The Downsides of Information Transmission for Voting: A Problem and Some Institutional Remedies

Keith E. Schnakenberg*

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Abstract

I analyze a model of information transmission in collective choice environments. An Expert possesses private information about the consequences of passing an exogenous proposal and engages in cheap talk to persuade voters to pass or reject the proposal. The Expert may successfully persuade the voters to take her preferred action even when all or most voters would receive a better *ex ante* payoff with no information transmission. I consider several remedies that an institutional designer may consider in order to avoid this problem while allowing information transmission that benefits the voters. I evaluate the effects of (i) limiting Expert communication to binary endorsements, (ii) encouraging competition between Experts, and (iii) restricting the agenda in order to consider only one dimension at a time. None of these proposals completely eliminate negative persuasion outcomes, but limiting the Expert to binary endorsements avoids the worst manipulation while preserving beneficial information transmission.

*Assistant Professor of Public Policy, Martin School of Public Policy and Administration, University of Kentucky. Contact: keith.schnakenberg@gmail.com.

Better information improves the expected payoff of a rational decision-maker. In contrast, recent research shows that a group of rational voters may be made worse off from strategic information revelation when there is no representative voter (Schnakenberg, 2015; Alonzo and Câmara, 2016; Schnakenberg, 2016). These results raise new questions about institutional design, since classic theories of legislative organization assumed that institutions should be created to maximize the acquisition and transmission of policy-relevant information.[1] This paper focuses on the core normative question raised by this research: How can voting bodies utilize the advice of experts while minimizing the chances of welfare-reducing manipulation?

To provide some answers to this question, I analyze a model in which an expert communicates to voters about a policy-relevant state of the world prior to a vote over whether or not to approve an exogenous proposal. I review and extend recent research about *manipulative persuasion*, which is defined as a situation in which expert advice lowers the *ex ante* expected utility of voters relative to voting with no information. I consider several possible remedies to the problem of manipulative persuasion. The arrangement that allows beneficial persuasion while preventing unanimously harmful manipulation is one that limits expert communication to binary endorsements. However, this mechanism does not rule out the possibility that a majority is made worse off by expert advice.

In addition to the preferred remedy for manipulative persuasion, I consider two alternatives: limiting decision-making to one dimension at a time, and inducing competition between experts. Manipulative persuasion may be prevented by limiting decision-making to one issue dimension at a time, though this solution introduces well-known problems that may be worse than expert manipulation. Consulting multiple opposing experts may deter some manipulative persuasion but does not always do so and may also eliminate beneficial

[1] For instance, Krehbiel (1991) argues that legislative organization reflects a need to facilitate information acquisition and transmission.

information transmission.

This paper does not analyze an exhaustive list of possible institutional remedies to expert manipulation. However, the failure of common institutions to avoid the problem of manipulative persuasion suggests that the welfare implications of information in real voting institutions are more nuanced thaan previously recognized.

1 Information transmission and voting

The insight driving my analysis is that experts have more tools at their disposal when attempting to persuade a voting body than when the audience is a single decision-maker. To see the difference between these two scenarios, consider two examples in which the decision-maker(s) and expert face similar decision problems.

Example 1 (Single decision-maker)**.** A policy expert is employed as a lobbyist for an organization supporting a new policy proposal. This proposal is "good" with probability $\frac{1}{3}$ and "bad" with probability $\frac{2}{3}$. The expert must convince the head of an agency to implement the proposal. The agency head receives a payoff of 0 if she does not implement the proposal, $\frac{3}{2}$ if she implements a good proposal, and -1 if she implements a bad proposal. *Ex ante*, the agency head does not want to implement the proposal because it is much more likely to be good than bad (her expected payoff from implementing the proposal is $-\frac{1}{6}$). However, the policy expert knows the quality of the proposal and is allowed to communicate with the agency head to influence her decision.

For well-known reasons, the expert cannot persuade the agency head to adopt the policy under any circumstances. The expert's problem boils down to credibility: suppose that the expert can announce "the policy is good" when the policy is actually good and cause the agency head to implement the policy. If this were true, the expert would have a strict incentive to make this same announcement even when the policy is bad. Furthermore, since the agency head knows that the expert has an incentive to make the same announcement no matter what, her rational response to this situation is to ignore all statements by the expert and reject the policy proposal.

Example 2 (Voting body)**.** To contrast with the previous example, assume that the same expert now faces a three-person legislative committee that operates by majority rule. Assume that the legislators know in advance that the policy is good for one and only one district, but are uncertain about which district benefits. For example, legislators may support a new project only if they believe that it will be built in their district. *Ex ante*, the policy has the same probability (1/3) of being good for each district. Note that each legislator faces a decision-problem that looks very similar to the one faced by the agency head in Example 1: for each district, the policy is good for the district with probability $\frac{1}{3}$ and bad for the district with probability $\frac{2}{3}$. When the policy is not implemented, all legislators get a payoff of zero. When the policy is implemented, a legislator gets a payoff of $\frac{3}{2}$ if the policy was good for her district and -1 otherwise. The policy is implemented if two or more legislators vote in favor.

