Communication with multiple senders: An experiment

Vespa and Wilson 2016

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Agenda

- Theory
- Experimental Design
- Result, Discussion and Conclusion

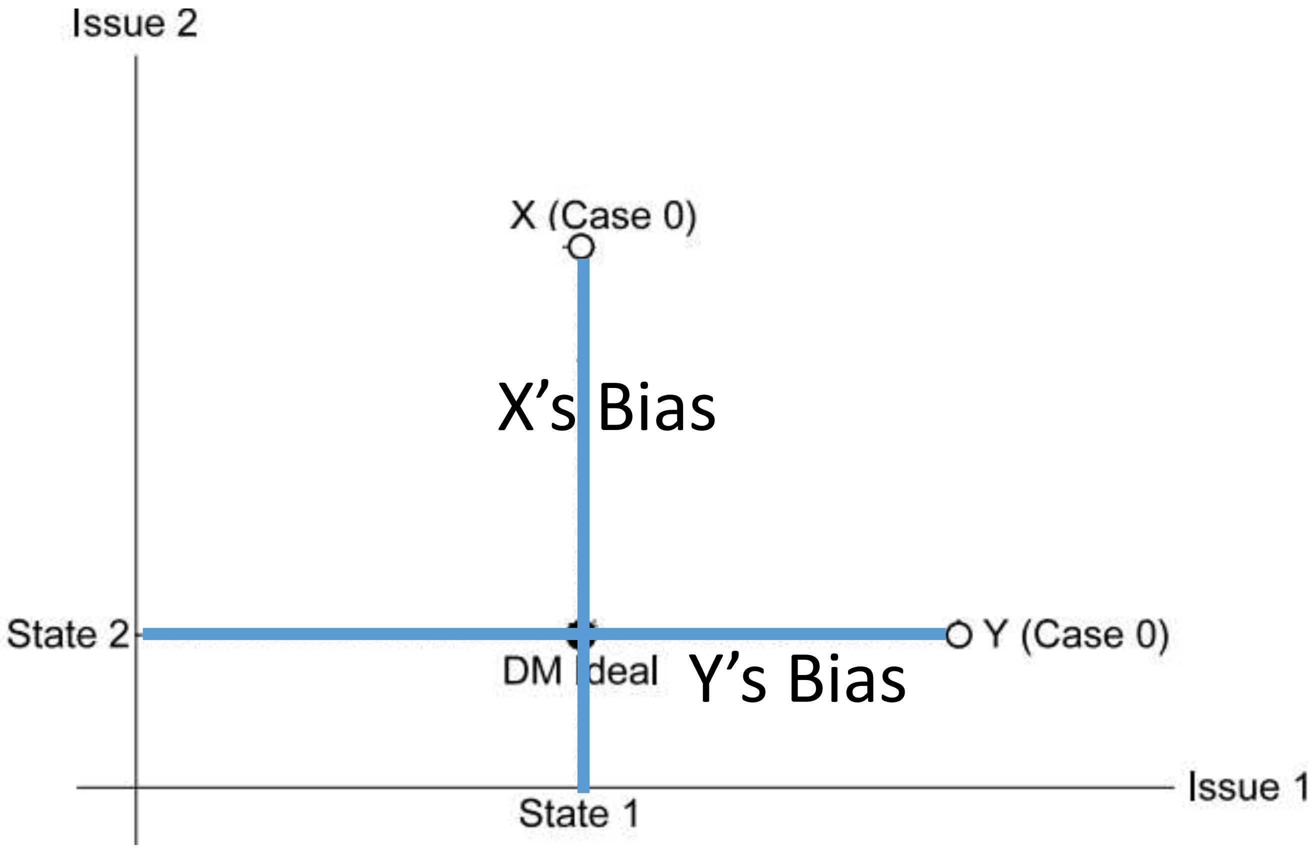
Theory

Full Revealing equilibrium

Battaglini 2002

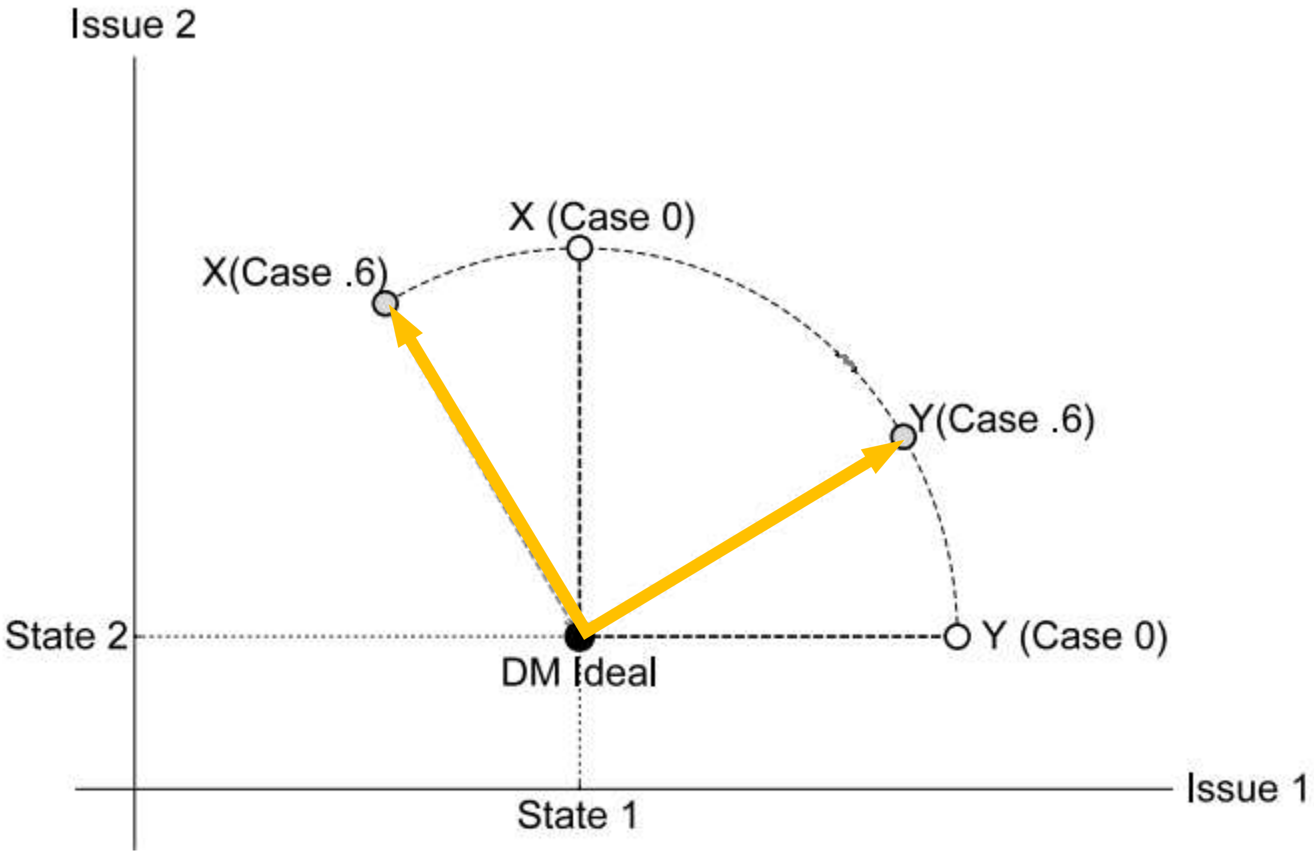
- Multi-sender, Multidimensional settings
- Decision maker combine expert’s recommendations and infer his best policy.
- By making each sender influential ONLY on the dimension of common interest with the receiver

Simplest case – Case 0



Knowing	Senders	Receiver
True state	+	-
Bias	+	+

Rotated from Case 0



Receiver's Strategy in Equilibrium

- When senders exaggerate in linearly independent, the sequentially rational receiver response is

