

Social Exchange of Motivated Beliefs

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Motivation

- ▶ What institutional settings make biases arising from motivated beliefs more or less severe?
- ▶ Common intuition: biases can grow when groups of people with similar motivation repeatedly socially exchange beliefs.
 - Concerns over online forums creating *echo chambers* leading to polarization and extremism; traders reinforcing each other's optimism creating *financial bubbles*; proliferation of conspiracy theories; *group-think* and *tunnel vision* in firms.

Goal: Study the impact of social exchange on motivated beliefs.

- ▶ Is there a behavioral asymmetry in how agents respond to social information?
- ▶ Do beliefs adjust to become more extreme as a result of social exchange, or are they pulled towards those with more moderate beliefs?

Summary of results

Social exchange of motivated beliefs worsens bias. This is driven by a form up asymmetric updating unique to social exchange.

- ▶ Subjects asymmetrically put more weight on others' beliefs when such beliefs are reinforcing of their motivation, but dismiss them otherwise.
- ▶ Difficult to rationalize as Bayesian response.
 - ▶ E.g., not driven by a naive failure to account for bias in other's beliefs.
- ▶ This contrasts with highly Bayesian response to objective signal.
- ▶ The effect is not driven by standard versions of confirmation bias.
 - ▶ The asymmetry aligned with motivation, not priors.

These patterns suggest motivated assignment of accuracy to others' beliefs.

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Literature

Non-bayesian interpretation of information:

Eil and Rao (2011), Charness and Levin (2005), Charness et al. (2007), Jin et al. (2016), Enke and Zimmermann (2017), Enke (2017), Eliaz and Schotter (2010), Moebius et al. (2013), Golman and Loewenstein (2015), Ambuehl and Li (2018), Ertac (2011), Coutts (2018), Fryer et al. (2019), Epstein and Halevy (2019), Shishkin and Ortoleva (2019), Liang (2019), Thaler (2020)

Overconfidence and memory:

Moore and Healy (2008), Hoelzl (2005), Grossman and Owens (2012), Zimmermann (2019), Huffman et al. (2019), Schwarzmann and van der Weel (2018), Chew et al. (2018)

Groups vs. individuals:

Charness et al. (2007a, b), Charness and Sutter (2012), Cooper and Kagel (2005)

Theory on overconfidence, motivated beliefs, group polarization:

Köszegi (2006, 2006), Brunnermeier and Parker (2005), Sarver (2018), Bracha and Brown (2012), Bénabou and Tirole (2002), Glaeser and Sunstein (2009), Roux and Sobel (2015)

Experimental Design

Design

5 Parts:

1. 10 Raven matrices
2. Belief question: Unmotivated $\rho = 0.6$
3. Belief question: Unmotivated $\rho = 0.7$ (reverse direction)
4. Belief question: **Treatment variation**
5. Survey: More on cognitive ability, beliefs over others, gender, major.

Part 4: Main elicitation task

Three treatments vary whether beliefs are motivated and whether there is social exchange of beliefs.

Task consists of three phases:

1. **Phase 1: (Initial beliefs, Seconds 1-44)** Subjects form a prior.
2. **Phase 2: (Interim beliefs, Seconds 45-89):** In exchange treatments, subjects are paired and observe their counterparts' beliefs in real time.
3. **Phase 3: (Public Signal, Seconds 90-180)** Subjects observe a *public signal with known accuracy* and update beliefs.

Part 4: Main elicitation task

Summary of Treatments

	Exchange-Motivation (E-M)	No Exchange-Motivation (NE-M)	Exchange-No Motivation (E-NM)
Group Assignment	Based on IQ score	Based on IQ score	Random
Group Composition	10 in Green, 10 in Red	10 in Green, 10 in Red	14 in Green, 6 in Red
Phase 1	No social interaction	No social interaction	No social interaction
Phases 2 & 3	Beliefs public in pairs	No social interaction	Beliefs public in pairs

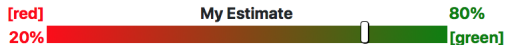
Treatments differ only in the main elicitation task in Part 4. These differences are described above.

