Candidate incentives under different voting systems, and the self-reinforcing deterioration of US democracy

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Abstract — **The USA has been and is evolving into an undemocratic state in which rich moneyed entities control politics to favor their own interests at the expense of the majority of the voting population. This evolution is a natural and inevitable consequence of certain logical-historical-economic-political laws that operate under the US's present system of government. The process is self-strengthening via "positive feedback." We back these statements up with evidence. We state and argue for the validity of several dynamical laws which underlie this. We then analyse the feedback process they cause. Six alterations in the political system are then proposed and analysed that could weaken the positive feedback and hopefully allow a renaissance of democracy. The most subtle, but perhaps quite effective, among our suggestions (and the only one to which we devote much analytic attention) is to replace the present "plurality voting system" with "range voting." It is argued that this will decrease both 2-party dominance and motivations for the major parties to try to appear identical ("Tweedledum and Tweedledee").**

Keywords — Range voting, Duverger's law, political convergence.

1 The failure of US democracy

Ralph Nader, Independent Candidate for US President in 2004, has two main criticisms of US government.[1]

Nader's first complaint about US politics is that the top two parties and their presidential candidates are nearly identical – "Tweedledum and Tweedledee" – offering voters little or no real choice.

For **example**, in the 2004 presidential election, the Democratic running mates Kerry & Edwards had (as senators) voted identically to their "opponents" Bush & Cheney on

1. both wars,
2. the (highly imbalanced) budgets,
3. the tax cuts (including many provisions especially favorable to the rich),
4. the poorly performing "no child left behind" education act,
5. the medicare prescription drugs-payment plan (whose expense now appears to have been underestimated by $134 billion),
6. The "Patriot act" (containing civil-rights-violating provisions which seem obviously unconstitutional[2]), and
7. the subsidy-laden $190 billion Farm Bill (passed May 2002; *The Economist* called it "absurdly bad," the *New York Times* "disastrous," and the WTO[3] ruled it illegal)

in other words, on every single major vote during the Bush 2000-2004 administration, with the sole exception of the $87 billion supplemental budget allocation for the Iraq campaign that Kerry & Edwards opposed. This single exceptional case allowed Bush to attack Kerry & Edwards for "not supporting our troops." But they replied that in fact they had merely voted against the $87 billion because it was unfunded by a tax increase and because of an insufficient accounting of the planned expenditures – in fact they supported the $87 billion in principle and indeed Kerry then said he wanted to *increase* US troops in Iraq beyond Bush's plans. So even this can hardly be termed "disagreement."

Meanwhile Nader (and a large fraction of Americans) would have opposed almost all of these things. In short, there is substantially greater agreement between Bush and Kerry than between Americans generally.

Nader's second complaint is that both of the two Tweedledee parties are increasingly dominated by the big business and highly-moneyed interests who fund their enormously expensive campaigns against each other. Not coincidentally, the politicians, once elected, use their power to return these favors a thousand-fold. Huge benefits then result for those interests, whose power and wealth continually grow, at the expense of the typical taxpayer, whose power and wealth continually

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[1] Nader has a record as one of the most successful citizen-activists of the 20th century, and is one of the greatest-ever students of American government – e.g. there are 63 books currently available from amazon.com authored or co-authored by Nader. Therefore, his views deserve consideration.

[2] The FBI is given absolute power to access doctors', libraries', bookstores', universities', or anybody else's records concerning third parties. It is made illegal to reveal cases where the FBI did that. The FBI is granted power to wiretap and search citizens without proving probable cause to suspect them of a crime. The power to prevent such maneuvers is removed from judges. No accounting system allows people to see whether the FBI is abusing these powers. Later note: some parts of the Patriot Act have now been ruled unconstitutional by the courts.

[3] Both Kerry and Bush say they support the WTO.

shrink.

We now give enough examples to make clear the **increasing gap between rich and poor in the US** over recent decades. First of all, during the period 1947-1979[4], family income across all economic segments of society rose between 86% (for the top 1%) and 116% (for the bottom 20%) i.e. a fairly uniform relative rise, with a somewhat higher relative rise among poorer people. But this changed drastically during 1979-2001, when family incomes rose in a very nonuniform and monotonic way (the "rich got richer"), with the top 5%'s income rising by 81% but the bottom 40%'s by less than 10%. The changes in *after tax* incomes during 1979-2001 were even more dramatically biased, with the bottom 60% of households gaining under 15% while the top 1% increased 201%. The US's median inflation-adjusted household income fell during each year between 1999 and 2004 [63]. Economists often measure societal inequality with respect to incomes (or any other quantity, such as years of education or land ownership) with the "Gini index." This index would be 100% in a society with maximum inequality (in which everything is owned by a single person) and 0% in a society with complete equality[5]. In 2003, the most equal country whose Gini Index was measured by the UN was Hungary (23%) and the most unequal Namibia (70.7%) ([62] table ending p.285). The US (40.8%) has the 7th highest value among the 41 "highly developed" countries whose Gini indices were known to the UN, and *the* topmost known value among the 30 OECD countries. Since the US Census department began measuring Gini index based on household incomes in 1967, it has either increased or stood still. It was initially about 30%, actually representing a more *equal* society than the majority of present-day countries. Almost all of the increase to 40.8% occurred after 1980. Another index of societal inequality developed by the UN is the "Human Poverty Index" (HPI2) which incorporates not only information about incomes (specifically, the proportion of the population with incomes below 50% of the median income) but also about literacy rate, proportion of deaths before age 60, and proportion of long term unemployed. In 2003, Sweden had the lowest known HPI2 at 6.5%, while the USA had the highest at 15.9% ([62], table ending p.249). Another kind of inequality is racial. The USA incarcerates blacks at about 10 times the rate for whites and the ratio of White median net worth to Black exceeded 8 in 1998 [67].

The ratio of the earnings of CEOs to the average worker in their corporations rose from 15 in the 1940s to 40 in 1970 to a record high of over 400 in the US in 2003, far higher than in any other country [25]. In 1992, the bottom 40% of US households owned only about 1% of the country's wealth, while the top 10% owned 66% (now 70%) and the top 1% owned over 30% [55] (which has now [67] increased to about 40%). The fraction of US wealth owned by the top 1% of US households has varied over the last 200 years and is thought to have reached its lowest points (about 21%) in 1810 and 1949 and its highest point, about 36%, in the twilight of the Robber Baron era shortly before the 1929 stock crash. However, the US now exceeds the latter. During 1983-1998 the bottom 40% of US households lost 76% of their wealth[6] whereas the wealth of the top 1% increased by 42%. About 12.5% of Americans and 20% of American children (30-40% of black ones) live below the poverty line despite the fact the US has the highest GDP per capita (table ending p.281 of [62]). The US-government-set "minimum wage" is well below the government-determined "poverty line" so that many people who work full time cannot afford to live. According to the US Census Office, the percentage of those living in poverty increased for the third consecutive year in 2003. In 1999, the bottom 30% of Americans had negative wealth (i.e. were in debt) [64]. The percentage of wage and salary workers who belong to labor unions decreased steadily from a high [58] of 37.0% in 1960 to 12.9% in 2003 (US dept. of Labor, bureau of statistics).

Another kind of inequality arises from unequal enforcement rates for different kinds of laws. In 1970, the US created OSHA (the Occupational Health and Safety Administration) and charged it with the task of protecting the nation's workers from unsafe working conditions. At the same time, they enacted *criminal* penalties in cases where willful violations of safety laws by employers resulted in worker deaths. In the next 22 years, over 200,000 deaths occurred in workplace accidents. The total number of jail terms handed out was *one*, a 45-day sentence [33]. In contrast, during the same period, there also were about 200,000 "conventional" homicides, about 80% of which resulted in jail sentences. The total number of US citizens residing in jail currently exceeds, on both an absolute and a per capita basis, that of any other country. A confidential 1993 survey by the *National law journal* of the senior attorneys of more than 200 US corporations found that slightly over 2/3 of them had (in the opinion of their own attorneys) operated in violation of Federal or State environmental laws during that year. In the US today, about 30,000 cancer deaths per year are estimated to be caused by exposure to chemical pollutants. By comparing death rates in more and less polluted areas (and during more and less polluted days) of the US one finds that increased pollution correlates to between 6% and 21% increased *overall* death rates.

Is income inequality a good or bad thing? Since doubling a poor person's income increases his happiness more than an increase of a 50× richer person's income by 1%, greater overall societal happiness arises in more equal societies. Some might counterargue that that may only be a short term effect, while in the long term, putting more money in the hands of richer (and hence perhaps more able) people will yield better overall economic benefits to society. While that "trickle down" argument may sound plausible (and in fact probably is correct for a hypothetical *exactly* equal society), in the regimes that are practically encountered it is wrong, according to a 1998 World Bank cross country study [21] showing that greater initial inequality is strongly nega-

[4] During which, perhaps not coincidentally, the US enjoyed greater prosperity, compared to the rest of the world, than at any other time throughout history.

[5] Precise definition: The Gini Index is the area between the convex-∪ "Lorenz Curve" $y = L(x)$ and a hypothetical line $y = x$ of absolute equality, expressed as a percentage of the total area under that line. Here $L(x)$ is the percentage of total income earned by the bottom x fraction of households.

[6] For compilations of data of this sort, see [61][67][60][34][51].

tively correlated to future economic growth[7].

To argue that this rise in disparity is **substantially the result of actions by the US government**, consider the following. The percentage of US government revenues coming from corporations has fallen from over 50% in the 1940s to 7.4% now, a record low. Theoretically the corporate tax rate was 35%, but 133 among the top 250 US corporations managed to pay less than half that rate during at least one year among 1996-1998, with 41 actually paying *negative* taxes [32]. By 2003, this situation had worsened to the point where 61% of US corporations paid no taxes. According to the U.S. Commerce Department, pretax corporate profits in the 3 years 1996-1998 rose by a total of 23.5% over these three years, which theoretically (with either a flat or progressive tax structure) should have led to at least the same factor increase in federal corporate income tax revenues – but in fact they rose by only 7.7%. So evidently, a large and increasing number of special corporate tax "loopholes" has had a dramatic effect. All this understates the true problem since US corporations are allowed to maintain two sets of books – one to show their shareholders and the other to show the IRS – with the latter in recent years showing only 70% of the income of the former.

As of 2004, personal tax rates on earnings are 23.4% on average, while personal tax rates on *investment* income are only 9.6% on average [31].[8] Before Ronald Reagan took office in 1980, the top tax rate on personal earnings was 50% (in the 1950s it had been 91%), on most investment income 70%, and on long term capital gains 35%; these rates by 2004 had fallen to 35, 35, and 15% respectively. During the 2000 Bush adminstration the US also drastically reduced the estate tax (or as Bush preferred to call it, the "death tax"; this was a tax on inheritances in the 98th percentile and above in size). This had a significant impact on rich people, since according to *Forbes magazine*'s 2004 list of world's richest people, the top 20 richest Americans include 10 whose wealth was largely inherited. The true situation is worse than these figures would indicate because federal tax cuts and corresponding decreases in federal money disbursements have caused an increase in local property taxes. Property taxes in the US are used to fund public schools; the net effect of that combined with local "zoning" regulations is to exacerbate a correlation between household incomes and children's education, in turn decreasing social mobility. More tax avoidance has become possible due to the cut of the number of permanent IRS employees from 111,980 in 1989 to 82,563 in 1999 (despite a 14% increase in the number of returns filed), including a cut in the number of revenue agents and tax auditors from 31,315 to 20,736, and the elimination of the IRS's random audits program (the most useful indicator of tax compliance rates). The biggest personal tax evasion case in US history, against fugitive multibillionaire Marc Rich, ended with his pardon by President Bill Clinton as one of Clinton's last acts in office.[9]

I would like to go even further than Nader. My claim in a nutshell is that the US has turned into a **sham democracy** which in reality is somewhere between a **plutocracy** and an oligarchy. Here are five facts to illustrate this:

1. In recent years slightly over 98% of US House members who run for re-election at the end of their 2-year terms win. (Compare: Ireland 83%; India below 50%.) This suggests the system is rigged.[10]
2. In New York State, 11474 consecutive votes on bills in the House and Senate have passed, with zero rejected (although only 4% of proposed bills managed to reach the stage where they are voted upon – the rest were blocked by party bosses and parliamentary maneuvering) [19]. Over 95% of the major bills passed in both houses of the NY legislature during 1997-2001 were passed with no open debate, no committee hearings, and no committee reports. Since the system is rigged so that every bill passes, all power is concentrated in the hands of 3 men: NY State governor G.Pataki, Republican party boss J.Bruno, and Democratic party boss S.Silver, the latter two of whom (a) decide which bills will be voted on and when, and (b) their job status cannot be affected even if the 98% of New York State voters not in their small districts wish to get rid of them.
3. The state of Texas recently decided to redistrict every time the party in power wants to, as opposed to the previous policy of only doing it after censuses. Some of the 2003-2004 districts (mainly the urban ones, such as Dallas's 100th and 103rd Texas House districts) plainly are highly gerrymandered; they have bizarre shapes with extremely rough, fractal-appearing, boundaries [57]. The US congressional districts in Texas are also highly gerrymandered; see [54] for a map of the 19th, which looks a bit like a swan in flight, and was designed to eliminate Rep. Charles W. Stenholm. With modern computer-aided gerrymandering and the financial resources available to a government (and the fact that the vote counts from each election are available at the "precinct" – very

[7] According to [12], "This conclusion is robust across different inequality measures, and to many different specifications of the growth regression. Furthermore, inequality appears to have a negative effect on *both* democracies and non-democracies. Interaction terms between inequality and regime type, when included in the base regression, do not affect [this]."