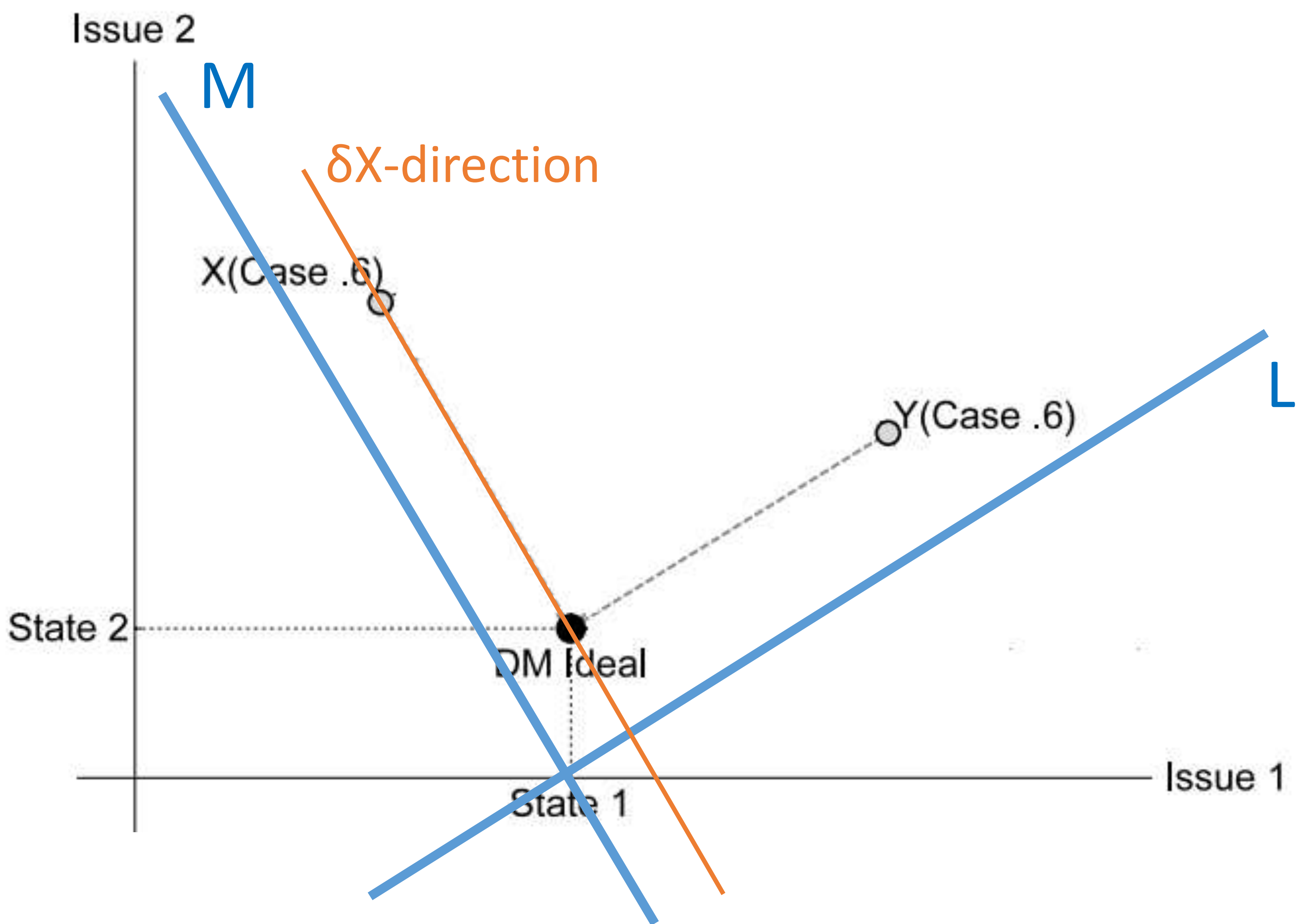
$$\zeta_{\mathbf{\Gamma}}(\mathbf{x},\mathbf{y}) = \left(\begin{array}{c} \alpha \cdot x_1 + (1-\alpha) \cdot y_1 + \beta_1 \cdot (y_2 - x_2) \\ (1-\alpha) \cdot x_2 + \alpha \cdot y_2 + \beta_2 \cdot (y_1 - x_1) \end{array} \right)$$

