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Beneficial mediated communication in cheap talk☆

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ABSTRACT

This paper investigates mediated communication between an informed sender and an uninformed receiver with conflicting preferences in the framework of Crawford and Sobel (1982). It provides a simple condition for mediation to be beneficial, that is, to give the receiver a higher ex-ante payoff than the uninformed decision. This condition in turn allows us to identify scenarios in which mediation is beneficial while all cheap-talk equilibria are uninformative. Our condition extends the conditions for beneficial mediation with a binary type space (Mitusch and Strausz, 2005) and mediation via a biased mediator (Ambrus et al., 2013). Finally, we show the connection between the identified condition and related conditions in other conflict resolution schemes: delegation (Alonso and Matouschek, 2008) and arbitration (Kovác and Mylovanov, 2009).

1. Introduction

Beginning with the classical work by Crawford and Sobel (1982), hereafter CS, the literature on cheap talk (or direct talk) emphasizes that conflict of interest is the main source of ineffective communication between an informed agent (the sender) and an uninformed decision maker (the receiver). Moreover, if this conflict is large, meaningful communication between the interacting parties is not feasible.[1] In this case, the parties must use alternative schemes of conflict resolution that facilitate communication. A common scheme is using a neutral (i.e., non-strategic) mediator who is initially not informed about the issue and cannot enforce his recommendations. The primary goal of the mediator is to privately obtain information from the sender and to give private advice to the receiver.[2] By properly distorting information received from the sender, the mediator may be able to provide the sender the incentive to reveal more information.

However, if the conflict of interest is so intense that direct talk is uninformative, it is not clear whether introducing a mediator can facilitate communication. Moreover, the mediator's participation often requires costs or effort from the conflicting parties. Hence it is important to identify scenarios in which: (1) all equilibria in the direct-communication game are uninformative, and (2) mediation is beneficial in that it improves upon the uninformed outcome. As to (1), CS provide a necessary and sufficient condition for the existence of uninformative equilibria only. Regarding (2), the existing literature provides conditions under which various conflict resolution and communication schemes are beneficial, e.g., delegation (Alonso and Matouschek, 2008), arbitration (Kovác and Mylovanov, 2009), communication via the strategic mediator (Ambrus et al., 2013), and cheap talk with a possibly uninformed sender (Austen-Smith, 1994).[3] But this has remained an open question for non-strategic mediation. This issue forms the central focus of our work.

Our results are as follows. First, we provide a sufficient condition for beneficial mediation in the CS framework.[4] This condition

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1 Krishna and Morgan (2001) and Ambrus and Takahashi (2008) show that communication can be facilitated by consulting multiple senders with conflicting preferences. However, if the bias between their preferences and that of the receiver is large, all equilibria are outcome-equivalent to the uninformative one.

2 Because a neutral mediator is not interested in the outcome of the game, he is equivalent to a mediation mechanism that commits to a certain algorithm of processing and transmitting information.

3 In delegation, the receiver commits to actions contingent on the sender's messages. In arbitration, the mediator's recommendations to the receiver are binding.

4 Thus, we do not rely on the uniform-quadratic specification used in most of the literature on mediated communication (Blume et al., 2007; Goltsman et al., 2009; Ivanov, 2010). To the best of our knowledge, the only papers on mediation beyond the uniform-quadratic case are Ambrus et al. (2013) and Alonso and Rantakari (2013). Also, Austen-Smith (1994) considers the CS framework with a possibly uninformed sender. However, all equilibria in that setup are outcome-equivalent to equilibria in mediation with the perfectly informed sender.

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is intuitively clear and can be easily verified. It requires the existence of a cutoff type such that a sender of this type strictly prefers the receiver's uninformed decision (the one based on prior information only) to the decision the receiver would take if told that the true type lies on a particular side of this cutoff, that is, above or below it. In particular, this condition holds if there exists a type whose ideal decision coincides with the uninformed decision. Second, we show that this condition is always satisfied when the mediation game admits an equilibrium with a partition of the type space into two subintervals; in this case, the type at the boundary between these intervals has the cutoff property. Third, by combining this condition with the CS condition for uninformative cheap talk, we identify scenarios in which mediation improves strictly upon direct communication.[5]

Fourth, we show the connection between our condition and related conditions in alternative schemes of conflict resolution: communication via the biased mediator (Ambrus et al., 2013), delegation (Alonso and Matouschek, 2008), and arbitration (Kovác and Mylovanov, 2009). In particular, our condition extends sufficient conditions by Ambrus et al. (2013), which are imposed on the sender's lowest type, to arbitrary types. It is, however, stronger than the condition of minimally aligned preferences in delegation (Alonso and Matouschek, 2008). Intuitively, additional restrictions in mediation stem from the optimality of the receiver's response to any relevant information. Finally, our condition is also equivalent to the necessary and sufficient condition for beneficial arbitration introduced by Kovác and Mylovanov (2009) under their regularity condition.

Also, our condition combines the two sufficient conditions for beneficial mediation by Mitusch and Strausz (2005) in the case of the binary set of sender's types and extends them to the continuous type space. This extension is not straightforward. The first difficulty is that Mitusch and Strausz (2005) impose conditions on the binary prior distribution that cannot be applied to other discrete distributions. Another difficulty stems from the fact that the incentives of any sender's type in continuous-type models cannot be separated from those of nearby types.[6] In particular, in the search for the sender's cutoff type with certain preferences over receiver's actions, we must take into account that these actions are affected by strategies of the sender's types above and below the cutoff type. In turn, the receiver's actions influence the preferences of the cutoff type. Clearly, this cyclical problem does not appear in the binary-type case.

