E C O N O M I C S   B U L L E T I N

Two (talking) heads are not better than one

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Abstract

I discuss a scenario in which second expert opinions may not benefit decision making. The introduction of a second expert creates the possibility of partisan bickering, which impairs information transmission.

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1 Introduction

Conventional wisdom has it that second opinion is helpful for wise decision making. However, there are scenarios that apparently call this principle into question. For example, voters often do not become better informed about issues by watching election debates than by listening to speeches given by one candidate or reading reports written by one expert. In this paper, I demonstrate that, by way of a formal example adapted from the Crawford and Sobel (1982) model, second opinion is not always helpful.

In my model, there are an uninformed decision maker and two perfectly informed experts. The experts have pertinent information that is relevant for the decision maker's action. For example, candidates (experts) in an election know more about policy issues than do the voting public (decision maker). The experts communicate with the decision maker by cheap-talk, in the hope of affecting the decision maker's action. The experts have biases that make their most preferred actions different from the decision maker's, which creates difficulty in communication. In addition, their biases are private information.

Clearly, how messages reflect the states determines how effective the decision making is. In the model, one can find the formal counterparts of intuitive concepts like "babbling" and "partisanship." Babbling happens when experts send messages that do not reflect the underlying state. Partisanship happens when experts send a self-serving message despite the true state. As I show below, babbling is worst for the decision maker since he learns no information about the state from the experts. On the other hand, having multiple experts introduces the possibility of a "partisan bickering" equilibrium that is worse than the one-expert equilibrium.

The relevance of the phenomenon I find in this example can be justified as follows. Suppose the party hosting the debate cares about both information transmission and "entertainment value," the latter measured by the frequency of strong disagreement between experts. Then, he may provide a reward that induces the the partisan-bickering equilibrium.

Austen-Smith (1993) also makes comparisons between one-expert and two-expert communication. He finds the incentive for a single expert to share her information with the decision maker is weakened when there is another expert *simultaneously* communicating with the decision maker. However, he still finds that two-expert communication is more informative than one-expert communication. This paper, on the other hand, finds that two-expert *sequential* communication is not necessarily superior to one-expert communication.

Other papers on multiple-expert communication with setups similar to mine include those of Gilligan and Krehbiel (1989), Krishna and Morgan (2001a) (2001b), and Gick (2006). In particular, Krishna and Morgan (2001b) show that two like-biased experts cannot generate better communication than the less-biased expert alone, though two opposite-biased experts can. A common feature of these papers is that the experts' biases are common knowledge, while in mine experts' biases are their private information.

In a parallel paper, Li (2004), I compare efficiency of information transmission between various two-expert mechanisms in the presence of asymmetric information about experts' biases, including the sequential consultation mechanism utilized in the current note. The interested reader may refer to that paper for more details of the setup.

2 The Setup

There are two experts and a decision maker. The decision maker takes an action in $[-1, 1]$. He wants to take an action that is equal to some underlying state, s, randomly and uniformly distributed on the set $S = \{-1, 0, 1\}$. The decision maker does not know the state, but the experts do. An expert has a type x, which is a random variable uniformly distributed on the type space $X = \{-1, 0, 1\}$. An expert is "unbiased" if her type is $x = 0$, "positive-biased" if $x = 1$, and "negative-biased" if $x = -1$. Experts do not know each other's types a priori. Neither does the decision maker know the types of the experts. The experts and the decision maker have utility functions of the form

$$u(y, s, \tilde{b}) = -(y - (s + \tilde{b}))^2. \tag{1}$$

where y is the action taken by the decision maker, s is the true state, and $\tilde{b}$ is the "bias" of the agent. For the decision maker $\tilde{b} = 0$, and for an expert of type $x \in X$,

$$\tilde{b} = bx,$$

where

$$b \in (\frac{47}{70}, \frac{13}{14}) \subset (\frac{2}{3}, 1).^1$$

Due to quadratic loss preferences, in state s, the ideal action is $s + \tilde{b}$ for a decision maker or expert with bias $\tilde{b}$. When there is uncertainty about the state, the most preferred action is $E(s) + \tilde{b}$.

