Dynamic remodeling of in-group bias during the 2008 presidential election

David G. Rand[a,b,1,2], Thomas Pfeiffer[a,1], Anna Dreber[a,c], Rachel W. Sheketoff[a], Nils C. Wernerfelt[a,d], and Yochai Benkler[e,f]

[a]Program for Evolutionary Dynamics, Harvard University, Cambridge, MA 02138; [b]Department of Systems Biology, Harvard Medical School, Boston, MA 02138; [c]Department of Economics, Stockholm School of Economics, 11358 Stockholm, Sweden; [d]Department of Mathematics, Harvard University, Cambridge, MA 02138; [e]Harvard Law School, Cambridge, MA 02138; and [f]Berkman Center for Internet and Society, Harvard University, Cambridge, MA 02138

People often favor members of their own group, while discriminating against members of other groups. Such in-group favoritism has been shown to play an important role in human cooperation. However, in the face of changing conflicts and shifting alliances, it is essential for group identities to be flexible. Using the dictator game from behavioral economics, we demonstrate the remodeling of group identities among supporters of Democratic presidential candidates Barack Obama and Hillary Clinton. After Clinton's concession in June 2008, Democrats were more generous toward supporters of their own preferred candidate than to supporters of the other Democratic candidate. The bias observed in June persisted into August, and disappeared only in early September after the Democratic National Convention. We also observe a strong gender effect, with bias both appearing and subsiding among men only. This experimental study illustrates a dynamic change in bias, tracking the realignment of real world conflict lines and public efforts to reconstitute group identity. The change in salient group identity we describe here likely contributed to the victory of Barack Obama in the 2008 presidential election.

dictator game | economic games | evolution of cooperation | Barack Obama | gender differences

In-group favoritism, or solidarity, is a well documented aspect of human behavior (1–5, 49). People give members of their own group preferential treatment, and often discriminate against members of other groups. Economic games are particularly well suited for measuring this solidarity, because they make expressing in-group favoritism costly (3–9). In the dictator game (10), for instance, subjects divide a resource between themselves and an anonymous recipient. To measure in-group favoritism, the recipient is identified as either a member of the subject's own group or a different group. On average, people give more to members of their group. This is true for both trivial groupings, such as a preference for the paintings of Klee or Kandinsky (5), and more meaningful groupings, such as political affiliation (4) or ethnicity (8). Similarly, people are more willing to help others with whom they share incidental similarities, such as birthdays or first names (11).

Several explanations for the evolution of in-group favoritism have been proposed. One such explanation is based on conflict between groups (12). Within a group, selection will disfavor both altruism toward in-group members and hostility toward out-group members, because these behaviors are costly. However, groups whose members engage in these solidaristic actions can out-compete groups that do not. Thus, group-level selection favoring solidarity can outweigh within-group selection against it (13–18, 50).

Another possibility for the evolution of in-group favoritism involves reciprocity heuristics (3, 19). Reciprocal altruism can promote cooperation if interactions are repeated (20–28). This is because an altruistic act can later be reciprocated, either by the same interaction partner (direct reciprocity) or a different individual (indirect reciprocity). Reciprocal altruism is only beneficial if the probability of a subsequent interaction is sufficiently large. However, in many situations, this probability might be difficult to assess. Heuristics can help offset this lack of information by providing guidelines for when it is favorable to cooperate (29, 30). Given that future interactions are more likely with in-group members than out-group members, it could therefore be an advantageous heuristic to preferentially cooperate with in-group members.

Whatever the mechanism for the evolution of in-group favoritism might have been, a flexible sense of group identity is essential. Many foraging societies display fission-fusion dynamics, in which group composition changes regularly as groups splinter and rejoin (31). Neighboring groups might battle each other over access to resources, but need to join forces when attacked by a powerful third group. Shifting coalitions can change frequent trading partners into outcasts, and foreigners into friends. Therefore, the ability to dynamically reform group identity at the individual level is an essential part of either evolutionary rationale. Despite related discussions in the psychological literature (32), reformation of individual-level group identity in response to new challenges has not yet been discussed in an evolutionary context, nor explored experimentally using incentivized economic games. Here, we investigate dynamic group remodeling in the context of the 2008 Democratic Party primary election.

