Rules and Commitment in Communication

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Introduction

We revisit a classic question in economics from a new perspective:

- How "much" **information** can be transferred under direct communication?

What we do:

- A framework nesting existing models under the same umbrella.
- With this framework, we test comparative statics **across** these models.

We produce comparative statics along two principal dimensions:

1. **Rules**: What can the sender say?
2. **Commitment**: Can sender write enforceable *contracts*?

Introduction

Focus on a minimal set-up:

- Binary state: Red and Blue.
- Two parties (*sender*, *receiver*) with conflicting interests.
- **Sender** has information, **Receiver** has ability to act.
- Three messages: red, blue and no message.

Rules

Rules: What can the sender say?

We explore two extremes:

- **Unverifiable** messages.

  There are no rules governing which messages the sender can send.

- **Verifiable** messages.

  When state **Red**: Sender can send **red** or **no message**.

  When state **Blue**: Sender can send **blue** or **no message**.

Commitment

Stage 1: Commitment.

- **Sender** selects her *commitment strategy*.
- This strategy will be revealed to the receiver.

Stage 2: Revision.

- **Sender** *learns* color of the ball.
- She can *revise* her previous choice.
- Revision is *not revealed* to the receiver.

With probability ρ

With probability $1 - \rho$

Stage 3: Guess.

- **Receiver** makes decisions as a function of message.
- The message comes from Commitment Stage with probability ρ.

Special Cases

This framework accommodates existing models as special cases.

Cheap Talk. Crawford and Sobel (1982)

Unverifiable and no commitment.

Disclosure. Grossman (1981), Milgrom (1981), Jovanovic (1982), Okuno-Fujiwara et al (1990)

Verifiable and no commitment.

Bayesian Persuasion. Kameniza and Gentkow (2011)

Unverifiable and full commitment.

Variations around a common basic structure, different predictions.

Exploit this framework to:

- Provide novel comparative statics: beyond preference alignment.
- Interaction of *Rules* and *Commitment* on strategic information transmission.
- Offer a broader perspective on these communication models.
- Test Bayesian persuasion.

Our **questions**:

1. Are senders able to exploit **commitment**?
2. Do receivers understand messages generated by commitment?
3. Do **rules** generate more responsiveness? (Policy: voluntary disclosure)

Findings

Preliminary results:

1. Qualitatively, commitment affects equilibrium informativeness in ways that are consistent with theory.
2. Yet, significant quantitative departures from the theory.
3. Commitment seems to work better when there are no rules.

   Hiding *good news* is harder than the lying about *bad ones*.

theory

Game

- Binary state $\Theta = \{R, B\}$. Common prior belief.
- Receiver actions $A = \Theta$.
- Receiver plays a guessing game: $u(\theta, a) := 1(a = \theta)$.

  Wins if she guesses right.

  Loses otherwise.
- Sender's utility: $v(a) := 1(a = R)$.

  Wins if Receivers guesses red.
- Set of messages M.

Game

Stage 1:

Sender chooses a **commitment** strategy: $\pi_C : \Theta \to \Delta(M)$.

Stage 2: With probability $1 - \rho$, she enters an **revision stage**:

Learns the realization of θ.

Chooses a **revision** strategy: $\pi_R(\theta) \in \Delta(M)$ conditional on θ.

Stage 3:

Receiver guesses. $a : M \to \Delta(A)$.

Parameter ρ captures the extent of commitment.

Predictions

Interacting *Rules* and *Commitment*:

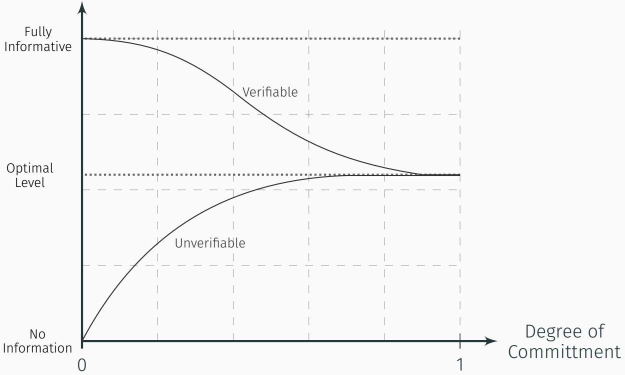
Proposition.

