Low-Information Voting:
Evidence from Instant-Runoff Elections

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Abstract

How do voters make decisions in low-information contests? Although some research has looked at low-information voter decision-making, scant research has focused on data from actual ballots cast in low-information elections. We focus on three 2008 Pierce County (Washington) Instant-Runoff Voting (IRV) elections. Using individual-level ballot image data, we evaluate the structure of individual rankings for specific contests to determine whether partisan cues underlying partisan rankings are correlated with choices made in nonpartisan races. This is the first time that individual-level data from real elections has been used to evaluate the role of partisan cues in nonpartisan races. We find that, in partisan contests, voters make avid use of partisan cues in constructing their preference rankings, rank-ordering candidates based on the correspondence between voters' own partisan preferences and candidates' reported partisan affiliation. However, in nonpartisan contests where candidates have no explicit partisan affiliation, voters rely on cues other than partisanship to develop complete candidate rankings.

Keywords: voting, low-information elections, instant-runoff voting, ranked voting, partisan cues, information shortcuts.

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1. INTRODUCTION

The role of partisanship on election outcomes is well-studied in the voter choice literature. Classical theories of voter choice suggest that voters display low levels of political interest and information, and vote based on long standing partisan attachments acquired early in life (Berelson et al. 1954; Campbell et al. 1960; Converse 1964). More recent theories support the view that, similar to other group attachments, partisanship colors the way individuals perceive candidates. According to some of these theories, voters behave in line with their partisan affiliation, following a desire to express their attachment and support toward a social group (Fowler and Kam 2007; Green et al. 2004; Schuessler 2000). Other scholars disagree with this sociological approach and claim that partisanship is used strategically as a heuristic or informational shortcut (Popkin 1991; Rahn 1993). Gathering and processing political information is a costly activity; therefore, in the absence of freely available information, rational voters resort to shortcuts such as following partisan cues (Downs 1957; Mondak 1993).

But what should be expected in low-information elections, where the partisan cue often is missing? In many states, municipal, school board, and county elections, and some statewide races, are officially nonpartisan. Other states, such as California and Washington, have electoral contexts where the top-two primary process can result in general elections that pit Republicans against Republicans, and Democrats against Democrats (Alvarez and Sinclair 2015). The 2016 U.S. Senate election in California is a case in point, with the general election contest pitting Democrats Loretta Sanchez and Kamala Harris against one another.

The prevalent view in the literature is that voters adapt to the informational context and make use of informational shortcuts to make inferences about candidates' qualifications

(Ansolabehere et al. 2006; Lupia 1994; Lupia and McCubbins 1998). Studies of the impact of information on voter choice have found that voters lend less support to candidates they know less about (Alvarez 1997; Bartels 1986, 1988). In races where an incumbent is running for office, voters typically know more about the incumbent than about the challenger. It is therefore not surprising that voters substitute incumbency cues for partisan cues when voting in nonpartisan contests (Ansolabehere et al. 2006; Krebs 1998; Schaffner, Streb, and Wright 2001; Streb and Frederick 2008). Other factors that may affect voter choice in nonpartisan elections are issue positions (Abrajano et al. 2005), electoral performance in previous elections (Lieske 1989), the order in which candidates appear on the ballot (Alvarez et al. 2006; Ho and Imai 2004; Miller and Krosnick 1998; Mueller 1970), endorsements made by local newspapers and organizations (Arceneaux and Kolodny 2009; Krebs 1998; Lupia 1994; Lupia and McCubbins 1998), name recognition (Baum 1987; Mueller 1970), and candidate traits, including physical appearance (Banducci et al. 2008; Mattes et al. 2010; Spezio et al. 2008; Todorov et al. 2005) and demographic characteristics such as gender, race, and occupation (Lovrich et al. 1988; McDermott 1997, 1998, 2005; Pomper 1966; Sigelman et al. 1995). In contrast to partisan contests, we do not expect voting in nonpartisan elections to be guided by a single-most-important underlying factor, as is the case with partisan cues in partisan races, but by multiple candidate-specific factors and traits.

However, nonpartisan elections are not necessarily devoid of partisan campaigning. Nonpartisan elections were introduced with the idea of preventing national parties from affecting local politics, preserving the independence of elected officials (especially in judicial elections), motivating voters to gather information about local issues and individual candidates (Adrian 1952, 1959; Williams and Adrian 1959; Lovrich et al. 1988), and limiting political polarization

and extremism (Alvarez and Sinclair 2015). However, voters are often able to learn about candidates' partisan affiliations based on the nature of endorsements made by local newspapers and organizations, and the candidates' histories, such as whether they previously ran for office in a partisan contest (Baum 1987). Using quasi-experimental approaches, studies have found that, when partisan cues are made available to voters, these cues activate latent partisan predispositions that later affect preferences over candidates in nonpartisan contests (Schaffner and Streb 2002; Squire and Smith 1988). Others have found, using survey experiments, that ideological cues might play a role in shaping voter choices in low-information elections (Boudreau et al. 2015). Some scholars have found that candidates' partisan affiliations and activities of partisan organizations may affect voting in nonpartisan elections, with Chicago elections often given as an example (Hagensick 1964; Hall 2001; Klein and Baum 2001; Krebs 1998; Welch and Bledsoe 1986). In this paper, we use ballot image data to determine whether voter choices in partisan elections are correlated with choices made by the same voters in concurrent nonpartisan elections.

Based on these theories and past research, we argue that voting behavior in local and low information contests is similar to what is typically seen for national and higher information elections. That is, when partisan cues are present in a low-information local election, voters will use those cues in their decisions. Therefore, our first hypothesis is that when a low-information and local election provides formal partisan cues, we will see evidence that partisan cues structure voter decisions. When partisan cues are absent, in particular in low-information and officially nonpartisan local elections, voters will not use partisan cues in their decisions, but instead will turn to candidate traits in order to decide how to cast their ballot. Our second hypothesis is that, when formal partisan cues are absent from local and low-information elections, partisanship will

not structure voter decisions, rather, voters will cast their ballots based on other candidate traits, experience, or backgrounds.

To test these two hypotheses, we focus on three 2008 Pierce County (Washington) elections that were conducted simultaneously in the November 2008 general election, soon after the county's adoption of Instant-Runoff Voting (IRV). We use individual-level ballot image data that was posted in the Pierce County Auditor's website, which is a unique source of information for a study like ours.¹ First, ballot image data are not widely used in research on political behavior. Instead of relying on self-reported rankings or evaluations of candidates, or ecological information, we can use the actual individual-level rankings of candidates as provided by voters. Second, the IRV ballot image data allows us to evaluate the structure of individual rankings for specific contests, and to analyze the connection between individual choices across races, in a way that is not possible with other types of data from typical plurality elections. An important reason to study voter behavior in the 2008 Pierce County elections is that voters participated in both partisan and nonpartisan contests; therefore, we are able to determine whether partisan cues underlying partisan rankings are correlated with choices made in nonpartisan races. To date, studies of voter behavior in partisan and nonpartisan contests, as well as studies of the impact of partisan cues on voter choice in nonpartisan elections, have used aggregate election outcomes or survey data. This is the first time that individual-level data from real elections has been used to evaluate the role of partisan cues in nonpartisan races.

