US Count Votes

National Election Data Archive Project

Working Paper

This Paper is Undergoing Revisions & Additions

Patterns of Exit Poll Discrepancies

More On the Implausibility of a "Uniform" Bias Explanation for the 2004 Presidential Election Exit Poll Discrepancies

May 5, 2005

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US Count Votes thanks **Bruce O'Dell** - Partner, Digital Agility and USCountVotes, Vice President for contributing his programmed exit poll simulations results to this paper.

This paper can be found on the Internet at:

http://uscountvotes.org/ucvAnalysis/US/exit-polls/USCV_exit_poll_simulations.pdf

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Abstract

New evidence from mathematical simulations conclusively shows that any constant mean exit poll response bias hypothesis such as the "reluctant Bush responder" (rBr) hypothesis is not consistent with the pattern shown by the Edison/Mitofsky exit polling data. Other explanations are required to explain the Edison/Mitofsky pattern of exit poll discrepancies and overall response rates.

US Count Votes' simulations have demonstrated that exit poll patterns in the November 2004 presidential election could be produced by an exit poll response bias distribution with constant mean if accompanied by shifting of votes cast for Kerry to Bush; or alternatively, the patterns could be caused by a differential pattern of exit poll response bias that would require further explanation.

E/M hypothesized that the discrepancy between their exit poll results and the reported vote was due to different exit poll response rates by Kerry and Bush voters. However, US Count Votes' simulations show that no plausible Kerry and Bush response rate distributions with constant mean can (with any realistic chance) reproduce the distribution and values of the Edison/Mitofsky[1] data for mean "within precinct error" (WPE), median WPE, and overall response rates.[2]

US Count Votes has simulated a variety of exit poll response rate (Gaussian) distributions for Bush and Kerry voters and studied the resulting exit poll within precinct error distributions. The simulations thus far suggest that possible ways to reproduce patterns of mean and median WPEs, and overall response rates that resemble the distribution of the actual reported E-M exit poll data include:

voter exit poll response rate distributions with means that vary widely with the percentage of Bush and Kerry votes cast in precincts.

voter response rate distributions with constant mean like the rBr hypothesis, accompanied by vote shifts from Kerry to Bush.

Introduction

This paper continues the debate surrounding the discrepancies between the exit polls and the official election results in the November 2004 presidential election, and introduces new evidence that supports the hypothesis that a shift of votes cast for Kerry to Bush is consistent with these exit poll discrepancies.

Liddle recently published[3] a simulation-based analysis of exit poll errors which has been interpreted to suggest that response bias may be able to account for some aspects of Edison/Mitofsky's reported exit poll discrepancies. In order to fully understand Liddle's analysis and to provide additional tests of Edison-Mitofsky's reluctant Bush responder (rBr) hypothesis, US Count Votes reproduced Liddle's simulation model with simulations that can calculate mean and median WPE and response rates that would result from hypothetical Kerry and Bush exit poll response biases. In addition, US Count Votes created a simulation to show the effect on WPE of vote shifts from Kerry to Bush.

[1] "Evaluation of the Edison/Mitofsky Election System 2004" January 19, 2005 http://www.exit-poll.net/election-night/EvaluationJan192005.pdf

[2] See Appendices E through G for derivation of the equations used to simulate WPE that would be produced from the Kerry and Bush hypothesized response rates and the percentage of Kerry and Bush votes in precincts.

[3] See http://www.geocities.com/lizzielid/WPEpaper.pdf

Edison/Mitofsky proposed a hypothetical exit poll response rate for Kerry and Bush voters of 56% and 50% respectively to explain the exit poll discrepancies.[4] However, US Count Votes' simulations showed that (Gaussian) distributions of Kerry and Bush voter response rates with means of 56%/50% did not reproduce the patterns which are found in the E/M data for mean "within precinct error" (WPE), median WPE, and overall response rates.

Some aspects of E/M's data could be reproduced for *some* types of precincts, but overall we found that that no simulation of uniform, randomly distributed Kerry/Bush response rates can reproduce the overall distribution and values of the Edison/Mitofsky data for mean WPE, median WPE, and reported precinct response rates. The ten percent of E/M precincts that fell in the High-Kerry and High-Bush categories were especially difficult to reconcile. There is a risk that by ignoring it we may overlook the key to understanding the source of the exit poll discrepancy.

US Count Votes also simulated the effect of shifting votes cast for Kerry to Bush to determine the patterns of Mean WPE that might result from hypothetical vote embezzlement. Simulations are only used in the absence of detailed source data. Edison/Mitofsky could help us resolve the lingering questions about exit poll discrepancies by releasing the data to enable us to directly measure – rather than infer – precinct level variance between poll results and official vote tallies.

US Count Votes will publish the information needed to reproduce its two simulations on its web site http://electionarchive.org/ucvAnalysis/exit-polls

Pattern in Precincts Where Bush Vote Was Over 80%

In our March 31st paper we noted that the E/M reported mean and median WPE for precincts where the Bush vote was greater than 80% was -10% and -5.8% respectively. This implies that half of these 40 high Bush vote precincts had very large WPEs of at least -14.2%.[5].

US Count Votes could reproduce the E-M pattern in these precincts with a large difference between Kerry and Bush response rates – in some cases 40% or more, or by shifting votes from Kerry to Bush. USCV's vote shift simulator will be upgraded to account for the distribution of precincts.

The total number of these high-Bush vote precincts sampled is small – only 40 out of 1250 precincts in Edison/Mitofsky's sample. If votes were shifted from Kerry to Bush in the 415 precincts in the 60% to 80% Bush vote precincts, then some of these 60% to 80% precincts, with high mean WPEs would "shift" to the 80% to 100% group. Hence, mean WPE in the 80% to 100% Bush vote grouping is very sensitive to vote shifting due to its small number of precincts. i.e. Much greater increases in WPE would occur when votes are shifted from a larger number of precincts to a smaller number of precincts than vice versa.

Analysis of the Aggregate Edison/Mitofsky Data[7]

The Edison/Mitofsky report only provides summary statistics, not precinct-level data.

To analyze their data, one approach is to simulate precinct-level values whose summaries mimic the E/M reported results. For those simulations, one can specify a mean and standard deviation of

[4] E-M 2005 Exit Poll Report p. 31.
[5] USCV, April 2005, op. cit., p. 14. http://electionarchive.org/ucvAnalysis/US/Exit_Polls_2004_Edison-Mitofsky.pdf
[7] See Appendix E by Ron Baiman

possible voter response rates to assess the effect that such a bias is likely to have on the overall exit poll errors. One can also simulate the effect that systematic, but random vote shifts might have on the apparent exit poll errors.

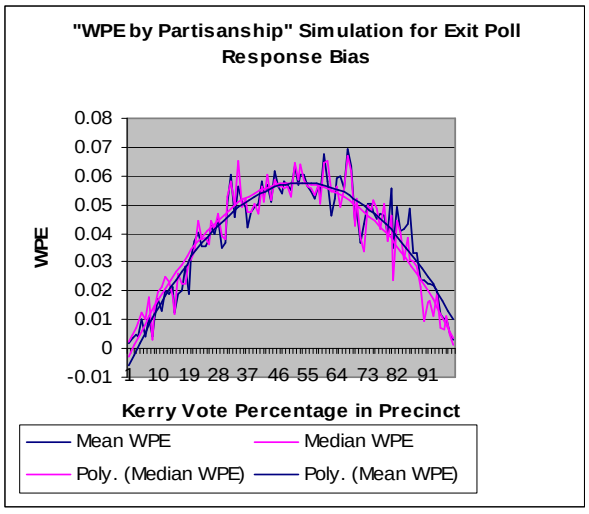
Another approach is to analyze the aggregate data. Means and medians are generally regarded as good descriptors of reasonably well behaved (approximately normally distributed) aggregate data like exit poll data. Simple parameters calculated from means and medians of aggregate data can be regarded as fairly good indicators of the mean and median values of the same parameters calculated from individual data points.