Part 4: Main elicitation task

Exchange-Motivation (E-M)

Part 4

Please input your estimate (you will receive your test result in 70 seconds).



The computer assigned the participants

with the

10

lowest scores to
red

10

highest scores
to green

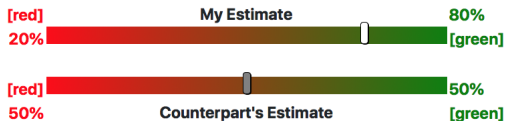
Your counterpart is in the **same group** as you are and you each must estimate the likelihood you are both in the **green group** vs. the **red group**.

Part 4: Main elicitation task

Exchange-Motivation (E-M)

Part 4

Please input your estimate (you will receive your test result in 36 seconds).



The computer assigned the participants

with the

10

lowest scores to

red

10

highest scores

to green

Your counterpart is in the **same group** as you are and you each must estimate the likelihood you are both in the **green group** vs. the **red group**.

Part 4: Main elicitation task

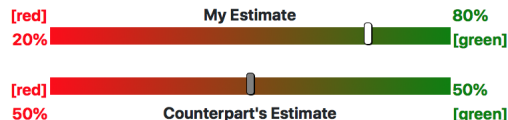
Exchange-Motivation (E-M)

Part 4

The test result is **red** (75% chance correct).

You and your counterpart are both shown the same test result (there is only one test).

Please input your estimate. There are 69 seconds left in the period.



The computer assigned the participants

with the

10

lowest scores to

red

10

highest scores

to green

Your counterpart is in the **same group** as you are and you each must estimate the likelihood you are both in the **green group** vs. the **red group**.

Design

Incentives:

- ▶ \$10 show up fee.
- ▶ One part randomly selected for payment (\$0 or \$10).

Part 1: Answer to randomly selected Raven question.

Part 2-4: Belief in randomly selected second (BSR).

Part 5: Answer to a randomly selected question.

Overview:

- ▶ Data from 220 subjects in 11 sessions at UCSB.

5 sessions of E-M, 3 sessions of NE-M and E-NM.

- ▶ Sessions computerized using *oTree*.

- ▶ 45-55 min sessions.

Results

Outline

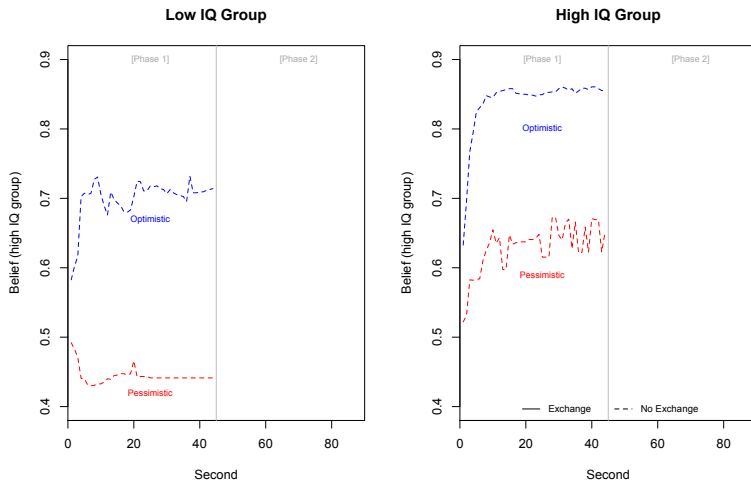
1. Impact of social exchange on beliefs.
2. Impact of objective signal on beliefs.
3. Discussion on the mechanism driving the amplification of bias.

Studying the impact of social exchange of beliefs

- ▶ Motivated sessions.
 - Mean: 0.67, Median: 0.70.