[8] The true situation is worse than that since it is estimated that at least 25% of investment income is not taxed at all since it is not reported. It is almost impossible for most wage earners to hide their income since payroll checks are reported directly to the IRS, which garnishes the paychecks before they even are printed. But rich investors have many ways to hide income (such as offshore "tax haven" countries, and the use of networks of multinational "holding companies") and there are many specially legislated tax exemptions they can also benefit from.

[9] Rich was often in the *Forbes Magazine* list of the 400 richest Americans. His ex-wife Denise donated $70,000 to Hillary Clinton's successful senate campaign and $450,000 to Bill Clinton's presidential library fund, as well as raising money for the Democratic Party. Marc Rich was also charged with numerous non-tax criminal offenses, totalling over 100 charges in all.

[10] Incumbency advantages include the fact that they did it before, gerrymandering to produce "safe" districts, ability to deliver "pork" and favors to powerful moneyed constituents, and the "franking" privilege (free postage). (See p.37 of [59] for a graph illustrating the fact that Congressmen abuse their franking privilege by sending campaign-related mail.) Studies have shown that more pork correlates to greater advantage but seems an insufficiently large effect to completely explain it. Today's 98% incumbency advantage is an increase over the 90% average during 1950-2000. The same trend also happened in state (as opposed to federal) government: "in 24 US states from 1970-1986, incumbency advantages roughly doubled" [18]. These increases are presumably due to better gerrymandering, the increase in the effect of and amount of money in political campaigning, and the fact that corporate campaign contributors like to maximize their probability of and amount of influence by contributing to the probable winner, i.e. the incumbent. The latter is our first example of a *positive feedback system.*

much smaller than "district" – level of resolution, and the fact that the party affiliations and street addresses of individuals are made available when they annually register to vote) it has become entirely technologically feasible to design district shapes so that if only slightly more than 25% of the electorate favors the party in power, then it will remain in power, completely legally.[11]

These three examples are completely contrary to the well known American maxim "no taxation without representation." Instead, in examples 1 and 2 taxpayers are effectively getting nearly zero representation. It is interesting to compare these 3 examples of US "democracy" with the governments of "dictators" such as Saddam Hussein and Fidel Castro. Unlike US House members, dictators have not managed to attain 98% probability of still being in power 2 years later. Although it is difficult to get data, it seems unlikely that most dictators have achieved so tremendous power that they can get their way about new laws 11474 consecutive times.[12] And finally, although it is assuredly true that dictators often remain in power despite the fact that they are supported by less than half of their population, they cannot remain in power if their support is *too* small. Hussein and Castro enjoyed or enjoy (respectively) at least 25% support and hence by the democratic standards of Texas deserved (or deserve) to remain in power.

4. Only Christian non-Hispanic white men have ever been US president, although they are only about 26% of the electorate.[13] Since James Buchanan in 1854, only Republicans and Democrats have ever been president, although they are only about 66% of the electorate.[14] If both of these factors are considered simultaneously and regarded as independent then (since $0.26 \times 0.66 = 0.17$) the probability that, say, 10 independent presidential elections would occur which by pure chance selected a White Male Christian Republican-or-Democrat non-Hispanic president each time, would be $0.17^{10} \approx 0.00000002$. Evidently, US presidential elections produce unrepresentative samples of the electorate. Indeed, the percentage of US congress/parliament seats occupied by women ($\approx 15\%$) is in the lowest quintile of applicable countries, well below such countries as Pakistan, Canada, Cuba, and Rwanda (whose percentages increase in order from 21 to 49%).

5. In the 2000 presidential election, polls showed J.McCain enjoyed greater voter support than either A.Gore or G.W.Bush. Therefore, in a democracy McCain presumably should have won the presidency. But instead, the two-party system (combined with the fact that more *Republicans* supported Bush than McCain) forced McCain to abandon his candidacy as hopeless.

2 The goal of this paper

This paper's thesis is that

1. Nader's complaints about US democracy are correct.
2. These trends are an inherent consequence of
   (a) The present structure of the US's government and electoral system,
   (b) certain realities about today's economy,
   (c) historo-political laws.

   They are a self-reinforcing positively-fedback juggernaut that are causing, or have caused, the conversion of US democracy into a sham which is really a plutocracy.
3. By altering that system, much of the positive feedback that creates these pernicious effects would go away, allowing a healthier democracy and society.

The purpose of this paper is analyse how the positive feedback system works, and then to use a simple mathematical model to explore what would happen to it if various changes were made, in particular if the present "plurality" voting system were replaced by alternative voting systems. The conclusion will be that we should support "range voting." That voting system was also advocated for entirely different and independent reasons in [48].

3 Five "Laws" of political science

Mathematicians commonly express feedback and growth/decay processes as ordinary differential equations (ODEs). Those ODEs exhibiting *positive feedback*, such as $\dot{x} = kx$ with the constant k *positive*, generically exhibit *exponential growth* – here $x(t) = e^{kt}$. In contrast, ODEs with negative feedback, such as $\dot{x} = -kx$ and $\ddot{x} = -kx$, tend to exhibit either exponential decay ($x = e^{-kt}$) or oscillation $x = \sin(\sqrt{k}t)$. Importantly, we can often tell that a system has positive feedback despite knowing almost nothing about it. For example $\dot{x} = F(x)$ will cause growth of x with time if $F(x)$ is any *positive*-real-valued function; and if in addition F ultimately increases unboundedly, then we will get a runaway positive feedback scenario in which x increases faster and faster towards ∞. Although any political-economic-historical system is extremely complicated and impossible to understand, we can sometimes become quite confident it is in a runaway positive feedback state merely by knowing the *signs* of various effects and by measuring some numbers quite crudely; and this may be entirely achieveable. That, we shall claim, is exactly what is going on in the USA today.

In this section we are going to list 5 laws[15] of political science. We claim that laws 1, 3, 4, and 5 in fact apply to the present

[11] Draw slightly more than 50% of the districts each to contain slightly more than a 50% fraction of supporters; make the remaining districts have 0% supporters.

[12] It is known [56] that Fidel Castro's regime in Cuba actually involves a considerable amount of voting by various bodies arranged in hierarchical fashion, i.e. really is somewhat intermediate between a democracy and a dictatorship. E.g. it it some ways is more democratic than the initial "democracy" in Athens Greece.

[13] 51% of the electorate is women, 77% are Christians [43], and (according to the 2000 US census) 70% are non-Hispanic white. Approximating these factors are independent, White Male non-Hispanic Christians are therefore about 26% of the population.

[14] US voters are divided approximately 33-33-33% into Republicans, Democrats, and Other (including both other parties and non-affiliated).

[15] This paper employs the word "law" with some hesitation, since by it we shall not mean a mathematical theorem nor a law as legislators understand the word. Rather, it is a semi-empirical phenomenon supported sometimes by "experimental" (i.e. historical) evidence, sometimes by logical reasoning including theorems valid in certain mathematical models of the situation, and sometimes by both.

US econo-political system and force damaging positive feedback scenarios.

Duverger's laws of political party development:
1. The plurality (1 winner) voting system tends to lead to a 2-party system.
2. The proportional representation (multiwinner) system tends to lead to many mutually independent parties. [16]

An excellent example of Duverger's first law is the USA. In about 1854 the two top parties, the Republicans and Democrats, solidified their control. Since then they have won the presidency in every election (with the asterisk that in 1864 the Republican party temporarily renamed itself the "Union" party; its candidate A.Lincoln still won). Their control has been so dominant that only once – in 1912 – was a 3rd party (Bull Moose / Progressive) even able to place above a distant 3rd, with its candidate T.Roosevelt garnering second place. This aberration was possible because the Bull Moose party was largely a split-off fragment of the Republican party led by former Republican president Roosevelt.

An excellent example of Duverger's second law is the Netherlands, historically with 7-15 parties.

There is a great deal of other historical evidence for these laws [44][23], and they nowadays seem well accepted. For example, European countries acquired more political parties when they switched from plurality to PR [41]. See pp.21-24 of [17] for a tabular comparison of the 16 two-elected-house democracies in the early 1990s. The only plurality-based democracy there was the USA with 1.94 and 1.96 as the "effective number of political parties" (ENPP, judged by seats); there were 13 with various forms of Proportional Representation and they all had ENPPs ranging from 2.18 to 8.6. The reason Cox tabulated 2-house democracies was that he wished to compare the relative ENPPs in the two houses; these comparisons agreed with the theoretical prediction from (his form of) Duverger's law. Duverger's laws 1 and 2 cannot be applied to the remaining two countries in Cox's table because they employ a different voting system.[17] Cox's table does not include (since they each only have one elected parliamentary body) the only two plurality-based democracies with more than 2 parties: Canada and India. Although these two countries have been proposed as exceptions to Duverger's law [44], I disagree that Canada is an exception, since [38] Canada is plainly dominated by the Liberal and Conservative parties with only one occasion since 1867 (namely in 1921) in which a third party got more seats than one of the top two (NPP, with more seats than the Conservatives) and with no third party ever getting more than 12% of the seats (except on that one occasion), while meanwhile both the top two parties have each always managed to get over 16% of the seats.

Those two countries presumably avoid Duverger law #1 (to the extent that they do) because they (a) are non-presidential (i.e. the electorate cannot directly choose a president) (b) their parties have high association with ethnic or geographic groups, and (c) India's government has only been operating since 1947 and may not have had time to stabilize yet.

There is a simple **reason** why Duverger's first law is operative. It is an immediate consequence of "strategic voting." In every US presidential election involving 3rd party candidates, the electorate is urged not to "waste their vote" by voting for the third party candidate. Instead they are told to vote for the least-disliked among the two candidates from the top parties. The tremendous underlying logic behind these urgings is widely recognized. Indeed, arguably the 2000 presidential election was lost by A.Gore to G.W.Bush precisely because of voters for the 3rd party candidate Nader. Polls indicate that these voters, had Nader been unavailable, would mostly have chosen Gore, which in view of the known official vote counts in New Hampshire and especially Florida would have been far more than enough to tip the election in Gore's favor. Many Nader voters, therefore, had reason to regret voting for Nader.[18]

It really *is* foolish to "waste one's vote." And this really is

[16] This is a verbatim translation of a 1980 statement by Maurice Duverger. Duverger went on to claim "3. The 2-ballot majority system tends to lead to multipartism moderated by alliances." This is a system used in France involving, if there is no majority winner, a second runoff election between the top contenders in the original election. A version of "Duverger's" law had in fact been stated by Henry Droop in 1869 [44].

[17] Australia elects its House and Senate via single-winner and multi-winner Hare-STV systems respectively ($\mathrm{ENPP}_{\mathrm{House}} = 2.03$ and $\mathrm{ENPP}_{\mathrm{Senate}} = 2.57$ in 1993). Japan elects district representatives with multiwinner (3 to 5 winner) plurality voting systems.