In this field study, 395 Democrats were recruited from public spaces in Cambridge, MA to act as dictators in a modified dictator game. Subjects first indicated their preferred candidate in the Democratic primary, Barack Obama or Hillary Clinton. Each subject was then given $6 to divide between herself and an anonymous recipient who supported either the same candidate or the other Democratic candidate. We doubled each dollar that subjects chose to give away so as to increase the average transfer and thereby increase the resolution of our bias measurements. The doubling factor also reflects the non-zero-sum aspect of cooperation as commonly defined in evolutionary biology, where one pays a cost c to give a benefit b to another, with $b > c$ (33). Recipients received no money other than what was given to them, and had no chance to respond or affect the outcome of the game. Our setup allows us to ask whether Democrats showed in-group bias by tending to give more to supporters of the same candidate than to supporters of the other Democratic candidate.

To address changes over time, data were collected in 3 rounds: June 10–18 ($n = 117$), immediately after Hillary Clinton's June

7 concession speech; August 9–14 ($n = 114$), preceding the August 25 start of the Democratic National Convention (DNC); and September 2–5 ($n = 164$), after the August 28 end of the DNC. Our data allow us to ask whether in-group bias existed among Democrats at the end of the primary season, and how this bias was transformed over time by the changing nature of the electoral conflict. For further details, see *Materials and Methods*.

Results

In June, men gave significantly more to supporters of the candidate they also supported than to supporters of the other Democratic candidate (Fig. 1*A*; 1-tailed Wilcoxon rank-sum, $P = 0.037$). This in-group bias among men persisted into August and the run-up to the DNC (Fig. 1*B*; 1-tailed Wilcoxon rank-sum, $P = 0.007$). However, after the DNC, in-group bias was not observed in early September (Fig. 1*C*; 1-tailed Wilcoxon rank-sum, $P = 0.26$). Women did not display significant in-group favoritism during any of the sampling periods (1-tailed Wilcoxon rank-sum, June $P = 0.13$, August $P = 0.74$, September $P = 0.41$). Although older female Clinton supporters were particularly outspoken in their opposition to Barack Obama, we see no significant in-group favoritism among women even if we restrict our analysis to female Clinton supporters >30 years of age (1-tailed Wilcoxon rank-sum, $P = 0.37$) or >40 years of age (1-tailed Wilcoxon rank-sum, $P = 0.58$).

Our results emphasize that group identities are flexible and can change over time. Significant in-group bias existed in June, because the Obama versus Clinton conflict was still salient. That this bias carried on into mid-August suggests that the absence of actual electoral conflict was insufficient to alter Democrats' perception of the salient grouping. The symbolic emphasis placed on party unity during the DNC may have been one important reason for the disappearance of Democratic in-group bias. Other changes in the political landscape, such as the Republican National Convention and the announcement of Sarah Palin as Republican vice presidential candidate, might have contributed as well.

The gender effect we observe is remarkable, because most previous dictator game studies have found no gender differences in bias with, for example, minimal groups (5), ethnic groups (8) or, most pertinent to the present experiment, political affiliation groups (4). Our results are consistent, however, with studies finding that men have a stronger response than women to intergroup competition (34, 35), and a greater tendency to seek dominance over other groups (36, 37). It has also been reported that men showed in-group bias based on ethnicity in a trust game (38) and based on religiosity in a common-pool-resource dilemma (39) whereas women did not; that men were sensitive to reciprocity concerns whereas women were not (44); and that boys developed in-group bias between the ages of 3 and 8 years whereas girls did not (40). Furthermore, we replicate this male-only gender effect in a second similar study, which matched Democrats with other Democrats or Republicans (see SI). The extreme salience of gender in the 2008 election, because of the presence of a female candidate, may help to explain why we observe a gender difference in bias based on political affiliation, whereas ref. 4 found no such gender difference during the 2004 election cycle. Further study is needed to clarify the relationship between gender and in-group favoritism.