As before, the legislators are *ex ante* opposed to the proposal, but the expert knows the benefit to each district and is allowed to make a public speech before voting occurs. Unlike in the single decision-maker example, the expert can persuade the legislators in this situation. A method for doing so is as follows. Given any information about the policy, the expert will randomly choose *one* of the legislators for whom the policy is bad and (accurately) reveal to that legislator that her district will not benefit from the proposal.

Upon hearing one of these messages, a rational legislator will use Bayes' rule to update her beliefs about the probability that the policy is good for her district. Thus, for a legislator that is not revealed to be a non-beneficiary, the probability that proposal is good for her district is $\frac{1}{2}$ and the expected payoff for voting in favor of passage is $\frac{1}{4}$. Therefore, the proposal passes in a 2-1 vote following all three messages. Furthermore, since the policy always passes, the legislators' expected utility is the same as their *ex ante* expected utility from passing the proposal, so the legislators all expect to be worse off when the expert offers advice.

These examples highlight two important differences between persuading an individual and persuading a voting body. First, the expert may be able to persuade a coalition of voters to support a proposal even when it would be impossible to persuade a single decision-maker. Second, voting bodies may be worse off from taking an expert's advice, since all voters expect lower utility given public communication. Both results depend on the fact that the voting rule allows collective preference cycles, which makes it possible for the expert to bundle information in such a way that a winning coalition expects to benefit following any speech even though all group members expect to lose overall. Schnakenberg (2015) establishes this connection more explicitly in a cheap talk setting: Within a wide class of voting rules, a rule permits manipulative persuasion if and only if that rule permits collective preference cycles.

In similar work, Alonzo and Câmara (2016) consider an *information control* problem with voting which differs from cheap talk in that the expert can commit to a signaling strategy before observing private information.[2] This commitment assumption improves the ability of the expert to influence the outcome, but the key mechanism in the model is similar to the cheap talk case: the expert can exploit preference divergence between coalitions of voters in order to increase the probability that her preferred policy is approved. Furthermore, as in the cheap talk case, a majority of voters can be made strictly worse off due to the expert's signals.

[2]The information control framework originates from Kamenica and Gentzkow (2011) and was applied to voters more recently by Alonzo and Câmara (2016).

2 The basic model

I analyze a generalization of the model in Schnakenberg (2015), expanded to include a (possibly) continuous state space and state-dependent preferences for the Expert. These generalizations allow the possibility of beneficial information transmission and permit the consideration of different institutional remedies to the downsides of information transmission in voting environments.

Let $N = \{1,\ldots,n\}$ denote the set of voters and let E denote a single Expert. The Voters must decide whether to implement a proposed policy ($x = 1$) or reject the proposal in favor of the status quo ($x = 0$). The utility to each agent from implementing the proposed policy depends on the state of the world, denoted $(\omega_E, \omega_1, \omega_2, \ldots, \omega_n)$. Specifically, the utility of agent i is represented by the function $u_i(x, \omega) = \omega_i x$ for all $i \in \{E\} \cup N$. Let $\Omega =\subset \mathbb{R}^{n+1}$ denote a convex set of feasible states of the world, with $(0,\ldots,0)$ in the interior of Ω.

Collective decision-making proceeds as follows. First, Nature determines the value of ω and reveals it to the Expert. Second, the Expert sends a payoff-irrelevant message $s \in \Omega$ to the voters. Finally, all voters observe the Expert's message and take an up-or-down vote $v_i \in \{\text{No, Yes}\}$. Let $\mathscr{D} \subset 2^N \backslash \{\emptyset\}$ denote a set of decisive coalitions. If $\{i \in N : v_i = \text{Yes}\} \in \mathscr{D}$, then the proposed policy is implemented ($x = 1$). Otherwise, the status quo persists ($x = 0$). Assume $\mathscr{D}$ is monotonic ($C \in \mathscr{D}$ and $C \subseteq C'$ imply $C' \in \mathscr{D}$) and proper ($C \in \mathscr{D}$ implies $N \backslash C \notin \mathscr{D}$). The resulting class of voting rules is related to that in Banks and Duggan (2000) and Kalandrakis (2006).

The state ω is private information to the Expert. The common prior about the distribution of ω is denoted $\mu_0 \in \Delta(\Omega)$, where $\Delta(\Omega)$ is the set of probability measures on Ω. Voters' beliefs following the observation of a message s are denoted $\mu_s \in \Delta(\Omega)$. For any $\mu \in \Delta(\Omega)$, let $\mathbb{E}_\mu[\omega_i]$ denote the expected value of ω_i under the probability measure μ. To ensure that there is a clear outcome under the prior, I assume that no voter is indifferent between passing and rejecting the proposal under the prior beliefs μ_0. I also assume that the Expert is not indifferent at any state (implying that $\Pr[\omega_E = 0] = 0$).

The analysis concerns perfect Bayesian equilibria in weakly undominated strategies. A signaling strategy σ maps elements of Ω into probability distributions over messages. A voting strategy v_i^* for each $i \in N$ maps messages into yes or no votes. The focus on pure voting strategies is not critical because voters can only randomize when they are indifferent. Thus, an equilibrium is a signaling strategy σ, a profile of voting strategies $v^* = (v_1^*, \ldots, v_n^*)$, and beliefs $\{\mu_s\}_{s \in \Omega}$ such that: (1) $v_i^*(s) = \text{Yes}$ if $\mathbb{E}_{\mu_s}[\omega_i] > 0$, and $v_i^*(s) = \text{No}$ if $\mathbb{E}_{\mu_s}[\omega_i] < 0$, (2) μ_s is consistent with Bayesian updating, and (3) $\sigma(\omega)$ places positive probability only on messages that maximize E's expected utility given v^* and ω.

