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Strategic information transmission networks ☆

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Abstract

We study a model of multi-player communication. Privately informed decision makers have different preferences about the actions they take, and communicate to influence each others' actions in their favor. We prove that the equilibrium capability of any player to send a truthful message to a set of players depends not only on the preference composition of those players, but also on the number of players truthfully communicating with each one of them. We establish that the equilibrium welfare depends not only on the number of truthful messages sent in equilibrium, but also on how evenly truthful messages are distributed across decision makers.

JEL classification: D82; D85

Keywords: Cheap talk; Multi-agent communication; Networks; Organizations; Strategic communication

1. Introduction

This paper studies multi-player strategic information transmission. We consider a setting in which multiple decision makers have private incomplete information about a state of the world, which influences all players' utilities. But, given the state, the decision makers have different preferences over the actions they take. Before making a decision, players communicate with

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each other, but the information transmitted is not verifiable. Our analysis can be applied to several economic and political scenarios. In many organizations, decision making is decentralized at the division level, but these divisions do not necessarily share the same preferences over the optimal course of action.[1] Before making decisions, the division leaders may communicate their information to each other. In international organizations, national leaders retain control of their own policy choice (such as national environmental, military, or economic policies), but the implementation of such policies may have spillovers on other States. Different States may have different preferences on policies. Before making decisions, the leaders communicate to each other within the context of international organizations.

We develop a natural extension of the uniform-quadratic version of the model of cheap talk by Crawford and Sobel [9]. There are n players, and an unknown state of the world θ, uniformly distributed on the interval $[0, 1]$. Each player i chooses an action y_i, that influences the utility of all players. Each player i would like that each player j's action y_j were as close as possible to $\theta + b_i$, where b_i represents player i's bias relative to the common bliss point θ; specifically, player i's payoff is $-\sum_j (y_j - \theta - b_i)^2$. Each player i is privately informed of a signal s_i, which takes the value of one with probability θ and the value of zero with complementary probability. Before players choose their actions, they simultaneously send messages to each other. A player can differentiate her message only across *audiences*, where the set of a player's audiences is a partition of the set of all the other players. Our model covers both the case of *private communication*, where every player can send a message privately to every other player, and the case of *public communication*, where every player's message is common to all other players.

A communication strategy profile is described by a (directed) network in which each link represents a truthful message, termed a *truthful network*. Our first result derives the equilibrium condition for truthful communication of player i with audience J. The characterization identifies the following equilibrium effects. First, each player's incentive to misreport a low signal in order to raise the action of lower bias opponents is tempered by the loss incurred from the increase in actions of all higher bias players who belong to the same audience J. Second, the composition of these gains and losses depends on the number of players truthfully communicating in equilibrium with each player in audience J. The reason for this is that the influence that player i's message has on player j's decision depends on player j's equilibrium information, i.e., on the number of truthful messages received by j in equilibrium. Third, an increase in the number of truthful messages received by a player j in an audience J has an ambiguous effect on i's capability to truthfully communicate with the audience J in equilibrium. If communication from player i to player j is private there is a stark congestion effect: the willingness of player i to communicate truthfully with player j declines with the number of players communicating with j. However, if j is part of a larger audience and her preferences are distant from i's preferences, an increase in the number of truthful messages received by j decreases the influence that i has on j's decision. Hence, player i capability to be truthful depends now more on the effect of her message on the other players in J, who have a bias closer to i's bias, than j's bias. As a result, player i may be more willing to communicate truthfully with audience J, than when j receives fewer truthful messages.

In our framework, an equilibrium maximizes the *ex-ante* utility of a player if and only if it maximizes the *ex-ante* utility of each one of the players. We find that each player i's ex-ante

[1] For example, the priorities of a marketing division may be different from the ones of the R&D division, when developing a new product.