Intelligence Disclosure in Repeated Interactions

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Intelligence Disclosure and Social Interactions

- ▶ Among other characteristics, intelligence has been shown to affect strategic behavior in repeated interactions (e.g. Jones, GEB 2008; Alaoui and Penta ReStud 2015; Gill and Prowse, JPE 2016; Proto et al., JPE 2019; ResStud forthcoming)

- ▶ In many real life situations, we often have some idea about the characteristics of the person we are dealing with

- ▶ Studies of strategic interactions are usually done in the lab, which typically ensure anonymity in interactions

- ▶ Important for the external validity of several laboratory experiments

Theoretical and Experimental Background

- We study the effect of disclosing information on intelligence of players on cooperation in Prisoner's Dilemma (PD) and Battle of Sexes (BoS)

- In the PD the key decision follows from identifying the trade-off between gain in the current interaction vs. loss in the future

Theoretical and Experimental Background

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- ▶ In the BoS tension is generated from how coordination results in different payoff appropriation
  - This tension can be exacerbated by higher inequality

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- ▶ In the BoS tension is generated from how coordination results in different payoff appropriation
    - This tension can be exacerbated by higher inequality
- ▶ We implement PD and two variants of BoS to investigate

PD Research Questions

RQ1

In the repeated PD, are the more intelligent less cooperative when cognitive skills are disclosed?

- Exploitation/no trust of other's ability?

RQ2

In the repeated PD, do the less intelligent cooperate more or less when cognitive skills are disclosed?

- Follow/suspicious of other's intentions?

RQ3

In the repeated PD, does cognitive skills disclosure lead to lower cooperation rates?

BoS with low inequality: Research Questions

RQ4
Do the more intelligent try to force coordination on their preferred outcome when cognitive skills are disclosed?

RQ5
Are the the less intelligent more likely to concede when cognitive skills are disclosed?

RQ6
Does cognitive skills disclosure lead to lower coordination rates?

BoS with high inequality: Research Questions

RQ7
Do the more intelligent force coordination on their preferred outcome more or less when the cognitive skills are disclosed?

RQ8
Do the less intelligent concede more or less when cognitive skills are disclosed?

RQ9
Does cognitive skills disclosure have a smaller effect in the BoS with high inequality than in the BoS with low inequality?

Experimental Design
Overview

1. Raven's test
2. Holt & Laury Task ▶ Details
3. Play indefinitely repeated games

   Depending on treatment:
   - ▶ Prisoner's Dilemma (PD)
   - ▶ Battle of Sexes with lower inequality (BoSLI)
   - ▶ Battle of Sexes with higher inequality (BoSHI)
4. Personality and demographics questionnaire
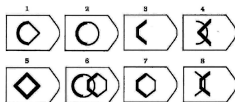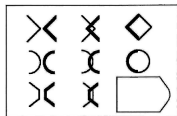
Implementation details:
- – 430 participants earning on average around 12 Euros
- – On Z-tree at AWI Experimental Lab in Heidelberg University and Goethe University Frankfurt
- – Sessions in November 2018 – October 2019

Raven Test

Disclosure of Raven Scores

- ▶ This information was on screen during play
- ▶ Grey range is overall possible test scores
- ▶ Black line indicates the actual scores in the session
- ▶ Yellow circle indicates own score
- ▶ Green range indicates where partner's score lies

