Equilibrium refinement vs. level-k analysis: An experimental study of cheap-talk games with private information

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- 1.Introduction
- 2.Theory and hypotheses
- 3.Experimental procedures and results
- 4.Conclusion

1.Introduction

- 1. Cheap-talk games with complete information
  - Farrell (1987, 1988).
- 2.Cheap-talk games with incomplete information
  - Crawford and Sobel(1982)
- 3.“truth bias”
  - McCornack and Parks(1986).
- 4. “truth-detection bias”
  - Burgoon et al. (1994)

Cheap-talk Game

- Senders:{A, B }
- Receiver = {X, Y, Z}.
- The payoffs for both players are then determined according to the combination of the sender's true type and the receiver's action.

Payoff

Table 1
Sender–receiver game payoff

Game 1

		Action		
		X	*Y*	*Z*
Type	*A*	4, 4	1, 1	3, 3
	B	1, 1	4, 4	3, 3

Game 2

		Action		
		X	*Y*	*Z*
Type	*A*	3, 4	2, 1	4, 3
	B	2, 1	3, 4	4, 3

Game 3

		Action		
		X	*Y*	*Z*
Type	*A*	4, 4	1, 1	2, 3
	B	3, 1	2, 4	4, 3

2. Theory and hypotheses

- 2.1 Theories
- Separating equilibria
- Babbling equilibria
- AQRE(agent quantal response equilibrium)
- Level-k
- Refinements
- Sequential equil

- Babbling equilibrium :
- sender‘s strategy is independent of type
- receiver’s strategy is independent of signal.

- Separating equilibrium :
- sender types sent signals from disjoint subsets of the set of available signals

Predictions by Level-K

- (1) In Games 1 and 2, the sender tells her type truth-fully and the receiver believes the sender's messages.
  (2) In Game 3, both sender types say they are type A, and the receiver plays Z upon receiving a and Y upon receiving b.

Predictions by Level-K

Table 2
Level-k predictions for Games 1, 2, and 3 when the $L0$ sender is the truth-teller and the $L0$ receiver is the randomizer

Game 1

	Sender	Receiver
$L1$	(a, b)	(X, Y)
$L2$	(a, b)	(X, Y)
$L3$	(a, b)	(X, Y)

Game 2

	Sender	Receiver
$L1$	(a, b)	(X, Y)
$L2$	(a, b)	(X, Y)
$L3$	(a, b)	(X, Y)

Game 3

	Sender	Receiver
$L1$	(a, b)	(X, Y)
$L2$	(a, a)	(X, Y)
$L3$	(a, a)	(Z, Y)

Predictions of play by various theories

Table 3
Predictions of play for Games 1, 2, and 3 by various theories

	Game 1	Game 2	Game 3
Sequential equil.	S.E and B.E.	S.E and B.E.	B.E.
Refinements	S.E.*	B.E.	B.E.
Level-k^+	(ab, XY)	(ab, XY)	(aa, ZY)

Note: S.E. means separating equilibria and B.E. means babbling equilibria.
* AQRE predicts B.E. in this case.
+ Predicted play of higher levels is shown.

2.2 Hypotheses

- 1 (Equilibrium prediction).
- Most play conforms to a separating equilibrium in Game 1, a babbling equilibrium in Games 2 and 3.

- 2 (Overcommunication).
- Overcommunication occurs in games with conflicting interests. The more aligned the interests, the more frequently the sender tells the truth.

- 3 (Truth bias).
- Receivers tend to believe senders'messages to be truthful even in games with conflicting interests.

- 4 (Truth-detection bias).
- The receiver guesses the sender's true type more correctly when the sender tells the truth than when she tells a lie.

3.1 Experimental procedures

- 26 subjects==>12+1 each sections
- 2 sections
- 13 rounds
- Payoff table(which game) and their roles
- Senders:{A, B } &Receiver : {X, Y, Z}
- Practice 3 rounds previously

What's more?

- Ramdonly
- An envelope with written instructions, a recording sheet, and questionnaire.
- Instructors other than the authors read the instructions aloud and conducted the experiment manually.
- The instructors knew nothing about the equilibria of the games.

