Title: How to sway voters

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Abstract: Competition for social influence is a major force shaping societies. Strategies that maximize social influence are, however, poorly understood. Applying game theory to a scenario where two advisers compete for a client, we find that the rational solution for advisers is to report truthfully when favoured by the client, but to exaggerate or blatantly lie when ignored. Across seven experiments, such a strategic adviser was consistently able to sway human voters, outcompeting an honest adviser. The game-theoretic strategy trumped truth-telling in swaying individual voters, the majority vote in anonymously voting groups, and the consensus vote in communicating groups. Our findings help demystify the success of political movements that thrive on blatant disinformation, vocal underdog politicians with no credible program, and overnight social media celebrities.

One sentence summary: We show that advisers who strategically lie can sway humans making decisions individually, in communicating groups and in voting groups.

Main Text: Despite emerging as a key figure behind Brexit, Boris Johnson did not necessarily believe that leaving the European Union was to Britain's advantage. Former Prime Minister David Cameron claimed that Johnson: "*risked an outcome he didn't believe in because it would help his political career*." On this account, Johnson "*was certain the Brexit side would lose. So backing it brought little risk of breaking up the government he wanted to lead one day. It would be a risk-free bet on himself*" (*1*). Strategic actions—that may twist the truth—to gain social influence play a pivotal role across society, from politicians competing for voters (*2, 3*) to consultancy firms competing for clients (*4, 5*) to social influencers competing for attention on social media (*6, 7*). The strategies that maximize social influence are, however, poorly understood. Understanding these strategies, as well as the conditions governing their success is of the essence, not in the least, because of their potential dire societal consequences (*8, 9*). We first identify the common hallmarks of competition for social influence. Then derive the rational strategies for winning influence under these conditions. And, finally, test the effectiveness of these rational strategies empirically in swaying human voters.

We identify three hallmarks of competition for social influence: information asymmetry, delegation of future decisions, and intractable uncertainty. Information asymmetry arises because influence seekers (e.g., politicians or financial advisers) generally know more about an issue than do the people they seek to influence (e.g., voters or clients) (*10*). For example, in the political arena, the issues at stake are often multidimensional and too complex for people to be fully informed. Competition for social influence also often involves delegation of future decisions (*11*)—for example, when voters or clients grant politicians or fund managers the power to make future decisions on their behalf. Finally, predicting the future is hard (*12*). Pundits who are tasked to predict future events in finance, politics, or sports often turn out to be consistently wrong (*13*).

Competition for social influence thus tends to emerge under high outcome uncertainty (*14*), making it difficult to evaluate advice accuracy and provides opportunities for competing advisers to seek influence strategically (e.g., by masking a strategic lie as a prediction error). Information asymmetry, delegation of future decisions and intractable uncertainty all shape the way competitors for social influence communicate their opinions strategically. Here we describe the influence-seeking strategy that best succeeds under these general conditions. Using game theory, we start by deriving the rational strategy in the most basic setting where two advisers compete for a client's attention.

Results

Strategic dishonesty emerges as the rational strategy

In a finite number of rounds, a client starts each round by selecting one of two advisers to place a bet on her behalf (i.e., delegation of decision). The bet is placed on either black or white. Both advisers (but not the client) then receive the same probabilistic evidence (p) about the probability of the winning colour being black (i.e., information asymmetry). They then simultaneously offer their respective recommendations s_1 and s_2 to the client indicating their estimates of the probability of black winning. The client follows the selected adviser's recommendation s_i and bets on black (white) if $s_i > 0.5$ ($s_i < 0.5$). Next, the winning colour is announced publicly and the client revaluates the two advisers' competence by assessing their recommendations in light of the outcome. The game then moves on to the next round.

Advisers know that, provided $s_1 \neq s_2$, the client updates their competence weights w_1 and w_2 according to

$$w_i^* = \frac{w_i c_i^2}{w_1 c_1^2 + w_2 c_2^2} \quad (1)$$

where $c_i = s_i$ when the winning colour is black and $c_i = 1 - s_i$ otherwise. If $s_1 = s_2$, the weights remain unchanged: $w_i^* = w_i$. This updating rule, which rewards highly confident correct advice and penalizes highly confident wrong advice, is a good approximation of the empirically observed updating behaviour in adviser selection (*15, 16*). In the first round, the client selects an adviser at random. In the following rounds, they select the adviser with the higher updated weight. If updated weights are equal, the client retains the adviser selected in the previous round. For the advisers, this is a zero-sum game: whenever one wins, the other loses. This permits us to employ the extensive game-theory literature on this class of games to ask if, given the client's updating rule and the uncertainty concerning the outcome of a lottery in each round, a rational advising strategy can be found. The advisers' decision problem in any round of the game is solved by backward induction, whereby we first work out their optimal choices in the last round and then work our way back through preceding rounds. In Box 1, we demonstrate this analysis for the last two rounds of the game. We find a consistent pattern of a rational advising strategy emerging.

When selected, a strategic adviser maximizes their likelihood of maintaining an advantage (i.e., higher weight) by providing moderate recommendations that stay relatively true to the observed evidence ($s_i \sim p$). When ignored, the strategic adviser seeks to strike lucky by offering highly confident recommendations that contradict the selected adviser's recommendation. The key intuition is that if the lottery outcome turns out to be in line with the ignored adviser's confident counterfactual recommendation, the client's updating rule (Eq. 1) will take a sizeable notice of this missed opportunity. Regrettably, our analysis indicates that in this game, principled honesty does not pay: An adviser that always (i.e., when selected and ignored) communicates the evidence truthfully ($s_i = p$) does worse than a strategic adviser who mixes the "sensible moderate" and "radical contrarian" strategies depending on being selected or ignored. In the Supplementary Materials, we further corroborate these result, showing that this rational strategy emerges under a wide range of starting conditions (Fig. S1-6, Tables S1, 2).

Strategic dishonesty sways individual voters

We conducted seven preregistered experiments (https://osf.io/9gjyc/) to empirically test whether a strategic adviser employing this mixed strategy would win a client's attention more often compared to an honest adviser that reports truthfully. In all experiments, human participants acted as clients. Over 20 rounds, they attempted to maximize their winnings by selecting, at the beginning of every round, one of two advisers (Fig. 2). Participants received the lottery ticket recommended by the selected adviser, but also observed the ignored adviser's recommendation. At the end of each round, the lottery outcome (win or loss) was randomly drawn from a distribution centred on p (for details see Supplementary Materials). Experimental instructions of all treatments are available at https://osf.io/9gjyc/.

In each round, both advisers received the same information (p), the likelihood that the lottery outcome is black. Programmed by the experimenter, one adviser was honest and the other strategic. The honest adviser always provided truthful predictions, in terms of both colour and confidence. The strategic adviser also recommended honestly when selected. Crucially, when it was ignored and received weak evidence, the strategic adviser lied by recommending, with medium to high confidence, the opposite of what the evidence had indicated. By contradicting the weak evidence (and by extension the honest adviser), the strategic adviser thus distinguished itself from the selected honest adviser when ignored. When ignored, the strategic adviser did not contradict strong evidence, thereby avoiding too many high-confidence errors. In the Supplementary Materials, we show this to be close to the rational solution for a strategic adviser who believes that their opponent is honest and their own weight is low (Fig. S7, 8). Note that in none of our experiments was the strategic adviser's recommendations more likely than the honest adviser's recommendation to be correct. Therefore, if clients were only persuaded by advisers' accuracy, they would remain indifferent between the two advisers or prefer the honest adviser. To test whether the strategic adviser was more popular than the honest adviser, we determined whether there was a significant positive effect of round on the likelihood to select the strategic adviser, using hierarchical Bayesian regression models (brms; see Table S3 for model results, and https://osf.io/9gjyc/ for data and analysis code).

We started by investigating whether the strategic adviser can draw the attention of single clients across different levels of evidence strength (i.e., the observed likelihood of winning a bet) and incentive regimes. In a pilot study, we observed that participants (N=28) were more likely to select the strategic, not honest, adviser (brm: β [CI] = 0.04 [0.01−0.08]; Fig. 3a; Fig. S9a). Using these results, we performed numerical simulations (see Supplementary Materials) to examine the impact of evidence uncertainty (i.e., distance between p and chance) on the strategic adviser's success. These simulations predicted the strategic adviser's influence to increase the higher the uncertainty (Fig. S10). Experiment 1 (N=160) tested this prediction across four levels of evidence strength. As predicted, the strategic adviser's influence was strongest at the weakest level of evidence (i.e., the highest level of uncertainty; evidence 1: β [CI] = 0.10 [0.07 - 0.14]; evidence 2: β [CI] = 0.03 [0.00 - 0.06]; evidence 3: β [CI] = 0.06 [0.03 - 0.09]; evidence 4: β [CI] = 0.03 [-0.00 - 0.06]; Fig. 3b). In Experiment 2 (N=140) we tested whether the strategic adviser's success depended on the client's incentive to win more lotteries. In contrast to Experiment 1, which incentivized participants for correct lottery outcomes, Experiment 2 did not incentivize participants for correct lottery outcomes; participants received a flat payment, independent of the number of winning rounds. Testing the same four levels of evidence strength, participants still preferred the strategic over the honest adviser when evidence was weakest, and progressively less with increasing evidence (evidence 1: β [CI] = 0.04 [0.01 - 0.07]; evidence 2: β [CI] = 0.03 [0.00 - 0.06]; evidence 3: β [CI] = 0.00 [-0.02 - 0.03]; evidence 4: β [CI] = -0.01 [-0.04 - 0.01]; Fig. 3c). In Experiment 3 (N=45), with uncertainty at maximum and incentives for correct outcomes reinstated, we replicated our key finding that participants preferred strategic over honest advisers, albeit not significantly (β [CI] = 0.01 [-0.01 - 0.04]; Fig. 3d). Note that across six experiments, this was the only case in which this treatment was not significant.

Strategic dishonesty sways voting and communicating groups

Having established the effectiveness of the game-theoretic rational strategy in winning individual clients' attention, we next examined whether this strategy could sway a crowd of voters. On one hand, the collective wisdom of a crowd may not fall for the strategic advice. On the other hand, if the individuals in the crowd voted entirely independently and, as observed so far, favoured the strategic adviser, Condorcet's jury theorem (*17*)—which states that combining independent binary decisions amplifies individual preferences—would predict that the majority vote would favour the strategic adviser even more strongly (see Fig. S11 for predictions). In Experiment 4, participants were recruited in groups of five clients (N=30 groups) whose anonymous votes were aggregated by majority rule, a common procedure in elections (*18*). The selected adviser's recommendation was the same for all group members. For direct comparison, a separate control experiment was conducted with individual clients (N=60). Figure 3e shows that single individuals (β [CI] = 0.09

[0.06 - 0.11]), individual votes within groups (β [CI] = 0.03 [0.01 - 0.04]), and majority vote decisions (β [CI] = 0.06 [0.03 - 0.09]) all favoured the strategic adviser. The design of Experiment 5 was identical to Experiment 4, with one exception: It was conducted online, not in a lab. All main findings were replicated (single individuals: β [CI] = 0.10 [0.08 - 0.13], N=50; individual votes within groups: β [CI] = 0.06 [0.04 - 0.08], N=25 groups; majority vote decisions: β [CI] = 0.10 [0.07 - 0.14]); Fig. 3f). In Experiments 4 and 5 the magnitude of the strategic adviser's success was similar across individuals and majority vote, indicating that groups were similarly vulnerable to being swayed by the rational strategy and that individuals within groups did not vote entirely independently (see also next section).

Finally, Experiment 6 investigated the strategic adviser's influence in persuading communicating individuals making joint decisions. Participants were recruited in dyads (N=50 dyads) and instructed to discuss and agree on which adviser to follow in each round. Previous works have shown that both perceptual decisions under uncertainty (*19*) and logical problem solving requiring reasoning by argumentation (*20*) benefit from face-to-face communication. These findings raise the possibility that face-to-face interacting clients may be able to see through the strategic adviser's tactic. However, dyadic decisions also favoured the strategic adviser over the honest adviser (β [CI] = 0.05 [0.03 - 0.07]; Fig. 3g), thereby lending further support to the generality of the rational strategy for persuasion.

The psychological basis of the success of strategic dishonesty

We had two hypotheses about the underlying psychological basis of the success of the game-theoretic rational strategy. First, following the instrumental-learning literature, we hypothesized that clients' choice of adviser would follow a "win–stay, lose–shift" strategy (*21, 22*). Our second hypothesis was that clients would be more likely to shift if the selected adviser gave the wrong advice (i.e., clients lost), and the ignored adviser had offered a contradicting recommendation. This hypothesis follows directly from the game-theoretic analysis of the client's updating rule (Eq. 1). Intuitively, a client who sees that they would have fared better with the ignored adviser, is more likely to switch in the next round. Critically, one key insight emerging from our work is that such common sense would be misguided under high uncertainty, when the available information is only weakly predictive of outcomes and can be exploited by a strategic contrarian such as our strategic adviser. To test our two hypotheses, we determined whether there was a significant positive effect of "bet lost," "contradicting advice," and their interaction on the likelihood to change adviser in the next round using hierarchical brms (see Table S4 for model results, and https://osf.io/9gjyc/ for data and analysis code).

Figure 4 shows the results of this analysis. For single individuals at evidence strength levels 1, 2 and 3 (Fig. 4a-c), individuals were most likely to change adviser if they lost and the ignored adviser's recommendation opposed the selected adviser's recommendation (evidence level 1: interaction: β [CI] = 1.03 [0.70 - 1.36]; level 2: lost: β [CI] = 1.15 [0.75 - 1.53], contradicting: β [CI] = 0.38 [-0.02 - 0.78]; level 3: interaction: β [CI] = 0.88 [0.20 - 1.56]). This was robustly found for all six single-client experiments at evidence level 1 (Fig. S12), illustrating the success of the strategic adviser's strategy of distinguishing itself from its competitor when ignored. At evidence level 4, the available evidence was always high, preventing the strategic adviser from using its contrarian strategy, effectively turning into an honest adviser. Hence, we could not test the effect of contradicting, but we did find an effect of bet lost (β [CI] = 0.94 [0.57 – 1.30]; Fig. 4d). Figures S13a-c, 14 show that the strategic adviser's success was independent of the exact confidence level it used when providing contradictory advice. The behaviour of individual voters within the majority-voting groups showed a more complex pattern. Whereas individuals supporting the majority vote in a given round showed a similar switching pattern to single clients (interaction: β [CI] = 1.18 [0.78 - 1.59]; Fig. 4e), individuals in the minority were most likely to switch when the group won and the ignored adviser presented opposing advice (β [CI] = interaction: -1.57 [-2.22 - -0.93]; Fig. 4f) adding support to the currently selected adviser. Finally, dyads were also more likely to change adviser when they lost (β [CI] = 0.75 [0.45 - 1.05]) and received opposing advice from the ignored adviser (β [CI] = 0.46 [0.14 - 0.78]; Fig. 4g). In all treatments, individuals' likelihood to change advisers decreased over the course of the experiment (Fig. S15; Table S4).

Discussion

Our theoretical and empirical findings provide converging evidence that by strategically using disinformation advisers can gain social influence when competing with other advisers. Historic and current times have seen no shortage of situations in which collective human wisdom has repeatedly fallen prey to conspicuously demonstrated false promises of loudmouth charlatans (*23*, *24*). Our results hark back to Aristotle, who defined *politics* as a socially interactive game of persuasion between "orators" and "members of assembly" about a future that involves uncertainty and asymmetric information (*25*). Echoing Aristotle's insight, the sobering observation from our results is that as long as the three conditions of information asymmetry, delegation of future decisions, and intractable uncertainty hold, then individuals, majority-voting groups, and consensual groups can indeed be swayed by a disingenuous persuasive strategy that is not committed to truth. Doing so, we extend current insights on persuasion which have shown that, for example, overconfidence can be an adaptive strategy (*26*). Our results help explain the prevalence of truth distortion across many domains of social influence, being it politics, economics, or social media.

A key psychological insight emerging from our work is that the adage of "voting for change" can be exploited by a manipulative adviser that follows the game-theoretic optimal strategy. Our results provide a compelling argument why opinions at odds with mainstream views appeal to a broad audience of voters. Our results further suggest that voting for "change" is especially appealing when experiencing economic losses (e.g., a reduction in income, or job loss) (*27*), even, and this is crucial, when this promise of "change" is not based on any credible evidence nor any benefit to the voter. This can, for example, explain the mismatch between local voting and local economic consequences in the Brexit vote (*28*). Future research is now needed to test the boundary conditions of such strategies (e.g., by relaxing the three hallmarks), investigate which character traits are especially vulnerable to such strategies, and develop ways to inoculate people from such strategies.

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Supplementary Materials

Materials and Methods

Figures S1-S15

Tables S1-S5

Box 1 | The game-theoretic analysis of the advisers' game

We demonstrate the backward induction procedure for the last two rounds of the advisers' game. In our analysis we restrict the advisers' choices s_i to the set {0, 1/9, 2/9, 3/9, 4/9, 5/9, 6/9, 7/9, 8/9, 1}. Relaxing this restriction does not change our conclusions. We also assume that the probability that the winning colour is black (p) is drawn from a uniform distribution on $[0,1]$ in each round.

The last round of interest is the one in which advisers' choices still matter to them, i.e., they can influence whom the client will select for her final bet. To illustrate the backward induction procedure, we consider the particular case when, at the start of this round, Adviser 1 is selected and has high influence over the client with $w_1 = 0.8$ and, by extension, Adviser 2 has low influence with $w_2 = 0.2$. The advisers can use (Eq. 1) to compute their updated weights for all possible combinations s_1 and s_2, conditional on whether the winning colour in the current round will be black or white (Fig. 1a). Using these weights, they generate advisers' payoffs, i.e., probabilities of being selected for the client's final bet (Fig. 1b) in terms of p and $q = 1-p$, the probability that the winning colour is white. As this is a zero-sum game, Adviser 2's payoffs are Adviser 1's payoffs subtracted from 1 and maximizing Adviser 2's payoff is equivalent to minimizing that of Adviser 1.

In a rational solution of the game—a Nash equilibrium—each adviser maximizes her expected payoff given her opponent's choice. We find one equilibrium by iteratively deleting weakly dominated strategies. Adviser 1's strategy $s_1 = 4/9$ dominates all $s_1 < 4/9$, since, irrespective of Adviser 2's choice, it always yields the same or higher payoff to Adviser 1 as any $s_1 < 4/9$ (Fig. 1c). Hence, we delete all $s_1 < 4/9$. Similarly, we delete all $s_1 > 5/9$. For Adviser 2, after these deletions, all $0 < s_2 < 1$ are dominated by $s_2 = 0$ and $s_2 = 1$. Deleting all $0 < s_2 < 1$ leaves advisers with two strategies each (Fig. 1c). In the Nash equilibrium of this reduced game, the selected Adviser 1 randomizes between the two most cautious advice strategies $s_1 = 4/9$ and $s_1 = 5/9$ with probabilities q and p respectively (see full derivation in Supplementary Materials). Provided $0 < p < 1$, the ignored Adviser 2 randomizes between the two most extreme advice strategies $s_2 = 0$ and $s_2 = 1$ with probabilities p and q. Adviser 1's and 2's equilibrium payoffs (i.e., their expected payoffs when both randomize as above) are $p^2 - p + 1$ (which is at least 0.75) and $p - p^2$ (at most 0.25) respectively, which illustrates the selected adviser's advantage.