Repeated Games

	C	D
C	48,48	12,50
D	50, 12	25,25

(a) PD

	W	B
B	48,25	0,0
W	0, 0	25,48

(b) BoSLI

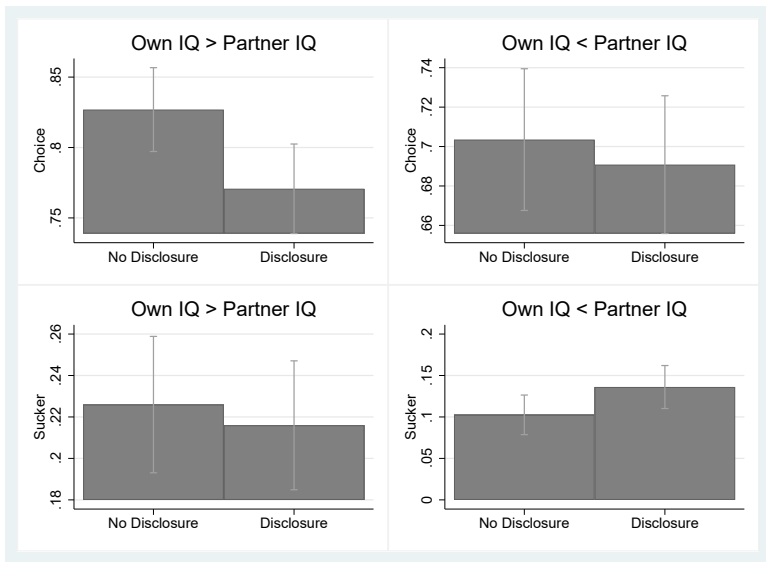|	W	B
B	48,12	0,0
W	0,0	12,48

(c) BoSHI

For all sessions induce infinite repetition with $\delta = 0.75$ ▸ Repetition details

Experimental units correspond to 0.003 Euros – paid sum of all earnings

PD: 1st periods cooperation and sucker by relative IQ

PD: Overall 1st periods cooperative choice

Cooperation in 1st period

Solid: Disclosure; Dash: No Disclosure

Supergames
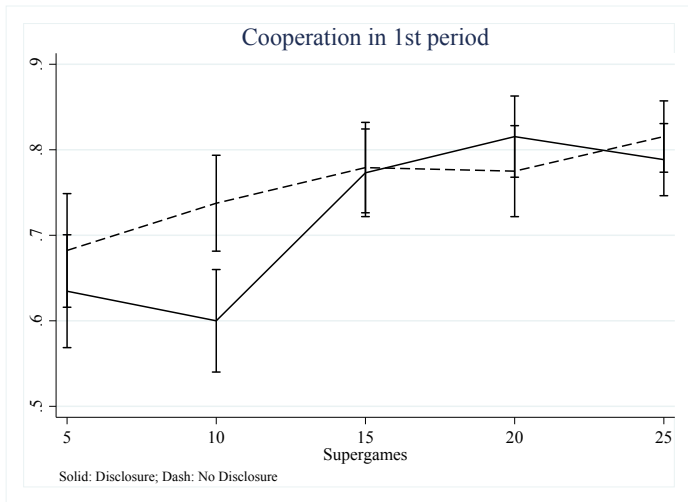
BoSLI: Preferred choices by relative IQ

