their individual needs and preferences. Gilbert's social credits would make full-time homemakers feel better about the choice they have made. To the extent that homemaking has lost status and respect, such encouragement is welcome. Unfortunately, Gilbert's proposal rests on faulty analysis of parental choices, promotes only one style of parenting among many, and exalts the traditional role of women as homemakers despite a veneer of gender neutrality. A more liberal approach to family policy would increase the choices available to both women and men and reduce sex stereotyping.

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NOTES

1. Gilbert, Neil, "In Support of Domesticity: A Neglected Family Policy Option," *Journal of Policy Analysis and Management, 2*(4) (1983): 628–632.
2. For example, in 1982, labor force participation rate of married women with a spouse present and all their children under age 6 was only 48.6%. For those with children aged 6–17 only, 63.2% worked. The weighted average for working thus as 57.3%, so that about 43% were home full time. Bureau of Labor Statistics, *Handbook of Labor Statistics,* Table 54, p. 123 (Bulletin 2175, December 1983).
3. *Ibid.,* pp. 628–629.
4. Moore, K. A., and Hofferth, S. L., "Women and Their Children," *The Subtle Revolution/Women at Work,* Ralph Smith, Ed. (Washington, DC: The Urban Institute, 1979), p. 145. The authors qualify their conclusion by citing the inadequacy of the available research. Interestingly, Gilbert draws on certain statistics on housework from a later chapter in this book.
5. *Ibid.,* p. 134.

THE WASTED VOTE FALLACY

Robert D. Behn
James W. Vaupel

Many people do not vote for their favorite politcal candidate in a three-way race for fear that supporting a dark horse will help throw the race to their least preferred alternative. They listen to the voice of apparent pragmatism not to "waste" their vote on a loser. This rationale in November 1980 persuaded most Anderson supporters to vote instead for Carter or Reagan; this year similar arguments have shifted primary votes from Jackson to Mondale.

But should you listen to such counsel? Or try to persuade others to do the same? Take, for instance, a race featuring you favorite Alice Allworthy, who has almost no chance to beat the two neck-and-neck frontrunners, Larry Lackluster and Daniel Disaster. Dare you support Allworthy when you are on the brink of Disaster?

This Insight works through some back-of-the-envelope decision analysis for the two main versions of your dilemma: Allworthy has no chance and Allworthy has a slim chance. For either, under reasonable assumptions, you should stick with Allworthy even if you are an opinion leader or newspaper editorialist and can sway more votes than your own. Only in unusual circumstances should you act strategically to prevent your least favorite outcome. In passing, we hope to show also that decision trees do not have to be complex to be constructive, and that decision analysis can help resolve personal and political dilemmas in addition to business and medical ones.[1]

Case 1: Allworthy Has No Chance

Even if Allworthy has no chance of winning the election, you may wish to support her for a number of reasons. You earn a sense of fulfillment and integrity by backing the best candidate. Every vote for Allworthy sends a message to Washington, the state house, or city hall. Every vote today will enhance the chances of future Allworthies. Moreover, if Allworthy receives enough votes, she may be entitled (in a presidential contest) to financial compensation from the Federal Election Commission. If these are your only considerations you should rally behind Allworthy without a qualm.

But suppose Lackluster and Disaster are running a dead heat—and you believe that your support for Lackluster would increase his chances. You want to support Allworthy even in a losing cause, but worry a lot about Disaster. Even your lone vote might possibly matter, and if you are Coretta King, Billy Graham, or David