[18] The official 2000 Bush-Gore 537-vote margin in Florida was so small that many other factors could also be said to have "caused" it. For examples, there were about 2,500 votes accidently cast for Buchanan, and there were over 2,000 illegally-cast votes (i.e. cast by dead or non-resident people). In the months before the election, Florida Gov. Jeb Bush (G.W.Bush's brother) and his Secretary of State and Supervisor of Elections Katherine Harris (who also happened to be G.W.Bush's Florida campaign chief) ordered local election supervisors to purge a list of 57,700 voters from registration lists because they were "felons" not entitled to vote. This list had been prepared by a division called DBT of a company called ChoicePoint, whose board contained many important Republicans; DBT had been paid $2,317,800 for the job, which they had been offered without competitive bidding; to allow them to do this, the contract with the company previously in charge of producing the list (for $5,700) was terminated. Although it was later found that about 90% of those 57,700 "felons" were innocent of any crime, more than half were guilty of being black [40]. (Blacks favored Gore over Bush by a 9:1 ratio; the number of blacks excluded by this and the next list constituted about 10% of the black voters in Florida.) In addition, 40,000 genuine felons, *but* who still had the right to vote under Florida law, were also removed from the voter rolls; about 90% of them were Democrats. 179,855 Florida ballots simply were never counted, because they were "invalid." Oddly enough, the rates of non-counting were considerably higher in the 4 blackest Florida counties than in the 4 whitest (one reason being that electronic voting machines in Gadsden had been adjusted to silently reject invalid ballots without any indication to the voter that it was happening):

County	% black	% uncounted	County	% black	% uncounted
Gadsden	52	12	Citrus	2	1/2
Madison	42	7	Pasco	2	3
Hamilton	39	9	Santa Rosa	4	1
Jackson	26	7	Sarasota	4	2

Although only 11% of Floridians are black, it was claimed in a speech in Congress on 21 Sept. 2004 that over half the state's invalid ballots appear to have been cast by blacks. Each of these effects were plainly far larger than required to cause Bush's victory. (Incidentally, in July 2004 the *new* felons list which Florida had prepared for the new presidential election, was found to contain 48,000 names, each racially identiified, and amazingly, only 61 of them identified their race as "Hispanic." Hispanics in Florida support Bush. Strangely enough, those 48,000 felons included 28,025 registered Democrats but only 9,521 Republicans.) Despite all these other causes, the official count of 97,488 Nader voters still loomed among the biggest.

recognized by almost all voters. (Nader received slightly under 3% of the vote in 2000. But the percentage of voters who privately thought he was the best among the 3 candidates exceeded 3% by about an order of magnitude. This is not just my belief; it is indicated by National Election Study polling that $< 15\%$ of the voters who thought Nader the best candidate, actually voted for him [11]. Similar remarks could be made about many previous 3rd party candidates.) This effect causes 3rd party candidates to lose plurality-system elections by greatly magnified margins compared with their true stature in the minds of voters. Over time, this tends to kill them off and solidify the power of the top two parties. Of course, the more powerful the top two parties become, the more valid the logic of avoiding "wasting your vote" becomes, i.e. we have *positive feedback*.

The two top US parties have been known to add injury to insult by then using their wealth and legislative and administrative power to make it even more difficult for 3rd parties to gain any foothold. (The US press in 2004 contained many stories about Democratic party moves, including about 20 simultaneous lawsuits and admitted organized mass infiltrations of meetings of Nader supporters, to try to prevent Nader from getting on state ballots.) This is yet another form of positive feedback.

Now let us consider some further laws of political science.

> **3. Law of convergence to the median voter:** The two parties and their major candidates (assuming a plurality voting system with 2-party dominance) will tend, in their apparent stances on all major issues, to converge both toward each other and toward the median-voter stance. Over time this causes them, like Tweedledum and Tweedledee, to greatly resemble one another.

This law is a Darwinian consequence of the simple 1-dimensional "spatial analysis" originally due to H.Hotelling in 1929 [29] and later redone in various flavors by [22], in the first chapters of [24] and [6], and it will again be redone in §9 of the present paper. The reason, essentially, is that any candidate with a well known non-median stance on an issue will have less voter support than an opponent whose stance is slightly different and closer to the median voter's stance. Over time this causes non-median candidates and parties to vanish from the political scene.

As an example of this kind of Darwinian weeding-out in action, consider the **top 5 biggest "landslides"** in US presidential election history. Barry Goldwater was perceived as actually quite different from his presidential opponent Lyndon Johnson in 1964 (and he made no attempt to seem identical, which was a tactical error) which cost him the largest landslide defeat ever. The same thing happened with G.McGovern versus R.M.Nixon in 1972, F.Mondale versus R.Reagan in 1984, and A.Landon versus F.D.Roosevelt in 1936. The 5th was J.Cox vs. W.Harding in 1920. In all of these 5 cases, except perhaps the first, the winning candidate (listed second) adopted a policy of banality (Harding's campaign slogans were "getting back to normalcy" and "Americanism") and staying away from discussion of most issues throughout his candidacy, while his losing opponent did not and/or was perceived as having out-of-the-mainstream views. The only tough issue Harding had to contend with was the League of Nations. He went to great lengths to make his stance on this as vague, confusing, concealed and platitude-filled as possible (meanwhile Cox supported it "with all my heart"; Cox was associated in the public's mind with the unpopular Wilson administration). But in a 1923 magazine article Harding approved *after* his election he said he had never intended to allow the US to join the League. Similarly, Nixon acted mysterious about what he would do about the Vietnam War, while avoiding most other issues; Reagan said he wanted to cut taxes and strengthen the military but avoided specifics and stayed vague on other issues; and Roosevelt too was famed for avoiding discussing specifics of his future plans. (These impressions are from [45][46].)

A revealing test of the law of convergence is to consider the congressional votes that took the US to **war** during the last 100 years.[19] One would expect the law of convergence to apply particularly strongly to war votes because of their importance and visibility compared to most other congressional votes. And indeed fig. 3.1 suggests that Congress was, in 5 out of 6 cases, closer to unanimity than the US population as a whole on war votes.[20]

War	date	House	Senate	P
2nd Iraq	11 Oct 2002	296-133	77-23	55
Afghanistan	15 Sep 2001	1 dissent	unanimous	80
1st Iraq	12 Jan 1991	250-183	52-47	70
Vietnam	7 Aug 1964	unanimous	2 dissents	55
World War II	Dec. 1941	388-1	unanimous	95
World War I	Apr. 1917	373-50	82-6	80
average	1910-2004	86%	87%	$72.5 \pm 2\%$

Figure 3.1. US votes for wars over the last 100 years. P is my best guess of the pro-war percentage of the US population. (It is difficult to tell the exact value since it depends heavily on the exact phrasing of the question asked in the poll and the exact time the poll was taken.) Other notes: The 2nd Iraq war resolution (11 Oct. 2002) was authorized "if Hussein refuses to give up weapons of mass destruction" and "if Pres. Bush declares that diplomatic measures failed."
Force in the Afghanistan War was authorized "against those nations, organizations, or persons [whom Pres. Bush] determines planned, authorized, committed, or aided the terrorist attacks."

[19] I believe that before the improvements in media (e.g. the appearance of radio) and education (e.g. the shrinkage of illiteracy rates below 10%) during and after the 1910s, convergence was less important because people were unable to know their representative's stands. Evidence for that includes the fact that none of the top 5 presidential landslides occurred before 1920, and the fact that a continuation of table 3.1 to wars before 1920 would suggest much less severe convergence.

[20] So far, Congress has never refused to authorize a war. The probability this 5 out of 6 is merely due to chance is $7/64 = 10.9\%$ (this is the probability that flipping 6 coins will lead to ≥ 5 heads), i.e. we have statistical significance nearly at the 90% level. Another test of statistical significance is the following. Assume, extremely generously, that the average P was 77%. Then the probability that 3000 votes, cast by random people, would have been $\geq 86\%$ in favor of war, would have been $\sum_{k=0}^{420} .77^{2580+k}.23^{420-k}\binom{3000}{420-k} \approx 2 \times 10^{-35}$. So there is extremely high confidence that the US House and Senate are more hawkish than random people.

"Vietnam" means the Tonkin Gulf resolution. Many legislators believed that the attacks on the US destroyer *Maddox* had been unprovoked. Administration officials failed to inform Congress that South Vietnam had been conducting commando raids in the area and that the second attack may not have occurred. Tape recordings of phone conversations between L.B.Johnson and R.McNamara surfaced much later [20] which made it clear how LBJ had deliberately faked the number and severity and motivation of the attacks and also had deliberately tried to provoke attack. The Tonkin Gulf resolution was later repealed 2 Jan. 1971.

Truman entered the Korean War without asking Congress for a declaration.

The immediate justification for the Spanish-American War was the sinking of the US battleship *Maine*, which the Naval Office believed was due to a mine. Half a century later, divers examining the wreck showed it had instead been caused by an accidental steam-boiler explosion. ▲

Before continuing, though, we must admit that it is difficult to quantify "convergence" and hence difficult to argue completely convincingly from experimental evidence that it is a real effect. Thus although the war vote evidence shows that the effect plainly exists, it is not tremendously large. Also, one might theoretically expect a more hawkish House than Senate since House elections are 3 times more frequent, but that is not supported by this evidence. For another example, from anecdotal evidence it is plausible that various other countries have high-level politicians who feel freer to express a wider range of sincere opinions than US high-level politicians. If so, that is evidence for convergence. *But*, it also appears from anecdotal evidence that this cross-country difference (if it exists) is not tremendous: it is certainly less than a factor of 10, and perhaps less than a factor of 2 (on some subjective scale). If so, that is evidence that convergence is not a tremendously strong effect. When we present our theoretical analysis of convergence in §9 we will also understand why convergence in the US is not total.

4. Corollary of increasing deception: Since necessarily political parties are almost entirely not composed of clones of the median voter, the preceding median-voter law requires them and their major candidates to lie about, mislead voters about, or at least disguise or hide, their true beliefs.

A version of law #4 already had been stated by Downs [22][21]. Personally, I regard corollary 4 as more damaging than law 3. It is not so much the convergence itself that bothers me as the fact that the plurality voting system – even with all the caveats (listed above) about the convergence argument – always makes it advantageous for politicians to lie, evade, and mislead.[22] The main result of this paper (law 8 in §9) will be an argument that with range voting, it perhaps can actually be *advantageous* for politicians to honestly express genuinely distinct views.

5. Money/corruption corollary: In the environment resulting from laws 1,3,4 in which politicians are expected to lie and evade questions as a matter of course, politicians tend to become a comparatively corrupt and dishonest subset of society. (The usual proverb that "Power corrupts, and absolute power corrupts absolutely" also contributes.) Perhaps more importantly, in the environment resulting from laws 1,3,4 in which important issues are marginalized and distinctions about them are minimized and hidden by both sides, something else, besides the important issues, has to be provided to furnish an argument for electing one of the two candidates instead of the other. That something necessarily must be irrational, e.g. emotional. That need can presently be filled only by ultra-expensive television advertising. This produces a tremendous appetite for *money* by the two candidates, leading to, indeed essentially forcing, big-money domination of US politics.

Sophisticated televised appeals to emotion, centered around comparatively unimportant pseudo-issues (and usually not explicitly stating distictions between the opposing candidates at all) now dominate US political advertising, and it is tremendously expensive to produce and televise them. (In contrast, simple textual statements about the issues, published on the internet and in major print media, would have been 100 times cheaper to produce, while nevertheless providing a much greater amount of useful information.[23]) For example, as I write this in August 2004 the Bush vs. Kerry race is dominated by ads alleging that Kerry's Vietnam War combat medals were undeserved since his war wounds were comparatively minor. Emotive images about Kerry's disrespect for the contributions of other Vietnam Veterans are also included. The objective importance of this "issue" for the purpose of deciding who should be the 2004 US president is, to say the least, minimal. Commentators continually tell us how greatly important it was that during the 1988 Bush vs. Dukakis race, in one "photo opportunity," Dukakis rode around on top of a tank while wearing a helmet which (in the words of columnist Maureen Dowd) made him look like a "dork." Bush also attacked Dukakis with a televised ad showing an unending line of scary-looking black prisoners flowing out of a revolving prison door. This ad was stimulated by a black prisoner named William Horton who, on a 48-hour furlough from a prison in Massachusetts during Dukakis' tenure as governor, committed rape and assault.[24] Bush also attacked Dukakis because the latter did not advocate making scholchildren recite "the pledge of allegiance to the flag." Again, these "issues"

[21] Obviously the advantageousness (for candidates) of such "strategies of ambiguity" is anti-correlated to how "risk averse" the voters are [47], but the above stories of the biggest presidential landslides suggest that this effect often is small.

[22] Fishel ([26] p.37-38) studied presidential campaign promises and found that 67, 63, 60, 65, and 53% were kept (either fully or partially) by Kennedy, Johnson, Nixon, Carter, and Reagan, respectively; the next President, Bush ("Read my lips: no new taxes") probably would score even lower still, suggesting these numbers are declining.