BoSLI: Evolution of Coordination

Disclosure vs. No Disclosure

Solid: Disclosure; Dash: No Disclosure

▸ Regression Analysis
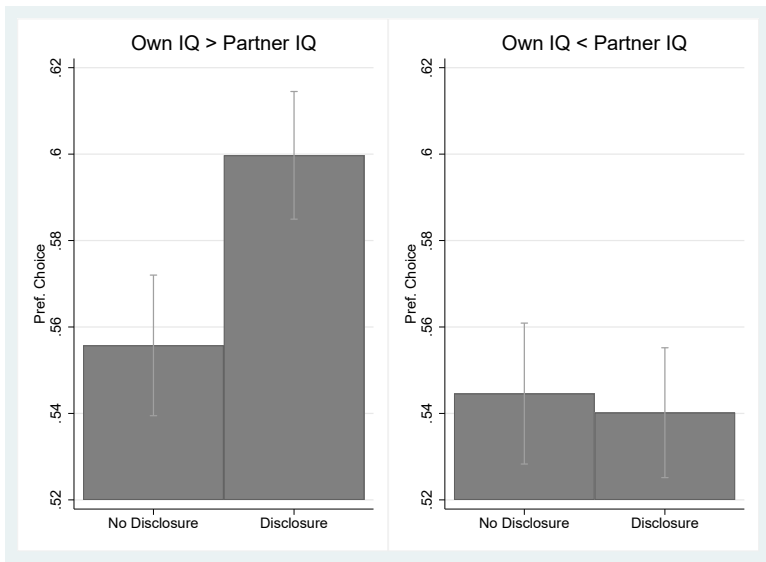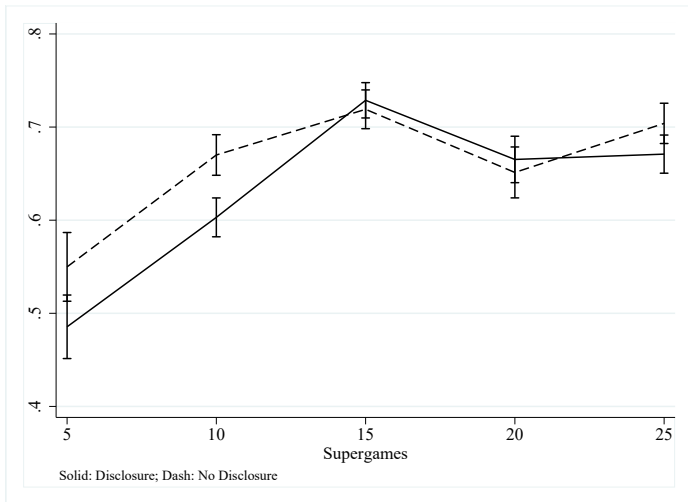
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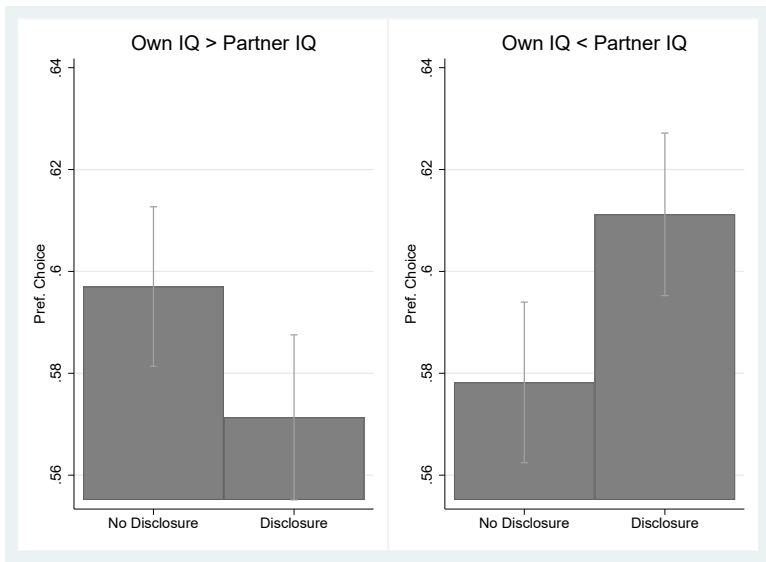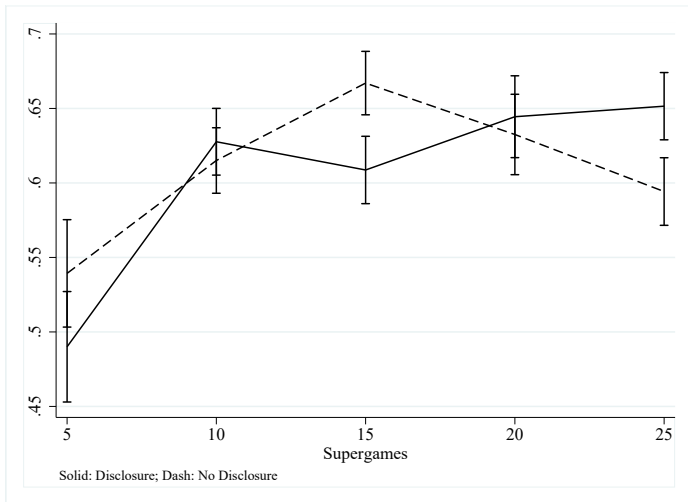
Both Battle of Sexes

Evolution of preferred outcome coordination by game variant and disclosure

Blue: BoSLI; Red: BoSHI

Both Battle of Sexes

	All	Own IQ > Partner IQ		Own IQ < Partner IQ	
	Coordination b/se	Pref. Out. b/se	Payoff b/se	Pref. Out. b/se	Payoff b/se
main					
Disclosure	0.79845***	1.11400	–0.25777**	0.22044*	–2.45483***
	(0.0655)	(0.1522)	(0.1040)	(0.1920)	(0.9301)
Disclosure*High Ineq.	1.38031***	0.69082*	0.53624***	3.36975	4.32163***
	(0.1699)	(0.1425)	(0.1611)	(4.2660)	(1.2148)
High Inequality	0.62079***	1.09994	–0.17568	0.00056***	–8.25568***
	(0.0621)	(0.2016)	(0.1182)	(0.0006)	(1.0312)
Own IQ	1.02156***	1.00489	–0.01754	1.08670	0.11416
	(0.0064)	(0.0130)	(0.0111)	(0.0995)	(0.0786)
Partner IQ	1.02169***	1.01486***	–0.00186	1.33371***	0.05709
	(0.0042)	(0.0054)	(0.0091)	(0.0820)	(0.0817)
N	30030	9630	9630	15015	15015