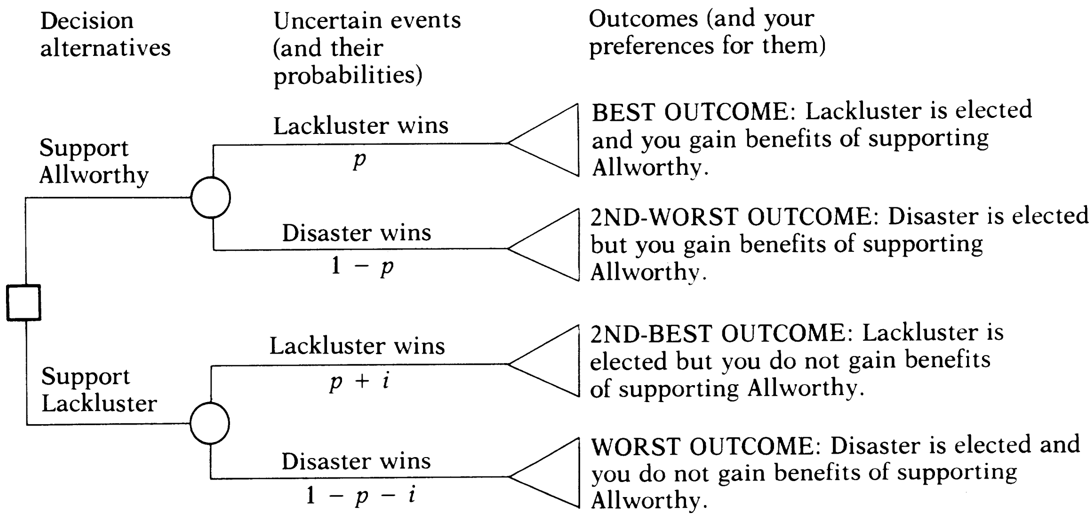

Figure 1. One formulation of the wasted vote dilemma. The square denotes the decision point, the two circles denote uncertain events, and the four triangles denote outcomes. You believe that if you support Allworthy, Lackluster has a p chance of winning the election, where p might be some number like 47%; under the assumption that Allworthy has no chance of winning, Disaster would then have a $1 - p$ chance of winning—e.g., 53%. You also believe that if you support Lackluster rather than Allworthy, Lackluster's chances will increase by some probability i, where i might be a number like one in a thousand or one in a million. You would gain some benefit from supporting Allworthy, but you would prefer to see Lackluster elected rather than Disaster.

Broder, you might be able to influence thousands of votes. Figure 1 shows your choices and the possible outcomes. One alternative is to support Allworthy; the other, to support Lackluster. In either case, only two outcomes need diagramming, because the assumption is that only Lackluster can beat Disaster.

What do you gain or lose from these outcomes? And how does your action affect them? Supporting Allworthy gains you considerable satisfaction and lets you send a message to the winner (and to other candidates or officials)—regardless of whether Lackluster or Disaster wins. This may be especially important in primaries. On the other hand, supporting Lackluster increases his chances by some small probability, and, perhaps more importantly, correspondingly decreases Disaster's chances. As shown in the figure, the outcomes are better if you support Allworthy, but the probabilities are better if you support Lackluster. Your choice depends on your appraisal of these differences. Unfortunately, the differences are small. This makes thinking about them difficult.

Breaking the problem into its components, as in the decision tree, can help. What the analysis will show is that you should deviate from voting for your favorite only if the election appears to be extremely close.

You might begin your analysis by roughly assessing how much difference your support would have to make before you would support Lackluster. Assume, to be specific, that you think Lackluster, without your support, has a 47% chance of winning the election. Would you support him instead of Allworthy if you could increase his chances by 1%? Suppose you could increase his chances by a mere one in a billion—or by just one in ten thousand? By contemplating a series of such hypothetical questions, you might decide that you would support Lackluster only if you could raise his chances (and decrease Disaster's chances) by at least one in a thousand; otherwise, you would rather support Allworthy and get the certain benefits of showing your true preference.[2]

Now consider the actual probability that your support would swing the election from Disaster to Lackluster. You can simplify the problem by assuming that Lackluster will win if he garners more than half of the combined Lackluster and Disaster vote. Suppose that opinion polls you trust show a virtual dead heat: Your best estimate is that Lackluster will amass $50 \pm 1\%$ of the Lackluster-plus-Disaster vote.[3] In such a close race, the probability that a presidential election will be determined by an additional x votes for Lackluster is roughly x in a million.[4] When buying lottery tickets or avoiding carcinogens, one in a million may be a "large" probability. But here you have decided that anything less than one in a thousand is "small."