3.2. Experimental results

3.2.1. Aggregate data

Table 4
Aggregate data

Game 1

		X	Y	Z	Total
A	a	99	0	13	112
	b	0	4	1	5
B	a	3	0	1	4
	b	1	92	20	113
Total		103	96	35	234

Game 2

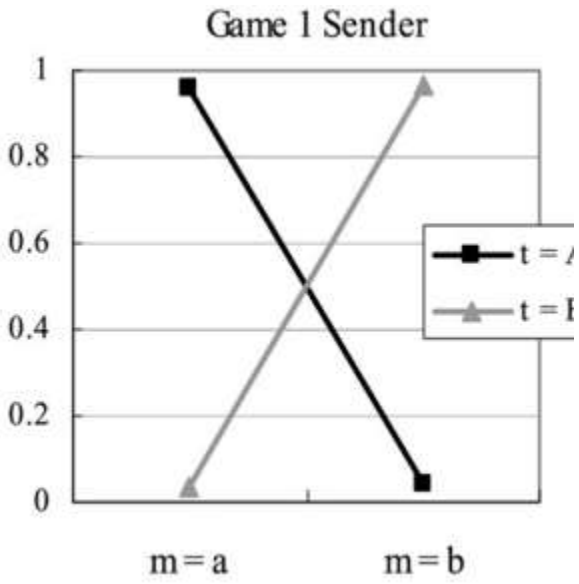
		X	Y	Z	Total
A	a	20	1	10	31
	b	1	5	2	8
B	a	3	1	0	4
	b	5	19	11	35
Total		29	26	23	78

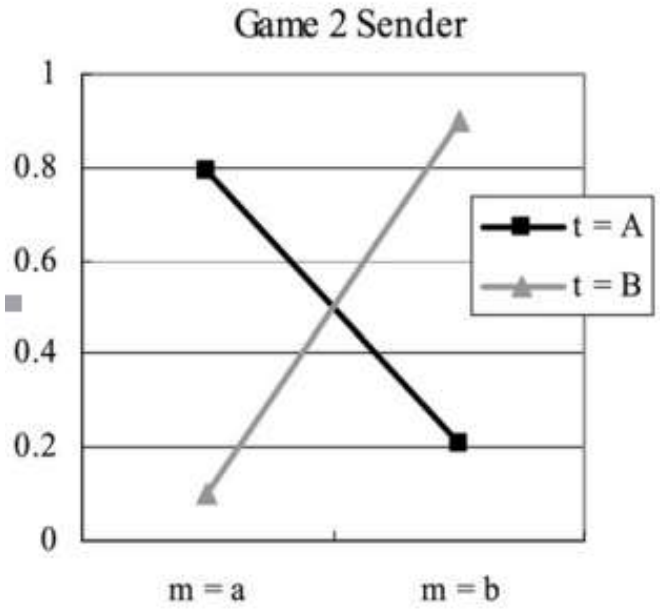
Game 3

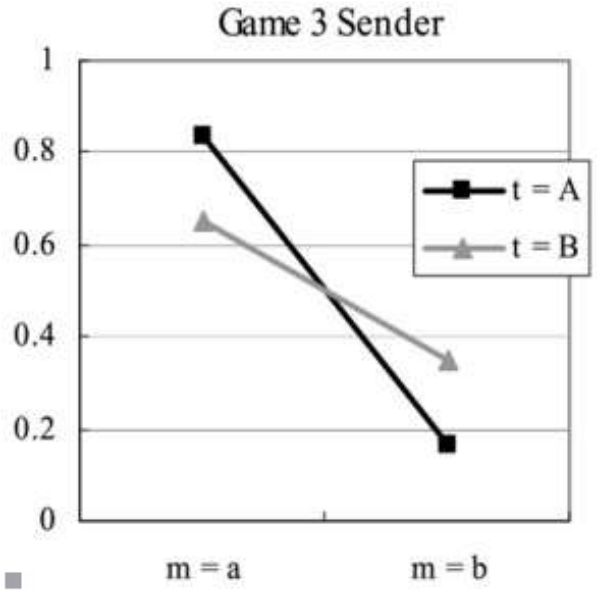
		X	Y	Z	Total
A	a	45	9	43	97
	b	1	9	10	20
B	a	26	12	40	78
	b	6	19	14	39
Total		78	49	107	234

- **Result 1.**
- The majority of play in Games 1 and 2 was separating equilibria, and a notable proportion of play was separating in Game 3 even though it has only babbling equilibria.
- (Hypothesis 1 is rejected)