Wrapping up

We study how disclosing players' intelligence influences coordination or cooperation and find:

1. In the PD disclosure disrupts cooperation:
   - More intelligent are in general less cooperative
   - Some implement more 'forgiving' strategies with disclosure

2. In the BoS with lower inequality again disclosure is disruptive:
   - More intelligent are more forceful
   - Less intelligent are conceding

3. In the BoS with higher inequality the disclosure effect is muted due to increased inequality:
   - More intelligent no longer forceful
   - Less intelligent less willing to concede

Thank you for listening

Holt & Laury Task

	Option X	Option Y	$EV(X)$ $-EV(Y)$
1	1/10 chance of 2.00; 9/10 chance of 1.60	1/10 chance of 3.85; 9/10 chance of 0.10	1.17
2	2/10 chance of 2.00; 8/10 chance of 1.60	2/10 chance of 3.85; 8/10 chance of 0.10	0.83
3	3/10 chance of 2.00; 7/10 chance of 1.60	3/10 chance of 3.85; 7/10 chance of 0.10	0.50
4	4/10 chance of 2.00; 6/10 chance of 1.60	4/10 chance of 3.85; 6/10 chance of 0.10	0.16
5	5/10 chance of 2.00; 5/10 chance of 1.60	5/10 chance of 3.85; 5/10 chance of 0.10	–0.18
6	6/10 chance of 2.00; 4/10 chance of 1.60	6/10 chance of 3.85; 4/10 chance of 0.10	–0.51
7	7/10 chance of 2.00; 3/10 chance of 1.60	7/10 chance of 3.85; 3/10 chance of 0.10	–0.85
8	8/10 chance of 2.00; 2/10 chance of 1.60	8/10 chance of 3.85; 2/10 chance of 0.10	–1.18
9	9/10 chance of 2.00; 1/10 chance of 1.60	9/10 chance of 3.85; 1/10 chance of 0.10	–1.52
10	10/10 chance of 2.00; 0/10 chance of 1.60	10/10 chance of 3.85; 0/10 chance of 0.10	–1.85

Procedure: The menu price of options the participants choose across. The outcomes are in Euros. One of the 10 rows was randomly chosen to be payoff relevant. According to which option a participant chose, the lottery was realized by the computer and participants paid accordingly.

IQ by Disclosure

▶ Participants in the disclosure treatments are warned that their score will anonymously be shown to other participants

▶ Specifically told:

> *A range including the number of your correct answers will be shown to other participants during a task later in the session. This will be presented anonymously, and there is no way others can trace the score back to you.*

▶ This had no effect on IQ scores (Kolmogorov–Smirnov test: p-value= 0.682)
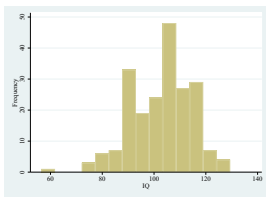
(a) No Disclosure
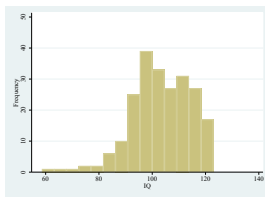
(b) Disclosure

Repeated Games: Implementation Details

Round Overall count of times stage game played

Supergame Each repeated game played

Period Round within specific supergame

- Each round is played in parallel among all pairs in the same session
- The game is repeated until either 30 minutes or completion of 92nd round
- Subjects play a supergame (SG) together until the game randomly ends according to δ
- When a SG terminates subjects randomly re-matched again
  - Pre-drawn realisation of SGs to ensure same length of play experience