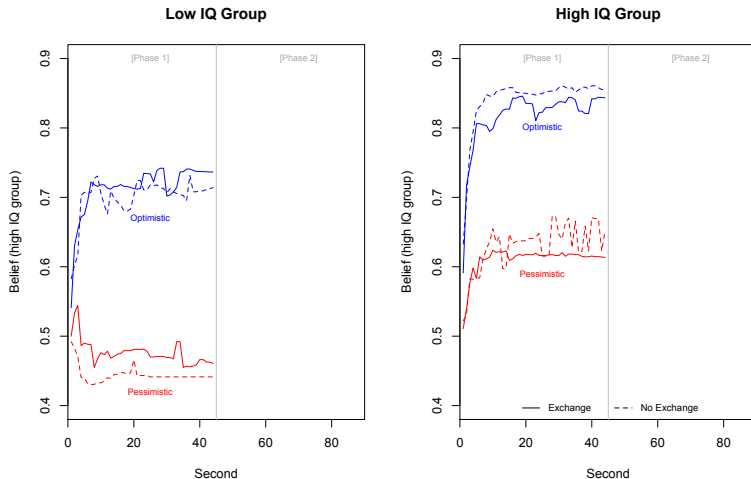
- ▶ Impact of social exchange of beliefs:
 - Focusing on the change from end of phase 1 to phase 2.
 - Separate subjects by whether they are relatively optimistic/pessimistic.

Beliefs stabilize before social exchange



Notes: The left hand panel shows subjects assigned to the low IQ group and the right hand panel shows subjects assigned to the high IQ group. The upper series (in blue) plots data for relatively optimistic counterparts and the lower series (in red) relatively pessimistic counterparts.

No difference between E-M and NE-M before social exchange



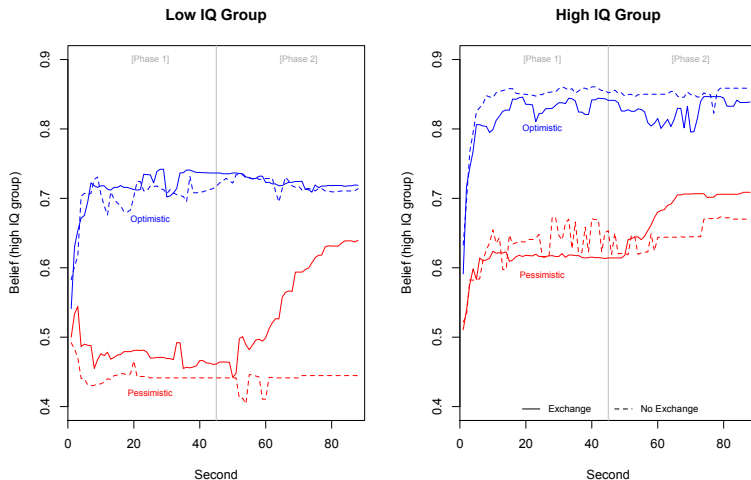
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Result: (*Design neutrality in phase 1*)

Subjects' beliefs stabilize in phase 1 of the experiment. On average, subjects in the low IQ group hold upward biased initial beliefs about their assignment to the high IQ group.

Beliefs in phase 1 are not statistically different between the Exchange and No Exchange treatment.

Social exchange increases optimism



Notes: The left hand panel shows subjects assigned to the low IQ group and the right hand panel shows subjects assigned to the high IQ group. The upper series (in blue) plots data for relatively optimistic counterparts and the lower series (in red) relatively pessimistic counterparts.

OLS Estimation (Dependent Variable: Change in Beliefs from Seconds 44 to 89)

	All	Low Group	High Group
Exchange	0.0481*** (0.0162)	0.0738*** (0.0247)	0.0224 (0.0205)
Constant	0.00650 (0.00492)	0.00200 (0.00234)	0.0110 (0.00950)
Observations	160	80	80

Standard errors (clustered at the pair level) in parentheses.

***1%, **5%, *10% significance.

Data from E-M and NE-M.

Exchange takes value 1 for E-M (0 otherwise).