3 Conditions for information transmission

The analysis will center around when information transmission from the Expert is influential. An equilibrium is influential if the voting outcome differs from the voting outcome under the prior following some message sent by the Expert. Specifically, let $x_O = 1$ if $\mathbb{E}_{\mu_0}[\omega_i] > 0$ for all $i \in D$ and some $D \in \mathscr{D}$ and $x_0 = 0$ otherwise. An influential equilibrium has $x \neq x_0$ following some message sent with positive probability by the Expert. [3] In the basic model, there are three possible scenarios. First, it is possible that there are no equilibria in which the Expert influences the outcome. Second, there may exist equilibria in which the Expert influences the outcome and this influence is harmful to voters, as in Example 2. Third, unlike the models in Schnakenberg (2015, 2016), there may be equilibria in which the Expert influences the outcome *and* a decisive coalition of voters benefits from this influence.[4] In this section, I will explain when each of these outcomes occur and characterize

[3] Recall that we assume no player is indifferent under μ_0 so x_0 is unique.

[4] As in any cheap talk model, there always exist a babbling equilibria with no information transmission. The argument for such an equilibrium is as follows: Suppose E randomizes uniformly over all messages

each type of equilibrium.

The combination of cheap talk messages and a binary outcome narrows the set of possible outcomes and simplifies the analysis. As Proposition 1 establishes, any equilibrium in which the outcome depends on the Expert's message must always produce the outcome that is consistent with the Expert's preferred outcome. The reasoning behind this result is the following. Consider a strategy profile in which the outcome depends on the Expert's message but there is some state of the world in which the proposal fails when the Expert would strictly prefer passage (or vice versa). Since messages are pure cheap talk and there exists some message that would lead to the opposite outcome, the Expert would strictly prefer to switch to a message that would produce the more desirable outcome. Therefore, such a profile could never be an equilibrium. In equilibrium, it must either be the case that all messages produce the same outcome (as in a babbling equilibrium) or that the Expert always gets her most preferred outcome.

Proposition 1. *In any equilibrium, either the outcome is constant or the Expert's preferred policy is always selected (i.e.* $x = 1$ *implies* $\omega_E > 0$ *and* $x = 0$ *implies* $\omega_E < 0$*).*

One interpretation of Proposition 1 is that, when Expert advice is persuasive, it produces the same outcome as delegating the policy choice to the Expert.[5] The conceptual difference between delegation and cheap talk in this model stems from the difference between *ex ante* and interim expected payoffs (that is, voters' expected payoffs after observing E's message but before learning the state of the world). In situations such as Example 2 the Expert's messages increase the interim expected payoffs of all members of some decisive coali-

following any state of the world. Then every message is uninformative to the voters and the voters choose according to their priors. Since voting strategies do not depend on messages, E has no strict incentive to deviate from this strategy, which shows that this is an equilibrium. In this paper I sidestep issues of equilibrium selection, focusing instead on whether or not influence is possible and whether or not it is desirable.

[5]In previous models, delegation may be preferred to cheap talk if preference divergence between the informed and uninformed agent is not too large (Dessein, 2002). That result does not hold in the discrete game considered here: if the Expert's advice influences the outcome then it is outcome-equivalent to delegation, and when all cheap talk equilibria are non-informative the voters generally would have preferred not to delegate.

tion enough to change their votes even though no decisive coalition would have preferred delegation *ex ante*.

The logic of delegation versus cheap talk makes it relatively simple to check for beneficial equilibria. In this model, a voter strictly benefits from Expert advice if and only if that voter would have strictly preferred to delegate the policy decision to the Expert rather than vote based on their priors. As Proposition 2 illustrates, the same argument can be used to predict whether a coalition of voters can benefit from taking Expert advice.

Proposition 2. *For any $D \in \mathscr{D}$, there exists an equilibrium giving each $i \in D$ a strictly higher expected utility than the babbling equilibrium if all voters in D would strictly prefer to delegate policy authority to the Expert.*

Proposition 2 shows the conditions under which there exist an influential equilibrium that is good for voter welfare in the sense of providing an *ex ante* expected utility increase for some decisive coalition. An immediate implication of Proposition 2 is that voters cannot benefit from information transmission in this way when the Expert's preferences do not depend on the state: delegating to the Expert would be equivalent to choosing the Expert's preferred policy with no additional information, which cannot strictly benefit the voters.

