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Sender–receiver games with cooperation☆

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HIGHLIGHTS

- In a generalized sender–receiver game, the sender is also a decision maker.
- At a "cooperate and talk" equilibrium (CTE), the receiver makes both decisions.
- A CTE is always beneficial to the receiver and regret-free.
- A CTE exists if the receiver has a uniform punishment decision against the sender.

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ABSTRACT

We consider generalized sender–receiver games in which the sender also has an action to choose, but this action is payoff-relevant only to himself. We study "cooperate and talk" equilibria (CTE) in which, before sending his message, the sender can commit to delegate his decision to the receiver. CTE are beneficial to the receiver (with respect to no communication) and unlike the equilibria of the plain cheap talk game, preserve him from afterwards regret. While existence of CTE cannot be guaranteed in general, a sufficient condition is that the receiver has a "uniform punishment decision" against the sender.

1. Introduction

In a by now standard model of strategic information transmission, an informed agent (with finitely many types) sends a costless message to a decision maker (with finitely many actions); the utility of both individuals depends on the type of the sender and the action of the receiver (see, e.g., Kreps and Sobel (1994), Section 7). In this model, it is well understood that:

(i) A nonrevealing equilibrium always exists.
(ii) The receiver's expected payoff, at any equilibrium, cannot be lower than his nonrevealing equilibrium payoff.
(iii) The previous property does not hold for the sender (unless specific assumptions are made on the players' utility functions).

For instance, it may happen that, whatever his type, the sender prefers the nonrevealing equilibrium over any other equilibrium. But he may nevertheless have to reveal information as a reply to the receiver's strategy. Sender–receiver games can have many equilibria and selecting among them is a delicate matter. A tractable characterization of all equilibrium outcomes appears as an unavoidable step (see, e.g., Forges (1990) or Myerson (1991), Section 6.7).

In this paper, we consider generalized sender–receiver games in which there is a single informed player (as usual) but the sender and the receiver must make simultaneous decisions. We minimally depart from the standard framework: we still assume that the sender's action does not directly affect the receiver's utility. This is a restrictive assumption, but it is likely to hold in many contexts where the informed player is himself a decision maker. Suppose for instance that the receiver is an investor while the sender is a financial expert who can make investments on his own, as an insider

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(see, e.g., Benabou and Laroque (1992) and Morgan and Stocken (2003)). The financial expert's investments convey information but are typically negligible with respect to the investor's profit.

When the sender is also a decision maker, he chooses his action as a function of his type, in the same way as his message. The equilibria of the plain cheap talk game – in which the players simultaneously choose an action after the informed player has sent a costless message – may not be "posterior" equilibria, in the sense that the receiver would not necessarily maintain his decision, should he have the opportunity to observe the sender's action. By contrast, the game and the equilibrium concept that we propose are motivated by the requirement that communication be regret-free, namely, robust with respect to the timing of choice, as in Green and Laffont's (1987) concept of "posterior implementation" (see also Jehiel et al. (2007)).

More precisely, in our generalized sender–receiver game, the informed player is asked to send a message right after having learnt his type. If he refuses to talk, the players make their decisions independently of each other. In this case, the uninformed player's strategy can be interpreted as a threat against the informed one. If the informed player accepts to talk, he delegates his decision to the receiver. This step captures, in a "reduced form," the fact that the sender's decision does not reveal further information. The model is formalized in Section 2.

By construction, in our game, the actions cannot convey more information than the informed player's message. However, the latter's agreement to talk, which is also an agreement to cooperate, can be type-dependent. Building on the idea that the sender's message exhausts all opportunities of information transmission, we focus on particular perfect Bayesian equilibria (PBE), in which the informed player accepts to cooperate, whatever his type. We call this solution concept "cooperate and talk equilibrium" (CTE) and define it in Section 3.1.

While, at first sight, CTE looks quite restrictive, it just amounts to PBE in the standard model of strategic information transmission recalled at the beginning of this introduction. Indeed, if the informed player has no decision to make, he does not care about delegation. Furthermore, refusal to talk is useless because the receiver can proceed as if some particular message had been sent. Given (iii) above, we should certainly not expect that CTE will always be beneficial to both players. But a property similar to (ii) above is true for CTE, in the sense that the uninformed player's expected payoff, at a CTE, cannot be lower than at a Bayesian Nash equilibrium of the game without communication. As noticed above, an equilibrium of the latter kind may not be regret-free and thus cannot necessarily be turned into a nonrevealing CTE. In fact, property (i) may not hold for CTE when the sender has a decision to make.