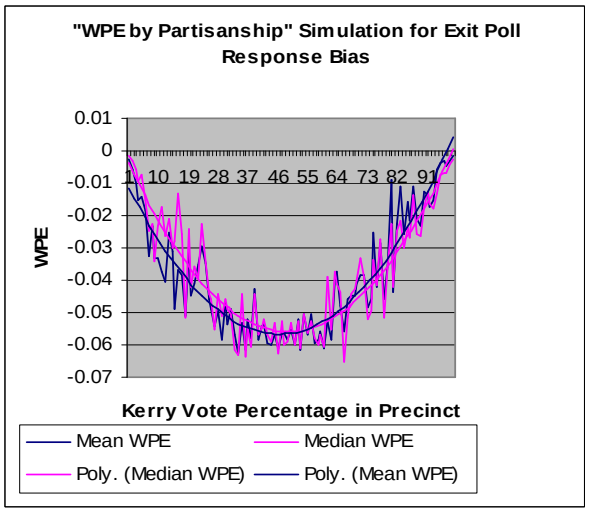
An analysis of the aggregated Edison/Mitofsky data (see Appendix E by Ron Baiman) suggests that it is highly improbable that the exit poll outcomes described in the E/M report are a result of a randomly distributed "exit poll bias" for Kerry and Bush voters, regardless of the mean response rates for Kerry or Bush voters.

The Signature of Exit Poll Bias[8]

Due to the algebraic properties of within precinct error (WPE)[9], any model of exit poll bias produces curves for WPE by partisanship with maximum WPE amounts where Bush and Kerry votes are closest to 50/50 and which goes to zero at the endpoints in both Bush and Kerry vote strongholds.

The curve on the left below shows the WPE pattern that would be expected if Kerry and Bush voters' overall mean exit poll response rates were 50% and 56% respectively, and the curve on the right shows the expected curve if K and B, Kerry and Bush mean response rates were reversed at 56% and 50% respectively. Positive WPEs (in the left chart below) result if the Bush voter response rates are higher than Kerry voters' response rates, and negative WPEs result if Kerry voters' response rates are higher (in the right chart below).



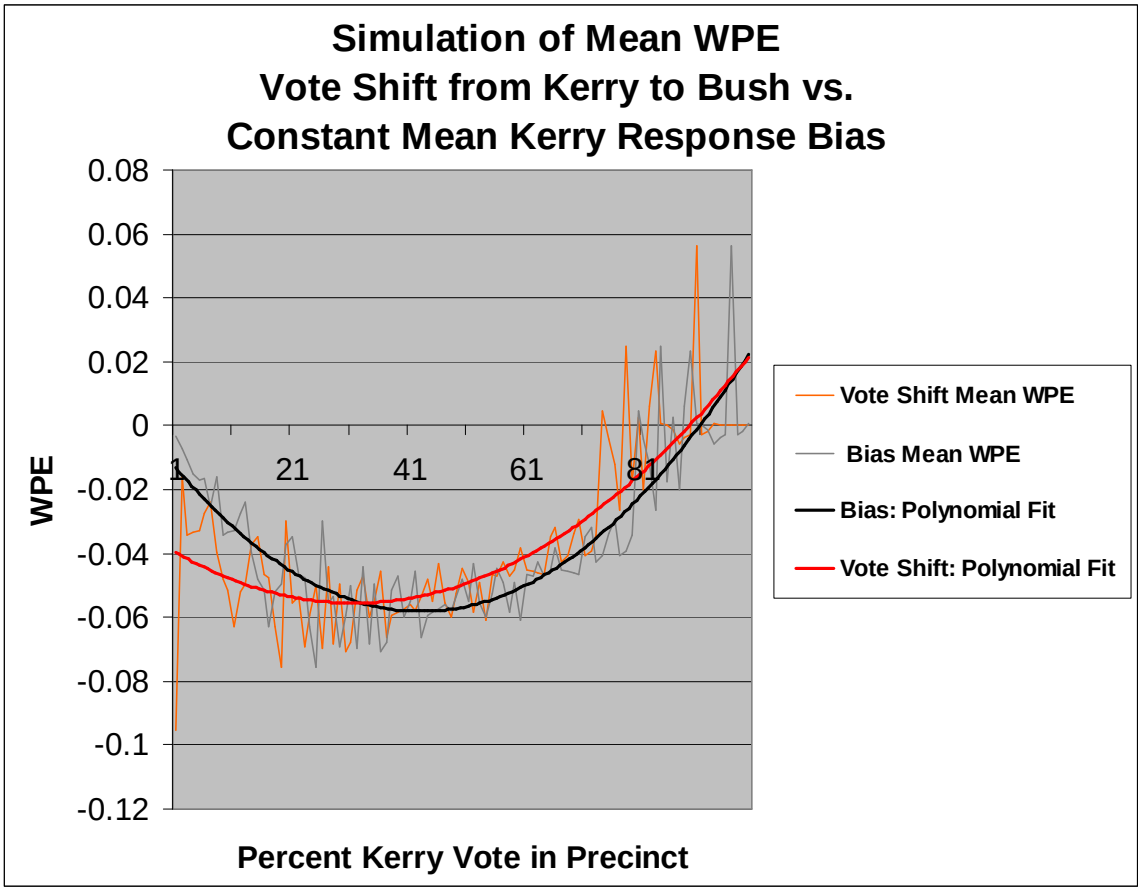


The actual simulated mean WPEs look jagged, and the smooth "poly" curves are the best fit curves to the simulated data.

[8] The charts in this section were created using USCV Dopp spreadsheet simulator.
[9] See Appendix B

The Signature of Vote Shifting[10]

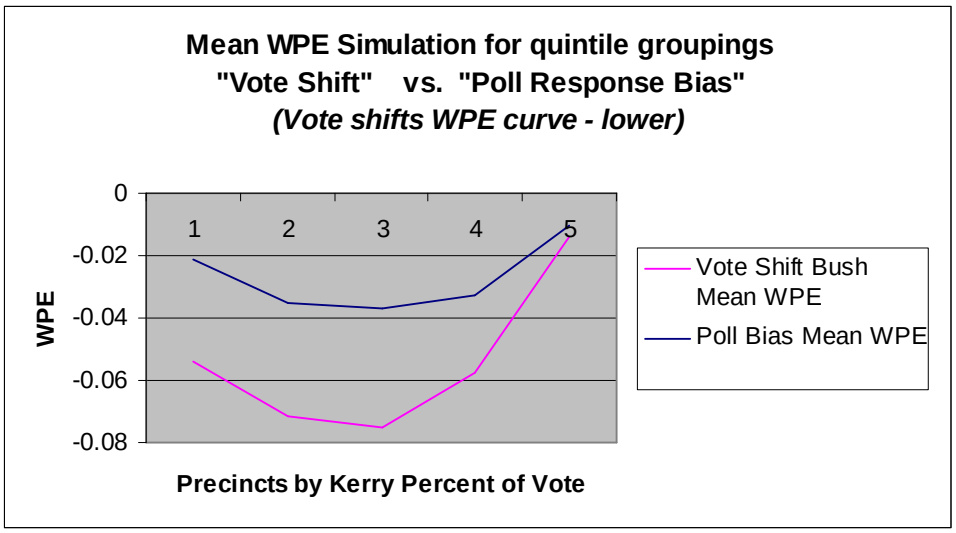
If votes cast for Kerry are shifted to Bush, then precincts where votes are shifted have larger proportions of Bush votes and smaller proportion of Kerry votes. Hence, a "vote shift" shifts the WPE curve left in the chart below (for mean K=56%, B= 50% with a 7% vote shift).



Notice that the WPE best fit curve representing "vote shift" goes to zero more quickly on the right (Kerry) side, and shows greater absolute WPE on the left (Bush) side, and that the actual simulated jagged data line has a large spike downwards in the highest Bush precincts. I.e. For high-Bush vote precincts a random vote shift amongst uniformly distributed precincts (assumed in the current simulation), generates a negative WPE anomaly on the far left (high Bush vote side) of the graph.