As Example 2 demonstrates, there may also exist influential equilibria that are not good for voter welfare. To illuminate these cases, I establish general conditions for the existence of influential equilibria and compare them to the conditions in Proposition 2. From Proposition 1, we know that any influential equilibrium must produce the same policy outcomes as would delegating to the Expert. Thus, to influence a group of voters, the Expert must design a messaging strategy σ with realizations $\{s_1, s_2, \ldots, s_K\}$ such that:[6]

- If $\Pr[s_j | \omega_E > 0] > 0$ then s_j induces beliefs μ_j such that $\mathbb{E}_{\mu_j}[\omega_i] \geq 0$ for all $i \in D$ and

[6]Since N is finite and each voter can take one of two actions, any equilibrium outcome can be supported using a finite number of messages. Thus, to simplify notation, I focus on signaling strategies that place positive probability on a finite number of messages.

some $D \in \mathscr{D}$;

- If $\Pr[s_j|\omega_E < 0] > 0$ then s_j induces beliefs μ_j such that $\mathbb{E}_{\mu_j}[\omega_i] \leq 0$ for all $i \in D$ and all $D \in \mathscr{D}$; and

- The beliefs μ_j induced by each signal realization $s_j \in \{s_1, s_2, \dots, s_K\}$ are consistent with Bayes rule given the strategy σ.

To establish the existence of an influential equilibrium, we must demonstrate the existence of a strategy σ with these properties.

To start, note that

$$\Pr[\omega = s_j] = \int_{\Omega} \mu_0(\omega)\sigma(s_j|\omega)d\omega.$$

The law of total probability demands that

$$\mu_0(\omega) = \sum_{s_j \in \text{support}(\sigma)} \Pr[\omega = s_j]\mu_j(\omega). \tag{1}$$

Thus, since the probabilities of the messages $\{s_1, s_2, \dots, s_K\}$ must add to one, the law of total probability provides us with a natural restriction on beliefs: the common prior beliefs must be a convex combination of the posterior beliefs induced by σ. The work of Kamenica and Gentzkow (2011) shows that this is the only relevant restriction imposed by Bayesian updating. Therefore, any set of posterior beliefs with μ_0 in its convex hull is feasible.[7] This insight leads us to Proposition 3.[8]

Proposition 3. *Let $W_{\mathscr{D}} = \{\mu \in \Delta(\Omega) :$ there exists $D \in \mathscr{D}$ such that $\mathbb{E}_{\mu}[\omega_i] \geq 0 \forall i \in D\}$ denote the set of posterior beliefs at which the proposal may pass and let $L_{\mathscr{D}} = \{\mu \in$*

[7]The convex hull of $\{\mu_1, \mu_2, \dots, \mu_K\} \subset \Delta(\Omega)$ is set of all $\mu \in \Delta(\Omega)$ such that, for some $(\rho_1, \rho_2, \dots, \rho_K)$ with $\rho_j \geq 0$ for all j and $\sum_{j=1}^{K} \rho_j = 1$, we have $\mu = \sum_{j=1}^{K} \rho_j \mu_j$.

[8]Proposition 3 and its proof are similar to the arguments in Alonzo and Câmara (2016); Schnakenberg (2015, 2016) but adapted to the situation with state-dependent expert preferences. Each of these results are applications of the basic argument in Kamenica and Gentzkow (2011).

$\Delta(\Omega)$: there does not exist $D \in \mathscr{D}$ such that $\mathbb{E}_\mu[\omega_i] > 0 \forall i \in D\}$ denote the set of posterior beliefs at which the proposal may fail. There exists an influential equilibrium if and only if $\mu_0(\omega|\omega_E > 0) \in co(W_\mathscr{D})$ and $\mu_0(\omega|\omega_E < 0) \in co(L_\mathscr{D})$ where $co(\cdot)$ denotes the convex hull of a set.

With Propositions 1-3 in hand, we can fully articulate the set of possible outcomes for any game as a function of the prior belief:

- If the conditions of Proposition 2 are met then there exists an influential equilibrium and that equilibrium increases the *ex ante* expected payoffs of all members of some decisive coalition. I refer to this as beneficial influence.

- If the conditions of Proposition 3 are met but not those of Proposition 2 then there is an influential equilibrium but that equilibrium does not increase the ex ante expected payoffs of all members of any decisive coalition. Furthermore, if all members of a coalition D would strictly prefer not to delegate to the Expert, then the influential equilibrium strictly decreases the ex ante expected payoffs of members of D. I refer to this outcome as *manipulative influence*. This may include cases in which the voters are made unanimously worse off ex ante by the Expert's influence (unanimously harmful manipulative influence).

- If the conditions of Proposition 3 are not met then there are no influential equilibria.

4 Possible institutional remedies

The results regarding manipulative persuasion in voting bodies point to a dilemma faced by those designing legislative and electoral institutions. Legislators and voters require information to make good decisions but they open themselves up to manipulation by seeking information from an expert. In response, institutions must be set up to allow beneficial policy advice from experts while preventing manipulation. In this section, I evaluate the merits of several possible solutions to this problem.

A proposed remedy for manipulative persuasion is most useful if it works well given any prior beliefs. The prior beliefs in the baseline model are associated with the effects of a particular policy under consideration but a voting body may wish to employ long-term institutional remedies that will be used for consideration of a number of different policies. If a decision-maker choose between institutions before knowing the players' prior beliefs about the effects of the policy proposal, then the best choice is one that eliminates manipulative influence for all prior beliefs and never eliminates beneficial influence. All of the proposed remedies fall short of this standard in some ways, but limiting the Expert's communication to binary endorsements eliminates unanimously harmful manipulative influence and does not eliminate beneficial influence.

