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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA

RON DUDUM, MATTHEW SHERIDAN,
ELIZABETH MURPHY, KATHERINE
WEBSTER, MARINA FRANCO & DENNIS
FLYNN,

Plaintiffs,

vs.

JOHN ARNTZ, Director of Elections of the
City and County of San Francisco; the
CITY & COUNTY OF SAN FRANCISCO, a
municipal corporation; the SAN
FRANCISCO DEPARTMENT OF
ELECTIONS; the SAN FRANCISCO
ELECTIONS COMMISSION; and DOES 1-
20,

Defendants.

Case No. C 10-00504 SI

**DECLARATION OF
JONATHAN KATZ, Ph.D, IN
SUPPORT OF PLAINTIFFS'
MOTION FOR
PRELIMINARY
INJUNCTION**

HEARING DATE: Mar. 12, 2010
HEARING TIME: 9:00 a.m.
JUDGE: Hon. Hon. Susan Illston
COURTROOM: 10

1 I, JONATHAN N. KATZ, Ph.D., hereby declare under penalty of perjury as follows:

2 1. The City of San Francisco adopted an instant runoff voting (“IRV”) in
3 March 2002 and first implemented that system in citywide elections in November
4 of 2004.

5 2. I have evaluated that system and a summary of my basic findings is as
6 follows:

- 7 • San Francisco’s use of a Restricted Instant Runoff Voting
8 system, where individuals are permitted to rank at most three
9 candidates, limits the ability of some voters to equally
10 participate in elections and regularly disenfranchises some
11 voters.
- 12 • This impact falls disproportionately on voters who prefer less-
13 popular candidates.
- 14 • The use of Restricted IRV has often resulted in the election of
15 candidates with less than a majority of the total votes cast, and
16 likely altered election outcomes from what would have resulted
17 under the standard unrestricted IRV or under the traditional
18 primary-runoff system.

19 **QUALIFICATIONS**

20 3. I am currently Professor of Social Sciences and Statistics and Division
21 Chair of the Humanities and Social Sciences (which is akin to being a dean at other
22 universities), at the California Institute of Technology. I was also formerly on the
23 faculty at the University of Chicago and a visiting professor at the University of
24 Konstanz (Germany). A complete copy of my *curriculum vitae* is attached hereto
25 as Exhibit 1 and incorporated herein by this reference.

26 4. I received my Bachelor of Science degree from the Massachusetts
27 Institute of Technology and my Masters of Arts and Doctor of Philosophy degrees,
28 both in political science, from the University of California, San Diego. I have also

1 done post-doctoral work at Harvard University and the Harvard-MIT Data Center.

2 5. I have done extensive research on American elections and on
3 statistical methods for political science data. I am a member of the Caltech/MIT
4 Voting Technology Project, serving as co-director since October 1, 2005.

5 6. I have written numerous articles published in the leading journals as
6 set forth in my curriculum vitae. I am currently the co-editor of *Political Analysis*,
7 a co-founding editor of the Political Science Network (a collection of on-line
8 journals) and sit on the editorial board of three leading academic political science
9 journals—the *American Journal of Political Science*, *Electoral Studies*, and
10 *Political Research Quarterly*—and have served as a referee of manuscripts for
11 most of the major journals in my fields of research and the National Science
12 Foundation. I am an elected fellow of the Society for Political Methodology. I am a
13 former fellow of the Center for the Advanced Study in the Behavioral Sciences.

14 7. Over the past decade, I have testified or consulted in numerous
15 elections cases involving the Federal Voting Rights Act, the evaluation of voting
16 systems, or the statistical evaluation of electoral data. I have testified or consulted
17 in court cases in the states of Arizona, California, Florida, Georgia, Indiana,
18 Illinois, Maryland, Michigan, Missouri, New Mexico, Oklahoma, Texas, and
19 Washington.