[23] It is a myth that it costs a tremendous amount for politicians to "transmit their message." The real expense arises from the cost of making and televising emotional appeals replete with music, actors, inspirational images, and professionally trained emotive voice-overs, all of which, logically speaking, are merely an irrelevant distraction. Indeed if laws 1,3,4,5 continue to operate, politician's television ads will continue to become more expensive despite continuing to say less and less about important issues.

[24] Political consultant Floyd Brown of Americans for Bush said at the time "When we're through, people are going to think that Willie Horton is Michael Dukakis' nephew."

were of little objective importance for the purpose of deciding who should be the 1988 president.

Such ads work. More precisely, big money is extremely effective in politics: In 1996, 92% of House races and 88% of Senate races were won by the candidate who spent the most money. Of course it is possible this advantage was due to incumbency instead of money, but that possibility can be nulled out by only considering "empty seat" House and Senate races in which no incumbent was running for re-election. 43 of the 53 House open-seat House races were won by the candidate who spent the most, and the top spenders in open seat Senate races won 12 out of 14 times. (Also: in the "competitive" House elections in 2000, that is those in which the challenger got more tha 40% of the vote, even though failing to unseat the incumbent, the challenger spent almost 6 times more money on average than the "uncompetitive" House challengers, i.e. who got less than 40%.) It also is important to note that this money comes from only a very small percentage of society: in 1992 only 4% of Americans made political contributions and $< 0.3\%$ contributed over $200.

The desire of corporate and special interest donors (who merge their money through PAC's, *p*olitical *a*ction *c*ommittees) to avoid "wasting" that money means that they prefer to donate to incumbents, since incumbents are much more likely than their challengers to be reelected. (Another reason is that moneys donated to candidates currently *in* office can influence their voting decisions *immediately*.) But this in turn increases the incumbency advantage! The effect of this positive feedback loop is to create "congressmen for life"; to remove any semblance of democracy; and to create a class of congressmen dependent on corporate and special interest money.

year	M	I	H	T
1974	unknown	87.7	unknown	unknown
1978	71.8	93.7	63	28
1982	78.9	90.6	94	69
1986	87.9	98.0	185	82
1988	90			

Figure 3.2. PACs & incumbency in US House 1974-1986.
M: The percent of PAC money contributed to House Incumbents seeking reelection, as opposed to their challengers,
I: the percent of incumbents who then won reelection,
H: The number of House winners who got at least half of their campaign funds from PACs,
T: The percentage of House winners who got at least 30% of their campaign funds from PACs,
all versus election year (data from [52] p.36, 73).
The number of PACs increased from 608 in 1974 to 4268 in 1981, while simultaneously the fraction of them that were corporate increased by about a factor of 4. In 1992 nearly half of all congressional campaign expenses were paid by PACs, and about half the PACs were corporate. ▲

Are PAC contributions intended to influence congressional votes, and do they? Yes. First, it is commonplace for PACs to contribute to both sides in contested races; to donate money to incumbents with *no* opponent or to those expected to win by enormous margins; to "switch horses" by donating to representatives they had previously tried to defeat; and to donate years before the election, well before any opponent has materialized. General Electric's PAC donated to 34 unopposed incumbents and to 34 who had won their previous races by $\geq$ 3:1 margins, in 1986 [52]. In the first half of 1987, there were 13 senators elected in 1986 who raised over $3 million each; more than half of that money came from PACs, and more than half of that came from PACs who were "switching horses"; and all these contributions came despite the fact that these senators each had 5 years to go before their terms expired.

Second, there is a large correlation between monetary contributions by special interest groups, and legislator votes in favor of those special interests but against the vast majority of their constituents, see figure 3.3.

a	A	b	B	c	C
>4000	90.2	>5000	100	>30000	100
1000-3000	88.3	2500-5000	97	20000-30000	97
1-1000	68.0	1000-2500	68	10000-20000	81
zero	34.2	1-999	45	2500-10000	60
		zero	20	1-2500	33
				zero	23

Figure 3.3. Money versus vote percentage.
a: dollars contributed by Nat'l Automobile Dealer's Assoc. PAC to legislator 1979-1982. Over 50% of legislators received contributions.
A: percent of those legislators voting to repeal "lemon law" (requiring used car dealers to report defects ahead of time to buyers); on 26 May 1982 the House voted 286-133, and the Senate 69-27, to repeal.
b: dollars contributed by sugar lobby to legislator 1979-1986.
B: percent of those legislators voting for sugar subsidies (26 Sept 1985). Measure passed.
c: dollars contributed by dairy lobby to legislator 1979-1986. 73% of legislators received contributions.
C: percent of those legislators voting for higher dairy price-support subsidies (26 Sept. 1985; would raise milk prices by 60 cents per gallon plus require higher taxes). Measure passed. Data copied from [52]. ▲

One unusual inside look at campaign contributions in action was provided by the Nixon tapes. In early 1971 the ITT corporation (at that time one of the 10 largest companies in the US, with over 400,000 employees) was under investigation by the Justice Department for antitrust violations. This investigation was headed by Richard McClaren, assistant attorney general for antitrust matters, who had been appointed for that purpose by Attorney General John Mitchell. On 19 April 1972, President Nixon said to J.Erlichman (as recorded on the White House Tapes) "I don't know whether ITT is bad, good, or indifferent. But there is not going to be any more antitrust actions as long as I am in this chair... goddamn it, we're going to stop it." Nixon then phoned McClaren's boss R.Kleindienst and said "I want something understood, and if it is not understood, McClaren's ass is out within an hour. The ITT thing – stay the hell out of it. Is that clear? That's an order." He clarified: "The order is to leave the goddamn thing alone... I do not want McClaren running around prosecuting people, raising hell about conglomerates, stirring things up." On 12 May 1971, Harold S. Geneen, president of ITT, gave a campaign contribution of $400,000 to Nixon's Republican Party for the purpose of supporting their upcoming 1972 convention in San Diego. Geneen's annual salary was $250,000. Actually, this was less of a contribution than it seemed, because ITT owned Sheraton, the largest hotel operator in San Diego, which would have easily recouped the $400,000. Nixon (to R.Haldeman on tape, 13 May): "Kleindienst has the ITT thing settled. He cut a deal with ITT." Haldeman: "Does ITT have any money?" Nixon: "Geneen? Oh God, yes. Does he ever! That's part of this ballgame. But it should be later. It should not be right now." On 3 June, the $400,000 contribution was announced by congressman Bob Wilson (R-Calif) and described only as coming from unidentified "San Diego interests," and in July the Republicans announced they would hold their convention in San Diego. Eight days later the Justice department officially announced that the ITT antitrust lawsuit was being dropped. In March 1972 columnist Jack Anderson revealed the money's source and made the ITT-antitrust connection, and the embarrassed Republicans suddenly decided (just months before the event) to move their convention to Miami.[25] Nixon appointed Kleindienst attorney general in 1972. Both he and Mitchell later gave false testimony about all this to Congress, for which they were convicted of perjury.

The increase in total campaign money available to a legislator in turn means that his opponents need to raise more money to compete with him. This causes a price increase for campaigns in turn causing a greater need for money, thus strengthening the present system further. This again is *positive feedback*.[26]

[25] All this is relevant when considering the McCain-Feingold "campaign finance reform" act of 2002 which made unlimited "soft money" donations (larger than $100,000) to political parties illegal, but did not outlaw huge donations to parties *for the purpose of funding their conventions*. In response, the combined cost of the Democratic and Republican national conventions immediately ballooned to $104 million (60% from private and corporate donations), in 2004, as opposed to $56 million in 2000; the 1992 conventions were only 14% funded by corporate and private donations.

[26] All this has just been based on *disclosed* and fully legal cash contributions. There have also been illegal contributions and deals at high levels:

(a) Vice President Spiro Agnew was convicted of bribery and jailed.

(b) In 1968, Ben Barnes, the speaker of the Texas house of representatives (he become Lt. Governor in 1969), claims he did a favor for then-congressman (later US president) G.H.W.Bush, as requested by Bush family friend, rich oilman Sid Adger: he catapulted Bush's son G.W.Bush (also later to become US president) ahead of hundreds of other applicants to enter the Texas Air National Guard, allowing him to avoid war service in Vietnam. (Those others had higher test scores than Bush, who scored 25%, a single percentage point above "too dumb to fly" status [35].) This story was stated by Barnes on the nationwide CBS news program *60 Minutes* on 8 Sept. 2004. Barnes said he'd arranged it via a phone call to General James Rose, head of the Texas Air National Guard. In retrospect, Barnes said he was "ashamed" of his action and his similar actions in getting other young men into the Guard. The Texas Air National Guard was known as the "champagne unit" because besides Bush Jr. it contained the sons of Lloyd Bentsen (the future vice-presidential candidate who won the 1970 Texas senatorial election against Bush Sr.) John Tower (then senator), and John Connolly (then Governor), as well as 7 members of the Dallas Cowboys football team. Col. Walter B. "Buck" Staudt, was apparently so pleased to have a VIP's son in his unit that he later staged a special ceremony so he could have his picture taken administering Bush's oath (instead of the captain who actually had sworn Bush in).

Barnes had also told the same story under oath in a 1999 trial. We now explain how that trial happened, which is even more interesting.

In 1997, G.W.Bush was Governor of Texas, and Ben Barnes was the top Texas lobbyist for GTech, the company running the Texas State Lottery (the nation's biggest). GTech encountered trouble: The state's lottery director Nora Linares was fired in Jan. 1997 after it was revealed that GTech had put her boyfriend Mike Moeller on its payroll for $6000/month while he was under indictment for bribery. (GTech said Moeller was hired by "errant" employee J.David Smith. Smith was convicted for his part in a GTech embezzlement/kickback scheme in New Jersey, for which GTech paid him $30,000 per month.) Lawrence Littwin, the new director, ordered an audit, terminated GTech's contract and put it out for rebid, and ordered an investigation of GTech's political contributions. Barnes had an advantage over most Texas lobbyists: Bush might have been grateful to him for his earlier role, or (even if not) Barnes had the potential to release the National Guard favor story, thus embarrassing Bush, who claimed (and still claims) he got into the Guard without either him or his father asking anybody for any special favors. Here's what happened: The Bush-appointed Texas Lottery Commision sacked Littwin, canceled the bidding (even though the low bidder had already been announced as GTech's replacement), stopped the audit and the political contribution investigation, and awarded a 5-year contract back to GTech with no competitive bidding. According to a letter to the US Justice Department (the letter was authored by an anonymous whistleblower, who, however, offerred to come forward in the event of a prosecution; it was leaked to journalist Greg Palast and is available on his web site `www.gregpalast.com`) this was the result of a Bush-Barnes deal.

Barnes's part was to agree that he would never confirm the Guard story. In 1998 Littwin filed suit against GTech, claiming that he'd lost his $82,000/year job as a result of illegal actions by GTech. Littwin subpoenaed Barnes. After an unsuccessful attempt to avoid the subpoena [28], Barnes in 1999 testified that he'd gotten Bush into the National Guard. Nick Kralj, a former Barnes aide, also testified at the Littwin trial that Barnes often turned names over to him for the purpose of getting them into the Texas Guard, although Bush's was not among them. (Kralj was then an assistant to Rose.) GTech had paid Barnes $23 million in lobbying fees, although it bought out and terminated its contract with him in February 1997 immediately after the alleged deal [9]. After that point GTech chairman Guy Snowden was a partner in a big real estate venture with Barnes' wife. In 1999 the Littwin suit was settled, with GTech agreeing to pay him $300,000 and Littwin agreeing to seal the transcript of Barnes' 5-hour testimony. Snowden resigned as GTech chair in 1998 after a British jury convicted him of trying to bribe British billionaire Richard Branson to drop his rival bid for the British National Lottery [10]. (Snowden was ordered to pay 100,000 pounds in damages and legal fees estimated at $2 million.) This story was reported by Grag Palast in the *Guardian* and *Observer* and in his later book [40].

(c) A third example which received curiously little press attention, is this. Nancy Reagan, the wife of President Ronald Reagan, received clothing, jewelry, shoes, and fashion accessories worth well over $1 million during his 2 terms in office (an amount comparable to or exceeding President Reagan's salary). Obviously, these were not "campaign contributions" (and indeed, Reagan never ran for another office) but instead were simply pocketed. Furthermore, the Reagans did not disclose this as "income" to the IRS, which would have cost them over $300,000 in income tax. Many of these gifts were flaunted by the first lady in public. The resulting photographs of her were later used by the IRS in a tax case brought against the Reagans after they left office in 1989. In 1990-1 the Reagans settled the tax case against them for a secret amount estimated to exceed $1 million. Similarly to the famous gangster Al Capone, no non-tax (i.e. ordinary criminal) charges were ever filed in the matter [4].