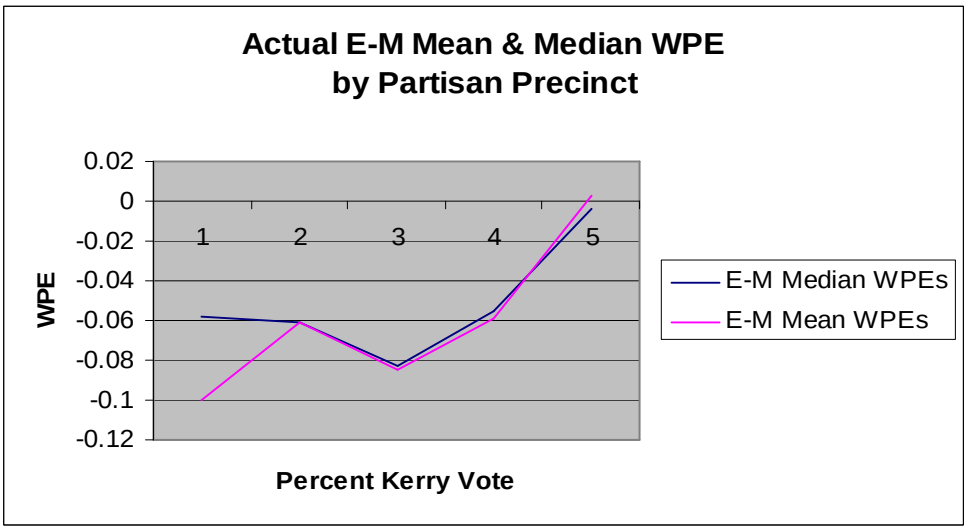
The current USCV "vote shift" simulation assumes a uniform distribution of precincts across partisanship precincts. The distribution of precincts significantly influences WPE patterns that vote shifts produce. For example, when values of mean WPEs from just a few precincts shift into a large number of precincts, it will have little effect. However, if values of mean WPEs from just a few precincts are shifted into a very small number of precincts, it will have a large effect on the mean WPE of the precinct group they are shifted into. USCV plans to refine its vote shift simulation to account for the distribution of precincts.

[10] The charts in this section were created using the USCV Dopp spreadsheet simulator.



The chart above shows the WPE pattern, aggregated into 20% groupings, that is caused by a response bias with means K=54% and B=50% (higher line), and the pattern (lower "vote shift" line) that results when mean values for K and B are K=54%, B=50% and an overall 7% of Kerry votes are shifted to Bush. [11]

The chart below shows the actual pattern of mean WPEs for the 20% groupings of precincts given by Edison/Mitofsky:

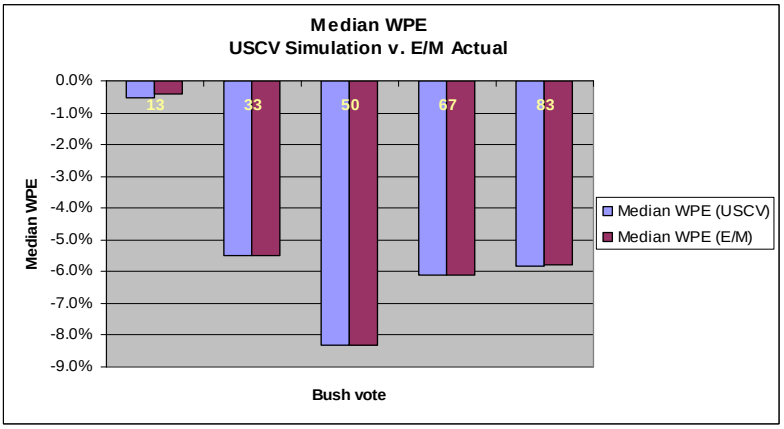


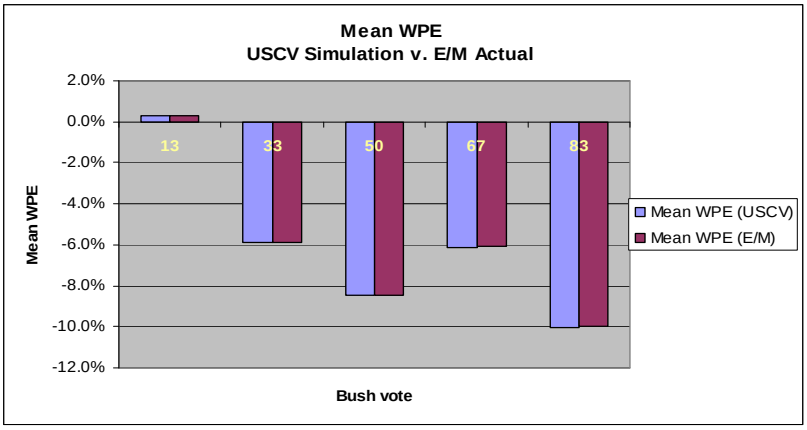
The unexpected sharp decline in the amount of WPE, to -10, in precincts with Bush vote percentages of over 80%, may be a marker that can distinguish vote count shifts from Kerry to Bush, from exit poll response bias alone. Notice how the "curves" produced by the actual Edison/Mitofsky data (above) resemble the pattern that is produced by a combination of exit poll response bias and a 7% overall vote shift from Kerry to Bush, assuming a uniform distribution of precincts. Smaller precinct groupings, like the 40 over 80% Bush vote precincts, are naturally more sensitive to vote shifts than the current USCV spreadsheet simulator version demonstrates.

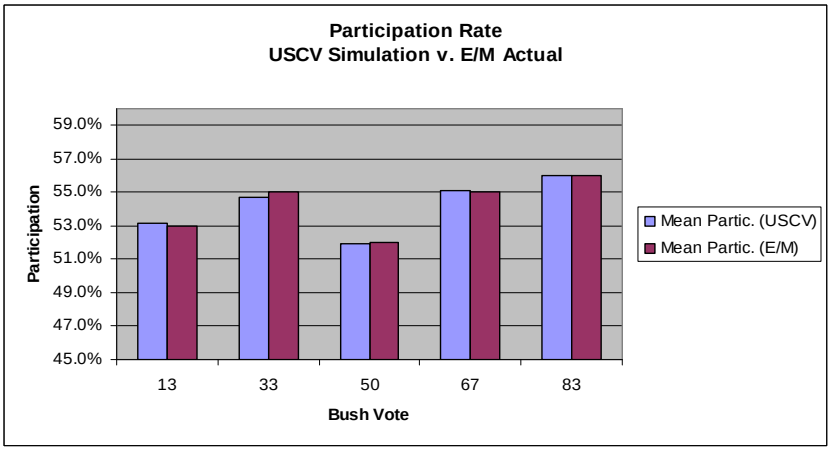
[11] The current vote simulator assumes a uniform distribution of precincts. It will be revised. The USCV spreadsheet simulation can be downloaded from http://uscountvotes.org/ucvAnalysis/US/exit-polls/

Differential Kerry and Bush Response Rates
Simulate the Actual Edison/Mitofsky Pattern of WPEs and Overall Response Rates[12]

As shown in US Count Votes' prior "Analysis of the 2004 Presidential Election Poll Discrepancies"[13], Kerry and Bush voter exit poll response rates must vary in implausible ways for the actual patterns of Edison/Mitofsky's exit poll data to occur. US Count Votes applied Liddle's response rate randomization (O'Dell Simulator) method to create a WPE simulator. The simulator was used to model a set of simulated precincts that can replicate Edison/Mitofsky's reported mean and median WPE and precinct participation data. As can be seen below, the O'Dell simulation very accurately reproduced E/M's actual mean WPE, median WPE, and overall participation rates.

