

Lying Aversion and Vague Communication: An Experimental Study

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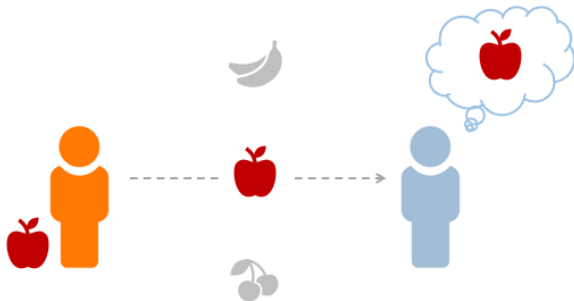
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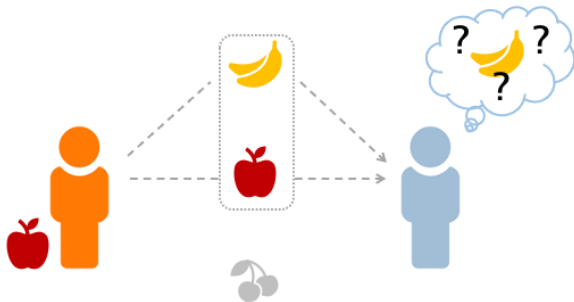
Vague communication



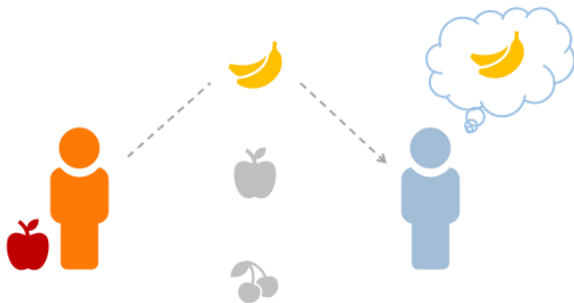
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Motivation

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Motivation

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- ▶ Strategic and behavioral aspects
 - ▶ Belief about the state of the world
 - ▶ Belief about how honest the sender is
 - ▶ Attitude toward different method or degree of misleading behavior
- ▶ Many applications: disclosure game, public-good provision game, ...

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1. The use of vague messages arises endogenously from the lying aversion.
 2. People prefer to be vague and truthful.

Preview of the results

- ▶ We present a model of information transmission with lying costs(guilt/reputation).
 - ▶ We test the theoretical predictions through an online experiment.
1. The use of vague messages arises endogenously from the lying aversion.
 2. People prefer to be vague and truthful.
 3. There exists a group of people who do not use vague messages even when that means they have to let go of potential monetary gain.

Literature

- ▶ Monetary vs non-monetary utility: Becker (JPE 1968)
- ▶ Psychological game: Geanakoplos, Pearce, and Stacchetti (GEB 1989)
- ▶ Signaling game: Crawford and Sobel (ECMA 1982)
- ▶ Rolling-a-die: Fischbacher and Föllmi-Heusi (JEEA 2013)
 - ▶ Abeler, Nosenzo, and Raymond (ECMA 2019)
 - ▶ Gneezy, Kajackaite, and Sobel (AER 2018)
 - ▶ Khlametski and Sliwka (AEJ Micro 2019)

▶ Rolling-a-die

Model

- ▶ A population of agents and one audience
- ▶ Each individual agent observes the state of the world i *i.i.d.* $Unif[\Omega]$ where $\Omega = \{1, 2, \dots, 10\}$
- ▶ The agent sends a message J after observing the true state of the world i .
- ▶ A message J is a non-empty subset of Ω .
 - ▶ A message J is truthful if $i \in J$, and is a lie otherwise.
 - ▶ A message is called precise if it is a singleton set, and vague otherwise.
- ▶ The agent receives the monetary payoff proportional to a number randomly drawn from her message.
 - ▶ Receives x for reporting a precise message x .
- ▶ One shot; no repeated interaction

Model: utility

- ▶ When the message is a lie ($i \notin J$) she incurs the internal cost of guilt
 - ▶ intrinsic aversion type $t \in [0, T]$ (fixed cost)
 - ▶ the size of the lie: $|i - \bar{j}|$ (variable cost)
- ▶ The agent also cares about her reputation
 - ▶ The audience is a rational Bayesian: $P(\text{honest}|J)$
- ▶ The agent's utility can be written by:

$$\begin{aligned} U(i, J, t) = & \text{monetary payoff}(J) \\ & - \mathbb{1}(i \notin J) \cdot \text{internal guilt}(|i - \bar{j}|, t) \\ & + \gamma \cdot \text{external reputation}(J) \end{aligned}$$

- ▶ A Bayesian equilibrium exists: Schmeidler 1973

Experiment design: precise vs vague

- ▶ Subjects first observe a random number between 1-10 on their web browser
- ▶ Subjects report the number to the experimenter by clicking boxes on screen.
- ▶ Two stages: within-subject analysis
 - ▶ Precise: can select only one box at a time
 - ▶ Vague: can select multiple boxes at a time
- ▶ Randomized order of the two stages

Experiment design: precise vs vague

The screenshot shows a web browser window displaying a Qualtrics survey preview. The browser's address bar shows the URL: https://usf1.as1.qualtrics.com/jfe/preview/SV_2ggP5vix8r0bNOPTQ_SurveyVersionID=current&.... The survey interface includes a header with a "Restart Survey" button, a "Place Bookmark" button, and a "Mobile view off" toggle. The main content area features the Washington University in St. Louis logo and the text "Stage 2". Below this, a question asks: "What number did you observe? Please select **one** number." The response options are a row of ten buttons labeled 1 through 10. At the bottom of the question area, there are two green buttons with left and right arrows. The footer of the survey area says "Powered by Qualtrics".

