The Informational Theory of Legislative Committees: An Experimental Analysis

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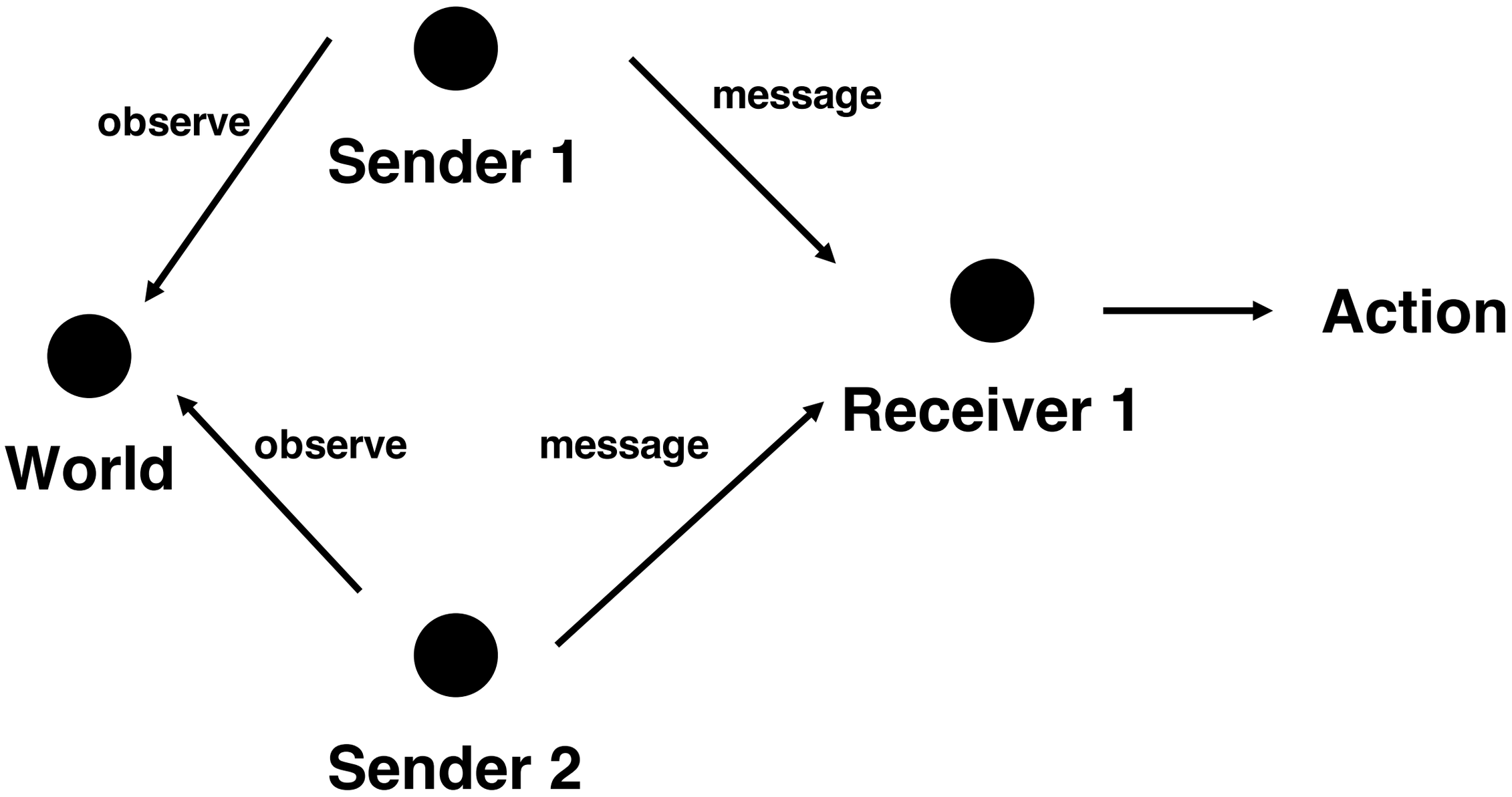
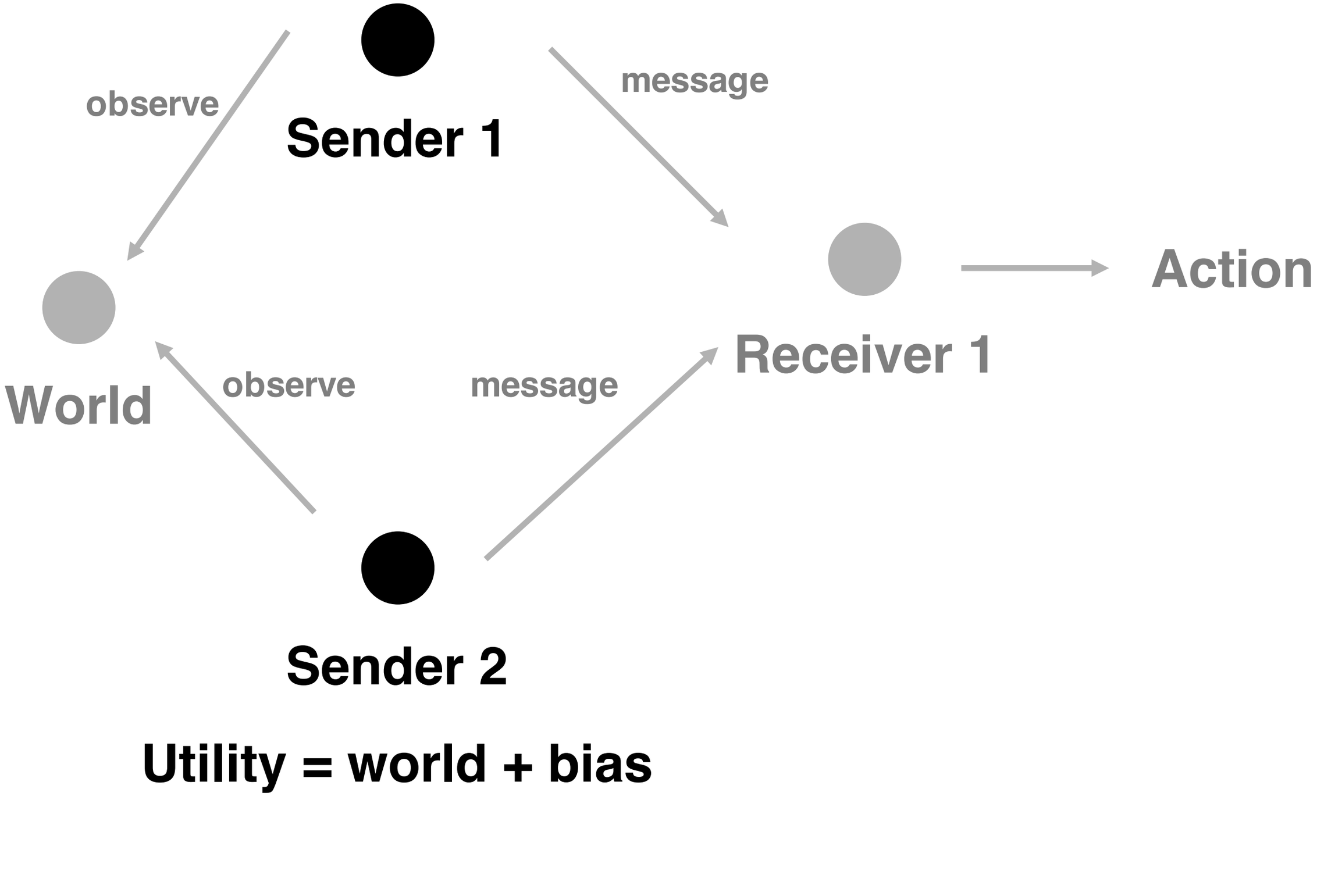
Agenda

- Research model set up
- Model prediction
- Experimental Design and procedure
- Outcome and findings

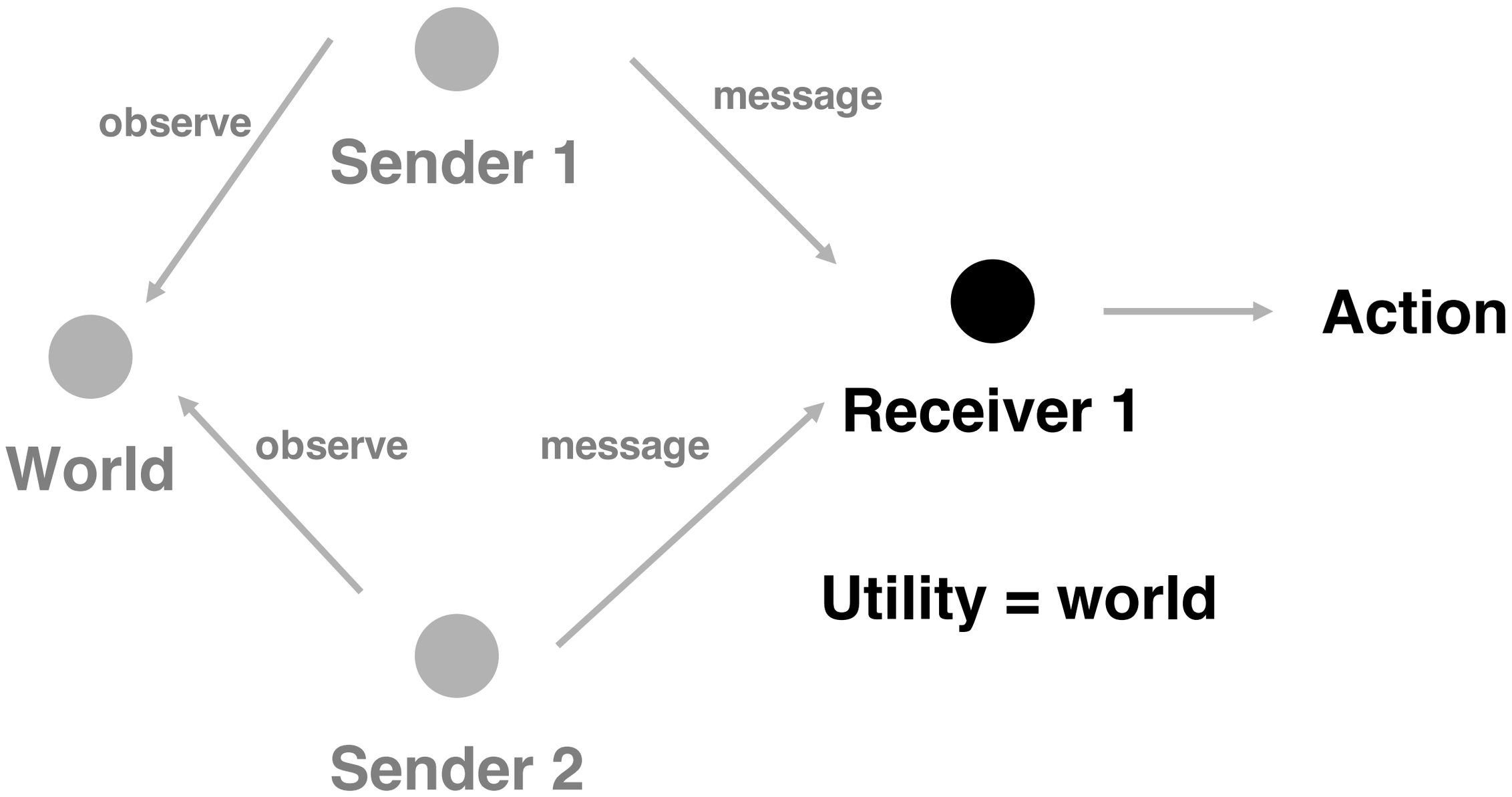
model set up

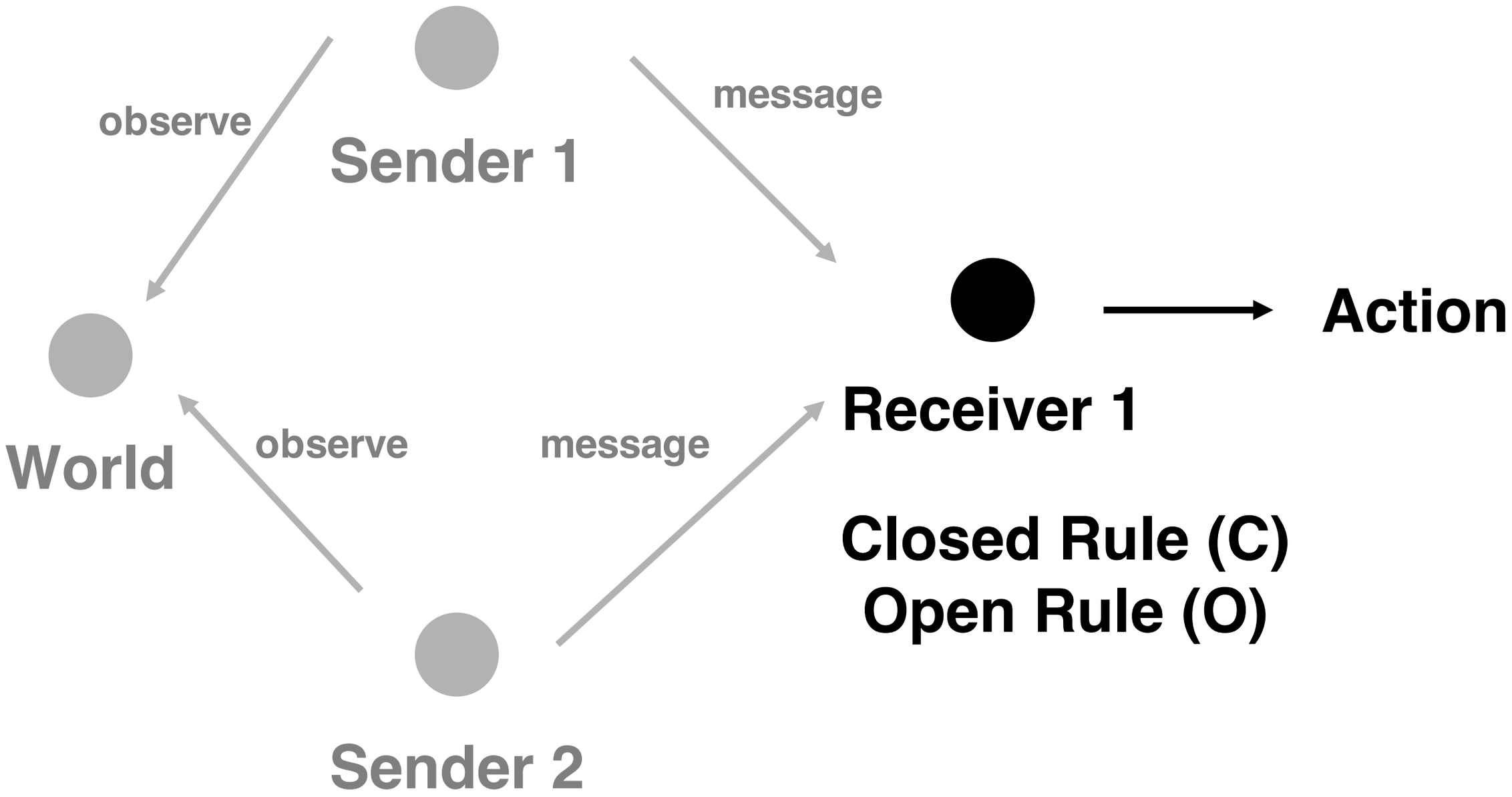

observe
Sender 1
message
Action
World
observe
message
Receiver 1
Sender 2

Utility = world - bias



Utility = world + bias


observe
Sender 1
message
Action
World
observe
message
Receiver 1
Utility = world
Sender 2



Closed Rule (C)
Open Rule (O)

model prediction

Result 1.

bias ↑ ⟶ all payoff ↓

by GK

where bias [0,1/4]. under open rule

bias ↑ ⟶ sender payoff ↓

receiver payoff ⟷

where bias [0,1/4]. under open rule

by KM

bias ↑ ⟶ all payoff ↓

by both

where bias [0,1/4]. under close rule

Result 2.

sender * 2 → **all payoff >**

sender * 1 **all payoff** **by both**

when sender's bias are heterogeneous

X(world) = a(world) - world

E(U) = - Var(X(world)) - (E(X(world)))^2

Dist. Eff. Info Eff.