To explore possible differences between Obama and Clinton supporters, we examine preconvention and postconvention transfer choices for supporters of each candidate separately (Fig. 2). The same effect is evident among supporters of both candidates: significant in-group bias existed among men before the DNC (1-tailed Wilcoxon rank-sum, Obama males $P = 0.022$, Obama females $P = 0.53$, Clinton males $P = 0.003$, Clinton females $P = 0.25$), whereas no significant bias existed after the DNC (1-tailed Wilcoxon rank-sum, Obama males $P = 0.07$,
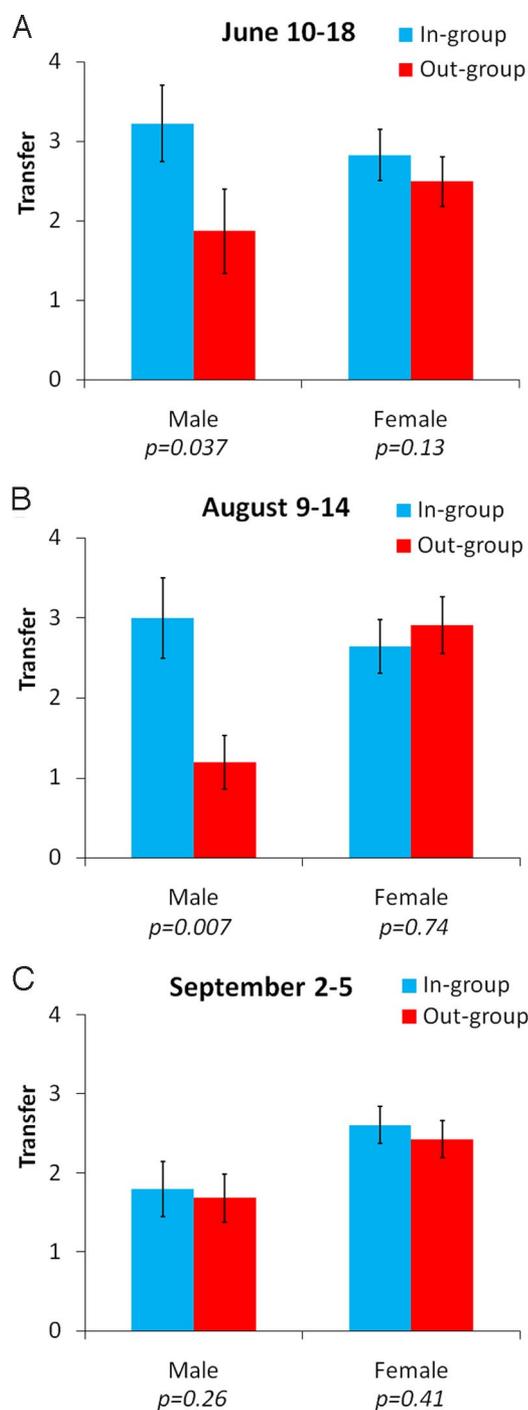

Fig. 1. Significant in-group favoritism exists among men in June (*A*) and August (*B*), but not September (*C*). Average transfer to supporters of the same candidate (In-group transfers, blue) and supporters of the other candidate (out-group transfers, red) are shown. Male Democrats transferred significantly more to in-group members before the DNC compared with after the DNC (2-tailed Wilcoxon rank-sum, $P = 0.013$). There was no significant pre-DNC vs. post-DNC difference, however, in the amount transferred by male Democrats to out-group members (2-tailed Wilcoxon rank-sum, $P = 0.78$). P values displayed in the figure were determined by 1-tailed Wilcoxon rank-sum tests. Error bars indicate standard error of the mean.

Obama females $P = 0.37$, Clinton males $P = 0.72$, Clinton females $P = 0.54$).

Furthermore, Fig. 2 allows a comparison of the level of bias among Obama and Clinton supporters. There is no significant
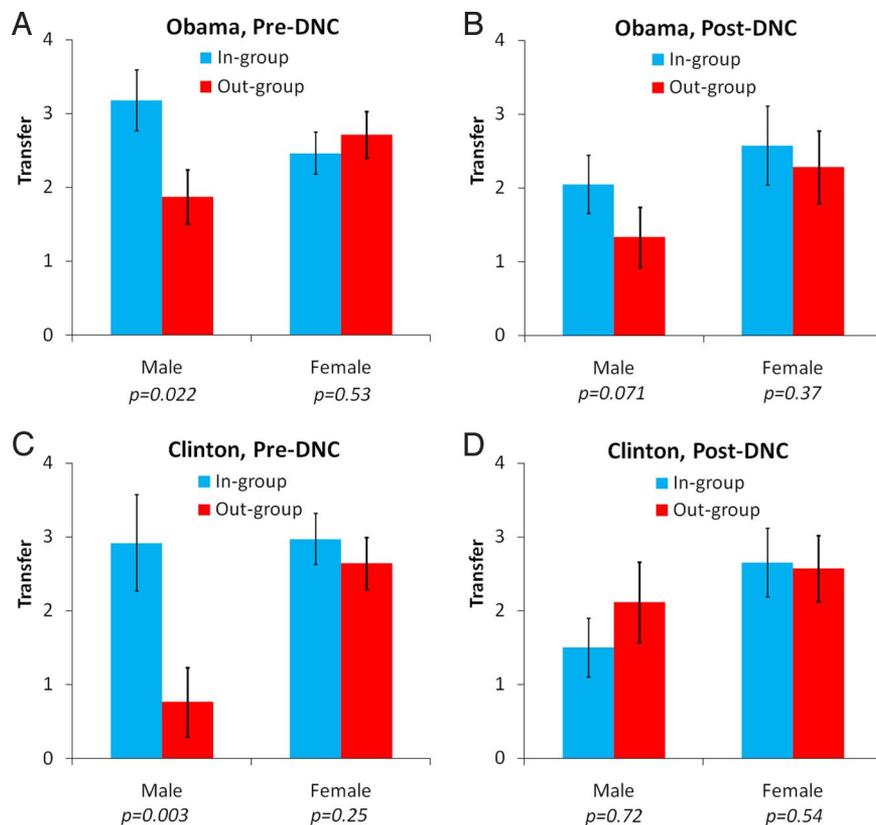
Fig. 2. The same pattern of changing in-group favoritism exists among supporters of Barak Obama and Hillary Clinton. Significant in-group bias exists before the Democratic National Convention (June and August data aggregated) among male Obama supporters (*A*) and male Clinton supporters (*C*). There is no significant in-group bias after the DNC among either Obama supporters (*B*) or Clinton supporters (*D*). Comparing the level of pre-DNC bias, there is some indication that Clinton supporters discriminated more than Obama supporters. There is no significant difference in transfers to in-group members among men before the DNC (Obama to Obama: $3.18, Clinton to Clinton: $2.92; 2-tailed Wilcoxon rank-sum, $P = 0.72$). However, there is a significant difference in male pre-DNC transfers to out-group members (Obama to Clinton: $1.88, Clinton to Obama: $0.77, 2-tailed Wilcoxon rank-sum, $P = 0.027$). P values displayed in the figure are determined by 1-tailed Wilcoxon rank-sum tests. Error bars indicate standard error of the mean.