20 **BACKGROUND ON INSTANT RUNOFF VOTING**

21 8. IRV was adopted by voters in San Francisco in March of 2002 and was
22 first used in elections there in November 2004. IRV is a member of the class of
23 Single Transferable Voting systems and is also known in the literature as Rank
24 Choice Voting, Preferential Voting, and Alternative Voting. I will refer to it as IRV
25 throughout this declaration.

26 9. In an IRV election an individual votes by ranking a list of candidates,
27 and the counting of ballots occurs in rounds. First, there is an initial count in
28 which the candidates are ordered according to the number of voters listing them as

1 their first choice. If any candidate has a majority of the first preference votes, he or
2 she is declared the winner and the election is over. If not, the last place candidate is
3 eliminated and his or her votes are reallocated to the second ranked candidate on
4 the individual ballots, resulting in an “instant” runoff without the need to conduct
5 an additional election. Again, if any candidate has a majority at this point, they are
6 the winner. If no candidate has a majority, then again the last place candidate is
7 eliminated and his or her votes reallocated to the next ranked and still viable
8 candidate on their ballot. This continues, runoff by runoff, until one candidate has
9 a majority, which must ultimately occur if there are only two candidates left.

10 10. The typical ballot for an IRV election has the voter rank as many or as
11 few candidates as he or she chooses. (I will refer to such a system as “unrestricted
12 IRV” throughout this declaration.) There is a concern that if voters do not rank
13 enough candidates, then all of their ranked candidates will be eliminated before
14 the final round of balloting is complete and their ballot becomes “exhausted.”¹ A
15 voter whose ballot is exhausted is effectively excluded from the final round of the
16 election that determines the ultimate winner. To put it simply, their vote does not
17 count. In fact, this concern causes some jurisdictions that use IRV to require
18 voters to rank all candidates in the race. This is done, for example, in elections for
19 the Australian House of Representatives.

20 11. San Francisco’s version of IRV, on the other hand, permits voters to
21 rank only a limited number of candidates, even if there are more candidates on the
22 ballot for a particular office. I will refer to this as “Restricted IRV.” Restricted IRV
23 is contrary to what most experts on voting systems recommend: among advocates
24

25 ¹ Ben Reilly & Michael Maley, *The Single Transferable Vote and the Alternate Vote*
26 *Compared, in* ELECTION IN AUSTRALIA, IRELAND, AND MALTA UNDER SINGLE TRANSFERABLE VOTE
27 (Shawn Bowler & Bernard Grofman eds., 2000) (“Reilly & Maley”); Gary W. Cox, INSTANT RUNOFF
28 VOTING WITH RESTRICTED VOTING (2003) (“Cox”) (submitted to the California Secretary of State as
Appendix A to Remcho, Johansen & Purcell, et al., *Submission to the Secretary of State Opposing
Certification of San Francisco’s Proposed Manual-Count, Instant Runoff Voting System* (May 23,
2003)).

1 of instant runoff voting “it has regularly been stressed that voters should be able to
2 choose how many preferences they will indicate.”² In San Francisco the number of
3 candidates that can be ranked is determined by the Chief Election Officer, but it
4 has been three for all elections held using Restricted IRV.

5 12. IRV is widely used in other countries, and with a few select exceptions
6 discussed below, they all use unrestricted IRV. A few of the international
7 jurisdictions where unrestricted IRV is used include: Australia, both for Federal
8 and all local elections;³ Ireland for all elections, including both houses of
9 Parliament and European elections; and Malta for all legislative elections.
10 Restricted IRV is unusual outside the United States, except for voting for the
11 Mayor of London and the President of Sri Lanka.⁴

12 13. While IRV is not widely used in the United States, a number of states,
13 including Arkansas, Louisiana and South Carolina, use unrestricted IRV for
14 military and overseas voters who vote absentee, where it is not practical given time
15 constraints for these voters to participate in the general and runoff election
16 without some such accommodation.

17 14. Additionally, Burlington, Vermont, and Takoma Park, Maryland, use
18 IRV, but they do not restrict the number of candidates a voter can rank.⁵ New York
19 City uses unrestricted IRV for its community school board elections, and has for
20 several decades. And finally, Cambridge, Massachusetts, uses a related Single-
21 Transferable-Vote system though in a multi-member, proportional representation
22 system. Cambridge does not limit the number of candidates that voters may rank.