¹ The ballot image data are publicly available at the following website: <http://wa-piercecounty2.civicplus.com/2940/Ranked-Choice-Results> (last accessed: January 9, 2018). See Burnett and Kogan (2015) for an analysis of voter fatigue which uses these data from Pierce County.

Methodologically, our approach begins with the use of the ballot image data to construct preference rankings, by voter, for these Pierce County elections. After giving a brief introduction to IRV and Pierce County, we discuss how we use the ballot image data to construct preference rankings and derive implicit preferences over pairs of candidates. We then use these pairwise preferences in a scaling procedure (principal component analysis, or PCA) to examine their underlying structure; this analysis lets us test our two hypotheses. As we will discuss in later sections of this paper, the underlying structure of preference rankings revealed by our PCA shows that the preference rankings for the partisan races are strongly associated with underlying partisan (Democratic and Republican) latent dimensions; generally the preference rankings from the nonpartisan races are not strongly associated with the partisan latent dimensions. Rather, the preference rankings from the nonpartisan races are associated with latent dimensions that we interpret as measuring candidate traits and attributes.

2. INSTANT-RUNOFF VOTING IN PIERCE COUNTY

IRV is a preferential voting system where voters are asked to report a preference ordering for a subset of alternatives. Under this system, votes are counted as follows. First, election officials evaluate whether one of the candidates received an absolute majority of first-place votes. If a candidate received a majority, this candidate is designated the winner. If no candidate received more than 50% of first-place votes, the candidate receiving the least number of votes is eliminated and the first-place votes cast for the eliminated candidate are transferred to the remaining candidates in accordance with the ordered preferences specified by voters. This process continues until one candidate earns an absolute majority of votes. IRV is intended to ensure that the election result is determined not only by voters' decisions as to which candidate

to rank first, but also by decisions about how to rank-order the remaining, less-preferred alternatives.

The adoption of IRV in Pierce County took place in the context of heated debate about the relative merits of simple plurality or single-member district plurality (SMDP) in relation to alternative voting systems (Hill 2002; Hill and Richie 2005; Olson and Hill 2002; Richie 2004). Advocates for the adoption of IRV argued that SMDP leads to polarized and adversary politics, undermines minority representation by disregarding the preferences of third-party voters, and could be expensive to implement when majority vote requirements call for a runoff election between a subset of candidates. IRV was lauded as a promising alternative for correcting the claimed shortcomings of SMDP (Hill and Richie 2005; Horowitz 1990, 2003; Olson and Hill 2002; Richie 2004).²

Altogether, three IRV contests were held in Pierce County in November 4, 2008, for the following positions: Executive, Assessor-Treasurer, and District 2 county council. Turnout in the November 4, 2008 general election in Pierce County reached approximately 81% of registered voters. For each of these contests, voters were asked to rank up to three candidates. The ballot provided a grid with as many rows as candidates running for office and three columns (one for each position in the ranking). Figure 1 shows sample ballots corresponding to two of the three IRV races.

² A preferential voting system is one where voters are asked to rank candidates per their preference ordering, and therefore uses ordinal or rank-ordered ballots. Instant Runoff Voting is the same as Alternative Vote (term commonly used in Australia and the United Kingdom); Ranked Choice Voting (term commonly used in some jurisdictions in the United States); single-member Single Transferable Vote (as opposed to multi-member Single Transferable Vote); or Majority-Preferential (as opposed to Quota-Preferential). See Figure 2 in Bormann and Golder (2013) for a useful depiction of the differences in these voting systems.

[FIGURE 1 ABOUT HERE]

The Executive race was a four-candidate county-wide partisan contest between Mike Lonergan (Executive Excellence Party, Councilmember), Pat McCarthy (Democrat, Pierce County Auditor), Calvin Goings (Democrat, Councilmember), and Shawn Bunney (Republican, Councilmember). The outcome of the contest was determined after three rounds of vote-counting. Pat McCarthy (D) was ranked in second place in 57% of the rankings where Calvin Goings (D) held the first position. In contrast, Shawn Bunney (R) was ranked second in only 17% of these rankings. Pat McCarthy won the contest with approximately 27% of first-place votes (less than Shawn Bunney, who got 35% of first-place votes) and 51% of last-round votes.

The Assessor-Treasurer race was a six-candidate county-wide nonpartisan contest between Dale Washam, Terry Lee (Council Chairman), Jan Shabro (former State Representative, former Councilmember), Bernardo Tuma, Barbara Gelman (Councilmember, former Pierce County Assessor-Treasurer), and Beverly Davidson (former Pierce County Assessor-Treasurer's employee). The outcome of the contest was determined after four rounds of vote-counting. Dale Washam won the contest with 25% of first-place votes and 52% of last-round votes.

Lastly, the District 2 county council race was a three-candidate district-level partisan contest between Al Rose (Democrat, Pierce County Deputy Prosecutor), Carolyn Merrival (Democrat), and Joyce McDonald (Republican, State Representative). The outcome of the contest was determined after two rounds of vote-counting. Joyce McDonald won the contest with almost 50% of first-place votes and 55% of last-round votes.

3. RANKING TYPES

We use these three elections to explore the relationship between voter behavior in the partisan (Executive and District 2) races, and in the nonpartisan (Assessor Treasurer) race. We use the notation $[a\ b\ c]$ to indicate a complete ranking structure where three different candidates, represented generically by the letters a , b , and c , are ranked first, second, and third, respectively. In situations where the same candidate is assigned to more than one position, we modify the notation accordingly by repeatedly using the same letter to fill in different slots. The notation $[a\ a\ a]$, for instance, indicates a ranking structure where the same candidate is assigned to all three positions. Lastly, we use dots ($\bullet$) to indicate empty ranking slots. A single letter followed by two dots (as in $[a\ \bullet\ \bullet]$), for example, indicates a situation where a candidate is selected as the top choice, but positions two and three in the ranking are left empty.

Table 1 gives the incidence of ranking types for IRV contests in Pierce County, Washington. We first consider ranking structures that have a straightforward interpretation, and that would be consistent with a set of underlying pairwise preferences obeying basic rationality assumptions (see Table 1a). There is little evidence of a relationship between the number of candidates running for office and the structure of individual preference. In most contests, almost 50% of voters reported complete $[a\ b\ c]$ rankings. This proportion is in line with the previous literature, which found that “51% of the respondents exhibited complete, transitive preference orderings” (Alvarez and Kiewiet 2009, 273-4). The only exception is the 2008 District 2 contest, where only 39% of the voters reported complete rankings. Moving to other ranking types, more than 20% of the voters reported bullet-votes where only the top-choice was identified and, except for the 2008 Assessor-Treasurer contest, approximately 14% of the voters reported a ranking $[a\ b\ \bullet]$, where the third position is left empty. Lastly, between 4% and 16% of the voters reported

empty rankings [$\bullet \bullet \bullet$], indicating absence of any preference or complete indifference between all the candidates.³

[TABLE 1 ABOUT HERE]

In partisan contests where two Democratic candidates were running for office, voters frequently ranked the two Democratic candidates first and second and left the third position empty, indicating a preference for either of the Democratic candidates to all Republican or Independent candidates. This helps to explain the higher incidence of [a b $\bullet$] rankings in the 2008 Executive and District 2 partisan contests compared to the nonpartisan 2008 Assessor-Treasurer contest. This finding is consistent with previous literature, where a large proportion of survey respondents, asked to make pairwise choices, ranked candidates in a “transitive, two indifferences” fashion and “grouped the four candidates into a top and bottom pair in a party-based fashion” (Alvarez and Kiewiet 2009, 274).