The two-expert communication mechanism I consider is called "sequential consultation," which is the same as the "sequential referral" rule of legislation making studied by Austen-Smith (1993). The decision maker asks one expert first, whom I call Expert A. She makes a report, which is observed by a second expert, Expert B, who in turn makes a report based on both the underlying state and A's report. The decision maker hears *both* reports and bases his action on these two reports. This setup can be considered to approximate the environment of a debate.

The experts' strategies can be defined respectively as

$$m_x^A : S \to M,$$
$$m_x^B : S \times S \to M,$$

where M is the set of possible messages. For A, $m_x^A(s)$ is the report sent by an expert of type x when the true state is s; for B, $m_x^B(s, t)$ is the report sent by an expert of type x

[1] There exists a fully revealing equilibrium when $b \leq \frac{1}{2}$, in which every expert tells the truth and the decision maker takes the corresponding actions. The restriction that $b \in (\frac{2}{3}, 1)$ ensures that the strategy profile constructed in Proposition 1 is an equilibrium, and that $b \in (\frac{47}{70}, \frac{13}{14})$ does the same for Proposition 2. This is not to say, however, the possible inferiority of two-expert equilibria to one-expert equilibria happens only for these b values. For example, consider $b = \frac{5}{4}$, Proposition 1 still holds. Although Proposition 2 does not hold, there exists an informative equilibrium that gives the decision maker even lower payoff than when the values of b considered in this paper.

when the true state is s and Expert A has reported t. Throughout the paper, I restrict M to be $\{-1, 0, 1\}$.The decision maker's strategy is

$$y : M \times M \rightarrow [-1, 1],$$

where $y(m^A, m^B)$ represents the action taken when the reports are respectively m^A and m^B.

I consider only pure strategy symmetric equilibria. Encompassing both the case with two experts and that with a single expert, an *equilibrium* is a strategy profile that satisfies the following conditions:

(EQ1) An expert of any type $x \in X$ sends the message that maximizes her expected utility in any state $s \in S$, given strategies of the other expert if applicable and the decision maker.

(EQ2) The decision maker takes action $y(m) = E(s|m)$ when receiving message (pair) m, so as to maximize his expected payoff. The expectation is taken according to his Bayesian belief.

In the rest of the paper, y_m is used instead of $y(m)$ when there is only one expert.

An equilibrium is *symmetric* if for all $i = A, B$, $x \in X$, $s, t \in S$, and $m \in S$ or $S \times S$, the following conditions are satisfied where they apply:

(SE1) $m^A_x(s) = -m^A_{-x}(-s)$;

(SE2) $m^B_x(s, t) = -m^B_{-x}(-s, -t)$;

(SE3) $y(m) = -y(-m)$.

Intuitively, in a symmetric equilibrium experts of type 1 and -1 behave in a similar way, and states and messages 1 and -1 are treated in a similar way. This results in a symmetric message distribution.

As in all cheap-talk models, a babbling equilibrium always exists. The messages contain no information, and the decision maker simply takes action 0, the unconditional expectation of the state. This equilibrium gives the decision maker the lowest payoff possible. However, I will focus on *informative* equilibria, meaning equilibria in which the decision maker's action takes on at least two different values with positive probability.

In the rest of the paper, I demonstrate that there exists an *informative* equilibrium in the two-expert mechanism that is worse for the decision maker than an *informative* equilibrium in the one-expert mechanism. Also, I interpret properties of the former equilibrium, and analyze why these properties cause information transmission to deteriorate. All detailed proofs can be found in an online note: http://alcor.concordia.ca/˜mingli/research/twoheads_bulletin_sup.pdf.

3 Equilibrium

First, I characterize an equilibrium of the single-expert mechanism.[2]

[2]In fact, this is the unique *symmetric* equilibrium. Li (2004) proves this fact.

