

# Formal Analysis: Cheap talk

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Week 7 Session 2



## Communication and cooperation

Asked to play one-shot prisoner's dilemma (or similar), players cooperate more if they communicate face-to-face beforehand (e.g. Ostrom 1997).

		Player 2	
		Cooperate	Defect
Player 1	Cooperate	3,3	1,4
	Defect	4,1	2,2

Why might this be?

## Cheap talk

**Definition:** message sent from one party to another that is not **payoff-relevant** for any player

- ▶ No cost for sending (not a **costly signal**, i.e. “sunk-cost” signal)
- ▶ Does not affect cost or benefit of future actions (not a “tying-hands” signal)

And yet, ignoring **psychological** mechanisms, can convey information *if the players have some shared interest*.

# Political science applications

When do we care about communication?

- ▶ Lobbying: interest group telling politician about its policy area
- ▶ Veto threats: one veto player telling another about her policy preferences (e.g. Matthews 1989 QJE)
- ▶ Legislative organization: committees (and other delegated bodies) acquire expertise that they communicate to the legislature (Gilligan and Krehbiel 1989 AJPS)
- ▶ Mediation: mediator telling party to a dispute about other side's resolve, etc (Kydd 2003 AJPS)

## Lobbying illustration

## Lobbying illustration: set up

There is a bill in the legislature.

MP must vote for, vote against, or abstain.

Lobbyist knows whether the bill helps or hurts the MP's constituents, and can tell the truth or lie to the MP.

MP wants to vote for the bill if it helps and against if it hurts; MP thinks  $\Pr(\text{helps}) = 1/2$ .

## Case 1: No common interest

Order of payoffs: Lobbyist, MP

		MP's vote		
		For	Against	Abstain
Effect of bill on MP's constituents	Helps	3,3	-1,0	0,2
	Hurts	3,0	-1,3	0,2

Suppose lobbyist says "It helps." What should the MP do?



## Case 2: Common interest

Order of payoffs: Lobbyist, MP

		MP's vote		
		For	Against	Abstain
Effect of bill on MP's constituents	Helps	3,3	-1,0	0,2
	Hurts	-1,0	3,3	0,2

Suppose lobbyist says "It helps." What should the MP do?

## Treaty game

## Treaty game: payoffs

State 1 (**sender**) and State 2 (**receiver**) face a choice about whether to implement a treaty to take joint action against climate change.

The benefit of implementing a treaty depends on the state of the world  $\omega$ , which could be

- ▶  $\omega_1$ : climate change is not that serious
- ▶  $\omega_2$ : climate change is serious

The payoff of implementing the treaty for player  $i$  is  $b(\omega) - c_i$ ; the payoff of not implementing the treaty is 0.

**Assumption:**  $b(\omega_1) < c_2 < b(\omega_2)$ , i.e. state 2 wants to take action if climate change is serious, but not otherwise.

## Treaty game: information and communication

State 1 (**sender**) receives a scientific report about how serious climate change is.

State 1 communicates one of two messages to State 2 (**receiver**):

- ▶ “Climate change is serious.”
- ▶ “Climate change is not that serious.”

**Question:** Under what conditions is there a *truthful equilibrium* in which

- ▶ State 1 reports honestly what the report says
- ▶ State 1 signs the treaty if the report says that climate change is serious
- ▶ State 2 signs the treaty if State 1 says that climate change is serious

## Variants of the treaty game

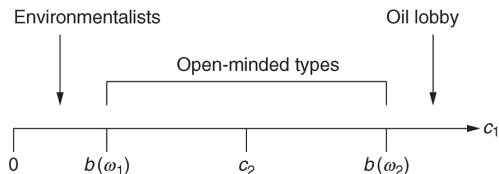
Kydd considers three variants:

Pr(error in report) ( $\epsilon$ )	Receiver's knowledge of sender's preferences/costs ( $c_1$ )
Zero	Perfect
Non-zero ( $\epsilon \in (0, .5)$ )	Perfect
Non-zero ( $\epsilon \in (0, .5)$ )	Imperfect (described by $F(c_1)$ )

## Case 1: report is 100% accurate, state 1's type is known

Three types of state 1 to consider:

- ▶ “open-minded” like State 2 ( $b(\omega_1) < c_1 < b(\omega_2)$ )
- ▶ “environmentalist” ( $c_1 < b(\omega_1)$ )
- ▶ captured by the “oil lobby” ( $c_1 > b(\omega_2)$ )



Truthful equilibrium only possible if state 1 is “open-minded”,  
i.e. has the same preferences as state 2.