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Discussion

Barack Obama's victory in the 2008 presidential election relied in part on the support of voters who favored Hillary Clinton in the Democratic primary. In the year preceding the presidential election, the Democratic Party was deeply divided by a long, bitter primary season. There was speculation that many Clinton supporters, angered by her defeat, would break with the Democratic Party and vote against Obama in the general election. Therefore, unifying the party by reducing the antagonism between Obama and Clinton supporters was a major goal of Democratic leaders after Clinton's concession. To achieve this, the group identities that were salient during the primary (Obama supporter and Clinton supporter) had to be replaced, with supporters of both candidates considering themselves Democrats.

Here, we have demonstrated this remodeling of group identity among supporters of Democratic presidential candidates Barack Obama and Hillary Clinton using economic games. In-group favoritism existed in male Democrats after Clinton's concession in June, persisted into August, and then disappeared after the Democratic National Convention. It is not clear that this lack of in-group bias translated into voting patterns in the 2008 general election, or that our observations were representative of Democrats outside of Cambridge, MA. We report changing attitudes toward supporters of Barack Obama and Hillary Clinton, as opposed to feelings about (or actual votes for) the candidates themselves. Nevertheless, national polls indicate a large increase in support for Obama among Clinton supporters immediately after the DNC (41), which is broadly consistent with our observations. Moreover, the outcome of the presidential election shows that Obama was able to gain broad support in key states where voters had favored Clinton in the primary, such as Pennsylvania and Ohio.

Although the 2008 Democratic primary was unusually bitter, all of the subjects in our study were, nonetheless, supporters of the same political party who shared similar ideological beliefs. It is thus not clear how the flexible nature of group identity that we observe translates to more dissimilar and deep-rooted groupings, such as ethnicity or religion. However, the historical record shows many cases of disparate groups uniting in the face of a common enemy, for example (42, 43). The extent and rate at which such deeper and more conflict-ridden group identities can be remodeled is of practical importance for understanding

contemporary conflicts. The degree to which these effects could be identified and measured through experimental economic games should be explored in the future.

Our study suggests that economic games such as the dictator game offer a potentially powerful tool for assessing political preferences. As in prediction markets (44), the financial incentives in these games may help reduce the tendency for politically correct "cheap talk," such as the hypothesized Bradley effect (45), that is observed in traditional polling methods. Further studies exploring the promise of economic games for predicting political outcomes are needed.

An interesting aspect of solidarity revealed by our study is that after the DNC, in-group transfers among men decreased, as opposed to out-group transfers increasing. Previous studies suggest that on average women give more than men in the standard dictator game (46). Together with this observation, our results suggest that in-group favoritism increased altruistic giving among males within the group, rather than decreasing altruistic giving to out-group members. This implies that positive feelings toward in-group members (i.e., "in-group love") were the motivation for in-group bias in our study, as opposed to negative feelings toward out-group members (i.e., "out-group hatred") (47–49).