Although deletion of weakly dominated strategies eliminates other equilibria in the non-reduced game of Fig. 1b, in zero-sum games like this one, a player's expected payoff from playing any equilibrium strategy against any equilibrium strategy of her opponent is always the same(*29*). This means that advisers do not care which equilibrium strategy they play, and one equilibrium is sufficient to determine advisers' equilibrium payoffs from any strategic (i.e., rational) play.

In the penultimate round, each adviser aims to maximize the probability of being selected at the end of the penultimate *and* the last round. Again, we consider the particular case when, at the start of this round, $w_1 = 0.8$. Advisers' weights and, hence, probabilities of being selected at the end of the penultimate round for all possible combinations s_1 and s_2 are the same as before (Fig. 1a,b). To obtain advisers' payoff matrices in the penultimate round, we need to add their expected probabilities of being selected at the end of the last round to those of being selected after the penultimate round. We focus on Adviser 1 and illustrate this here for the diagonal $s_1 = s_2$ (see Fig. 1d and Supplementary Materials for all combinations s_1 and s_2). In this case, irrespective of the lottery outcome in the penultimate round, her weight at the start of the last round will be 0.8. As already shown, her payoff in the last round will be $p^2 - p + 1$. At this stage, advisers do not know the value p in the last round, but they know that it will be drawn from a uniform distribution on $[0,1]$. Therefore, the expected value of her payoff in the last round is obtained by integrating $\int_0^1 p^2 - p + 1 \, dp \approx 0.83$. Hence, Adviser 1's expected payoff in the penultimate round is the sum of her expected probabilities of being selected at the end of the penultimate *and* the last round: $1 + 0.83 = 1.83$. Adviser 2's payoff in the penultimate round is Adviser 1's payoff subtracted from 2.

Figure 1d shows advisers' payoff matrices for the particular case of $p = 0.6$ in the penultimate round. As can be seen, these are similar to the advisers' payoff matrices in the last round (Fig. 1b). The selected Adviser 1 maximizes her expected payoff by using "moderate" strategies close to the truth, i.e., $p = 0.4$, while the ignored Adviser 2's best response is to select "extreme" strategies. Indeed, in the only Nash equilibrium in this scenario, Adviser 1 randomizes between $s_1 = 4/9$ and $s_1 = 5/9$ with probabilities 0.65 and 0.35 respectively, while Adviser 2 randomizes between $s_2 = 0$ and $s_2 = 1$ with probabilities 0.4 and 0.6. In the Supplementary Materials, we solve the game when $w_1 = 0.8$ and 0.6 for $p = 0.4$, 0.25, and 0.1 to corroborate the emerging pattern of advisers' strategy choices.

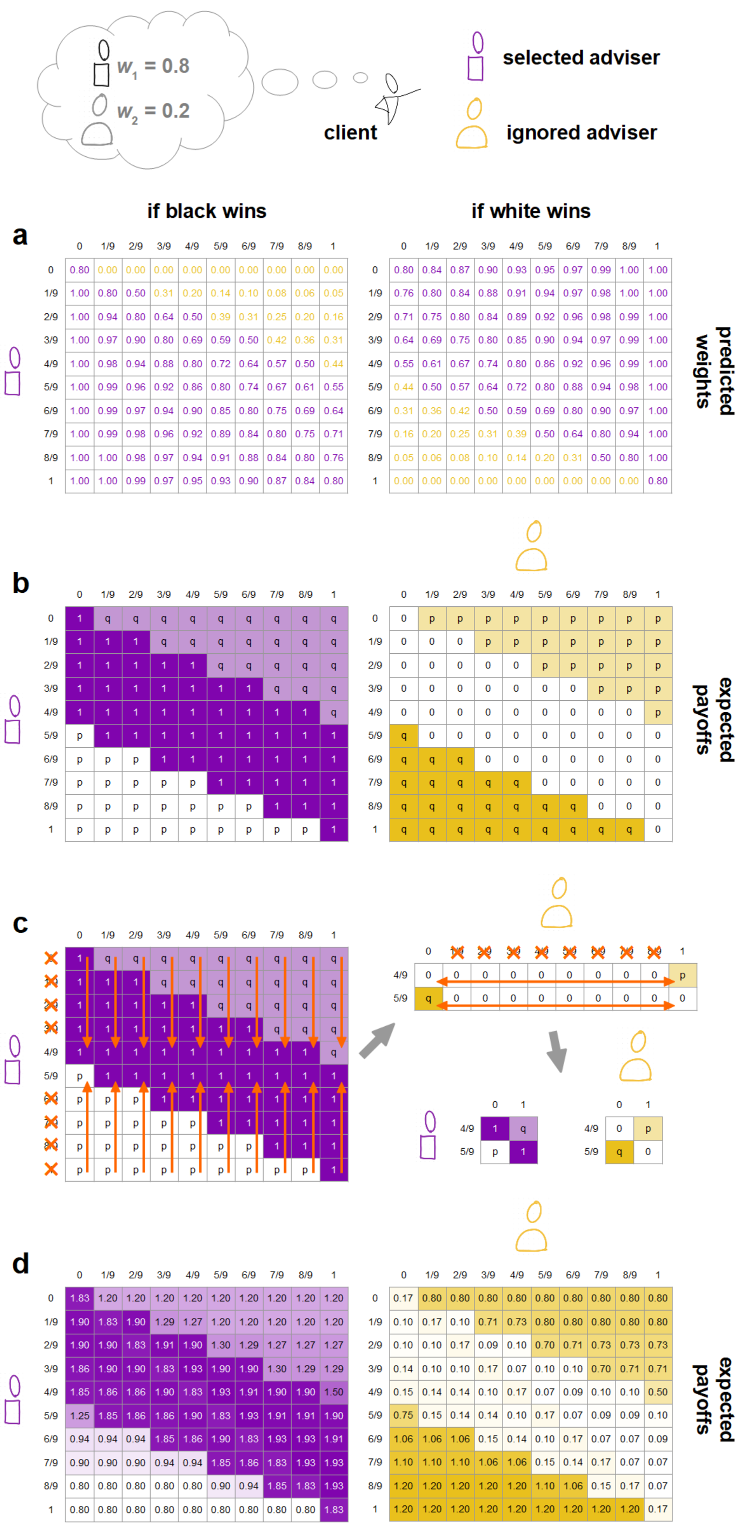

Fig. 1. The game-theoretic analysis of the advisers' game. The game-theoretic analysis for the case where the selected Adviser 1 has high influence over the client with $w_1 = 0.8$ and the ignored

Adviser 2 has low influence with $w_2 = 0.2$ in the last (**a-c**) and the penultimate (**d**) round. In all matrices, Adviser 1 chooses between s_1 identified by rows; Adviser 2 chooses between s_2 identified by columns. **a.** Adviser 1's predicted (updated) weights, starting from $w_1 = 0.8$, conditional on whether the winning colour is black (matrix on the left) or white (right) for all possible combinations s_1 and s_2. Weights greater than or equal to 0.5 are shown in purple, resulting in Adviser 1 being selected for the following round. Weights below 0.5 are shown in yellow, resulting in Adviser 2 being selected for the following round. Note that $w_1 + w_2 = 1$. **b.** Expected payoffs, i.e., probability of being selected for the following round for Adviser 1 (left) and Adviser 2 (right). For Adviser 1 (2) these are obtained by taking p in each cell where Adviser 1's predicted weight, conditional on the winning colour being black, is shown in purple (yellow), and adding q where Adviser 1's predicted weight, conditional on the winning colour being white, is shown in purple (yellow). Colour-scaling indicates lowest (white) to highest (dark) payoff, assuming $p = 0.4$. **c.** Iterative deletion of weakly dominated strategies leaves advisers with two strategies each: Adviser 1 randomizes between two cautious (4/9, 5/9) and Adviser 2 between two extreme (0, 1) advice strategies. **d.** Expected payoffs in the penultimate round for Adviser 1 (left) and Adviser 2 (right). Payoffs correspond to *the sum* of probabilities of being selected at the end of the penultimate round *and* at the end of the last round. Here, at the start of the penultimate round, $w_1 = 0.8$ and $p = 0.4$. The colour scaling is similar to **b**.

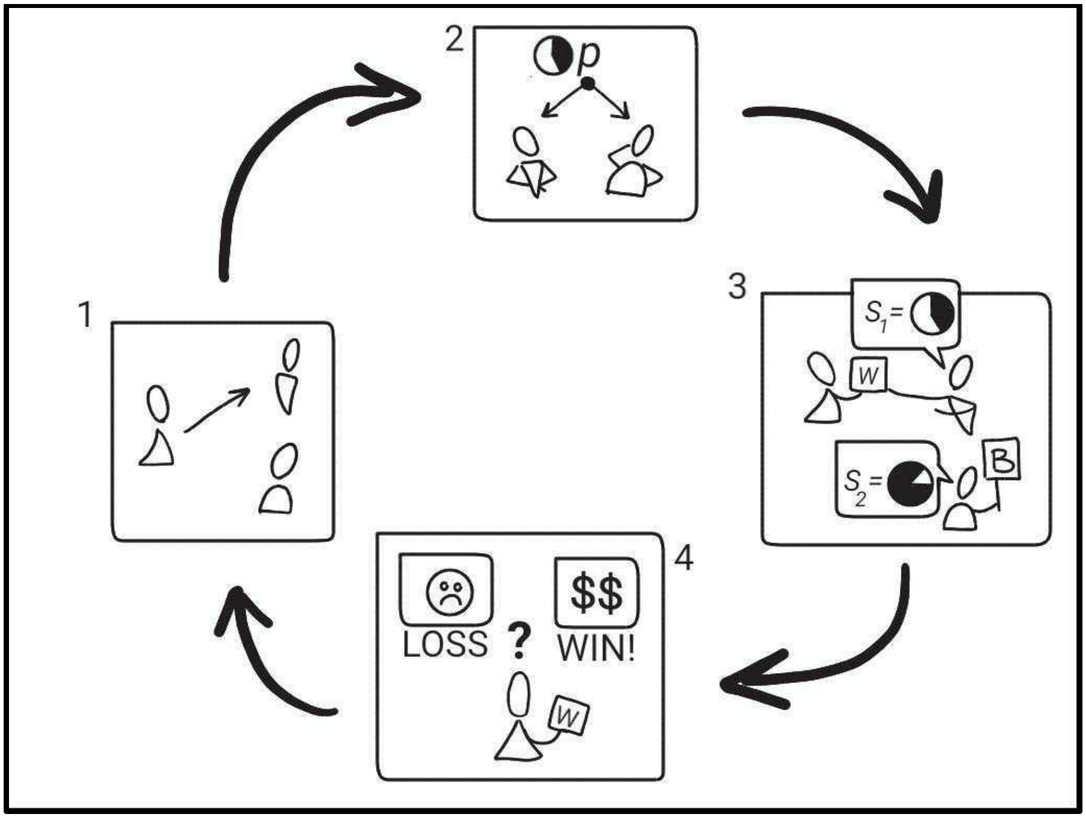

Fig. 2. The experimental paradigm for testing the success of the strategic adviser. 1. At the beginning of each round, participants select an adviser to choose a lottery ticket on their behalf. **2.** Both advisers then observe the evidence. The pie chart indicates that the evidence (*p*) weakly favours white. **3.** The selected adviser provides participants with a ticket (here, White lottery with low confidence corresponding to the weak evidence for white). The ignored adviser also states its recommendation (here Black with high confidence). **4.** The lottery is played out and participants may win or lose. Note that the ignored adviser depicted here follows the game-theoretic rational strategy by contradicting the available evidence, effectively lying with high confidence.

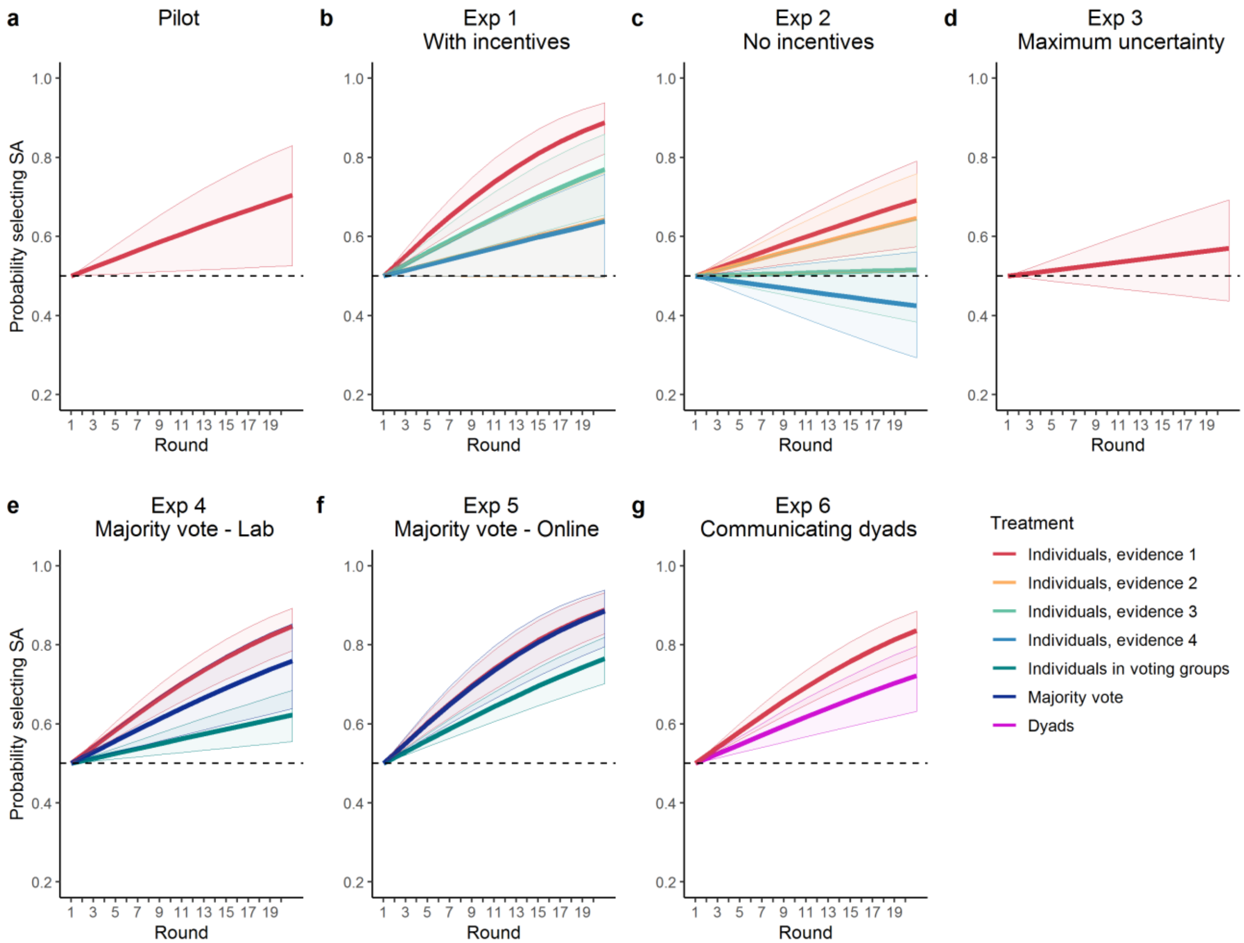

Fig. 3. The strategic adviser (SA) exerts a larger influence over single clients, majority-voting groups and communicating dyads at low evidence strength (i.e., high uncertainty). The likelihood to select the strategic adviser over 20 rounds across the seven studies with 0.5 being the chance expectation (horizontal dashed line). **a**, In the pilot, single participants were more likely than chance to select the strategic adviser. **b**, **c**, Single participants were most likely to select the strategic adviser at the lowest evidence level (i.e., highest level of uncertainty), independent of whether lottery outcomes were incentivized (**b**) or not (**c**). In (**b**) the blue and yellow line overlap **d.** Under maximum uncertainty, single clients showed a trend for favouring the strategic adviser. **e**, **f**, Individuals in majority voting groups (dark green line) were more likely than chance, but less likely than single participants (red line), to select the strategic adviser. The majority vote (i.e.,

aggregating the independent decisions of a group; dark blue line) was as likely as single participants to select the strategic adviser, both in the lab (**e**) and online (**f**). In (**f**) the dark blue and red line overlap. **g**. Communicating dyads were more likely than chance to select the strategic adviser. Thick lines show the mean of the posterior distributions and bands 95% credible intervals of Bayesian regression models.

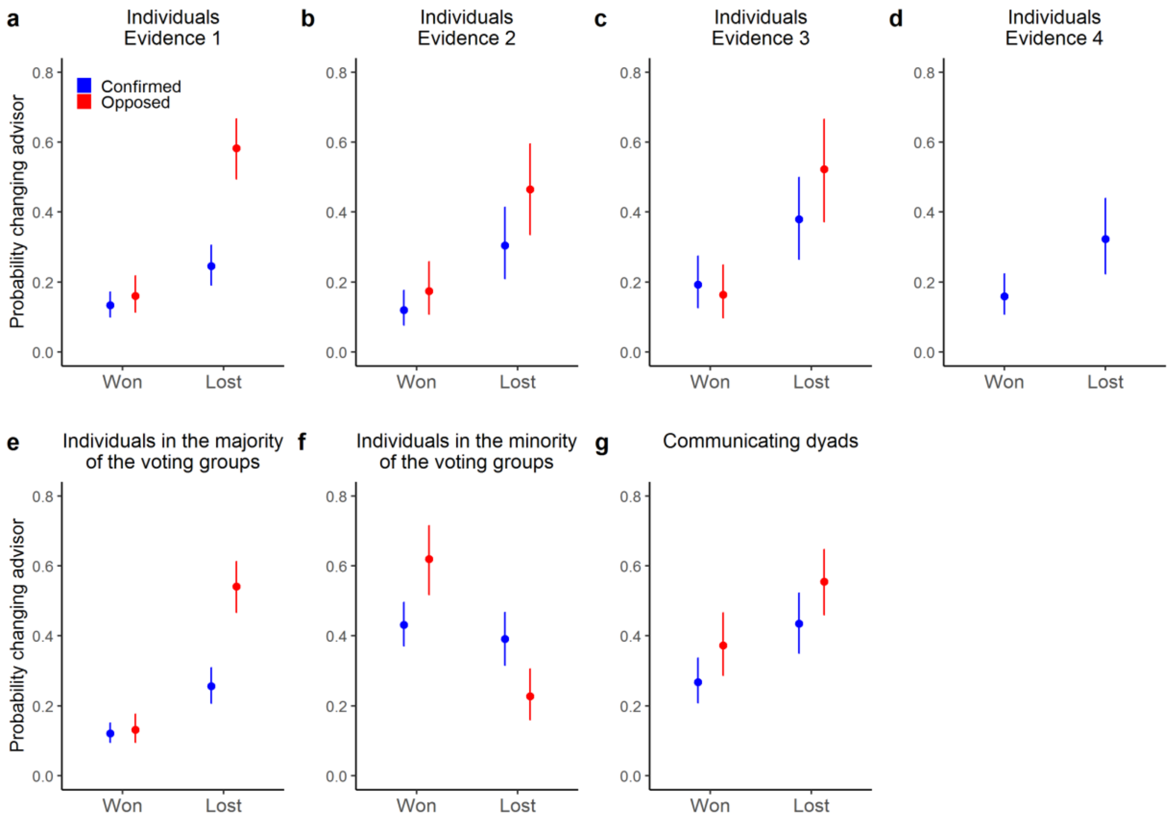

Fig. 4. Participants were most likely to change adviser when losing a bet and when the ignored adviser provided opposing advice to the selected adviser. The likelihood to change adviser in the next round as a function of whether the participant(s) won/lost, and the ignored adviser confirmed/opposed the advice of the selected adviser per treatment. **a**, At the lowest evidence level (i.e., highest uncertainty level) participants were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice (data are collapsed across Pilot + Experiments 1-6; see Fig. S4 for results per experiment). **b**, **c**, Similarly at evidence level 2 (**b**) and 3 (**c**) participants were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. **d**, At evidence level 4, the available evidence was always high, preventing the strategic adviser from using its contrarian strategy. **b-d**, data are collapsed across Experiments 1+2. **e**, Individuals in the majority of the voting groups were most likely to change

adviser when they lost and the ignored adviser gave the opposing colour advice. **f**, Individuals in the minority of the voting groups were, however, most likely to change adviser when their group won (against the minority's opinion) and the ignored adviser gave the opposing colour advice. **e, f**, Data are collapsed across Experiments 4+5. **g**, Communicating dyads were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. Shown are the mean of the posterior distributions and 95% Credible Intervals of Bayesian regression models.