Additionally, I consider remedies that do not involve barring the Expert from speaking. Though allowing a vote over whether to bar the Expert from speaking may avoid the problems associated with manipulative influence, such a policy would also violate the constitutional laws of most democracies.[9]

4.1 Endorsements

Beneficial influence in the model is outcome-equivalent to a situation in which the expert truthfully reveals whether or not she is in favor of the proposal. I refer to this type of communication as an endorsement. The most obvious applications of endorsements include endorsements of candidates and ballot measures by newspapers and advocacy organiza-

[9] In a setting where barring the Expert to speak is feasible, Proposition 4 can be interpreted as a prediction about when voters would allow the Expert to speak: voters would take advice from the Expert when they would be equally willing to delegate their decision to that Expert.

tions. Other examples in different voting contexts include binary endorsements in the form of signs and bumper stickers, signing of petitions, cosponsoring legislation, or participating in a public vote in a situation in which the Expert is not pivotal. The key feature of these forms of communication is that they permit the Expert to state a position but limit the opportunities for additional explanations. Though mandating binary endorsements by statute may be no more feasible or desirable than barring communication altogether, institutions may be put in place that encourage these simplistic forms of communication.

Limiting communication to binary endorsements never eliminates an equilibrium with beneficial endorsements. Note, however, that limiting experts to endorsements in no way requires that their endorsements be honest: experts are free to be insincere in choosing whether to endorse or not endorse a policy.

As Proposition 4 demonstrates, limiting communication to endorsements also eliminates unanimously harmful manipulative persuasion. The reasoning behind this result is that a voter who can always veto the outcome in equilibrium must weakly benefit from the expert's advice. Therefore, if the expert's advice is *ex ante* harmful to all voters, it must be that all voters are left out of some decisive coalition that selects the outcome along the path of play. Since the rule is proper, implying that any two decisive coalitions have at least one voter in common, this situation can only arise when the expert's strategy places positive probability on at least three messages. Thus, binary endorsements cannot support such outcomes.

Proposition 4. *If communication is limited to binary endorsements then there does not exist an equilibrium that provides a strictly lower ex ante expected payoff than a babbling equilibrium to all voters.*

A stronger version of Proposition 4 might claim that binary endorsements eliminate equilibria that provide a lower ex ante expected payoff to all members of some decisive coalition. Unfortunately, this stronger statement is false. Though the argument above implies that the two coalitions that choose the policy in equilibrium cannot unanimously lose out from endorsements, there may be a third (unused) decisive coalition that unanimously loses from endorsements. Example 3 illustrates this point.

Example 3. Consider a three-member voting body operating by majority rule. Let $\Omega = (1,1,1,-2),(1,1,-2,1)$ where the first element of each $\omega \in \Omega$ corresponds to the Expert's payoff and the rest to the voters' payoffs. Assume that the probability of each state is one half. Ex ante, voter 1 prefers passage and voters 2 and 3 prefer to reject the proposal, since these voters are equally likely to gain one unit of payoff or lose two units of payoff. However, the Expert can guarantee passage by "endorsing" the proposal if and only if $\omega = (1,1,1,-2)$, which fully reveals both states of the world (since not endorsing must imply $\omega = (1,1,-2,1)$) and causes the proposal to pass in a 2-1 vote following either message. However, note that both members of the decisive coalition $\{2,3\}$ get a negative ex ante expected payoff from playing this equilibrium.[10]

Though the remedy of limiting experts to endorsements is limited in that it does not eliminate all undesirable forms of expert manipulation, this solution eliminates the worst types of manipulation while allowing beneficial expert advice to occur when possible. For this reason, endorsements appear most desirable out of the institutional remedies I consider. For the remainder of this section, I will consider several alternative remedies and describe their limitations.

[10]This example also demonstrates that obfuscation is not necessary for manipulative persuasion. Instead, the result simply shows that some ambiguity is helpful from an ex ante perspective when it avoids pitfalls of majority voting. This argument resembles the philosophical concept of a veil of ignorance: voter behavior can be made more consistent with (ex ante) social welfare when the voters are uncertain about who the identities of the winners and losers.

4.2 Competition Between Experts

The basic model considers a single expert communicating to a group of voters. This raises the possibility that expert manipulation can be remedied by establishing institutions that require advice from multiple experts with opposing preferences. In previous work, the presence of multiple experts can lead to full revelation of information (Battaglini, 2002) or to “jamming” messages that present policy-makers with irreconcilable messages that prevent them from learning at all (Minozzi, 2011). I explore the effects of competition by considering a version of the game with two experts and sequential communication.[11] The consequences of multiple senders in my model are similar to jamming models: competition between senders may eliminate opportunities for persuasion by leaving pivotal voters uncertain about which expert has offered the most honest advice. When sender influence is manipulative, competition may serve as a remedy to expert manipulation. However, competition may also prevent communication that would have benefited the voters and does not create additional opportunities for beneficial information transmission.

Schnakenberg (2016) analyzed a special case of the cheap talk game considered here and demonstrated that under certain conditions sequential competition prevents persuasion that reduce the ex ante expected utility of all voters. Example 4 provides a simple demonstration of when competition may prevent manipulative persuasion.