(d) Another way companies can pay off politicians is by giving them enormous fees for "speeches" they make after their retirement, by getting them involved in "lucky investments," and by hiring them as lobbyists or "employees." For example the telecommunications company Global Crossing (which went bankrupt in 2002 amidst scandals) in 1998 paid former president George Bush with 100,000 shares of stock (not at that time available to the public, since GC was at that time privately held) in recompense for Bush giving them a single speech. On 16 Nov. 1999 Bush sold the stock for $4.45 million. GC had earlier (in 1997) given Democratic Party boss Terrence McAuliffe the opportunity to buy $100,000 worth of its stock, which McAuliffe later sold for $18 million. In 1999 former NY Senator A.D'Amato received a $500,000 fee for making a *single phone call* to New York City MTA chairman E. Virgil Conway to help developer Tamir Sapir obtain a $230 million loan (despite misgivings by an MTA attorney about Sapir's ability to finish the project on time and on budget) [5]. "God bless Mr. D'Amato, because if not for him my business would be broke," Sapir testified to a NY State Assembly committee hearing investigating the matter.

All these key logical factors necessary to cause (and make inevitable) corruption and big-money domination of government have been available throughout US history, except for two:

1. the rise of PACs, which constitute a tool allowing many entities with similar special interests to combine their moneys into one well-targeted pile,
2. The large scale appearance of television during the 1950s, and its development into an effective tool of mass psychological manipulation with the aid of rapid-feedback polls and the use of "focus groups."

These were the final ingredients that triggered the present runaway positive feedback scenario which grew exponentially during 1960-2000. Although many more television channels now are available via "cable" (which might naively be thought, via the law of supply, to lessen the cost of TV advertising) in fact that just means that more television advertising is needed to get the same market coverage; simultaneously, demand for nonpolitical TV advertising continues to increase. Thus, the law of supply *and* demand really causes the price of political campaigns to continually *rise*. Indeed, the price of political campaigns has risen in every US presidential election during the television age, at a rate far exceeding inflation and population growth,[27] and despite continual technological improvements in communication. Expenditures during the 2004 election are predicted to exceed $\$10^9$. Since television remains unequalled as a emotive advertising medium, I cannot forsee any change in this trend in the forseeable future.

Cross-country comparison: Total US campaign spending in 2004 on all races will be about $\$5 \times 10^9$, which is about 1 part in 2200 of the USA's GDP and about \$17 per person. Compare this with total campaign spending in the last *UK* elections before 2002, in which about \$80 million was spent in all races combined. This was about 1 part in 20000 of the UK's GDP and about \$1.34 per person. In the UK, TV and radio broadcasters are obliged to give major parties free air-time during campaigns, while paid broadcast advertisements are banned. There are also campaign subsidies, i.e. payments to parties or candidates from public funds, intended to limit the need for private and corporate contributions.

In *Canada* during the 1997 elections a total of \$50 million was spent, which was about 1 part in 19000 of the GDP and about \$1.50 per person. Since this was felt to be too high, Canada enacted campaign spending and lobby-group contribution limit laws in 2000.

Note the **near-maximally strong incentives** operating on every part of the positive-feedback system: in the case of politicians, the incentives are their seats, in the case of donors, the incentives are their wealth, and the figures we've presented indicate very large effects – larger than from any other known cause – on both of these things are got by "going with the flow."

Some have countered that an $\approx 80\%$ probability that the top-spending candidate will win his race, is not 100%. But we riposte that "80%" considerably understates the true effect of money on politics for two reasons. First, politicians see money as 80% correlated to victory and know that this is the most correlated quantity they can readily control [1]. Therefore, fundraising is their top priority, and they devote a tremendous amount of time and effort[28] to it. Second, there are huge statistical **amplification** effects. Specifically, suppose the 100-member Senate votes on some issue affecting big-money interests, and thanks to the effect of monetary contributions, the Senators have a 60% bias (i.e can be modeled as 60-40 coin flips)[29]. The probability that the vote is won by the "60" side is then $\sum_{k=1}^{50} .6^{50+k} .4^{50-k} \binom{100}{50+k} = 97.3\%$. The corresponding probability in the 435-member House is 99.9987%. If we are considering, not one vote, but instead a sequence of many votes, then the probability that most of them will be in the "60" direction is far closer still to 100%. As Isaac Asimov in his *Foundation* novels[30] declared, in the presence of larger numbers of people, history can in some ways actually become *more* predictable. The US Senate and House (backed up by the enormous numbers of people voting for each member of them) are, in the long run, very predictable. The entire area of psychological manipulation of voters via television advertising has reached a similarly high level of predictability. The only unpredictable elements in the US government are the President (a single person) and (to a lesser degree) the Supreme Court (9 people). However, the President can at best hold the status quo (by vetoing bills passed by the Senate and House) without actually being able to force bills to push society in a direction opposite to the direction the House and Senate want. Because the president usually comes out of the same system as his compadres in the Senate and House, he often is not motivated to do even that. (Meanwhile, the Supreme Court seems essentially irrelevant to the trends we are discussing in this paper.)

4 Why can't voters simply remove the politicians who cause these problems?

One reason is that the two parties can use limited voter choice as a weapon to cram policies down our throats. The problem is that in a 2-party system, a vast multiplicity of issues must be condensed down in each voter's mind to a single binary choice. If there are 6 issues, it would be entirely possible for the two parties to disagree on all of them and simultaneously each to disagree with *you* on 3 of them and agree on 3 of them,

[27] Since the 1950s, presidential campaign spending has roughly doubled every 8 years.

[28] The Senators and Congressmen interviewed in [52] estimated 70-90% of their time in office was devoted to fundraising. To raise the year-2000 mean price of a winning congressional campaign required acquiring 1 mean annual household income worth of money every 3 weeks, sustained throughout a congressman's 2-year term; while senators had to raise money at a rate of about 1 mean annual household income worth of money every 10 days, sustained throughout their 6-year terms.

[29] One illustration of the power of highly-moneyed pressure groups on the Senate was provided by a vote on 2 March 2004 on a liability-shield bill for gun manufacturers. Midway through the voting, the National Rifle Association changed its stance on the bill for strategic reasons and because of tacked on amendments (e.g. a renewal of a ban on "assault weapons") and emailed the senators notifying them of this decision. A large number of senators changed their votes, causing a sudden 80-vote swing and the unexpected defeat of the bill!

[30] These novels concerned the hypothetical future scientific area of "psychohistory," which is somewhat similar to today's "political science."

each representing (in your mind) $3 - 3 = 0$ net progress. Under these circumstances, what is a reasonable choice for your vote? How can you by so voting hope to exert any influence in a positive direction? You cannot, unless there were more than 2 parties.

To put it another way: What if you know that both the Republican and the Democrat will approve 3 special tax loopholes once elected? For whom do you then vote in an effort to support tax reform?

To put it another: Both Kerry & Edwards and their opponents Bush & Cheney, voted for the Iraq war and for tax cuts (favoring the rich) in an era of large budget deficits. For whom should you vote if you were against the war and budget deficits?

A second reason is that many of the measures that are gradually making the US wealth and income distributions more top heavy, are both very obscure (probably most of them never become known to 99% of voters) and even when they are revealed their authors – and sometimes their beneficiaries – remain anonymous. Let us illustrate that with two **examples**.

1. In paragraph 4 of section 1114(c) of the Tax Reform Act of 1986, we find that any corporation which happens to have been incorporated on 15 December 1924 (and meeting certain other very peculiar specific requirements), should utilize a different-than-usual definition of "highly compensated employee" for the purpose of 401(k) plans. Nobody knows who wrote that paragraph. When it was repealed 15 years later, it was revealed that almost certainly the only corporation meeting those requirements was the J.C.Penney department store chain – whose lobbyists had pushed for the original paragraph (it undoubtably gave J.C. Penney special advantages worth at least tens of millions of dollars annually), but which no longer found the special definition favorable.

2. Sections 1714-1717 of the Homeland Security Act (signed by Pres. Bush on 25 Nov. 2002) seem of little relevance to Homeland Security. Their purpose instead [53] was to force any lawsuits about thimerosal into a special "vaccine court" as part of the VICP (Vaccine Injury Compensation Program), and to award extra legal protections to thimerosal manufacturers. Thimerosal is an organo-mercury compound produced by the Eli Lilly Company, consisting of about 50% mercury by weight. At the time, Lilly was the defendant in thousands of lawsuits alleging that Thimerosal had caused severe neurotoxicity to the plaintiffs' children, and that, indeed, it may be the cause of most of the contemporary cases of "autism" in the USA. US autism frequency increased by about an order of magnitude between 1980 and 2000, coinciding with a tripling in the number of thimerosal-containing vaccines commonly injected into infants. At present in the USA, somewhere between 1 in 150 and 1 in 500 children are autistic. If thimerosal really is the cause of the autism epidemic, then Lilly's liability would be over a hundred billion dollars.[31] But thanks to the Homeland Security Act, all those lawsuits (which had been filed in ordinary courts) would have to be dropped and refiled in vaccine court, in which awards are determined according to a preset list of injuries for each vaccine; those awards are then paid out of a special VICP fund financed by taxes. There is no provision in the VICP list for thimerosal, since it is not a vaccine, but instead was added to many vaccines as a preservative.

Lilly had given \$1.6 million to candidates in the 2002 election cycle (79% to the then-controlling Republican party), more than any other drug company. Nobody knows who wrote this rider. After this rider's existence was revealed in the national press (it could hardly be kept private, considering all those angry plaintiffs), a furor arose, and Rep. Dan Burton (R-IN), who said his grandson had become autistic a few days after receiving 9 inoculations, introduced legislation to repeal it. Burton had chaired a house subcommittee which in 1999 investigated links between thimerosal and autism. The rider then indeed was repealed in Feb. 2003. But in the meantime, Lilly had successfully filed for dismissal both of a Texas lawsuit and of most of the thimerosal lawsuits in Oregon. In March 2003, i.e. immediately after the rider's repeal, Senator Bill Frist (R-TN) introduced bill S.15, again seeking to protect drug companies from Thimerosal litigation while eliminating legal recourse for families with children injured by thimerosal. In 2002, Eli Lilly Co. and its employees contributed \$226,250 to the National Republican Senatorial Campaign Committee that Frist chaired during 2001-2004. Eli Lilly also bought 5,000 copies of Frist's book on bioterrorism (published after the 11 Sept. 2001 attacks) and distributed it to doctors around the US.

Our purpose in presenting the second example has not been to argue that thimerosal caused the autism epidemic. I do not know that. Our point is merely that in both these examples:

1. Highly moneyed special interests have, thanks to their political influence, lobbyists, and/or campaign or other monetary contributions to politicians, effectively gained large amounts of money which came from a much larger group of poorer and less-influential people. In the Lilly example, the amount of money involved is of order $\$10^{11}$ or higher, i.e. comparable to the entire US government's 2004 record budget deficit all by itself.
2. The authors of the relevant legislation never revealed themselves.
3. The legislation was very obscure, suggesting that most such legislation never becomes known to the public.

[31] The American Academy of Family Physicians, and American Academy of Pediatrics, and the US Public Health Sevice had in 1999 jointly called for removing thimerosal as soon as possible from vaccines for infants; in 1982 the FDA proposed, and in 1998 implemented, a ban on thimerosal in over the counter products. Simply by following a standard vaccine schedule, Lyndelle Redwood's son received 187.5μg Hg during his first 6 months of life, which on a time-averaged basis exceeded the EPA's estimated maximum safe dose of 0.1μg Hg per day per kg body weight. His *peak* exposure, immediately after the shots, was over 100$\times$ the EPA limit for that day [42]. The EPA's number had been arrived at by dividing the smallest dose of mercury that had resulted in mildly neurotoxic babies (in an Iraqi incident where mercury-contaminated bread had resulted in 450 deaths and 6000 hospitalizations) by a safety factor of 10.

Heavy metal analysis detected 4.8 ppm Hg in a lock of Redwood's baby's hair taken at 20 months of age; 5 ppm is considered diagnostic for mercury toxicity. In November 2002 a California study found that a 3$\times$ increase in classic autism diagnoses in that state between 1987 and 1998 was real, and cannot be explained as a result of improved diagnostic techniques and case-finding.