23 15. San Francisco became the first jurisdiction in the United States to use
24

25 ² Cox, *supra*, at 3 (quoting Reilly & Maley, *supra*, at 43).

26 ³ Several jurisdictions require the ranking of all candidates by voters including Federal
legislative elections.

27 ⁴ Cox, *supra*, at 1.

28 ⁵ Opponents of IRV in Burlington have submitted signatures for a ballot proposition to
repeal it.

1 Restricted IRV, in 2004. A few local jurisdictions have adopted restricted IRV
 2 since that time, following the San Francisco model. These include: Aspen,
 3 Colorado,⁶ Pierce County, Washington;⁷ Oakland, California; Berkeley, California;
 4 San Leandro, California;⁸ and Minneapolis, Minnesota.⁹

5 16. The reason for adopting Restricted IRV appears to be to save costs for
 6 the jurisdictions. By using Restricted IRV they can use their old optical scan
 7 equipment with minor modifications for both the local Restricted IRV elections as
 8 well as the non-IRV elections for state and Federal offices and ballot measures.

9 **RESTRICTED INSTANT RUNOFF VOTING IN SAN FRANCISCO**

10 17. To see how the restricted version of IRV used in San Francisco can
 11 both disenfranchise some voters and alter election outcomes consider the example
 12 in Table 1, below, which is drawn from Cox (2003):¹⁰

13 **Table 1: Comparison of Election Results**
 14 **Unrestricted IRV vs. Restricted IRV**

# of Voters in Bloc	Voters' Candidate Rankings (Unrestricted IRV)	Voters' Candidate Rankings (Restricted IRV)
8,000	ABC	ABC
9,000	BA	BA
3,500	CDEAB	CDE
2,000	DECAB	DEC
1,000	EDCAB	EDC

21
 22 18. In this hypothetical election there are five candidates competing. We
 23 denote the candidates with the capital letters: A, B, C, D, E. Each voter has
 24

25 ⁶ Aspen voters repealed IRV in November 2009 in a non-binding vote.

26 ⁷ Pierce County voters repealed IRV in November 2009.

27 ⁸ However, Oakland, Berkeley, and San Leandro have yet to hold any elections using IRV.
 They propose to do so for the first time in November 2010.

28 ⁹ Minneapolis has held only one election using restricted IRV, in November 2009.

¹⁰ See footnote 1, *supra*.

1 preferences or a ranking over them. For example, a voter with ranking BACDE
2 most prefers candidate B, ranks A second, ranks C third and so forth. A voter that
3 is indifferent between candidates is denoted by excluding them. For example, a
4 voter who prefers candidate A to B but with no clear ranking of the remaining
5 three candidates is denoted by AB.

6 19. The 23,500 voters in this election are grouped into five blocs based
7 upon their preferences that are given in the second column of the table. We can
8 see that there are two large groups, with a combined total of 17,000 votes, that split
9 their first-choice votes between candidates A and B. There are also three blocs
10 with 6,500 combined voters that most prefer minor candidates (*e.g.*, C, D, and E).

11 20. If we assume that individuals vote sincerely¹¹ under unrestricted IRV,
12 where there are no restrictions on how the voters may rank the candidates, then
13 the ballots should conform to the second column of the table. Candidate A would
14 then win the election. In the first round, candidate E, with the fewest votes, is
15 eliminated and his or her votes transferred to candidate D.¹²

16 21. However, these additional 1,000 votes are not sufficient to prevent the
17 elimination of D in the next round, since his or her 3,000 (2,000 first preference
18 votes plus the 1,000 second choice votes from the supporters of E) ranks them last.
19 These 3,000 votes are then transferred to candidate C giving him or her 6,500
20 votes in the third round, but this is still less than both A and B. The 6,500 are
21 transferred to A, who is ranked fourth by all the supporters of the minor
22

23 ¹¹ An individual votes “sincerely” if they rank their preferred candidate first on the ballot,
24 their second most preferred candidate second, and so on, in order of their true preferences. This
25 is in contrast to “strategic” voting, where a voter may misrepresent his or her ranking in the belief
26 that it will ultimately influence the final outcome to benefit the candidate they favor. This is
27 discussed more below.