Next, we consider rankings types that lack a straightforward interpretation (see Table 1b). Between 4% and 10% of voters reported anomalous rankings that are not consistent with a structure of individual preferences obeying basic rationality assumptions. In most of these cases, inconsistency was the result of an individual overvoting, particularly by selecting the same candidate for all positions in the ranking. This type of voting behavior may result from a misunderstanding of the voting system, confusing IRV with cumulative voting (where a person can give more than one vote to their preferred candidate), or from a desire to express strong preference for one of the candidates. In all contests, between 2% and 3% of the voters reported rankings of the form [a a a]; the incidence of this ranking type was lowest in the 2008 Assessor-

³ In Online Appendix A2 we report summary statistics of the incidence of ranking types across precincts.

Treasurer contest. A very small proportion of the voters (0.4%) reported anomalous rankings such as those described in the second and third section of Table 1b, where a filled position is preceded by an empty position.

In the Pierce County IRV ballot image data, individual-level outcomes were assigned a “record ID” that can be used to match individual-level rankings across contests. This allowed us to determine how the same person voted across 2008 IRV contests and evaluate whether individuals who reported a particular ranking type for the Executive contest exhibited a similar behavior in the Assessor-Treasurer and District 2 contests.

[FIGURE 2a ABOUT HERE]

[FIGURE 2b ABOUT HERE]

These data show several important types of individual preference ordering behaviors. First, more than 98% of those voters who reported rankings of type [a b c], [a b •], [a • •] and [• • •] in the Executive contest behaved in an analogous manner in other contests. Except for those reporting Executive rankings of type [a b •], these individuals exhibited the same preference-ordering behavior across races. Those reporting a complete ranking of type [a b c] for the Executive contest, repeated this type of ranking in the Assessor-Treasurer and District 2 contests. If they reported a bullet ranking of type [a • •] for the Executive contest, they did so again in the Assessor-Treasurer and District 2 contests. Those reporting an empty ranking [• • •] for the Executive contest repeated this ranking type in the Assessor-Treasurer and District 2 contests. We use these rankings in our next set of analyses, where we look at the underlying structure of the candidate rankings to test our two hypotheses.

4. A DIMENSIONAL ANALYSIS OF RANKING DATA

In this section, we focus on rankings that have a straightforward and rationalizable interpretation ($[a\ b\ c]$, $[a\ b\ \bullet]$, $[a\ \bullet\ \bullet]$ and $[\bullet\ \bullet\ \bullet]$) and ignore those exhibiting clear anomalies (such as overvotes and filled positions preceded by an empty position). One way of assessing whether rankings reflect substantively-meaningful preferences is to evaluate whether it is possible to extract meaning from the rankings. If candidate orderings are built based on substantive criteria like partisanship, then studying the structure of rationalizable rankings can help us learn about the latent determinants of individual preferences, even in the absence of information about voters' attributes and attitudes. We conducted a dimensional analysis to determine whether underlying partisan dimensions can help explain the variation in implicit pairwise preferences between pairs of candidates running for office. Subsequently, we examined the relationship between latent dimensions and implicit pairwise preferences and use the results of this analysis to determine whether voter choices in nonpartisan contests are to some extent driven by partisan cues. This gives us a unique way to test if partisan cues are being used by the voters in these officially nonpartisan local elections. If we recover latent dimensions which have a partisan interpretation, that supports the hypothesis that voters are using partisan cues in these elections. If we recover latent dimensions which have other interpretations more directly linked to the candidates themselves, that supports the hypothesis that voters are using candidate cues in these elections. Finally, we can examine how the candidate rankings, for partisan and nonpartisan races, are correlated with partisan and candidate latent dimensions, to test whether voters are using partisan or candidate cues in their voting decisions in these low information elections.

Our dimensional analysis was based on principal component analysis (PCA) of implicit pairwise preferences. This model-free approach uses matrix transformations to convert the set of

correlated pairwise preferences into a set of uncorrelated latent factors. PCA is an unsupervised machine learning approach, commonly used to explore datasets and to reduce their dimensionality for better visualization and understanding of the structure across the elements of the dataset (Hastie et al. 2016). While not widely used to study political behavior or public opinion, PCA has a long history in statistics and more recently machine learning (Shalev-Shwartz and Ben-David 2014, chapter 23). The set of correlated preferences is expressed as a linear combination of uncorrelated factors, where the first factor explains most of the variation in the data, the second factor explains most of the remaining variation in the data, and so on. Because we do not observe pairwise preferences, this approach requires making assumptions about the set of underlying pairwise preferences that resulted in observed candidate rankings.⁴ We make the following assumptions about the relationship between ranking types and individual preferences over candidates, using the notation “P” and “I” to denote strict preference and indifference between alternatives, respectively:

- If the individual reports $[a \ b \ c]$, then $a \ P \ b$, $b \ P \ c$, $a \ P \ c$, $a \ P \ h$, $b \ P \ h$, $c \ P \ h$, $a \ P \ k$, $b \ P \ k$, $c \ P \ k$, $h \ I \ k$, where h and k represent any pair of candidates excluded from the $[a \ b \ c]$ ranking.
- If the individual reports $[a \ b \ \bullet]$, then $a \ P \ b$, $a \ P \ h$, $b \ P \ h$, $a \ P \ k$, $b \ P \ k$, $h \ I \ k$, where h and k represent any pair of candidates excluded from the $[a \ b \ \bullet]$ ranking.
- If the individual reports $[a \ \bullet \ \bullet]$, then $a \ P \ h$, $a \ P \ k$, $h \ I \ k$, where h and k represent any pair of candidates excluded from the $[a \ \bullet \ \bullet]$ ranking.

⁴ Brady (1990) proposes an alternative methodology for the dimensional analysis of ranking data that does not require making assumptions about underlying pairwise preferences. Instead, Brady models the probability of each candidate ordering as a function of latent factors, which in turn requires a different set of modeling and identifying assumptions (see Brady 1990, 1034-36).

- If the individual reports $[\bullet \bullet \bullet]$, then $h \succ k$, where h and k represent any pair of candidates.

Based on these assumptions, we transformed three-candidate rankings into sets of implicit pairwise preferences taking values -1, 0 or 1. This procedure resulted in 6 implicit pairwise preferences for the Executive contest (four candidates running for office); 3 implicit pairwise preferences for the District 2 contest (three candidates running for office); and 15 implicit pairwise preferences for the Assessor-Treasurer contest (six candidates running for office). For example, we followed the following criterion for coding the pairwise preference between McCarthy and Goings:

$$McCarthy \succ Goings = \begin{cases} 1 & \text{if } r(McCarthy) > r(Goings) \\ 0 & \text{if } r(McCarthy) = r(Goings) \\ -1 & \text{if } r(McCarthy) < r(Goings) \end{cases}$$

where $r(McCarthy)$ indicates McCarthy's position in the individual ranking, and $r(Goings)$ indicates Goings's position in the individual ranking. Similar criteria were used to code the remaining pairwise preferences.