5 What can be done to break this self-reinforcing vicious cycle?

The US has several features which make these problems more severe than in other countries. The US has a winner-take-all plurality-based presidential election system, unlike the (usually parliamentary) governmental structure of most other democracies. The US is the world's wealthiest and most powerful country, causing all parts of the logical chain to operate with more force than they would have if less were at stake. The positive feedback system has been operating for a long time, so that at present it is very entrenched. Finally, the US has deeply ingrained principles of "free speech" which make it difficult or legally impossible to restrict the power of money in political advertising. Here are 6 ideas to improve the situation.

A. Standardize requirements for getting on ballots: Anybody who can collect at least 0.2% of their constituents' signatures on a petition should qualify, plus at least the top *three* signature-getters among the candidates for each office automatically qualify, plus *at least* the top three political parties in the preceding election should always be given automatic ballot slots in the next repetition of that election.

B. Require that television channels provide *free* political advertising to all candidates who got on the ballot (as in A) – in total at least as much of the free as paid variety. Such a demand would be legally imposable because the airwaves are US government property.[32] However, this by itself would be logically insufficient to break the cycle: laws 1, 3, and 4 would be unaffected, and only law 5 would be weakened, although not eliminated.

C. Require reduced rates for broadcast ads which consist purely of the candidate speaking (or text or data) without any extraneous (i.e. possibly emotional) footage. Demand that all laws and all voting records by all politicians be instantly available to all voters via a web site; outlaw non-recorded "voice" votes; and demand that every line of every bill be credited to a non-anonymous author.

D. The worst gerrymandering should be made illegal by requiring that districts

1. Have at most 6% population deviation from the average
2. Be convex in shape (i.e. their boundaries always curve left or go straight, except at state lines and unfordable rivers)
3. Have isoperimetric ratio L^2/A upper bounded by 18 (where L is the circumference of its boundary and A its area)
4. Be redrawn only after US censuses.

However, gerrymandering has been happening for 200 years (the name was coined in 1812) with no law of the sort we just described ever having been passed to restrict it.[33] We can only conclude from this that politicians are very happy about gerrymandering and (presumably) also any other factor increasing incumbency advantages.

E. Offer candidates the option – if they agree to forgo all contributions and qualify to get on the ballot as in (A) – of accepting all their campaign money from a government fund. This is similar to Maine's "clean money" system [13]. (The amount on offer should be the 90% of the average of all expenditures in the previous version of this sort of race.) Forbid honoraria and any gifts of money that elected officials and declared candidates can eventually put into their own pocket. Forbid carrying over of campaign-budget surpluses to future campaigns, instead requiring that all such moneys be turned over to a Federal fund. Demand that all political advertisements reveal their top 3 non-front-group sponsors.

All of the 5 suggestions above have been fairly obvious and conventional (which is not at all intended to disparage them). This paper shall instead explore the following, non-obvious, idea.

F. *Improve the voting system* by replacing the presently dominant "plurality voting system" with something else. This has the potential of weakening or eliminating both Duverger's law #1, and the median voter convergence law #3. Suppose so, and that, indeed, we could get anti-Duverger and anti-convergence laws to replace them, bringing us a stable attractor state with *more* than two parties, motivated to appear substantively *different*. Then their corollary (law #4) would be significantly reduced since politicians with different views could at least sometimes actually find a host party allowing them to express those views without penalty, and so would its further consequence (law #5) since issues might actually then become important compared to emotive appeals and pseudo-issues. Hopefully this would allow the US government eventually to return to its pre-hijacked state, and indeed – since there would now be a better voting system, a greater diversity of visible politician's views and of choices among politicians, and a reduction in political deception – to an improvement upon it.

6 Voting system descriptions

We now describe several voting systems for electing one winner from among N candidates. In the *plurality* system, each voter names a single candidate. The candidate with the most votes wins. In the *approval voting* [2][7] system, each voter names an arbitrary subset of the candidates (those he "approves"). Again, the candidate with the most votes wins.

In *range voting*, each voter provides a numerical score in a fixed range (e.g. the real interval $[0, 1]$) to each candidate. The candidate with the greatest total score-sum wins. In the *Borda system* the voter rank-orders the candidates. A voter's top-ranked candidate is awarded a score of $N-1$, his second-ranked candidate a score of $N-2$,... his Kth ranked candidate a score of $N-K$,... and his last-ranked candidate a score of 0. The candidate with the greatest total score-sum wins.

We now describe the Hare-STV (single transferable vote) system, which more recently has been called the *IRV (instant runoff voting)* system. Voters provide a rank-ordering of the N candidates as their vote. The candidate with the fewest top-ranked votes is eliminated in round 1, and he is erased

[32] In contrast, banning all televised political advertisements, or banning political parties, would be impossible under US constitutional principles.

[33] The best I am aware of is a 1982 amendment to the Voting Rights Act forbidding drawing districts with the intent of diminishing the voting rights of racial minorities – whatever that means.

from all preference orderings. The procedure is now repeated in the next round, but now with only $N-1$ candidates. In the final $(N-1)$th round only 2 candidates remain and the preference relations are used to perform an ordinary majority vote to obtain the winner.

In the *Condorcet least reversal system*, again each voter provides a rank-ordering of the N candidates. We now construct a directed graph with N vertices and $(N-1)N/2$ arcs. The arc between vertex p and vertex q points toward the winner of the 2-candidate subelection got by ignoring all candidates except for p and q, and is labeled with the numerical margin of victory. We now reverse some of these 2-candidate subelection arcs, if necessary, to cause there to be a unique "winner" w to whom all pw arcs point. Which arcs are reversed? Among all possible subsets of the arcs whose reversal would yield a winner (including, possibly, the empty set if no reversals are needed at all) we choose the arc-subset having minimum total victory-margin-sum.

In practice some more refinements would be needed, e.g. there would need to be rules about what to do about Borda or IRV voters who refused to rank all N of the candidates. There are many other systems, only some of which have been considered previously. For example, in 1882 E.J.Nanson [39] suggested a hybrid system like IRV, except that each "round" subelection would be run using the Borda system[34]. For another example, in the *Bullet* voting system (which nobody recommends) each voter names one candidate he hates, and the candidate with the *fewest* votes wins. For much more extensive discussions of different voting systems and their properties, see [8][48][50].

It was shown in [48] that the approval and range systems have the property that a voter's strategically-best vote in a 3-candidate election, never conflicts with the $\le$ relations defining his honest ordering of the 3 candidates. But this "3-candidate honesty theorem" is false for every other voting system we have mentioned. Thus in range and approval voting the "wasted vote" phenomenon which underlies Duverger's law #1 is no longer present.

7 Which voting system is "best"?

The largest and best comparative study of voting systems was my own [48][35] Here is a summary.

Every voting system will sometimes arguably produce the "wrong" winner [48][49]. The question is how often this happens and how severely wrong that wrong winner is. That is an experimental question. The experiment can be done by generating, inside a computer, artificial "candidates" and "voters" and running millions of simulated "elections" under different voting systems. When doing this experiment, we can artificially force each "voter" to have known private mental opinions about the numerical utility of each candidate's possible election victory. There are many possible randomized "utility generators" than can be used for this purpose. Once the election is over, we can then use these utilities to assess the utility deficit (expressed as a sum over all voters) that society suffered during that election as a result of that voting system sometimes electing a candidate with non-maximal society-wide utility. This deficit, when averaged over a vast number of randomized elections with some voting method V, is called the *Bayesian regret* of V.

Before each election, we can also provide each voter with information from "pre-election polls" about what the other voters think, and then allow that voter to combine that information with his own private utility estimates to decide how to vote "strategically." Or, we could simply make our voters vote "honestly." We could also confound our voters by adding "ignorance" and "noise" to the picture. All of these things were tried in [48].

Amazingly, across *all* of these possible variations (over a hundred were tried), a *robust conclusion* shined through:

Range voting experimentally minimizes Bayesian regret. Range voting always had the least society-wide Bayesian regret of all voting systems tried.[36]

Because Bayesian regret is a *quantitative* statistical yardstick (easily translatable into very real measures such as "lost money" or "wasted lives") it is possible from this study's output data to assess just how great a society-wide improvement would result from switching to range voting instead of the present plurality system. The assessment depends on the details of the experiment, but based on typical numbers in 3-5 candidate elections, the conclusion is

Range voting is a big win: The reduction in Bayesian regret expected by switching from plurality to range *exceeds* the improvement from switching from "pick a random winner" to plurality.

In other words, if you think democracy was an improvement over monarchy – if you think Oliver Cromwell had a good idea – then you surely must think range voting is an even bigger improvement. This makes range voting perhaps the greatest available opportunity for vast societal improvement at tiny cost.

8 Warning

But before we continue, we must note that the preceding results [48] were only assessing the expected Bayesian regret for average *single* typical future elections with 3-5 candidates, considered *independently* in *isolation.* But in fact a sequence of dependent elections, over historical time, can cause (via laws such as Duverger's and ours) dramatic societal restructuring. That kind of indirect effect was completely ignored in our preceding study [48].

In particular: suppose Duverger's law #1 also holds in some other (non-plurality) voting system V. In that case there would usually be at most *two* credible candidates in almost all elections. But all the voting schemes we have described in §6 are *identical* in a two-candidate election! All those "improved" non-plurality voting schemes only differ from plurality if there are at least 3 candidates! So in that case we would still not expect a big improvement by adopting V. Similarly,

[34] Actually, Nanson wanted to eliminate all candidates with a below-average Borda score each round, not merely the one with the least score.
[35] It also contains numerous references, which we therefore shall not cite here.
[36] Except in a single experiment class where its regret still was minimal to within statistical errors.

if the law of convergence to the median voter held under voting system V, then all candidates would usually try to appear nearly identical, causing voters effectively still to have little real choice. Again in that case V could not yield great societal improvement.

This highlights the critical importance of analysing what will happen to these historo-political laws under alternatives to the plurality voting system.

9 Voting system analyses leading to additional laws

Let us first understand the Law of Convergence. In a "two party system" where there are always at most 2 candidates with a chance, I claim both candidates always have incentive to appear as similar as possible on each issue. To see this, let the spectrum of possible stances on an issue be represented by a real interval

```
-------------------------------.
```

Let the two candidates be A and B and let their stances be

```
-------------------A----B------.
```

In this circumstance, B will be able to get more votes (a larger fraction of the interval will be closer to B than A) if B moves slightly to the left of A:

```
bbbbbbbbbbbbbbbbbbBAaaaaaaaaaa.
```

in the diagram all the "b"s are votes for B while the "a"s are votes for A. (The original situation was

```
aaaaaaaaaaaaaaaaaaAaabbBbbbbbb.)
```

But then A has incentive to move slightly to the left of B:

```
aaaaaaaaaaaaaaaaaABbbbbbbbbbbb.
```

And so on. We only reach a stable state when both A and B are exactly in the center of the voter pool (except for ϵ difference[37]):

```
aaaaaaaaaaaaaaABbbbbbbbbbbbbbb
```

at which point they both get 1/2 the votes and any further motion by either A or B will decrease the number of votes for him.

We have thus explained Law #3[38]. To be more formal, the logical axioms required to make the above discussion work were the following:

1. The policy space is the fixed finite interval $[0, 1]$ of the real line, where position x ($0 \leq x < 1$) represents a position to the right of a fraction x of the electorate.
2. Every voter has a unimodal (strictly increasing then decreasing single-peaked) utility curve over the policy space.
3. Each voter votes in a way based upon his view of the candidate's utilities, as determined by the positions of those candidates and his utility curve.
4. Candidate positions are known to the voters.
5. Candidates may reposition themselves without cost.
6. Candidates do reposition[39] themselves (repeatedly) always in such a way as to increase their share of the vote under the assumption that their opposing candidates stay the same.

This axiom list is a modification of a similar list written down by G.W.Cox [14]. Many of our results were previously discovered (independently, since I did not know of Cox when I derived them) by Cox. We'll explain that later. We shall continue to employ this 1-dimensional model and these axioms, but sometimes also with the final additional assumption

7. Each voter's utility curve is even-*symmetric* about its peak. Sometimes we shall employ the even stronger *distance-only assumption* that these curves are always of the form $y = r - s|x - t|$ where r, s, t are voter-dependent constants, $s > 0$.