Dist. Eff.-> opposite of expected value

Info Eff.-> opposite of variance

Result 3. by GK

close rule → receiver info eff. >

open rule → receiver info eff.

bias ↑ → receiver info eff. ↓

when b [0,1/4]

note: info efficiency -> opposite of variance

Result 3. by GK

open rule → receiver dist. eff. >

close rule → receiver dist. eff.

receiver dist. eff. = 0

when b [0,1/4]. under open rule

bias ↑ → dist. eff. ↑

& is positive

where bias [0,1/4]. under close rule

note: distributional efficiency -> opposite of expected value

Result 4. by KM

open rule → **receiver info eff. >**

close rule → **receiver info eff.**

receiver info eff. = 0

when b [0,1/4]. under open rule

receiver info eff. != 0

under close rule

note: info efficiency -> opposite of variance

Result 4. by KM

receiver dist. eff. = 0

when b [0,1/4]. under both rule

note: distributional efficiency -> opposite of expected value

Experimental Design and Procedure

Experimental Design

- The state space, the message space, the action space -> [0.00, 100.00]
- 6 treatments with biases of b = 10 and 20

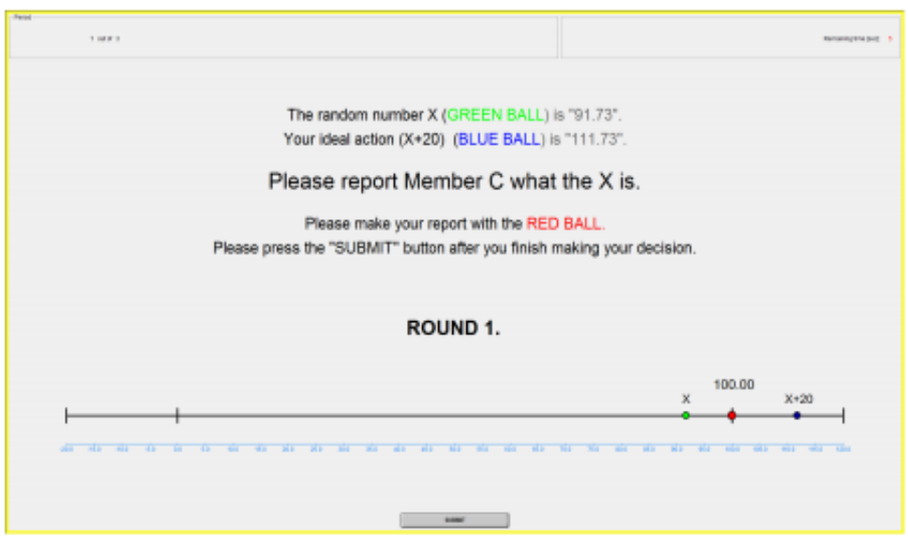
b = 10/ b =20	Two Senders	One Senders
Open rule	*O-2*	*O-1*
Closed rule	*C-2*	*N/A*

- Between-subject design and random matching were used

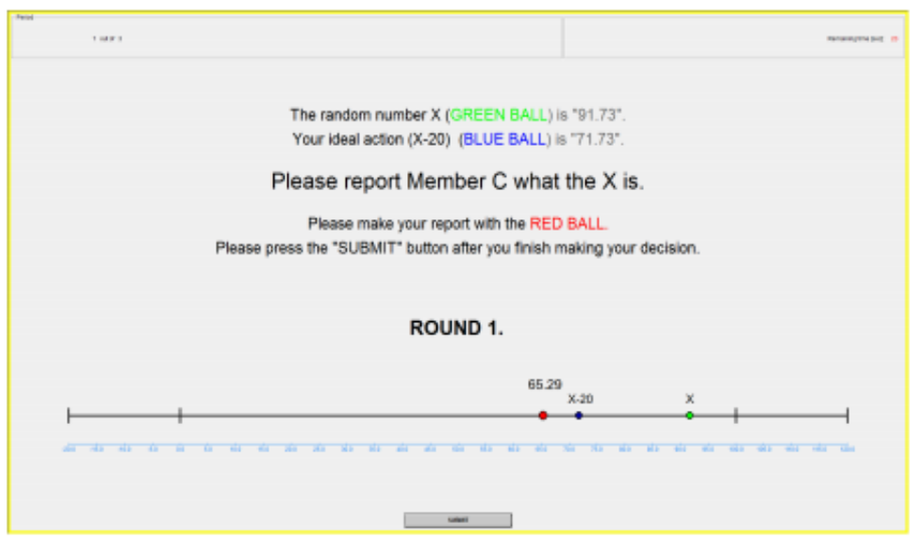
Experimental Procedure

- 1 practice round and 30 official rounds

- Open Rule -- After revealed the instruction, Sender 1 (Member A), sender 2 (Member B) would need to report numbers according to their ideal action on the screen.



(a) Member A's Screen



(b) Member B's Screen

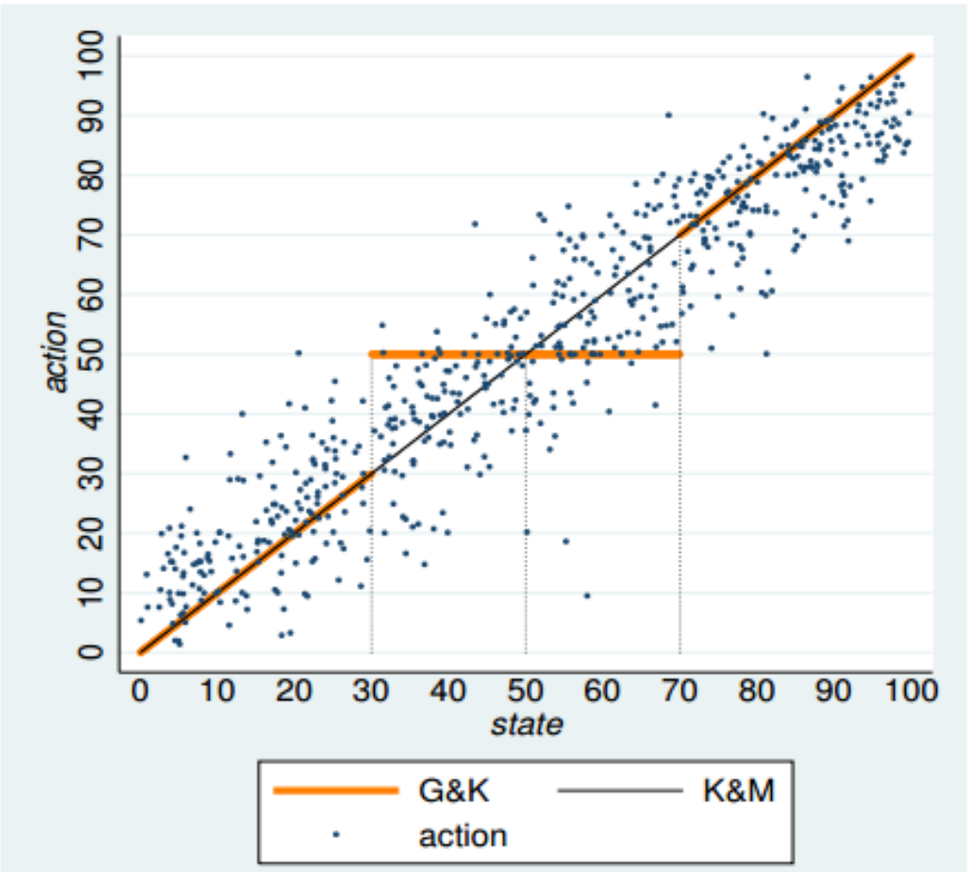
Experimental Procedure

- Open Rule -- Receiver (Member C) made action according to the reports from Member A and Member B
- Close Rule -- After revealed the instruction, Sender 2 (Member B) would need to report interval message instead

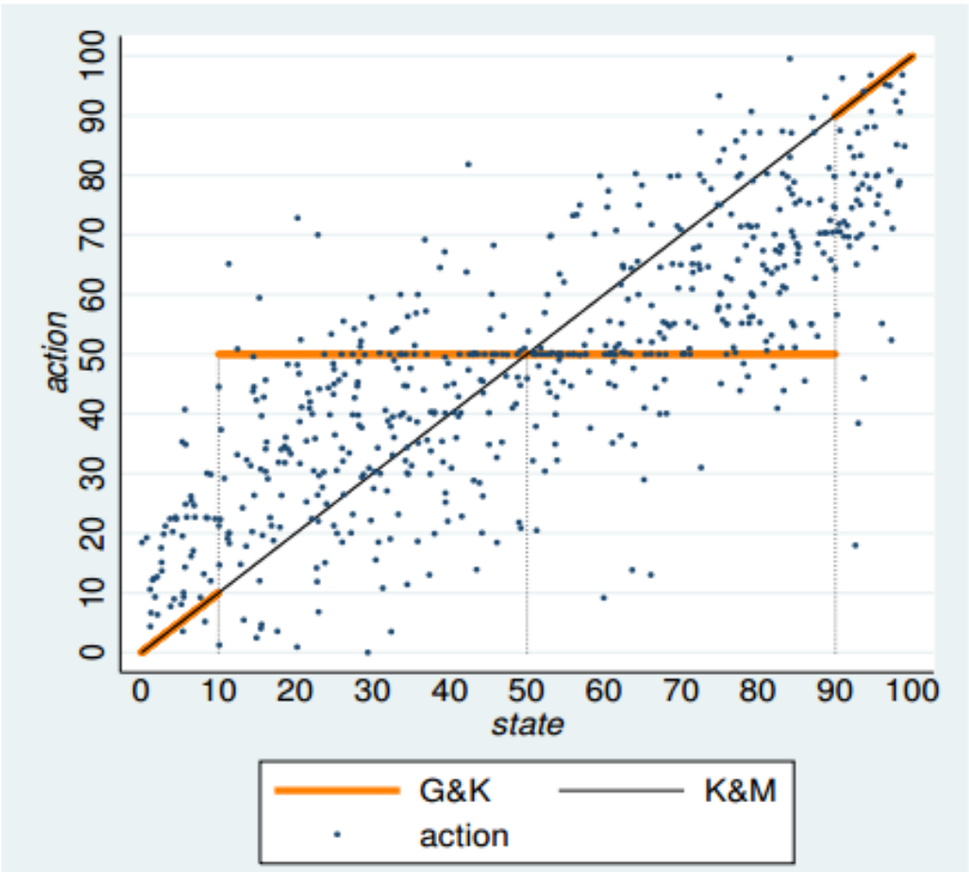
Outcome and Findings

Open rule and 2 senders

with different biases



(a) $b = 10$

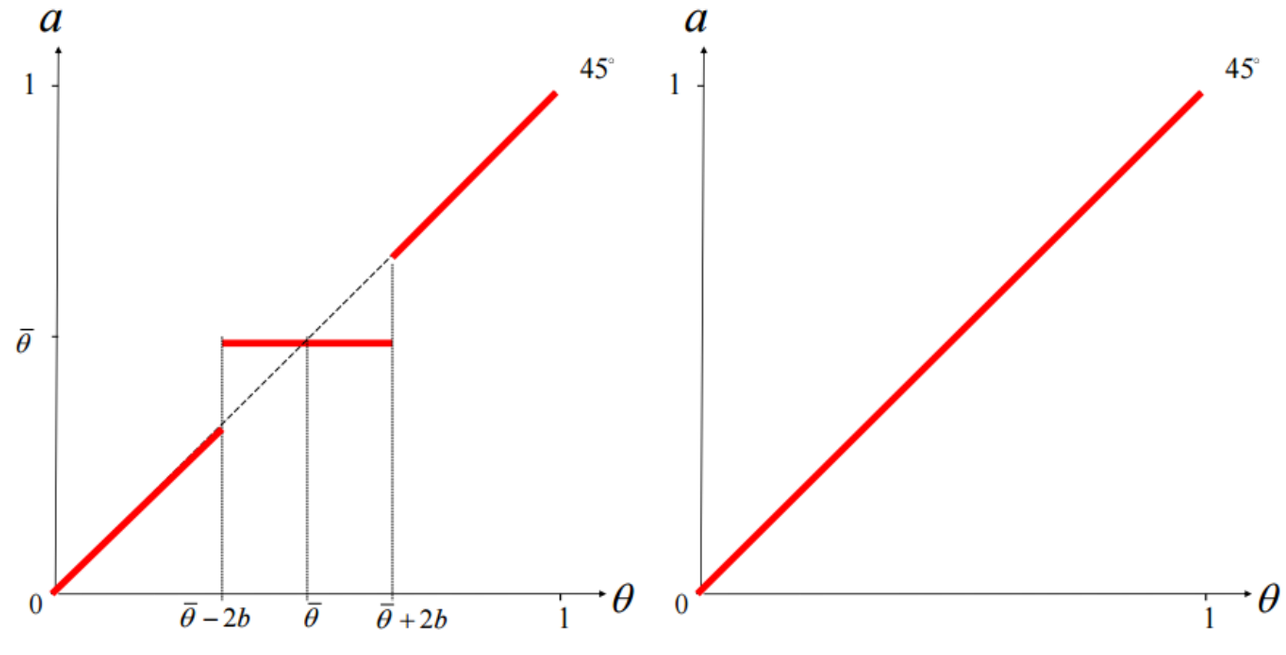


(b) $b = 20$

Open Rule and 2 Senders with different biases

- The receivers' action was positively correlated with the state as in both Gilligan and Krehbiel [1989] and Krishna and Morgan [2001]