The rest of the paper is structured as follows. Section 2 presents the formal model. In Section 3, we provide the sufficient condition for beneficial mediation and characterize scenarios in which mediation is beneficial while cheap talk is uninformative. Section 4 establishes the connection between our condition and related conditions in other conflict resolution schemes. Section 5 concludes the paper.

2. The model

Our model is based on the CS framework. There are two players in the game, a privately informed sender (S) and an uninformed receiver (R). The sender perfectly knows state θ, which is distributed according to a continuous distribution function F with a density $f > 0$ on the support $\Theta = [0, 1]$. The receiver takes a decision (or action) $y \in \mathbb{R}$. The preferences of player $i \in \{S, R\}$ are given by the payoff function $U_i(y, \theta)$, which is strictly concave in y for each θ, continuous and strictly supermodular in (y, θ), and achieves the maximum at the *ideal decision* $y_i(\theta)$ for all $\theta \in \Theta$.[7] This implies that $y_i(\theta)$, $i \in \{S, R\}$ is unique and bounded for all $\theta \in \Theta$, and continuous and strictly increasing in θ.

If the receiver holds a posterior belief $\mu \in \Delta\Theta$, his interim payoff

$$EU_R(y|\mu) = E_\mu [U_R(y, \theta)],$$

has the unique maximizer $y^*(\mu)$. For $s < t$, consider the receiver's interim payoff given the belief that $\theta \in [s, t]$,

$$EU_R(y|s, t) = \frac{1}{F(t) - F(s)} \int_s^t U_R(y, \theta) f(\theta)\, d\theta,$$

and the maximizer of $EU_R(y|s, t)$,

$$y_s^t = \arg\max_{y \in \mathbb{R}} EU_R(y|s, t).$$

Let

$$y_z^*(p) = \arg\max_{y \in \mathbb{R}} pEU_R(y|0, z) + (1 - p) EU_R(y|z, 1) \tag{1}$$

be the maximizer of the receiver's interim payoff given the belief that $\theta \in [0, z]$ with probability p and $\theta \in [z, 1]$ with probability $1 - p$. The uniqueness of $y_z^*(p)$ implies that it is continuous in p (Sydsæter et al., 2005, p. 103).

Strategies and mediation rules. The timing of the game is as follows. First, the sender observes θ and sends a signal s to the mediator. The mediator then sends a message m to the receiver, who takes a decision y. Thus, the sender's strategy $\xi : \Theta \to \Delta\mathcal{S}$ is a measurable mapping from Θ into the set of probability distributions over a measurable *signal space* $\mathcal{S} \supset \Theta$. A *mediation rule* $\sigma : \mathcal{S} \to \Delta\mathcal{M}$ is a measurable mapping from the signal space into the set of probability distributions over a measurable *message space* $\mathcal{M} \supset \mathbb{R}$. The receiver's strategy $y : \mathcal{M} \to \mathbb{R}$ specifies the decision $y(m) \in \mathbb{R}$ as a function of the mediator's message m.[8]

Equilibrium. We can employ the Revelation Principle and restrict attention to direct truthtelling equilibria. In these equilibria, the sender truthfully reports her type to the mediator, and the receiver follows the mediator's recommendation. That is, the mediation rule in a direct truthtelling equilibrium is a mapping $\sigma : \Theta \to \Delta\mathbb{R}$ from the state space Θ into the set of probability distributions over the action space $\mathbb{R}$.

For each sender's report θ, a mediation rule induces a distribution over recommended actions. We call such a distribution a *lottery* and restrict the mediator to rules for which each lottery has a (possibly discrete) density $\sigma(.|\theta)$.[9] Given a mediation rule σ and a recommendation y, the receiver's posterior belief conditional on truthful reporting by the sender is denoted by $\mu(y|\sigma) \in \Delta\Theta$. The mediation rule σ is an *equilibrium* one if

$$y = y^*(\mu(y|\sigma)) \quad \text{for all } y \in \mathcal{A}, \text{ and} \tag{2}$$

$$\theta \in \arg\max_{\theta' \in \Theta} \int_{\mathcal{A}} U_S(y, \theta)\, \sigma\left(y|\theta'\right) dy \quad \text{for all } \theta \in \Theta, \tag{3}$$

where $\mathcal{A} = \cup_{\theta \in \Theta} \operatorname{supp} \sigma(.|\theta)$ and the integral is the interim payoff of a sender of type θ who reports θ'. Condition (2) is the

5 However, our condition does not guarantee an improvement over *informative* direct communication.

6 Because sender's types are isolated from each other in the discrete-type setup, there exists the fully separating equilibrium if the conflict of interest is small enough. This is never the case with a continuum of types unless the players' preferences are perfectly aligned.

7 A function $U(y, \theta)$ is *strictly supermodular* if $U\left(y'', \theta''\right) - U\left(y'', \theta'\right) > U\left(y', \theta''\right) - U\left(y', \theta'\right)$ for all $y'' > y'$, $\theta'' > \theta'$.

8 By the strict concavity of $U_R(y, \theta)$ in y for all $\theta \in \Theta$, $y^*(\mu)$ is unique for any receiver's posterior belief $\mu \in \Delta\Theta$. Thus, he never mixes over different decisions.

9 In the literature, most equilibrium lotteries in models of mediation (or lotteries in the mediated equilibria that are outcome-equivalent to equilibria under other communication protocols) are discrete distributions over recommended actions; e.g., Krishna and Morgan (2004), Blume et al. (2007), Goltsman et al. (2009), Ivanov (2010) and Ambrus et al. (2013). For lotteries involving mixtures of continuous and discrete distributions, see Proposition 8 of Blume et al. (2007).