We first propose a characterization of CTE in terms of three properties, which have a familiar analog in mechanism design (see e.g., Myerson (1991)): incentive compatibility (IC), optimality for the uninformed player (Opt) and individual rationality for the informed player (IR). (IC) says in particular that, for every type, the sender is indifferent between any two messages that he sends with positive probability given his type. This formulation of (IC) is well-known in sender–receiver games in which the sender can randomize over finitely many messages (see, e.g., Bester and Strausz (2001) and Aumann and Hart (2003)). (Opt) says that the receiver chooses a joint decision that maximizes his own posterior expected utility given the sender's message. This condition reflects the fact that even if the receiver gets full decision power, the interaction takes place as in a sender–receiver game. Hence the receiver cannot commit to a mechanism before he gets the sender's message. The condition (IR) corresponds to the informed player's interim participation constraint. (IR) is generated endogenously in our model, by the actions that the players can choose when the informed one does not cooperate. As a consequence, unlike in standard mechanism design, without further assumption, (IR) cannot be written as a list of separate participation constraints, one for every type. The characterization of CTE is proposed in Section 3.2.

Once a characterization of CTE is available, the next question is whether the existence of a CTE can be guaranteed under meaningful assumptions. A sufficient condition for existence turns out to be that the receiver has a "uniform punishment decision" (UPD). Such a decision enables the receiver to credibly punish the sender as if the latter's type were common knowledge. UPD is compatible with many utility functions, reflecting various extents of the players' conflict of interest. As a concrete example (Example 2 in Section 4.2) illustrates, UPD is satisfied if the receiver's optimal choice, when he considers all sender's types equally likely, consists of a status quo decision (in our concrete example, not hiring a job candidate) that harms the sender, whatever his type. In this example, the players benefit from cooperation: the expected payoffs at the CTE, both for the informed player, whatever his type, and the uninformed one, are strictly higher than those of the Bayesian Nash equilibrium of the game without communication.

We also show, on a much simpler example (Example 1 in Section 4.1), that existence of a CTE may fail in the absence of a UPD. But, adding a UPD, although intuitively helpful, does not make the construction of a CTE straightforward, as the continuation of Example 1 (in Section 4.2) demonstrates. The problem is to satisfy the demanding (IC) conditions (which require in particular player 1 to be indifferent between the various messages he sends with positive probability) at the same time as the other two properties above, namely, (Opt) and (IR). Similar difficulties were solved by Simon et al. (1995) and Renault (2000) to establish the existence of Nash equilibria in repeated games with incomplete information. By making use of their achievements (stated precisely in the Appendix), we prove that, if the receiver has a UPD, a CTE exists in our generalized sender–receiver game, without any further assumptions on the utility functions. This is our main result, stated in Section 4.1.

When the uninformed player has a UPD, the condition (IR) takes the form of a participation constraint *for each type* of the informed player, as in standard principal–agent problems. However, as pointed out above, we do not allow the uninformed player – the principal – to commit to a mechanism. Such problems, in which no decision of the principal is contractible, are studied as a particular case in Bester and Strausz (2001). They characterize solutions in terms of conditions taking the same form as here, namely, (IC), (Opt) and (IR) but in which the sender's interim participation constraints are exogenously determined by an outside option.

As mentioned above, the generalized sender–receiver game considered in this paper does not allow the receiver's payoff to depend on the sender's action. Forges et al. (2016) also investigate cheap talk and cooperation but do not impose this restriction. The latter paper differs from the present one by introducing a semi-cooperative solution concept (in which signaling is strategic but agreements are exogenous) and more importantly, by relying on possibly noncredible punishments to induce cooperation. A detailed discussion can be found in Section 5.1.

We consider two other variants of the model studied all along the paper. A natural benchmark is the plain cheap talk game briefly mentioned above, in which the informed player sends a costless message but does not make any commitment. Not surprisingly, there are examples in which partially revealing cheap talk is enough to improve on the equilibrium payoffs that both players get in the absence of communication but CTE does even better, i.e., the sender is happy to talk and even happier to cooperate and talk.

As a last variant of our generalized sender–receiver game, one could also imagine that the informed player first sends a message to the uninformed one, who then makes a proposal to cooperate.