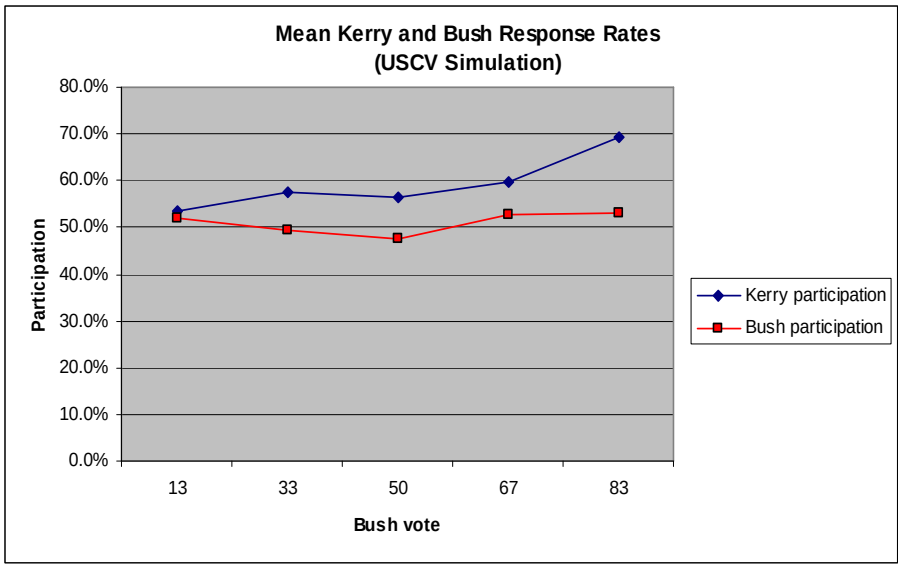






[12] The charts in this section were created using the O'Dell USCV simulator.
[13] http://electionarchive.org/ucvAnalysis/US/Exit_Polls_2004_Edison-Mitofsky.pdf

The following charts depict the simulated exit poll response rates required to produce the Edison/Mitofsky patterns of mean WPE, median WPE, and overall response rates. The mean exit poll response rates required to simultaneously match the three constraints of E/M's mean WPE, median WPE and participation rate are clearly not constant as a function of partisanship, especially in the High-Bush precincts.



US Count Votes' simulation of E/M's actual results under the Liddle randomization protocol confirms that the Kerry and Bush exit poll response rates must be non-uniform in order to match E/M's published numbers. These simulation results do not definitively rule out "uniform" bias, but they suggest that that uniform bias alone cannot explain these data.

See Appendix F for details of the O'Dell simulation. Source code will be made available on http://electionarchive.org

Conclusions

We remain concerned that massive electoral mistabulation may have occurred in 2004. Crucially, we also believe that the U.S. electoral system is vulnerable to massive fraud in the future.

Much work must be done to secure American democracy. We intend our continuing investigation of the 2004 election, including the construction of a national election data archive to contribute to that work. We welcome the efforts of all who share the goal of protecting and strengthening U.S. democratic processes, despite inevitable disagreements.

The persistence of credible hypotheses of election fraud, six months after the election, underscores the fragility of the U.S. electoral system. Our country can and must do better.

We are presently considering other tests that could help to discriminate between the “reluctant Bush responder” hypothesis and various mechanisms of vote fraud. This paper and USCV's simulators for determining the effects of exit poll bias and vote shift on WPEs are undergoing revisions.

Recommendations

Few procedures are more important to the strength and health of U.S. democracy than credible and transparent, fair and free, elections. We appeal to our fellow citizens, the media, our courts, and our elected officials, to implement:

- a thorough non-partisan investigation of the 2004 presidential election
- full funding of the National Election Data Archive precinct level database
- election equipment that permits access by non-specialist citizen election judges to recount voter verified paper ballots
- routine 3%, randomly selected, independent audits of all elections
- transparent and publicly accessible exit polling
- election administration by non-partisan public civil servants
- non-proprietary open-source coding for all computerized election equipment
- no wired or wireless network connections to any vote casting or counting equipment

Vote counts in America need to be routinely and independently audited. It is not enough to require voter verified paper records of ballots. These paper records must be easily and "independently" auditable by persons other than the voting machine vendor, preferably without having to hire computer technicians, paper roll advancers, bar code readers, and laptops, as is true with many voting systems on the market today.

In particular, 3% of randomly selected precincts can be recounted, using the paper record, immediately when polls close, in the precinct, before removing ballots from the precinct. If discrepancies are found, a county-wide recount can be automatically triggered. Additional funding may need to be allocated to state and county election offices to routinely perform independent audits of vote counts.

In order to audit their vote counts and monitor the accuracy of vote counting systems, all state and county election offices should set up election data reporting systems to quickly and easily make publicly available, their precinct-level vote totals, broken out by vote type (i.e. election day, absentee, overseas, provisional, early voting, etc.) If vote counts are not reported down to this detailed level, then padded votes in one vote type can easily "cancel out" under-votes in another type. In other words votes can be subtracted from one candidate in one vote type, while being added for another candidate in another vote type, yet these two problems, when added together, may look perfectly normal.

Edison/Mitofsky can materially improve collective understanding of the exit polls -- and whether they are evidence of vote fraud -- by a full release of the data with precinct identifiers and by conducting further tests on the exit poll data, including analysis of variables for voting method and size of place [urban vs. non-urban] to help resolve this issue.

We emphasize that our objective is to ensure that, if election fraud occurred, it never does again in the future.

The Future: How would a National Election Data Archive Protect Democracy?

If, for decades, we had never independently audited our financial institutions, we would expect to see ubiquitous insider embezzlement of monies. For decades now, we have counted the vast majority of U.S. votes via mechanical or electronic methods, yet there have never been any routine independent audits of vote counts.

US Count Votes is seeking funding to create the first-ever nation-wide database of precinct-level and vote-type election results in order to statistically audit U.S. vote counts to detect patterns that suggest the embezzlement of votes. To obtain all the needed election data in all its diverse forms from the over 33,000 separate election offices in America is a huge project. Full-time programming staff, statisticians, and administrative staff are needed. For somewhat less than one million dollars, the National Election Data Archive could assist all candidates of any party to determine whether or not their elections were accurately counted, and produce court-worthy evidence that is needed to obtain recounts, investigations, or possibly even re-elections.

The "National Election Data Archive" project is particularly important, given the fact that private exit pollsters could, in the future, elect to adjust exit poll data to conform to actual official election results and neglect to publicly release any "unadjusted" exit poll data.

The development of a "National Election Data Archive" would provide the public with all the data it needs to analyze vote counts within days of the November 2006 election. The technical implementation of well-developed and sound plans for such a system needs to begin very soon, in order to ensure by January 2007 and thereafter, that the candidates actually selected by the voters, are sworn into office. Our hope is that through careful analysis, we can develop the capacity to identify future vote count errors, whether fraudulent or inadvertent, in time to challenge the outcomes.

Appendix A: Voter Response Rate Calculations

Calculated Kerry and Bush voters' response rates required to reconcile Edison/Mitofsky's Precinct Partisanship data as given in Table 1.

We assume that there are no significant differences in precinct size between the various precinct groupings by partisanship. For any assumed percentage of Bush and Kerry voters within any partisanship precinct group, there exist equations where the unknowns are "the response rate for Bush voters" and "the response rate of Kerry voters" that have a single solution.

For Each Partisan Precinct Grouping we let

N	be the number of votes cast in each precinct grouping
n	be the number of voters in the exit poll sample where n = qN
q	be the overall sampling proportion for the precinct grouping
k	be the proportion of Kerry votes in the precinct grouping
b	be the proportion of Bush votes in the precinct grouping
K	be the proportion of Kerry voters in the sample who answer the exit poll. (Kerry voter response rate)
B	be the proportion of Bush voters in the sample who answer the exit poll (Bush voter response rate)
R	be the overall response rate within each sample i.e. the proportion of all voters in the sample who answered the exit poll surveys
E	be the mean WPE error for that precinct grouping
m	be the miss rate
$M = k - b$	be the margin difference in Bush and Kerry percentage votes
$w = K - B$	be the differential response rate of Kerry and Bush voters
$\alpha = \frac{K}{B}$	be the ratio of Kerry response rate to Bush response rate

First, we calculate Bush and Kerry response rates, K and B, as a proportion of the *sample*:

kn	is the number of Kerry voters in the sample
bn	is the number of Bush voters in the sample
kN	is the number of Kerry votes/voters in the precinct grouping
bN	is the number of Bush votes/voters in the precinct grouping

knK is the number of Kerry voters in the sample who responded to exit polls

bnB is the number of Bush voters in the sample who responded to the exit polls

Rn is the total number of voters who completed the exit poll in the precinct grouping