- When messages are *verifiable*, commitment **decreases** informativeness.
- When messages are *unverifiable*, commitment **increases** informativeness.

When Θ binary,

- Informativeness converges to the same point as $\rho \to 1$, regardless of rules.

Predictions



Special Cases

How “much” **information** can be transferred in equilibrium?

1. **Cheap Talk**.

   No information transmitted: *Babbling*.

2. **Disclosure**.

   All information transmitted: *Unraveling*.

3. **Bayesian Persuasion**.

   Some information is transmitted: *Lie, but keep it credible*.

design

Setup:

- Urn has three balls: two blue and one red.
- Receiver wins $2 if guesses correctly.
- Sender wins $2 if Receivers says Red.
- Up to three messages: **red**, **blue**, **no message**.
- Rules:

  Verifiable: truth or no message.

  Unverifiable: no constraints.

Setup:

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Lab 1 Match 1 of 2

You are the Sender

Communication Stage

Here you choose your COMMUNICATION PLAN.
After you click Confirm, we will communicate the plan you chose to the Receiver.

If the ball is RED:

Send Message	with probability:
Red	50 %
Blue	30 %
No Message	20 %

0 25 50 75 100

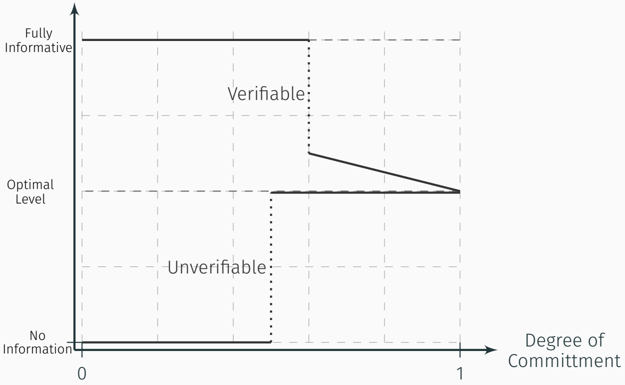
If the ball is BLUE:

Send Message	with probability:
Red	25 %
Blue	65 %
No Message	10 %

0 25 50 75 100

CONFIRM

Prediction (revisited)



Treatments

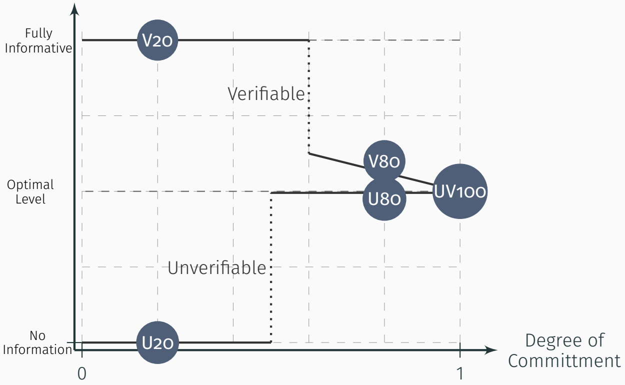
Treatments (2x3):

Rules: Verifiable *vs* Unverifiable.
Commitment: $\rho = \{20, 80, 100\}$.

Labeling:

	Commitment		
Rules	V20	V80	V100
	U20	U80	U100

Treatments


Fully
Informative
Optimal
Level
No
Information
V20
Verifiable
V80
U80
UV100
Unverifiable
U20
0
1
Degree of
Committment

Equilibrium Behavior

	Sender								Receiver	
	Commitment				*Revision*				*Guessing*	
Treat.	Ball	Message			Ball	Message			Mes.	Guess
		red	blue	no		red	blue	no		
V20	R	1		0	R	1		0	red	*red*
	B		x	$1-x$	B		x	$1-x$	blue	*blue*
									no	*blue*
V80	R	0		1	R	1		0	red	*red*
	B		$\frac{3}{4}$	$\frac{1}{4}$	B		0	1	blue	*blue*
									no	*red*
V100	R	0		1					red	*red*
	B		$\frac{1}{2}$	$\frac{1}{2}$					blue	*blue*
									no	*red*
U20	R	x	y	$1-x-y$	R	1	0	0	red	*blue*
	B	x	y	$1-x-y$	B	1	0	0	blue	*blue*
									no	*blue*
U80	R	1	0	0	R	1	0	0	red	*red*
	B	$\frac{3}{8}$	$\frac{5}{8}$	0	B	1	0	0	blue	*blue*
									no	*blue*
U100	R	1	0	0					red	*red*
	B	$\frac{1}{2}$	$\frac{1}{2}$	0					blue	*blue*
									no	*blue*