Now let us contrast with the situation where there are *three* candidates A, B, C, all of whom are regarded by all voters as having a chance (i.e. for some reason 2-party domination is not operative in this election, so the voters vote honestly rather than strategically). If candidate C steps into the A, B equilibrium situation

```
aaaaaaaaaaaaaaABbbbbbbbbbbbbbb
```

to get

```
aaaaaaaaaaaaaaABCccccccccccccc
```

he grabs almost all of B's votes. But then B has incentive to move slightly to the left of A to grab A's votes:

```
bbbbbbbbbbbbbBA*Cccccccccccccc.
```

But now A wants to move either to the left of A or right of C slightly... The candidate in the middle always has incentive to jump to slightly outflank the leftist or rightist. That causes a drift apart to the left or right. This drift stops when the gap between the leftmost and rightmost candidates widens enough so that it contains $\epsilon + 1/2$ of the voters (and the far left and right subsegments each have $1/4 - \epsilon/2$) so that it pays for the moderate to stay in the middle (where he gets 1/4 of the votes) instead of moving to a flank (where he would get slightly fewer votes):

[37] Throughout this paper "ϵ" will represent a very small positive quantity.

[38] Incidentally, note that if one off-center candidate, e.g. B in the initial scenario, *refused* to reposition, then A's optimal position would be nearly identical to but slightly more central than B, and A would win. Thus, interestingly, by insisting on taking an unpopular off-center stance, a top-2 candidate can still win the day as far as the sign of that issue is concerned, albeit perhaps at the cost of losing the election itself.

[39] If the reader does not like the idea that candidates continually reposition themselves without cost, then we reassure him that there is a mathematically equivalent formulation without any repositioning. Namely, over historical time, candidates in a disadvantageous position lose and then next election are replaced by more-winning alternative repositioned candidates. The same effects then ensue, just more slowly.

```
aaaaaaAaaabbbBbbbcccCcccccc.
```

The vote split now (ignoring ϵ's and assuming utility-curve-symmetry) is $A = 3/8$, $B = 1/4$, $C = 3/8$, i.e. a 3:2:3 vote split. Now one might naively think A has incentive to slide a little rightward to grab more of B's votes. But if he tries that, then B would counter by immediately jumping slightly to A's left, at which point we would have $B = 1/4$, $A = 1/4$, $C = 1/2$, so that A cannot move one iota without suffering tremendously by losing 1/3 of his vote-count. Similarly C cannot gain any advantage from moving, so the 3:2:3 situation is a stable equilibrium. We (interestingly) conclude:

> **6. Three-candidate honest-voter plurality law:** The moderate always loses to a radical in a 1-issue 3-candidate plurality election with honest voters with symmetric utility curves, and the vote split will be about 3:2:3.

Note that in this case the Law of Convergence would *not* hold, since in fact the two flank parties would find it *advantageous* to appear discernibly *different* both from each other and the (doomed to lose) moderates. Note also that the moderates, although losing, could shift the election toward the flank candidate of their choice – but only by moving their stance *away* from that candidate's.

Of course, in reality we would usually expect voters to be *strategic* rather than honest (as over 90% of them evidently are in US presidential elections[40]) and hence would expect 2-party domination via Duverger's law. In that case this 3-candidate law, and the consequential conditional failure of the Law of Convergence, both would be irrelevant.

Still, this all does point to a limitation in our crude analysis. That in turn may explain why it is that convergence in the US (which has plurality voting) is not total. There are several reasons complete convergence (and hence complete indistinguishability among candidates) has not occurred in the US:

1. The 1-dimensional model is too simplistic.
2. Since politicians must vote yes or no on bills, their voting records cannot be hidden from the public.
3. Politicians who stay ambiguous and noncommittal are accused of being "flip floppers" and can sometimes be made to look bad.
4. To get ahead within their own party, politicians find it advantageous to appear median *within that party*, but to get ahead in the wider world, they find it advantageous to appear median *within that wider world*. This conflict forces successful politicians from the two major parties to be somewhat distinguishable (although it also gives them more motivation to be ambiguous).
5. If the two parties A and B indeed were almost identical, then one of them (say B) could *split* into a moderate and a radical fragment (call them B and C). The radical fragment (upon renaming itself as a genuine party) would then win most of the votes of the original party, with the more-moderate half-party getting almost no votes:

   ```
   aaaaaaaaaaaaaaABbcCccccccccccc
   ```

   (To be more precise, that only would happen if the voters were honest. In fact most voters are strategic, and if they judged the split-off fringe party to be so insignificant that a vote for them would be "wasted" then this would not happen. Still, enough voters are honest enough that the radical fragment party C *would* draw off *some* of the votes of the main party B, often enough to cause them to lose to A. This is in fact what happened in the US 2000 presidential election if Nader supporters are regarded as C and the Democrats as B.) In order to prevent this split and the resulting damage to their fortunes, it is necessary for each major party to try to make their radical fringe feel appreciated. That either requires genuine distance from the opposing major party, or a great deal of intentional ambiguity. Either way, complete convergence is prevented (although lies, evasions, and misleading of the public remain in no way discouraged).

All these analyses had been assuming plurality voting. Now instead assume some kind of rank-ordered voting. Then the situation is this

```
aaaaaaAaaabbbBbbbcccCcccccc
bbbbbbAbbbaaaBcccbbbCbbbbbb
ccccccAccccccBaaaaaaCaaaaaa
```

where each voter's preference permutation is now denoted by a vertical string of 3 letters, and the fraction of the electorate to the left of A is L votes, to the right of C is R votes, and the remaining (middle) portion is M votes:

```
------A------------C------
   L          M          R
```

where $L + R + M = 100\%$. Then we'll get (assuming honest voters)

```
L+M/4  votes of form   abc
M/4    votes of form   bac
M/4    votes of form   bca
R+M/4  votes of form   cba.
```

If the voters use honest Borda voting[41] and always vote 1 for their favorite, 0 for their most hated, and 0.5 for the remaining candidate, then we get these election results:

```
A: gets  L+3M/8        votes.
B: gets  L/2+R/2+3M/4  votes.
C: gets  R+3M/8        votes.
```

In this case the vote split with an $L = 1/4, M = 1/2, R = 1/4$ voter population (which had led to the 3:2:3 vote split scenario in law 6) would be $A = 7/16, B = 12/16, C = 7/32$ so that now the *moderate* would always win! In that case both flankers A, C are motivated to slide inward toward B to grab

[40] About 33% of US voters are "Independent" or anyhow not Republican and not Democrat. Their choice to be independent costs them voting power and hence can only be explained by postulating that it reflects their true beliefs. But the percentage of voters who actually *vote* for independent and third party presidential candidates (when given the opportunity) is more like 3%.

[41] With vote counts rescaled by a factor of 2 for convenience.

some of B's votes, and B now cannot counter this move by suddenly hopping slightly to A's left because B would then lose the Borda election instead of win. So A and C will continue to slide toward B until the Borda election is tied 1:1:1, i.e. when $L + 3M/8 = L/2 + R/2 + 3M/4 = R + 3M/8$ and $L + M + R = 1$ i.e. (solving these simultaneous equations) when $L = R = 1/2$ and $M = 0$. In other words,

> **7. Law of 3-candidate honest-voter Borda elections:** With honest Borda voting in a ($\leq$ 3)-candidate election all the candidates will strive to appear identical. In the 3-candidate case since the moderate always wins, the flank candidates will not even try to seem ϵ different, but instead will literally attempt to seem *identical* to get a 1/3 probability of election by a random tie-breaking process (as opposed to zero probability of election).

The same convergence will happen with honest **approval** voters assuming they approve of the middle candidate an average of half the time. This same approval-voting law was previously discovered by Cox [15][16][42] but without need of any utility-curve-symmetry assumption and with any number N of candidates allowed, with no requirement that $N \leq 3$. However, as we shall see in law #8, the introduction of *strategic* voters discourages convergence.

Cox [16] also analysed the **Condorcet** system with honest voters and concluded the Law of Convergence would still hold for it (with any number of candidates). (Analysing *strategic* Condorcet voting is not presently possible because its optimal voter strategy is not understood.)

Finally, we may also consider IRV voting with honest voters in a 3-candidate election, using the same notation as in the Borda analysis above. If $M < 4L$ then the centrist B loses by elimination in the first round, and then a flanker (A or C) wins, and this is what happens in the $L = 1/4$, $M = 1/2$, $R = 1/4$ location scenario in law 6. But now A and C are motivated to slide inward toward B both to grab even *more* votes and, more importantly, to try to win the second round. But they cannot do that, because any iota of inward motion by A would be met by B's countermove of suddenly jumping to slightly outflank him, at which point the top-rank vote counts in the first round would be $B = \epsilon + 1/4$, $A = 1/4 - \epsilon$, $C = 1/2$ and A would be eliminated in round 1 followed by a second round won by C by a hair over B. So the same scenario that is the Plurality-voting Nash strategic equilibrium also is the IRV Nash strategic equilibrium – nobody can move without worsening matters from his own point of view.

> **6′. Three-candidate honest-voter IRV law:** The moderate always loses to a radical in a 1-issue 3-candidate IRV election with honest voters with symmetric utility curves, and the vote split of the top-rank votes in the first round will be about 3:2:3. In other words, IRV with honest voters will behave exactly the same as Plurality in our 1D repositioning model.

Almost all of the above has (unrealistically) been assuming honest voters. We now consider strategic voters. Unfortunately analysing strategic voters is somewhat messy. That is because each voter's strategic voting decision depends not only on the candidates' stances on the issues, but *also* on how well they did in pre-election polls. That means we have to analyse everything *both* under the assumption that A and B are leading in those polls *and* under the alternative assumption that A and C are leading (B and C are handled by symmetry), and possibly still more cases can arise. Furthermore, when considering the possibility of a "crossover" repositioning, where, e.g. B decides to suddenly relocate himself on the other side of A, we now have to ask: should A and B's status in the pre-election polls be modeled as the same as they were before, or do they switch, with A now getting B's pre-election poll numbers and vice versa?

In **strategic plurality voting**, the strategic vote is always for one of the two poll frontrunners. Therefore the voters ignore all other candidates, and the top two candidates also ignore all the others and the situation is, for all practical purpses, a 2-candidate race. In that case both frontrunners locate themselves at the median position $\pm\epsilon$ and we get both Duverger's law and convergence. This all is assuming that "frontrunner in the pre-election polls" status does not change during crossover location-moves – which seems to be a true assumption in practice, although it is conceivable that if some other voting system were used it no longer would be.

Now suppose **strategic Borda voting** is used. Optimum strategy is to award one of the two pre-election-poll frontrunners your maximum vote, the other the minimum, and then by the rules of the Borda system, the remaining candidate gets the middle vote, regardless of his virtues. Consequently

```
A:  gets L+M/2 votes.
B:  gets 1/2   votes.
C:  gets R+M/2 votes.
```

If $L = R$ and $L + R + M = 100\%$ then this is a 1:1:1 vote tie and the winner is not predetermined by the forces of nature, i.e, amazingly, *voters really will get a genuine 3-way choice.* Another way of looking at it, though, is that the "dark-horse" candidate will have an equal chance of getting elected – no matter what his virtues – as the two "top dogs" in any well-contested election. *This* view makes Borda look really bad in the presence of strategic voters!

Now suppose **strategic range voting**, which is the same thing as **strategic approval voting** is used. We shall assume each voter uses the "better than expectation" strategy: each candidate has an estimated probability of winning, and these probabilities sum to 100%. For each voter, every candidate has a utility value. We shall assume distance-based utilities ($y = r - s|x - t|$ as in §9). For each voter, then, it is possible to calculate his expectation (in terms of utility) for the election. His optimal strategy is to approve every candidate whose utility is greater than the voter's expectation (and flip a coin in the case of exact equality). There are now 3 cases:

1. If A and C (the two flankers) are the pre-election frontrunners, then B (the centrist) will win by locating himself midway between them. In that case A and C each

[42] Even before Cox, Brams and Fishburn had already raised, as one of their few criticisms of approval voting (see the introduction to [7]), the spectre that it would cause a sterile convergence to centrism.

get average vote 1/2 (assuming they are symmetrically located, which each can assure no matter where the other goes) but B gets half a vote from every voter who outflanks the flankers and a full vote from every voter lying between them and hence wins. This election result contradicts the pre-election polls. (To prevent B's victory, A and C can co-locate at the median, in which case we get a 3-way tie.)

2. If A and B (a flanker and the centrist) are the frontrunners (and maintain that status despite any candidate repositionings), then C wins by moving between them: again a contradiction.
3. If we assume that swapping candidate locations swaps perceived frontrunner status also, then the two frontrunners (call them A and B) ignore the other candidates and position themselves purely to win the battle against the other. I.e, both co-locate at the median. Then C decides where to optimally locate himself, which is also at the median. The election result is then a 1:1:1 three-way tie. This again contradicts the pre-election polls, albeit in a weaker fashion, and anyhow renders the election result (who wins the tie-break) unpredictable.