$\frac{knK}{Rn}$ and $\frac{nbB}{Rn}$ are the ratios of Kerry and Bush voters who responded to exit polls

$k - 0.5E$ is the ratio of Kerry voters who responded to exit polls given the WPE discrepancy

$b + 0.5E$ is the ratio of Bush voters who responded to exit polls given the WPE discrepancy

Note that $k + b = 1$ and $kK + bB = R$

So that,

$\frac{nkK}{Rn} = k - 0.5E$ and $\frac{nbB}{Rn} = b + 0.5E$

Solving for K and B we obtain:

Equation 1. $K = \frac{(k - 0.5E)R}{k}$ and $B = \frac{(b + 0.5E)R}{b}$

Appendix B: WPE and Differential Partisan Response

WPE is a poor measure of "differential response by party" since its magnitude is affected by the partisan composition of the precinct (k or b) and by the overall response rate (R), in addition to the relative response to exit pollsters by members of each party.[14] This can be seen by inspecting Tables 2-4 above. This is because, in addition to differential response by party, overall response rates and Bush/Kerry vote rates affect WPE

This can be seen by setting K = r - .5w and B = r +.5w, where $w = B - K$ is "differential response by party" and r is "mean response by party", and substituting these into the solutions for K and B in Equation 1. Appendix A, to get the following two equation system for r and w:

$$\frac{(k-0.5E)R}{k} = r - 0.5w \quad \text{and} \quad \frac{(b+0.5E)R}{b} = r + 0.5w$$

The solution of this system for w is:

$$w = \left(\frac{R}{b}\right)\left(\frac{E}{2} + b\right) + \left(\frac{R}{k}\right)\left(\frac{E}{2} - k\right)$$

so that when $b + k = 1$ as we assume in this report (neglecting the response of "independent voters" who made up 1% or so of the national electorate) we get:

Equation 3. $$w = \left(\frac{RE}{2}\right)\left(\frac{1}{b(1-b)}\right) = \left(\frac{RE}{2}\right)\left(\frac{1}{k(1-k)}\right)$$ or conversely

Equation 4. $$E = \left(\frac{2w}{R}\right)b(1-b) = \left(\frac{2w}{R}\right)k(1-k)$$

From equation 4, we see that E, or WPE, increases in size as the difference between the Bush and Kerry response rates, w, increases, and is largest when k or b goes to 0.5, and is smaller when the overall response rate, R, increases. Competitive precincts (when $b \to 0.5$ $k \to 0.5$) and precincts with lower overall response rates R, will have higher absolute WPE.

The difference in response rates between Kerry and Bush voters, w, will *not* be equal to E unless $\left(\frac{2}{R}\right)k(1-k) = \left(\frac{2}{R}\right)b(1-b) = 1$ for a perfectly competitive precinct $(b = k = 0.5)E = \left(\frac{0.5}{R}\right)w$, its maximum value. If, in addition, R = 0.5, then $E = w$.

This suggests that the WPEs listed in Tables 2-4 of our report substantially understate the differences between Bush and Kerry response rates, especially for high Bush precincts. As we have shown, w, the difference of Bush and Kerry voter exit poll response rates, has to be implausibly large in all cases, if WPEs are to be explained.

If there were a pervasive and more or less constant bias in exit polling because of a differential response by party, WPE should be greatest in absolute value for more balanced precincts and fall

[14] We thank Elizabeth Liddle, of the University of Nottingham, U.K., for calling our attention to the effect of precinct partisanship on the relationship between differential partisan response and WPE. We take full responsibility for the derivations and conclusions that we have arrived at from analyzing this pattern in this Appendix.

towards zero as precincts become more partisan. The data presented on p. 36, 37 of the E/M report and displayed in Table 1 of our report above, show that this is the pattern *for all except the most highly partisan Bush precincts for which WPE dramatically increases in size to -10.0%. The difference in Bush and Kerry exit poll response rates necessary to generate this level of WPE in these precincts ranges from 40% (Table 2) to an absolute minimum of 20.5% (Table 4).* This pattern of higher WPE in Bush strongholds could be caused by either "Bush Strongholds have More Vote-Corruption" (Bsvcc) or if enough votes were shifted from Kerry to Bush that it caused precincts from lower categories with higher WPE to shift into precinct categories with higher proportion of Bush votes.

Signed WPE versus Absolute WPE in Partisan Precincts

The mean absolute value WPE (unsigned WPE) for high Bush vote precincts *declines* to 12.4 % relative to lesser Bush vote precincts (having WPEs of 13.2% and 13.4%) and more balanced precincts (15.2%). Only highly partisan Kerry precincts have a lower mean absolute value WPE of 8.8%.[15]

Comparing this to the mean WPEs in Table 2 shows that:

a) High Kerry vote precincts had large absolute value WPE's (totaling 8.8%) but these included both pro-Kerry and pro-Bush discrepancies that off-set each other so that the average (signed) WPE was only 0.3%. Pro-Bush bias was almost offset by pro-Kerry bias in these precincts, as one would expect for random sampling bias and random measurement error.

b) Similar, but less balanced, patterns occurred in more evenly divided precincts where (signed) WPE, though consistently negative, was roughly half the magnitude of mean absolute value WPE (signed and unsigned values being -5.5 and 13.4, -8.3 and 15.2, -6.1 and 13.2, respectively). This suggests that in these precincts about half of pro-Kerry exit poll bias was offset by pro-Bush exit poll bias. While this is not what one would expect from random exit poll bias and measurement error, it at least moves in the expected direction.

c) The dramatic and unexpected increase in (signed) mean WPE in highly Bush precincts of -10.0% is also unexpectedly close to the mean absolute value WPE (12.4%) in these precincts. *This suggests that the jump in (signed) WPE in high Bush vote precincts occurred primarily because (signed) WPE discrepancies in these precincts were, unlike in a) above, and much more so than in b) above, overwhelmingly one-sided negative overstatements of Kerry's vote share.*

These results lend further support to the "Bush Strongholds have more Vote-Corruption" (Bsvcc) hypothesis[16] or alternatively this pattern could be produced by vote shifts to Bush in precincts that would normally fall into categories with fewer Bush vote percentages.

We would like Edison/Mitofsky to explain why signed WPE in highly partisan precincts is not lower than in less partisan precincts as would be mathematically expected, and why these patterns are at odds with the more or less random pattern of signed WPE error in highly Kerry precincts.

15 p. 36 of E/M report op. cit to E-M report URL in footnote 1.

[16] Discussed in http://electionarchive.org/ucvAnalysis/US/Exit_Polls_2004_Edison-Mitofsky.pdf, in our discussion of the " Implausible Patterns of Exit Poll Participation Are Required to Satisfy E/M's data in 80-100% Bush Precincts".

Appendix C: Exit Poll Response Bias Using the Ratio of Kerry and Bush Response Rates

Let $\alpha = \frac{K}{B}$, the ratio of Kerry voters' exit poll response rate to Bush voters' exit poll response rate

Using Equations 1. In Appendix A which gives the response rates for Kerry and Bush voters, K and B, in terms of the WPE, E, the percentages of Bush and Kerry votes, b and k, and the overall response rate R, we can calculate

$$\alpha = \left(\frac{K}{B}\right) = \frac{(k-0.5E)\left(\frac{R}{k}\right)}{(b+0.5E)\left(\frac{R}{b}\right)}$$ which reduces to

Equation 5. $$\alpha = \frac{b(k-0.5E)}{k(b+0.5E)}$$

The above equation gives a measure for exit poll partisanship response bias in terms of WPE and the percent of Kerry and Bush votes. [17] Taking the natural logarithm of Equation 5. produces a bias index that is symmetric around zero. i.e. 2 and 0.5 don't average out to 1, but ln 2 and ln 0.5 do average out to ln 1.