Both the gender effect and the increasing within-group cooperation in times of conflict may also shed light on the possible evolutionary roots of in-group favoritism. The fact that only men showed bias could be consistent with either evolutionary explanation. However, the mobilization of resources when confronted by an enemy, followed by a poststruggle demobilization, seems more consistent with an evolutionary rationale based on intergroup conflict than on reciprocity heuristics. Nevertheless, the precise mechanisms for evolution of in-group favoritism remain uncertain. The origins of solidarity and the role of dynamic group membership in the evolution of cooperation and in-group favoritism merit further empirical and theoretical study.

Materials and Methods

Between June 10 and Sept 5 2008, 395 Democrats were recruited from public spaces in Cambridge, MA to participate as dictators in a 1-shot modified dictator game (DG) (10). The average participant age was 30.3 years, and 58% were female. Another 395 Democrats were recruited in a similar way to act as recipients in the dictator game.

After identifying themselves as supporters of the Democratic Party, subjects indicated their preference for Barack Obama or Hillary Clinton during the Democratic primary. Each subject then participated in a modified dictator

game in which she chose how to divides six $1 bills between herself (the dictator) and an anonymous other who was recruited at a later time (the recipient). The interaction was framed in neutral language, with the dictator referred to as "you" and the recipient as "the other person." The only information the dictator received about the recipient was which candidate the recipient supported during the Democratic primary (Obama or Clinton). Dictators were shown photographs of the candidate supported by the dictator and the candidate supported by the recipient. Each dictator was given an envelope marked "You," in which they put the money they chose to keep, and an envelope marked "Other Person" in which they put any money they chose to give away. The dictator was informed that any money put in the "Other Person" envelope would be doubled by the experimenters after the session, and then given to a recipient.

We chose to double any money given away by the dictator to increase the average transfer by providing an added incentive to give. In addition to altruism (caring about increasing the other's payoff), dictators might also give out of a concern for efficiency (maximizing the total payoff of both players). Although this means that we cannot quantitatively compare the results from this setup with a standard dictator game, the nature of the bias we observe remains the same. It might be argued that there is an interaction between efficiency concerns and in-group bias, such that people care more about efficiency when interacting with in-group members compared with out-group members. However, such an interaction would tend to amplify the effects of bias by creating an even greater difference between in-group and out-group transfers. Thus, a decrease in bias using this design is even more compelling than in a standard dictator game.

In addition to making a decision in the modified dictator game, subjects reported their age and gender. Sample instructions are included in the SI. Each subject participated only once, was paired with only 1 recipient (either a supporter of Obama or Clinton), and did not know that the other conditions existed. This between-subject design minimizes the possibility of an experimenter demand effect for in-group bias.

To address changes over time, data were collected in 3 rounds: June 10–18, immediately after Hillary Clinton's June 7 concession speech; August 7–14, preceding the August 25 start of the Democratic National Convention (DNC); and September 2–5, after the August 28 end of the DNC.

1. Tajfel H, Billig RP, Flament C (1971) Social categorization and intergroup behavior. *Eur J Social Psychol* 1:149–178.
2. Tajfel H (1981) *Human Groups and Social Categories* (Cambridge Univ Press, Cambridge, UK).
3. Yamagishi T, Jin N, Kiyonari T (1999) Bounded generalized reciprocity: Ingroup boasting and ingroup favoritism. *Advances Group Processes* 16:161–197.
4. Fowler JH, Kam CD (2007) Beyond the Self: Social Identity, Altruism, and Political Participation. *J Politics* 69:813–827.
5. Yamagishi T, Mifune N (2008) Does shared group membership promote altruism? Fear, greed, and reputation. *Rationality Society* 20:5–30.
6. Buchan NR, Croson RTA, Dawes RM (2002) Swift neighbors and persistent strangers: A cross-cultural investigation of trust and reciprocity in social exchange. *Am J Sociol* 108:168–206.
7. Goette L, Huffman D, Meier S (2006) The impact of group membership on cooperation and norm enforcement: Evidence from random assignment to real social groups. *Am Econ Rev* 96:212–216.
8. Whitt S, Wilson RK (2007) The dictator game, fairness and ethnicity in postwar Bosnia. *Am J Political Sci* 51:655–668.
9. Efferson C, Lalive R, Fehr E (2008) The coevolution of cultural groups and ingroup favoritism. *Science* 321:1844–1849.
10. Forsythe R, Horowitz JL, Savin NE, Sefton M (1994) Fairness in simple bargaining games. *Games Econ Behav* 6:347–369.
11. Burger JM, Messian N, Patel S, Prado Ad, Anderson C (2004) What a coincidence! The effects of incidental similarity on compliance. *Personality Social Psychol Bull* 30:35–43.
12. Choi JK, Bowles S (2007) The coevolution of parochial altruism and war. *Science* 318:636–640.