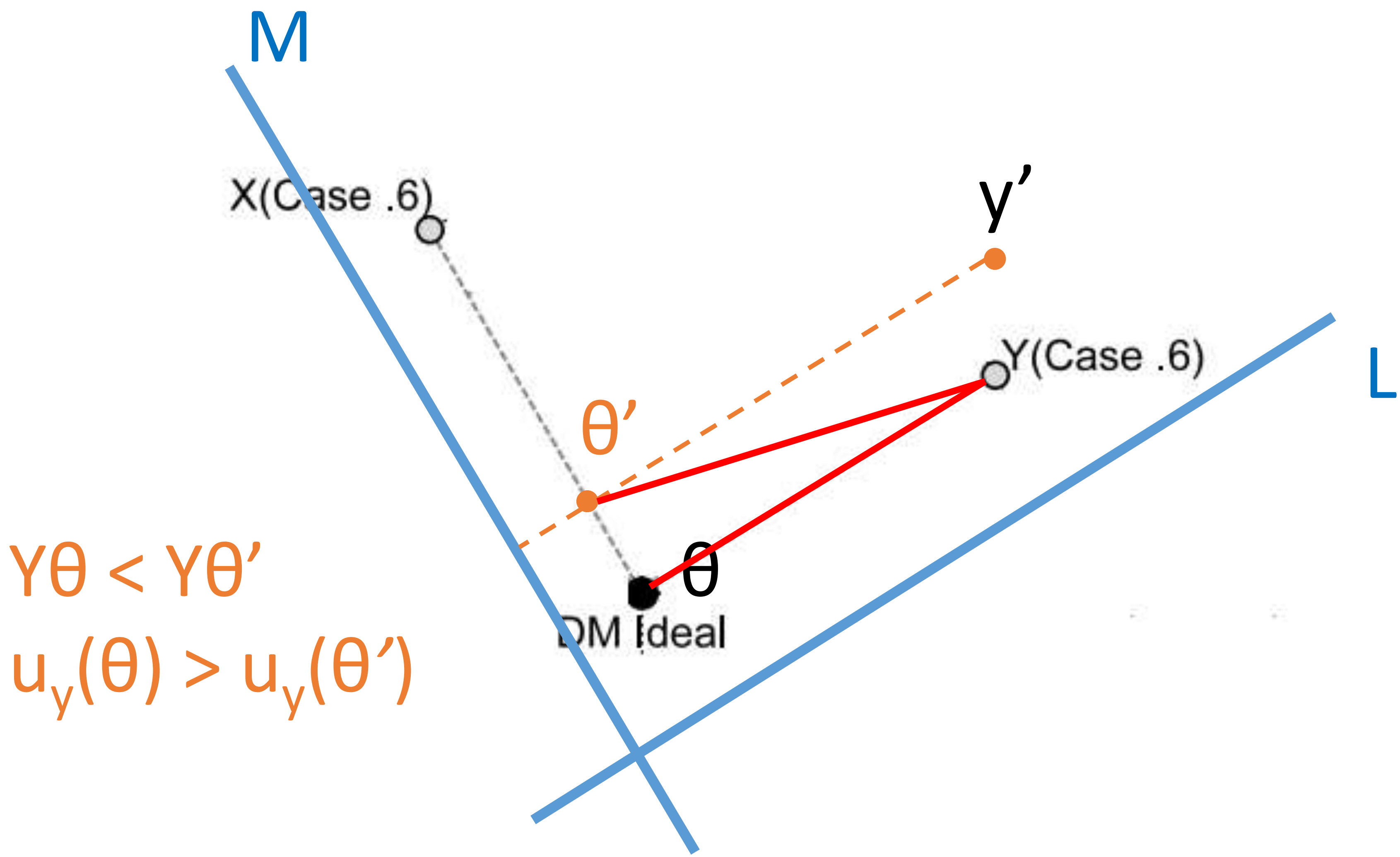
- α: **With-in** issue weighted parameter
- ß: **Across** issue weighted parameter