Equation 6. $$\log_e \alpha = \log\left(\frac{K}{B}\right) = \log_e\left[\frac{b(k-0.5E)}{k(b+0.5E)}\right]$$

Appendix D: WPE Error in Terms of Exit Poll Response Bias $\alpha = \frac{K}{B}$

Solving Equation 5. in Appendix C $\alpha = \frac{b(2k-E)}{k(2b+E)}$ for E, gives

Equation 7. $$\text{E} = \frac{2bk(1-\alpha)}{k\alpha + b}$$

This gives WPE error, E, in terms of the percentages of Bush and Kerry voters, k and b, and the response bias factor α.

[17] Note: The equations here are equivalent to those used by Liddle in her paper published on April 16, 2005 (see http://www.geocities.com/lizzielid/WPEpaperARCH.pdf). We disagree with Liddle's conclusions. However, we appreciate Liddle's work that pointed USCV towards the use of WPE simulations using Gaussian distributions for Kerry and Bush response rates. Adding this refinement to our modeling has enabled us to clearly show that the pattern of Edison/Mitofsky's data cannot be reproduced by an overall exit poll response bias.

Appendix E: Aggregate Analysis by Ron Baiman

Bias with Constant Mean Explanation for E-M Data is Highly Unlikely

Statistics such as means and medians are generally regarded as good descriptors of reasonably well behaved (approximately normally distributed) aggregate data like exit poll data. Simple parameters calculated from means and medians of aggregate data are regarded as fairly good indicators of the mean and median values of the same parameters calculated from individual data points.

The following table displays mean and median calculations for a "bias" or "Alpha" parameter (Alpha=K/B in our Appendix A notation) – see Liddle (previous citation). We have also included the values for B, K and w derived in our report (Table 2, Appendix A, Appendix B notation).

As can be seen from this table, it is highly unlikely that the actual mean and median of Alpha, calculated from precinct level data, would be equal across categories of precincts.

Table 1

Precinct Vote			Mean Based Calculations					Median Based Calculations				
Bush	Kerry	R	Mean WPE	B	K	Alpha	w	Median WPE	B	K	Alpha	w
0.1	0.9	0.53	0.3%	53.8%	52.9%	0.984	0.9%	-0.4%	51.9%	52.9%	1.019	-1.0%
0.3	0.7	0.55	-5.9%	49.6%	57.3%	1.156	-7.7%	-5.5%	50.0%	57.3%	1.147	-7.4%
0.5	0.5	0.52	-8.5%	47.6%	56.4%	1.186	-8.8%	-8.3%	47.7%	56.4%	1.183	-8.7%
0.7	0.3	0.55	-6.1%	52.6%	60.6%	1.152	-8.0%	-6.1%	52.6%	60.6%	1.152	-8.0%
0.9	0.1	0.56	-10.0%	52.9%	84.0%	1.588	-31.1%	-5.8%	54.2%	84.0%	1.550	-29.8%

The following Table 2 (calculated from means) shows that a fixed "Alpha" will allow for some WPE asymmetry across precincts. However, a level of Alpha (1.15) will generate the roughly 6.5% overall WPE reported by E/M, this "ratio" effect is hardly enough to account for the highly asymmetric differences in WPE by precinct partisanship displayed in Table 1. The "ratio effect" is a purely mathematical result of linking a *ratio* of percentages (Alpha) to a *difference* in percentages (WPE).

Table 2

Partisan "Bias" with Alpha=1.15 and varying R
Based on E=2bk(1-alpha)/(k*alpha + b)
w=R(b+E/2)/b - R(k-E/2)/k and r=R(k-E/2)/2k + R(b+E/2)/2b

Bush	Kerry	Alpha	R	r	w	WPE	B	K
0.1	0.9	1.15	53%	50.20%	-7.0%	-2.4%	46.7%	53.7%
0.3	0.7	1.15	55%	53.51%	-7.5%	-5.7%	49.8%	57.2%
0.5	0.5	1.15	52%	52.00%	-7.3%	-7.0%	48.4%	55.6%
0.7	0.3	1.15	55%	56.58%	-7.9%	-6.0%	52.6%	60.5%
0.9	0.1	1.15	56%	59.31%	-8.3%	-2.7%	55.2%	63.4%

Table 3, below, calculated from means, shows that a constant "partisan response differential" w = K – B (see Appendix B) does *not* generate asymmetric WPE by precinct partisanship.

Both Tables 2 and 3 show that the most important effect of either a fixed "Alpha" or a fixed "w" on WPE is to greatly reduce WPE in highly partisan precincts in direct contradiction to the large increase in mean WPE, and small decline in median WPE, in 90% Bush precincts in Table 1.

Table 3

Alpha and WPE with w = -6.5% and Varying R
Based on r = R - w(1-k)/w + wk/2 from Appendix B

Bush	Kerry	w	R	r	B	K	WPE	Alpha
0.1	0.9	-6.5%	53%	50.4%	47.2%	53.7%	-2.3%	1.138
0.3	0.7	-6.5%	55%	53.7%	50.5%	57.0%	-5.5%	1.129
0.5	0.5	-6.5%	52%	52.0%	48.8%	55.3%	-6.5%	1.133
0.7	0.3	-6.5%	55%	56.3%	53.1%	59.6%	-5.5%	1.123
0.9	0.1	-6.5%	56%	58.6%	55.4%	61.9%	-2.3%	1.117

Finally, we estimated mean and median overall response rates (R) necessary to obtain the E/M reported mean and median WPE outcomes under the E/M (and Liddle hypothesis) of a constant 50% exit poll participation by Bush voters (B = .50) and 56% participation by Kerry voters (K = .56) so that Alpha is constant at 1.12 (Alpha = K/B = .56/.50 = 1.12).

The results are shown in Table 4 below (with partisanship shares adjusted to match the USCV simulation experiments – see below).

Table 4

Overall Response Rate with B=.50, K=.56, Alpha=1.12, and E/M Reported WPE Values
Based on R = (4bkr(1-alpha))/(E(1-alpha)) and r = (B+K)/2

Bush	Kerry	B	K	Alpha	r	Mean WPE	R from Mean	Median WPE	R from Median
0.17	0.83	50.0%	56.0%	1.12	53.0%	0.3%	-564.4%	-0.4%	423.3%
0.33	0.67	50.0%	56.0%	1.12	53.0%	-5.9%	45.0%	-5.5%	48.2%
0.5	0.5	50.0%	56.0%	1.12	53.0%	-8.5%	35.3%	-8.3%	36.1%
0.67	0.33	50.0%	56.0%	1.12	53.0%	-6.1%	43.5%	-6.1%	43.5%
0.83	0.17	50.0%	56.0%	1.12	53.0%	-10.0%	16.9%	-5.8%	29.2%

As can be seen from this table the results for the high Kerry precincts are *mathematically impossible* as they would require overall response rates of over 100% and a negative overall response rate of over 100% for the calculation from means.

Though, the results for the high Bush districts are not mathematically impossible, they are *highly implausible* as they would require very large declines in overall response in these particular precincts relative to all other categories of precincts.

Liddle (p. 18) and E/M (p. 37) claim that the difference in overall response rates between categories of precincts is not, or may not, be statistically significant. However, these estimates suggest that it would have to be much *higher* in high Kerry precincts and significantly *lower* in high Bush precincts, if the uniform bias hypothesis were true. As we have pointed out in our earlier report (USCV, 2005), the E/M reported overall response rates (R) in Table 1 show the *opposite* pattern.

These tables all indicate that it is highly improbable that the exit poll outcomes described in the E/M report are a result of a randomly distributed "bias" that has a uniform mean and median, and a declining, or even flat, overall response rate, across categories of precinct partisanship.

Appendix F: O'Dell's USCV Simulation Methodology and Results

1) We defined five simulated precinct sets corresponding to E/M's classifications: 90 precincts with Bush vote <= 20%, 165 precincts with Bush vote between 20 and 40%, 540 precincts with Bush vote between 40 and 60%, 415 precincts with Bush vote between 60 and 80%, and 40 precincts with Bush vote >= 80%.

2) We estimated the mean actual Bush vote for each range, using values similar to our original Appendix B's estimate of 13%, 33%, 50%, 67% and 83% (a little lower than the original 87%, but corresponding to the median Bush vote in separate analysis).