13. Wynne-Edwards VC (1962) *Animal Dispersion in Relation to Social Behavior* (Oliver and Boyd, London).
14. Wilson DS (1975) A theory of group selection. *Proc Natl Acad Sci USA* 72:143–146.
15. Boyd R, Richerson P (1990) Group selection among alternative evolutionarily stable strategies. *J Theor Biol* 145:331–342.
16. Bowles S (2001) *Social Dynamics*, eds Durlauf SN, Young HP (MIT Press, Cambridge, MA), pp 155–190.
17. Bowles S (2006) Group competition, reproductive leveling, and the evolution of human altruism. *Science* 314:1569–1572.
18. Traulsen A, Nowak MA (2006) Evolution of cooperation by multilevel selection. *Proc Natl Acad Sci USA* 103:10952–10955.
19. Kiyonari T, Tanida S, Yamagishi T (2000) Social exchange and reciprocity: Confusion or a heuristic? *Evolution and Human Behavior* 21:411–427.
20. Trivers R (1971) The evolution of reciprocal altruism. *Q Rev Biol* 46:35–57.
21. Axelrod R, Hamilton WD (1981) The evolution of cooperation. *Science* 211:1390–1396.
22. Alexander R (1987) *The Biology of Moral Systems* (Aldine de Gruyter, New York).
23. Fudenberg D, Maskin E (1990) Evolution and cooperation in noisy repeated games. *Am Econ Rev* 80:274–279.
24. Nowak MA, Sigmund K (1992) Tit for tat in heterogeneous populations. *Nature* 355:250–253.
25. Kandori M (1992) Social norms and community enforcement. *Rev Econ Stud* 59:63–80.
26. Nowak MA, Sigmund K (2005) Evolution of indirect reciprocity. *Nature* 437:1291–1298.
27. Pfeiffer T, Rutte C, Killingback T, Taborsky M, Bonhoeffer S (2005) Evolution of cooperation by generalized reciprocity. *Proc Biol Sci* 272:1115–1120.
28. Ohtsuki H, Iwasa Y (2006) The leading eight: Social norms that can maintain cooperation by indirect reciprocity. *J Theor Biol* 239:435–444.

29. Cosmides L, Tooby J (1989) Evolutionary psychology and the generation of culture: Part II. A computational theory of social exchange. *Ethol Sociobiol* 10:51–97.

30. Cosmides L, Tooby J (1992) *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, eds Barkow JH, Cosmides L, Tooby J (Oxford Univ Press, New York), pp 163–228.

31. Marlowe FW (2005) Hunter-Gatherers and Human Evolution. *Evol Anthropol* 14:54–67.

32. Sherif M, Harvey OJ, White BJ, Hood WR, Sherif CW (1961) *Intergroup Conflict and Cooperation: The Robber's Cave Experiment* (Institute of Group Relations, University of Oklahoma, Norman, OK).

33. Nowak MA (2006) Five rules for the evolution of cooperation. *Science* 314:1560–1563.

34. van Vugt M, de Cremer D, Janssen DP (2007) Gender differences in cooperation and competition. *Psychol Sci* 18:19–23.

35. Tooby J, Cosmides L (1988) *The evolution of war and its cognitive foundations. Tech. Rep. 88-1* (Institute for Evolutionary Studies, Palo Alto, CA).

36. Pratto F, Sidanius J, Stallworth LM, Malle BF (1994) Social dominance orientation: A personality variable predicting social and political attitudes. *J Personality Social Psychol* 67:741–763.

37. Sidanius J, Pratto F (1999) *Social Dominance: An Intergroup Theory of Social Hierarchy and Oppression* (Cambridge University Pres, New York).

38. Fershtman C, Gneezy U (2001) Discrimination in a Segmented Society: An Experimental Approach. *Q J Econ* 116:351–377.

39. Sosis R, Ruffle BJ (2003) Religious ritual and cooperation: Testing for a relationship on Israeli religious and secular kibbutzim. *Curr Anthropol* 44:713–741.

40. Fehr E, Bernhard H, Rockenbach B (2008) Egalitarianism in young children. *Nature* 454:1079–1083.

41. Gallup (2008) Poll 109957, Aug 21–31. Available at www.gallup.com/poll/109957/Obama-Gains-Among-Former-Clinton-Supporters.aspx. Accessed September 24, 2008.

