
AN EXPERIMENTAL INVESTIGATION OF COMMUNICATION WITH
EVIDENCE

Jeanne Hagenbach (CNRS, Ecole Polytechnique)
Eduardo Perez-Richet (Ecole Polytechnique)

A Simple Example

- ▶ Bob wants to go to a party thrown tonight
- ▶ Only Alice received the invitation and knows if it is in *Palaiseau* or *Paris*
- ▶ Will Alice show the invitation to Bob?
- ▶ What should Bob believe if Alice does not show the invitation?
- ▶ It depends on Alice's intentions...

A Simple Example

Case 0: **Alice wants to go with Bob.**

Case 1: **Alice wants Bob to go to Palaiseau.**

Case 2: **Alice wants to go without Bob.**

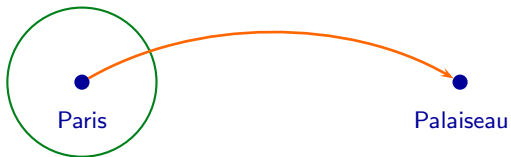
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



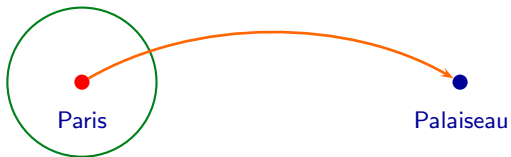
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



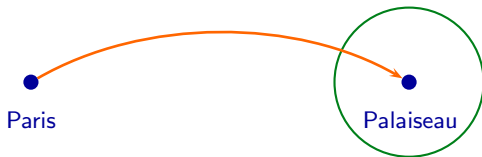
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



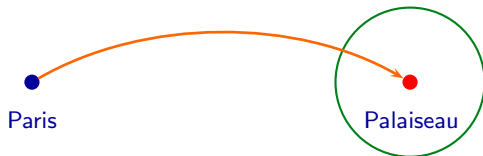
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



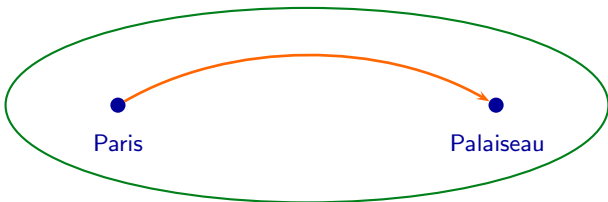
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



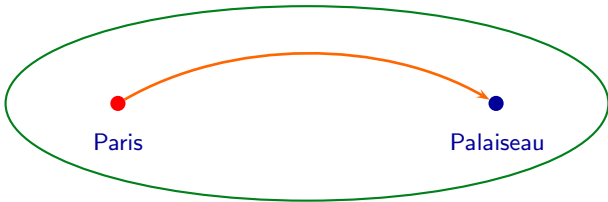
A Simple Example

Case 1: Alice wants Bob to go to Palaiseau.



A Simple Example

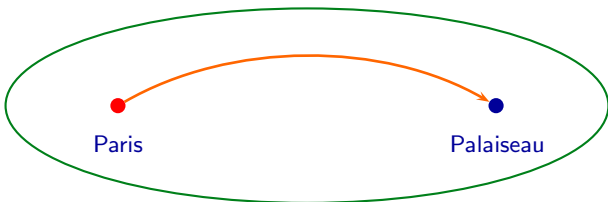
Case 1: Alice wants Bob to go to Palaiseau.



Skeptical belief

A Simple Example

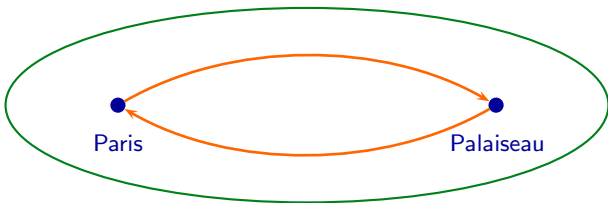
Case 1: Alice wants Bob to go to Palaiseau.



Skeptical belief... is natural,
and leads to a fully revealing equilibrium

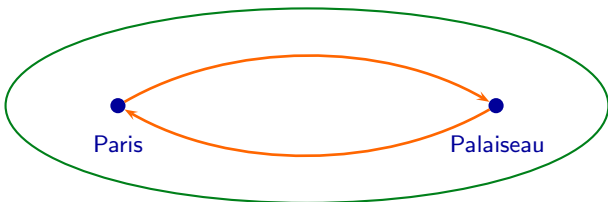
A Simple Example

Case 2: Alice wants to go without Bob.



