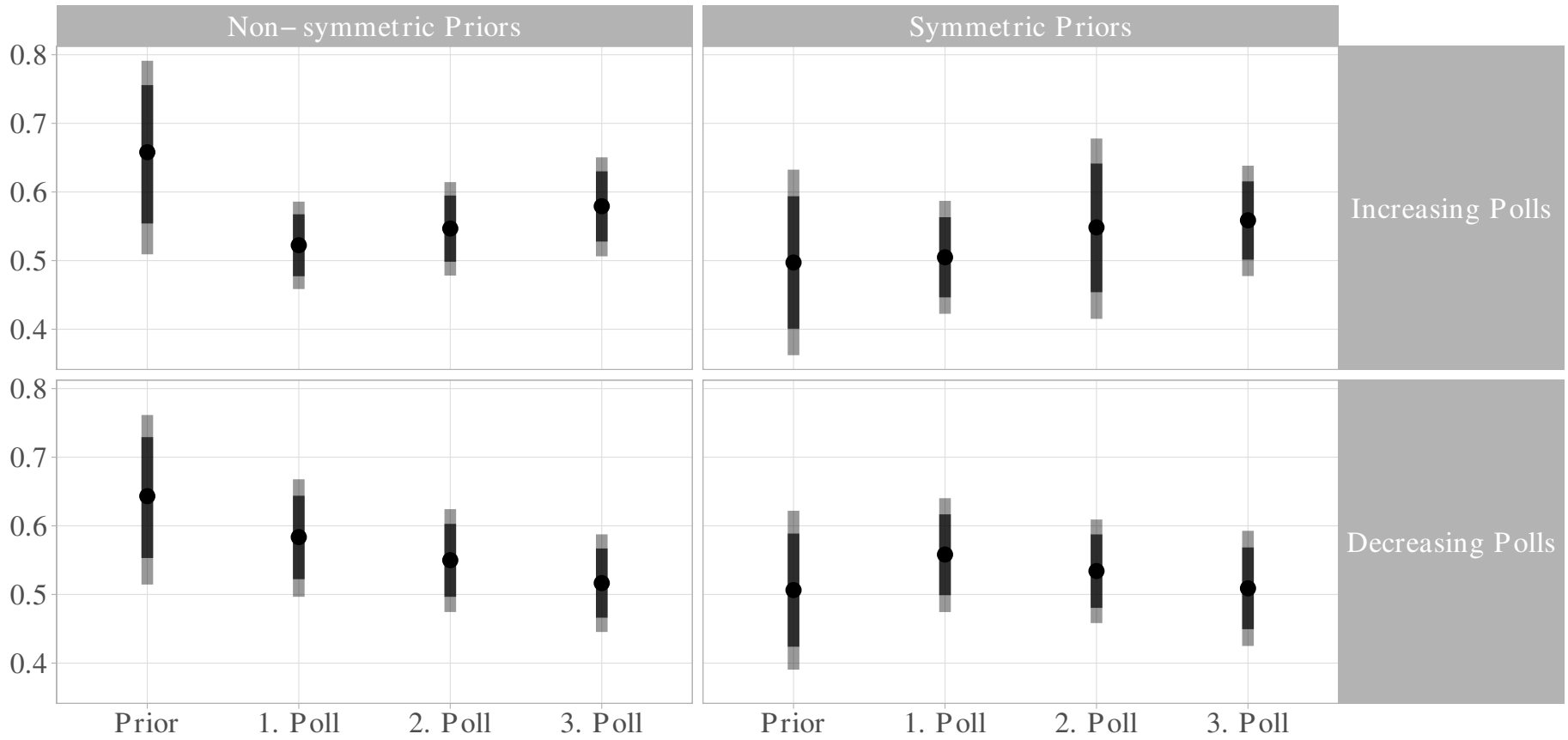


Learning Model – Pilot Study

Symmetry	Direction	α	β	d	ρ	σ
N.-sym. Priors	Inc. Polls	145.09	126.09	0.00	0.18	0.10
N.-sym. Priors	Dec. Polls	51.87	29.21	0.27	0.17	0.09
Sym. Priors	Inc. Polls	36.09	36.49	0.26	0.11	0.19
Sym. Priors	Dec Polls	62.79	61.44	0.22	0.14	0.09

Table: Results from paramteric learning model for different scenarios

- Rate of adaption around 0.85
- Standard Error of the Poll two to three times as large