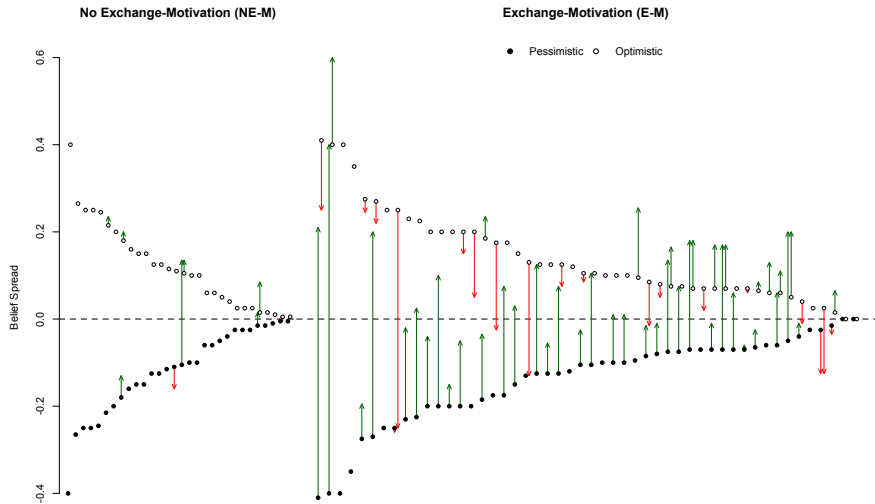
Result: (*Amplification of bias*)

Beliefs adjust systematically upwards as a result of social exchange, particularly for those in the low IQ group.

Social exchange thus worsens bias on average.

No similar effects occur in the absence of social interaction.

Belief adjustments for all matched pairs in the E-M and NE-M



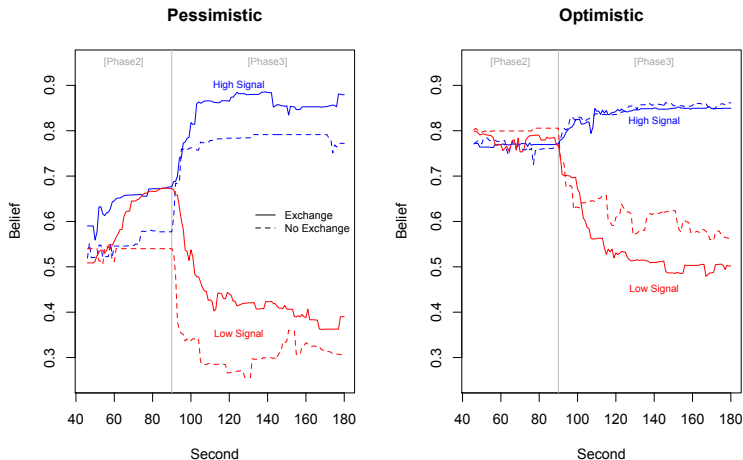
Notes: Dots show beliefs at the 44th second for the optimistic (hollow dots) and pessimistic (solid dots) normalized symmetrically around zero. Arrows show adjustments in beliefs between the end of phase 1 and the end of phase 2.

Result: (*Asymmetry in adjustment*)

The majority of pessimistic subjects adjust significantly upwards towards their more optimistic counterpart in Exchange-Motivation.

By contrast only a minority of optimistic subjects adjust downwards towards their pessimistic counterpart (and almost as many adjust away from their pessimistic counterpart).

Impact of objective signal



Notes: Panels break up data by relatively pessimistic and optimistic counterparts. The upper series (in blue) plots data for subjects who receive an h signal (indicative of being in the high IQ group) at the beginning of phase 3 and the lower series (in red) for subjects who receive an l signal (indicative of being in the low IQ group) .

Result: *(Impact of objective signal)*

Subjects respond strongly to the objective signal.

Objective signal mostly corrects for the amplification of bias generated by social exchange of beliefs.

A closer look at the data reveals:

- ▶ Response to social information is asymmetric.
 - ▶ Difficult to reconcile with Bayesian updating.
- ▶ By contrast, response to objective signal is highly Bayesian.
- ▶ Direction of asymmetry aligns with motivation, not prior.

This is consistent with [motivated assignment of accuracy](#) to others' beliefs.

Regression approach to study response to social information

For any signal \mathbf{s} , by Bayes' rule:

$$\frac{p}{1-p} = \frac{p_0}{1-p_0} \left(\frac{\rho_h}{\rho_l} \right)$$

where

- ▶ p_0 is the prior,
- ▶ p is the posterior,
- ▶ ρ_h (ρ_l) is probability of observing \mathbf{s} in the high (low) state.