A Simple Example

Case 2: Alice wants to go without Bob.



No skeptical interpretation,
and no fully revealing equilibrium

A Simple Example

- ▶ **What is particular about information transmission ?** Hard info, certifiable messages and not cheap talk (but costless to send)
- ▶ **What is the difference between cases 1 and 2 ?** Bob can “back engineer” the way Alice wants to fool him in case 1 but not in case 2
- ▶ **Why does it help ?** Alice’s refusal to show the invitation can be deterred by Bob’s use of a skeptical belief in case 1 but not in case 2

Introduction

We study strategic communication in a collection of sender-receiver games with **hard information**

- ▶ **We represent sender's incentives in these games by a masquerading graph:** an application of *Hagenbach, Koessler, Perez-Richet*, Ecta 2014
- ▶ Two theoretical distinctions matter in these graphs:
 - ▶ **Acyclic versus cyclic graphs:** in acyclic graphs skeptical inferences can be used by receivers to enforce full revelation
 - ▶ **Envious versus narcissistic types:** full disclosure is weakly dominated for narcissistic type (provided that evidence is respected)
- ▶ We examine the **relevance of these theoretical distinctions in the lab**
- ▶ We look at how experimental subjects **use and interpret evidences**

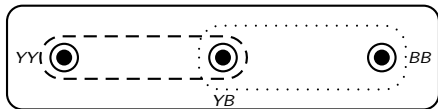
Experimental design

The Sender-Receiver Game

- ▶ Nature randomly picks 2 cards: $T = \{YY, YB, BB\}$ with $p = (\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$

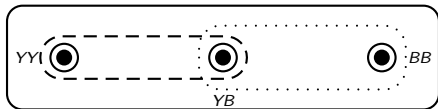
The Sender-Receiver Game

- ▶ Nature randomly picks 2 cards: $T = \{YY, YB, BB\}$ with $p = (\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$
- ▶ S discovers her two cards and **decides to show one, two or no card to R**



The Sender-Receiver Game

- ▶ Nature randomly picks 2 cards: $T = \{YY, YB, BB\}$ with $p = (\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$
- ▶ S discovers her two cards and **decides to show one, two or no card to R**



- ▶ R observes what S showed him and chooses an action $a \in \{A, B, C\}$
- ▶ Full feedback
- ▶ During the whole game, subjects observe two payoff matrices: one giving S's payoff for every pair (t, a) and one giving R's payoff for every pair (t, a) .

Sender's Screen

Période 1 de 2

Temps restant [sec]: 48

Vous avez le rôle : **Joueur 1**.

Distribution des cartes :




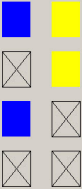
Table des gains : **Joueur 1**

	A	B	C
2 Jaunes	0	3	0
1 Jaune, 1 Bleue	0	3	0
2 Bleues	0	0	3

Table des gains : **Joueur 2**

	A	B	C
2 Jaunes	3	0	0
1 Jaune, 1 Bleue	0	3	0
2 Bleues	0	0	3

Merci de sélectionner l'une des options :



OK

Receiver's Screen

Période

1 de 2

Temps restant [sec]: 59

Vous avez le rôle : **Joueur 2**

Voici les cartes que vous montre le Joueur 1 :



Table des gains : **Joueur 1**

	A	B	C
2 Jaunes	0	3	0
1 Jaune, 1 Bleue	0	3	0
2 Bleues	0	0	3

Table des gains : **Joueur 2**

	A	B	C
2 Jaunes	3	0	0
1 Jaune, 1 Bleue	0	3	0
2 Bleues	0	0	3

Merci de sélectionner l'une des actions :



Overall Design

In each session, agents play 20 or 30 rounds of the same sender-receiver game

- ▶ Payoff matrices are kept unchanged for the whole experimental session
- ▶ Subjects get the role of Sender or Receiver once and for the whole experiment
- ▶ New pairs are formed randomly in every round

We ran 14 experimental sessions (+ controls), each with different payoff matrices

- ▶ In 8 sessions, the payoff matrices were such that the game was acyclic
- ▶ In 6 sessions, the payoff matrices were such that the game was cyclic

Cross-game approach

Overall Design

In the 14 sessions, we kept fixed the receiver's payoffs and varied the masquerading graphs by playing on the sender's payoffs only