3) We use the Liddle (2005) randomization method, generating independent pesudo-Gaussian distributions of exit poll response rates for both Bush and for Kerry voters, centered on 50%, plus or minus 25%. The simulation accepts an exit poll participation bias parameter for either Bush or Kerry voters which moves the mean of the participation curve to the right or to the left of 50%, independently for either candidate. We ran the simulator repeatedly, adjusting both positive and negative participation bias percentages for both Bush and Kerry voters, until we were able to reproduce E/M's reported mean and median WPE. In a few cases we randomly "tweaked" a few individual precinct participation rates, as necessary, to reproduce Median WPE but without unduly disturbing the overall "pseudo-randomness" of the simulation output.

4) We then adjusted the overall poll participation numbers for Bush and Kerry voters by a constant factor to match the precinct response rates which can be done easily without changing mean and median WPE.

Bush vote	Bias	alpha	Mean WPE	Median WPE	Mean Kerry Particip-ation	Mean Bush Particip-ation	Min Kerry Partic.	Max Kerry Partic.	Min Bush Partic.	Max Mush Partic.	Particip-ation	E/M Mean WPE	E/M Median WPE	E/M Particip-ation
Simulation 1														
13	1.3%	1.0759	0.3%	-0.5%	53.3%	52.1%	30.8%	76.9%	20.9%	76.0%	53.2%	0.3%	-0.4%	53.0%
33	7.9%	1.2071	-5.9%	-5.5%	57.3%	49.4%	36.1%	79.3%	20.3%	71.9%	54.7%	-5.9%	-5.5%	55.0%
50	8.6%	1.2342	-8.5%	-8.3%	56.3%	47.6%	33.2%	79.6%	24.7%	70.6%	51.9%	-8.5%	-8.3%	52.0%
67	6.7%	1.1802	-6.1%	-6.1%	59.6%	52.9%	33.5%	84.8%	27.5%	78.2%	55.1%	-6.1%	-6.1%	55.0%
83	16.2%	1.4366	-10.0%	-5.8%	69.4%	53.3%	40.0%	96.2%	24.3%	81.8%	56.0%	-10.0%	-5.8%	56.0%
Simulation 2														
13	1.3%	1.0759	0.3%	-0.5%	53.3%	52.1%	30.8%	76.9%	20.9%	76.0%	53.2%	0.3%	-0.4%	53.0%
33	7.9%	1.2071	-5.9%	-5.5%	57.3%	49.4%	36.1%	79.3%	20.3%	71.9%	54.7%	-5.9%	-5.5%	55.0%
50	8.6%	1.2342	-8.5%	-8.3%	56.3%	47.6%	33.2%	79.6%	24.7%	70.6%	51.9%	-8.5%	-8.3%	52.0%
67	6.7%	1.1802	-6.1%	-6.1%	59.6%	52.9%	33.5%	84.8%	27.5%	78.2%	55.1%	-6.1%	-6.1%	55.0%
83	17.8%	1.4059	-10.0%	-5.8%	70.7%	53.0%	50.4%	93.7%	30.5%	72.3%	56.0%	-10.0%	-5.8%	56.0%

By its very nature, there are many potential “response randomization” simulation results which can accurately reproduce E/M’s reported data. We observe that while the individual simulated precincts’ data elements vary for each simulation run, the aggregated values of mean and median WPE and computed Bush and Kerry response rates are similar.

Appendix G: Overview of Simulation Methodology

USCVs simulator, written by Bruce O'Dell is a "Monte Carlo" Simulator. This simulator is closely based on Liddle's approach, and can reproduce its results. It is a "Monte Carlo" Simulator because it uses random numbers to simulate the essence of what happens in the field during an exit poll. The detailed specification of the USCV Monte Carlo Simulator may be found in Appendix A.

This Monte Carlo simulator attempts to model only the essence of how an exit poll might be conducted in the real world. It assumes that in some precincts, Bush supporters will be more likely to participate, and that in others, Kerry supporters will be more likely to participate. It models this uncertainty formally by establishing a range of possible response rates. The default range for each candidate's supporters is between 25% and 75%, with a mean participation rate of 50%. This is a reasonable range, since E/M reported participation rates around 50% for all types of precinct, and with a reasonable standard deviation, a range of plus or minus 25% should cover most common variations. Liddle and USCV use a "Gaussian" distribution of response rates which ensures that the balance between simulated response rates near the mean and at the extremes occurs in a well-known pattern frequently encountered in statistics.

To simulate WPE, we must first assign an actual Bush and Kerry vote count. For simplicity's sake, Liddle uses just nine precinct types, with a simulated actual vote of Bush=10% and Kerry=90%; then Bush =20%, Kerry=80%; and so on, until Bush = 90% and Kerry=10%.

Within each category of precincts, we randomly select an exit poll response rate for Kerry and for Bush voters, each from a different range of numbers. The ranges can be independently adjusted to simulate a number of different response bias scenarios. These four numbers – actual Kerry vote, actual Bush vote, simulated Kerry response rate and simulated Bush response rate – are all we need to calculate WPE. We repeat this calculation many times for each simulated precinct type to aggregate WPE in a way that resembles what happens in the field.

Liddle's simulation included 1,000,000 iterations for each precinct type. We compared the values for 10,000 iterations with 100,000 iterations and with Liddle's 1,000,000 iterations and found no significant differences. For the USCV simulator, we run 10,000 iterations for each precinct type and save every simulated result to a file to enable the raw data to be imported into Excel for further analysis.

The alpha values required to simultaneously match the three constraints of E/M's mean WPE, median WPE and participation rate are clearly non-uniform as a function of partisanship, as are the corresponding Kerry response bias percentages: especially so in the High-Bush precincts.

In our simulations of High-Republican precincts, we found that it takes a cluster of extremely negative WPEs to reproduce the divergence between E/M's observed Mean and Median WPE values. In fact, in order to also simultaneously match the observed 56% participation rate constraint in High-Bush precincts, both Bush and Kerry mean participation rates are elevated. Some required Kerry voter exit poll participation rates are extremely high; as you can see, in some cases 40 to 60% higher than the corresponding Bush participation rates in the same precinct.

Though the charts are all based on simulation 1, there are comparable results in simulation run 2 (see Appendix). Although the clusters of highly-negative WPE precincts in the two simulations have different characteristics, note that mean alpha is quite comparable (1.41 and 1.44).

Moreover, another set of simulation results that were run using a constant alpha of .13 (corresponding to E/M suggested "uniform Kerry bias" of +6.5%) generated precinct participation rates which were at their highest in High-Kerry precincts and lowest for High Bush precincts - just the opposite of what E/M reports. In fact, the uniform Kerry bias of +6.5% (alpha = 1.13) requires High Kerry precinct participation to be almost 6.5% higher than High Bush precinct participation; this seems to rule out uniform bias, since E/M's data shows roughly flat or even slightly increasing response rates with increasing Bush vote.

Details of O'Dell's USCV Monte Carlo Simulator

1) For the simulation of Kerry + 6.5%, Liddle (and our simulator) used nine sets of official vote counts (Bush = 10% to Bush = 90%, step 10%). Call those "plateaus". For Kerry +6.5%, Liddle used 1 million iterations per plateau; USCV used 10,000 or 100,000 (it made little difference).

For the simulation of E/M's actual data we defined five simulated precinct sets corresponding to E/M's classifications: 90 precincts with Bush vote <= 20%, 165 precincts with Bush vote between 20 and 40%, 540 precincts with Bush vote between 40 and 60%, 415 precincts with Bush vote between 60 and 80%, and 40 precincts with Bush vote >= 80%.

2) We estimated the mean actual Bush vote for each plateau, using values similar to our original Appendix B's estimate of 13%, 33%, 50%, 67% and 83% (a little lower than the original 87%, but corresponding to the median Bush vote in separate analysis).

3) We used Liddle's randomization method, generating independent pseudo-Gaussian distributions of exit poll response rates for both Bush and for Kerry voters, centered on 50%, plus or minus 25%. The formula is: *participation rate = (rnd() + rnd())/4 + .25*

The O'Dell simulator accepts an exit poll participation bias parameter for either Bush or Kerry voters, which moves the mean of the participation curve to the right or to the left of 50%, independently for either candidate.