In log form:

$$\log \left(\frac{p}{1-p} \right) = \log \left(\frac{p_0}{1-p_0} \right) + \log \left(\frac{\rho_h}{\rho_l} \right)$$

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Regression approach to study response to social information

Estimate the following (Grether, 1980):

$$\log\left(\frac{p}{1-p}\right) = \alpha \log\left(\frac{p_0}{1-p_0}\right) + \beta_h \mathbf{1}(\lambda_{\tilde{p}} > 1) \log(\lambda_{\tilde{p}}) + \beta_l \mathbf{1}(\lambda_{\tilde{p}} \leq 1) \log(\lambda_{\tilde{p}})$$

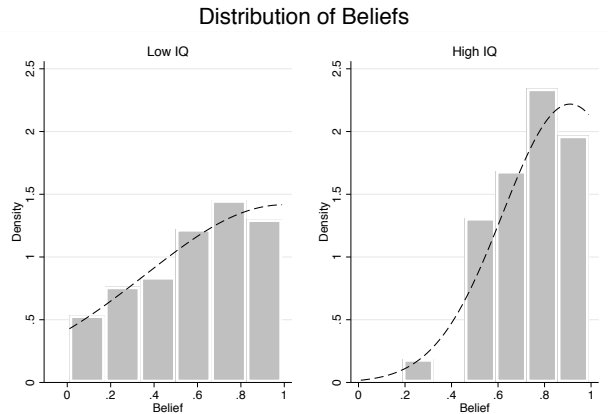
- ▶ p is posterior (end of phase 2).
- ▶ p_0 is the prior (end of phase 1).
- ▶ $\lambda_{\tilde{p}}$ is the likelihood ratio of observing \tilde{p} .

Two benchmarks for $\lambda_{\tilde{p}}$:

Naive: Take \tilde{p} at face value.

Sophisticated: Rational expectations on \tilde{p} .

Empirical distribution of beliefs with best fit at end of phase 1



Includes data from second 44 of treatments with Motivation.

Notes: Columns represent histogram of actual beliefs. Best fit distribution (truncated normal) shown with dashed line:

For the High Group: $(\mu, \sigma) = (0.91, 0.29)$; For the Low Group: $(\mu, \sigma) = (1, 0.64)$.

Response to social information difficult to rationalize as Bayesian

OLS Estimation (Dependent Variable: Log Posterior Odds Ratio End of Phase 2)

	<i>Sophisticated Benchmark</i>		<i>Naive Benchmark</i>	
	Exchange	No-Exchange	Exchange	No-Exchange
α	0.721*** (0.117)	1.034*** (0.0235)	0.773*** (0.110)	1.039*** (0.0215)
β_h	2.808*** (0.693)	0.212 (0.239)	0.363*** (0.0832)	0.0290 (0.0354)
β_l	0.0655 (0.0776)	0.0292 (0.0256)	0.0334 (0.0589)	0.0406 (0.0334)
$H_0 : \beta_h = \beta_l$	0.001	0.462	0.007	0.075
Observations	100	60	100	60

Estimation results are on updating from end of phase 1 to 2.

Standard errors in parentheses; clustered at the pair level in E-M and subject level in NE-M.

The second to last row shows p-values associated with testing $\beta_h = \beta_l$.

*** 1%, ** 5%, * 10% significance. Data from Motivation treatments.

Result: *(Asymmetry in updating with social information)*

The effect of social exchange on beliefs cannot be explained as a Bayesian response to

- (i) correct beliefs about the accuracy of initial beliefs;
- (ii) a naive failure to account for bias in others' beliefs.

Response to objective signal is Bayesian

OLS Estimation (Dependent Variable: Log Posterior Odds Ratio End of Phase 3)

	No-Exchange	Exchange
α	0.857*** (0.119)	0.798*** (0.123)
β_h	0.999*** (0.205)	1.295*** (0.325)
β_l	1.030*** (0.191)	1.254*** (0.234)
$H_0 : \beta_h = \beta_l$	0.914	0.927
Observations	60	100

Estimation results are on updating from end of phase 2 to 3.