Supplementary Materials for

How to sway voters

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Contents

1 Game-theoretical analysis

1.1 Nash equilibria in the last round when $w_1 = 0.8$

As described in Box 1 in the main text, iterative deletion of weakly dominated strategies leaves advisers with two strategies each. We distinguish between pure and mixed strategies. In the reduced game, i.e., the remaining game after deletions, Adviser 1's pure strategies are $s_1 = 4/9$ and $s_1 = 5/9$; Adviser 2's pure strategies are $s_2 = 0$ and $s_2 = 1$. In a Nash equilibrium, each adviser maximizes her expected payoff given her opponent's strategy. The cases when $p = 0$ and $p = 1$ are trivial, since, irrespective of Adviser 2's strategy, Adviser 1 guarantees a sure win by playing her pure strategy $s_1 = 4/9$ and $s_1 = 5/9$ respectively. When $0 < p < 1$, there is no equilibrium in pure strategies: if Adviser 1 plays $s_1 = 4/9$, Adviser 2 maximizes her payoff with $s_2 = 1$, but if Adviser 2 plays $s_2 = 1$, Adviser 1 maximizes her payoff with $s_1 = 5/9$, and so on. In other words, Adviser 1 tries to align her advice with Adviser 2 by choosing the s_1 closest to s_2, while Adviser 2 tries to differentiate from Adviser 1 by choosing the s_2 furthest from s_1. As a result, their best response choices of pure strategy are in a continuous cycle. In equilibrium, both advisers thus play mixed strategies, randomizing between their pure strategies with some probabilities.

We find these probabilities by using the fact that, in a mixed-strategy equilibrium, the expected payoffs from all pure strategies that a player plays with positive probability must be equal. Let ϵ and $1 - \epsilon$ be the probabilities with which Adviser 2 plays $s_2 = 0$ and $s_2 = 1$ respectively. Adviser 1's expected payoffs from playing her pure strategies $s_1 = 4/9$ and $s_1 = 5/9$ are $\epsilon + q(1 - \epsilon)$ and $p\epsilon + 1 - \epsilon$ respectively. Equating the two and making use of $q = 1 - p$ yields $\epsilon = p$. Similarly, it can be derived that Adviser 1 plays $s_1 = 4/9$ with probability q. Thus, when $0 < p < 1$, there is one Nash equilibrium in the reduced game of Fig. 1b. Adviser 1 randomizes between her pure strategies $s_1 = 4/9$ and $s_1 = 5/9$ with probabilities q and p respectively, while Adviser 2 randomizes between $s_2 = 0$ and $s_2 = 1$ with probabilities p and q. Note that the lower the p, the higher the likelihood that Adviser 1 announces $s_1 = 4/9$ and Adviser 2 announces $s_2 = 1$ (her extreme strategy that is furthest from p). Adviser 1's expected equilibrium payoff is obtained by plugging $\epsilon = p$ into the payoff from playing any of her pure strategies to which she assigns positive probability in mixed strategy equilibrium play (i.e., $\epsilon + q(1 - \epsilon)$ or $p\epsilon + 1 - \epsilon$). This yields $p^2 - p + 1$, the lowest value of which is 0.75 when $p = 0.5$. Adviser 2's payoff is Adviser 1's payoff subtracted from 1: $p - p^2$.

Deletion of weakly dominated strategies eliminates other equilibria in the non-reduced game of Fig. 1b. However, Adviser 2's equilibrium strategy is the same in all Nash equilibria of the non-reduced game. This is because, in zero-sum games like this one, equilibria are equivalent, meaning that a player's expected payoff in all equilibria is the same, and interchangeable, meaning that if strategy pairs (s_1, s_2) and (s_1^*, s_2^*) constitute equilibria, then so do (s_1, s_2^*) and (s_1^*, s_2)(*1*). Therefore, an adviser's equilibrium strategy must yield the same expected payoff and be payoff-maximizing against any possible equilibrium strategy of her opponent. It is easy to see from Fig. 1b that no deviation from Adviser 2's equilibrium strategy found earlier satisfies these criteria for Adviser 1. There are, however, deviations from Adviser 1's equilibrium strategy above that satisfy these criteria for Adviser 2. For example, Adviser 1 may use probabilities q and p to randomize between $s_1 = 0$ and $s_1 = 5/9$. Altogether, Adviser 1 has 15 equilibrium strategies to choose from. In each, she randomizes between some $s_1 \leq 4/9$ and some $s_1 \geq 5/9$ with probabilities q and p respectively (Table S1).

Table S1. Adviser 1's equilibrium strategies in the last round when $w_1 = 0.8$.

Pure strategies which adviser 1 plays with probabilities q and p in the 15 Nash equilibria.															
q	0	1/9	2/9	3/9	4/9	1/9	2/9	3/9	4/9	2/9	3/9	4/9	3/9	4/9	4/9
p	5/9	5/9	5/9	5/9	5/9	6/9	6/9	6/9	6/9	7/9	7/9	7/9	8/9	8/9	1

1.2 Nash equilibria in the last round when $w_1 \geq w_2$

When $w_1 \geq w_2$, iterative deletion of weakly dominated strategies reduces Adviser 1's payoff matrix to a $n \times n$ matrix in which Adviser 2 always retains her extreme strategies $s_2 = y_1 = 0$ and $s_2 = y_n = 1$ whenever $n \geq 2$ (Fig. S1). Fig. S2 shows this for $w_1 = 0.9$, 0.8, 0.7, 0.6, and 0.5. When $p = 0$ or $p = 1$, no matter what Adviser 2 does, Adviser 1 guarantees a sure win by playing her pure strategy $s_1 = x_1$ or $s_1 = x_n$ respectively. When $0 < p < 1$, there is no Nash equilibrium in pure strategies (see Section 1.1). As previously, the probabilities with which advisers randomize between pure strategies in a mixed-strategy Nash equilibrium can be found by using the fact that, in a mixed-strategy equilibrium, the expected payoffs from all pure strategies that a player plays with positive probability must be equal.

Fig. S1. Adviser 1's reduced payoff matrix in the last round when $w_1 \geq w_2$. The size of the $n \times n$ matrix depends on the value of w_1.

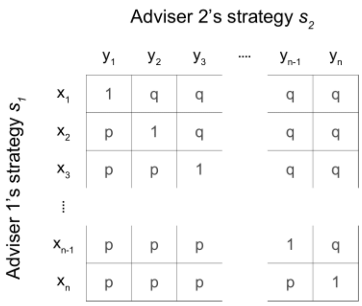

Fig. S2. Obtaining Adviser 1's reduced payoff matrix in the last round. a-e. In each panel the top matrices show Adviser 1's predicted (updated) weights, conditional on whether the winning colour is black (top left) or white (top right) for all possible combinations s_1 and s_2. Weights greater than or equal to 0.5 are shown in purple, resulting in Adviser 1 being selected for the following round. Weights below 0.5 are shown in yellow, resulting in Adviser 2 being selected for the following round. Note that $w_1 + w_2 = 1$. The bottom left matrix shows Adviser 1's expected payoffs (i.e., probabilities of being selected for the following round). These are obtained by taking p in each cell where Adviser 1's predicted weight, conditional on the winning colour being black, is shown in purple, and adding q where Adviser 1's predicted weight, conditional on the winning colour being white, is shown in purple. The highlighted strategies are deleted during iterative deletion of weakly dominated strategies. Bottom right is the reduced payoff matrix after these deletions, where strategies that are equivalent in terms of potential payoffs are lumped together. Matrices are shown for **a.** $w_1 = 0.9$. **b.** $w_1 = 0.8$. **c.** $w_1 = 0.7$. **d.** $w_1 = 0.6$. **e.** $w_1 = 0.5$.

a

Adviser 2's strategy s2

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.90	0.69	0.50	0.36	0.26	0.20	0.16	0.12	0.10
2/9	1.00	0.97	0.90	0.80	0.69	0.59	0.50	0.42	0.36	0.31
3/9	1.00	0.99	0.95	0.90	0.84	0.76	0.69	0.62	0.56	0.50
4/9	1.00	0.99	0.97	0.94	0.90	0.85	0.80	0.75	0.69	0.64
5/9	1.00	1.00	0.98	0.96	0.93	0.90	0.86	0.82	0.78	0.74
6/9	1.00	1.00	0.99	0.97	0.95	0.93	0.90	0.87	0.84	0.80
7/9	1.00	1.00	0.99	0.98	0.96	0.95	0.92	0.90	0.87	0.84
8/9	1.00	1.00	0.99	0.98	0.97	0.96	0.94	0.92	0.90	0.88
1	1.00	1.00	0.99	0.99	0.98	0.97	0.95	0.94	0.92	0.90

Adviser 2's strategy s2

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.90	0.92	0.94	0.95	0.97	0.98	0.99	0.99	1.00	1.00
1/9	0.88	0.90	0.92	0.94	0.96	0.97	0.98	0.99	1.00	1.00
2/9	0.84	0.87	0.90	0.92	0.95	0.96	0.98	0.99	1.00	1.00
3/9	0.80	0.84	0.87	0.90	0.93	0.95	0.97	0.99	1.00	1.00
4/9	0.74	0.78	0.82	0.86	0.90	0.93	0.96	0.98	1.00	1.00
5/9	0.64	0.69	0.75	0.80	0.85	0.90	0.94	0.97	0.99	1.00
6/9	0.50	0.56	0.62	0.69	0.76	0.84	0.90	0.95	0.99	1.00
7/9	0.31	0.36	0.42	0.50	0.59	0.69	0.80	0.90	0.97	1.00
8/9	0.10	0.12	0.16	0.20	0.26	0.36	0.50	0.69	0.90	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	1	1	q	q	q	q	q	q
2/9	1	1	1	1	1	1	1	q	q	q
3/9	1	1	1	1	1	1	1	1	1	1
4/9	1	1	1	1	1	1	1	1	1	1
5/9	1	1	1	1	1	1	1	1	1	1
6/9	1	1	1	1	1	1	1	1	1	1
7/9	p	p	p	1	1	1	1	1	1	1
8/9	p	p	p	p	p	p	1	1	1	1
1	p	p	p	p	p	p	p	p	p	1

	y_1
x_1	1

b

Adviser 2's strategy s2 (columns); Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.80	0.50	0.31	0.20	0.14	0.10	0.08	0.06	0.05
2/9	1.00	0.94	0.80	0.64	0.50	0.39	0.31	0.25	0.20	0.16
3/9	1.00	0.97	0.90	0.80	0.69	0.59	0.50	0.42	0.36	0.31
4/9	1.00	0.98	0.94	0.88	0.80	0.72	0.64	0.57	0.50	0.44
5/9	1.00	0.99	0.96	0.92	0.86	0.80	0.74	0.67	0.61	0.55
6/9	1.00	0.99	0.97	0.94	0.90	0.85	0.80	0.75	0.69	0.64
7/9	1.00	0.99	0.98	0.96	0.92	0.89	0.84	0.80	0.75	0.71
8/9	1.00	1.00	0.98	0.97	0.94	0.91	0.88	0.84	0.80	0.76
1	1.00	1.00	0.99	0.97	0.95	0.93	0.90	0.87	0.84	0.80

Adviser 2's strategy s2 (columns); Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.80	0.84	0.87	0.90	0.93	0.95	0.97	0.99	1.00	1.00
1/9	0.76	0.80	0.84	0.88	0.91	0.94	0.97	0.98	1.00	1.00
2/9	0.71	0.75	0.80	0.84	0.89	0.92	0.96	0.98	0.99	1.00
3/9	0.64	0.69	0.75	0.80	0.85	0.90	0.94	0.97	0.99	1.00
4/9	0.55	0.61	0.67	0.74	0.80	0.86	0.92	0.96	0.99	1.00
5/9	0.44	0.50	0.57	0.64	0.72	0.80	0.88	0.94	0.98	1.00
6/9	0.31	0.36	0.42	0.50	0.59	0.69	0.80	0.90	0.97	1.00
7/9	0.16	0.20	0.25	0.31	0.39	0.50	0.64	0.80	0.94	1.00
8/9	0.05	0.06	0.08	0.10	0.14	0.20	0.31	0.50	0.80	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80

Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	1	q	q	q	q	q	q	q
2/9	1	1	1	1	1	q	q	q	q	q
3/9	1	1	1	1	1	1	1	q	q	q
4/9	1	1	1	1	1	1	1	1	1	q
5/9	p	1	1	1	1	1	1	1	1	1
6/9	p	p	p	1	1	1	1	1	1	1
7/9	p	p	p	p	p	1	1	1	1	1
8/9	p	p	p	p	p	p	p	1	1	1
1	p	p	p	p	p	p	p	p	p	1

	y_1	y_2
x_1	1	q
x_2	p	1

c

Adviser 2's strategy s2 (columns); Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.70	0.37	0.21	0.13	0.09	0.06	0.05	0.04	0.03
2/9	1.00	0.90	0.70	0.51	0.37	0.27	0.21	0.16	0.13	0.10
3/9	1.00	0.95	0.84	0.70	0.57	0.46	0.37	0.30	0.25	0.21
4/9	1.00	0.97	0.90	0.81	0.70	0.60	0.51	0.43	0.37	0.32
5/9	1.00	0.98	0.94	0.87	0.78	0.70	0.62	0.54	0.48	0.42
6/9	1.00	0.99	0.95	0.90	0.84	0.77	0.70	0.63	0.57	0.51
7/9	1.00	0.99	0.97	0.93	0.88	0.82	0.76	0.70	0.64	0.59
8/9	1.00	0.99	0.97	0.94	0.90	0.86	0.81	0.75	0.70	0.65
1	1.00	0.99	0.98	0.95	0.92	0.88	0.84	0.79	0.75	0.70

Adviser 2's strategy s2 (columns); Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.70	0.75	0.79	0.84	0.88	0.92	0.95	0.98	0.99	1.00
1/9	0.65	0.70	0.75	0.81	0.86	0.90	0.94	0.97	0.99	1.00
2/9	0.59	0.64	0.70	0.76	0.82	0.88	0.93	0.97	0.99	1.00
3/9	0.51	0.57	0.63	0.70	0.77	0.84	0.90	0.95	0.99	1.00
4/9	0.42	0.48	0.54	0.62	0.70	0.78	0.87	0.94	0.98	1.00
5/9	0.32	0.37	0.43	0.51	0.60	0.70	0.81	0.90	0.97	1.00
6/9	0.21	0.25	0.30	0.37	0.46	0.57	0.70	0.84	0.95	1.00
7/9	0.10	0.13	0.16	0.21	0.27	0.37	0.51	0.70	0.90	1.00
8/9	0.03	0.04	0.05	0.06	0.09	0.13	0.21	0.37	0.70	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70

Adviser 1's strategy s1 (rows)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	q	q	q	q	q	q	q	q
2/9	1	1	1	1	q	q	q	q	q	q
3/9	1	1	1	1	1	q	q	q	q	q
4/9	p	p	1	1	1	1	1	q	q	q
5/9	p	p	p	1	1	1	1	1	q	q
6/9	p	p	p	p	p	1	1	1	1	1
7/9	p	p	p	p	p	p	1	1	1	1
8/9	p	p	p	p	p	p	p	p	1	1
1	p	p	p	p	p	p	p	p	p	1

	y_1	y_2
x_1	1	q
x_2	p	1

d

Adviser 2's strategy s2

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.60	0.27	0.14	0.09	0.06	0.04	0.03	0.02	0.02
2/9	1.00	0.86	0.60	0.40	0.27	0.19	0.14	0.11	0.09	0.07
3/9	1.00	0.93	0.77	0.60	0.46	0.35	0.27	0.22	0.17	0.14
4/9	1.00	0.96	0.86	0.73	0.60	0.49	0.40	0.33	0.27	0.23
5/9	1.00	0.97	0.90	0.81	0.70	0.60	0.51	0.43	0.37	0.32
6/9	1.00	0.98	0.93	0.86	0.77	0.68	0.60	0.52	0.46	0.40
7/9	1.00	0.99	0.95	0.89	0.82	0.75	0.67	0.60	0.53	0.48
8/9	1.00	0.99	0.96	0.91	0.86	0.79	0.73	0.66	0.60	0.54
1	1.00	0.99	0.97	0.93	0.88	0.83	0.77	0.71	0.65	0.60