	A	B	C
YY	0	3	3
YB	0	0	3
BB	0	0	3

Table : S's payoffs

	A	B	C
YY	3	0	0
YB	0	3	0
BB	0	0	3

Table : R's payoffs



	A	B	C
YY	0	3	0
YB	3	0	0
BB	0	0	3

Table : S's payoffs

	A	B	C
YY	3	0	0
YB	0	3	0
BB	0	0	3

Table : R's payoffs



Overall Design

In the 14 sessions, we kept fixed the receiver's payoffs and varied the masquerading graphs by playing on the sender's payoffs only

	A	B	C
YY	0	1	3
YB	0	1	3
BB	0	0	3

Table : S's payoffs

	A	B	C
YY	3	0	0
YB	0	3	0
BB	0	0	3

Table : R's payoffs



	A	B	C
YY	1	3	0
YB	3	1	0
BB	0	0	3

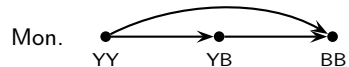
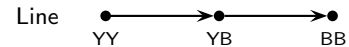
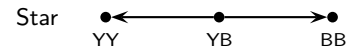
Table : S's payoffs

	A	B	C
YY	3	0	0
YB	0	3	0
BB	0	0	3

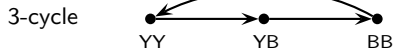
Table : R's payoffs



Masquerading Graphs



Acyclic Games



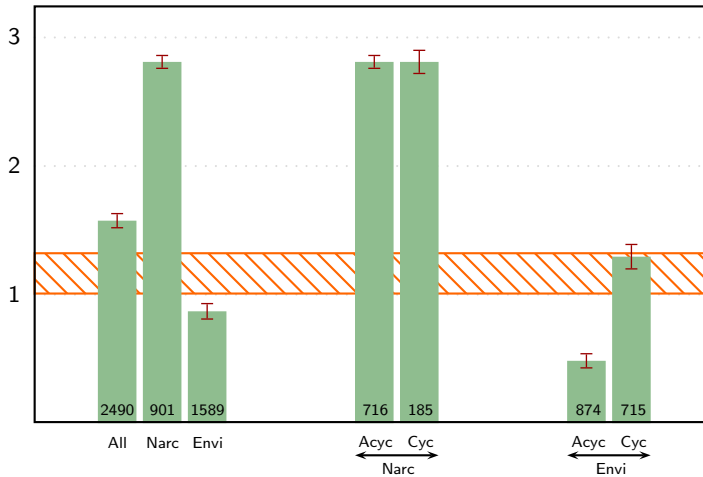
Cyclic Games

Practical Remarks

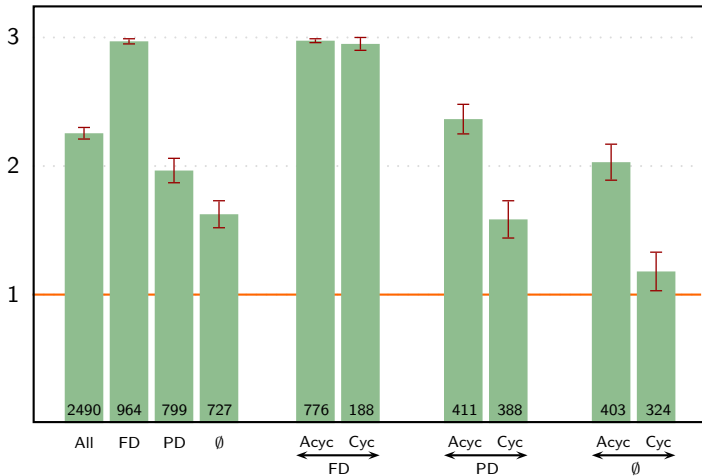
- ▶ Experiments were ran at the Polytechnique Lab
- ▶ 224 subjects: mainly Polytechnique students, a few Polytechnique staff members
- ▶ Subjects were paid **proportionally to the total number of points** they gained over the 20 or 30 rounds
- ▶ Payments: 5 € show-up + from 5 € to 30 € gains (average including show-up: 16.5 €)