28 ¹² The Restricted IRV used in San Francisco allows for multiple candidates to be eliminated
in a round of counting, if given their current votes and possible transfers in subsequent rounds of
counting, it is mathematically impossible for them to win, as is the case here. The analysis and
results of this hypothetical election would be the same under this rule, but there would be fewer
rounds of counting.

1 candidates, and A wins. Notice that under unrestricted IRV all voters can
2 participate in the final choice of winner.

3 22. The situation is different under Restricted IRV that limits voters to
4 ranking no more than three choices, as used in San Francisco. If we again assume
5 that individuals vote sincerely,¹³ then they should mark their restricted ballots as in
6 column three of Table 1. The first three rounds of vote counting will be as in the
7 unrestricted case, with candidates E, D, and C being eliminated in that order. But
8 now we run into the problem that the supporters of the minor candidates (the last
9 three rows) have had their ballots exhausted. That is, their votes cannot be
10 transferred to their fourth choice candidates because election officials do not know
11 their full preferences given the restriction to only ranking three candidates, and
12 they are instead excluded from participating in the rest of the election. In this
13 hypothetical election, because we cannot transfer the remaining 6,500 ballots, the
14 final round leads to candidate B winning with 9,000 votes to candidate A's 8,000
15 with 6,500 votes left uncounted.

16 23. Note that had this election been held under a traditional two-part
17 election with a primary and runoff election, or under unrestricted IRV, these 6,500
18 voters could have fully participated in the election. We have already seen this for
19 unrestricted IRV. For a primary and runoff system, in the primary candidates A
20 and B would have advanced to the runoff. Then assuming that the same voters
21 turned out to vote in the runoff, the supporters of minor candidates would be able
22 to participate if they choose to, and A would win.¹⁴

23 24. As noted above (see footnote 13), the assumption of sincere voting is
24

25 ¹³ The assumption of sincere voting is less plausible under Restricted IRV than under
26 Unrestricted IRV. As will be discussed in more detail below, Restricted IRV provides increased
incentives for a voter to vote strategically—that is, to misreport his or her preferences by ranking a
less-preferred candidate higher than a more-preferred one.

27 ¹⁴ The assumption of no change in turnout may also be implausible in real elections, but as
28 long as the change in turnout is not correlated with a voter's preferences for candidates, and the
change is not too large, this would still be the likely outcome.

1 less-plausible under Restricted IRV than under unrestricted IRV, as there is more
2 of an incentive for voters to misreport their voting preference. This misreporting
3 of preferences in an election is referred to as “strategic voting” in the academic
4 literature. Consider, for example, a voter with preferences EDCAB. He or she
5 would be better off voting EDA, as opposed to the sincere vote of EDC, because his
6 or her vote would now impact the race between A and B that ultimately decides the
7 election.

8 25. However, for such an individual to vote strategically they have to both
9 (1) know that their first- and second-choice candidates are not likely to make it to
10 the final round and then (2) be able to accurately forecast which other candidates
11 will be in the final round. This may be a difficult task and places a greater burden
12 on supporters of less popular candidates who will otherwise be excluded from the
13 final round of voting. On the other hand, supporters of popular candidates are
14 guaranteed to fully participate in the election by merely voting for their most
15 preferred candidate. In short, Restricted IRV penalizes voters who support
16 unpopular candidates. This is particularly problematic, since one of the main
17 justifications for using IRV is to ensure that all voters, regardless of their political
18 preferences, can equally participate in the election by preventing them from
19 wasting votes.¹⁵

20 **SAN FRANCISCO IRV ELECTION RESULTS**

21 26. This concern with Restricted IRV is hardly just the result of some
22 idealized academic exercise. Consider, for example, the 2006 race in San Francisco
23 for the member of the Board of Supervisors for District 4. There were six
24 candidates in the race: Chan, Dudum, Ferguson, Jew, Mak, and Zheng. The first
25 round of counting was a very close race between Dudum with 5,134 votes, Jew with
26
27

28 ¹⁵ A wasted vote is one that does not affect the final outcome of an election.