Adviser 2's strategy s2

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.60	0.65	0.71	0.77	0.83	0.88	0.93	0.97	0.99	1.00
1/9	0.54	0.60	0.66	0.73	0.79	0.86	0.91	0.96	0.99	1.00
2/9	0.48	0.53	0.60	0.67	0.75	0.82	0.89	0.95	0.99	1.00
3/9	0.40	0.46	0.52	0.60	0.68	0.77	0.86	0.93	0.98	1.00
4/9	0.32	0.37	0.43	0.51	0.60	0.70	0.81	0.90	0.97	1.00
5/9	0.23	0.27	0.33	0.40	0.49	0.60	0.73	0.86	0.96	1.00
6/9	0.14	0.17	0.22	0.27	0.35	0.46	0.60	0.77	0.93	1.00
7/9	0.07	0.09	0.11	0.14	0.19	0.27	0.40	0.60	0.86	1.00
8/9	0.02	0.02	0.03	0.04	0.06	0.09	0.14	0.27	0.60	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	q	q	q	q	q	q	q	q
2/9	p	1	1	q	q	q	q	q	q	q
3/9	p	p	1	1	q	q	q	q	q	q
4/9	p	p	p	1	1	q	q	q	q	q
5/9	p	p	p	p	p	1	1	q	q	q
6/9	p	p	p	p	p	p	1	1	q	q
7/9	p	p	p	p	p	p	p	1	1	q
8/9	p	p	p	p	p	p	p	p	1	1
1	p	p	p	p	p	p	p	p	p	1

	y_1	y_2	y_3	y_4	y_5	y_6
x_1	1	q	q	q	q	q
x_2	p	1	q	q	q	q
x_3	p	p	1	q	q	q
x_4	p	p	p	1	q	q
x_5	p	p	p	p	1	q
x_6	p	p	p	p	p	1

e

Adviser 2's strategy s2

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.50	0.20	0.10	0.06	0.04	0.03	0.02	0.02	0.01
2/9	1.00	0.80	0.50	0.31	0.20	0.14	0.10	0.08	0.06	0.05
3/9	1.00	0.90	0.69	0.50	0.36	0.26	0.20	0.16	0.12	0.10
4/9	1.00	0.94	0.80	0.64	0.50	0.39	0.31	0.25	0.20	0.16
5/9	1.00	0.96	0.86	0.74	0.61	0.50	0.41	0.34	0.28	0.24
6/9	1.00	0.97	0.90	0.80	0.69	0.59	0.50	0.42	0.36	0.31
7/9	1.00	0.98	0.92	0.84	0.75	0.66	0.58	0.50	0.43	0.38
8/9	1.00	0.98	0.94	0.88	0.80	0.72	0.64	0.57	0.50	0.44
1	1.00	0.99	0.95	0.90	0.84	0.76	0.69	0.62	0.56	0.50

Adviser 2's strategy s2

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.50	0.56	0.62	0.69	0.76	0.84	0.90	0.95	0.99	1.00
1/9	0.44	0.50	0.57	0.64	0.72	0.80	0.88	0.94	0.98	1.00
2/9	0.38	0.43	0.50	0.58	0.66	0.75	0.84	0.92	0.98	1.00
3/9	0.31	0.36	0.42	0.50	0.59	0.69	0.80	0.90	0.97	1.00
4/9	0.24	0.28	0.34	0.41	0.50	0.61	0.74	0.86	0.96	1.00
5/9	0.16	0.20	0.25	0.31	0.39	0.50	0.64	0.80	0.94	1.00
6/9	0.10	0.12	0.16	0.20	0.26	0.36	0.50	0.69	0.90	1.00
7/9	0.05	0.06	0.08	0.10	0.14	0.20	0.31	0.50	0.80	1.00
8/9	0.01	0.02	0.02	0.03	0.04	0.06	0.10	0.20	0.50	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50

Adviser 1's strategy s1	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	p	1	q	q	q	q	q	q	q	q
2/9	p	p	1	q	q	q	q	q	q	q
3/9	p	p	p	1	q	q	q	q	q	q
4/9	p	p	p	p	1	q	q	q	q	q
5/9	p	p	p	p	p	1	q	q	q	q
6/9	p	p	p	p	p	p	1	q	q	q
7/9	p	p	p	p	p	p	p	1	q	q
8/9	p	p	p	p	p	p	p	p	1	q
1	p	p	p	p	p	p	p	p	p	1

Let ϵ_i be the probability with which Adviser 2 plays $s_2 = y_i$. Adviser 1's expected payoff from playing her pure strategy $s_1 = x_1$ is $\epsilon_1 + q(1-\epsilon_1)$, that from playing $s_1 = x_2$ is $p\eta_1 + \epsilon_2 + q(1 - \epsilon_1 - \epsilon_2)$, and so on. In general, the expected payoff from playing $s_1 = x_i$ is $p(\epsilon_1 + \epsilon_2 + \ldots + \epsilon_{i-1}) + \epsilon_i + q(1 - \epsilon_1 - \epsilon_2 - \ldots - \epsilon_i)$. Equating expected payoffs from any two adjacent x_{i-1} and x_i yields $\epsilon_i = (q/p)\epsilon_{i-1}$, from which it follows that $\epsilon_i = (q/p)^{i-1}\epsilon_1$. Making use of $\sum_i \epsilon_i = 1$ gives $\epsilon_1[1 + q/p + (q/p)^2 + \ldots + (q/p)^{n-1}] = 1$, where the elements in square brackets are the sum of terms in a geometric series. Thus, whenever $p \neq 0.5$, this yields:

$$\epsilon_1 = \frac{1 - q/p}{1 - (q/p)^n}$$

Inserting this into the formula for ϵ_i gives:

$$\epsilon_i = (q/p)^{i-1} \frac{1 - q/p}{1 - (q/p)^n}$$

It can be similarly derived that Adviser 1 plays $s_1 = x_i$ with probability:

$$\eta_i = (p/q)^{i-1} \frac{1 - p/q}{1 - (p/q)^n}$$

When $p = 0.5$, advisers play all x_i and y_i with equal probabilities $\frac{1}{n}$.

When $p < 0.5$ (in which case $p/q < 1$) η_i is decreasing in i, i.e., Adviser 1 uses higher probabilities for $s_1 \leq 4/9$ than for $s_1 \geq 5/9$ (vice versa when $p > 0.5$). When $n \geq 2$, this is reversed for Adviser 2. (When $n = 1$, it does not matter what Adviser 2 does because Adviser 1 always wins.) The fact that in zero-sum games equilibria are equivalent and interchangeable implies that this is the only Nash equilibrium in the reduced game of Fig. S1, and the above conclusions hold in every equilibrium of a non-reduced game too (see Section 1.1).

When $p \neq 0.5$, Adviser 1's expected equilibrium payoff can be computed by plugging ϵ_1 derived above into the formula for the expected payoff from playing her pure strategy $s_1 = x_1$ (i.e., $\epsilon_1 + q(1-\epsilon_1)$). Simplified and rearranged, this yields:

$$P_n = \frac{p^{n+1} - q^{n+1}}{p^n - q^n}$$

When $p = 0.5$:

$$P_n = \frac{1}{2} + \frac{1}{2n}$$

Adviser 2's expected payoff is $1 - P_n$. Since $P_n > 0.5$ for all p and n, the selected adviser always has an advantage.

1.3 Generating payoff matrices in the penultimate round

As noted earlier, iterative deletion of weakly dominated strategies in the last round yields the $n \times n$ payoff matrix (Fig. S1) where n is determined by advisers' weights at the end of the penultimate round. When $w_1 \geq w_2$, n increases from 1 to 10 as w_1 decreases from 1 to 0.5 (Fig. S2). Fig. S3 shows Adviser 1's payoff matrices in the last round when, at the end of the penultimate round, $w_1 = 0.836$ and $w_1 = 0.835$. In these cases, iterative deletion of weakly dominated strategies yields payoff matrices of sizes $n = 1$ and $n = 2$ respectively. As can be seen, n changes from 1 to 2 when Adviser 1's payoff associated with the pair of strategies $s_1 = 5/9$ and $s_2 = 0$ changes from 1 to p, i.e., when Adviser 1's updated end-of-round weight when the winning colour is white falls below 0.5. Advisers know that the client updates their competence weights using (Eq. 1). Thus, solving

$$\frac{w_1(1-5/9)^2}{w_1(1-5/9)^2 + w_2(1-0)^2} = 0.5$$

shows that this happens when w_1 falls below 81/97 ≈ 0.8351. Cut-off weights for other values n can be obtained similarly (Table S2).

We use this information to generate Adviser 1's payoff matrix in the penultimate round. In the main text we consider the particular case when, at the start of this round $w_1 = 0.8$, and illustrate the procedure for the diagonal $s_1 = s_2$. Here we show the procedure for other combinations s_1 and s_2.

Suppose the advisers were to announce $s_1 = 1/9$ and $s_2 = 2/9$ in the penultimate round. Adviser 1 would be certain to be selected at the end of the round and her updated weight would be either $w_1 = 0.5$ or $w_1 = 0.84$, depending on whether the winning colour in the penultimate round is black (the probability of which is p) or white (the probability of which is q) respectively (Fig. 1a,b). The general formula for Adviser 1's equilibrium payoff P_n in the last round was derived in Section 1.2. The corresponding values n when, at the start of the last round, $w_1 = 0.5$ and $w_1 = 0.84$, are 10 and 1 respectively (Table S2). At this stage advisers do not know the value p in the last round, but they know that it will be drawn from a uniform distribution on $[0,1]$. What matters, thus, are the expected values of Adviser 1's payoffs in the last round that are obtained by integrating P_1 and P_{10} with respect to p. These values are given in the Table S2. Thus, Adviser 1's expected payoff from the pair of strategies $s_1 = 1/9$ and $s_2 = 2/9$ in the penultimate round is $1 + p\int_0^1 P_{10}\,dp + q\int_0^1 P_1\,dp = 1.75 + 0.25q$. Adviser 1's complete payoff matrix is shown in Fig. S4a.

Fig. S3. Adviser 1's payoff matrices in the last round when, at the end of the penultimate round, $w_1 = 0.836$ (left) and $w_1 = 0.835$ (right).

Left ($w_1 = 0.836$): Adviser 2's strategy s_2 (columns); Adviser 1's strategy s_1 (rows)

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	1	q	q	q	q	q	q	q
2/9	1	1	1	1	1	q	q	q	q	q
3/9	1	1	1	1	1	1	1	q	q	q
4/9	1	1	1	1	1	1	1	1	1	1
5/9	1	1	1	1	1	1	1	1	1	1
6/9	p	p	p	1	1	1	1	1	1	1
7/9	p	p	p	p	p	1	1	1	1	1
8/9	p	p	p	p	p	p	p	1	1	1
1	p	p	p	p	p	p	p	p	p	1

Right ($w_1 = 0.835$): Adviser 2's strategy s_2 (columns); Adviser 1's strategy s_1 (rows)

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1	q	q	q	q	q	q	q	q	q
1/9	1	1	1	q	q	q	q	q	q	q
2/9	1	1	1	1	1	q	q	q	q	q
3/9	1	1	1	1	1	1	1	q	q	q
4/9	1	1	1	1	1	1	1	1	1	q
5/9	p	1	1	1	1	1	1	1	1	1
6/9	p	p	p	1	1	1	1	1	1	1
7/9	p	p	p	p	p	1	1	1	1	1
8/9	p	p	p	p	p	p	p	1	1	1
1	p	p	p	p	p	p	p	p	p	1

Table S2. Sizes of the reduced payoff matrix in the last round and the corresponding expected equilibrium payoffs for all possible w_1 at the end of the penultimate round.

Adviser 1's weight at the end of the penultimate round	Size of the $n \times n$ reduced game in the last round	Adviser 1's expected equilibrium payoff in the last round when p is unknown
$0.835\ldots < w_1$	1	$\int_0^1 P_1\, dp = 1$
$0.692\ldots < w_1 < 0.835\ldots$	2	$\int_0^1 P_2\, dp = 0.833...$
$0.623\ldots < w_1 < 0.692\ldots$	4	$\int_0^1 P_4\, dp = 0.774...$
$0.609\ldots < w_1 < 0.623\ldots$	5	$\int_0^1 P_5\, dp = 0.765...$
$0.576\ldots < w_1 < 0.609\ldots$	6	$\int_0^1 P_6\, dp = 0.761...$
$0.558\ldots < w_1 < 0.576\ldots$	8	$\int_0^1 P_8\, dp = 0.756...$
$0.441\ldots < w_1 < 0.558\ldots$	10	$\int_0^1 P_{10}\, dp = 0.754...$
$0.423\ldots < w_1 < 0.441\ldots$	8	$1 - \int_0^1 P_8\, dp = 0.243...$
$0.390\ldots < w_1 < 0.423\ldots$	6	$1 - \int_0^1 P_6\, dp = 0.239...$
$0.376\ldots < w_1 < 0.390\ldots$	5	$1 - \int_0^1 P_5\, dp = 0.234...$
$0.307\ldots < w_1 < 0.376\ldots$	4	$1 - \int_0^1 P_4\, dp = 0.226...$
$0.164\ldots < w_1 < 0.307\ldots$	2	$1 - \int_0^1 P_2\, dp = 0.166...$
$w_1 < 0.164\ldots$	1	$1 - \int_0^1 P_1\, dp = 0$

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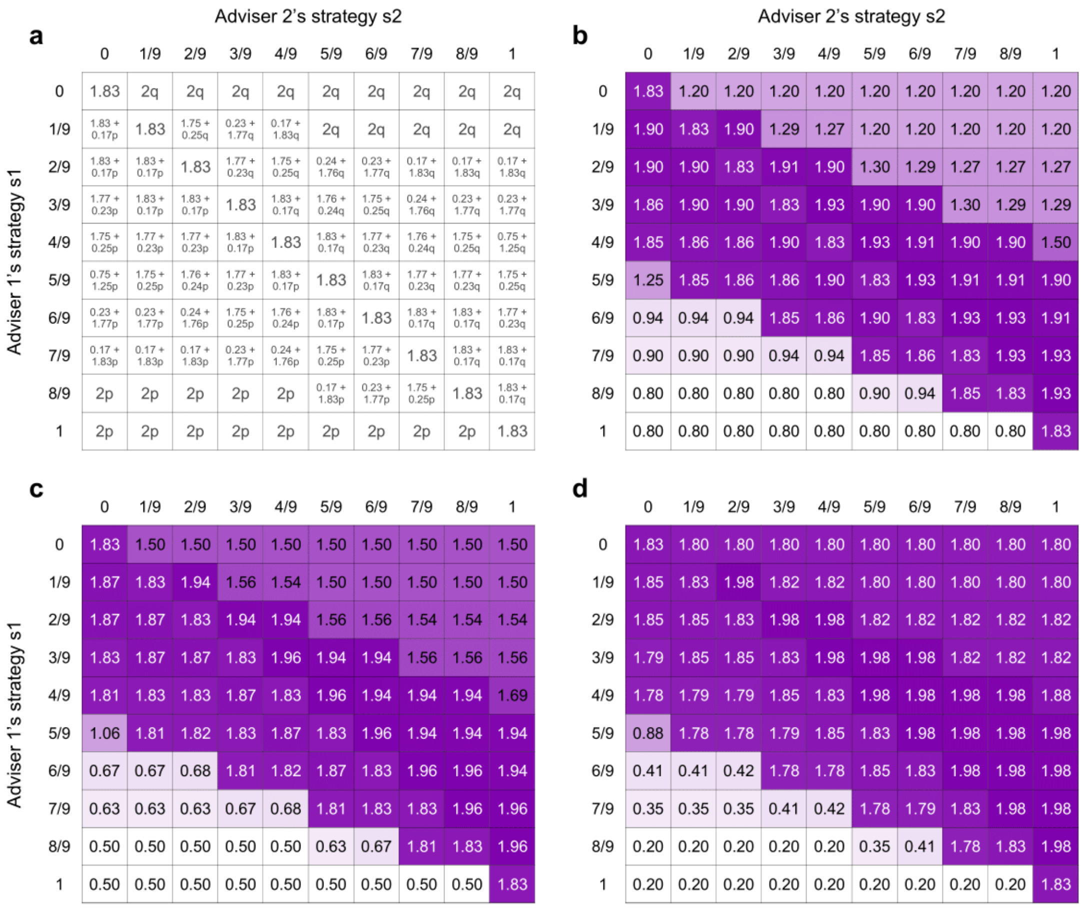
1.4. Nash equilibria in the penultimate round when $w_1 = 0.8$ and $w_1 = 0.6$

We next solve the game in the penultimate round when $w_1 = 0.8$ and $w_1 = 0.6$ for $p = 0.4$, 0.25, and 0.1. Adviser 1's payoff matrices are shown in Fig. S4 ($w_1 = 0.8$) and Fig. S5 ($w_1 = 0.6$). To compute the advisers' equilibrium strategies, we use the freely available software Game Theory Explorer (*2*) (http://www.gametheoryexplorer.org/). There is only one Nash equilibrium in each considered scenario. The probabilities with which advisers randomize between their pure strategies in each equilibrium are shown in Fig. S6. The selected adviser (i.e., Adviser 1) randomizes between moderate strategies closer to the truth as compared to the ignored adviser (i.e., Adviser 2). The ignored adviser assigns high probabilities to strategies that are contrary to what the selected adviser reports. Also, when the ignored adviser's weight is low, she is most likely to announce $s_2 = 0$ or $s_2 = 1$ that is furthest from truth.

Fig. S4. Adviser 1's payoff matrix in the penultimate round when $w_1 = 0.8$. a. Any p. **b.** $p = 0.4$. **c.** $p = 0.25$. **d.** $p = 0.1$. Colour-scaling indicates lowest (white) to highest (dark) payoff.