42. Bront PA (1953) The Hellenic League against Persia. *Historia: Zeitschrift für Alte Geschichte* 2:135–163.

43. Sekulic D (1997) The creation and dissolution of the multinational state: The case of Yugoslavia. *Nations and Nationalism* 3:165–179.

44. Arrow KJ, et al. (2008) The promise of prediction markets. *Science* 320:877–878.

45. Clayton D (2007) The audacity of hope. *J Black Studies* 38:51–63.

46. Eckel CC, Grossman PJ (1998) Are women less selfish than men? Evidence from dictator experiments. *Econ J* 108:726–735.

47. Brewer MB (1999) The psychology of prejudice: Ingroup love or outgroup hate? *J Social Issues* 55:429–444.

48. Halevy N, Bornstein G, Sagiv L (2008) In-group love and out-group hate: A new game paradigm. *Psychol Sci* 19:405–411.

49. Gaertner L, Insko CA (2000) Intergroup discrimination in the minimal group paradigm: Categorization, reciprocation, or fear? *J Personality Soc Psychol* 79:77–94.

50. Paulsson J (2002) Multileveled selection on plasmic replication. *Genetics* 161:1373–1384.

POLITICAL SCIENCES

EVOLUTION

Supporting Information

Rand et al. 10.1073/pnas.0811552106

SI Methods

Between July 29th and August 5th 2008, 100 Democrats were recruited from Harvard Yard in Cambridge MA to participate in a 1-shot modified dictator game, as in the main study. The average participant age was 27.7 years, and 53% were female. Another 50 Democrats and 50 Republicans were recruited in the same way to act as recipients in the dictator game.

Subjects were first asked to identify themselves as supporters of the Democratic or Republican party. Each subject then participated in a modified dictator game in which she chose how to divides six $1 bills between herself (the dictator) and an anonymous other who was recruited at a later time (the recipient). The interaction was framed in neutral language, with the dictator referred to as "you" and the recipient as "the other person." Similar to the main study (and ref. 1), the only information the dictator received about the recipient was which political party the recipient supported. Dictators were shown photographs of the presidential candidate of the party supported by the dictator and the party supported by the recipient (Barack Obama or John McCain). The dictator was also informed that each dollar transferred to the recipient would be doubled by the experimenters. In addition to making a decision in the DG, subjects reported their age, gender, and how strongly they supported the party of their choice, on a scale from 1 (very little) to 7 (very strongly). Each subject participated only once, and was paired with only 1 recipient (either a Democrat or a Republican).

It has been suggested that in-group bias is motivated by a "group heuristic," as opposed to greater positive feelings toward in-group members (2). To reduce the role explicit reciprocity concerns might play in motivating in-group bias, we follow the "unilateral knowledge" manipulation of (3). Each dictator was given an envelope marked "You," in which they put the money they chose to keep, and an envelope marked "Other Person" in which they put any money they chose to give away. Any money put in the "Other Person" envelope was doubled by the experimenters after the session, and then each envelope was given to a recipient. Dictators were specifically told that recipients would not know the dictator's group membership. Moreover, the "Other Person" envelope came with 2 stickers pasted on it, one indicating the dictator's group membership and the other indicating the recipient's group membership. To make the lack of recipient knowledge especially salient, dictators were instructed to remove the sticker indicating their own group membership.

SI Results and Discussion

To assess in-group bias, we compare transfers of dictators giving to other Democratic supporters with dictators giving to Republican supporters (Table S1). We also explore the role of gender, age, and strength of party support. Using amount transferred as the dependent variable shows a significant negative interaction between party support strength and recipient's party for men ($P = 0.028$), such that the stronger a male dictator's support for the Democratic Party, the less he would give to a Republican. The significant negative interaction between party support strength, recipient's party, and gender ($P = 0.048$) indicates a significant difference between men and women. For women, there is no significant relationship between party support strength and bias (net coefficient $P = 0.87$), such that women on average did not display in-group bias regardless of their party support strength. We find no significant main effect of other's party ($P = 0.10$), age ($P = 0.35$), or gender ($P = 0.22$), and no significant interactions other than those mentioned above ($P > 0.10$ for all other interactions). Thus, we see that, consistent with the main study, men show in-group bias whereas women do not. Furthermore, we find that in-group bias is correlated with the commitment strength.

The results for committed Democrats are visualized in Fig. S1. Because in-group bias among men is increasing with strength of party support, we show data for subjects with support strength >4 (of 7). A comparison of means confirms the previous regression results. Committed male Democrats gave significantly less to supporters of the other party, whereas committed female Democrats did not (1-tailed Wilcoxon rank-sum evaluating the hypothesis that transfers to Republicans are lower than transfers to Democrats; men, $P = 0.035$; women, $P = 0.94$).