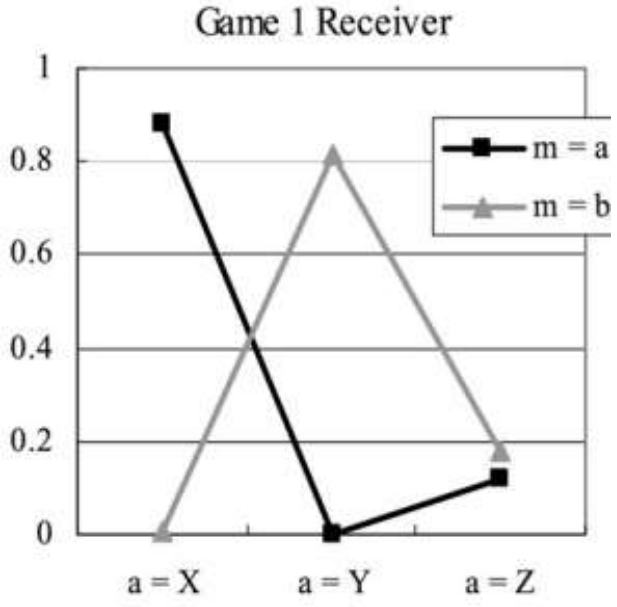
- **Result 2.**
- Overcommunication is observed in Games 2 and 3. The more aligned the interests are between sender and receiver, the more frequently the sender tells the truth.

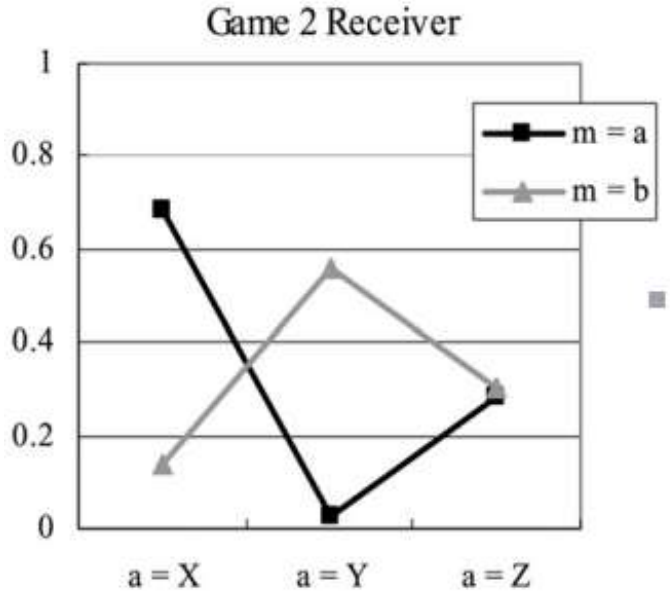


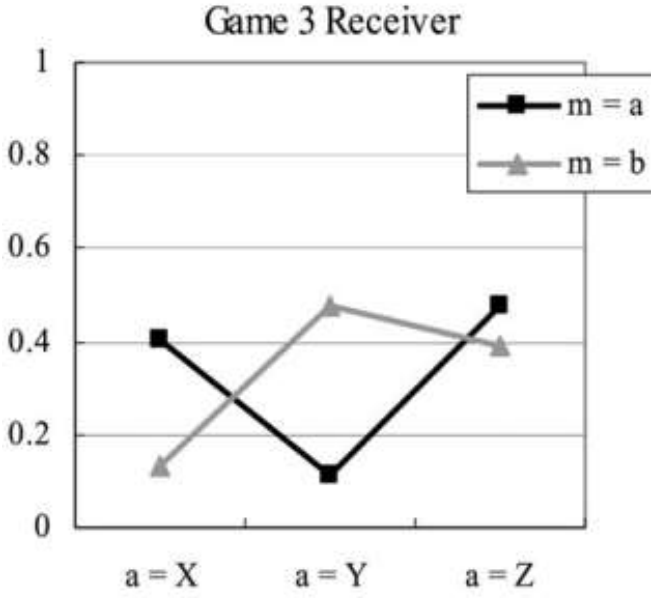




- **Result 3.**
- Truth bias is observed. Furthermore, the more aligned the interests are between sender and receiver, the more frequently receiver believes the sender's message to be truthful.