Standard errors in parentheses, clustered at the pair level in E-M and subject level in NE-M.

The second to last row shows p-values associated with testing $\beta_h = \beta_l$.

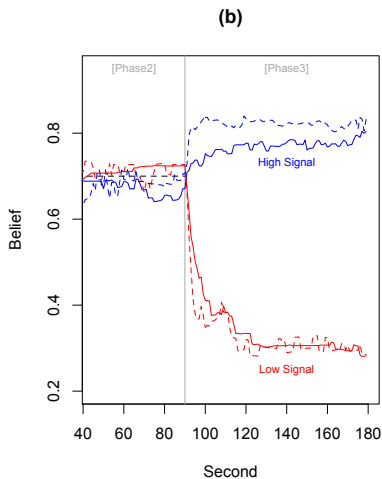
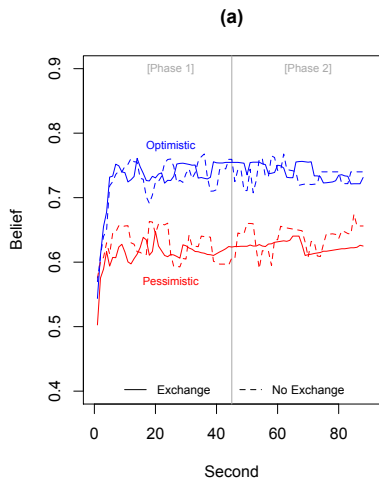
***1%, **5%, *10% significance. Data from Motivation treatments.

Result: (*Bayesian response to objective information*)

In contrast to social exchange, there is no asymmetry in response to the objective signal.

The response to the objective signals is consistent with Bayesian updating.

Social exchange has no impact without motivation



Result: (*Beliefs unaffected by exchange in E-NM*)

Social exchange does not have a significant effect on beliefs when there is no private information or scope for motivation.

The asymmetry is aligned with subjects' motivation, not prior

OLS Estimation (Dependent Variable: Log Posterior Odds Ratio End of Phase 2)

	<i>Sophisticated Benchmark</i>		<i>Naive Benchmark</i>	
	$\rho_0 < 0.5$	$\rho_0 > 0.5$	$\rho_0 < 0.5$	$\rho_0 > 0.5$
α	0.509 (0.712)	0.786*** (0.0842)	0.526 (0.622)	0.873*** (0.0723)
β_h	3.476 (3.706)	2.527*** (0.554)	1.036 (0.947)	0.328*** (0.0680)
β_l	0.543 (0.630)	0.0142 (0.0593)	0.584 (0.663)	0.0221 (0.0479)
$H_0 : \beta_h = \beta_l$	0.656	0.000	0.756	0.001
Observations	16	76	16	76

Estimation results are on updating from end of phase 1 to 2.

Bootstrapped standard errors (clustered at the pair level) in parentheses.

The second to last row shows p-values associated with testing $\beta_h = \beta_l$.

***1%, **5%, *10% significance. Data from E-M.

Result: *(No support for confirmation bias)*

The asymmetric updating we observe in social exchange is not supportive of confirmation bias.

There is no evidence that subjects with initially low priors respond more strongly to signals that are in the same direction as their prior that decrease optimism (undermine subject's motivation).

Summary of results:

- ▶ Social exchange of motivated beliefs worsens bias.
- ▶ This is driven by a form up asymmetric updating unique to social exchange.
 - ▶ Ambiguity in the information value of social exchange generates scope for motivated assignment of accuracy.

Implications:

- ▶ Results provides clues to the conditions under which biases can amplify in social settings and of how policies might be constructed to combat this effect.
- ▶ Two crucial ingredients are ambiguity about the value of socially transmitted information, and motivation to hold some beliefs over others.
 - ▶ Design institutions to reduce ambiguity in social information.
 - ▶ Public signals with objective accuracy are effective in correcting beliefs.