Adviser 2's strategy s2

Adviser 1's strategy s1

a

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.83	2q	2q	2q	2q	2q	2q	2q	2q	2q
1/9	1.83 + 0.17p	1.83	1.75 + 0.25q	0.23 + 1.77q	0.17 + 1.83q	2q	2q	2q	2q	2q
2/9	1.83 + 0.17p	1.83 + 0.17p	1.83	1.77 + 0.23q	1.75 + 0.25q	0.24 + 1.76q	0.23 + 1.77q	0.17 + 1.83q	0.17 + 1.83q	0.17 + 1.83q
3/9	1.77 + 0.23p	1.83 + 0.17p	1.83 + 0.17p	1.83	1.83 + 0.17q	1.76 + 0.24q	1.75 + 0.25q	0.24 + 1.76q	0.23 + 1.77q	0.23 + 1.77q
4/9	1.75 + 0.25p	1.77 + 0.23p	1.77 + 0.23p	1.83 + 0.17p	1.83	1.83 + 0.17q	1.77 + 0.23q	1.76 + 0.24q	1.75 + 0.25q	0.75 + 1.25q
5/9	0.75 + 1.25p	1.75 + 0.25p	1.76 + 0.24p	1.77 + 0.23p	1.83 + 0.17p	1.83	1.83 + 0.17q	1.77 + 0.23q	1.77 + 0.23q	1.75 + 0.25q
6/9	0.23 + 1.77p	0.23 + 1.77p	0.24 + 1.76p	1.75 + 0.25p	1.76 + 0.24p	1.83 + 0.17p	1.83	1.83 + 0.17q	1.83 + 0.17q	1.77 + 0.23q
7/9	0.17 + 1.83p	0.17 + 1.83p	0.17 + 1.83p	0.23 + 1.77p	0.24 + 1.76p	1.75 + 0.25p	1.77 + 0.23p	1.83	1.83 + 0.17q	1.83 + 0.17q
8/9	2p	2p	2p	2p	2p	0.17 + 1.83p	0.23 + 1.77p	1.75 + 0.25p	1.83	1.83 + 0.17q
1	2p	2p	2p	2p	2p	2p	2p	2p	2p	1.83

b

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.83	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
1/9	1.90	1.83	1.90	1.29	1.27	1.20	1.20	1.20	1.20	1.20
2/9	1.90	1.90	1.83	1.91	1.90	1.30	1.29	1.27	1.27	1.27
3/9	1.86	1.90	1.90	1.83	1.93	1.90	1.90	1.30	1.29	1.29
4/9	1.85	1.86	1.86	1.90	1.83	1.93	1.91	1.90	1.90	1.50
5/9	1.25	1.85	1.86	1.86	1.90	1.83	1.93	1.91	1.91	1.90
6/9	0.94	0.94	0.94	1.85	1.86	1.90	1.83	1.93	1.93	1.91
7/9	0.90	0.90	0.90	0.94	0.94	1.85	1.86	1.83	1.93	1.93
8/9	0.80	0.80	0.80	0.80	0.80	0.90	0.94	1.85	1.83	1.93
1	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	1.83

c

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.83	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1/9	1.87	1.83	1.94	1.56	1.54	1.50	1.50	1.50	1.50	1.50
2/9	1.87	1.87	1.83	1.94	1.94	1.56	1.56	1.54	1.54	1.54
3/9	1.83	1.87	1.87	1.83	1.96	1.94	1.94	1.56	1.56	1.56
4/9	1.81	1.83	1.83	1.87	1.83	1.96	1.94	1.94	1.94	1.69
5/9	1.06	1.81	1.82	1.83	1.87	1.83	1.96	1.94	1.94	1.94
6/9	0.67	0.67	0.68	1.81	1.82	1.87	1.83	1.96	1.96	1.94
7/9	0.63	0.63	0.63	0.67	0.68	1.81	1.83	1.83	1.96	1.96
8/9	0.50	0.50	0.50	0.50	0.50	0.63	0.67	1.81	1.83	1.96
1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.83

d

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.83	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1/9	1.85	1.83	1.98	1.82	1.82	1.80	1.80	1.80	1.80	1.80
2/9	1.85	1.85	1.83	1.98	1.98	1.82	1.82	1.82	1.82	1.82
3/9	1.79	1.85	1.85	1.83	1.98	1.98	1.98	1.82	1.82	1.82
4/9	1.78	1.79	1.79	1.85	1.83	1.98	1.98	1.98	1.98	1.88
5/9	0.88	1.78	1.78	1.79	1.85	1.83	1.98	1.98	1.98	1.98
6/9	0.41	0.41	0.42	1.78	1.78	1.85	1.83	1.98	1.98	1.98
7/9	0.35	0.35	0.35	0.41	0.42	1.78	1.79	1.83	1.98	1.98
8/9	0.20	0.20	0.20	0.20	0.20	0.35	0.41	1.78	1.83	1.98
1	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	1.83

Fig. S5. Adviser 1's payoff matrix in the penultimate round when $w_1 = 0.6$. a. Any p. **b.** $p = 0.4$. **c.** $p = 0.25$. **d.** $p = 0.1$. Colour-scaling indicates lowest (white) to highest (dark) payoff.

a

Adviser 2's strategy s2 (columns); Adviser 1's strategy s1 (rows)

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.76	1.77q	1.83q	1.83q	1.83q	2q	2q	2q	2q	2q
1/9	1.75 + 0.25p	1.76	0.17 + 1.6q	1.83q	1.83q	2q	2q	2q	2q	2q
2/9	0.75 + 1.25p	1.75 + 0.25p	1.76	0.24 + 1.53q	0.17 + 1.66q	0.17 + 1.66q	2q	2q	2q	2q
3/9	0.24 + 1.76p	0.75 + 1.25p	1.75 + 0.08p	1.76	0.75 + 1.02q	0.23 + 1.6q	0.17 + 1.83q	0.17 + 1.83q	0.17 + 1.83q	2q
4/9	0.23 + 1.77p	0.23 + 1.77p	0.24 + 1.76p	1.75 + 0.08p	1.76	0.75 + 1.08q	0.24 + 1.59q	0.23 + 1.77q	0.17 + 1.83q	0.17 + 1.83q
5/9	0.17 + 1.83p	0.17 + 1.83p	0.23 + 1.77p	0.24 + 1.59p	0.75 + 1.08p	1.76	1.75 + 0.08q	0.24 + 1.76q	0.23 + 1.77q	0.23 + 1.77q
6/9	2p	0.17 + 1.83p	0.17 + 1.83p	0.17 + 1.83p	0.23 + 1.6p	0.75 + 1.02p	1.76	1.75 + 0.08q	0.75 + 1.25q	0.24 + 1.76q
7/9	2p	2p	2p	2p	0.17 + 1.66p	0.17 + 1.66p	0.24 + 1.53p	1.76	1.75 + 0.25q	0.75 + 1.25q
8/9	2p	2p	2p	2p	2p	1.83p	1.83p	0.17 + 1.6p	1.76	1.75 + 0.25q
1	2p	2p	2p	2p	2p	1.83p	1.83p	1.83p	1.77p	1.76

b

Adviser 2's strategy s2 (columns)

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.76	1.06	1.10	1.10	1.10	1.20	1.20	1.20	1.20	1.20
1/9	1.85	1.76	1.13	1.10	1.10	1.20	1.20	1.20	1.20	1.20
2/9	1.25	1.85	1.76	1.16	1.17	1.17	1.20	1.20	1.20	1.20
3/9	0.94	1.25	1.78	1.76	1.36	1.19	1.27	1.27	1.27	1.20
4/9	0.94	0.94	0.94	1.78	1.76	1.40	1.19	1.29	1.27	1.27
5/9	0.90	0.90	0.94	0.88	1.18	1.76	1.80	1.30	1.29	1.29
6/9	0.80	0.90	0.90	0.90	0.87	1.16	1.76	1.80	1.50	1.30
7/9	0.80	0.80	0.80	0.80	0.83	0.83	0.85	1.76	1.90	1.50
8/9	0.80	0.80	0.80	0.80	0.80	0.73	0.73	0.81	1.76	1.90
1	0.80	0.80	0.80	0.80	0.80	0.73	0.73	0.73	0.71	1.76

c

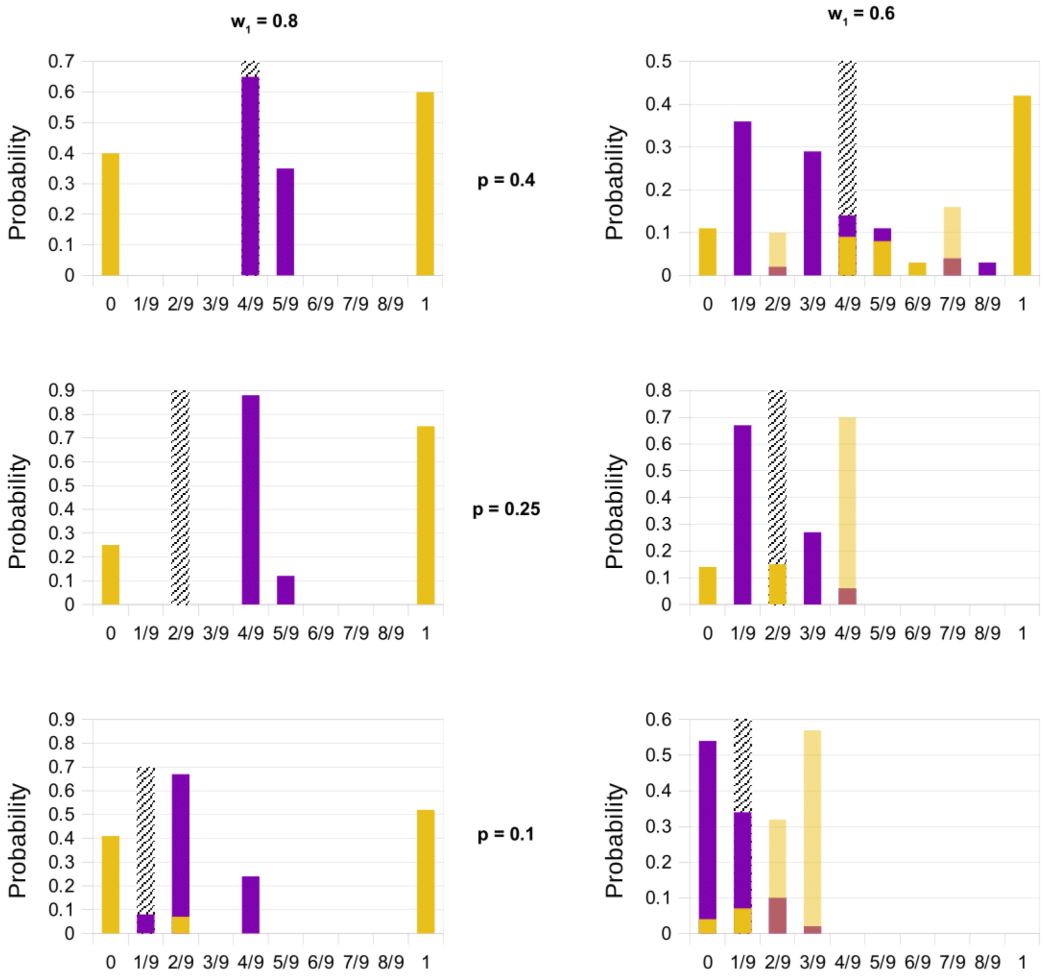
Adviser 1's strategy s1 (rows)

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.76	1.33	1.37	1.37	1.37	1.50	1.50	1.50	1.50	1.50
1/9	1.81	1.76	1.37	1.37	1.37	1.50	1.50	1.50	1.50	1.50
2/9	1.06	1.81	1.76	1.39	1.42	1.42	1.50	1.50	1.50	1.50
3/9	0.68	1.06	1.77	1.76	1.52	1.43	1.54	1.54	1.54	1.50
4/9	0.67	0.67	0.68	1.77	1.76	1.56	1.43	1.56	1.54	1.54
5/9	0.63	0.63	0.67	0.64	1.02	1.76	1.81	1.56	1.56	1.56
6/9	0.50	0.63	0.63	0.63	0.63	1.01	1.76	1.81	1.69	1.56
7/9	0.50	0.50	0.50	0.50	0.59	0.59	0.62	1.76	1.94	1.69
8/9	0.50	0.50	0.50	0.50	0.50	0.46	0.46	0.57	1.76	1.94
1	0.50	0.50	0.50	0.50	0.50	0.46	0.46	0.46	0.44	1.76

d

s1 \ s2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	1.76	1.59	1.65	1.65	1.65	1.80	1.80	1.80	1.80	1.80
1/9	1.78	1.76	1.61	1.65	1.65	1.80	1.80	1.80	1.80	1.80
2/9	0.88	1.78	1.76	1.62	1.66	1.66	1.80	1.80	1.80	1.80
3/9	0.42	0.88	1.76	1.76	1.67	1.67	1.82	1.82	1.82	1.80
4/9	0.41	0.41	0.42	1.76	1.76	1.72	1.67	1.82	1.82	1.82
5/9	0.35	0.35	0.41	0.40	0.86	1.76	1.82	1.82	1.82	1.82
6/9	0.20	0.35	0.35	0.35	0.39	0.85	1.76	1.82	1.88	1.82
7/9	0.20	0.20	0.20	0.20	0.34	0.34	0.39	1.76	1.98	1.88
8/9	0.20	0.20	0.20	0.20	0.20	0.18	0.18	0.33	1.76	1.98
1	0.20	0.20	0.20	0.20	0.20	0.18	0.18	0.18	0.18	1.76

Fig. S6. Probabilities with which advisers randomize between their pure strategies in mixed-strategy Nash equilibria in the penultimate round. The selected Adviser 1 randomizes with probabilities shown in purple. The ignored Adviser 2 randomizes with probabilities shown in yellow. The striped column indicates pure strategy that is closest to the observed evidence (p).



1.5. Strategic versus honest adviser

While honest reporting of truth—announcing $s_i = p$ with probability 1—is often a payoff-maximizing strategy in the last round (because of multiplicity of Nash equilibria), this is rarely the case in earlier stages of the game. This plays to a strategic (i.e., payoff-maximizing) adviser's advantage: whenever honest reporting is not part of equilibrium play, the strategic adviser's payoff is higher than in an equilibrium and, hence, her chances of being selected go up. If a strategic adviser believes her opponent to be also strategic, her choice of strategy is determined the same way as before. However, if she knows or believes her opponent to be honest, she can increase her chances of being selected even further by choosing the best, i.e., a payoff-maximizing, strategy in response to honest play. In this section we consider this scenario.

Once selected, a strategic adviser can switch to honest reporting of truth, since this guarantees her a sure win in all subsequent rounds of the game. To determine her payoff-maximizing strategy when she is not selected, we start by analysing the last round of the game. Consider the case when, at the start of this round, her weight is $w_1 = 0.2$. Fig. S7a shows her updated weights at the end of this round for all possible combinations s_1 and s_2, conditional on whether the winning colour in this round will be black or white. Using these weights we can generate Adviser 1's payoffs, i.e., probabilities of being selected for the client's final bet (Fig. S7b). The honest adviser always chooses s_2 that is closest to p. Thus, having observed p, the strategic adviser knows what her opponent will do. Differently from payoff matrices analyzed earlier, each column here, therefore, represents the strategic adviser's decision problem for a known value p. For example, when p is close to 1/9 (and the honest adviser, therefore, chooses $s_2 = 1/9$) the strategic adviser maximizes her chances of winning by announcing $s_1 \geq 3/9$. She will win if the winning colour is black, the probability of which is p, i.e., close to 1/9. While announcing $s_1 = 0$ or $s_1 = 1$ that is furthest from p is always the strategic adviser's payoff-maximizing strategy in this scenario, she can afford to choose moderate s_1 that are closer to truth when p is sufficiently small or large.

Figure S8 shows the case when $w_1 = 0.4$. In this scenario, for intermediate values p, the strategic adviser does best by overstating the evidence. For example, when p is close to 3/9, she maximizes her payoff by announcing $s_1 \leq 1/9$. She can also afford to play moderate strategies that are not far from truth by just slightly overstating the strength of observed evidence for the winning colour being either black or white.

In the penultimate round, the strategic adviser aims to maximize the probability of being selected at the end of the penultimate *and* the last round. Consider the case when, at the start of the penultimate round, her weight is $w_1 = 0.2$. To generate her payoff matrix, we need to first compute her expected payoffs in the last round for the possible updated weights w_1 at the end of the penultimate round (Fig. S7a). Suppose that the advisers in the penultimate round were to announce

$s_1 = 1/9$ and $s_2 = 1/9$. Irrespective of the colour drawn in the penultimate round, her weight at the start of the last round would be $w_1 = 0.2$. The relevant payoff matrix in the last round is, therefore, that of Fig. S7b. Her payoffs for all possible p in the last round are the maximum values of each column in this matrix. Since the value p in the last round is at this stage unknown, her expected payoff is a weighted sum of these maximum values: $2 \times 1/18 \times 1/36 + 2 \times 1/9(1/9 + 2/9 + 3/9 + 4/9) = 0.25$ (because the ranges of values p that are associated with $s_2 = 0$ and $s_2 = 1$ are half the size of the ranges associated with any other s_2, we use weights 1/18 and 1/9 accordingly). The strategic adviser knows that she will not be selected at the end of the penultimate round when $s_1 = 1/9$ and $s_2 = 1/9$. As such, her expected payoff from this pair of strategies in the penultimate round is 0.25 derived above.

Performing the remaining calculations yields the penultimate round payoff matrix of Fig. S7c. For intermediate values p, a strategic adviser does best by playing strategies that are far from truth and contrary to the received evidence. But as p becomes sufficiently small or large, her payoff-maximizing strategies are closer to the truth. Fig. S8c shows the case when $w_1 = 0.4$. In this scenario, for intermediate values p, the strategic adviser does best by playing moderate strategies that are not far from truth and just slightly overstate the strength of observed evidence.

To summarize, when ignored, i.e., not selected by the client, what the strategic adviser does depends on what she believes her current weight to be. If she thinks that her weight is relatively high, she plays moderate strategies that are not far from truth by slightly overstating the observed evidence. However, as she begins to suspect that her weight may be low, she becomes increasingly likely to opt for extreme strategies that are contrary to the observed evidence and the honest adviser's reports. Once selected, however, the strategic adviser reverts to reporting truth.