Application to Partisian Bias

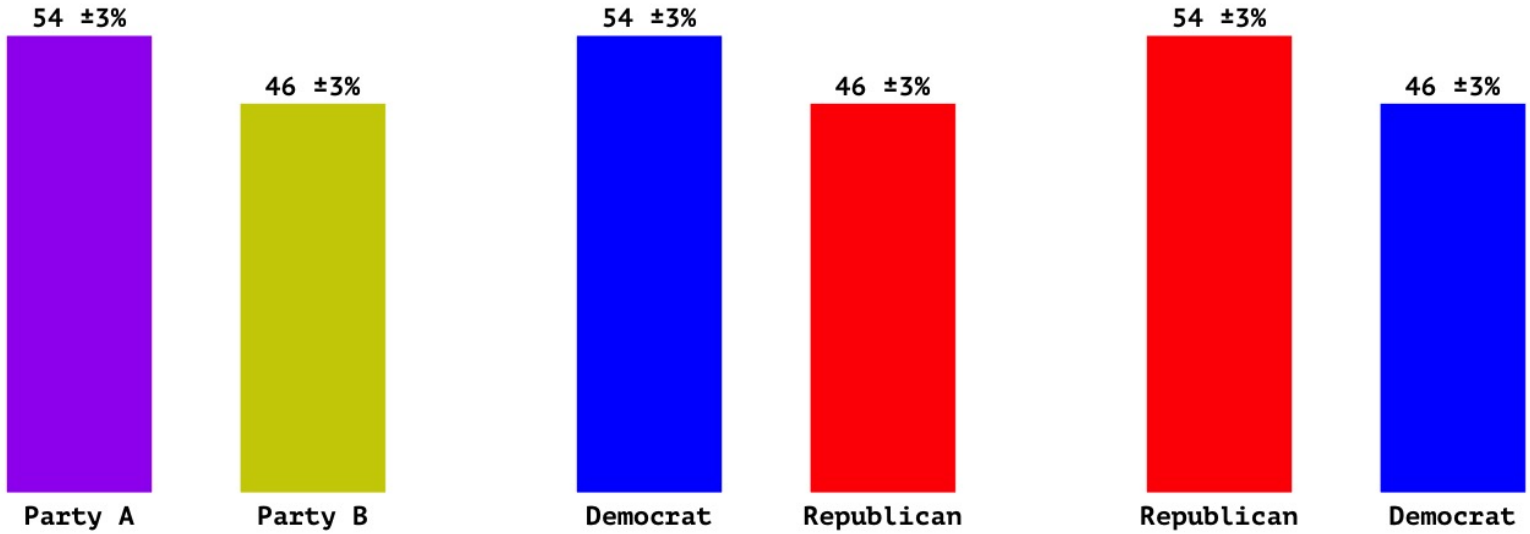
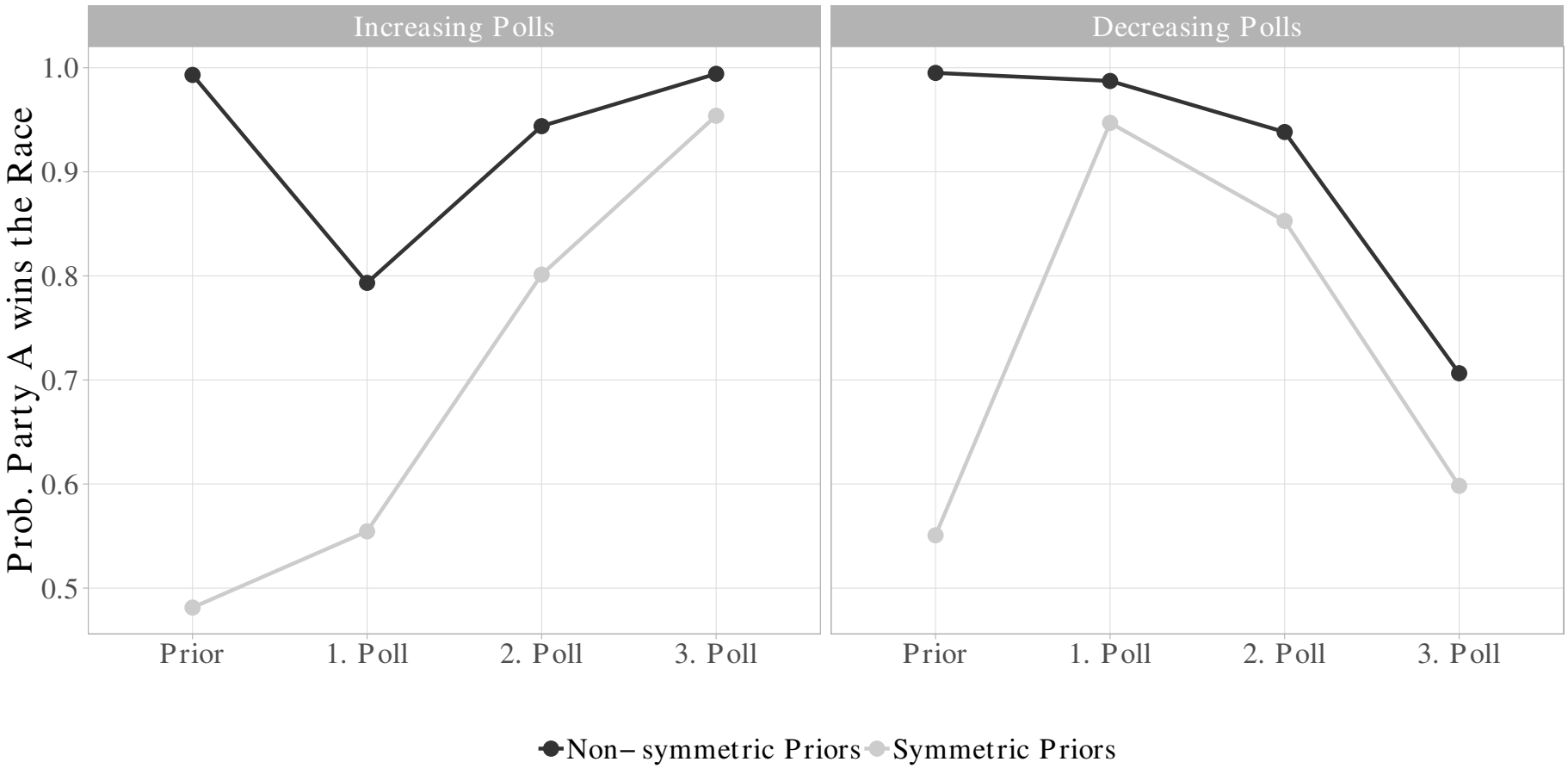


Figure: Screenshot the three possible frames (neutral, democratic, and republican visualization).

Conclusion

- Bayesian model of beliefs for vote shares.
- Discount rate (d) and sample inflation parameter (ρ) lead to a adaption rate (δ) .
- Q1: How do people perceive polling information?
- Q2: What are differential effects?
- Q3: How can one optimally communicate polling results?

Descriptive Results Pilot Study



Descriptive Results Pilot Study