4) For each simulated plateau:

4.0) For each simulated precinct:

4.1) Call a function that returns the Kerry poll participation rate (between .25 and .75, mean .5, pseudo-Gaussian distribution). Call this the Kerry participation rate.

4.2) If a Kerry supporter exit poll participation bias is specified (e.g. Kerry +6.5% , we add that to the Kerry participation rate. That has the effect of uniformly shifting the pseudo-Gaussian distribution from between .25 and .75 to between .315 and .815.

4.3) Call a function that returns the Bush poll participation rate (between .25 and .75, mean .5, also pseudo-Gaussian).

(4.4) If there is a percentage poll participation bias for Bush, apply that. That bias will shift the

Bush distribution left if negative and right if positive.

(4.5) Calculate alpha = (Number of Kerry poll participants/Number of Kerry Voters)/(Number of Bush poll participants/Number of Bush voters)

(4.6) Calculate WPE using Liddle's formula, based on alpha and actual Kerry vote.

(4.7) Write all the variables to a file for later analysis

(4.8) Select the next precinct, and when done with all simulated precincts

(5) Select the next plateau, and when all plateaus are simulated, the simulation is complete.

USCV "Bias and Fraud" Spreadsheet Simulator

USCV's spreadsheet simulator, created by USCV President, Kathy Dopp, uses the equations 5 and 7, from Appendix C above.

$\alpha = \left(\frac{K}{B} \right)$ E = $\frac{2bk(1-\alpha)}{k\alpha + b}$. Given any mean values for K and B (Kerry and Bush exit poll response rates) and any k and b (proportion of Kerry and Bush votes), it generates 100 simulated values for K and B for each percent change of partisanship vote rates k and b (Kerry and Bush vote count percentages) and calculates the corresponding WPE (E). Then it redraws the graphical representations for the distributions of Mean and Median WPEs and overall Response Rates R. It also calculates the expected curve for the given combination of exit poll bias and a fixed vote shift from Kerry to Bush. Probability calculations are performed with each 100 simulations for obtaining the same pattern as Edison-Mitofsky data within the tolerances set by the user.

We generated a Gaussian distribution for Kerry response rates, and another Gaussian distribution for Bush votes, with mean values and standard deviations that the user can set by typing them into the first worksheet of the spreadsheet simulation. From the simulated values for K and B, and the proportions of Bush and Kerry voters in each precinct, we determine the resulting WPEs for each simulation, and plot them in charts so that folks can visually see the change in the patterns. Also, we allow people to vary the standard deviations of the Gaussian distributions, and the tolerances for matching the E-M data. (which never happens with any reasonable tolerances.)

Make sure to set the spreadsheet to calculate manually. The spreadsheet is very large and takes a lot of memory, because it has so many formulas in it. If memory were not limited, the formulas could be copied down and the number of simulations it performs can be increased from 101 to approximately 50,000.

The "vote shift" simulation is new and not refined yet. It assumes a uniform distribution of precincts. In actuality, vote shift patterns are highly affected by the distribution of precincts within partisanship precinct groupings.

The USCV Dopp spreadsheet Exit Poll Simulator can be found at:
http://uscountvotes.org/ucvAnalysis/US/exit-polls/

Appendix H: USCV Dopp Simulator Shows that E-M Reported Outcomes are Infeasible

The Dopp simulator, created by USCV President Kathy Dopp, uses equations 5 and 7, from Appendix C above.

$\alpha = \left(\frac{K}{B}\right)$ $\quad$ $E = \frac{2bk(1-\alpha)}{k\alpha + b}$. Given any mean values for K and B (Kerry and Bush exit poll response rates), it generates 100 simulated values for K and B for each percent change of partisanship vote rates k and b (Kerry and Bush vote count percentages) and calculates the corresponding WPE (E). Then it redraws the graphical representations for the distributions of Mean and Median WPEs and overall Response Rates R. It also calculates the expected curve for the given combination of exit poll bias and a fixed vote shift from Kerry to Bush. Probability calculations are performed with each 100 simulations for obtaining the same pattern as Edison-Mitofsky data within the tolerances set by the user.

The USCV Dopp Simulator can be found at: http://uscountvotes.org/ucvAnalysis/US/exit-polls/

Dopp Simulation Shows that E/M Reported Outcomes are Infeasible

In Table 5 below we have chosen a standard deviation of 0.05 for competitive precincts (.40 <=k<=.60) and derived standard deviations for other precinct categories based on their respective E/M sample sizes.

Table 5

Variance Calculation Based on Choice of Variance for Competitive Precincts

Choose SD	Sample Size	Derived C	Precinct Grouping
0.05	540	1.16	**40<=k<60**
Implied SD's	**Sample Sizes**	**Constant**	
0.12	90	1.16	**1=<k<.20**
0.09	165	1.16	**20<=k<40**
0.06	415	1.16	**60<=k<80**
0.18	40	1.16	**80<=k<=99**

These standard deviations generate "Alpha" variations from below 0.6 to above 2 for extreme outliers.

We have entered these and the E/M and Liddle "Uniform Response Hypothesis" (K=0.56, B=0.5, Alpha=1.12) into the USCV spreadsheet simulator described in Appendix G. Table 6 below shows the values entered into the "parameters" worksheet of the USCV simulator and the results of this simulation.

As can be seen from the table there is only a 0.0297 probability (less than 3%) probability of obtaining the E/M response rates, and a 0.0000 probability of obtaining the E/M mean WPE values (see Table 7 below) with these parameter settings.

In order to determine if there is *any* partisan distribution of precincts that will generate the E/M reported values from these parameters we calculated simulation values based on detailed precinct categories that give results that are as close as possible to the E/M values.

Table 6

Parameters for USCV Feasibility Simulation

INPUTS - Overall Response Rates		INPUT	s.d.	Calculated Parameters	
Kerry (K)	0.56	k< .2	0.12	alpha = K/B	1.12
Bush (B)	0.50	.2<k<.4	0.09	w = K-B	0.06
error tolerance R*	0.020	.4<k<.6	0.05	ln alpha	0.1133
error tolerance WPE*	0.020	>.6<k<.8	0.06		
		.8<k<1	0.18		

** error tolerance for matching WPE and overall Response R of E-M*

Calculated Probability for input K and B	
probability of E-M's overall response rates by	0.0297
probability of E-M's Mean WPEs by partisanship given K	0.0000
Combined Probability	0

These simulations assume, for example, that *all* of the precincts in the (.01 <=k<=.20) category are of the type that will result in minimum WPE for this simulation. For these simulations this means that all of these precincts would have k=0.15. Similarly we find the detailed precinct type within the four other precinct partisanship 20% groupings that generates minimum, or maximum, WPE or overall response as shown in Table 7 below.

Table 7

Closest USCV Simulations Across Precinct Partisanship Types

	1=<k<.20	20<=k<40	40<=k<60	60<=k<80	80<=k<=99
E-M WPE Means	-0.100	-0.061	-0.085	-0.059	0.003
Closest USCV WPE Means	-0.054	-0.089	-0.089	-0.089	-0.030
	min	min	min	min	max
E-M Median WPEs	-0.058	-0.061	-0.083	-0.055	-0.004
Closest USCV WPE Medians	-0.045	-0.084	-0.084	-0.084	-0.022
	min	min	min	min	max
E-M Response Rates	0.56	0.55	0.52	0.55	0.53
Closest USCV Response Rates	0.53	0.53	0.52	0.55	0.53
	max	max	min	max	min

As can be seen from the Table, in this simulation there is no possible distribution of precinct partisanship categories that will produce the E/M reported WPE and overall response values. The low and high WPE means for extremely partisan precincts cannot be replicated. The low median for high Bush precincts cannot be obtained. Finally the high overall response rates for (.01 <=k<.20) and (.20 <=k< .40) cannot be obtained.

We conclude that it is impossible (with any realistic chance) to obtain the E/M reported results from the E/M and Liddle "uniform response bias hypothesis".