The probability that your support will be decisive decreases rapidly as the election becomes less close. For instance, if your best guess is that Lackluster will amass $49.5 \pm 1\%$ of the Lackluster–Disaster vote, then the probability is cut in half that an additional x votes for Lackluster will decide the election. Unless you can sway many votes in an extraordinarily close election, you should

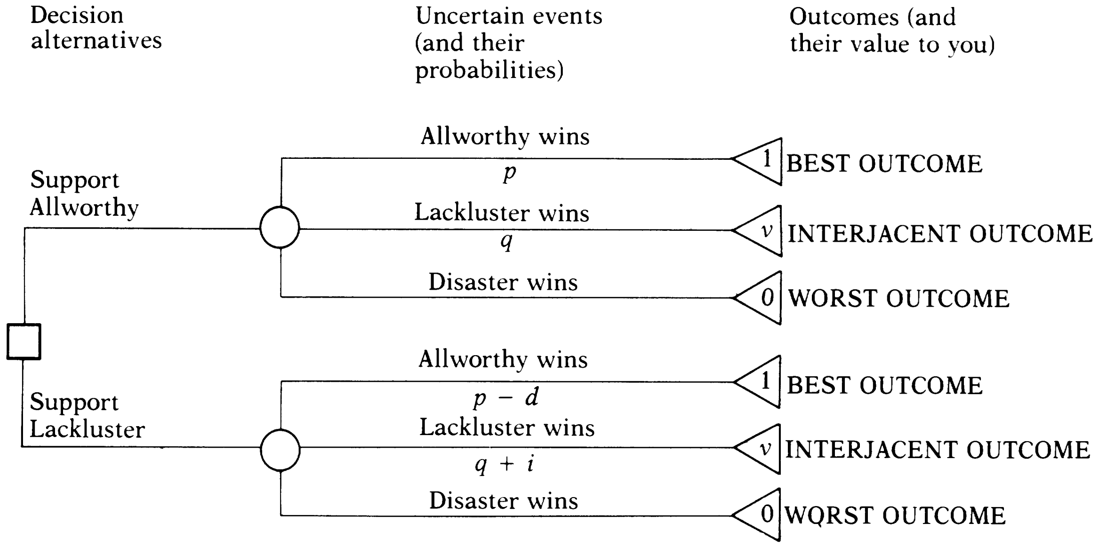

Figure 2. A second formulation of the wasted vote dilemma. If you support Allworthy, she has a p chance of winning the election and Lackluster has a q chance. If you support Lackluster, Allworthy's chance of winning declines by some small probability d and Lackluster's chance increases by some probability i; d and i do not necessarily have to be equal. Because this formulation of the dilemma ignores any satisfaction you might gain from supporting Allworthy, the best outcome occurs when Allworthy wins, regardless of whether you supported Allworthy or Lackluster. Similarly the worst outcome occurs when Disaster wins. If Lackluster wins, you consider the outcome to be of middling desirability. A preference probability of one is assigned to the best outcome and a preference probability of zero is assigned to the worst outcome. Some value v, between zero and one, is assessed as the preference probability of the interjacent outcome.

clearly use your vote or your influence to support your candidate Allworthy.

Case 2: Allworthy Has a Chance

What if your favorite has a faint chance of actually winning the election? If you would have supported Allworthy even if she had no chance of winning, then of course you should stay with your woman if you might help her win—*a fortiori*, as lawyers say. But suppose all you care about is who wins: The satisfaction and signalling benefits of case 1 are unimportant to you. Should you now listen to advice to vote for your second best?

This version of your dilemma could be diagrammed as shown in Figure 2. As indicated in the figure, if you support Lackluster rather than Allworthy, the probability that Allworthy will win decreases by some small amount from p to $p - d$, and Lackluster's chances increase from q to $q + i$. The value of d might equal i, but not necessarily: Switching your support from Allworthy to Lackluster might hurt Allworthy more than it helps Lackluster, or vice versa. This difference is the key to your decision.

You might, for instance, think that if you supported Allworthy, she would have a 10% chance of winning the election and Lackluster would have a 40% chance. Disaster's chances would then have to be 50%. If, however, you supported Lackluster, you might believe that his chances would increase by two in a million and Allworthy's chances would decrease by three in a million: Disaster's chances, as a result, would increase by one in a million.

The values in the triangles represent preference probabilities, sometimes called BRLTs or utilities. The best outcome is assigned a value of one; the worst, a value of zero; and outcomes in between a value of v between zero and one. The value v indicates how desirable the in-between outcome is on the scale from zero to one.[5] Thus, a value of v equals to 0.5 would imply that Lackluster is halfway between Disaster and Allworthy in desirability; a value of v of 0.1 would mean that you think that, compared with Allworthy, Lackluster is almost as bad as Disaster.