This supplemental study replicates the gender difference in solidarity we observe in the main study, with only male Democrats displaying in-group bias. The supplemental study was carried out >1 month after Clinton's concession, and before the addition of Sarah Palin to the Republican ticket. The presidential candidates of both parties were men, and yet female Democrats still showed no in-group bias. This demonstrates that the lack of response among women in the main study was not a direct result of choosing between a male and female candidate.

1. Fowler JH, Kam CD (2007) Beyond the self: Social identity, altruism, and political participation. *J Politics* 69(3):813–827.
2. Yamagishi T, Jin N, Kiyonari T (1999) Bounded generalized reciprocity: Ingroup boasting and ingroup favoritism. *Advances Group Processes* 16:161–197.
3. Yamagishi T, Mifune N (2008) Does shared group membership promote altruism? Fear, greed, and reputation. *Rationality Society* 20(1):5–30.
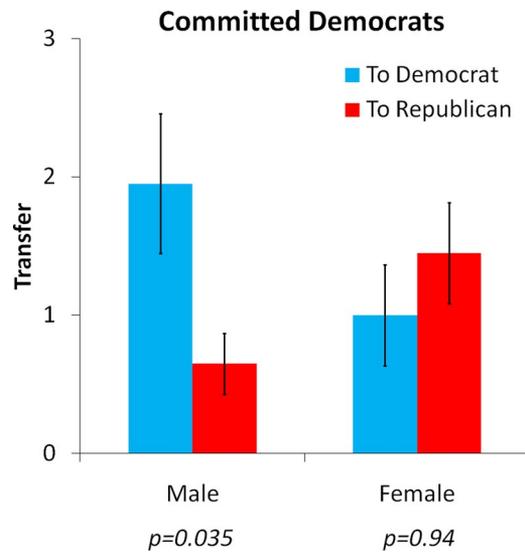
Committed Democrats

- To Democrat (blue)
- To Republican (red)

	Male	Female
	p=0.035	p=0.94

Fig. S1. Significant in-group favoritism (Democrat versus Republican) exists among committed male Democrats, but not among women. A ''committed'' Democrat is one whose strength of support for the Democratic Party is >4 (of 7). Average transfers to other Democrats (blue) and to Republicans (red) are shown. P values determined by 1-tailed Wilcoxon rank-sum tests. Error bars indicate standard error of the mean.

Table S1. OLS regression with robust standard errors of transfers from Democrats to other Democrats and to Republicans

Dependent variable: Transfer	Coefficient	Test statistic	*P*
Other's party (0 = Democrat, 1 = Republican)	3.096	1.67	0.10
Age	0.015	0.94	0.35
Gender (0 = Male, 1 = Female)	−0.696	−1.23	0.22
Gender × Other's Party	−2.785	−1.26	0.21
Support Strength (1 to 7)	−0.015	−0.07	0.94
Support Strength × Other's Party	−0.694	−2.24	0.028
Support Strength × Other's Party × Gender	0.754	2.00	0.048
Constant	1.422	1.06	0.29

$N = 100$, $R^2 = 0.101$.

Other Supporting Information Files

SI Appendix

1. Sample instructions

In this study, you will be able to earn between $0 and $6, based on your decisions. The money will be paid to you in cash immediately. The study is completely anonymous and there is no possibility that you can identify or be identified by any other participants. The other person is REAL – there is no deception in this study.

You have indicated that you supported Hillary Clinton during the Democratic primary.

You have been randomly assigned to interact with one other participant who instead supported Barack Obama during the Democratic primary.

YOUR CANDIDATE   OTHER'S CANDIDATE

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Photo                                               Photo
  of                                                  of
Hillary                                             Barack
Clinton                                             Obama
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Experimental setup

You have been given 2 envelopes. 1 envelope is marked YOU, and the other envelope is marked OTHER PERSON.

In the YOU envelope, you have $6 in $1-bills. You can choose to give $0-6 to the other person, by taking money from the YOU envelope and putting it into the OTHER PERSON envelope.

Whatever you don't give to the other person, you get to keep. Whatever you do give away will be multiplied by 2, so that the other person will receive TWICE what you decide to give.

After having decided how much to give to the other person, $0-6, the study is over for you. We will give your payment to the other person at a later time. Again, the other person is REAL and will really get any money you give.

Please decide how much to give to the other person now, and turn in this sheet with the OTHER PERSON envelope.

Age:_____   Gender: M or F