PD: 1st periods cooperation and sucker by relative IQ
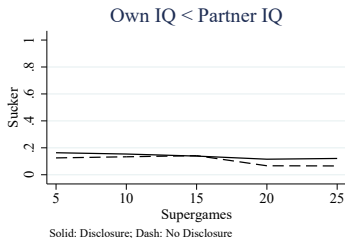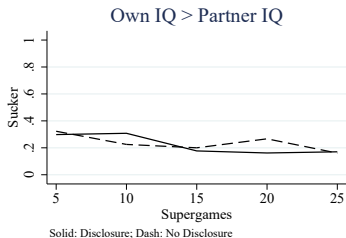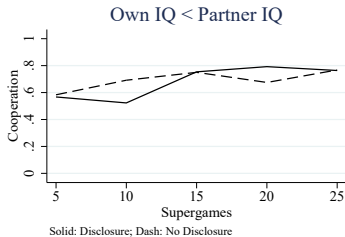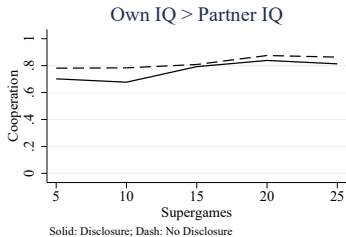
PD: 1st periods cooperative choice by relative IQ
Panel logit with random effects – *b* is expressed in odds ratios

	Own IQ > Partner IQ		Own IQ < Partner IQ	
	1	2	3	4
	b/se	b/se	b/se	b/se
choice				
Disclosure	0.20290**	0.74122	0.26699*	0.57362
	(0.1429)	(0.6591)	(0.1894)	(0.4402)
Disclosure*IQ diff.		0.81483***		0.88588**
		(0.0613)		(0.0496)
IQ diff.		1.04490		1.05300**
		(0.0456)		(0.0256)
Own IQ	1.16499*	1.18881**	1.13511	1.13340
	(0.0976)	(0.1035)	(0.0950)	(0.0925)
N	1250	1250	1250	1250

PD: Strategies in SGs in the first half of session

| Strategy | Own IQ > Partner IQ | | | | Own IQ < Partner IQ | | | |
	No Disclosure		Disclosure		No Disclosure		Disclosure	
Always Cooperate	0.1031	*	0.0102		0.0878		0.0498	
	(0.0548)		(0.0478)		(0.1239)		(0.0611)	
Always Defect	0.1329	**	0.1449		0.2455	***	0.1707	
	(0.0637)		(0.0992)		(0.0755)		(0.1241)	
Grim after 1 D	0.3396	**	0.2832	***	0.2462	**	0.3515	***
	(0.1381)		(0.0941)		(0.1026)		(0.1167)	
Tit for Tat (C first)	0.4244	***	0.5616	***	0.4204	***	0.4280	***
SC	0.7640		0.8448		0.6666		0.7795	
Gamma	0.5121	***	0.5724	***	0.5163	***	0.6130	***
	(0.1147)		(0.0469)		(0.0602)		(0.0440)	
beta	0.876		0.852		0.874		0.836	
Average Periods	3.625		3.625		3.625		3.625	
Observations	1,152		1,248		1,152		1,248	

PD: 1st periods cooperative choice

Panel logit with random effects – b is expressed in odds ratios

	Round 1 Cooperate b/se	Round 1 Cooperate b/se	1st Half Cooperate b/se	1st Half Cooperate b/se	All Cooperate b/se	All Cooperate b/se
choice						
Disclosure	0.65712	6.11118*	0.28940**	0.74653	0.25820**	0.91731
	(0.3052)	(6.0493)	(0.1514)	(0.4535)	(0.1523)	(0.5683)
Disclosure*IQ diff.		0.69879***		0.89158**		0.84913***
		(0.0920)		(0.0464)		(0.0367)
IQ diff.		1.25098**		1.01436		1.03585
		(0.1238)		(0.0293)		(0.0231)
Own IQ	1.05828	1.08294	1.12252**	1.11608**	1.14146**	1.12840**
	(0.0468)	(0.0541)	(0.0545)	(0.0551)	(0.0640)	(0.0587)
N	100	100	1200	1200	2500	2600

▸ Back

BoSLI

Choices & pref. outcome by relative IQ
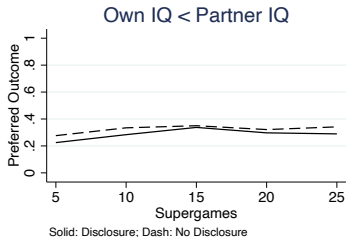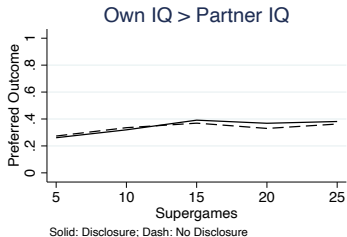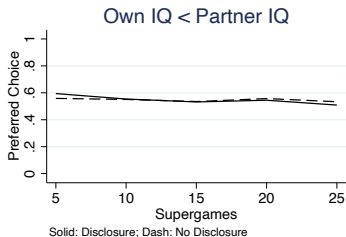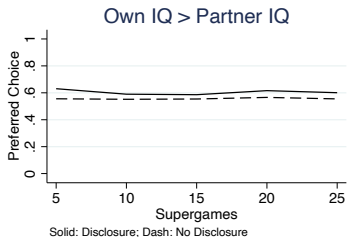
Battle of Sexes with Low Inequality ▸ Back