- Evidence of pooling for states near E(θ) as predicted by Gilligan and Krehbiel [1989], especially for b = 20



(a) Gilligan and Krehbiel [1989]

(b) Krishna and Morgan [2001]

Open rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
	O-2 ($b = 10$)		
1	−0.03	−100.80	−100.83
2	−0.58	−121.40	−121.97
3	−1.02	−70.41	−71.43
4	−2.56	−80.89	−83.45
Mean	−1.05	−93.37	−94.42
	O-2 ($b = 20$)		
1	−5.18	−280.71	−285.89
2	−8.30	−243.57	−251.87
3	−0.07	−398.26	−398.33
4	−12.96	−280.55	−293.51
Mean	−6.63	−300.77	−307.40

Significant ↑ in receivers' payoff => **GK prediction** ✔

Open rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
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4	−12.96	−280.55	−293.51
Mean	−6.63	−300.77	−307.40

Significant ↓ in informational inefficiency
=> **GK prediction ✔**

Open rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
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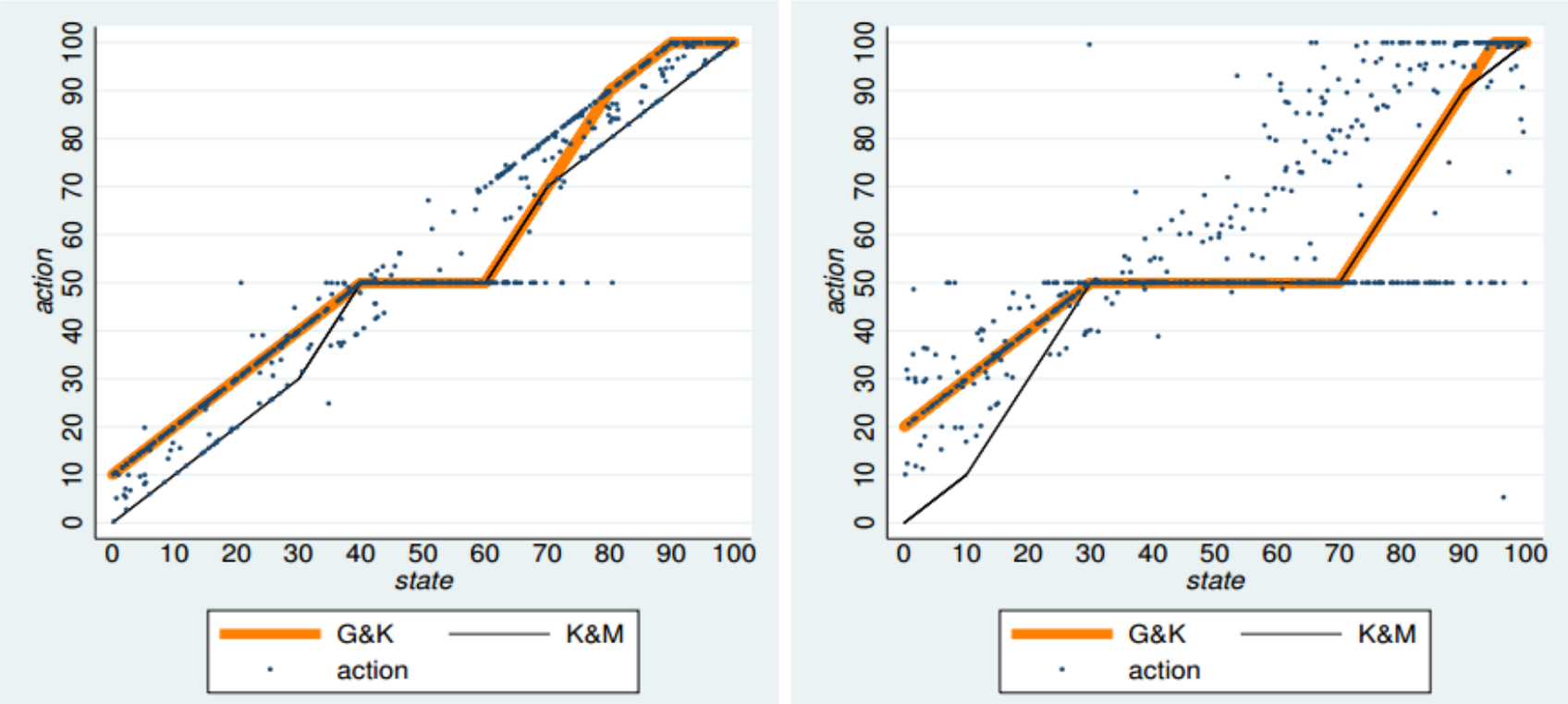
Mean	−6.63	−300.77	−307.40

Not Significant ↓ in distributional inefficiency

⇒ **GK prediction ✘**

⇒ **KM prediction ✘**

Close rule and 2 senders with different biases



(a) $b = 10$ (b) $b = 20$

Close rule and 2 senders with different biases

- Sender 1s' proposals were adopted in more extreme states, $\theta \in [0, 40) \cup (60,100]$ for b = 10 and $\theta \in [0, 30) \cup (75,100]$ for b = 20

- The status quo 50 was chosen in intermediate states,

$\theta \in [40,60]$ for b = 10 and $\theta \in [30,75]$ for b = 20

- For states $\theta \in [60,80]$ for b = 10 and $\theta \in [75,95]$ for b = 20 , the receivers mixed between Sender 1s' proposals and the status quo

Close rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
		C-2 ($b = 10$)	
1	−27.29	−42.20	
2	−30.16	−49.48	
3	−22.91	−52.76	
4	−30.83	−44.38	
Mean	−27.80	−47.20	
		C-2 ($b = 20$)	
1	−31.08	−449.05	
2	−13.68	−287.98	−301.66
3	−118.33	−190.54	−308.87
4	−57.36	−256.85	−314.21
Mean	−55.11	−296.11	−351.22

All > 0

⇒**GK prediction ✔**

⇒**KM prediction ✘**

Close rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
	C-2 ($b = 10$)		
1	−27.29	−42.20	−69.49
2	−30.16	−49.48	−79.64
3	−22.91	−52.76	−75.67
4	−30.83	−44.38	−75.21
Mean	−27.80	−47.20	−75.00
	C-2 ($b = 20$)		
1	−31.08	−449.05	−480.13
2	−13.68	−287.98	−301.66
3	−118.33	−190.54	−308.87
4	−57.36	−256.85	−314.21
Mean	−55.11	−296.11	−351.22

Significant ↑ in receivers' payoff

=> **GK prediction**

✔

⇒ **KM prediction**

✔

Close rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
		C-2 ($b = 10$)	
1	−27.29	−42.20	−69.49
2	−30.16	−49.48	−79.64
3	−22.91	−52.76	−75.67
4	−30.83	−44.38	−75.21
Mean	−27.80	−47.20	−75.0
		C-2 ($b = 20$)	
1	−31.08	−449.05	−480.13
2	−13.68	−287.98	−301.66
3	−118.33	−190.54	−308.87
4	−57.36	−256.85	−314.21
Mean	−55.11	−296.11	−351.22

Significant ↓ in informational efficiency

=> **GK prediction ✔**

⇒ **KM prediction ✔**

Close rule and 2 senders with different biases

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
		C-2 ($b = 10$	
1	−27.29	−42.20	
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4	−57.36	−256.85	
Mean	−55.11	−296.11	−351.22

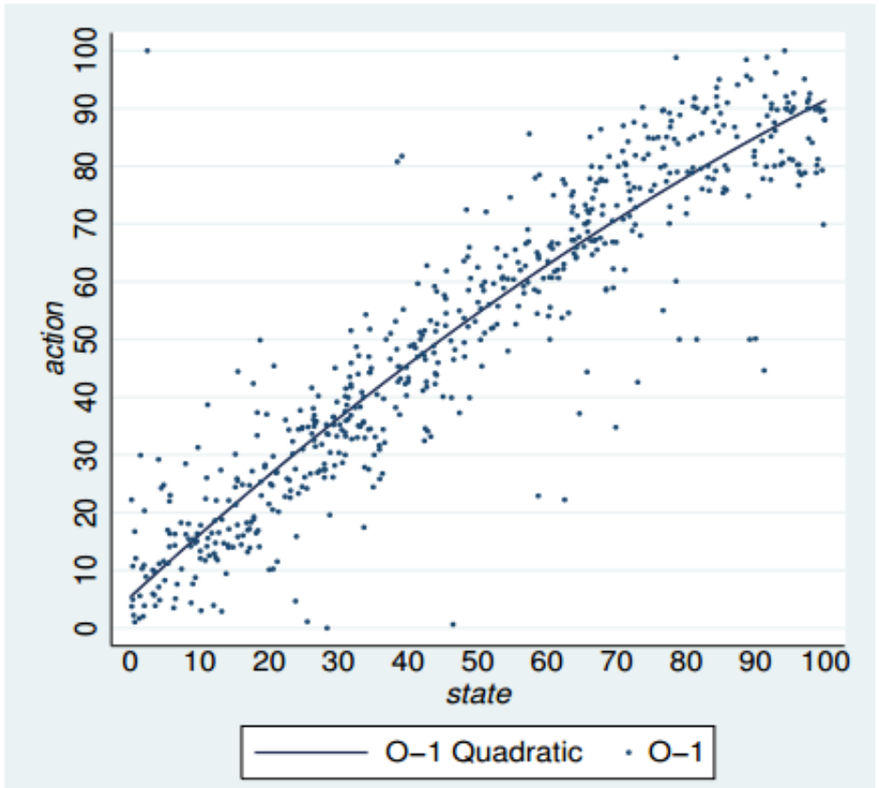
Not Significant ↓↑ in distributional inefficiency