Restart Survey Place Bookmark Mobile view off Tools

Washington University in St. Louis

Stage 2

What number did you observe? Please select **one** number.

1 2 3 4 5 6 7 8 9 10

← →

Powered by Qualtrics

Experiment design: precise vs vague

The screenshot shows a web browser window with the Qualtrics URL: https://wustl.as1.qualtrics.com/jfe/preview/SV_2ggP5vix8r0bNOPTQ_SurveyVersionID=current&.... The survey is titled "Washington University in St. Louis" and is at "Stage 1".

Instructions: "What number did you observe? You may select a **set of numbers** by clicking multiple numbers. After you submit your selection, the computer will randomly choose one from the set of numbers you selected."

Response options: A row of ten buttons labeled 1 through 10.

Navigation: A green arrow pointing left and a green arrow pointing right.

Footer: "Powered by Qualtrics C"

Experiment design: anonymity

- ▶ Anonymity of agents: between-subject analysis
 - ▶ Identifiable: real name, student ID, video on
 - ▶ Anonymous: screen name, no student ID, video off
- ▶ Observability of the true state
 - ▶ Identifiable: the random number is generated outside the experiment software.
 - ▶ Anonymous: the random number is generated inside the software and the experimenter can observe the true state.

Experiment design: treatments

	Identifiable & Unobs.	Anonymous & Obs.
Precise	IP	AP
Vague	IV	AV

- ▶ two dimensions, four treatments
- ▶ Online environment: zoom meetings for the instructions, Qualtrics for the main experiment

Hypotheses

Hypothesis 1 (IP-AP).

Under the precise (restricted) communication,

- i. *more agents lie in the anonymous environment: $lie_{IP} \leq lie_{AP}$;*
 - ii. *agents earn more monetary payoff on average in the anonymous environment: $earning_{IP} \leq earning_{AP}$.*
- Intuition: place an agent in two different games. The agent should feel more comfortable to lie when there is no reputation concern.

Hypotheses

Hypothesis 2.

In the AV environment,

- i. all truth-tellers in AV uses optimal vague messages:
 $\{i, x^*, x^* + 1, \dots, 10\}$;*
 - ii. no message contains a number less than the true observation;*
 - iii. no precise message except $\{10\}$ is truthful.*
- Intuition: if one feels the internal guilt only when the message is a lie, the agent's problem becomes a comparison between constrained vs unconstrained optimization problem: $\max_{j: i \in J} U(i, j, t)$ vs $\max_j U(i, j, t)$

Hypotheses

Hypothesis 3 (AP-AV).

In the anonymous environment,

- i. *more agents lie when the communication is restricted (precise): $lie_{AP} \geq lie_{AV}$;*
- ii. *an agent who is truthful in AP is also truthful in AV conditional on the same observation;*
- iii. *some agents who lie in AP reports truthfully in AV conditional on the same observation;*
- iv. *agents earn more monetary payoff on average when the communication is not restricted (vague): $earning_{AP} \leq earning_{AV}$;*

Hypotheses

Hypothesis 4.

In both the IV and the AV environment, people use vague messages.

- ▶ Intuition:
 - ▶ AV: straightforward from the use of optimal vague messages
 - ▶ IV: proof by contraposition; some type of agents benefit by using a truthful and vague message.

Hypotheses

Hypothesis 5 (Conjecture).

- i. *Under the vague (unrestricted) communication, agents earn more monetary payoff on average in the anonymous environment: $\text{earning}_{IV} \leq \text{earning}_{AV}$;*
- ii. *In the identifiable environment, agents earn more monetary payoff on average when the communication is not restricted (vague): $\text{earning}_{IP} \leq \text{earning}_{IV}$;*

Data Summary

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

- ▶ 69 subjects recruited.
- ▶ 4 Anonymous sessions and 7 Identifiable sessions, with the average size of 8.3 and 5.1 participants in each session, respectively.
- ▶ Each session lasted approximately 30 minutes.
- ▶ Subjects received \$9.46 on average, including \$2 show-up fee

Result 1: IP-AP

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
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Hypothesis 1 (IP-AP).

Under the precise (restricted) communication,

- i. ~~agents lie in the anonymous environment: $lie_{IP} \leq lie_{AP}$;~~
- ii. *agents earn more monetary payoff on average in the anonymous environment: $earning_{IP} \leq earning_{AP}$.*
 - ▶ *Under the precise (restricted) communication, participants reported higher in the anonymous environment.*
 - ▶ *The one-sided t-test is not very significant: p-value = 0.3876*

Result 2: AV

Hypothesis 2.