Sender’s Exaggeration Strategy

- Based on receiver’s sequential rationality and sender’s optimality

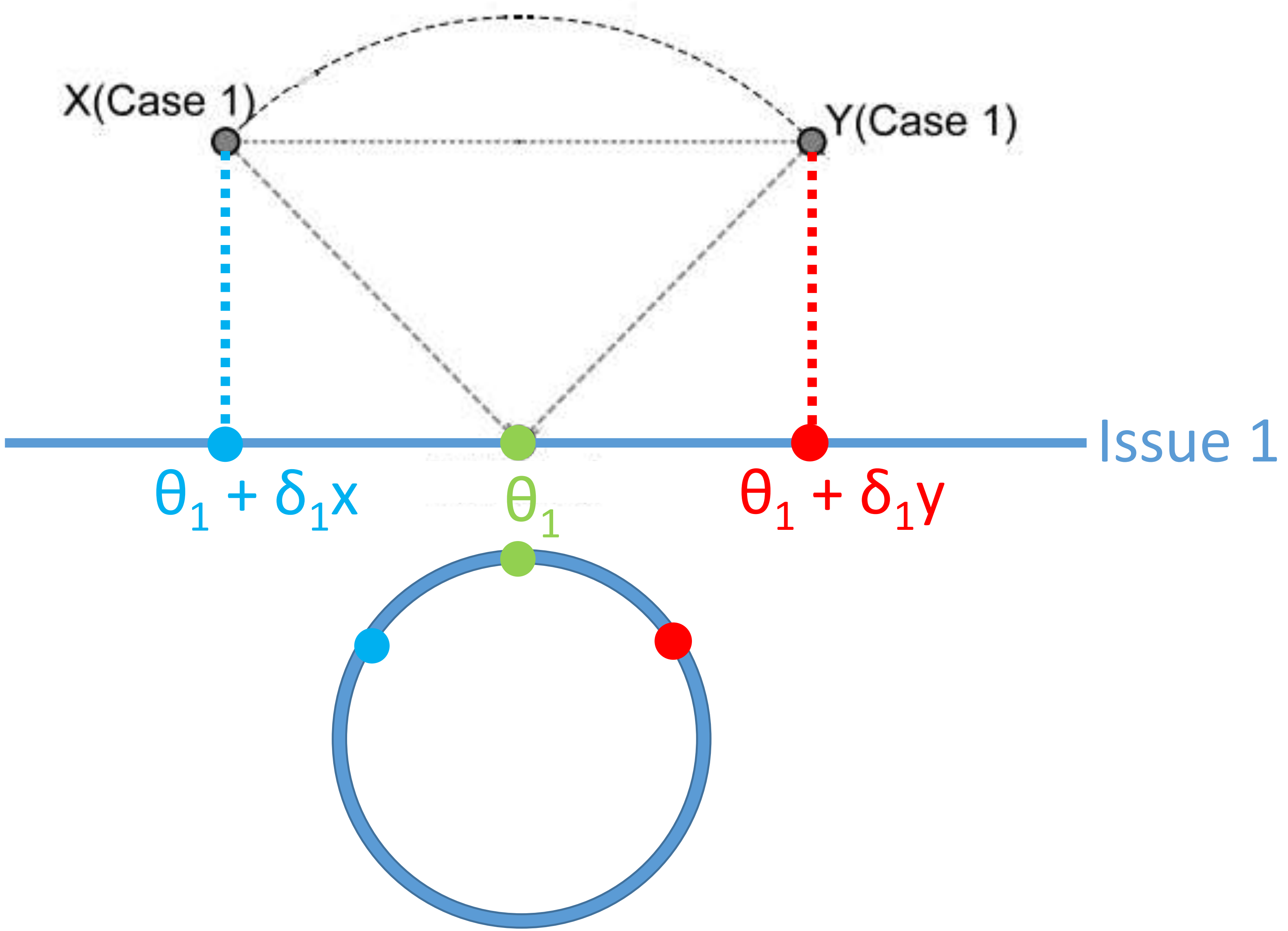
$$\gamma X(\Delta) \perp \delta Y \text{ and } \gamma Y(\Delta) \perp \delta X$$