⇒ **GK prediction ✘**

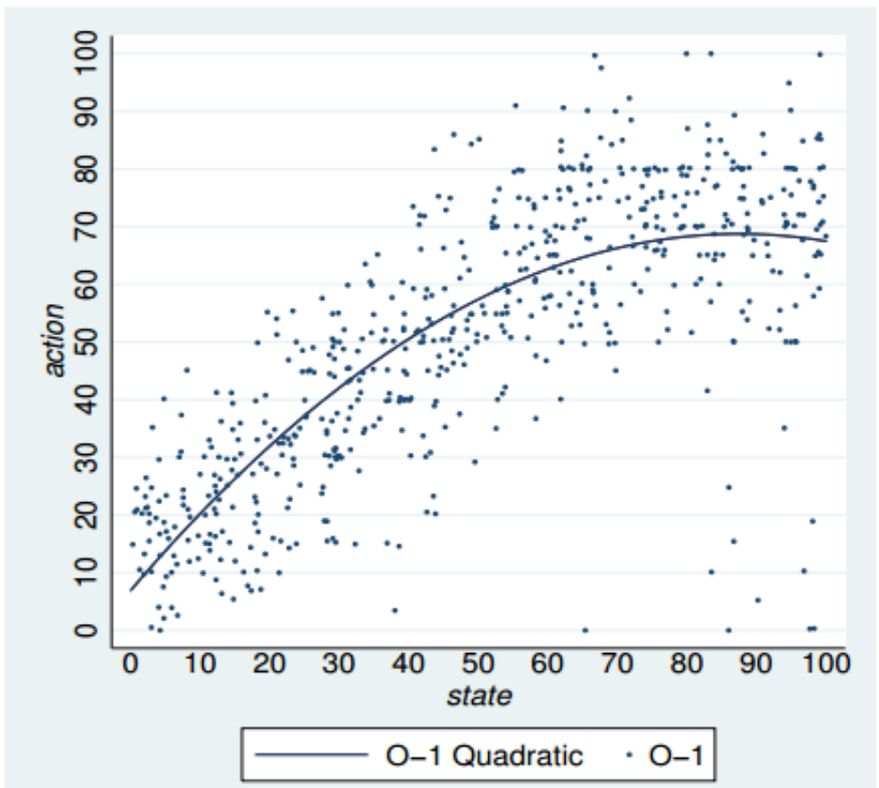
⇒ **KM prediction ✔**

Open rule and 1 sender

- Overcommunication



b = 10



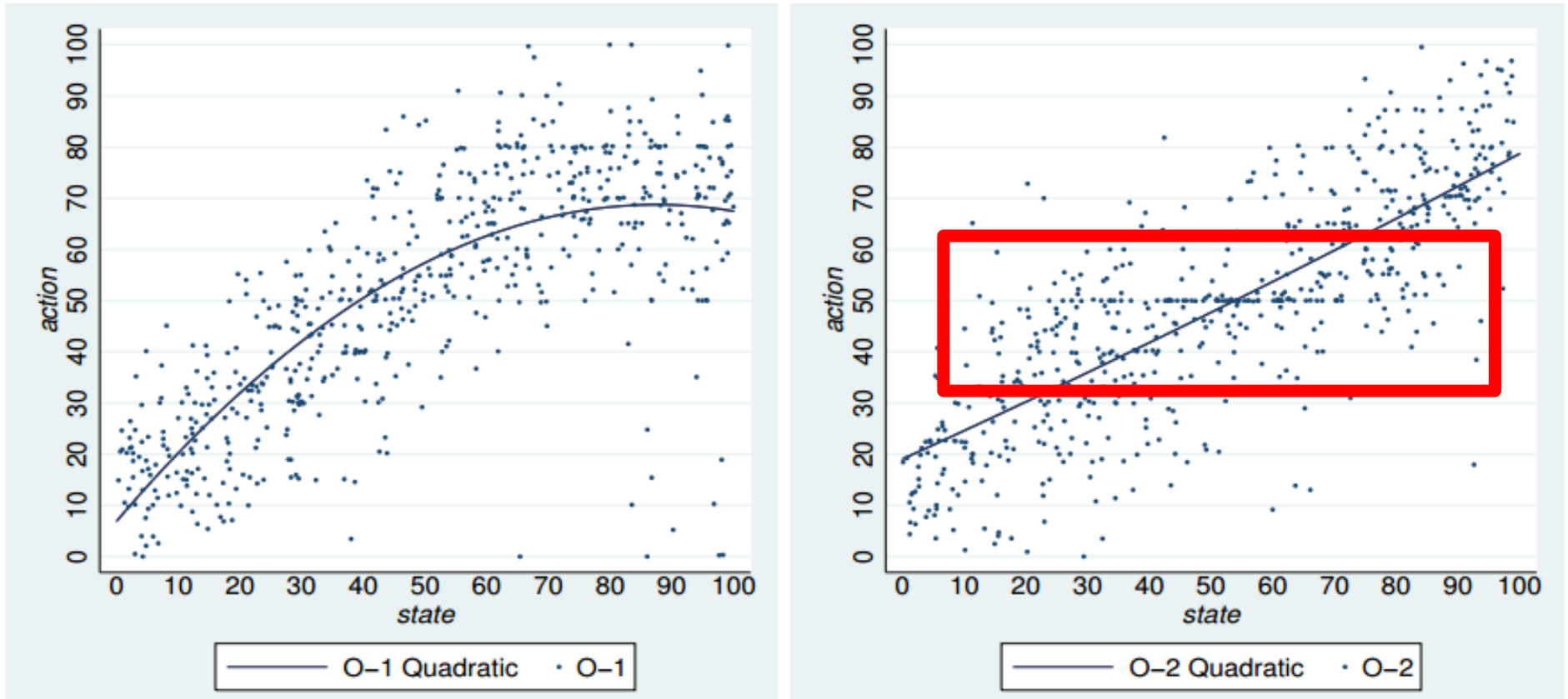
b = 20

O-1 vs *O-2*

Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receiver's Payoffs
	O-2 ($b = 10$)			*O-1* ($b = 10$)	
−0.03	−100.80	−100.83	−5.50	−82.61	−88.10
−0.58	−121.40	−121.97	−17.30	−131.35	−148.65
−1.02	−70.41	−71.43	−1.15	−205.85	−207.00
−2.56	−80.89	−83.45	−14.14	−78.58	−92.73
−1.05	−93.37	−94.42	−9.52	−124.60	−134.12
	O-2 ($b = 20$)			*O-1* ($b = 20$)	
−5.18	−280.71	−285.89	−10.50	−335.38	−345.43
−8.30	−243.57	−251.87	−7.64	−518.19	−525.83
−0.07	−398.26	−398.33	−0.00	−334.95	−334.95
−12.96	−280.55	−293.51	−5.21	−320.90	−326.11
−6.63	−300.77	−307.40	−5.72	−377.36	−383.08

No significant difference

O-1 vs *O-2*

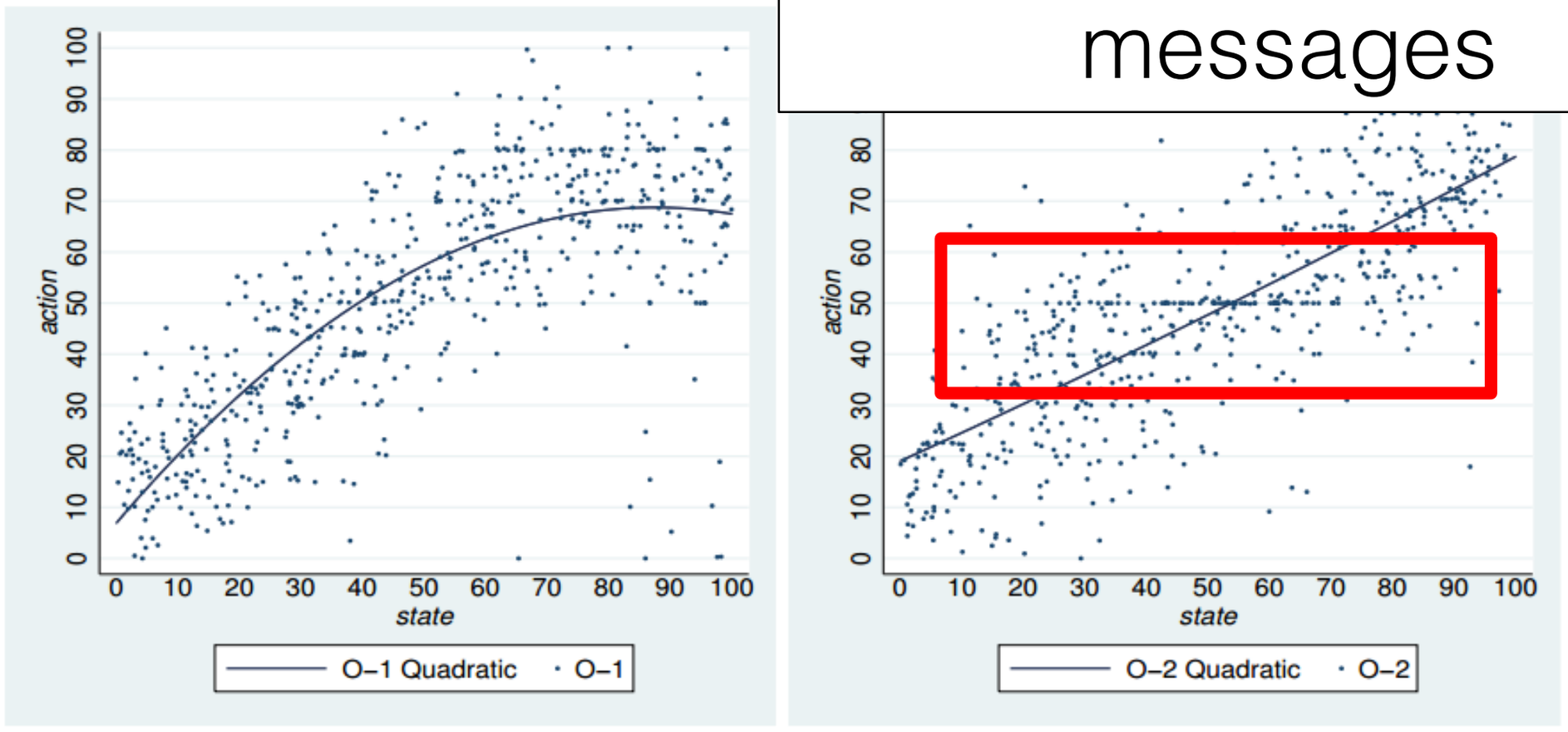


(a) *O-1* (b) *O-2*

Figure 6: Information Transmission in *O-2* and *O-1* for $b = 20$

O-1 vs *O-2*

two conflicting messages



(a) *O-1* (b) *O-2*

Figure 6: Information Transmission in *O-2* and *O-1* for $b = 20$

C-2 vs *O-1*

Close rule had greater distributional inefficiency

⇒ **GK prediction ✔**

Dist. Eff $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
	C-2 ($b = 10$)				
−27.29	−42.20	−69.49	−5.50	−82.61	−88.10
−30.16	−49.48	−79.64	−17.30	−131.35	−148.65
−22.91	−52.76	−75.67	−1.15	−205.85	−207.00
−30.83	−44.38	−75.21	−14.14	−78.58	−92.73
−27.80	−47.20	−75.00	−9.52	−124.60	−134.12
	C-2 ($b = 20$)			*O-1* ($b = 20$)	
−31.08	−449.05	−480.13	−10.50	−335.38	−345.43
−13.68	−287.98	−301.66	−7.64	−518.19	−525.83
−118.33	−190.54	−308.87	−0.00	−334.95	−334.95
−57.36	−256.85	−314.21	−5.21	−320.90	−326.11
−55.11	−296.11	−351.22	−5.72	−377.36	−383.08

C-2 vs *O-1*

Information inefficiency:
C-2 < O-1 only for b=10

Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receiver's Payoffs
	C-2 ($b = 10$)			*O-1* ($b = 10$)	
−27.29	−42.20	−69.49	−5.50	−82.61	−88.10
−30.16	−49.48	−79.64	−17.30	−131.35	−148.65
−22.91	−52.76	−75.67	−1.15	−205.85	−207.00
−30.83	−44.38	−75.21	−14.14	−78.58	−92.73
−27.80	−47.20	−75.00	−9.52	−124.60	−134.12
	C-2 ($b = 20$)			*O-1* ($b = 20$)	
−31.08	−449.05	−480.13	−10.50	−335.38	−345.43
−13.68	−287.98	−301.66	−7.64	−518.19	−525.83
−118.33	−190.54	−308.87	−0.00	−334.95	−334.95
−57.36	−256.85	−314.21	−5.21	−320.90	−326.11
−55.11	−296.11	−351.22	−5.72	−377.36	−383.08

C-2 vs *O-1*

Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receiver's Payoffs
	C-2 ($b = 10$)			*O-1* ($b = 10$)	
−27.29	−42.20	−69.49	−5.50	−82.61	−88.10
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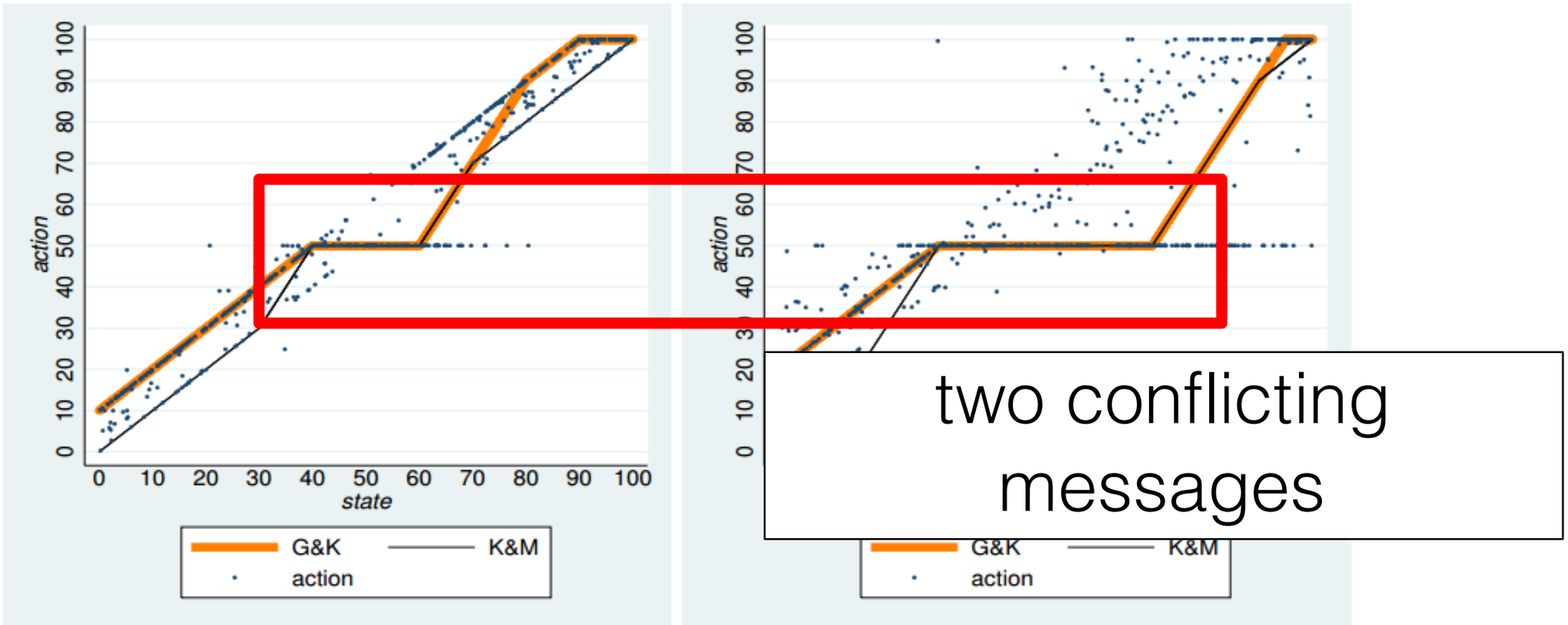
−118.33	−190.54	−308.87	−0.00	−334.95	−334.95
−57.36	−256.85	−3			.11
−55.11	−296.11	−3			.08

Close rule have greater receivers' average payoff only for b=10

C-2 vs *O-1*



(a) $b = 10$ (b) $b = 20$

Figure 4: Information Transmission in *C-2*

O-2 vs *C-2*

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
		C-2 ($b = 10$)			*O-2* ($b = 10$)	
1	−27.29	−42.20	−69.49	−0.03	−100.80	−100.83
2	−30.16	−49.48	−79.64	−0.58	−121.40	−121.97
3	−22.91	−52.76	−75.67	−1.02	−70.41	−71.43
4	−30.83	−44.38	−75.21	−2.56	−80.89	−83.45
Mean	−27.80	−47.20	−75.00	−1.05	−93.37	−94.42
		C-2 ($b = 20$)			*O-2* ($b = 20$)	
1	−31.08	−449.05	−480.13	−5.18	−280.71	−285.89
2	−13.68	−287.98	−301.66	−8.30	−243.57	−251.87
3	−118.33	−190.54	−308.87	−0.07	−398.26	−398.33
4	−57.36	−256.85	−314.21	−12.96	−280.55	−293.51
Mean	−55.11	−296.11	−351.22	−6.63	−300.77	−307.40

Close rule had greater distributional inefficiency

⇒ **GK prediction ✔**

O-2 vs

The open rule was more informationally inefficient **but not as much as expected**

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' P	Dist. Eff.	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
		C-2 ($b = 10$)			*O-2* ($b = 10$)	
1	−27.29	−42.20	−69.49	03	−100.80	−100.83
2	−30.16	−49.48	−79.64	58	−121.40	−121.97
3	−22.91	−52.76	−75.67	02	−70.41	−71.43
4	−30.83	−44.38	−75.21	56	−80.89	−83.45
Mean	−27.80	−47.20	−75.00	05	−93.37	−94.42
		C-2 ($b = 20$)			*O-2* ($b = 20$)	
1	−31.08	−449.05	−480.13	8	−280.71	−285.89
2	−13.68	−287.98	−301.66	0	−243.57	−251.87
3	−118.33	−190.54	−308.87	7	−398.26	−398.33
4	−57.36	−256.85	−314.21	06	−280.55	−293.51
Mean	−55.11	−296.11	−351.22	3	−300.77	−307.40

Significant!