For the two 2008 partisan contests, we conducted a PCA on the set of correlated pairwise preferences and retained the subset of latent dimensions that captures most of the variability in the data. For the county-wide Executive contest, the analysis was implemented using data from 292,642 (93.56%) voters who reported rankings of type $[a \ b \ c]$, $[a \ b \ \bullet]$, $[a \ \bullet \ \bullet]$ or $[\bullet \ \bullet \ \bullet]$. For the District 2 contest, the analysis was done using data from 41,335 (95.0%) voters who reported one of these four ranking types. Tables 2a and 2b summarize the results of the PCA for each contest. Columns give the correlation between the estimated latent dimensions and the implicit pairwise preferences.

[TABLES 2a and 2b ABOUT HERE]

In the Executive contest (Table 2a), the first dimension explains 45.3% of the variation in pairwise preferences, and can be interpreted in partisan terms. The first dimension is positively correlated with preference for Democratic candidates (McCarthy and Goings) over the Republican candidate (Bunney); with preference for Democratic candidates (McCarthy and Goings) over the Independent candidate (Lonergan); and with preference for the Independent candidate over the Republican candidate. Furthermore, this dimension has low correlation with preference for one Democratic candidate over the other, suggesting that it does not help differentiate between same-party candidates. The second dimension explains 23.2% of the variation in pairwise preferences. It can be interpreted as preference for Independent candidates, as it is positively correlated with preference for the Independent candidate (Lonergan) over Democratic and Republican candidates. For those pairwise preferences that do not involve the Independent candidate, the second dimension is correlated with preference for McCarthy (Pierce County Auditor at the time of the election) over both the other Democratic candidate and the Republican candidate. The third dimension explains 20.2% of the variability in the data, and can be interpreted as preference for McCarthy's candidate traits. This dimension is highly correlated with preference for McCarthy over both the other Democratic and Independent candidates. Together, the first three dimensions explain 88.6% of the variability in the data.⁵

In the District 2 contest (Table 2b), the first dimension explains 59.1% of the variability in implicit pairwise preferences and again can be interpreted in partisan terms. It is positively correlated with preference for Democratic candidates (Rose and Merrival) over the Republican

⁵ Figure A4 in Online Appendix A4 shows the proportion of the variability in the data explained by all dimensions extracted using principal component analysis.

candidate (McDonald). Consistently with what we found for the Executive contest, the first dimension has low correlation with preference for one Democratic candidate over the other. In the same contest, the second dimension explains 35.1% of the remaining variation and is highly correlated with preference for one Democratic candidate over the other. This suggests that, in the District 2 contest, the second dimension captures candidate traits that help distinguish between same-party candidates, just like the third dimension in the Executive contest. Overall, the first two dimensions explain 94.2% of the variability in implicit pairwise preferences.

Figures 3a and 3b give factor maps that can be used to visualize the similarity between pairwise preferences for the two partisan contests. For the Executive contest, the coordinate of the end of each vector indicates the correlation between a particular pairwise preference and two latent dimensions. In both plots, the horizontal axis corresponds to the partisan dimension, and the vertical axis corresponds to the candidate-traits dimension (that is, the dimension that explains preferences for same-party candidates). These plots show that there is large similarity between preferences for either Democrat over the Republican candidate, and that these preferences are considerably different from preferences for same-party candidates. While the former are explained by the first dimension (horizontal axis), the latter are explained by the second or third dimension (vertical axis).

[FIGURE 3a and 3b ABOUT HERE]

District 2 voters participated in three IRV contests. For these voters, we conducted an additional dimensional analysis of the complete set of 24 pairwise preferences (9 corresponding to two partisan contests, and 15 corresponding to the nonpartisan Assessor-Treasurer race), to determine whether partisan dimensions guiding voter behavior in the partisan contests also

contribute to explaining choices made in the nonpartisan race. Table 3 gives the results of this dimensional analysis. In total, the first five dimensions explain 63.2% of the variation in the 24 pairwise preferences. The first two dimensions have clear partisan interpretations. The first is positively correlated with preference for Republican candidates; and the second is positively correlated with preference for Democratic candidates. Dimensions three through five capture candidate traits corresponding to candidates running in the nonpartisan Assessor-Treasurer race but explain very little of the variation in preferences for candidates running in any of both partisan contests.⁶

[TABLE 3 ABOUT HERE]

Although partisan dimensions do explain part of the variation in nonpartisan preferences among District 2 voters, we cannot conclude that some of the candidates participating in the nonpartisan contest are perceived as having partisan affiliations, or that voters construct rankings in nonpartisan contests based on partisan cues. The first two dimensions are positively correlated with preference for some of the candidates participating in the nonpartisan contest (Lee and Washam), even though they reflect opposite partisan preferences. This indicates that some of the voters who preferred Lee in the nonpartisan contest voted Democratic in partisan contests, but others tended to vote Republican. Figure 4 gives a graphical representation of the results contained in the first two columns of Table 3. It shows that, although preferences for Democratic candidates and two nonpartisan candidates (Washam and Lee, denoted as N_2 and N_1) tend to increase with the second dimension, the same preferences are correlated in opposite directions with the first dimension. In short, the results of the dimensional analysis of the 24

⁶ The third dimension is highly correlated with preference for Treasurer Candidate Washam, the fourth for candidate Shabro, and the fifth for Lee and Gelman, over other candidates participating in the nonpartisan contest.

pairwise preferences suggest that, while partisan cues are key for the construction of candidate rankings in partisan contests, candidate rankings in nonpartisan contests are constructed based on evaluation of candidate traits.

[FIGURE 4 ABOUT HERE]

To further evaluate the extent to which partisan cues are associated with voting in partisan and nonpartisan contests, we estimated a series of regression models explaining preferences between pairs of candidates in each contest as a function of latent partisan dimensions estimated using data from only the Executive contest. The results of this analysis are presented in Table 4. Each regression model included two explanatory variables: “latent partisan trait,” measuring preference for Democrats over Republicans (first dimension from PCA analysis of Executive contest) and “latent independence trait,” measuring preference for Independent candidates (second dimension from PCA analysis of Executive contest). Results for the Executive contest are unsurprising; they confirm that the partisan trait is associated with partisan ordering of candidates (with higher values of the latent partisan trait correlating with greater preference for Republicans), and that the independence trait is associated with preference for Independent candidates. For this contest, the two included traits explain more than 50% of the variation in pairwise preferences, except for the comparison of the two Democratic candidates, which naturally cannot be explained in terms of partisan preferences.