Fig. S7. Strategic versus honest adviser when $w_1 = 0.2$. a. Adviser 1's updated weights, conditional on whether the winning colour is black (matrix on the left) or white (matrix on the right) for all possible combinations s_1 and s_2. Weights greater than or equal to 0.5 are shown in yellow, resulting in Adviser 1 being selected for the following round. Weights below 0.5 are shown in purple, resulting in Adviser 2 being selected for the following round. **b.** Adviser 1's expected payoffs, i.e., probabilities of being selected in the following round. **c.** Adviser 1's expected payoffs in the penultimate round, i.e., probabilities of being selected at the end of the penultimate round plus probabilities of being selected at the end of the last round, when, at the start of the penultimate round, $w_1 = 0.2$. Colour-scaling indicates lowest (white) to highest (dark) payoff.

a (black)

Advisor 2's strategy s_2 (columns); Advisor 1's strategy s_1 (rows)

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.20	0.06	0.03	0.02	0.01	0.01	0.01	0.00	0.00
2/9	1.00	0.50	0.20	0.10	0.06	0.04	0.03	0.02	0.02	0.01
3/9	1.00	0.69	0.36	0.20	0.12	0.08	0.06	0.04	0.03	0.03
4/9	1.00	0.80	0.50	0.31	0.20	0.14	0.10	0.08	0.06	0.05
5/9	1.00	0.86	0.61	0.41	0.28	0.20	0.15	0.11	0.09	0.07
6/9	1.00	0.90	0.69	0.50	0.36	0.26	0.20	0.16	0.12	0.10
7/9	1.00	0.92	0.75	0.58	0.43	0.33	0.25	0.20	0.16	0.13
8/9	1.00	0.94	0.80	0.64	0.50	0.39	0.31	0.25	0.20	0.16
1	1.00	0.95	0.84	0.69	0.56	0.45	0.36	0.29	0.24	0.20

a (white)

Advisor 2's strategy s_2

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.20	0.24	0.29	0.36	0.45	0.56	0.69	0.84	0.95	1.00
1/9	0.16	0.20	0.25	0.31	0.39	0.50	0.64	0.80	0.94	1.00
2/9	0.13	0.16	0.20	0.25	0.33	0.43	0.58	0.75	0.92	1.00
3/9	0.10	0.12	0.16	0.20	0.26	0.36	0.50	0.69	0.90	1.00
4/9	0.07	0.09	0.11	0.15	0.20	0.28	0.41	0.61	0.86	1.00
5/9	0.05	0.06	0.08	0.10	0.14	0.20	0.31	0.50	0.80	1.00
6/9	0.03	0.03	0.04	0.06	0.08	0.12	0.20	0.36	0.69	1.00
7/9	0.01	0.02	0.02	0.03	0.04	0.06	0.10	0.20	0.50	1.00
8/9	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.06	0.20	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20

b

Advisor 1's strategy s_1 (rows)

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0	0	0	0	0	4/9	3/9	2/9	1/9	1/36
1/9	1/36	0	0	0	0	0	3/9	2/9	1/9	1/36
2/9	1/36	0	0	0	0	0	3/9	2/9	1/9	1/36
3/9	1/36	1/9	0	0	0	0	0	2/9	1/9	1/36
4/9	1/36	1/9	0	0	0	0	0	2/9	1/9	1/36
5/9	1/36	1/9	2/9	0	0	0	0	0	1/9	1/36
6/9	1/36	1/9	2/9	0	0	0	0	0	1/9	1/36
7/9	1/36	1/9	2/9	3/9	0	0	0	0	0	1/36
8/9	1/36	1/9	2/9	3/9	0	0	0	0	0	1/36
1	1/36	1/9	2/9	3/9	4/9	0	0	0	0	0

c

s_1 \ s_2	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.25	0.24	0.21	0.23	0.36	0.89	0.67	0.44	0.22	0.06
1/9	0.20	0.25	0.23	0.19	0.27	0.29	0.67	0.44	0.22	0.06
2/9	0.20	0.21	0.25	0.21	0.23	0.23	0.69	0.47	0.25	0.06
3/9	0.13	0.36	0.19	0.25	0.22	0.20	0.27	0.47	0.25	0.08
4/9	0.13	0.29	0.26	0.19	0.25	0.20	0.21	0.51	0.29	0.08
5/9	0.08	0.29	0.51	0.21	0.20	0.25	0.19	0.26	0.29	0.13
6/9	0.08	0.25	0.47	0.27	0.20	0.22	0.25	0.19	0.36	0.13
7/9	0.06	0.25	0.47	0.69	0.23	0.23	0.21	0.25	0.21	0.20
8/9	0.06	0.22	0.44	0.67	0.29	0.27	0.19	0.23	0.25	0.20
1	0.06	0.22	0.44	0.67	0.89	0.36	0.23	0.21	0.24	0.25

Fig. S8. Strategic versus honest adviser when $w_1 = 0.4$. a. Adviser 1's updated weights, conditional on whether the winning colour is black (matrix on the left) or white (matrix on the right) for all possible combinations s_1 and s_2. Weights greater than or equal to 0.5 are shown in yellow, resulting in Adviser 1 being selected for the following round. Weights below 0.5 are shown in purple, resulting in Adviser 2 being selected for the following round. **b.** Adviser 1's expected payoffs, i.e., probabilities of being selected in the following round. **c.** Adviser 1's expected payoffs in the penultimate round, i.e., probabilities of being selected at the end of the penultimate round plus probabilities of being selected at the end of the last round, when, at the start of the penultimate round, $w_1 = 0.4$. Colour-scaling indicates lowest (white) to highest (dark) payoff.

a

Advisor 2's strategy s_2 (rows: Advisor 1's strategy s_1)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/9	1.00	0.40	0.14	0.07	0.04	0.03	0.02	0.01	0.01	0.01
2/9	1.00	0.73	0.40	0.23	0.14	0.10	0.07	0.05	0.04	0.03
3/9	1.00	0.86	0.60	0.40	0.27	0.19	0.14	0.11	0.09	0.07
4/9	1.00	0.91	0.73	0.54	0.40	0.30	0.23	0.18	0.14	0.12
5/9	1.00	0.94	0.81	0.65	0.51	0.40	0.32	0.25	0.21	0.17
6/9	1.00	0.96	0.86	0.73	0.60	0.49	0.40	0.33	0.27	0.23
7/9	1.00	0.97	0.89	0.78	0.67	0.57	0.48	0.40	0.34	0.29
8/9	1.00	0.98	0.91	0.83	0.73	0.63	0.54	0.47	0.40	0.35
1	1.00	0.98	0.93	0.86	0.77	0.68	0.60	0.52	0.46	0.40

Advisor 2's strategy s_2

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.40	0.46	0.52	0.60	0.68	0.77	0.86	0.93	0.98	1.00
1/9	0.35	0.40	0.47	0.54	0.63	0.73	0.83	0.91	0.98	1.00
2/9	0.29	0.34	0.40	0.48	0.57	0.67	0.78	0.89	0.97	1.00
3/9	0.23	0.27	0.33	0.40	0.49	0.60	0.73	0.86	0.96	1.00
4/9	0.17	0.21	0.25	0.32	0.40	0.51	0.65	0.81	0.94	1.00
5/9	0.12	0.14	0.18	0.23	0.30	0.40	0.54	0.73	0.91	1.00
6/9	0.07	0.09	0.11	0.14	0.19	0.27	0.40	0.60	0.86	1.00
7/9	0.03	0.04	0.05	0.07	0.10	0.14	0.23	0.40	0.73	1.00
8/9	0.01	0.01	0.01	0.02	0.03	0.04	0.07	0.14	0.40	1.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40

b

(rows: Advisor 1's strategy s_1)

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0	0	7/9	6/9	5/9	4/9	3/9	2/9	1/9	1/36
1/9	1/36	0	0	6/9	5/9	4/9	3/9	2/9	1/9	1/36
2/9	1/36	1/9	0	0	5/9	4/9	3/9	2/9	1/9	1/36
3/9	1/36	1/9	2/9	0	0	4/9	3/9	2/9	1/9	1/36
4/9	1/36	1/9	2/9	3/9	0	4/9	3/9	2/9	1/9	1/36
5/9	1/36	1/9	2/9	3/9	4/9	0	3/9	2/9	1/9	1/36
6/9	1/36	1/9	2/9	3/9	4/9	0	0	2/9	1/9	1/36
7/9	1/36	1/9	2/9	3/9	4/9	5/9	0	0	1/9	1/36
8/9	1/36	1/9	2/9	3/9	4/9	5/9	6/9	0	0	1/36
1	1/36	1/9	2/9	3/9	4/9	5/9	6/9	7/9	0	0

c

	0	1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	1
0	0.47	0.58	1.56	1.33	1.11	0.89	0.67	0.44	0.22	0.06
1/9	0.40	0.47	0.54	1.36	1.12	0.91	0.69	0.47	0.22	0.06
2/9	0.32	0.53	0.47	0.52	1.18	0.93	0.72	0.51	0.25	0.08
3/9	0.30	0.46	0.72	0.47	0.48	1.03	0.77	0.56	0.29	0.13
4/9	0.30	0.44	0.65	0.90	0.47	1.04	0.83	0.64	0.36	0.20
5/9	0.20	0.36	0.64	0.83	1.04	0.47	0.90	0.65	0.44	0.30
6/9	0.09	0.29	0.56	0.77	1.03	0.48	0.47	0.72	0.46	0.30
7/9	0.08	0.25	0.51	0.72	0.93	1.18	0.52	0.47	0.53	0.32
8/9	0.06	0.22	0.47	0.69	0.91	1.12	1.36	0.54	0.47	0.40
1	0.06	0.22	0.44	0.67	0.89	1.11	1.33	1.56	0.58	0.47

2. Experimental Methods

2.1 Experiment protocols

All experimental studies were either approved by the Institutional Review Board of the University College London (UCL ICN; Pilot, Exp. 2, 3; Ethics approval number: 5375/001) or of the Max Planck Institute for Human Development (MPIB; Exp. 1, 4, 5, 6; Ethics approval numbers: A2020-7, A2019/39, A2019/18, A2019/38). For lab studies, participants signed a consent form prior to starting the experiment, and for online studies, participants checked a box, indicating their consent. All lab studies were conducted at the behavioural lab of the Center for Adaptive Rationality (ARC) at the MPIB. All online studies were conducted at Amazon Mechanical Turk (MTurk), only including individuals from the United States with a minimum HIT approval rating of 90%, and a history of at least 100 approved HITs. All six experiments (but not the pilot) were preregistered (https://osf.io/qkncz/). The order of presentation of the studies in the Main Text slightly deviates from the presentation order of the preregistrations (see Table S5). All studies were programmed in LIONESS (*3*).

2.1.1. Pilot experiment

In the pilot experiment single participants observed two advisers, symbolized by cartoon figures, and had to decide for 20 rounds which of the two advisers they wanted to hire (Fig. 2, see https://osf.io/vybak/ for screenshots). The sequence of a round was as follows: 1) The participant selected which adviser to follow. 2) Both advisers observed the available evidence. The evidence was generated as follows: a rack of 100 balls was filled with a mix of white and black balls and both advisers observed the same (randomly sampled) 75 balls from the rack. 3) Both advisers communicated their advice to the client. Their advice consisted of (i) colour (i.e., black or white), and (ii) confidence level (1-5 scale). The participant betted on the colour advice of the selected adviser, but also observed the recommendation of the ignored adviser. 4) One ball from the rack was randomly drawn. If the colour advice of the selected adviser matched (did not match) the colour of the drawn ball, the participant won (lost). The two advisers played different strategies: honest or strategic. The honest adviser reported the colour honestly: if the majority of balls it observed was white (black), it reported white (black) to the participant. It also reported confidence honestly, using a linear mapping of evidence level and confidence: majority of one colour: 51-60%: Confidence (CF) = 1. 61-70%: CF = 2. 71-80%: CF = 3. 81-90%: CF = 4. 91-100%: CF = 5. A small amount of noise was added: in 25% of cases the CF level was increased (or decreased) with one unit, provided this was possible.

The strategy of the strategic adviser depended on whether or not it was selected. When selected, the strategic adviser reported the colour and confidence honestly. When ignored, its strategy depended on the strength of the evidence: if the evidence it observed was strong (> 75% of balls it observed were of the same colour), the strategic adviser reported honestly. However, if the evidence it observed was weak (<= 75% of observed balls were of the same colour), it reported the colour of the minority of the balls with a (randomly sampled) confidence level of 2, 3 or 4. Its strategy is thus to deviate from the observed evidence whenever it was ignored and there was only weak evidence. The 20 rounds encompassed five “easy” rounds with 90 balls of one colour (either black or white), and 15 “difficult” rounds with 50 balls of one colour. The twenty rounds were shown in random order. We used a mix of easy and difficult rounds to increase variation in task difficulty within a participant for a more realistic sampling experience. Participants who started the experiment but did not finish were removed from all analyses. Prior to starting the experiment, participants were required to read the instructions. Participants needed to pass a comprehension check before being allowed into the experiment. The experiment took approximately 10 minutes and participants who successfully completed the experiment received a $3 participation fee. In total 28 individuals (mean ± standard deviation (S.D.) age = 36.1 ± 8.7 years; 25% female, and 75% male) completed the experiment.

2.1.2 Experiment 1

Experiment 1 (preregistration: https://osf.io/qkncz/) followed the same setup as the pilot experiment, with the exception that we used four levels of evidence, varying the ratio of black vs. white balls. All four treatments included five "easy" rounds with 90 balls of one colour (either black or white). The four treatments differed in the remaining 15 rounds. These rounds consisted either of 50, 60, 70 or 80 balls of one colour. From 50 to 80 balls of one colour, the outcome of the rounds becomes increasingly easier to predict. The five easy rounds and the remaining 15 rounds were shown in random order. We generated predictions for the different evidence levels using simulations (see Simulations). Participants received a \$3 participation fee, and an additional \$0,10 for each correct outcome (i.e., a win). We collected data for 40 participants per treatment, resulting in 160 participants in total (mean ± S.D. age = 37.2 ± 10.3 years; 40% female, 59% male, and 1% other).

2.1.3 Experiment 2

Experiment 2 (preregistration: https://osf.io/rsn8h/) was similar to Experiment 1, with the exception that correct choices were not incentivized. That is, participants only received a \$3 participation fee and did not receive a bonus payment for correct outcomes. This was done to test if we could replicate the results of Experiment 1 without incentivizing correct choices. In each treatment, we collected data for 35 participants, resulting in a total of 140 participants (mean ± S.D. age = 35.2 ± 9.5; 38% female, 62% male). The results of Experiments 1 and 2 showed that, as predicted, the strategic adviser gains the highest influence in the most uncertain condition (i.e., 15 rounds with 50/50 ratio of balls, and 5 rounds with 90/10 ratio; Fig. 3b,c). We, therefore, continued with this condition in all subsequent experiments.

2.1.4 Experiment 3

Experiment 3 (preregistration: https://osf.io/bpngu/) was similar to Experiment 1, with the exception that we only collected data in the environment with the weakest evidence. This was done to test if we could replicate the effect in this environment once more. Participants received a \$3 participation fee, and \$0,10 for each correct decision. In total 45 individuals (mean ± S.D. age = 35.7 ± 10.8 years; 49% female, 51% male) completed the experiment.

2.1.5 Experiment 4

Experiment 4 (preregistration: https://osf.io/2ydh3/; screenshots: https://osf.io/hfkuy) investigated whether the strategic adviser can also gain influence in a group of participants whose decisions are combined under an anonymous majority vote. This experiment was done at the lowest evidence level. We generated predictions for the influence of the strategic adviser in groups versus individuals using simulations (see Simulations). We conducted two treatments: an individual and a group treatment. The individual treatment served as a control and was the same as in Experiments 1-3. In the group treatment, five participants performed the experiment together as a group. In each round, each of the five individuals made an individual decision which adviser to follow. The adviser chosen by most group members was selected, and all group members followed the selected adviser's recommendation. Group members only saw the outcome of the majority vote (i.e., which adviser was selected) but not the size of the majority nor the decisions of individual group members. In both treatments, participants could only enter the experiment if they completed a list of comprehension questions. This study was conducted in the lab. In the individual treatment, participants performed the experiment alone sitting behind a desktop. In the group treatment, participants started as soon as all five group members completed the comprehension test. In the group treatment, individuals worked independently using their own tablet. The tablets were controlled by a central server. Group members were sitting in the same room, and made aware that they were doing this experiment with the people in the same room. In both treatments, participants received a participation fee of €6 plus a bonus payment of €0.10 for each correct outcome. The study took approximately 15 minutes for the individual treatment and 20 minutes for the group treatment. For the individual treatment, we collected data for 60 participants (mean age = 27.6 ± 5.5 years; 59% female, 41% male). For the group treatment, we collected data on 30 groups of five individuals, resulting in 150 participants (mean ± S.D. age = 27.1 ± 5.1 years; 63% female, 35% male, and 2% other).

2.1.6 Experiment 5

Experiment 5 (preregistration: https://osf.io/z8k3c/) was a replication of Experiment 4 but conducted online to test if we could replicate our findings from Experiment 4 online. We again conducted an individual and a group treatment (group size five). In the group treatment, participants entered a virtual waiting room after completing the comprehension questions, and waited until they were paired with four other group members upon which the experiment started. As this was an online group study, we needed to implement a policy for non-responders. Participants that did not respond (i.e., did not decide which adviser to follow) within 10 seconds (except round 1: 30 seconds, and round 2: 20 seconds), were removed from the group ("drop-outs"), to assure that the experiment would move forward in the case of non-responders. Participants that dropped out of the experiment were not replaced, hence these groups continued with a smaller group size. Participants were not informed about the number of dropouts and in case of a tie (i.e., equal amount of support for both advisers), one of the advisers was selected randomly. In both treatments, participants received a $3 flat fee for participation, plus a bonus payment of $0,10 for each correct outcome. For the individual treatment, we planned to collect data for 50 individuals, and for the group treatment, we planned to collect data for 25 groups successfully completing the experiment. A successful completion was defined as having at least three participants remaining in the last round. In total 147 individuals completed the experiment: 50 singletons (mean ± S.D. age = 35.4 ± 9.5 years; 37% female, 61% male, and 2% other) and 97 individuals distributed over 25 groups (mean ± S.D. age = 36.2 ± 11.4 years; 42% female, 58% male). Five groups finished with five participants; twelve with four participants, and eight with three participants.

2.1.7 Experiment 6

Experiment 6 (preregistration: https://osf.io/8h47m/; screenshots: https://osf.io/b5gxq/) took place in the lab and investigated the strategic adviser's ability to gain influence in communicating groups. Participants performed the experiment in dyads, sitting together at one computer screen. Dyads were instructed to discuss their opinions with each other and reach a consensual agreement on which adviser to follow. Participants received a participation fee of €6 plus a bonus payment of €0.10 for each correct outcome. The study took approximately 20 minutes to complete. We did not perform an additional individual treatment, but used the individual treatment of experiment 4 as control because all participants were from the same participant pool (i.e., the participant pool of the lab of ARC of the MPIB). We collected data of 50 dyads, resulting in a total of 100 participants (mean ± S.D. age = 27.3 ± 5.7 years; 57% female, 41% male, and 2% other).

2.2 Statistical analysis

In the earliest preregistrations we announced that we would exclude participants that did not sample both advisers. In all seven studies we observed participants that did not sample both advisers but in all seven studies it was more likely that these participants always chose the strategic adviser and not the honest one (Fig. S9). Therefore, we consider this behaviour a feature of participants' strategy and not a lack of engagement, and decided to include these participants in the statistical analysis. For all statistical analyses we used R (version 3.6.2). We used Bayesian hierarchical generalized linear models using the brm function from the brms package (*4*) and its default priors. For each model, we ran three chains in parallel with 6,000 iterations, of which the first 3,000 were discarded as burn-in to reduce autocorrelations. Visual inspection of the Markov chains and the Gelman-Rubin statistic

(Rhat) indicated that all Markov chains converged. Unless stated otherwise, the points and error bars reported reflect the mean estimates and the 95% credible intervals (CI) of the posterior distribution.

2.2.1 Strategic versus honest adviser.

To test if individuals were more likely to select the strategic adviser than the honest adviser, we fitted "Selected Adviser" (strategic or honest) as binomial response variable, and "Round Number" (either alone (Pilot + Exp. 3) or in interaction with Treatment (Exp. 1, 2, 4, 5 and 6)) as population-level ("fixed") effect(s). Since in the first round, individuals did not have any information about the advisers, and their choices were thus random, we fixed the intercept at Round 1 at 0.5. "Individual (or Dyad) Identity" was included as group-level ("random") effect. In the majority voting experiments (Experiments 4+5) "Individual Identity" was nested in "Group Identity". A preference of the strategic adviser over the honest adviser was inferred by evaluating whether there was a positive and credible (i.e., non-overlapping with 0) effect of "Round Number" on "Selected Adviser". See Table S3 for models results, and https://osf.io/9gjyc/ for data and code.

2.2.2 Changing adviser.

To test how lottery outcome and the ignored adviser's advice direction affected the likelihood to change adviser across the different treatments, we fitted "Changing Adviser" (yes/no) as binomial response variable, and "Lottery Outcome" (lost/won), "Ignored Adviser's Advice" (opposing/confirming), and their interaction, as population-level effects. To test how time affected the likelihood to change adviser, we also fitted "Round Number" as a population-level effect. "Individual (or Dyad) Identity" was, again, included as group-level effect. In the majority voting experiments (Experiments 4+5) "Individual Identity" was, again, nested in "Group Identity". As inference criterion, we evaluated whether the effects were credibly different from 0 (either the main effects or their interaction). See Table S4 for model results, and https://osf.io/9gjyc/ for data and code.