>

>

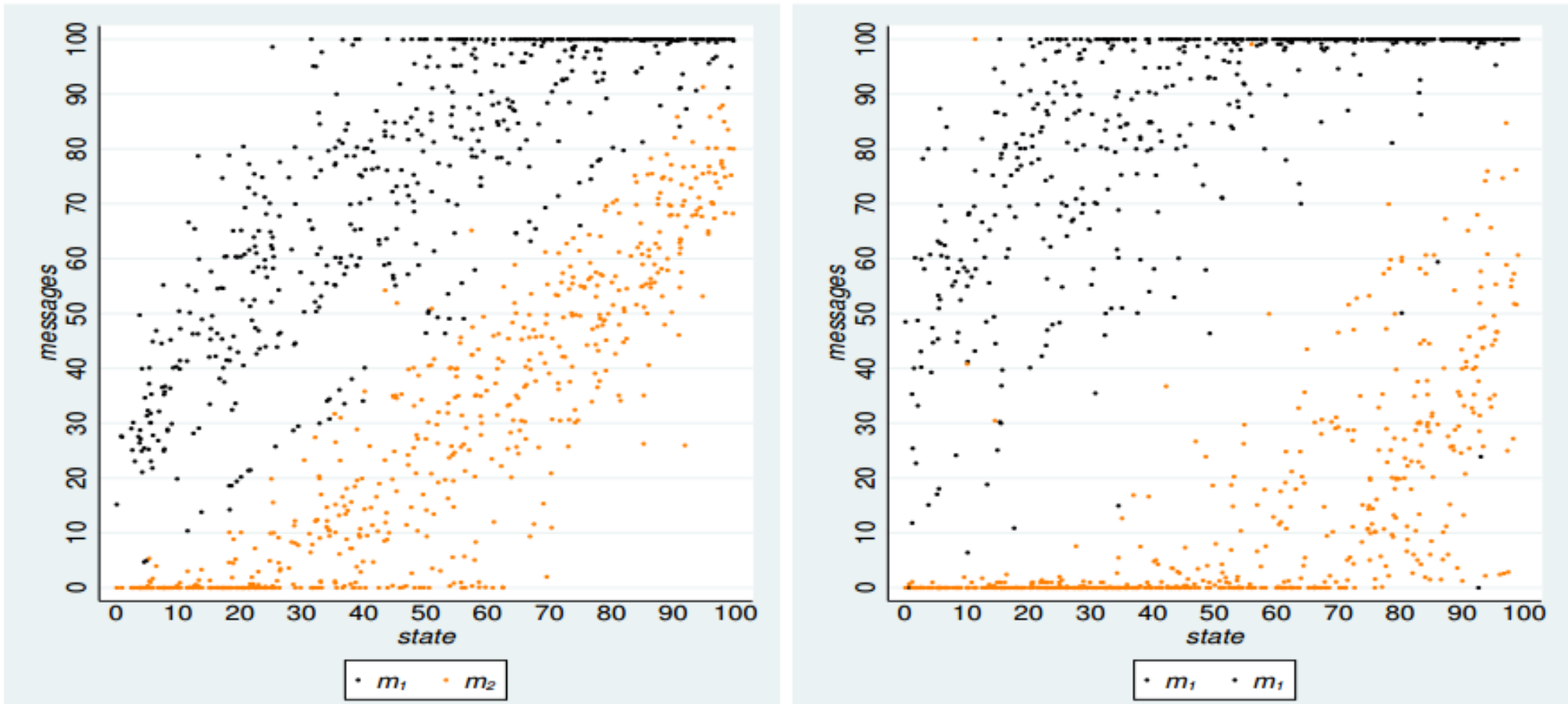
But not significant

O-2 vs *C-2*

Session/ Matching Group	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs	Dist. Eff. $-(EX(\theta))^2$	Info. Eff. $-Var(X(\theta))$	Receivers' Payoffs
	C-2 ($b = 10$)			*O-2* ($b = 10$)		
1	−27.29	−42.20	−69.49	−0.03	−100.80	−100.83
2	−30.16	−49.48	−79.64	−0.58	−121.40	−121.97
3	−22.91	−52.76	−75.67	−1.02	−70.41	−71.43
4	−30.83	−44.38	−75.21	−2.56	−80.89	−83.45
Mean	−27.80	−47.20	−75.00	−1.05	−93.37	−94.42
	C-2 ($b = 20$)			*O-2* ($b = 20$)		
1	−31.08	−449.05	−480.13	−5.18	−280.71	−285.89
2	−13.68	−287.98	−301.66	−8.30	−243.57	−251.87
3	−118.33	−190.54	−308.87	−0.07	−398.26	−398.33
4	−57.36	−256.85	−314.21	−12.96	−280.55	−293.51
Mean	−55.11	−296.11	−351.22	−6.63	−300.77	−307.40

The receivers' payoff differences between the open and the closed rules were not statistically significant