[TABLE 4 ABOUT HERE]

More interestingly, the two latent traits estimated using data from the partisan Executive contest explain close to 40% of the variation in pairwise preferences between Democratic and Republican candidates in the partisan District 2 contest, but less than 5% of the variation in

pairwise preferences in the nonpartisan Assessor-Treasurer contest (see column 4 in Table 4). A one-unit increase in the latent partisan trait is associated with a 0.56 increase in the preference for the runner-up over the winner (Rose vs. McDonald) in the partisan District 2 contest, but only a 0.14 decrease in the preference for the winner over the runner-up (Washam vs. Gelman) in the nonpartisan Assessor-Treasurer contest.⁷ To help visualize these differences between partisan vs. nonpartisan contests, we created Figure 5, showing the relationship between the latent partisan trait and pairwise preferences between winners and runner-ups in the District 2 and Assessor-Treasurer contests. The relationship between the latent partisan trait and preference for Rose over McDonald in the partisan contest is noticeably stronger than the relationship between the latent partisan trait and preference for Washam and Gelman in the nonpartisan contest.⁸ The association between partisan traits and preferences for the remaining fourteen pairs of candidates in the nonpartisan contest is even weaker. These results suggest that partisan consideration are strongly associated with voting in partisan races, but they are much less associated with voter behavior in nonpartisan contests.

[FIGURE 5 ABOUT HERE]

Our overall conclusion is that, to a large extent, candidate rankings can be interpreted in partisan terms. In partisan contests, where candidates can be ordered along a partisan dimension,

⁷ Latent traits were standardized with mean 0 and unit standard deviation before inclusion in the regression model. Therefore, a one unit increase in the latent partisan trait corresponds to a one standard deviation increase along this variable.

⁸ The coefficients associated with the latent partisan and independence traits are statistically significant for most pairs of candidates, in both partisan and nonpartisan contests. It is important to note, however, that given the large sample size, even small and substantively minor effects are bound to be statistically significant. For this reason, we focus our discussion on effect magnitudes and goodness of fit.

voters make avid use of partisan cues in constructing their preference rankings. When multiple candidates from the same-party are running for office—or when candidates have no explicit partisan affiliation (as in nonpartisan contests)—then additional criteria (such as evaluation of candidate traits) are needed for voters to develop a complete candidate ranking. Our dimensional analysis of voter choice in partisan IRV contests suggests that both partisan cues and evaluations of candidate traits are important building blocks for defining individual preferences.

5. CONCLUSION

The data in these analyses come from real ballots cast by real voters in binding elections. Such data are rarely used in the study of political behavior, and this analysis is unique because we can study individual-level voter choice from the ballots cast. Studying voter behavior using IRV election outcomes required applying a different methodology relative to that used in the past to analyze survey data. Specifically, we studied whether individuals repeated their behavior across contests, and we conducted a dimensional analysis of the ranking data to determine whether implicit pairwise preferences are correlated with latent partisan dimensions. In our analysis, we used principal component analysis (PCA), demonstrating the usefulness of this unsupervised machine learning methodology for studying complex preference rankings data and also for testing hypotheses about political behavior.

We found that individual preference rankings are not constructed at random: voters exhibiting a certain preference-ordering behavior in one race (e.g. reporting a complete preference ranking) tend to repeat this behavior across contests. The dimensional analysis of IRV ranking data suggests, additionally, that individual preferences carry substantive meaning. In partisan contexts, voters order candidates following partisan cues or based on preference for

independence. Pairwise preferences over candidates in partisan versus nonpartisan races are, however, only weakly correlated. This last result is telling, as it suggests that, in nonpartisan contexts, preferences over candidates are primarily driven by evaluations of candidate traits. This is a strong test of the extent to which partisan considerations guide voting in nonpartisan contexts.

REFERENCES

- Abrajano, M.A., J. Nagler, and R.M. Alvarez. 2005. A Natural Experiment of Race-Based and Issue Voting: The 2001 City of Los Angeles Elections. *Political Research Quarterly* 58: 203-18.
- Adrian, C.R. 1952. Some General Characteristics of Nonpartisan Elections. *American Political Science Review* 46(3): 766-76.
- Adrian, C.R. 1959. A Typology for Nonpartisan Elections. *Western Political Quarterly* 12(2): 449-58.
- Alvarez, R.M. 1997. *Information and Elections*. Ann Arbor: University of Michigan Press.
- Alvarez, R.M. and D.R. Kiewiet. 2009. Rationality and Rationalistic Choice in the California Recall. *British Journal of Political Science* 39(2): 267-90.
- Alvarez, R.M, J.S. Sinclair. 2015. *Nonpartisan Primary Election Reform: Mitigating Mischief*. New York: Cambridge University Press.
- Ansolabehere, A., S. Hirano, J.M. Snyder, Jr, and M. Ueda. 2006. Party and Incumbency Cues in Voting: Are They Substitutes? *Quarterly Journal of Political Science* 1(2): 119-37.
- Arceneaux, K. and R. Kolodny. 2009. Educating the Least Informed: Group Endorsements in a Grassroots Campaign. *American Journal of Political Science* 53(4): 755-70.
- Banducci, S.A., J.A. Karp, M. Thrasher, and C. Rallings. 2008. Ballot Photographs as Cues in Low-Information Elections. *Political Psychology* 29(6): 903-17.
- Berelson, B., P. Lazarsfeld, and W. McPhee. 1954. *Voting*. Chicago: University of Chicago Press.
- Bartels, L.M. 1986. Issue Voting Under Uncertainty: An Empirical Test. *American Journal of Political Science* 30(4): 709-23.
- Bartels, L. 1988. *Presidential Primaries and the Dynamics of Public Choice*. Princeton: Princeton University Press.
- Baum, L. 1987. Explaining the Vote in Judicial Elections: The 1984 Ohio Supreme Court Elections. *Western Political Quarterly* 40(2): 361-71.
- Bormann, Nils-Christian and Matt Golder. 2013. "Democratic Electoral Systems Around the World, 1946-2011. *Electoral Studies* 32(2), 360-369.
- Boudreau, Cheryl, Christopher S. Elmendorf, and Scott A. MacKenzie. 2015. "Lost in Space: Information Shortcuts, Spatial Voting, and Local Government Representation." *Political Research Quarterly* 68(4), 843-855.
- Brady, H.E. 1990. Dimensional Analysis of Ranking Data. *American Journal of Political Science* 34(4): 1017-48.
- Burnett, Craig M., and Vladimir Kogan. 2015. Ballot (and voter) "exhaustion" under Instant Runoff Voting: An examination of four ranked-choice elections. *Electoral Studies* 37: 41-49.