3. Simulations

3.1 Evidence levels.

We used numerical simulations to predict how the level of evidence (i.e., the level of uncertainty) would affect the strategic adviser's influence (see preregistration https://osf.io/rsn8h/ for a description of the simulations). The simulations were based on the behaviour of the participants in the pilot experiment. In the pilot, 28 participants performed 20 rounds in the most uncertain environment. To predict how participants would perform across the four different levels of uncertainty, we used simulations, closely following the stages in the experiments. In the simulations, a client decides for 20 rounds which of two advisers (honest or strategic) to follow. The simulations (implemented in R) consisted of the following steps: (i) A rack of 100 balls is filled with a mix of white and black balls. (ii) Both advisers observe 75 of the 100 balls. (iii) In the first round, the client randomly selects either of the two advisers. (iv) Both advisers communicate their advice to the client (colour + confidence) following their respective strategies. (v) One ball is randomly drawn from the rack. If the advice of the selected adviser matches (does not match) the drawn ball, the client wins (loses). (vi) The client decides whether or not to change adviser for the next round. This changing likelihood is based on the observed values in the pilot (Fig. S10a). As an example, if the client lost and the ignored adviser gave the opposing advice with confidence level 4, the client's likelihood to change adviser is 0.86 (most left bar in Fig. S10a). We performed these simulations at the four levels of uncertainty as described in Experiment 1. That is, all four treatments included five easy rounds with 90 balls of one colour. The four treatments differed in the remaining 15 rounds. These rounds consisted either of 50, 60, 70 or 80 balls of one colour. From 50 to 80 balls of one colour, the outcome of the rounds becomes increasingly easier to predict, hence the level of uncertainty decreases. For each of the four settings, we ran 10,000 simulations, each consisting of 20 rounds. We reported averaged values over all runs. Fig. S10b shows the results of the simulations. In the treatment with the highest uncertainty (50 balls of each colour, Evidence 1), we replicate the results of pilot 1: a strong preference for the strategic adviser (Fig. 3a). This was expected, since the simulations are based on the observed behaviours in the pilot. This does, however, suggests that the simulations capture the key variables of interest. Increasing the level of evidence results in a gradual shift in the direction of the honest adviser. The intuition behind this result is that the more certain the environment becomes, the less the strategic adviser can utilize its strategy of going against the evidence when ignored, because it only uses this strategy if the evidence is weak. Also note that the strategic adviser is predicted to never perform worse than the honest one. At the highest evidence level, the strategic adviser effectively turns into an honest adviser (since the available evidence is always strong); this thus serves as a control condition. The main prediction that we tested in Experiments 1+2 is thus that the lower the evidence level (i.e., the higher the uncertainty), the higher the strategic adviser's influence.

3.2 Majority voting groups.

We also used numerical simulations to predict the influence of the strategic adviser in groups using an anonymous majority vote (see preregistration https://osf.io/z8k3c/ for a description of the simulations). The basis of the simulations are the observed likelihoods of change for single individuals in the most uncertain environment, combining the data of the Pilot, and Experiments 2+3 (Fig. S11a). As can be observed, participants are most likely to switch when they lost and the ignored adviser gave opposing evidence from the selected adviser. To predict how these transition probabilities would change for a group of five individuals making independent decisions under a majority vote, we used the Condorcet's Jury Theorem (CJT). For a group size of five this implies: $p^5 + (p^4).(1\text{-}p).5 + (p^3).(1\text{-}p)^2.10$, with p being the individual transition probability. Under the CJT, probabilities above (below) 0.5 increase (decrease) with increasing group size. Fig. S11b shows the updated transition probabilities of a group of five individuals using a majority vote. This calculation predicts that the likelihood that a group of five individuals changes adviser after it lost and the ignored adviser gave the opposing advice increases (as they are individually above 0.5). All other probabilities are expected to decrease (as they are individually below 0.5). Note that this calculation assumes that individuals in groups have the same individual transition probabilities as individuals performing the task alone. In reality, individuals in groups may show different behaviour than when performing this task alone. We then plugged these transition probabilities of individuals and groups into the simulations as described above, simulating single agents making decisions over 20 rounds; and groups of five agents whose independent decisions were combined with a majority vote over 20 rounds. From this, we calculated the average likelihood of selecting the strategic adviser over the 20 rounds, averaged over 10,000 simulation runs per treatment. Fig. S11c, d shows the results: the strategic adviser is predicted to have a stronger influence in majority voting groups compared to single individuals. This prediction was tested in Experiments 4+5.

Fig. S9. The mean probability to select the strategic adviser (SA) per study. a-d, The mean probability to select the strategic adviser per participant. Each dot shows a single participant. **e**, **f**, Red dots show individual participants (control). Dark green dots show participants in majority voting groups. Dark blue dots show the majority vote (i.e., the mean probability per group to select the strategic adviser under the majority vote). **g.** The mean probability to select the strategic adviser per dyad. Each dot shows a dyad. In all panels, the first choice (i.e., round 1) was excluded as this constituted a random choice. Violin plots show median and interquartile ranges. Black dashed horizontal lines indicate chance level (0.5).

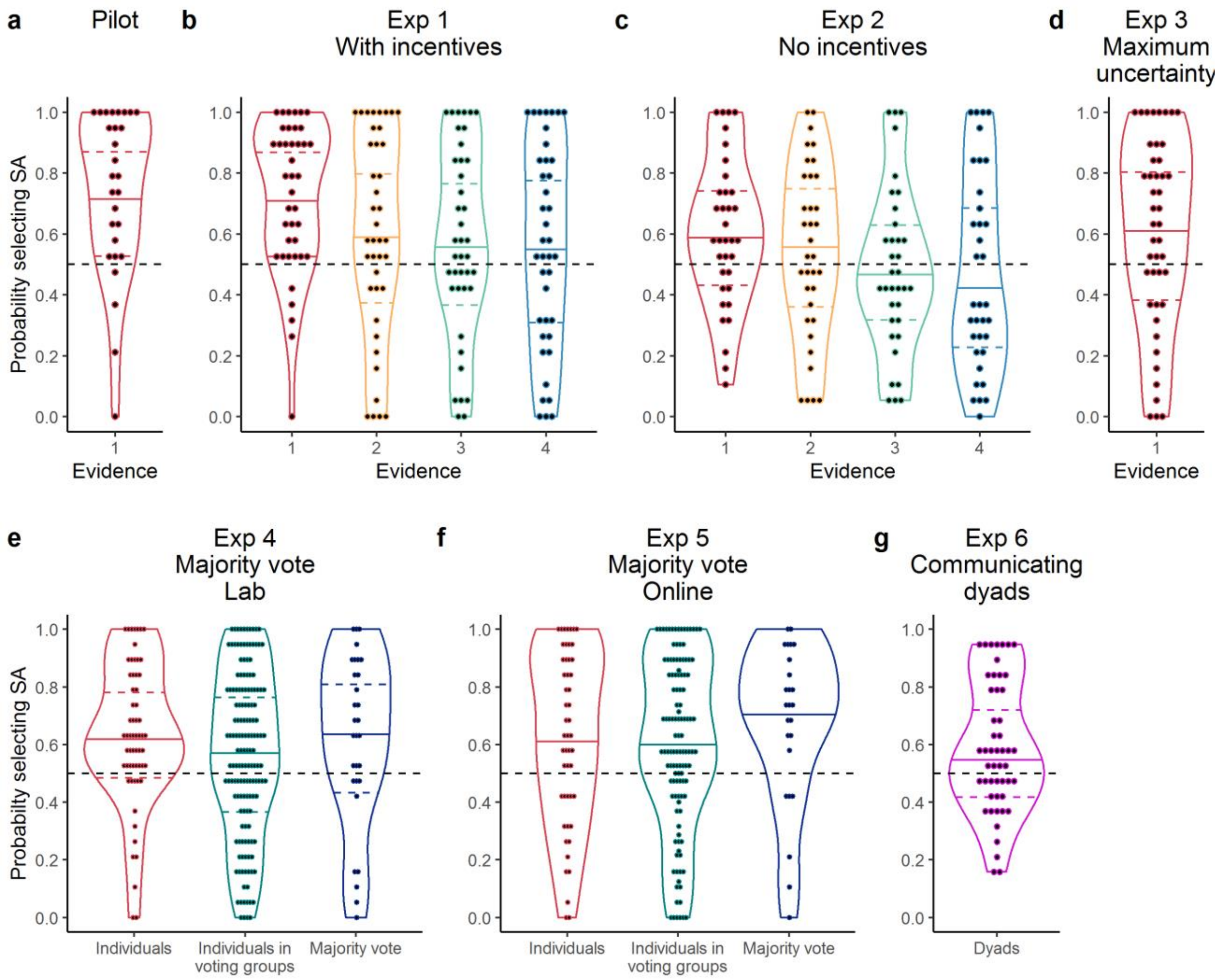


Fig. S10. Results of the pilot experiment, and simulations for generating predictions on how the level of uncertainty affects the success of the strategic adviser (SA). a. The mean likelihood to change adviser in the next round as a function of whether participants lost or won, and the confidence of the ignored adviser in the pilot. Red (blue) colours indicate that the ignored adviser's colour advice opposed (confirmed) the selected adviser's colour advice. Numbers show the number of occurrences per category. **b.** The observed switching probabilities in (**a**) were used in simulations to generate predictions on how the evidence level would affect the strategic adviser's success (see 3. Simulations for details). These simulations predict that the lower the evidence level (i.e., the higher the uncertainty), the higher the influence of the strategic adviser. Evidence level 1 was the evidence level used in the Pilot. This prediction was subsequently tested in Experiments 1+2.

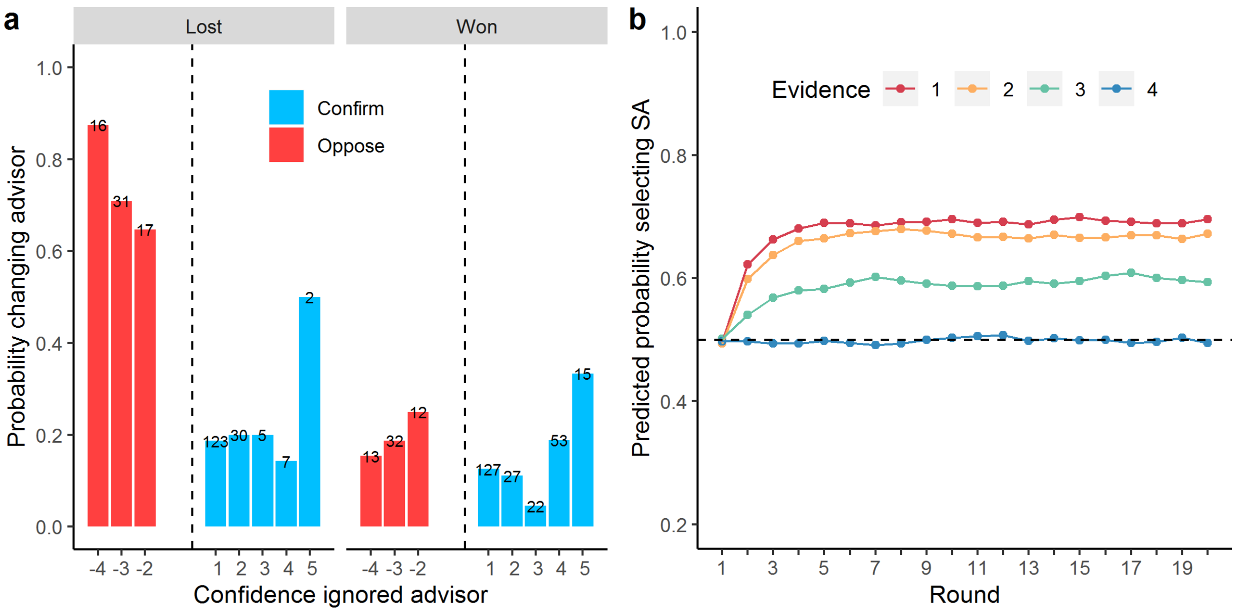


Fig. S11. Prediction for the strategic adviser's influence in majority-voting groups. We used simulations to predict the strategic adviser's success when advising majority-voting groups. **a.** As input, we used the observed likelihoods of changing advisers for single individuals in the most uncertain environment, pooling data of the Pilot, and Experiments 2+3. In these experiments, participants were most likely to change when they lost and the ignored adviser gave opposing evidence from the selected adviser (**a**). To predict how these switching probabilities would change for a group of five individuals making independent decisions under a majority vote, we used the Condorcet's Jury Theorem (CJT). Under the CJT, individual probabilities above (below) 0.5 increase (decrease) with group size. **b** The updated switching probabilities of a group of five individuals using a majority vote. We next used these individual and group switching probabilities to simulate agents making decisions alone (**c**) or in majority-voting groups of size five (**d**) over 20 rounds. These simulations predict that the strategic adviser has a stronger influence in majority voting groups (**d**) compared to single individuals (**c**, see 3. Simulations for simulation details).

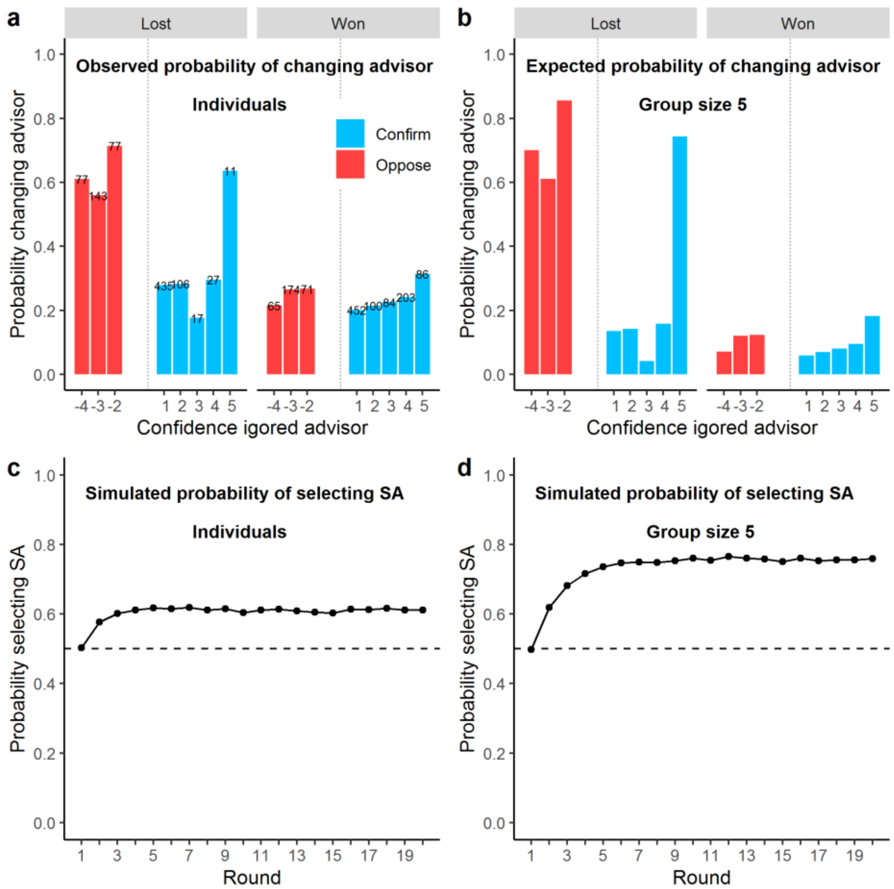


Fig. S12. Single participants at the lowest evidence level (i.e., highest level of uncertainty) were most likely to change adviser when losing a bet and when the ignored adviser provided opposing colour advice. a-f, In all six studies, single participants at maximum uncertainty were most likely to change adviser when they lost and the ignored adviser opposed the colour advice of the selected adviser. Shown are the mean of the posterior distributions and 95% Credible Intervals of Bayesian regression models.

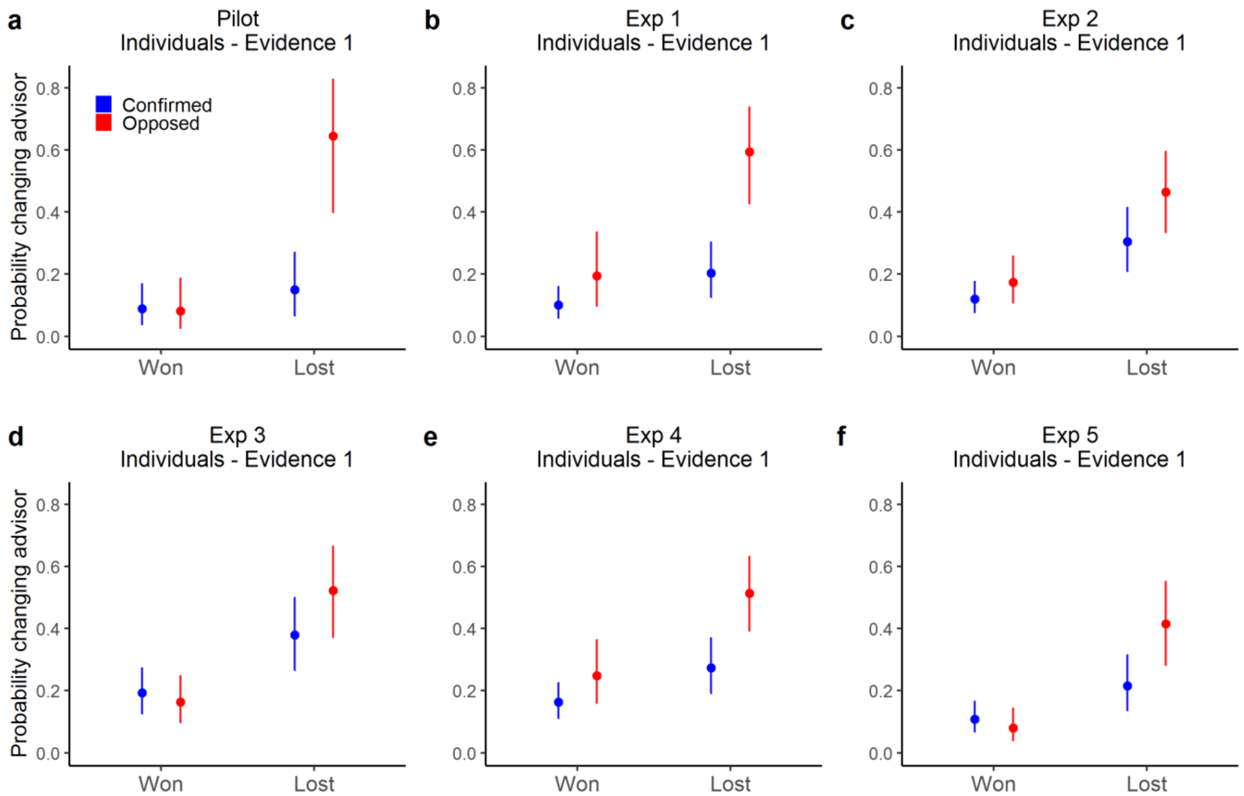


Fig. S13. The likelihood to change adviser per confidence category per treatment | The mean likelihood to change adviser in the next round as a function of whether the participant(s) won or lost, and the ignored adviser opposed (red) or confirmed (blue) the colour advice of the selected adviser per level of confidence. The red bars represent the strategy of the strategic adviser who contradicted ("opposed") the honest adviser when ignored and evidence was weak. When doing so, it used a, randomly selected, confidence level of 2, 3 or 4. **a**, At the lowest evidence level (i.e., highest level of uncertainty), participants were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice (data are collapsed across Pilot + Experiments 1-6; see Fig. S14 for results per experiment). **b**, **c**, Similarly, at evidence level 2 (**b**) and 3 (**c**) participants were more likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. **d**, At evidence level 4, the available evidence was almost always high, preventing the strategic adviser from using its contrarian strategy. **b-d**, data are collapsed across Experiments 1+2. **e**, Individuals in the majority of the voting groups were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. **f**, Individuals in the minority of the voting groups were most likely to change adviser when their group won (against the minority's opinion) and the ignored adviser gave the opposing colour advice. **e, f**, Data are collapsed across Experiments 4+5. **g**, Communicating dyads were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. Numbers in the bars show the number of occurrences per category. Across all conditions, the strategic adviser's absolute level of confidence when recommending opposing advice (i.e., the red bars) did not impact the likelihood that participants' changed adviser. What mattered more was that the advice was opposing.