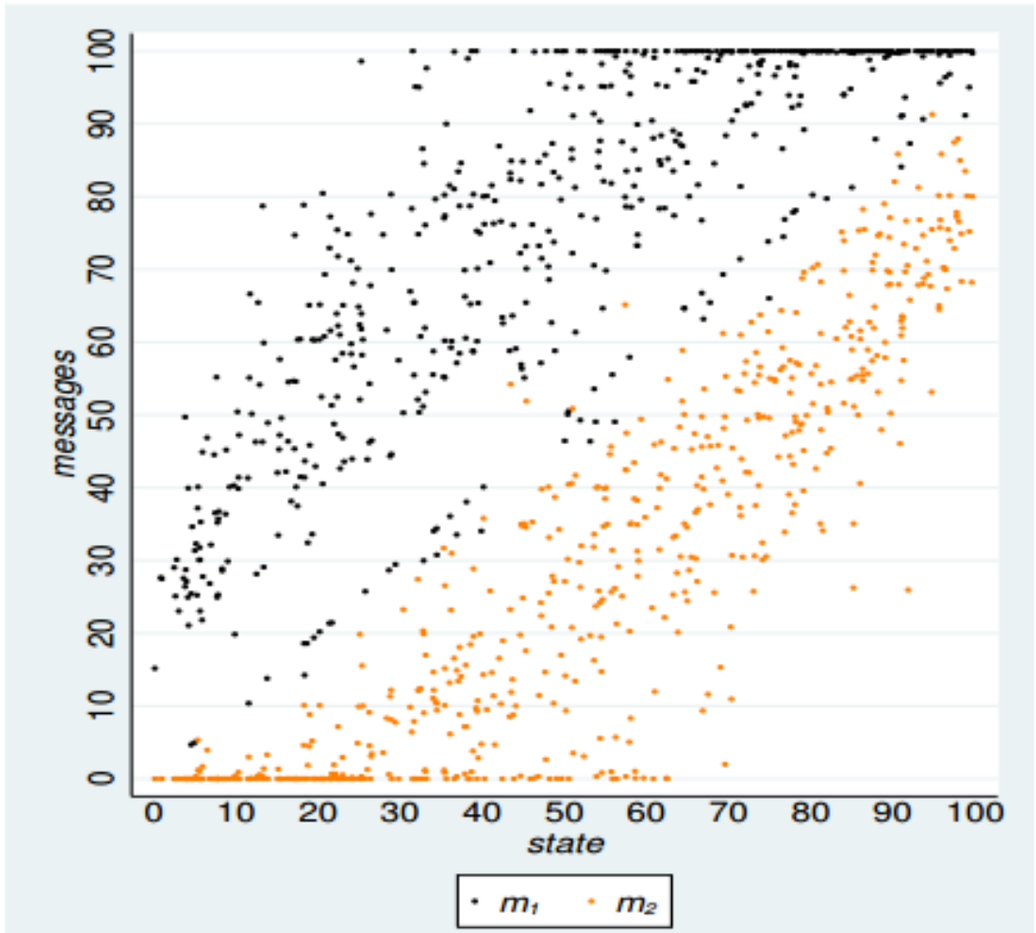
Strategies for *O-2*



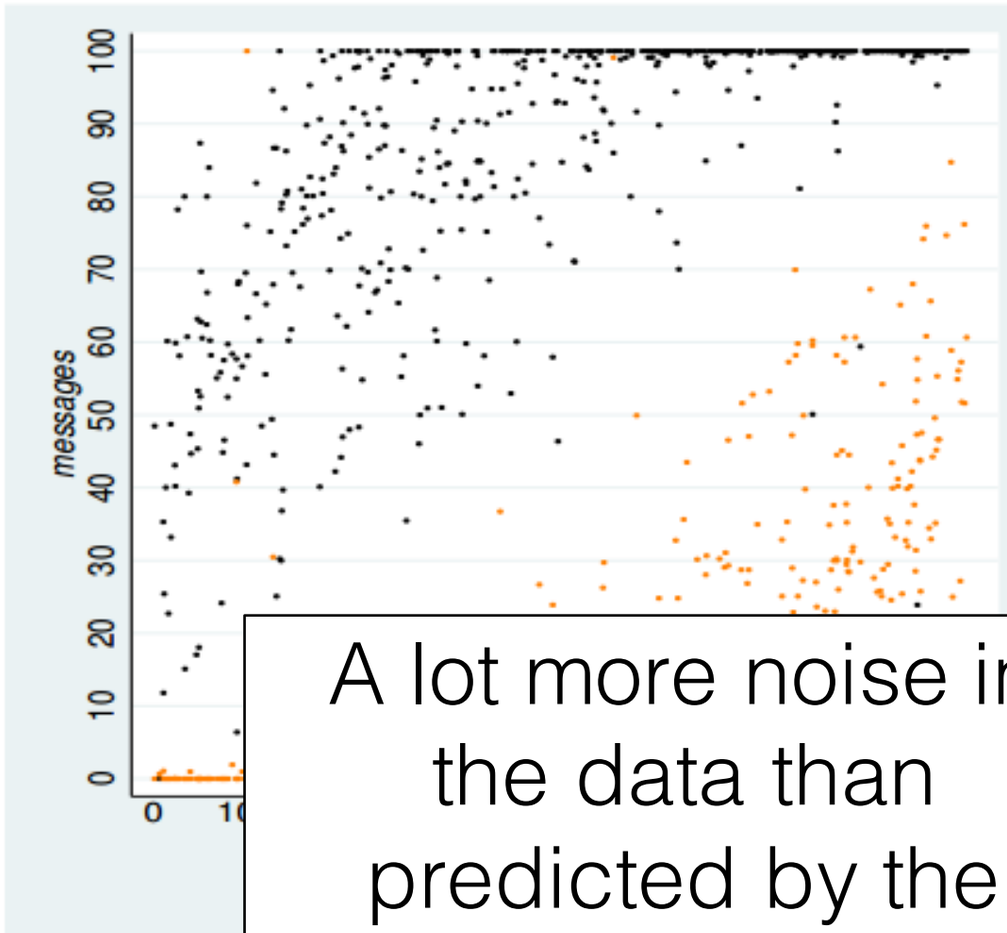
(a) $b = 10$ (b) $b = 20$

Figure 7: Senders' Messages in *O-2*

Strategies for *O-2*



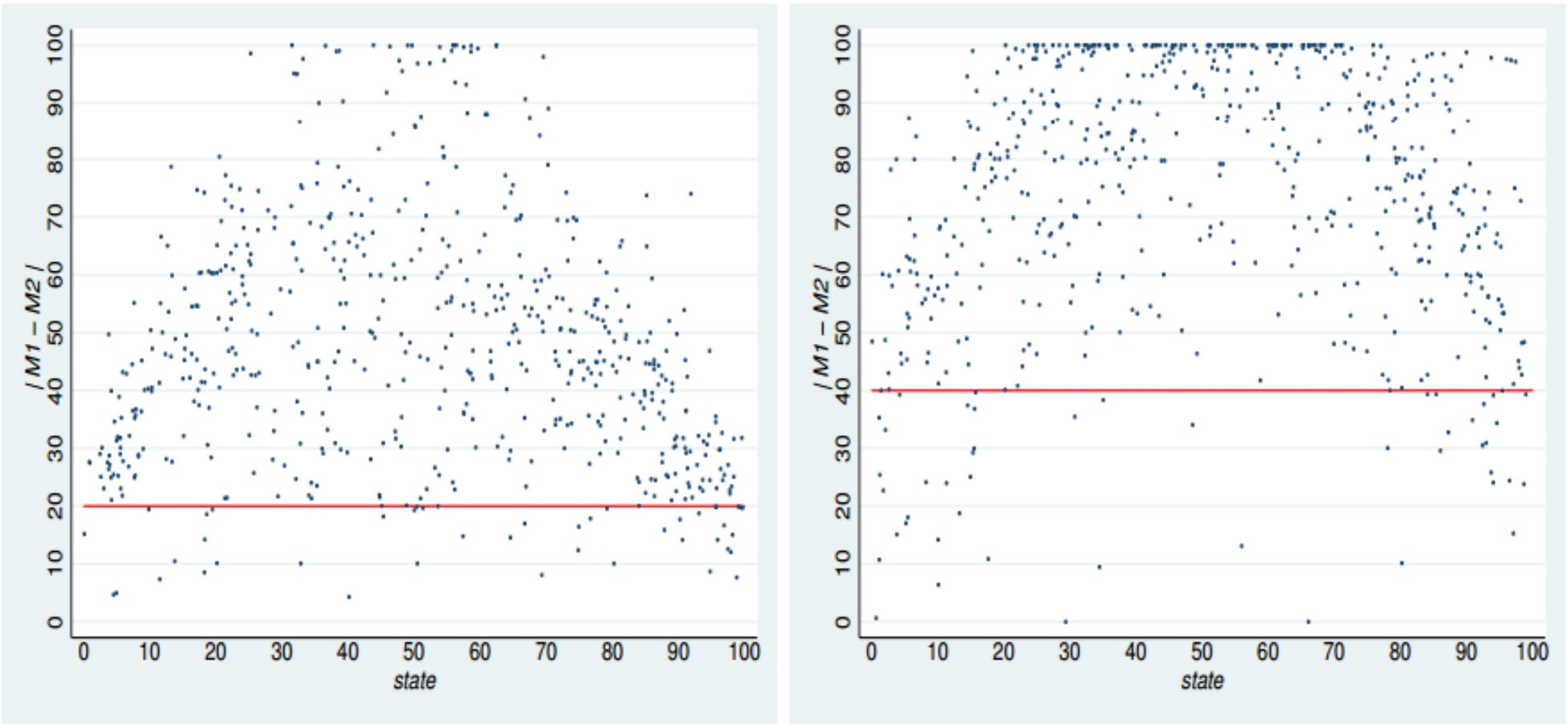
(a) $b = 10$



A lot more noise in the data than predicted by the theory

Figure 7: Senders' Messages in *O-2*

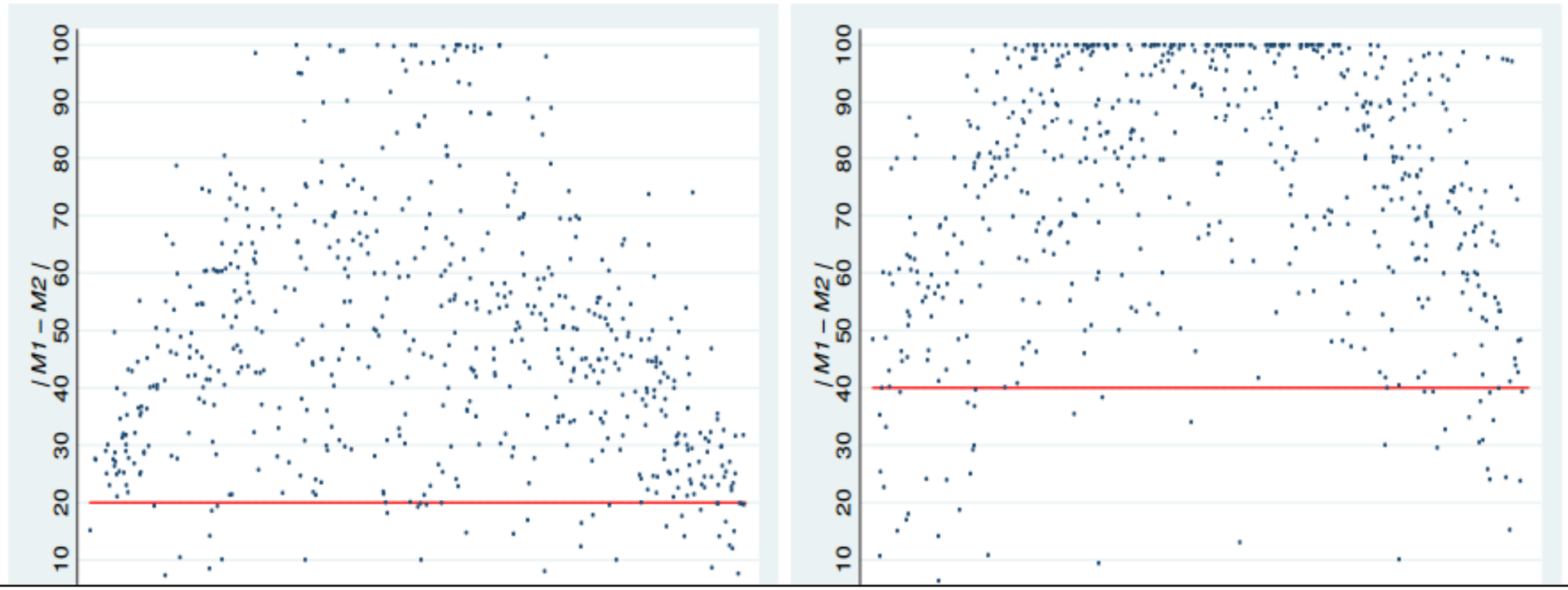
Even if we consider the full revelation in different states



(a) $b = 10$ (b) $b = 20$

Figure 8: Distance of Messages $|m_1 - m_2|$ in *O-2*

Even if we consider the full revelation in different states

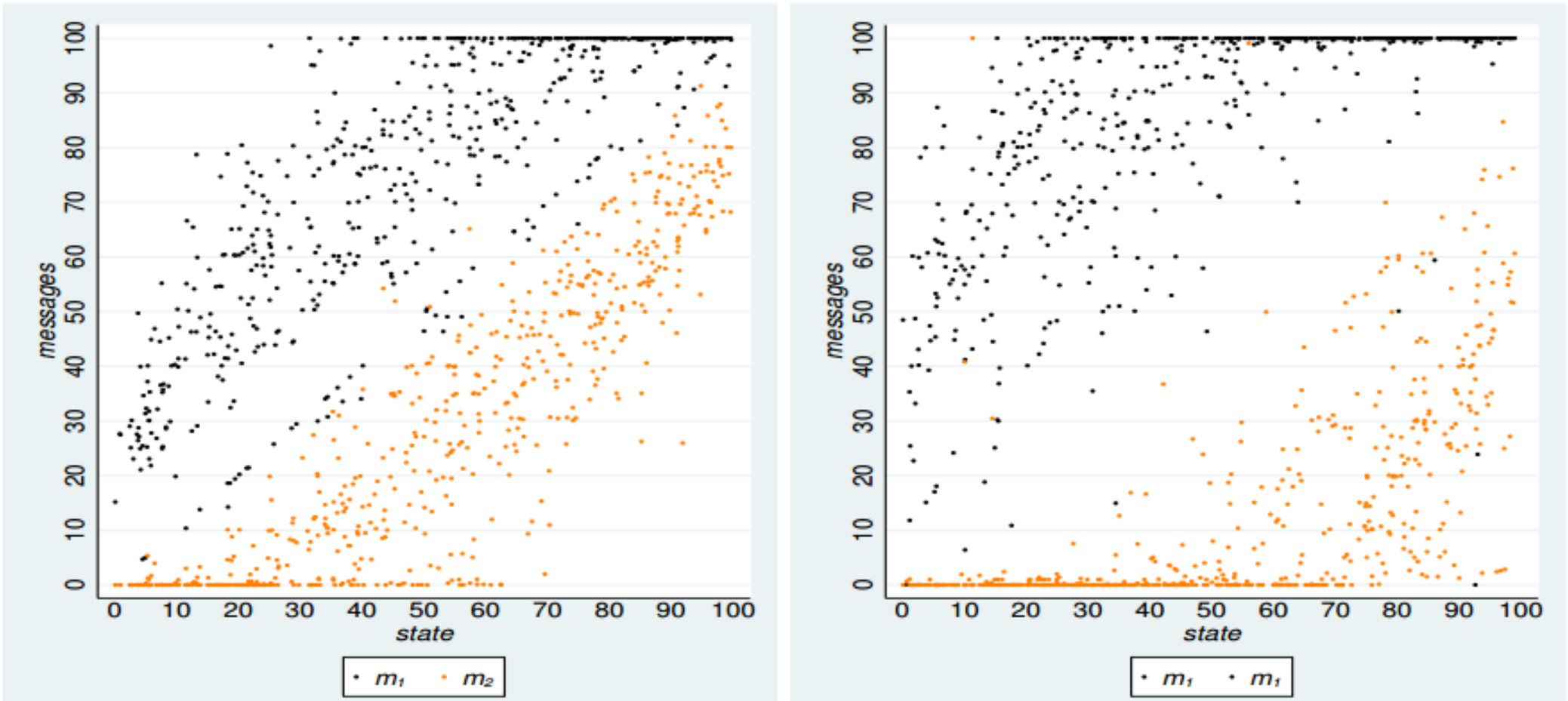


In both theories, full revelation (when $|m1 - \mathrm{m2}| = \mathbf{constant}$) should happen in different states, but obviously it's not.

(a) $b = 10$ (b) $b = 20$

Figure 8: Distance of Messages $|m_1 - m_2|$ in *O-2*

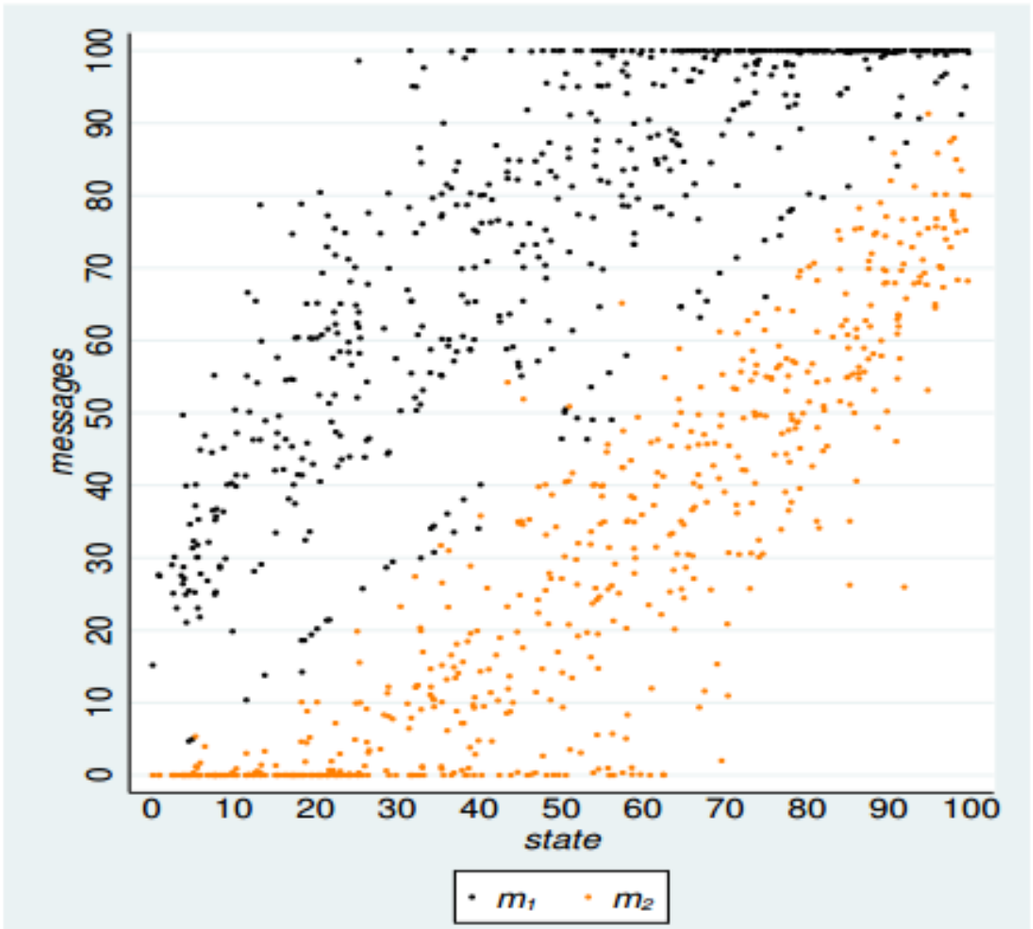
Why?



(a) $b = 10$ (b) $b = 20$

Figure 7: Senders' Messages in *O-2*

Why?

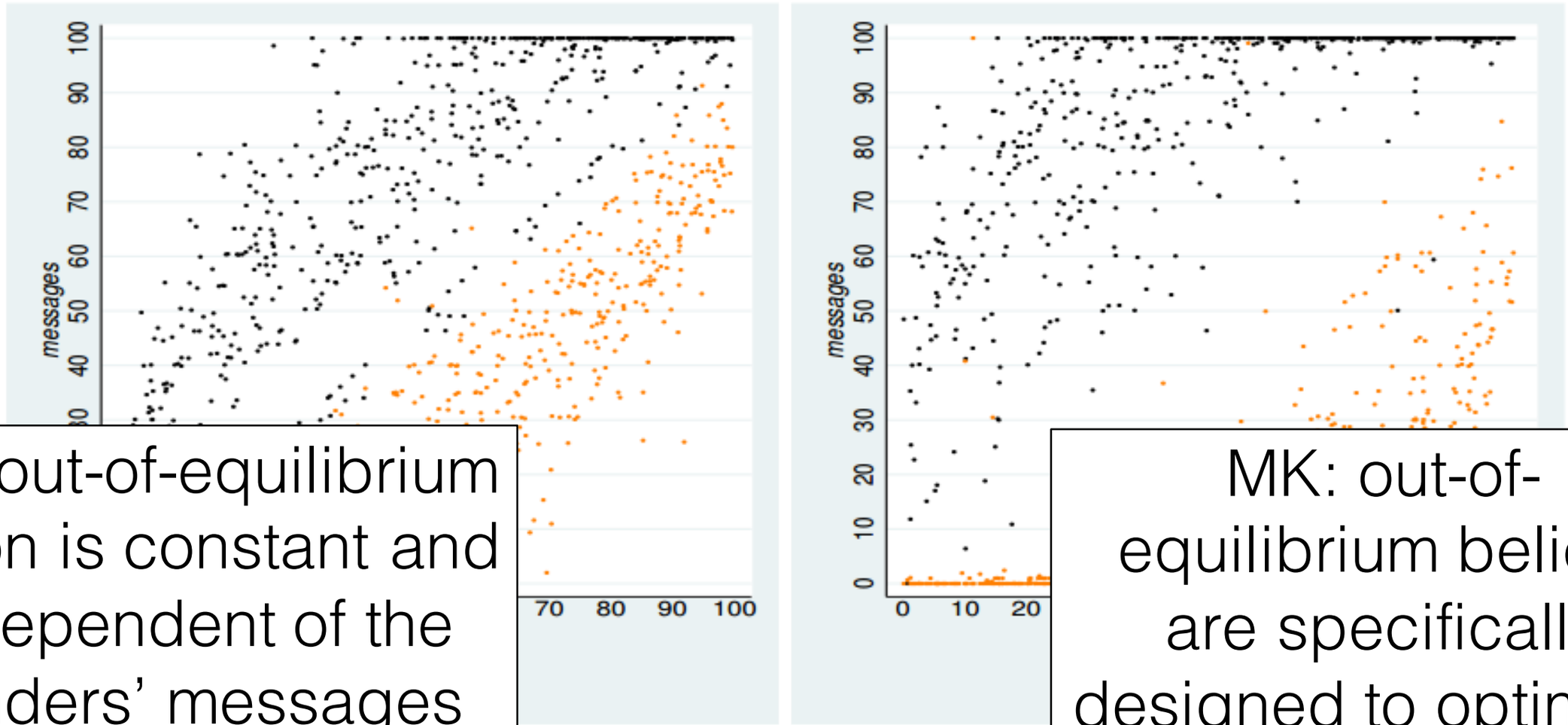


(a) $b = 10$

Figure 7: Senders' Messages in O-2

Believe in higher/lower message => the more biases in receivers' actions

But as both theories, they shouldn't have incentive to send extreme message…?