| | Preferred Choices | | | |
	Own IQ > Partner IQ		Own IQ < Partner IQ	
	1	2	3	4
	b/se	b/se	b/se	b/se
preferredchoice				
Disclosure	1.32290**	1.40183**	0.90679	1.08107
	(0.1830)	(0.2192)	(0.1049)	(0.1911)
Disclosure*IQ diff.		0.99189		0.96921
		(0.0120)		(0.0203)
IQ diff.		1.01347		1.02495
		(0.0090)		(0.0171)
Own IQ	0.99626	0.99328	0.97713	0.98112
	(0.0177)	(0.0178)	(0.0142)	(0.0175)
N	7735	7735	7735	7735

| | Preferred Outcome | | | |
	Own IQ > Partner IQ		Own IQ < Partner IQ	
	1	2	3	4
	b/se	b/se	b/se	b/se
preferredoutcome				
Disclosure	0.93869	1.07270	0.74730***	0.87681
	(0.1097)	(0.1680)	(0.0696)	(0.1546)
Disclosure*IQ diff.		0.97739		0.97234
		(0.0167)		(0.0251)
Own IQ	1.00086	1.01338	0.99717	0.98292
	(0.0152)	(0.0181)	(0.0142)	(0.0172)
Partner IQ	1.02118**	1.00759	1.01230	1.02559
	(0.0084)	(0.0129)	(0.0155)	(0.0180)
N	7735	7735	7735	7735

BoSLI: Strategies in SGs in the first half of session

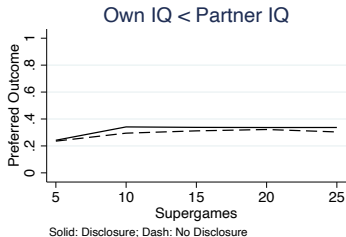| Strategy | Own IQ > Partner IQ | | | | Own IQ < Partner IQ | | | |
	No Disclosure		Disclosure		No Disclosure		Disclosure	
Always Preferred	0.1633	***	0.2365	***	0.1427	**	0.1619	*
	(0.0527)		(0.0774)		(0.0703)		(0.0833)	
Forceful Rev. Tit for Tat	0.3829	***	0.2089	**	0.1542	*	0.0888	
	(0.1006)		(0.1021)		(0.0916)		(0.0640)	
Forceful Teaching	0.0858		0.2076	***	0.2828	***	0.1541	**
	(0.0757)		(0.0721)		(0.0888)		(0.0655)	
Always Concede	0.0563		0.0703	**	0.0720		0.1297	*
	(0.0502)		(0.0348)		(0.0623)		(0.0680)	
Submissive Rev. Tit for Tat	0.3072	***	0.2107	***	0.1880	***	0.3636	***
	(0.0884)		(0.0607)		(0.0656)		(0.0699)	
Submissive Teaching	0.0045		0.0660		0.1603	**	0.1020	*
Forceful	0.6320		0.6530		0.5797		0.4048	
Submissive	0.3680		0.3470		0.4203		0.5953	
Gamma	0.6703	***	0.7165	***	0.8601	***	0.9142	***
	(0.0385)		(0.0590)		(0.0989)		(0.0830)	
beta	0.816		0.801		0.762		0.749	
Average Periods	3.625		3.625		3.625		3.625	
Observations	1,872		2,208		1,872		2,208	

BoSLI: Effect of disclosure on coordination

Panel logit with random effects – b is expressed in odds ratios

	Round 1 b/se	Round 1 b/se	1st Half b/se	1st Half b/se	All b/se	All b/se
coordboseq						
Disclosure	0.53161	0.62923	0.75468***	0.84706	0.78522***	0.88222
	(0.2060)	(0.3111)	(0.0811)	(0.1223)	(0.0710)	(0.1054)
Disclosure*IQ diff.		0.97066		0.98045		0.98013*
		(0.0521)		(0.0154)		(0.0116)
Own IQ	1.02319	1.02045	0.99722	0.99537	1.01641**	1.01447*
	(0.0339)	(0.0343)	(0.0083)	(0.0086)	(0.0077)	(0.0080)
Partner IQ	1.01556	1.01243	1.00085	0.99863	1.01759***	1.01527***
	(0.0324)	(0.0332)	(0.0079)	(0.0078)	(0.0058)	(0.0059)
N	170	170	7990	7990	15470	15470