Example 4. Consider the case in Example 2: in any state, if the policy is implemented, one voter $i \in \{1,2,3\}$ receives a payoff of $\frac{3}{2}$ and the other two receive a payoff of -1. Each voter is equally likely *ex ante* to receive the high payoff. An expert, labelled E_1, receives a positive payoff if the proposal passes and a negative payoff if the proposal fails. As established in 2, E_1 can guarantee passage in all states by randomly revealing one of

[11] The results may differ somewhat from games with simultaneous communication which are not analyzed here. Sequential communication is a more realistic model of political communication since advocates are rarely asked to speak without responding to one another.

the two voters who is *not* the beneficiary, meaning that the other two believe they will be the beneficiaries with probability $\frac{1}{2}$ and the proposal will pass. However, all voters would receive a higher *ex ante* expected utility if E_1 could not offer advice. Now consider a situation in which another expert, E_2, is allowed to speak after E_1. Suppose E_2 is opposed to the policy. In this instance, E_2 can clearly block the influence of E_1 simply by fully revealing all information.

Though 4 makes competition appear to be a promising solution to expert manipulation, three important caveats are required. First, relying on competition as a remedy for expert manipulation requires assumptions about equilibrium selection. Including sequential cheap talk never eliminates equilibria. For instance, in Example 4, there is also a perfect Bayesian equilibrium in which E_1 uses the persuasive strategy and E_2 babbles. Schnakenberg (2016) sidesteps this problem by assuming that E_2 always uses its payoff-maximizing strategy, but such an assumption may not be reasonable in all contexts. Second, though it is easy to construct examples in which competition blocks manipulative persuasion, this remedy does not work in all situations. Schnakenberg (2016) shows that, for some parameters, E_1 can construct a communication strategy that always leads to passage and never leaves E_2 with a credible strategy for transmitting new information. Finally, as 5 demonstrates, competition between experts can also prevent *helpful* communication.

Example 5. Consider a game with two experts, E_1 and E_2, and three voters $N = \{1,2,3\}$. A state of the world is a 5-dimensional vector giving the payoff to each actor from passage of the proposal. The prior distribution over states of the world is given below.

ω	E_1	E_2	1	2	3	$\Pr[\omega]$
ω_1	1	-1	3	-1	-1	1/4
ω_2	1	-1	-1	3	-1	1/4
ω_3	1	-1	-1	-1	3	1/4
ω_4	-1	-1	-3	-3	-3	1/4

Thus, in one state all players prefer rejection of the proposal. In the other states, one voter receives a large benefit from passing the proposal and the others pay a cost. E_1 prefers passage only if some player benefits – this is consistent with the idea that E_1 wants to maximize total voter welfare. E_2 categorically prefers rejection of the proposal. The *ex ante* expected payoff to each voter from passing the proposal is $-\frac{1}{2}$, so the proposal fails unanimously without communication.

First consider a game in which only E_1 is allowed to speak. In this case, there exists a persuasive equilibrium in which E_1 reveals when $\omega = \omega_4$ and pools on the other states. The proposal is unanimously rejected when $\omega = \omega_4$. In the other states, each voter expects to receive the high payoff with probability $\frac{1}{3}$ which means that each voter has a positive interim expected payoff of $\frac{1}{3}$ and the proposal passes unanimously. Furthermore, each voter's *ex ante* expected payoff from playing this equilibrium is $\frac{1}{3}$, which is a strict improvement over automatically rejecting the proposal.

Now consider a game in which E_2 is allowed to speak either before or after E_1. Clearly E_2 can prevent passage by announcing the true state of the world and this strategy is credible since it always leads to rejection of the proposal. Thus, expert competition in this example strictly reduces the *ex ante* expected utility of all voters.

4.3 Domain Restrictions and Structure-Induced Equilibrium

I have shown that expert manipulation utilizes the same mechanisms that give rise to collective preference cycles in multidimensional policy spaces. In other social choice settings, the problem of collective preference cycles can eliminated by restricting the domain of preferences to be one-dimensional and single-peaked. Given this insight, intuition suggests that expert manipulation may be eliminated by similar domain restrictions. As Proposition 5 indicates, this intuition is correct at least for majority rule: when the states of the world are restricted to those corresponding to one-dimensional spatial preferences, a majority of voters must benefit from information transmission.

Proposition 5. *Assume that n is odd and that the voters use majority rule. Fix a vector $z = (z_1, \ldots, z_n) \in \mathbb{R}^n$ and for $q \in \mathbb{R}$ let*

$$\Theta(q) = \{\omega \in \Omega : \exists \theta \in \mathbb{R} \text{ s.t. } \omega_i = (z_i - q)^2 - (z_i - \theta)^2 \ \forall i \in N\}.$$

If $\mu_0(\Theta(q)) = 1$ for some $q \in \mathbb{R}$, then all influential equilibria are majority preferred.

Proposition 5 represents a restriction on preferences rather than an institutional remedy. Furthermore, this restriction may be unrealistic for policy proposals that reflect multiple goals. However, the result could motivate a potential remedy: voters could consider only one dimension at a time, limiting the expert's ability to manipulate outcomes. Shepsle and Weingast (1981) explored a similar mechanism as a form of *structure-induced equilibrium* that eliminates instability in majority voting. Since the instability of collective preferences is the root of the problem with communication to voting bodies, their solution may eliminate undesirable Expert manipulation. Unfortunately, this solution leads to other problems that are equally problematic. Example 6 shows that dimension-by-dimension voting can generate Pareto-dominated outcomes even under complete information.