No matter which of these cases apply, *the pre-election polls were wrong or useless*, i.e. predicted the wrong winner, or the winner was unpredictable since the result of breaking a 3-way tie. This kind of phenomenon in which pre-election polls tend (in the presence of maximally strategic voters) to invalidate themselves, is very interesting. In my previous [48], voting systems with that property had been called "suicidal," and it was pointed out that the Bullet voting system is suicidal. However, it was not there noticed that range (and approval voting, since strategic range voters always choose to vote approval-style) in fact can be suicidal, because the present 1-dimensional issue-based voting model had not there been examined theoretically.

We conclude from all this:

MAIN RESULT:

8. Non-Duverger law for Strategic range voters: With strategic range (and hence also approval) voters, we expect that Duverger's first law will *not* hold – three parties should be able to stably coexist – as it will not be the case that one of the "top two parties" will reliably win a contest between 3 discernibly different candidates.
But convergence is still predicted to occur by the 1D model.

We believe, though, that convergence occurs to a lesser extent in races with more than two serious contestants, because it becomes more strategically important to distinguish oneself from the competitors by coming up with some idea or stance that is uniquely one's own. In other words: "more voices, more choices."

This is wonderful news – it offers us hope to break the positive feedback cycle destroying US democracy.

Finally, let us analyse 3-candidate elections under the (therefore 2-round) **Hare-STV=IRV** system. As we've seen, with honest voters a flank candidate should always win, and the voters really will have only a 2-way choice since opting for moderation is hopeless and the result of the first round (namely, that the moderate will be eliminated) is a foregone conclusion.[43]

Now, note that under IRV, a 3-party system would inherently be unstable since the moderate party would always lose and thus tend to die off, leaving us with a 2-party system. This could also be argued simply by regarding the first round as a (now strategic) plurality vote subject to law #3. Either way, we would expect Duverger's law – 2-party domination – to still hold. In the absence of a 3rd party, IRV would be equivalent to plain plurality, and hence we would expect the law of convergence to operate to cause the two parties to become identical to the median voter[44].

9. Duverger-convergence law under IRV: With the IRV (also called Hare STV) voting system, we still expect 2 party domination just like under plurality voting, and we also expect Tweedledee convergence.

Our proposed law #9 is not merely the outcome of theoretical reasoning in a debatable model; **experimental evidence** supports it. Consider Ireland, the only country with a Hare-STV winner-takes-all presidential election. According to [30][38], Irish politics remain dominated by the two political parties that grew out of Ireland's civil war. Fianna Fail was formed by those who opposed the 1921 treaty partitioning the island. Although treaty opponents lost the civil war, Fianna Fail is usually Ireland's largest political party. Fine Gael ('Tribe of the Gaels'/United Ireland Party, FG), as successor of the CG representative of the pro-treaty forces, remains the country's second-largest party. These parties alternate in government, with FG usually forming a coalition with the (much smaller 3rd place) Labour Party (which typically gets 5-10% of the first-rank votes). This all is entirely compatible with our proposed law.

Indeed, it is very interesting that Ireland is 2-party dominated, because it also has a parliament elected via Proportional Representation (Hare-STV multiwinner systems in districts). This brings Duverger's law #2 into direct conflict with (our IRV version #9 of) Duverger's law #1. The experimental evidence says that not only does our IRV Duverger law #9 hold, it holds with enough power to win the battle with the Duverger law #2 about proportional representation – and that even though Ireland's president is fairly weak. We would thus expect that if IRV were adopted in USA elections, but without the moderating influence of a parliament elected by PR, we should *definitely* expect continued 2-party domination. (Nevertheless, since in Ireland the 3rd party gets 5-10% of the 1st-rank votes, it seems not as *completely* overwhelmed as are third parties in the USA.)

Further evidence: As we have mentioned in footnote 17, Australia elects its *House* members by IRV single-winner elections. Its House in 1993 had 2.03 as its "effective number of

[43]If the voters are aware of this, they might argue that top-ranking the moderate is a stupid wasted vote and they will prefer the strategy of always artificially ranking the moderate candidate in the middle of their ranking. In that case, the moderate candidate will still always be eliminated in the first round (albeit even more conclusively), and our conclusions are unaffected.

[44]The same criticisms that we listed before of our analysis of convergence under plurality voting, would still apply with IRV voting, though.

political parties" ([14] pp.21-24). Historically [38] since 1946 Australia has been dominated by the Labor and Liberal parties, which have always each gotten at least 32% of the votes; meanwhile no third party has ever exceeded 11.4%. Again this 2-party domination has been strong enough to win the battle with Duverger's law #2 (i.e. despite the fact that the Australian Senate uses a PR system).

Third parties, pay attention to this: I have urged the Green Party (the US 3rd party which supported Nader for US president in 2000) to support a non-plurality voting system, specifically, range voting. I was hoping the urge for survival would motivate them, since, due to Duverger's law and the "wasted vote" strategic phenomenon, they have no chance for any power without a change in the voting system.

The Green Party partially responded to this by advocating (as also does the Libertarian Party) the IRV system. Unfortunately, our proposed law #9 indicates that this voting system would *still* lead to 2-party domination – in view of which, essentially, these third parties are *still* ignorantly advocating their own destruction!

10 Anthony Downs

In 1957, Anthony Downs wrote the seminal work *An economic theory of democracy* [22]. He summarized it as follows

> Our main thesis is that parties in democratic politics are analogous to entrepreneurs in a profit-seeking economy. To attain their private ends they formulate whatever policies they believe will gain the most votes. ...In order to explore the implications of this thesis, we have also assumed that citizens behave rationally in politics... [These] lead to a set of 25 "propositions" [which Downs lists] which can be tested empirically.

Downs' ideas have a great deal of commonality with our own and it is interesting to re-examine them now, nearly 50 years later. Do Downs' 25 testable "propositions" survive comparison with reality? Mostly, I think they do. However, I disagree at least partially with two of them:

Downs' prop. #6: Democratic governments tend to redistribute income from the rich to the poor.

Wrong: as we have seen, due in significant part to governmental actions, the rich have got richer and the poor poorer in recent decades. This conclusion of Downs had come from a too-naive application of law #3. But Downs neglected the forces we have described in the present paper, which (a) allow parties to gain more votes by acquiring more *money* by doing more legislative favors for rich groups and individuals, and (b) this process depends heavily on expensive emotive television advertising correlated to strategies of hiding, disguising and evading questions about important issues. The fact that (b) works at all contradicts Down's hypothesis of the rationality of voters; in fact enough voters are ill-informed and/or illogical enough so that this strategy works. See §4 for why that is not surprising.

Downs' prop. #2: Both parties in a 2-party system will agree on any issue that a majority of its citizens strongly favor.

Wrong. In the USA a substantial majority (68%, in a poll during 2000) of citizens presently favor legal abortions, but a substantial minority, particularly important in highly religious regions of the country, strongly favor abolishing abortions. Despite this, the Republican Party Platform has included a plank for the last 28 consecutive years calling for a constitutional amendment that "the unborn child has a fundamental individual right to life which cannot be infringed."[45]

Individual politicians from both parties, even on a simple binary issue such as "should abortion be legal?", miraculously find a way to disguise their stances with vagueness, numerous evasions and qualifications ("as a man, I feel... but as a Christian I feel... but as an elected official I feel...") in such a way as actually to convert the binary issue to a continuum issue. The goal is to settle into the ideal position in the vague-hints continuum, necessarily then leaving all voters guessing which parts are for real. Party Platforms are ignored and unread by $90\%^+$ of voters.

The standard stance among high level US politicians is to steadfastly avoid acting directly on the matter and leave it up to the courts, while occasionally acting indirectly and generally attempting to tell all sides whatever they want to hear. Thus at present the overriding US law is set by the Supreme Court's 30 year old decision in *Roe vs. Wade*, which somehow found in the US Constitution the requirement that abortions be legal during the first two trimesters of pregnancy. "Jane Roe," who claimed to have been raped, still was unable to obtain an abortion since the court's decision came too late. She gave up the child for adoption. Roe later revealed her identity as Norma McCorvey and proclaimed that she'd lied – she had not been raped – and further that she no longer believes abortions should be legal. At any time during the next 30 years (or before that) the US Congress could have converted this court decision to genuine law, or attempted to alter it, but has never done so. Since then the main moves in the battle have been indirect and consist of attempts to appoint judges who may or may not feel differently on the matter.

Mostly, though, Downs' prop. #2 seems correct; it may be that exceptions like abortion are fairly rare.

11 Summary

Our main new theoretical result has been that adopting *range* or *approval* voting ultimately should eliminate 2-party domination and weaken the "law of convergence" which motivates politicians to try to appear identical. Both of these developments would be good. But neither effect would happen under all the other voting systems, including IRV, that we have been able to analyse.

At the very least, I hope the Green or some other US third party will pay attention both to the urge for survival and to

[45] Admittedly even this seemingly unequivocal stance – this amendment would outlaw all abortions except in cases where the mother was 100% certain of losing her life without it – actually could be regarded as faked in the sense that everyone knows it is highly unlikely such an amendment could be ratified.

our results here and in [48][49], and therefore advocate Range Voting. But I see no basis for any great optimism.

We have presented enough facts to make it clear the US is now firmly in the grip of a powerful runaway positive feedback system which increases societal inequality. We have suggested 6 measures to weaken this positive feedback, only one of which (adopting range voting) will operate in a non-obvious way. If the feedback system continues to operate, eventually it will saturate at a level of inequality near maximum possible for our sort of society. That has not happened yet; there remains plenty of room for further motion. For example, President Bush recently floated the idea that all government should be funded by a flat sales tax. This would actually be the opposite of a progressive tax, in the sense that it would cause poorer people to pay a *greater* proportion of their incomes than richer people; such regressivity already is instituted in the FICA taxes that fund the "Social Security" system. "Progressive" income taxes resulted from the "progressive" political movement in the US in the 1920s; previously the US government had been funded largely by tariffs, a scheme which had a regressive impact similar to the sales tax proposal. Continual battles about "tort reform" are now being fought in the US political arena, with the object of forbidding, or capping damages in, various kinds of lawsuits against corporations. Gerrymandering could increase in severity. Workplace-safety inspectors, tax collection efforts, and antipollution laws could be weakened and decreased. All these moves would tend to increase the power and wealth of corporations and their rich owners in comparison to most people.

At what point will this process saturate? What will the resulting society be like? The situation ultimately probably will resemble present-day Brazil, a country with 61% Gini index of societal inequality – the highest among large democratic countries with industrial and agricultural economy both urban and rural. (Like the US, Brazil also claims to be a presidential democracy, but its plutocracy has been accelerated by history.) It is believed ([51] p.122) that the US's Gini index reached 0.60 in 1866-1871 shortly after freeing the slaves, which was probably its highest ever[46].

It may be, however, that Brazil's 61% is not the limit, because still higher Gini indices are reachable by *non*democracies. The 6 highest-Gini countries (according to the UN) in 2004, i.e. the only ones with Gini> 60%, *all* were non-democracies, which, considering that about 60% of countries are ostensibly democratic in 2004, is highly statistically significant (probability< 0.005 this happened by chance). Of the 127 countries with Gini indices known to the UN in 2004, the USA is ranked 52nd in order of decreasing Gini index, and *not one* of the 51 countries with Ginis above the USA's qualifies as one of the 21-23 "stable democracies" which has remained democratic since World War II, unless you count Costa Rica and/or South Africa. Assuming we (generously) do that, this again is a highly statistically significant event – the probability that, by pure chance, only 2 out of 23 stable democracies would happen to fall within the 51 top-Gini among 127 slots, is < 0.001.

Tatu Vanhanen believes, based on his comprehensive cross-country and cross-time statistical studies [65][66], that democracy happens whenever "power resources are widely enough distributed that no one group can maintain... hegemony... A high concentration of [control of] any one power resource is enough to prevent democracy." If so, that might indicate that the USA is doomed to lose what democracy it has left, which could lead to very bad consequences both for it and for the rest of the world.

12 Acknowledgements

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So there were 4 peaks: late 1860s, 1890s, late 1920s, and now. All of these achieved records of different kinds: The 1860s had probably the highest-ever Gini index (0.6, based on income).

The 1890s was probably the era with the greatest concentration at the very top, due to the monopolists. E.g. J.D. Rockefeller achieved a greater fraction of US wealth and a greater ratio of Personal Wealth to Median US Wealth than anybody ever. (Today's top monopolist Bill Gates got within a factor of 3 or so by the latter but not the former measure.)

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