## Case 2: report is wrong with probability $\epsilon$ , state 1's type is known

Suppose the report is wrong with probability  $\epsilon$ .

Denote by  $\rho_1$  a report saying "Climate change is serious ( $\omega_1$ )" and  $\rho_2$  a report saying "Climate change is not very serious ( $\omega_2$ )".

Then  $P(\rho_1|\omega_2) = P(\rho_2|\omega_1) = \epsilon$ .

Suppose state 1 gets a report of  $\rho_1$ . What is the probability that climate change is serious (i.e.  $P(\omega_2|\rho_1)$ )?

## Bayes' Law

Relationships among **joint**, **conditional**, and **prior** probabilities:

$$P(\rho_1, \omega_2) = P(\rho_1|\omega_2)P(\omega_2) = P(\omega_2|\rho_1)P(\rho_1)$$

Therefore

$$P(\omega_2|\rho_1) = \frac{P(\rho_1|\omega_2)P(\omega_2)}{P(\rho_1)}.$$

See animation:

[https://andyeggers.shinyapps.io/cheap\\_talk/](https://andyeggers.shinyapps.io/cheap_talk/)



## Bayes' Law and the treaty game

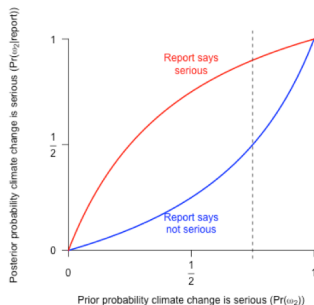
The expected benefit of the treaty, given a signal of  $\rho_1$  (i.e. "Climate change is not that serious"):

$$E[b|\rho_1] = (1 - P(\omega_2|\rho_1))b(\omega_1) + P(\omega_2|\rho_1)b(\omega_2).$$

The expected benefit of the treaty, given a signal of  $\rho_2$  (i.e. "Climate change is serious"):

$$E[b|\rho_2] = (1 - P(\omega_2|\rho_2))b(\omega_1) + P(\omega_2|\rho_2)b(\omega_2).$$

So the expected benefit is a weighted average, with weight given to  $b(\omega_2)$  shown in this figure:

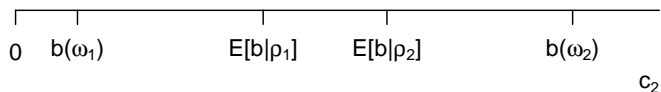


## Bayes' Law and the treaty game

Uncertainty about report but certainty that state 1 is  
"open-minded":



Uncertainty about report and uncertainty about whether state 1 is  
"open-minded":



## Veto threat illustration

## Veto threat setup

Agenda setter  $A$  and veto player  $B$  have Euclidean preferences on a unidimensional policy space.



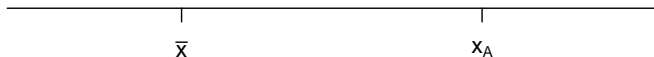
Status quo  $\bar{x}$  and agenda setter's ideal point  $x_A$  common knowledge, but only  $B$  knows  $x_B$ .

Timing of game:

- ▶ Veto player  $B$  sends message to agenda setter  $A$
- ▶ Agenda setter proposes policy  $x$
- ▶ Veto player  $B$  accepts or rejects

## Veto threats: analysis

Could there be a truthful equilibrium where  $B$  tells  $A$  exactly what  $x_B$  is?



- ▶ How would  $A$  choose  $x$  in such an equilibrium?
- ▶ Given that choice, could  $B$  do better by lying in any circumstance?

## Veto threats: analysis

Could there be a truthful equilibrium where  $B$  tells  $A$  whether she would accept a proposal of  $x_A$ ?



- ▶ How would  $A$  choose  $x$  in such an equilibrium?
- ▶ Given that choice, could  $B$  do better by lying in any circumstance?

## Veto threats: result

Matthews (1989) shows that there can be only two types of subgame perfect Nash equilibrium, depending on  $A$ 's beliefs about  $B$ 's possible types:

**Size one** equilibrium: regardless of the message sent,  $A$  proposes some  $x^* \in (\bar{x}, x_A)$  based on risk-reward tradeoff



**Size two** equilibrium:

- ▶  $B$  announces that  $x_B$  is above or below a cutoff  $c$
- ▶ if above,  $A$  proposes  $x_A$ ;
- ▶ if below,  $A$  proposes some  $x^{**}$  based on risk-reward tradeoff