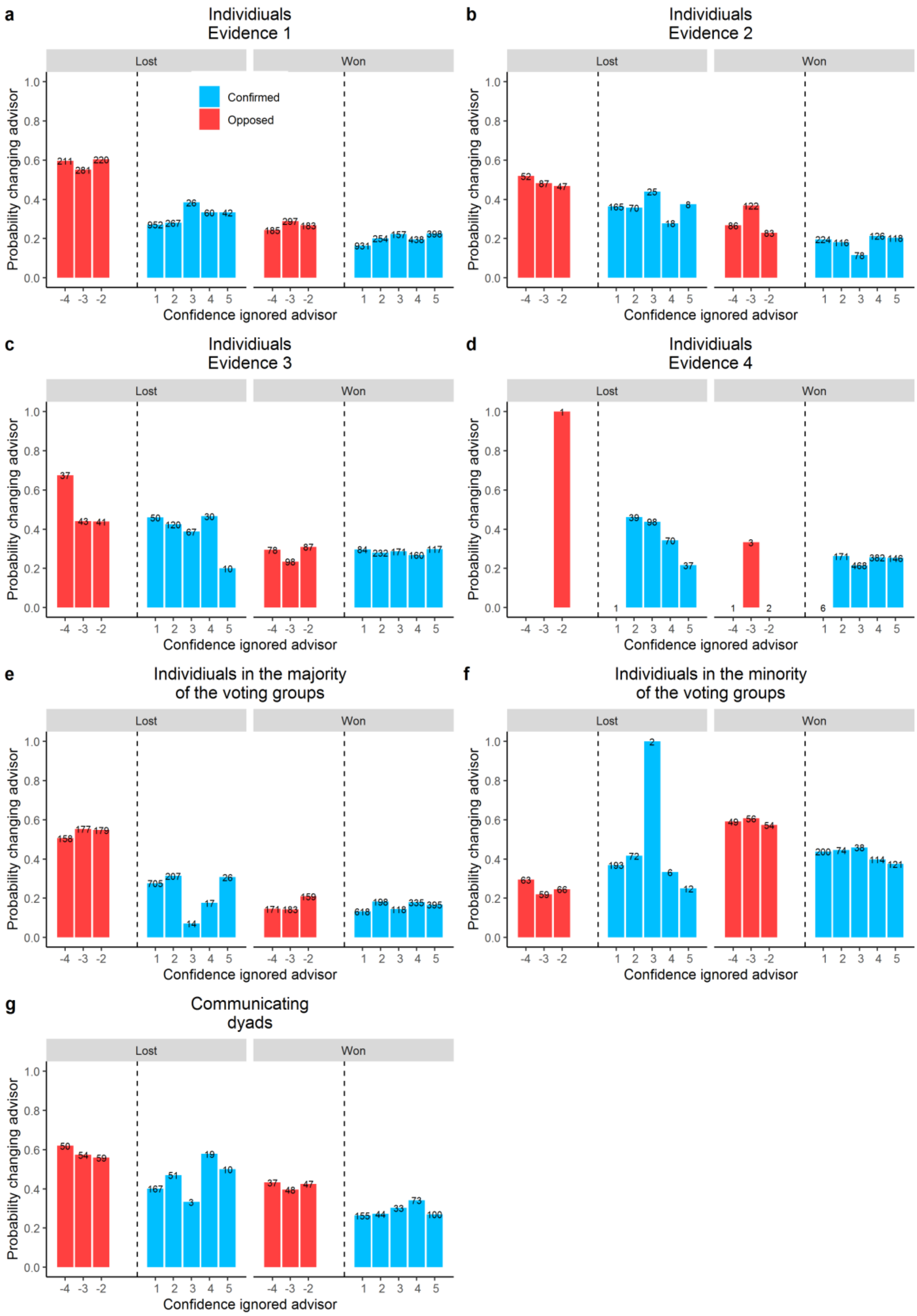

a
Individiuals
Evidence 1
b
Individiuals
Evidence 2
c
Individiuals
Evidence 3
d
Individiuals
Evidence 4
e
Individiuals in the majority
of the voting groups
f
Individiuals in the minority
of the voting groups
g
Communicating
dyads
Lost
Won
Confirmed
Opposed
Probability changing advisor
Confidence ignored advisor

Fig. S14. The likelihood to change adviser per confidence category for single individuals at the lowest level of evidence (i.e., highest uncertainty) | a-f, The mean likelihood to change adviser in the next round as a function of whether the participant won or lost, and the ignored adviser opposed (red) or confirmed (blue) the colour advice of the selected adviser per level of confidence. The red bars represent the strategic adviser's strategy who contradicted ("opposed") the honest adviser when ignored and evidence was weak, using a, randomly selected, confidence level of 2, 3 or 4. In all six studies, at the lowest evidence level, single participants were most likely to change adviser when they lost and the ignored adviser gave the opposing colour advice. Numbers in the bars show the number of occurrences per category. Across all conditions, the strategic adviser's absolute level of confidence when recommending opposing advice (i.e., the red bars) did not impact the likelihood that participants' changed adviser. What mattered more was that the advice was opposing.

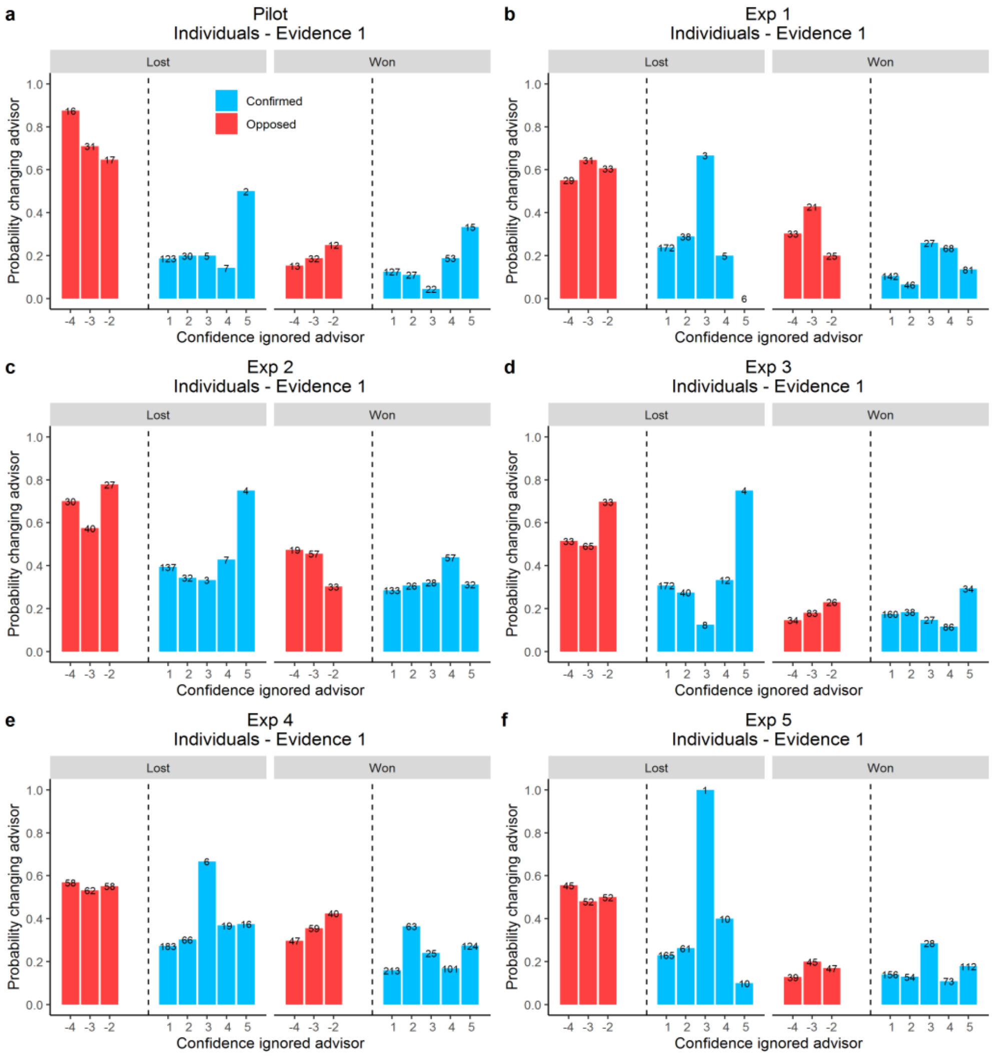


Fig. S15. The likelihood to change adviser decreased over time across all studies. a-d, Single participants became increasingly less likely to change adviser over the course of the experiment, independent of the level of evidence. **e**, **f**, Also individuals in majority voting groups (dark green line) and the majority vote itself (i.e., the aggregation of the independent decisions in a group; dark blue line) became less likely to change adviser over time. **g**, Communicating dyads were also less likely to change adviser over time. Thick lines show the mean of the posterior distributions and bands 95% credible intervals of Bayesian regression models.

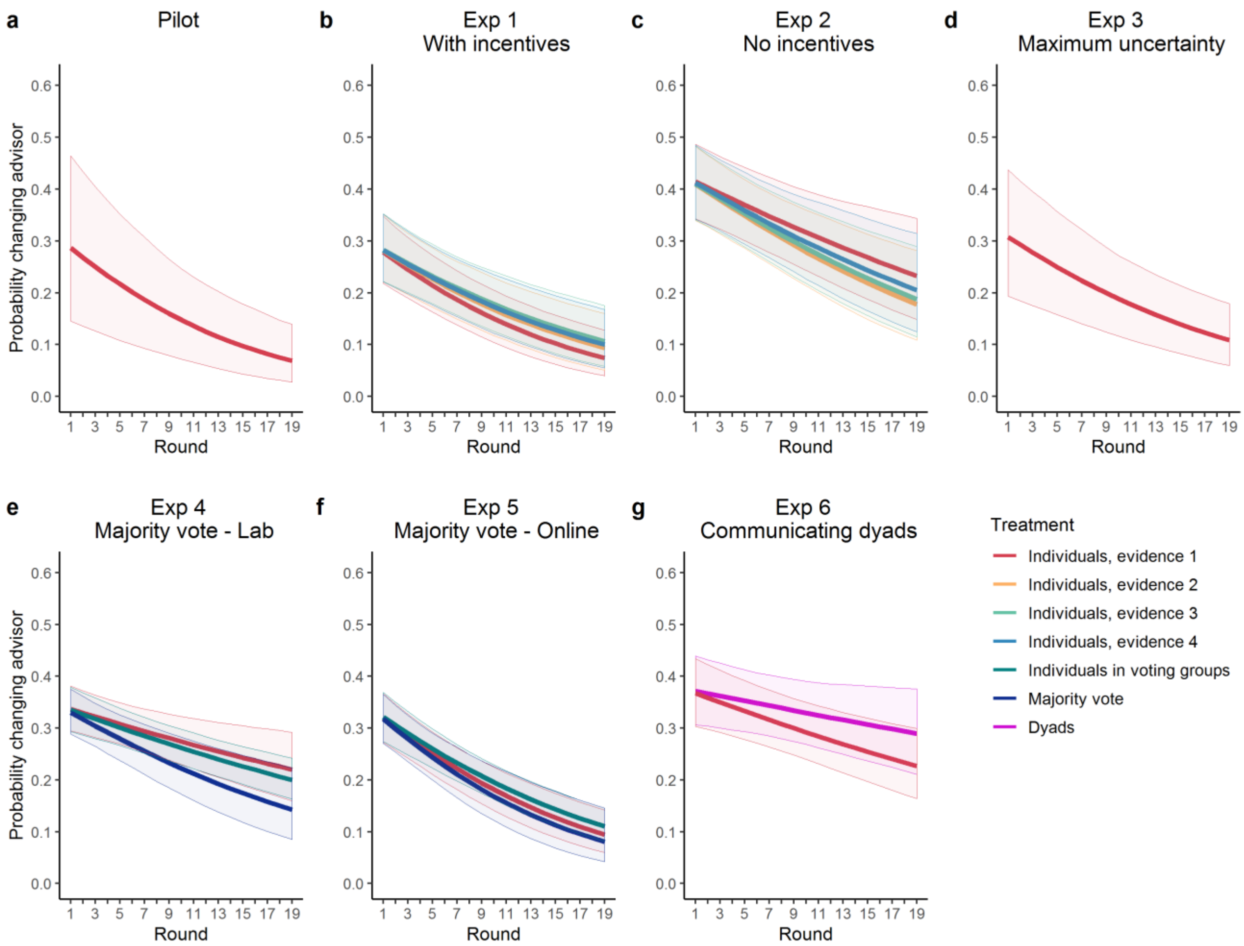


Table S3. Bayesian linear regression results of selected adviser.

Response: Selected_adviser (strategic versus honest)						
Predictor	Estimate	Est.Error	l−95% CI	u−95% CI	Eff.Sample	Rhat
Pilot						
Round	0.04	0.02	0.01	0.08	4490	1.00
Experiment 1						
Round:evidence1	0.10	0.02	0.07	0.14	5567	1.00
Round:evidence2	0.03	0.01	0.00	0.06	5597	1.00
Round:evidence3	0.06	0.01	0.03	0.09	5080	1.00
Round:evidence4	0.03	0.01	-0.00	0.06	5153	1.00
Experiment 2						
Round:evidence1	0.04	0.01	0.01	0.07	6616	1.00
Round:evidence2	0.03	0.01	0.00	0.06	6960	1.00
Round:evidence3	0.00	0.01	-0.02	0.03	7022	1.00
Round:evidence4	-0.01	0.01	-0.04	0.01	6990	1.00
Experiment 3						
Round	0.01	0.01	-0.01	0.04	5522	1.00
Experiment 4						
Round:individuals	0.09	0.01	0.06	0.11	5925	1.00
Round:indiv_maj_vote	0.03	0.01	0.01	0.04	4935	1.00
Round:majority_vote	0.06	0.02	0.03	0.09	6727	1.00
Experiment 5						
Round:individuals	0.10	0.01	0.08	0.13	5776	1.00
Round:indiv_maj_vote	0.06	0.01	0.04	0.08	6006	1.00
Round:majority_vote	0.10	0.02	0.07	0.14	5887	1.00
Experiment 6						
Round:individuals	0.08	0.01	0.06	0.10	8539	1.00
Round:dyads	0.05	0.01	0.03	0.07	8518	1.00

Table S4. Bayesian linear regression results of changing adviser.

Predictor	Estimate	Est.Error	l−95% CI	u−95% CI	Eff.Sample	Rhat
Response: Changed_adviser (yes / no)						
Singletons, Evidence 1						
Intercept	-1.26	0.13	-1.52	-1.00	4432	1.00
Lost	0.75	0.10	0.56	0.94	12051	1.00
Opposed	0.14	0.12	-0.10	0.39	10695	1.00
Round	-0.06	0.01	-0.08	-0.05	18455	1.00
Lost:Opposed	1.03	0.17	0.70	1.36	9406	1.00
Singletons, Evidence 2						
Intercept	-1.36	0.27	-1.90	-0.83	2730	1.00
Lost	1.15	0.20	0.75	1.53	9105	1.00
Opposed	0.38	0.20	-0.02	0.78	8731	1.00
Round	-0.07	0.01	-0.09	-0.04	18043	1.00
Lost:Opposed	0.31	0.31	-0.29	0.94	7768	1.00
Singletons, Evidence 3						
Intercept	-0.73	0.28	-1.28	-0.20	2129	1.00
Lost	0.93	0.19	0.55	1.31	10441	1.00
Opposed	-0.27	0.21	-0.68	0.13	9372	1.00
Round	-0.07	0.01	-0.10	-0.05	14854	1.00
Lost:Opposed	0.88	0.35	0.20	1.56	7629	1.00
Singletons, Evidence 4						
Intercept	-1.17	0.25	-1.68	-0.68	2271	1.00
Lost	0.94	0.18	0.57	1.30	17896	1.00
Round	-0.05	0.01	-0.08	-0.03	19625	1.00
Voting groups, in majority						
Intercept	-1.38	0.16	-1.68	-1.08	6982	1.00
Lost	0.94	0.11	0.72	1.17	12411	1.00
Opposed	-0.01	0.16	-0.33	0.30	10640	1.00
Round	-0.06	0.01	-0.08	-0.05	20260	1.00
Lost:Opposed	1.18	0.21	0.78	1.59	9212	1.00
Voting groups, in minority						
Intercept	-0.12	0.18	-0.47	0.23	7606	1.00
Lost	-0.16	0.18	-0.51	0.17	7780	1.00
Opposed	0.76	0.23	0.32	1.21	9267	1.00
Round	-0.02	0.01	-0.04	0.01	11170	1.00
Lost:Opposed	-1.57	0.33	-2.22	-0.93	5714	1.00
Dyads						
Intercept	-0.72	0.22	-1.16	-0.30	6027	1.00
Lost	0.75	0.15	0.45	1.05	10396	1.00
Opposed	0.46	0.16	0.14	0.78	11552	1.00
Round	-0.03	0.01	-0.05	-0.00	11853	1.00

Table S5. Overview of experimental studies.

Order of studies in main text	Treatments	Online/lab	Order of studies in preregistrations
Pilot experiment	Singletons, evidence 1, no incentives	Online	Pilot experiment
Experiment 1	Singletons, evidence 1-4, with incentives	Online	Experiment 6
Experiment 2	Singletons, evidence 1-4, no incentives	Online	Experiment 1
Experiment 3	Singletons, evidence 1, with incentives	Online	Experiment 2
Experiment 4	Majority vote, evidence 1, with incentives	Lab	Experiment 4
Experiment 5	Majority vote, evidence 1, with incentives	Online	Experiment 3
Experiment 6	Dyads, evidence 1, with incentives	Lab	Experiment 5

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