GK: out-of-equilibrium action is constant and independent of the senders' messages

MK: out-of-equilibrium beliefs are specifically designed to optimally punish deviations

(a) $b = 10$

Figure 7: Senders' Messages in *O-2*

But as both theories, they shouldn't have incentive to send extreme message…?

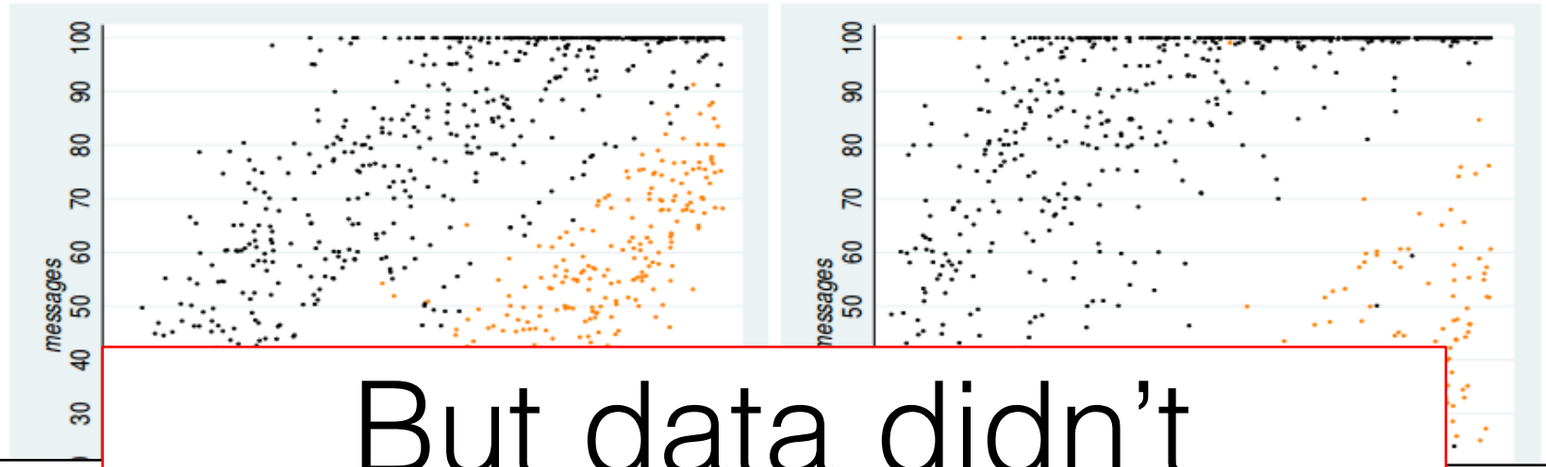


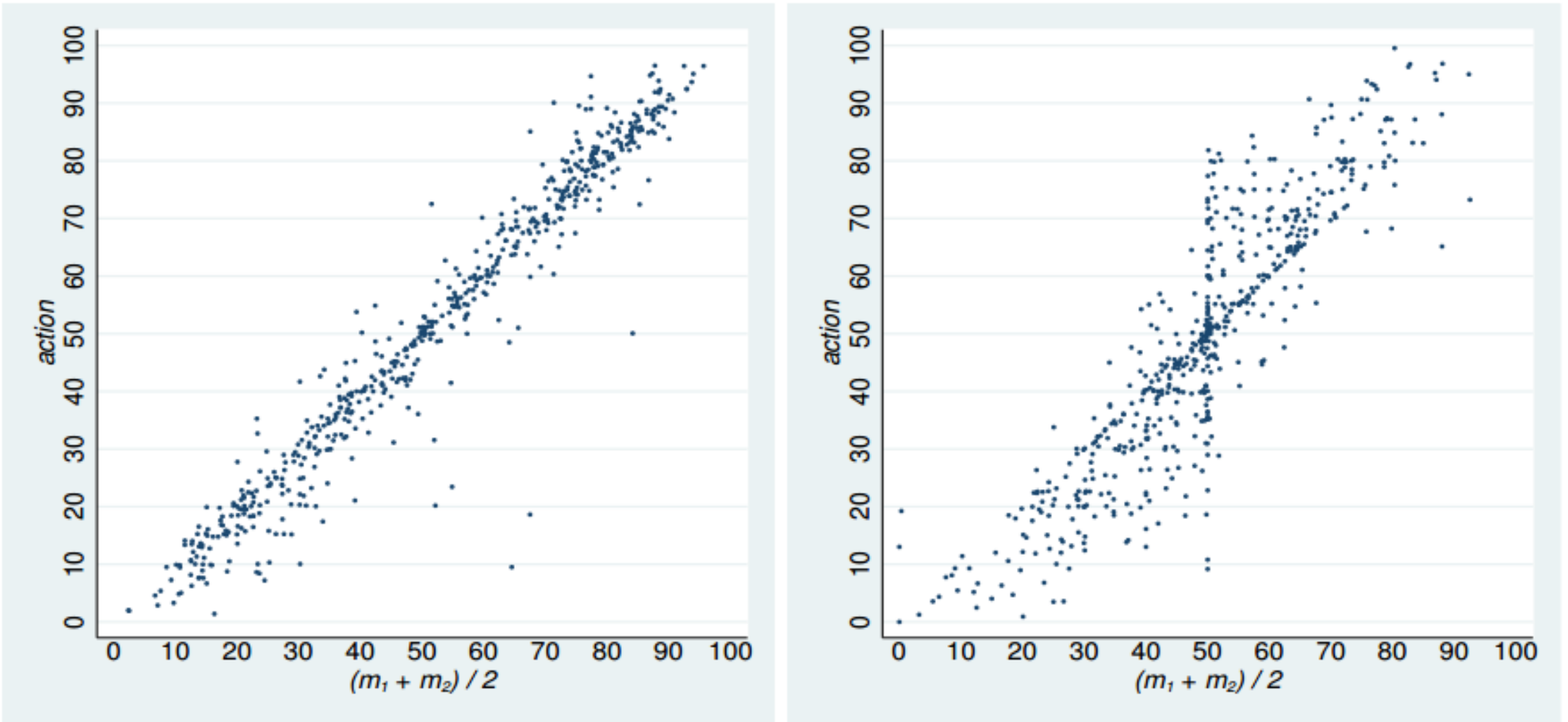
Figure 7: Senders' Messages in *O-2*

GK: out-of-equ
action is const
independent
senders' mes

But data didn't support either of them!

K: out-of-
brium beliefs
specifically
designed to optimally punish deviations

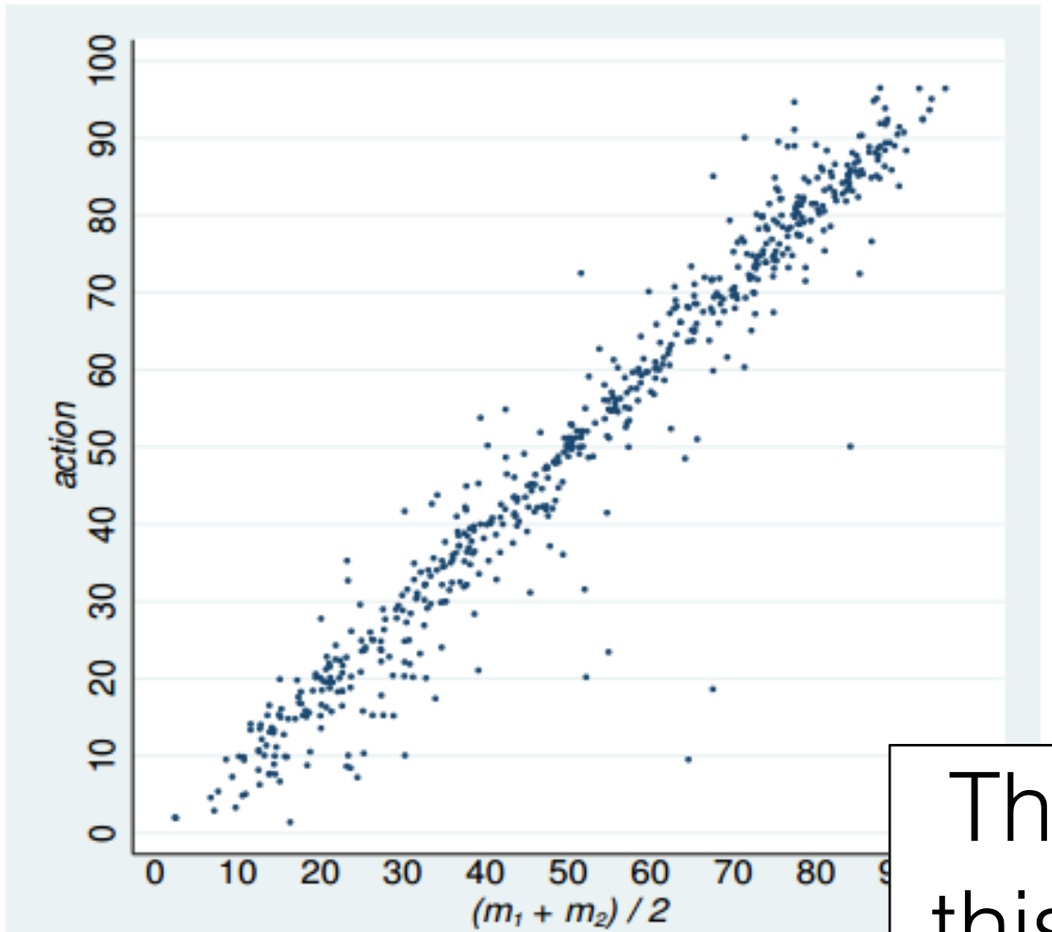
Receivers appeared to follow a more "naive" rule of **choosing a policy close to the average** of the messages



(a) $b = 10$ (b) $b = 20$

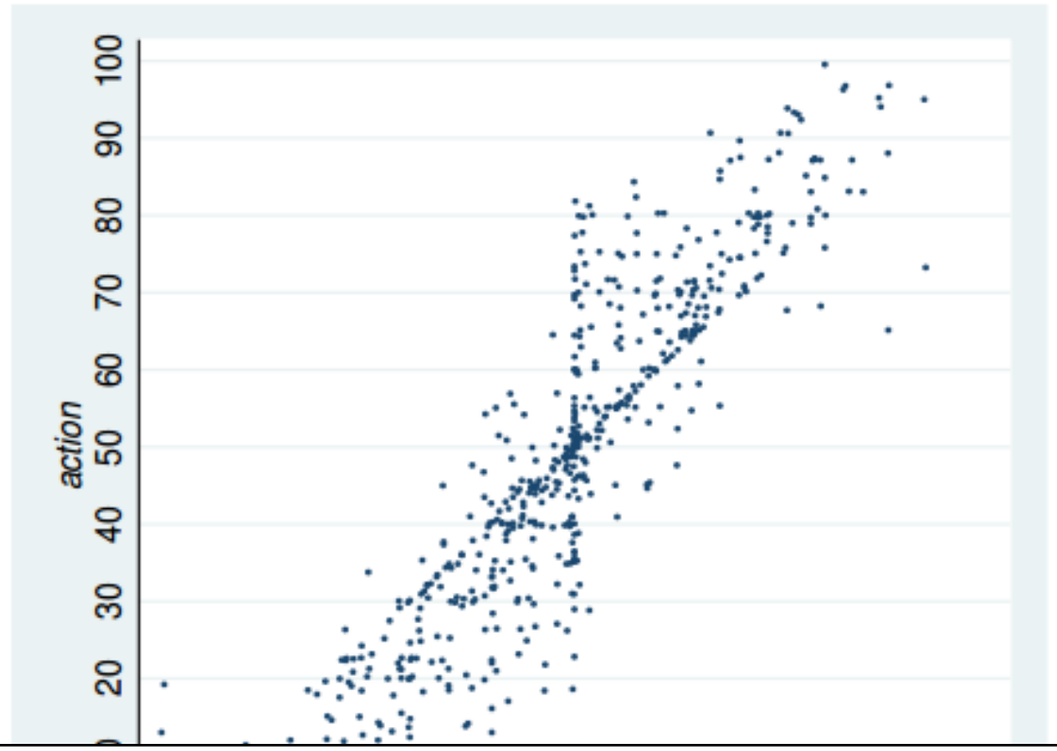
Figure 11: Receivers' Actions as a Function of Average Messages in *O-2*

Receivers appeared to follow a more "naive" rule of **choosing a policy close to the average** of the messages