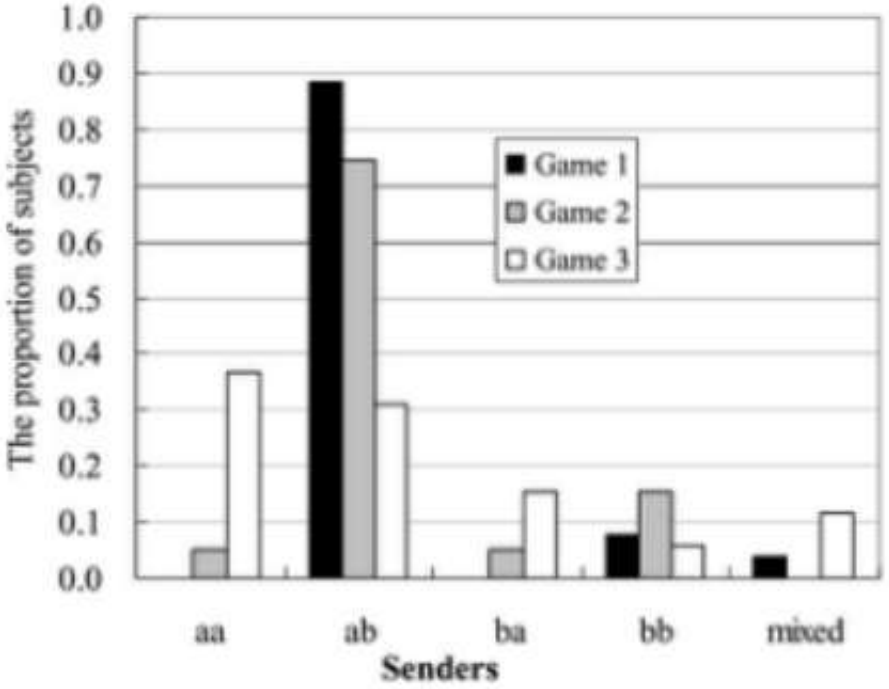




- **Result 4.**
- Truth-detection bias is observed.
- The receiver guesses the sender's true type more correctly when the sender tells the truth than when she tells a lie.

3.2.2. Individual data

- level-k analysis can explain our experimental data better than any other theories.



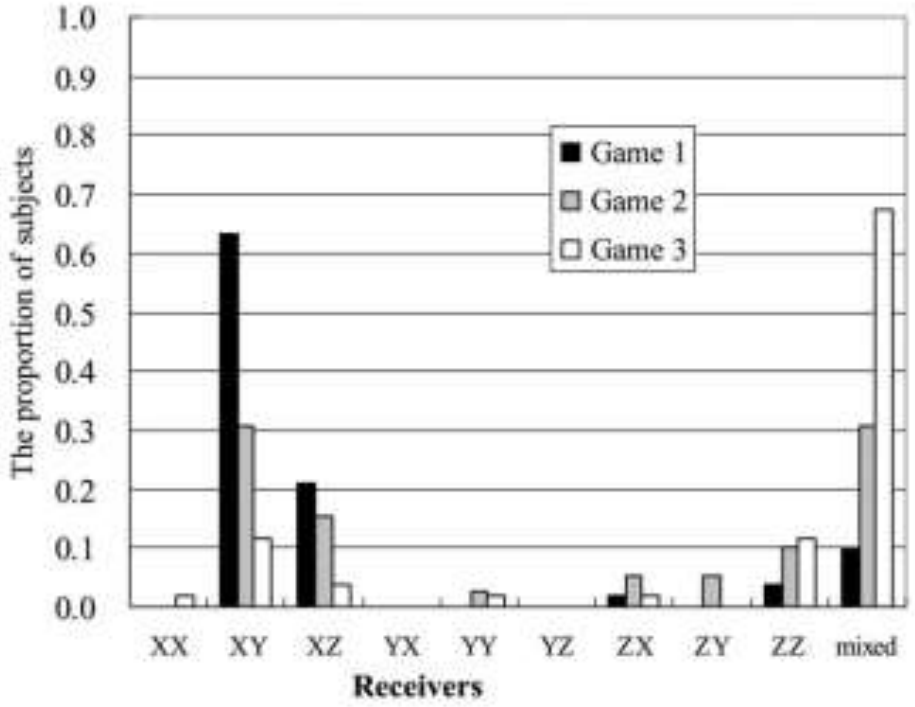


Fig. 3. The distribution of each behavioral type.

4. Conclusion

- 1.The less aligned the interests===》》》 the more frequently babbling equilibrium play.
- 2.Refinement theories only work in the case of aligned interests, level-k analysis works well in conflicting interest cases as well as in aligned interest cases.
- 3.Confirm the existence of “truth bias” and “truth-detection bias.”
- 4.Truth-telling and truth-guessing are more intrinsic to human communication than is supposed in game theory.

- Thanks
  - Sishi Lin