BoSHI

Choices & pref. outcome by relative IQ

Battle of Sexes with High Inequality

	Preferred Choices			
	Own IQ > Partner IQ		Own IQ < Partner IQ	
	1	2	3	4
	b/se	b/se	b/se	b/se
preferredchoice				
Disclosure	0.88769	0.83939	1.12211	1.13673
	(0.1411)	(0.1403)	(0.1649)	(0.1830)
Disclosure*IQ diff.		1.00848		0.99766
		(0.0070)		(0.0124)
Own IQ	1.00785	1.00671	0.97233	0.97164*
	(0.0190)	(0.0191)	(0.0177)	(0.0170)
N	7280	7280	7280	7280

	Preferred Outcome			
	Own IQ > Partner IQ		Own IQ < Partner IQ	
	1	2	3	4
	b/se	b/se	b/se	b/se
preferredoutcome				
Disclosure	0.78438*	0.94734	1.33566***	1.12464
	(0.1044)	(0.1320)	(0.1436)	(0.1802)
Disclosure*IQ diff.		0.97005**		1.02802
		(0.0142)		(0.0203)
Own IQ	1.01744	1.03390	0.98441	0.99907
	(0.0177)	(0.0210)	(0.0158)	(0.0152)
N	4503	4503	4503	4503

BoSHI: Strategies in SGs in the first half of session

Strategy	Own IQ > Partner IQ No Disclosure		Own IQ > Partner IQ Disclosure		Own IQ < Partner IQ No Disclosure		Own IQ < Partner IQ Disclosure	
Always Preferred	0.2078	***	0.0897		0.1684	**	0.2568	***
	(0.0757)		(0.0579)		(0.0652)		(0.0890)	
Forceful Rev. Tit for Tat	0.2712	***	0.2540	**	0.0642		0.4332	***
	(0.0812)		(0.1130)		(0.0685)		(0.0974)	
Forceful Teaching	0.1342	**	0.2997	**	0.3256	***	0.0000	
	(0.0664)		(0.1190)		(0.0957)		(0.0511)	
Always Concede	0.0000		0.0347		0.0701		0.0000	
	(0.0236)		(0.0348)		(0.0431)		(0.0258)	
Submissive Rev. Tit for Tat	0.3714	***	0.3192	***	0.3198	***	0.2730	***
	(0.0759)		(0.0671)		(0.0691)		(0.0643)	
Submissive Teaching	0.0154		0.0027		0.0519		0.0370	
Forceful	0.6132		0.6434		0.5582		0.6900	
Submissive	0.3868		0.3566		0.4418		0.3100	
Gamma	0.6763	***	0.8067	***	0.8718	***	0.7811	***
	(0.0803)		(0.0716)		(0.0747)		(0.0599)	
beta	0.814		0.776		0.759		0.782	
Average Periods	3.625		3.625		3.625		3.625	
Observations	1,968		1,872		1,968		1,872	

▸ Back

BoSHI: Effect of disclosure on coordination

b is expressed in odds ratios

	Round 1 b/se	Round 1 b/se	1st Half b/se	1st Half b/se	All b/se	All b/se
coordboseq						
Disclosure	1.15304	2.06671	0.94762	1.04744	1.09694	1.17099
	(0.4049)	(1.2535)	(0.0912)	(0.1331)	(0.0957)	(0.1225)
Disclosure*IQ diff.		0.91257		0.98433		0.99001
		(0.0698)		(0.0136)		(0.0089)
Own IQ	1.00976	1.00202	1.02697***	1.02530**	1.02546**	1.02452**
	(0.0325)	(0.0328)	(0.0104)	(0.0101)	(0.0105)	(0.0103)
Partner IQ	0.98726	0.98047	1.02944***	1.02800***	1.02518***	1.02433***
	(0.0321)	(0.0324)	(0.0082)	(0.0082)	(0.0059)	(0.0060)
N	160	160	7520	7520	14560	14560