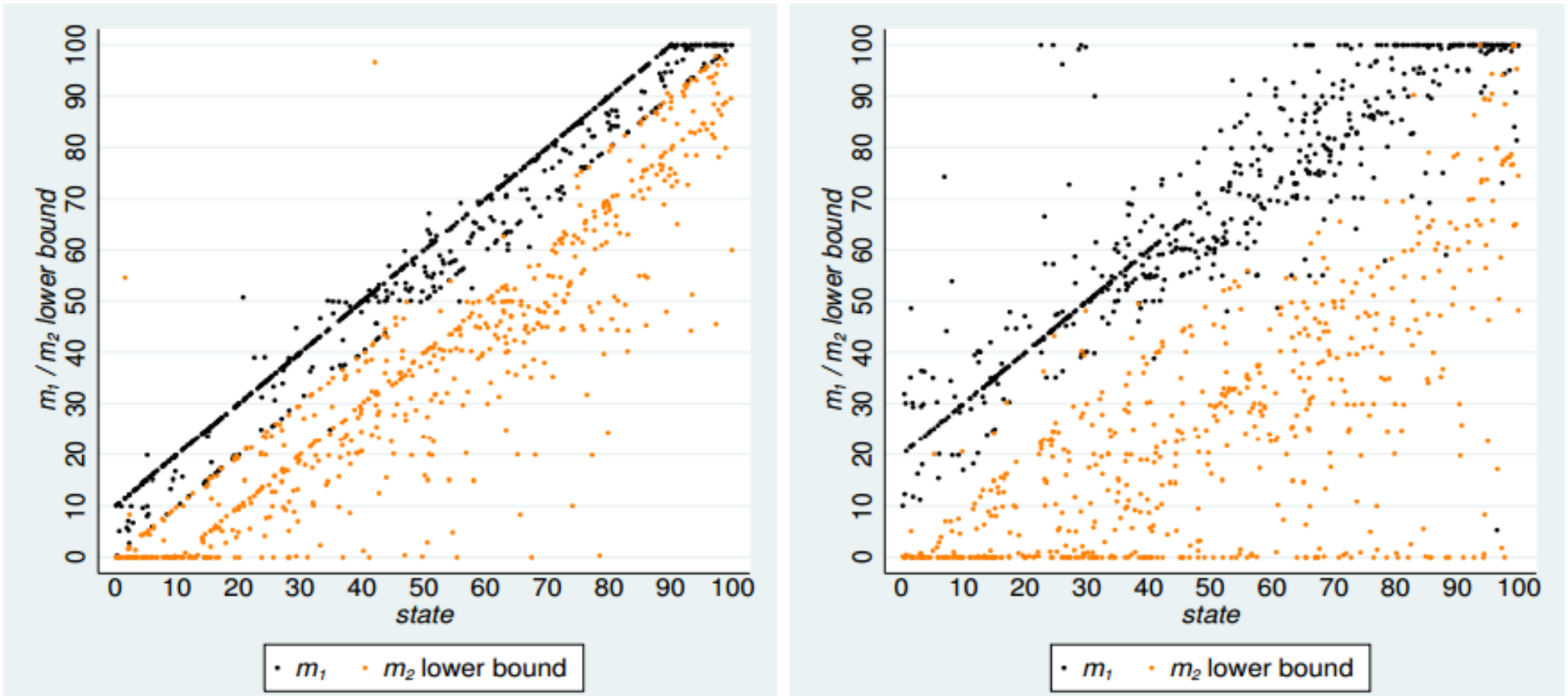
(a) $b = 10$

Figure 11: Receivers' Actions



The senders could exploit this naive reaction function if they were fully expecting it

C-2 Strategies

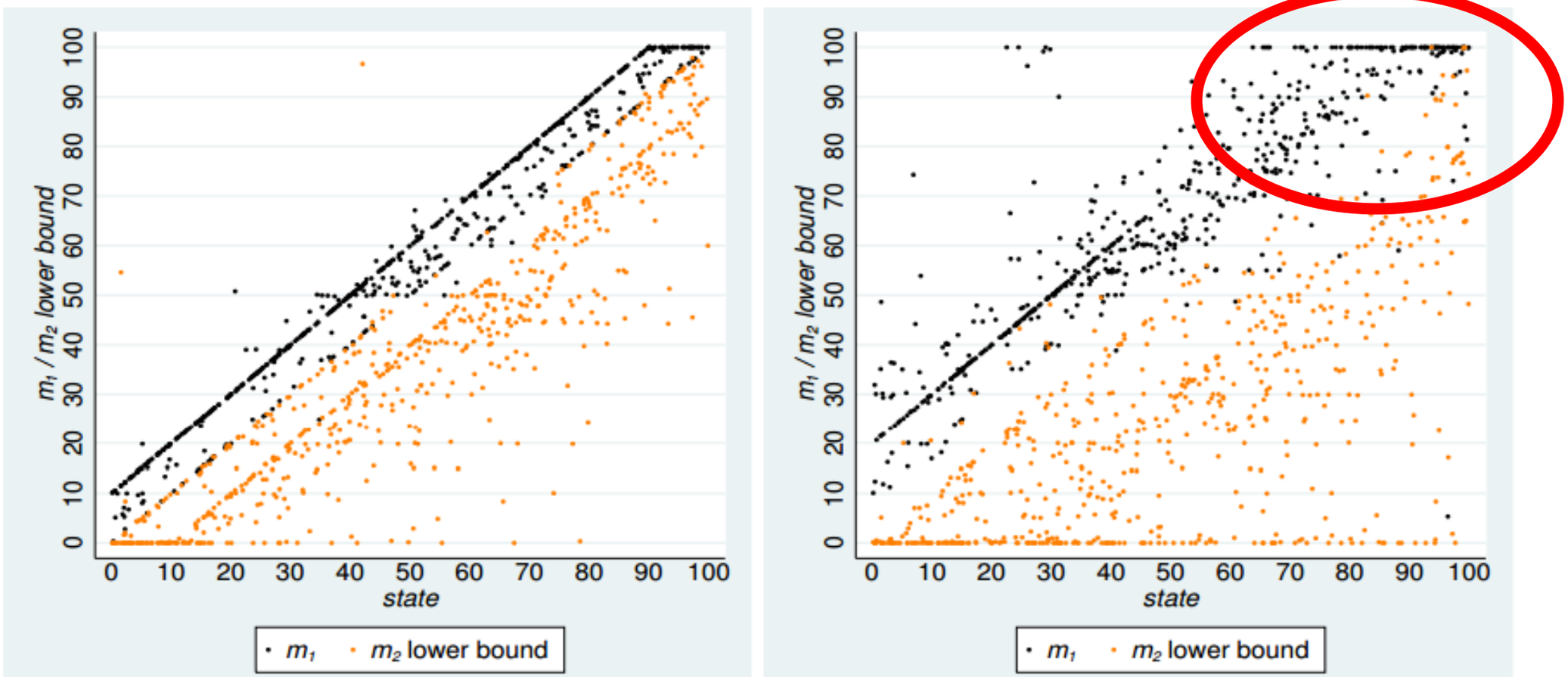


(a) $b = 10$ (b) $b = 20$

Figure 12: Sender 1s' Proposals and the Lower Bounds of Sender 2s' Interval Messages in *C-2*

C-2 Strategies

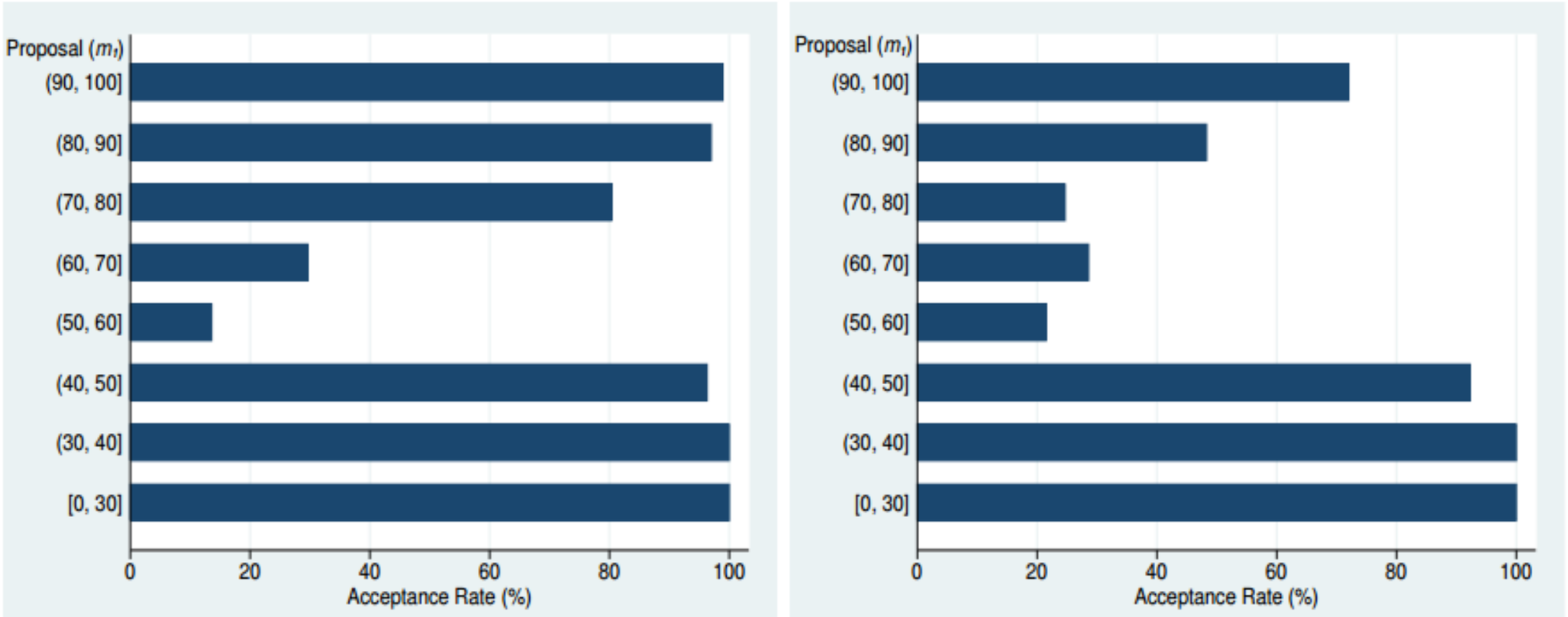
Compromise



(a) $b = 10$ (b) $b = 20$

Figure 12: Sender 1s' Proposals and the Lower Bounds of Sender 2s' Interval Messages in *C-2*

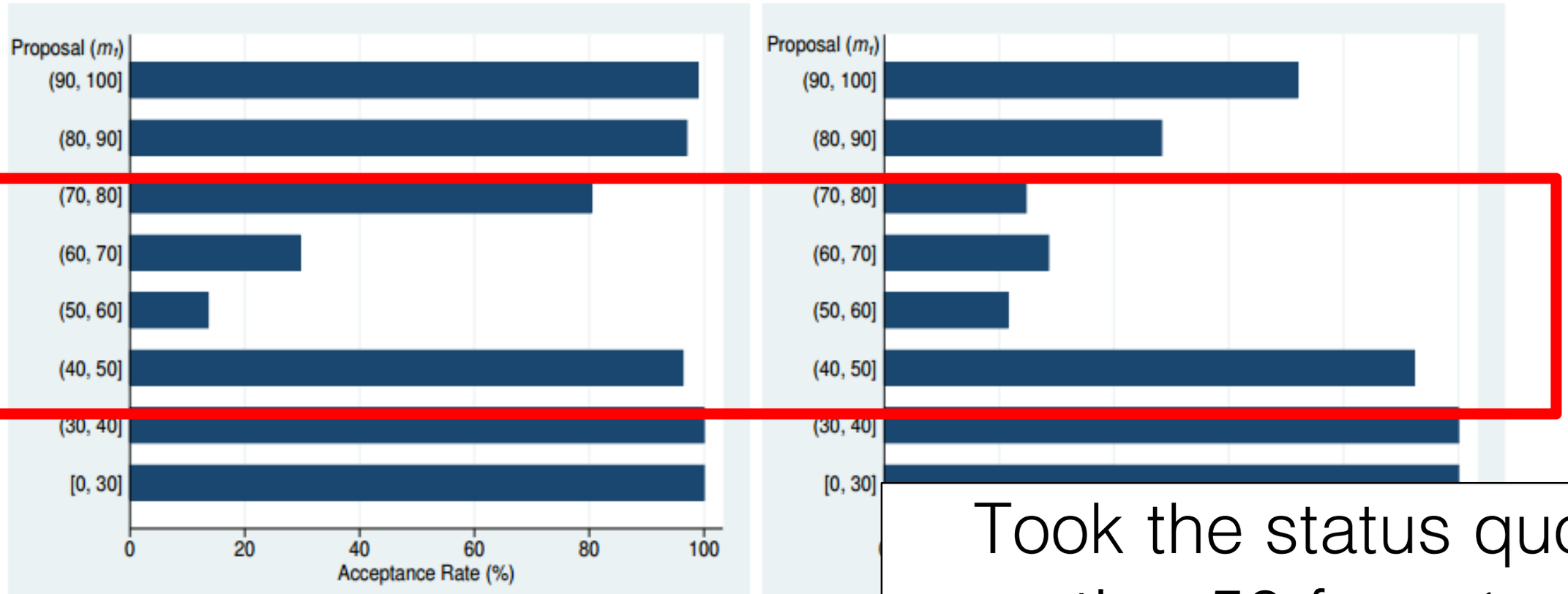
Receivers' strategies in *C-2*



(a) $b = 10$ (b) $b = 20$

Figure 13: Receivers' Acceptance Rate of Sender 1s' Proposals in *C-2*

Receivers' strategies in *C-2*



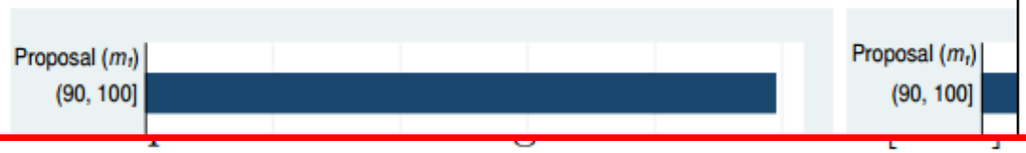
(a) $b = 10$

Figure 13: Receivers' Acceptance Rate of

Took the status quo action 50 for $\mathbf{m1} \in [50, 50 + 2b]$

Receivers' strategies in *C-2*

Took the status quo action 50 for $\mathbf{m1} \in [50, 50 + 2b]$



Sender 1s, $m_1(\theta) = \theta + b < 100$, the receivers accept the proposal if and only if

$$\underbrace{-b^2}_{accepting\ m_1} > \underbrace{-(50 - m_1 + b)^2}_{rejecting\ m_1} \quad \Leftrightarrow \quad m_1 \notin [50, 50 + 2b],$$

and Sender 2s prefer m_1 over the status quo if and only if

$$\underbrace{-(2b)^2}_{from\ m_1} > \underbrace{-(50 - m_1 + 2b)^2}_{status\ quo} \quad \Leftrightarrow \quad m_1 \notin [50, 50 + 4b].$$

Figure 13: Receivers' Acceptance Rate of Sender 1s' Proposals in *C-2*

Only compromise is accepted? …No!

(a) $b = 10$ (b) $b = 20$

Figure 14: Receivers' Acceptance Rate of Sender 1s' Proposals in $(50 + 2b, 50 + 4b)$ Conditioned on Different Ranges of (m_1 − Lower Bound of m_2) in *C-2*

Summary

- Committees can help improve the legislature's decisions by credibly communicating valuable information

- Evidences for GK prediction:
    - Outliner principle
    - Efficiency principle
    - Restrictive-rule principle
- Behavioral phenomena -> deviations

Thank you for your attention!