The overall desirability of supporting Allworthy, taking into account the risk that Lackluster or Disaster might get elected, can be calculated by multiplying the probabilities by the preference probabilities and adding up:[6] The value turns out to be $p + qv$. The overall desirability of supporting Lackluster is $p + d + (q + i)v$. Supporting Lackluster is preferable if the second of these expressions exceed the first. Simplifying this relationship yields the criterion: Support Lackluster rather than Allworthy only if v exceeds d/i.

The criterion is intriguing. Note that it does not depend on Lackluster's chances of winning or on Allworthy's or Disaster's either. It depends on two factors: (1) the value of v, which measures how you rate Lackluster compared with Allworthy and Disaster, and (2) the ratio of d to i, which measures how much your support would matter to Allworthy compared with Lackluster. Because v has to be less than one, it is clear that you should definitely support Allworthy if you think your support means more to her than it does to Lackluster. If you think v is about 0.5, i.e., that Lackluster is roughly halfway between Disaster and Allworthy in desirability, then you should only switch from Allworthy to Lackluster if you think you will increase Lackluster's chances of winning by at least twice as much as you decrease Allworthy's chances.

On reflection, the criterion may become commonsensible and thus more plausible: Analysis is often most useful in the crucial role of midwife to intuition. The criterion essentially says that if you can help your favorite candidate more than you can help the second-best candidate, you should certainly do so—even if your favorite does not have much chance of winning. And even if you could help the second-best candidate more than you could help your favorite, you should do so only if you can help him much more—and if he is better than mediocre. What is critical is not the probability of the outcomes, but how much difference you can make at the margin.

Any number of complications could be added to these bare-boned analyses, but to little purpose. The details of a voting decision will change depending on who the candidates are, what office they are running for, who is likely to win, how much your support can alter each one's chances, and what your tastes and opinions are. The essence of most three-candidate dilemmas is, however, captured by the tradeoffs diagrammed in Figures 1 and 2. The message is clear. If you think that an Allworthy is considerably better than the alternatives, then you should support Allworthy whether by doing so you seek merely personal satisfaction and to send a message or whether you actually hope to win. Unless your distaste for candidate Disaster is very great and his race with Lackluster is so extremely close that your support could be decisive, the real waste is to support Lackluster rather than Allworthy.

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NOTES

1. For other examples of these applications and an introduction to the principles and methods of decision analysis, see Behn, Robert D., and Vaupel, James W., *Quick Analysis for Busy Decision Makers* (New York: Basic Books, 1982).
2. Instead of thinking about this probability, an alternative approach would be to think about your preferences for the four outcomes. These preferences can be combined with the probabilities to determine the best alternative. This kind of analytical approach is taken in case 2 below; it can be equally well applied to case 1.
3. More precisely, assume that the distribution is normal with a mean of 0.50 and a standard deviation of 0.005, so that there is about a 95% chance that Lackluster's share of the vote will fall between 0.49 and 0.51.
4. The general formula for $d(x)$, the probability that a popular election will be determined by an additional x votes for Lackluster (that otherwise would not have been cast for either Lackluster or Disaster) is

$$d(x) = Z(a/s) - Z[(a - x/n)/s],$$

where $Z(y)$ is the value of the cumulative standard normal distribution at y, a is the absolute value of $p - 0.5$, p and s are the expected value and standard deviation of Lackluster's share of the combined Lackluster–Disaster vote, and n is the total number of votes for Lackluster or Disaster (not including the x additional votes). When x is small compared with ns, $d(x)$ is approximately given by the product of x/ns and $z(a/s)$, where $z(y)$ is the value of the standard normal density function at y. Because of the Electoral College and other complexities, the formula does not exactly apply to U.S. elections, but it does give a reasonable order-of-magnitude estimate.
5. Specifically, v is the probability such that you think the in-between outcome is exactly as desirable as a hypothetical gamble in which there is a v chance at the best outcome and a $1 - v$ chance at the worst outcome. See Behn and Vaupel, *op. cit.*
6. For an explanation of this method, see the appendix to Chapter 6 in Behn and Vaupel, *op. cit.*