In the AV environment,

- i. *all truth-tellers in AV uses optimal vague messages:*
 $\{i, x^*, x^* + 1, \dots, 10\}$;
 - ▶ 44.4% (12 of 27) of truth-tellers used OVM, 18.5% (5 of 27) used a pair of the true observation and 10, and 33.3% (9 of 27) used a precise message
- ii. *no message contains a number less than the true observation;*
 - ▶ only 1 out of 33 participant included a number less than the true observation in the report
- iii. *no precise message except $\{10\}$ is truthful.*
 - ▶ all precise messages (except $\{10\}$) were truthful

Result 3: AP-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 3 (AP-AV).

In the anonymous environment,

- i. *more agents lie when the communication is restricted (precise):*

$$lie_{AP} \geq lie_{AV};$$

- ▶ *more participants lied when the communication is restricted*
(*p-value = 0.006*)

Result 3: AP-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 3 (AP-AV).

In the anonymous environment,

- ii. *an agent who is truthful in AP is also truthful in AV conditional on the same observation;*
 - ▶ *participants reported higher on average when the communication is not restricted (p -value = 0.005)*

Result 3: AP-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 3 (AP-AV).

In the anonymous environment,

- iii. *some agents who lie in AP reports truthfully in AV conditional on the same observation;*
 - ▶ *all participants who were truthful in AP remained truthful in AV*

Result 3: AP-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
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Hypothesis 3 (AP-AV).

In the anonymous environment,

- iv. *agents earn more monetary payoff on average when the communication is not restricted (vague): $\text{earning}_{AP} \leq \text{earning}_{AV}$;*
 - ▶ *6 out of 12 liars in AP reported switches to truthful messages in AV despite lower expected monetary payoff*

Result 4: IV-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 4.

In both the IV and the AV environment, people use vague messages.

- ▶ In the IV environment, 25 out of 36 participants (69.4%) used a vague message.
- ▶ In the AV environment, 18 out of 33 participants (54.5%) used a vague message.
- ▶ More people use vague messages in IV, and the size of the vague message is also larger in IV.

Result 5-1: IV-AV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 5.

- i. *Under the vague (unrestricted) communication, agents earn more monetary payoff on average in the anonymous environment: $earning_{IV} \leq earning_{AV}$;*
- ▶ The result supports Hypothesis 5-1.
 - ▶ However, the one-sided t-test is inconclusive with a p-value of 0.4154.

Result 5-2: IP-IV

	Average Report		Lie		Size	N
	Precise	Vague	Precise	Vague		
Identifiable	6.556	8.208			3.72	36
Anonymous	6.788	8.285	12 (36.36%)	6 (18.18%)	3.06	33

Hypothesis 5.

- ii. *In the identifiable environment, agents earn more monetary payoff on average when the communication is not restricted (vague): $earning_{IP} \leq earning_{IV}$;*
- ▶ The result supports Hypothesis 5-2.
 - ▶ The one-sided t-test is significant with a p-value of 0.0098.

Concluding remarks

- ▶ The vagueness of a message only costs the reputation and does not affect the internal cost of lying.
- ▶ The use of vague messages endogenously arises from the lying aversion.
- ▶ Overall, participants reported much higher on average when the vague communication is allowed.
- ▶ Some portion of the observed aversion for monetary-payoff-maximization in previous experiments could be attributed to the restriction on the message space.
- ▶ Analogous to the “warm glow” giving: as long as they can signal that their goodwill, no extra cost seems necessary.

Concluding remarks

- ▶ The existence of precise truth-tellers in the anonymous environment
- ▶ A possible alternative: the existence of another motivation for truth-telling
- ▶ A concern for accuracy or a concern for the self-image of good intention?

Work in progress

- ▶ likelihood estimation for the lying probability in the identifiable environments
- ▶ a possible concern for a meta-game: are the precise and the vague treatments independent?

1. a logit regression:

$$\text{lie}_{AV} = \begin{cases} 1 & \text{if } \beta_0 + \beta_1\theta_{AV} + \beta_2\theta_{AP} + \beta_3\text{lie}_{AP} + \epsilon > 0 \\ 0 & \text{otherwise.} \end{cases}$$

2. order of the precise / vague treatments

- ▶ better characterization of the equilibria in the identifiable environments

Thank you!

For more information, please visit <https://kehkuansun.github.io>
or email me at sun.k@wustl.edu.

Rolling-a-die experiment



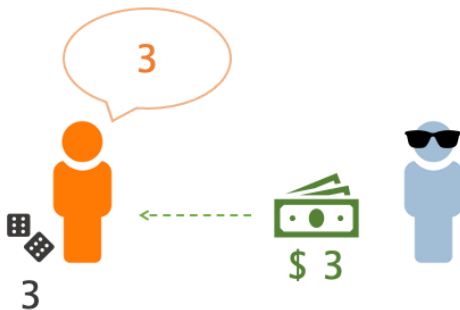
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