- Campbell, A., P.E. Converse, W.E. Miller, and D.E. Stokes. 1960. *The American Voter*. New York: Wiley.
- Converse, P.E. 1964. The Nature of Belief Systems in Mass Publics. In *Ideology and Discontent*, David Apter (editor). New York: Free Press.
- Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper and Row.
- Fowler, J.H. and C.D. Kam. 2007. Beyond the Self: Social Identity, Altruism, and Political Participation. *Journal of Politics* 69(3): 813–27.
- Green, D., B. Palmquist, and E. Schickler. 2004. *Partisan Hearts and Minds: Political Parties and the Social Identities of Voters*. New Haven: Yale University Press.
- Hastie, T., R. Tibshirani, and J. Friedman. 2016. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. New York: Springer.
- Hagensick, A.C. 1964. Influences of Partisanship and Incumbency on a Nonpartisan Election System. *Western Political Quarterly* 17(1): 117-24.
- Hall, M.G. 2001. State Supreme Courts in American Democracy: Probing the Myths of Judicial Reform. *American Political Science Review*. 95(2): 315-30.
- Hill, S. 2002. *Fixing Elections: The Failure of America's Winner Take All Politics*. New York: Routledge.
- Hill, S. and R. Richie. 2005. Success for Instant Runoff Voting in San Francisco. *National Civic Review* 94(1):65–68.
- Horowitz, D.L. 1990. Comparing Democratic Systems. *Journal of Democracy* 1(4): 73-79.
- Horowitz, D.L. 2003. Electoral Systems: A Primer for Decision Makers. *Journal of Democracy* 14(4):115–127.
- Ho, D.E. and K. Imai. 2004. The Impact of Partisan Electoral Regulation: Ballot Effects from the California Alphabet Lottery, 1978-2002. Harvard University. <http://people.iq.harvard.edu/~dho/research/alphabet.pdf> (last accessed: July 5, 2012).
- Klein, D. and L. Baum. 2001. Ballot Information and Voting Decisions in Judicial elections. *Political Research Quarterly* 54(4): 709-28.
- Krebs, T.B. 1998. The Determinants of Candidates' Vote Share and the Advantages of Incumbency in City Council Elections. *American Journal of Political Science* 42(3): 921-35.
- Lieske, J. 1989. The Political Dynamics of Urban Voting Behavior. *American Journal of Political Science* 33(1): 150-74.
- Lovrich, N, Jr., C.H. Sheldon, and E. Wasmann. 1988. The Racial Factor in Nonpartisan Judicial Elections: A Research Note. *Western Political Quarterly* 41(4): 807-16.
- Lupia, A. 1994. Shortcuts Versus Encyclopedias: Information and Voting Behavior in California Insurance Reform Elections. *American Political Science Review* 88(1): 63-76.

- Lupia, A. and M.D. McCubbins. 1998. *The Democratic Dilemma*. Cambridge: Cambridge University Press.
- Mattes, K., M. Spezio, H. Kim, A. Todorov, R. Adolphs, and R.M. Alvarez. 2010. Predicting Election Outcomes from Positive and Negative Trait Assessments of Candidate Images. *Political Psychology* 31(1): 41-58.
- McDermott, M.L. 1997. Voting Cues in Low-Information Elections: Candidate Gender as a Social Information Variable in Contemporary United States Elections. *American Journal of Political Science* 41(1): 270-83.
- McDermott, M.L. 1998. Race and Gender Cues in Low-Information Elections. *Political Research Quarterly* 51(4): 895-918.
- McDermott, M.L. 2005. Candidate Occupations and Voter Information Shortcuts. *Journal of Politics* 67(1): 201-19.
- Miller, J.M. and J.A. Krosnick. 1998. The Impact of Candidate Name Order on Election Outcomes. *Public Opinion Quarterly* 62(3): 291-330.
- Mondak, J.J. 1993. Public Opinion and Heuristic Processing of Source Cues. *Political Behavior* 15(2): 167-92.
- Mueller, J.E. 1970. Choosing Among 133 Candidates. *Public Opinion Quarterly* 34(3): 395-402.
- Olson, E.C. and S. Hill. 2002. Big Wins for Democracy: San Francisco and Vermont Vote for Instant Runoff Voting. *National Civic Review* 91(2): 201-204.
- Pomper, G. 1966. Ethnic and Group Voting in Nonpartisan Municipal Elections. *Public Opinion Quarterly* 30(1): 79-97.
- Popkin, S.L. 1991. *The Reasoning Voter: Communication and Persuasion in Presidential Campaigns*. Chicago: University of Chicago Press.
- Rahn, W.M. 1993. The Role of Partisan Stereotypes in Information Processing about Political Candidates. *American Journal of Political Science* 37(2): 472-96.
- Richie, R. 2004. Instant Runoff Voting: What Mexico (and Others) Could Learn. *Election Law Journal* 3(3): 501-12.
- Schaffner, B.F., M. Streb. 2002. The Partisan Heuristic in Low-Information Elections. *Public Opinion Quarterly* 66(4): 559-81.
- Schaffner, B.F., M. Streb, and G. Wright. 2001. Teams Without Uniforms: The Nonpartisan Ballot in State and Local Elections. *Political Research Quarterly* 54(1): 7-30.
- Schuessler, A.A. 2000. *A Logic of Expressive Choice*. Princeton: Princeton University Press.

- Sigelman, C.K., L. Sigelman, B.J. Walkosz, and M. Nitz. 1995. Black Candidates, White Voters: Understanding Racial Bias in Political Perceptions. *American Journal of Political Science* 39(1): 243-65.
- Shalev-Shwartz, Shai and Shai Ben-David. 2014. *Understanding Machine Learning: From Theory to Algorithms*. New York: Cambridge University Press.
- Spezio, M.L., A. Rangel, R.M. Alvarez, J.P. O'Doherty, L. Mattes, A. Todorov, H. Kim, and R.A. Adolphs. 2008. A Neural Basis for the Effect of Candidate Appearance on Election Outcomes. *Social Cognitive and Affective Neuroscience* 3(4): 344-52.
- Squire P. and E.R.A.N. Smith. 1988. The Effect of Partisan Information on Voters in Nonpartisan Elections. *Journal of Politics* 50(1): 169-79.
- Streb, M.J. and B. Frederick. 2008. Conditions for Competition in Low-Information Judicial Elections: The Case of Intermediate Appellate Court Elections. *Political Research Quarterly* 62(3): 523-37.
- Todorov, A., Mandisodza, A. N., Goren, A., and Hall, C. C. 2005. Inferences of Competence from Faces Predict Election Outcomes. *Science* 308(5728): 1623-1626.
- Welch, S. and T. Bledsoe. 1986. The Partisan Consequences of Nonpartisan Elections and the Changing Nature of Urban Politics. *American Journal of Political Science* 30(1): 128-39.
- Williams, O.P. and C.R. Adrian. 1959. The Insulation of Local Politics under the Nonpartisan Ballot. *American Political Science Review* 53(4): 1052-63.