Equilibrium

Sender's **equilibrium behavior** in two extreme cases:

U100

		messages *r*	*b*	*n*
Ball	R	100%	0	0
	B	50%	50%	0

V100

		messages *r*	*b*	*n*
Ball	R	0	0	100%
	B	0	50%	50%

Intuition and main *tensions*:

- U100. Lie as much as you can, while keeping it credible.
- V100. Never release good news: "No news, good news."

Effectively redefine a language.

Experimental Details

Implementation:

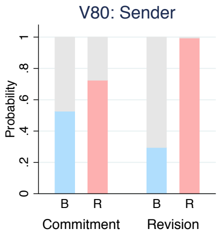
- Two unpaid practice rounds.
- 25 periods played for money in **fixed roles**.
- Random rematching between periods.

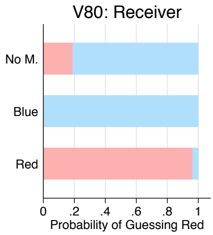
General Information:

- Six treatments, three to four sessions per treatment.
- 336 subjects ($\approx$ 16 per session; between 12 and 24).
- Average earnings: \$24 (including \$10 show up fee).
- Average duration: 100 minutes.

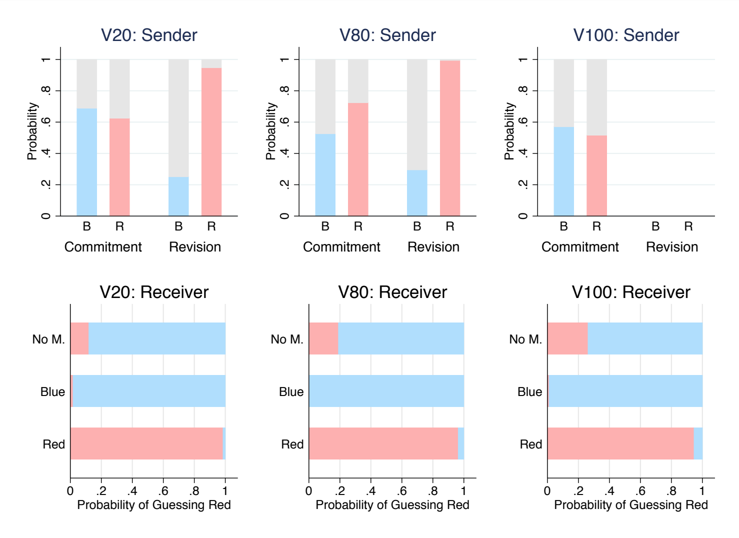
results

Behavior Under Verifiable Messages





Behavior Under Verifiable Messages



Behavior Under Unverifiable Messages

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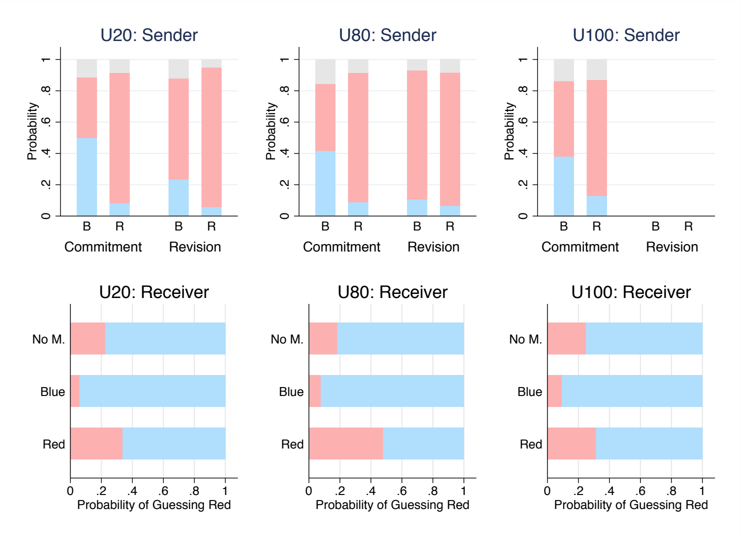


Informativeness: Correlation

How to measure equilibrium **informativeness**?