Consulting One Expert

Proposition 1. *For all $b \in (\frac{2}{3}, 1)$, when the decision maker consults only one expert, the following strategy profile is the* unique *pure strategy symmetric equilibrium:*
1) $m_0(s) = s$, $m_{-1}(s) = s - 1$ *if* $s \neq -1$, $m_{-1}(-1) = -1$, $m_1(s) = s + 1$ *if* $s \neq 1$, *and* $m_1(1) = 1$*;*
2) $y_m = \frac{2}{3}m$.
In equilibrium, the decision maker's expected payoff is $-\frac{10}{27} \approx -0.3704$.

In equilibrium, a biased expert always misrepresents the state when possible. That is, an expert of type 1 reports state -1 as 0 and 0 as 1. They are able to do so since there are no forces to counteract or punish biased reports. In a sense, this is the worst that could happen to the decision maker in an informative equilibrium. It is imaginable that by introducing another expert, the situation can be improved. Indeed, it is true that there exist equilibria in sequential consultation that are more informative than the above one-expert equilibrium. But in the following subsection, I show that it also generates equilibria that are less informative.

Consulting Two Experts

The following proposition characterizes an equilibrium of the sequential-consultation game.

Proposition 2. *When $b \in (\frac{47}{70}, \frac{13}{14})$, and when the decision maker consults the two experts sequentially, the following strategy profile constitutes an equilibrium:*

(1) $m_0^A(s) = s$, $m_1^A(s) = 1$, *and* $m_{-1}^A(s) = -1$ *for all* $s \in S$*;*

(2) $m_1^B(s, -1) = 1$, $m_{-1}^B(s, 1) = -1$ *for all* $s \in S$, $m_x^B(s, -s) = s$ *for all* x, s, $m_x^B(s, 0) = 0$ *for all* x, s, $m_0^B(0, t) = -t$ *for* $t = -1, 1$, $m_0^B(1, 1) = m_1^B(1, 1) = 1$, *and* $m_0^B(-1, -1) = m_{-1}^B(-1, -1) = -1$*;*

(3) $y(0, m^B) = 0$ *for all* $m^B \in S$, $y(1, -1) = -y(-1, 1) = -\frac{1}{7}$, $y(1, 0) = -y(-1, 0) = -\frac{1}{7}$ *or* $\frac{4}{5}$, $y(1, 1) = -y(-1, -1) = \frac{4}{5}$.

In this equilibrium, the decision maker's expected payoff is $-44/105 \approx -0.4190$*, strictly less than that in Proposition 1.*

The main point of the proposition is that two experts may provide less information than a single expert. I call this phenomenon "Two Heads Are Not Better than One," or THANBO.

Observe that babbling gives the lowest level of communication. On the other hand, the equilibrium in Proposition 2 presents an extreme form of partisan bickering—an expert sending a self-serving message regardless of the underlying state. First, a positive-biased Expert A reports "1" regardless of the state. In addition, whenever expert A reports "-1," a positive-biased Expert B always refutes her by reporting "1." The behavior of a negative-biased expert is similar.[3] More than half (to be precise, 14/27) of the time, the decision maker

[3] Note that the equilibrium fails to satisfy monotonicity, since $y(1, -1) < y(0, -1)$. This violation cannot be resolved by renaming messages, since $y(1, 1) > y(0, 1)$.

receives the message pair $(1, -1)$ or $(-1, 1)$. These two pairs have the property that they are sent in all states: $-1, 0$, and 1, with only a slightly higher chance for one of the states. In particular, when message pair $(1, -1)$ is received, the conditional distribution of the state over $\{-1, 0, 1\}$ is $(3/7, 2/7, 2/7)$, which is very close to the unconditional distribution, and the decision maker indeed takes an action that is close to the unconditional expectation. This outcome confirms the casual observation that when two experts fiercely disagree with each other, they do not provide too much information to the audience. In fact, the informativeness of the two-expert equilibrium is largely sustained by the "truthful" reporting of the unbiased type.