Experimental Results: Overall Performances

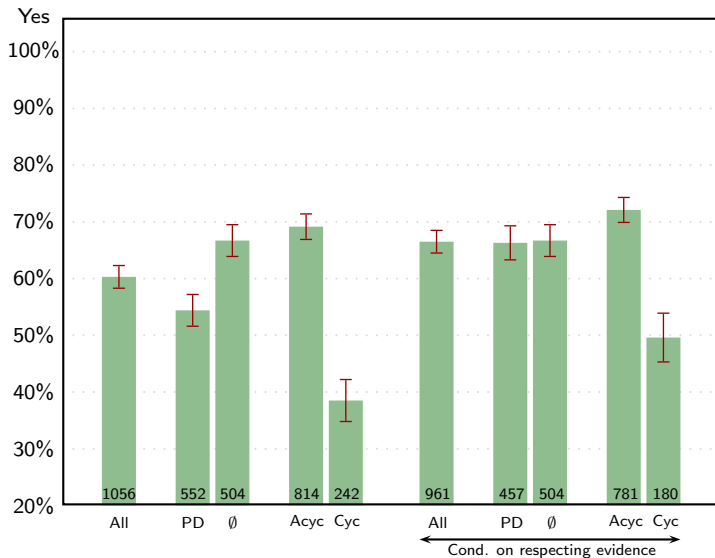
Senders' mean payoffs



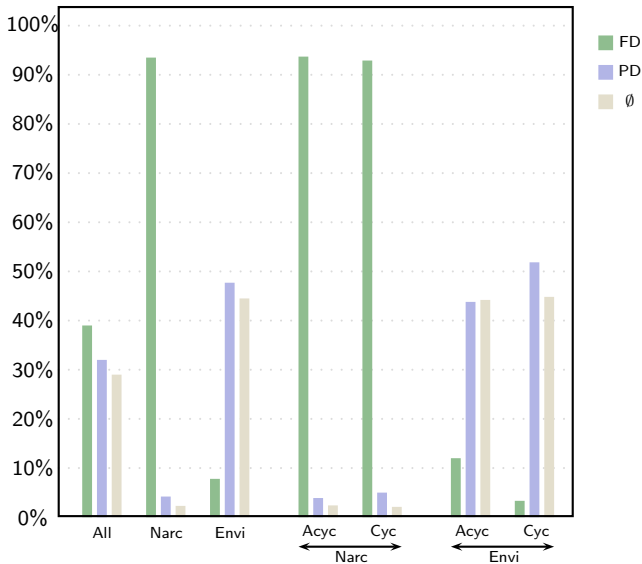
Receivers' mean payoffs



Receivers' skepticism



Senders' disclosure



Explaining Performances

Explaining envious senders performance

We say that an envious sender succeeds if the receiver takes the action which is optimal given the type this sender wants to masquerade as

Linear Probability Model for Success of Envious Senders

Cyclic	0.289***	(0.034)	–	–
No FRE	–	–	0.302***	(0.029)
Unique Envious	–0.059**	(0.029)	–0.106***	(0.27)
Three Envious	0.056	(0.051)	0.218	(0.048)
Many Arrows	–0.034	(0.027)	–0.059	(0.028)
Type YY or BB	0.014	(0.033)	–0.020	(0.032)
Two Poss. Succ.	0.022	(0.032)	0.022	(0.031)
Payoff=1 if FD	0.012	(0.030)	–0.031	(0.025)
Const.	0.088	(0.040)	0.158	(0.035)

*** $p < 0.01$, ** < 0.05 , * < 0.10 , $n = 1686$ $R_1^2 = 0.138$, $R_2^2 = 0.148$

Explaining receivers' accuracy facing PD and Silence

Linear Probability Model for Receiver's Accuracy

Cyclic	-0.207***	(0.045)	-	-
No FRE	-	-	-0.170***	(0.048)
Unique Envious	0.201***	(0.048)	0.240***	(0.049)
Three Envious	-0.027	(0.067)	-0.066	(0.069)
Many Arrows	-0.023	(0.051)	0.015	(0.052)
Silence	-0.123***	(0.025)	-0.122***	(0.025)
Const.	0.752	(0.037)	0.712	(0.037)

*** $p < 0.01$, ** < 0.05 , * < 0.10 , $n = 1616$ $R_1^2 = 0.109$, $R_2^2 = 0.101$

Conclusion

One of the first experiment on **communication with evidence**

The theoretical distinctions matter

Receivers:

- ▶ take the evidence into account
- ▶ perform better in acyclic games and with more precise messages
- ▶ exercise skepticism more in acyclic games

Senders:

- ▶ fully disclose if narcissistic and use vague messages if envious
- ▶ when envious, perform better in cyclic games than in acyclic games

Further: effect of the structure of evidences ?