Pearson **correlation index** ϕ between Ball and Guess.

(Definition ▷)

Intuition:

If no information, $\phi = 0$. Receiver always says blue.

If full information, $\phi = 1$. Receiver perfectly matches the state.

We focus attention on data from last 10 rounds.

INFORMATIVENESS: CORRELATION

Theory:

	Commitment (ρ)		
	20%	80%	100%
Verifiable	1	0.57	0.50
Unverifiable	0	0.50	0.50

Data:

	Commitment (ρ)		
	20%	80%	100%
Verifiable			
Unverifiable			

Informativeness: Correlation

Theory:

	Commitment (ρ)		
	20%	80%	100%
Verifiable	1	0.57	0.50
Unverifiable	0	0.50	0.50

Data:

	Commitment (ρ)				
	20%		80%		100%
Verifiable	0.83	$\approx$	0.78	$>$	0.68
	$\vee$		$\vee$		$\vee$
Unverifiable	0.10	$<$	0.20	$\approx$	0.22

Informativeness: Correlation

Verifiable:

Commitment decreases correlation, although much less then it should.

Unverifiable:

Commitment increases correlation, although much less then it should.

Informativeness: Correlation

Verifiable:

Commitment decreases correlation, although much less then it should.

Unverifiable:

Commitment increases correlation, although much less then it should.

This measure takes into account at the same time:

1. Senders' behavior.
2. Receivers' behavior.
3. Inherent randomness of the experiment.

It cumulates mistakes from all sides.

Who is getting it wrong and why?

Correlation with Bayesian Receivers

Theory:

	Commitment (ρ)		
	20%	**80%**	**100%**
Verifiable	1	0.57	0.50
Unverifiable	0	0.50	0.50

Data + Bayesian Rec:

	Commitment (ρ)				
	20%		**80%**		**100%**
Verifiable	0.92	$>$	0.84	$\approx$	0.79
	$\vee$		$\vee$		$\vee$
Unverifiable	0.00	$<$	0.33	$\approx$	0.30

Correlation with Bayesian Receivers

A general improvement in point predictions.

Observation 1.

Senders take partial advantage of commitment in the directions predicted by the theory.

Most interesting deviation:

- Even with rational receivers: $U100 \ll V100$

Focus on Receivers

How to establish **rationality** of a receiver?

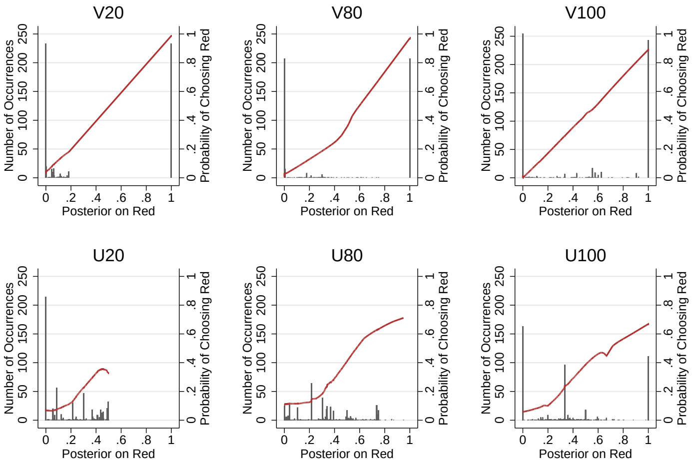
A Bayesian receiver:

1. Gets a **message** m.
2. Computes the **posterior** belief $\mu(R|m) \in [0, 1]$.
3. Guess Red if and only if $\mu(R|m) \geq \frac{1}{2}$.

A weak test for rationality:

- Label m of the message doesn't matter.
- The likelihood of guessing red is **increasing** $\mu(R|m)$.

Focus on Receivers



Bars indicate the number of messages inducing this posteriors on the ball being RED (left axis).
The red line indicates the probability that such a message yields a red guess (right axis).

Focus on Receivers

Overall, receivers respond to incentives.

Observation 2.

Response function is increasing in posterior beliefs.

Most interesting deviation:

- Receivers are overly skeptical in U-treatments.
- Rules (partially) override skepticism. (Pareto improvement)

Still, Obs 2 $\Rightarrow$ let's go beyond correlation index.