Table 1: Incidence of ranking types in Pierce County IRV contests

Table 1a: Rankings consistent with individual rationality

Ranking	2008 Executive (4 candidates)		2008 Assessor-Treasurer (6 candidates)		2008 District 2 (3 candidates)	
	N	%	N	%	N	%
[a b c]	153,183	48.98	150,323	48.06	17,110	39.19
[a b •]	48,045	15.36	25,454	8.14	6,122	14.02
[a • •]	78,078	24.96	74,873	23.94	14,459	33.12
[• • •]	13,336	4.26	50,078	16.01	3,644	8.35
TOTAL	292,642	93.56	300,728	96.15	41,335	94.67

Table 1b: Rankings inconsistent with individual rationality

Ranking	N	%	N	%	N	%
[a a a]	11,816	3.78	7,221	2.31	1,459	3.34
[a b a]	2,023	0.65	1,165	0.37	248	0.57
[a a b]	1,827	0.58	715	0.23	103	0.24
[a b b]	2,072	0.66	1,265	0.40	290	0.66
[a a •]	1,225	0.39	441	0.14	112	0.26
[a • b]	511	0.16	441	0.14	40	0.09
[• a b]	132	0.04	264	0.08	18	0.04
[• a •]	207	0.07	184	0.06	20	0.05
[• • a]	51	0.02	221	0.07	21	0.05
[a • a]	171	0.05	82	0.03	9	0.02
[• a a]	94	0.03	44	0.01	6	0.01
TOTAL	20,129	6.43	12,043	3.84	2,326	5.33

Table 2a: Dimensional Analysis of Individual Pairwise Preferences – Executive Contest

	Dimension 1	Dimension 2	Dimension 3
<i>McCarthy (D) P Loneragan (I)</i>	0.67	-0.42	0.51
<i>Goings (D) P Loneragan (I)</i>	0.64	-0.69	-0.07
<i>Loneragan (I) P Bunney (R)</i>	0.55	0.68	-0.33
<i>McCarthy (D) P Goings (D)</i>	0.09	0.44	0.85
<i>McCarthy (D) P Bunney (R)</i>	0.89	0.28	0.10
<i>Goings (D) P Bunney (R)</i>	0.87	0.07	-0.32
% explained	45.26	23.19	20.20
% explained (cumulative)	45.26	68.44	88.64

Correlation between implicit pairwise preferences and latent factors. N=292,642. 2008 Pierce County Executive contest.

Table 2b: Dimensional Analysis of Individual Pairwise Preferences – District 2 Contest

	Dimension 1	Dimension 2
<i>Rose (D) P Merrival (D)</i>	0.19	0.97
<i>Rose (D) P McDonald (R)</i>	0.95	0.10
<i>Merrival (D) P McDonald (R)</i>	0.91	-0.31
% explained	59.12	35.11
% explained (cumulative)	59.12	94.23

Correlation between implicit pairwise preferences and latent factors. N=41,335. 2008 Pierce County District 2 contest.

Table 3: Dimensional Analysis of Individual Pairwise Preferences – All 2008 IRV Contests

		Dimension 1	Dimension 2	Dimension 3	Dimension 4	Dimension 5
Executive	<i>McCarthy (D) P Loneragan (I)</i>	-0.50	0.28	0.04	0.02	-0.06
	<i>Goings (D) P Loneragan (I)</i>	-0.47	0.29	0.10	0.03	-0.10
	<i>Loneragan (I) P Bunney (R)</i>	-0.37	0.41	0.16	-0.01	-0.04
	<i>McCarthy (D) P Goings (D)</i>	-0.03	-0.01	-0.07	-0.03	0.07
	<i>McCarthy (D) P Bunney (R)</i>	-0.65	0.52	0.16	0.01	-0.06
	<i>Goings (D) P Bunney (R)</i>	-0.63	0.52	0.19	0.03	-0.09
District 2	<i>Rose (D) P Merrival (D)</i>	0.06	0.25	-0.08	0.01	0.03
	<i>Rose (D) P McDonald (R)</i>	-0.56	0.56	0.09	-0.04	-0.08
	<i>Merrival (D) P McDonald (R)</i>	-0.60	0.47	0.14	-0.04	-0.10
Assessor-Treasurer (nonpartisan)	<i>Washam P Lee</i>	0.38	0.07	0.84	0.00	-0.11
	<i>Washam P Shabro</i>	0.48	0.35	0.44	-0.52	0.24
	<i>Washam P Tuma</i>	0.43	0.24	0.59	0.11	0.48
	<i>Washam P Gelman</i>	0.71	0.45	0.31	-0.03	-0.17
	<i>Washam P Davidson</i>	0.60	0.50	0.36	0.16	0.18
	<i>Lee P Shabro</i>	0.14	0.36	-0.46	-0.57	0.42
	<i>Lee P Tuma</i>	0.04	0.25	-0.39	0.16	0.70
	<i>Lee P Gelman</i>	0.43	0.48	-0.57	-0.01	-0.04
	<i>Lee P Davidson</i>	0.28	0.53	-0.54	0.21	0.35
	<i>Shabro P Tuma</i>	-0.10	-0.12	0.13	0.83	0.23
	<i>Shabro P Gelman</i>	0.33	0.18	-0.11	0.61	-0.47
	<i>Shabro P Davidson</i>	0.16	0.20	-0.08	0.86	-0.06
	<i>Tuma P Gelman</i>	0.44	0.31	-0.26	-0.18	-0.73
	<i>Tuma P Davidson</i>	0.29	0.38	-0.25	0.07	-0.32
	<i>Gelman P Davidson</i>	-0.25	-0.01	0.07	0.26	0.50
	% explained	17.89	13.12	11.48	10.87	9.88
	% explained (cumulative)	17.89	31.01	42.48	53.35	63.23

Correlation between implicit pairwise preferences and latent factors. The analysis was conducted for District 2 voters who participated in the three 2008 IRV contests.

Table 4: Latent Traits and Partisan or Nonpartisan Preferences

		Regression coefficients			R ²
Dependent variable		Intercept	Latent partisan trait	Latent independence trait	
Executive	<i>McCarthy (D) P Lonergan (I)</i>	-0.09	0.56	-0.34	0.59
	<i>Goings (D) P Lonergan (I)</i>	-0.14	0.54	-0.59	0.87
	<i>Lonergan (I) P Bunney (R)</i>	0.05	0.49	0.60	0.76
	<i>McCarthy (D) P Goings (D)</i>	0.04	0.02	0.41	0.22
	<i>McCarthy (D) P Bunney (R)</i>	-0.02	0.83	0.26	0.86
	<i>Goings (D) P Bunney (R)</i>	-0.07	0.83	0.04	0.76
District 2	<i>Rose (D) P Merrival (D)</i>	-0.14	0.03	0.01	0.00
	<i>Rose (D) P McDonald (R)</i>	0.09	0.56	0.10	0.36
	<i>Merrival (D) P McDonald (R)</i>	0.18	0.55	0.09	0.36
Assessor-Treasurer (nonpartisan)	<i>Washam P Lee</i>	-0.09	-0.07	0.02	0.01
	<i>Washam P Shabro</i>	-0.07	-0.08	0.04	0.01
	<i>Washam P Tuma</i>	-0.24	-0.06	0.03	0.01
	<i>Washam P Gelman</i>	-0.07	-0.14	0.03	0.03
	<i>Washam P Davidson</i>	-0.16	-0.09	0.03	0.02
	<i>Lee P Shabro</i>	0.01	-0.01	0.03	0.00
	<i>Lee P Tuma</i>	-0.19	0.01	0.02	0.00
	<i>Lee P Gelman</i>	-0.01	-0.08	0.02	0.01
	<i>Lee P Davidson</i>	-0.09	-0.02	0.02	0.00
	<i>Shabro P Tuma</i>	-0.22	0.02	0.00	0.00
	<i>Shabro P Gelman</i>	-0.04	-0.06	0.01	0.01
	<i>Shabro P Davidson</i>	-0.13	-0.01	-0.01	0.00
	<i>Tuma P Gelman</i>	0.18	-0.08	0.01	0.01
	<i>Tuma P Davidson</i>	0.09	-0.03	0.00	0.00
	<i>Gelman P Davidson</i>	-0.13	0.07	0.00	0.01

Each row presents the results of a linear regression of the row variable on the latent partisan and independence traits (previously estimated via PCA using data from the Executive race). The first three columns give regression coefficients and the last column gives a measure of goodness-of-fit (R-squared). Bold font indicates high statistical significance ($p < 0.01$, evaluated using robust standard errors, clustered at the precinct level). Regressions were estimated using data from District 2 voters only. The sample size was 39,788 for all regressions.