Now, consider the one-expert equilibrium. The message 0 is sent $1/3$ of the time, and can be considered babbling, since the conditional distribution of the state is the same as the unconditional distribution. The frequency is much lower than the $14/27$ of "near babbling" in the two-expert equilibrium above. In a one-expert mechanism, there is no possibility of refuting. Thus, an expert with a moderate bias (such as the value of b considered above) would not "blatantly lie" (for example, report "1" when the state is actually -1), since it would not be optimal for her. However, a biased Expert A may do so in the two-expert mechanism, because she anticipates being refuted by Expert B. In the two-expert equilibrium, a biased Expert B always refutes the report opposite to her bias, even if Expert A's report matches the underlying state. This is due to a relatively large bias value.

Based on the above discussion, a sufficient condition for the THANBO effect is that the absolute value of bias be relatively large, but not so large that a single biased expert finds it optimal to send a self-serving message regardless of the state. On the other hand, the argument in Footnote 1 shows that this condition is not necessary.

The equilibrium in Propsition 2 is not the most informative equilibrium of the game. In fact, one can construct an equilibrium in which one expert always babbles and is ignored, and the decision maker and the other expert play according to the strategy profile in Proposition 1. There are also additional equilibria, as shown by Li (2004). Those equilibria indeed give the decision maker as least as high payoffs as does the one-expert equilibrium.

To demonstrate the relevance of the equilibrium in Proposition 2, I propose the following intuitive argument. Suppose the medium of information transmission is provided by a third party, say, a TV channel who hosts the debate. This third party may care about both information transmission and "entertainment value," the latter measured by the frequency of fierce contradictions between the experts. Suppose the medium provider gives each expert a reward whenever one expert says 1 while the other says -1. Then, this reward destroys the equilibrium in which one expert babbles while the other expert plays the one-expert equilibrium. To see this, observe that all messages of the babbling expert must be treated the same way by the decision maker, as otherwise it is impossible for different types of experts to agree on which message is optimal in all states. However, given that all messages are treated equally by the decision maker, the babbling expert would have a strict preference for the message that is the opposite of the message sent by the other expert. Since the other expert is informative, the babbling expert's message has to be informative about the state as well, a contradiction. The only alternative strategy profile that generates the same outcomes as the one-expert equilibrium is one in which one expert sends messages according to that equilibrium, while the other expert says exactly the opposite. In other words, the second expert reveals the same information by using completely opposing language. This equilibrium, however, is ruled out if the reward for contradictions is large enough, as a type 1 expert would not want to say 0 in state -1 because saying 1 instead would bring her a higher payoff. Furthermore, all the equilibria identified by Li (2004) break down when the reward for contradictions is high enough. On the other hand, the equilibrium I characterize in Proposition 2 remains one.

4 Conclusion

I show in this paper that the THANBO effect is possible. That is, soliciting advice from two experts may generate worse equilibria than soliciting advice from just one. The reason is that partisan bickering, which in effect comes close to babbling, can happen with a high frequency. An example of this effect is television debates between political candidates or pundits, which are notoriously uninformative due to their apparent partisan tone. Participants of debates are encouraged to refute each other or more argumentative debaters are more frequently chosen, so as to make the programs more entertaining, and hence to increase their ratings.

The utility function and type distribution used in this paper are very stylized, which simplifies the exposition. In fact, the expert's utility function does not have to be quadratic. All the results, including the equilibrium construction and utility values, will carry through as long as the expert's utility is a decreasing function of the distance between the decision maker's action and her most preferred action. If the decision maker's utility is not quadratic, but is strictly concave, similar results can be established, although the numerical values would change. Furthermore, prolonging the debate does not necessarily make things better, in that the rounds that follow the initial round of exchange may be either just repetitions of what the experts have said in earlier rounds or pure babbling.

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