Informativeness: Random Posteriors

What posteriors do senders attempt to induce?

Chain of events: $\theta \Rightarrow m \Rightarrow \mu(R|r)$

Goal:

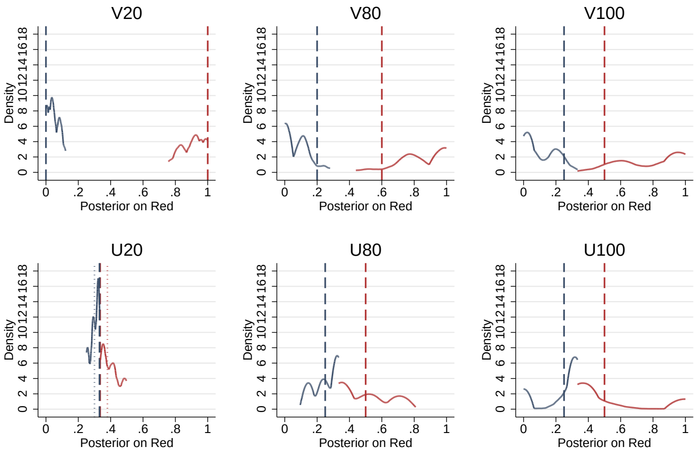
Extracting informativeness from induced posteriors.

Much cleaner measure than correlation.

We use:

Conditional **posterior** belief **variance**.

Informativeness: Random Posteriors



Posteriors on the ball being RED.
The color of the line indicates the state.
Vertical lines indicate the equilibrium predictions.

Informativeness: Random Posteriors

	Commitment (ρ)					
	20%		80%		100%	
Verifiable	0.86	(1.00)	0.78	(0.40)	0.69	(0.25)
	B	R	B	R	B	R
	0.05	0.91	0.07	0.85	0.10	0.80
Unverifiable	0.11	(0.00)	0.23	(0.25)	0.30	(0.25)
	B	R	B	R	B	R
	0.30	0.40	0.26	0.49	0.23	0.53

Informativeness: Random Posteriors

We confirm that senders understand how to exploit commitment.

Also, this shows under a different light that:

Observation 3.

The point prediction of V100 is further off than U100.

Redefining a Language (Theory)

What is going on in V100?

Full commitment, no lies.

Let's review equilibrium behavior in U100 and V100.

U100

		messages		
		r	b	n
Sates	R	100%	0	0
	B	50%	50%	0

V100

		messages		
		r	b	n
Sates	R	0	0	100%
	B	0	50%	50%

What is going on in V100?

Full commitment, no lies.

Let's see the aggregate data in U100 and V100.

U100

		messages r	messages b	messages n
Sates	R	74%	12%	14%
	B	44%	39%	17%

V100

		messages r	messages b	messages n
Sates	R	51%	0	49%
	B	0	58%	42%

Redefining a Language

What's going on?

- In V100, senders have to strategically hide "good news."
- In U100, senders have to strategically lie about "bad news."

Overall, senders get the former to a much lesser extent than the latter.

Local experimentation / Naive learning doesn't help them.

conclusions

Conclusions

We study the role of *rules* and *commitment* on informativeness.

- Present a simple framework nesting known models as special cases.
- We perform comparative statics **across** models.
- Look at communication models from a different perspective.

Preliminary Results:

- Commitment affects informativeness as predicted.
- Yet, substantial deviations in levels.
- Hiding good news is harder than the lying about bad ones.
- Rules matter more than commitment.

appendix

Informativeness: Correlation

Pearson Correlation index btw Ball and Guess. $\phi := \dfrac{n_{Rr}n_{Bb} - n_{Rb}n_{Br}}{\sqrt{n_R n_B n_r n_b}}$.

	$a = r$	$a = b$	
$\theta = R$	n_{Rr}	n_{Rb}	n_R
$\theta = B$	n_{Br}	n_{Bb}	n_B
	n_r	n_b	

where

$$n_{\theta,a} = \sum_{m \in M} \hat{\pi}(m|\theta)\sigma(a|m)$$

and

$$\hat{\pi}(m|\theta) := \rho\pi_C(m|\theta) + (1-\rho)\pi_U(m|\theta)$$

◁