Figure 1: Instant Runoff Voting Sample Ballot (Pierce County, Washington, 2008)

Precinct: 31-673 Type: 1406 - B
 140602

Ranked Choice Voting Ballot

Pierce County, Washington
General Election - November 4, 2008

Instructions:
 You may rank up to three choices.
 Vote across in each race.
 Use a pencil or blue pen to connect the arrow.

1. Mark your first choice in Column 1.
2. Mark your second choice in Column 2. This choice must be different from your first choice.
3. Mark your third choice in Column 3. This choice must be different from your first and second choices.
4. You may rank less than three candidates. You may leave any remaining columns blank.
5. If you mark the same candidate in more than one column, your vote for that candidate will only count once.

How to change a vote or correct a mistake:

- Call 253-798-VOTE to request a replacement ballot.
- If unable to call, draw a line through the entire candidate's name like this: George Washington ←
- You have the option of making another choice.
- Do not sign your ballot.

Column 1 Executive	Column 2 Executive	Column 3 Executive
1 First Choice (Vote for One)	2 Second Choice (This must be different from your first choice. Vote for One.)	3 Third Choice (This must be different from your first and second choices. Vote for One.)
Mike Lonergan Exec. Excellence	Mike Lonergan Exec. Excellence	Mike Lonergan Exec. Excellence
Pat McCarthy Democrat	Pat McCarthy Democrat	Pat McCarthy Democrat
Calvin Golings Democrat	Calvin Golings Democrat	Calvin Golings Democrat
Shawn Bunney Republican	Shawn Bunney Republican	Shawn Bunney Republican
(Write-In)	(Write-In)	(Write-In)

Column 1 Assessor - Treasurer	Column 2 Assessor - Treasurer	Column 3 Assessor - Treasurer
1 First Choice (Vote for One)	2 Second Choice (This must be different from your first choice. Vote for One.)	3 Third Choice (This must be different from your first and second choices. Vote for One.)
Dale Washam Nonpartisan	Dale Washam Nonpartisan	Dale Washam Nonpartisan
Terry Lee Nonpartisan	Terry Lee Nonpartisan	Terry Lee Nonpartisan
Jan Shabro Nonpartisan	Jan Shabro Nonpartisan	Jan Shabro Nonpartisan
Bernardo Tuma Nonpartisan	Bernardo Tuma Nonpartisan	Bernardo Tuma Nonpartisan
Barbara Gelman Nonpartisan	Barbara Gelman Nonpartisan	Barbara Gelman Nonpartisan
Beverly Davidson Nonpartisan	Beverly Davidson Nonpartisan	Beverly Davidson Nonpartisan
(Write-In)	(Write-In)	(Write-In)

Turn Over - Side One
 Precinct: 31-673 Type: 1406 3-1406

Source: 2008 Pierce County's Official Local Voters' Pamphlet.

Figure 2a: Repetition of ranking types across contests (Executive vs. Assessor-Treasurer)

In this matrix plot, rows correspond to choice of ranking type in the 2008 Pierce County Executive contest, and columns correspond to choice of ranking type in the 2008 Assessor-Treasurer contest by the same individual. For each row, cell color intensity indicates the incidence of a particular behavior in the Assessor-Treasurer contest (darker colors correspond to higher row percentages). For instance, the close-to black color of cell (abc,abc) indicates that most individuals who report a complete ranking in the Executive contest, also report a complete ranking in the Assessor-Treasurer contest. N = 312,771.

Figure 2b: Repetition of ranking types across contests (Executive vs. District 2)

In this matrix plot, rows correspond to choice of ranking type in the 2008 Pierce County Executive contest, and columns correspond to choice of ranking type in the 2008 District 2 County Council contest by the same individual. For each row, cell color intensity indicates the incidence of a particular behavior in the District 2 contest (darker colors correspond to higher row percentages). For instance, the close-to black color of cell (abc,abc) indicates that most individuals who report a complete ranking in the Executive contest, also report a complete ranking in the District 2 contest. N = 43,661.

Figure 3a: Dimensional Analysis of Individual Pairwise Preferences (Executive Contest)

The factor map depicts the projection of pairwise preferences (vectors) into the first and third latent dimensions (horizontal and vertical axes), for the 2008 Pierce County Executive contest. Vector coordinates represent the correlation between pairwise preferences and each latent dimension. The longer the vector, the better the two dimensions explain the corresponding pairwise preference. The notation "aPb" represents the pairwise preference between candidates a and b. Democratic candidates are represented using the letter "D," Republican candidates are represented using the letter "R" and Independent candidates are represented using the letter "I."

Figure 3b: Dimensional Analysis of Individual Pairwise Preferences (District 2 Contest)

The factor map depicts the projection of pairwise preferences (vectors) into the first two latent dimensions (horizontal and vertical axes), for the 2008 Pierce County District 2 contest. Vector coordinates represent the correlation between pairwise preferences and each latent dimension. The longer the vector, the better the two dimensions explain the corresponding pairwise preference. The notation "aPb" represents the pairwise preference between candidates a and b. Democratic candidates are represented using the letter "D," Republican candidates are represented using the letter "R" and Independent candidates are represented using the letter "I."

Figure 4: Dimensional Analysis of Individual Pairwise Preferences (All 2008 Contests)

The factor map depicts the projection of pairwise preferences (vectors) into the first two latent dimensions (horizontal and vertical axes), for the three 2008 IRV contests. Vector coordinates represent the correlation between pairwise preferences and each latent dimension. The longer the vector, the better the two dimensions explain the corresponding pairwise preference. The notation “aPb” represents the pairwise preference between candidates a and b. Democratic candidates are represented using the letter “D,” Republican candidates are represented using the letter “R,” Independent candidates are represented using the letter “I,” and candidates competing in nonpartisan contests are represented using the letter “N.”

Figure 5: Effects of Partisan Trait on Partisan and Nonpartisan Preferences

District 2 Contest (partisan): Rose (D) vs. McDonald (R)

Assessor-Treasurer Contest (nonpartisan): Washam vs. Gelman

Horizontal lines represent the predicted value of the pairwise preference (in the -1 to 1 interval) between the winner and runner-up in each contest (vertical axis) for different values of the latent partisan trait (horizontal axis), setting the latent independence trait at zero. Predicted values were calculated over 1,000 simulations for each contest, by drawing from the robust variance-covariance matrix of regression coefficients. Vertical intervals cover the distance between the minimum and maximum predicted value over all simulations.