1 5,184 votes, and Mak with 4,569.¹⁶ Now consider the supporters of the other three
2 candidates: they would have to correctly forecast that the final round would be
3 between Dudum and Jew and mark their ballots accordingly, which does not seem
4 obvious given the closeness of the race, or their ballots will be excluded from the
5 election.

6 27. Unfortunately, unlike the example above, we do not observe the
7 complete rankings of the voters, but only the totals after each round of counting.
8 However, by the fourth and final round of this election, there were 6,010 exhausted
9 ballots or 27.3% of the total ballots cast in the election. This strongly suggests that
10 some voters were excluded because they failed to correctly forecast the final round,
11 so all three of their ranked candidates were eliminated. It is also the case that were
12 more complete rankings of these 6,010 voters allowed to be expressed, the election
13 outcome could have easily changed given that the margin in the final round was
14 801 votes—or less than one-seventh the number of exhausted ballots.

15 28. But perhaps the most difficult case faced by some voters in San
16 Francisco using Restricted IRV was the election for the District 5 Supervisor in
17 2004. That race had 22 candidates enter. The eventual winner was Ross
18 Mirkarimi, and counting took 19 rounds. Voters supporting almost all of the other
19 candidates would have had to correctly forecast that the race with all these
20 candidates would come down to Mirkarimi and Haaland. Clearly many did not,
21 since 13,144 ballots were exhausted—or 33.5% of the total ballots cast. Again this
22 is far greater than the margin of victory in the final ballot counting round.

23 29. These two examples from San Francisco's experience with Restricted
24 IRV are hardly atypical. Table 2 presents all the number and percentage of
25 exhausted ballots for all San Francisco elections in which there was not a first
26 round winner, so that there really was an "instant runoff."

27 _____
28 ¹⁶ The election results, a copy of which are attached hereto as Exhibit 2 and incorporated
herein by this reference, come from the San Francisco Department of Elections website.

Table 2: Exhausted Votes in San Francisco Restricted IRV Elections Election Number of Exhausted Votes Percentage of Exhausted Votes

Election	# of Exhausted Votes	% of Exhausted Votes
2004 Supervisor District 1	4,781	15.6%
2004 Supervisor District 5	13,144	33.5%
2004 Supervisor District 7	10,580	30.3%
2004 Supervisor District 11	6,595	26.5%
2006 Supervisor District 4	6,010	27.3%
2006 Supervisor District 6	2,269	11.4%
2008 Supervisor District 1	2,781	8.8%
2008 Supervisor District 3	4,291	14.3%
2008 Supervisor District 9	2,973	10.3%
2008 Supervisor District 11	5,294	27.4%

30. As these results demonstrate, the numbers of exhausted ballots are typically large both in absolute terms and the percentage of ballots cast. The largest is for the 2004 race for Supervisor for District 5 that had 22 candidates, so the restriction to only 3 rankings was severe. Further the number of exhausted ballots exceeds the margin of victory in every race. Note that the voters who cast these exhausted ballots were disenfranchised and were not allowed to vote or to have their votes counted in any of the subsequent runoff rounds of counting.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct of my own personal knowledge except for those matters stated on information and belief and, as to those matters, I believe them to be true. If called as a witness, I could competently testify thereto.

Executed on February 3, 2010, at Pasadena, California.

/s/ Jonathan N. Katz

 JONATHAN N. KATZ

1 I, Christopher E. Skinnell, the e-filer of this document, attest that
2 concurrence in the filing of this document has been obtained from the signatory.

3 Dated: February 3, 2010 By: /s/Christopher Skinnell
4 Christopher E. Skinnell

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