Example 6. Consider a three-dimensional spatial model with three voters and majority rule. We will ignore the Expert for this example. Let the status quo policy be $q = (0,0,0)$ and and let the ideal points be $z_1 = (-2,1,1)$, $z_2 = (1,-2,1)$, $z_3 = (1,1-2)$. Passing the proposal is known to move policy to the point $\theta = (1,1,1)$.[12] In a majority vote, all voters oppose passage since $||z_i - \theta|| = 3 > ||z_i - q|| = \sqrt{6}$. If voting is dimension-by-dimension, the policy is moved to θ since θ is equal to the dimension-by-dimension median. Thus, dimension-by-dimension voting is Pareto dominated in this case.

As Example 6 demonstrates, though dimension-by-dimension voting may limit the expert's ability to manipulate outcomes to the detriment of voters, this solution introduces equally serious problems. Thus, restricting the domain of preferences through agenda-setting is not a desirable solution to the problem of expert manipulation.

5 Conclusions

I have developed a theory of communication in voting bodies in which an Expert may influence the outcome of a vote over an exogenous proposal by sending public cheap talk messages to the voters. The Expert may succeed in changing the voting outcome even when all or most of the voters are made worse off by allowing information transmission by the Expert. These negative outcomes from information transmission, which I refer to as manipulative influence, reflect substantive differences between the effects of information in voting environments as opposed to decision-theoretic problems.

I explore different institutional remedies that may be used to mitigate the problems associated with manipulative influence. A voting body may encourage expert communication that takes the form of binary endorsements, promote competition between experts, or limit the agenda in order to restrict the domain of policy choices. Though each of these

[12] In the language of our model, prior beliefs place full mass on $\omega_i = \left(||z_i - q||^2 - ||z_i - \theta||^2\right)_{i \in \{1,2,3\}}$.

solutions are imperfect or ineffective in some situations, the most promising solutions are those that encourage binary endorsements. Using endorsements eliminates the worst types of manipulative influence, which are detrimental to all of the voters, without destroying opportunities for beneficial types of influence. However, under some circumstances, even binary endorsements may be used in a way that is detrimental to a majority of voters.

One remedy not considered in this paper is changing the voting rule. Schnakenberg (2016) shows that increasing the threshold required to pass a proposal by supermajority rule may lead to improvements by eliminating unfavorable equilibria. However, that result depends crucially on the assumption that manipulative equilibria are the result of communication by senders who wish to *change* the status quo. If the Expert were biased in favor of the status quo then the result would be reversed: higher supermajority thresholds would make it easier for the Expert to manipulate the voters. Since voting bodies are unlikely to exclusively face one type of Expert, changes to the voting rule do not appear to be a general remedy.

Overall, the results suggest that the possibility of manipulative influence is a persistent feature of information transmission in voting environments. Thus, the observation that information may decrease ex ante welfare is relevant in societies that make decisions by voting and where individuals are allowed to speak freely.

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A Proofs of Propositions

The verbal arguments in the body of the paper are sufficient to prove Propositions 1 and 4. The proofs of the remaining results are below.

Proof of Proposition 2. Proposition 1 implies that any equilibrium with influential cheap talk results in passing the proposal any time $\omega_E > 0$ and rejecting the proposal any time $\omega_E < 0$. Thus, an influential equilibrium strategy profile (σ^*, v^*) partitions Ω into two sets

$$S_P \supseteq \{x : \omega_E > 0\}, \text{ and}$$

$$S_F \supseteq \{x : \omega_E < 0\}$$

such that the outcome is $x = 1$ when $\omega \in S_P$ and $x = 0$ when $\omega \in S_F$. Let $x_0 \in \{0, 1\}$ be the voting outcome if all players vote according to their prior. For any $D \in \mathscr{D}$, the strategy profile (σ^*, v^*) is strictly preferred to a babbling equilibrium by the members of D if and only if

$$\Pr[\omega \in S_P]\mathbb{E}_{\mu_0}[\omega_i|\omega \in S_P] > x_0\mathbb{E}_{\mu_0}[\omega_i] \quad (2)$$

for all $i \in D$. Equation 2 is also the condition under which all members of D would strictly prefer to delegate to the Expert.

Furthermore, if (2) holds then we can support and equilibrium with two messages $s \neq s'$ where $\sigma(s|\omega) = 1$ if $\omega \in S_P$ and $\sigma(s'|\omega) = 1$ if $\omega \in S_F$. To prove this statement, note that

$$\mathbb{E}_{\mu_0}[\omega_i] = \Pr[\omega \in S_P]\mathbb{E}_{\mu_0}[\omega_i|\omega \in S_P] + \Pr[\omega \in S_F]\mathbb{E}_{\mu_0}[\omega_i|\omega \in S_F]$$

by the law of total expectation. Thus, (2) implies that

$$\Pr[\omega \in S_F]\mathbb{E}_{\mu_0}[\omega_i|\omega \in S_F] < \mathbb{E}_{\mu_0}[\omega_i]. \tag{3}$$

Thus, all members of D will vote in favor of passage when it is revealed that $\omega \in S_P$ (by 2) and against when it is revealed that $\omega \in S_F$ (by 3). Furthermore, given these outcomes, E has no incentive to deviate from the messaging strategy, so this describes an equilibrium. ■

Proof of Proposition 3. The law of total probability and Proposition 1 imply that there does not exist an influential equilibrium if $\mu_0(\omega|\omega_E > 0) \notin \text{co}(W_{\mathscr{D}})$ or $\mu_0(\omega|\omega_E < 0) \notin \text{co}(L_{\mathscr{D}})$, since no feasible distribution of posteriors can lead to outcomes consistent with the preferences of the Expert. Thus, I show that $\mu_0(\omega|\omega_E > 0) \in \text{co}(W_{\mathscr{D}})$ and $\mu_0(\omega|\omega_E < 0) \in \text{co}(L_{\mathscr{D}})$ implies the existence of an influential equilibrium. Suppose that $\mu_0(\omega|\omega_E > 0) \in \text{co}(W_{\mathscr{D}})$ and $\mu_0(\omega|\omega_E < 0) \in \text{co}(L_{\mathscr{D}})$.. By Caratheodory's theorem, there are finite sets of priors (with size K_P and K_F) $\{\mu_1, \dots, \mu_{K_P}\} \subset W_{\mathscr{D}}$ and $\{\mu_{K_P+1}, \dots, \mu^F_{K_P+K_F}\} \subset L_{\mathscr{D}}$ and real vectors $(\rho_1, \dots, \rho_{K_P})$ and $(\rho_{K_P+1}, \dots, \rho_{K_P+K_F})$ such that:

- $\rho_j \geq 0$ for all $j \in \{1, \dots, K_P + K_F\}$
- $\sum_{j=1}^{K_P} \rho_j = 1$ and $\sum_{j=K_P+1}^{K_P+K_F} \rho_j = 1$;
- $\mu_0(\omega|\omega_E > 0) = \sum_{j=1}^{K_P} \rho_j \mu_j(\omega)$ and $\mu_0(\omega|\omega_E < 0) = \sum_{j=K_P+1}^{K_P+K_F} \rho_j \mu_j(\omega)$.
- $\mu_j(\omega) = 0$ if for $j \in \{1, \dots, K_P\}$ if $\omega_E < 0$ and $\mu_j(\omega) = 0$ for $j \in \{K_P + 1, \dots, K_P + K_F\}$ if $\omega_E > 0$.

Consider the following mixed strategy for E with support on a finite set of messages $\{s_1, \dots, s_{K_P}, s_{K_P+1}, \dots, s_{K_P+K_F}\}$:

$$\sigma^*(s_j|\omega) = \frac{\mu_j(\omega)\rho_j}{\mu_0(\omega)}. \tag{4}$$

Note that this strategy has the property that $\sigma^*(s_j|\omega) = 0$ if $\omega_E < 0$ and $j \leq K_P$ and $\sigma^*(s_j|\omega) = 0$ if $\omega_E > 0$ and $j \geq K_P$. The voters' posterior beliefs following $s = s_j$ are then

$$\mu_{s_j}(\omega) = \frac{\mu_0(\omega)\frac{\mu_j(\omega)\rho_j}{\mu_0(\omega)}}{\int_\Omega \mu_0(\omega')\frac{\mu_j(\omega')\rho_j}{\mu_0(\omega)}d\omega'} = \frac{\mu_j(\omega)\rho_j}{\int_\Omega \mu_j(\omega')\rho_j d\omega'} = \frac{\mu_j(\omega)\rho_j}{\rho_j} = \mu_j(\omega). \tag{5}$$

Thus, σ^* induces posterior beliefs in $\{\mu_1,\ldots,\mu_{K_P}\} \subset W_{\mathscr{D}}$ for all $\omega_E > 0$ and induces posterior beliefs in $\{\mu_{K_P+1},\ldots,\mu_{K_P+K_F}\} \subset L_{\mathscr{D}}$ for all $\omega_E < 0$. Thus, given sequentially rational voting strategies we have $x = 1$ when $\omega_E > 0$ and $x = 0$ when $\omega_E < 0$, and E has no incentive to deviate from this strategy. ■

Proof of Proposition 5. Let $\bar{z}$ be the median of $(z_1,\ldots,z_n)$ and let $\bar{i}$ be the index of the voter with $z_i = \bar{z}$. Since the number of voters is odd, $\bar{z}$ is preferred to all points in $\Theta(q)$. Banks and Duggan (2006) show that, if voters' utility functions are quadratic and there exists a core point at a voter's ideal point, then the core voter is decisive over lotteries. That is, for all $\mu \in \Delta(\Omega)$, $\{i \in N : \mathbb{E}_\mu[\omega_i] \geq 0\} \in \mathscr{D}^m$ if and only if $\mathbb{E}_\mu[\omega_{\bar{i}}] \geq 0\}$. Thus, since proposals only pass if $\mathbb{E}_{\mu_s}[\omega_{\bar{i}}] > 0$, it must be the case that $U^*_{\bar{i}}(\sigma, v^*) \geq x_0\mathbb{E}_{\mu_0}[\omega_{\bar{i}}]$ if (σ, v^*) is a persuasive equilibrium. Furthermore, by the result of Banks and Duggan, this implies that $\{i \in N : U^*_i(\sigma, v^*) \geq x_0\mathbb{E}_{\mu_0}[\omega_i]\} \in \mathscr{D}^m$.