Issue 2
M
δX-direction
X(Case .6)
Y(Case .6)
L
State 2
DM Ideal
Issue 1
State 1

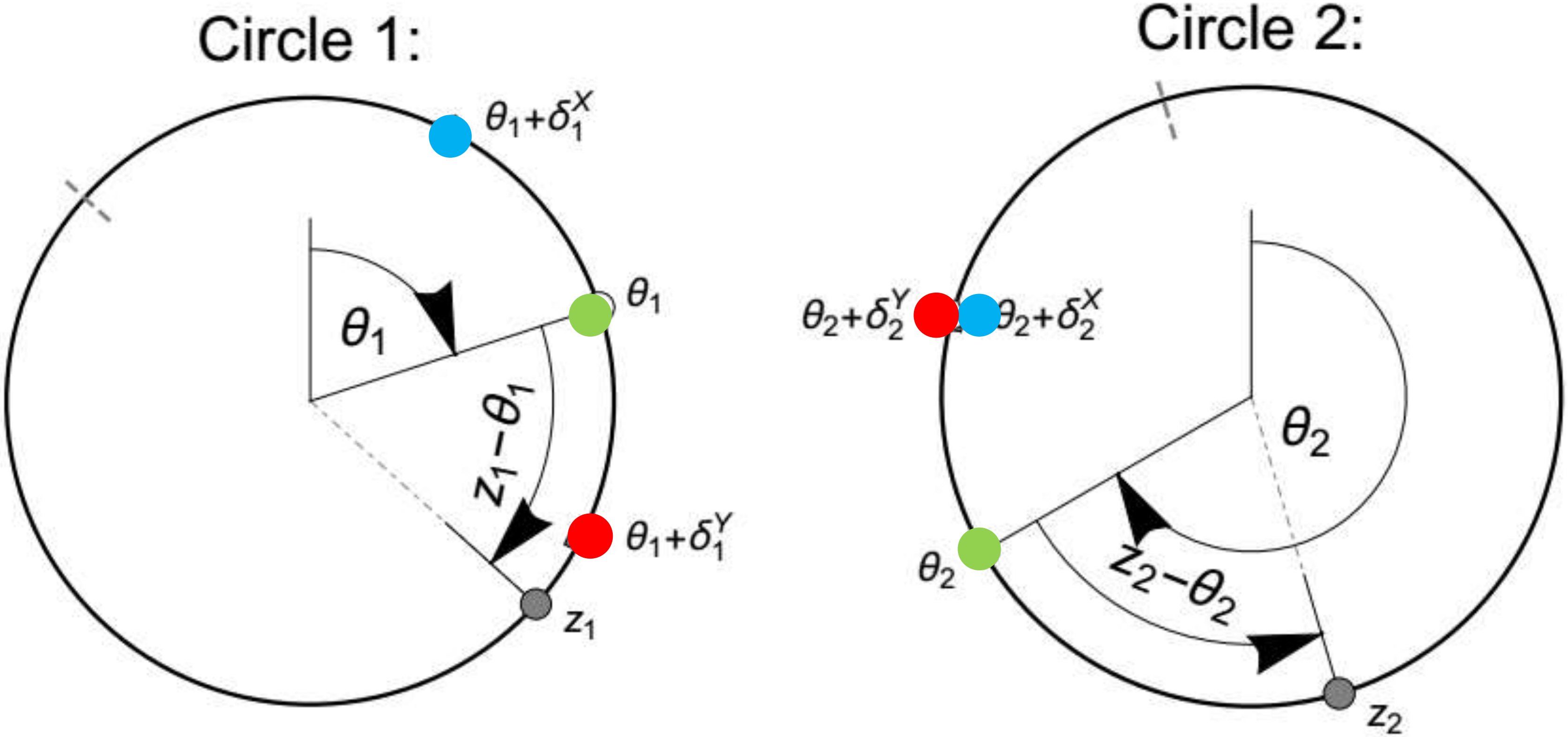


Senders do not prefer to deviate

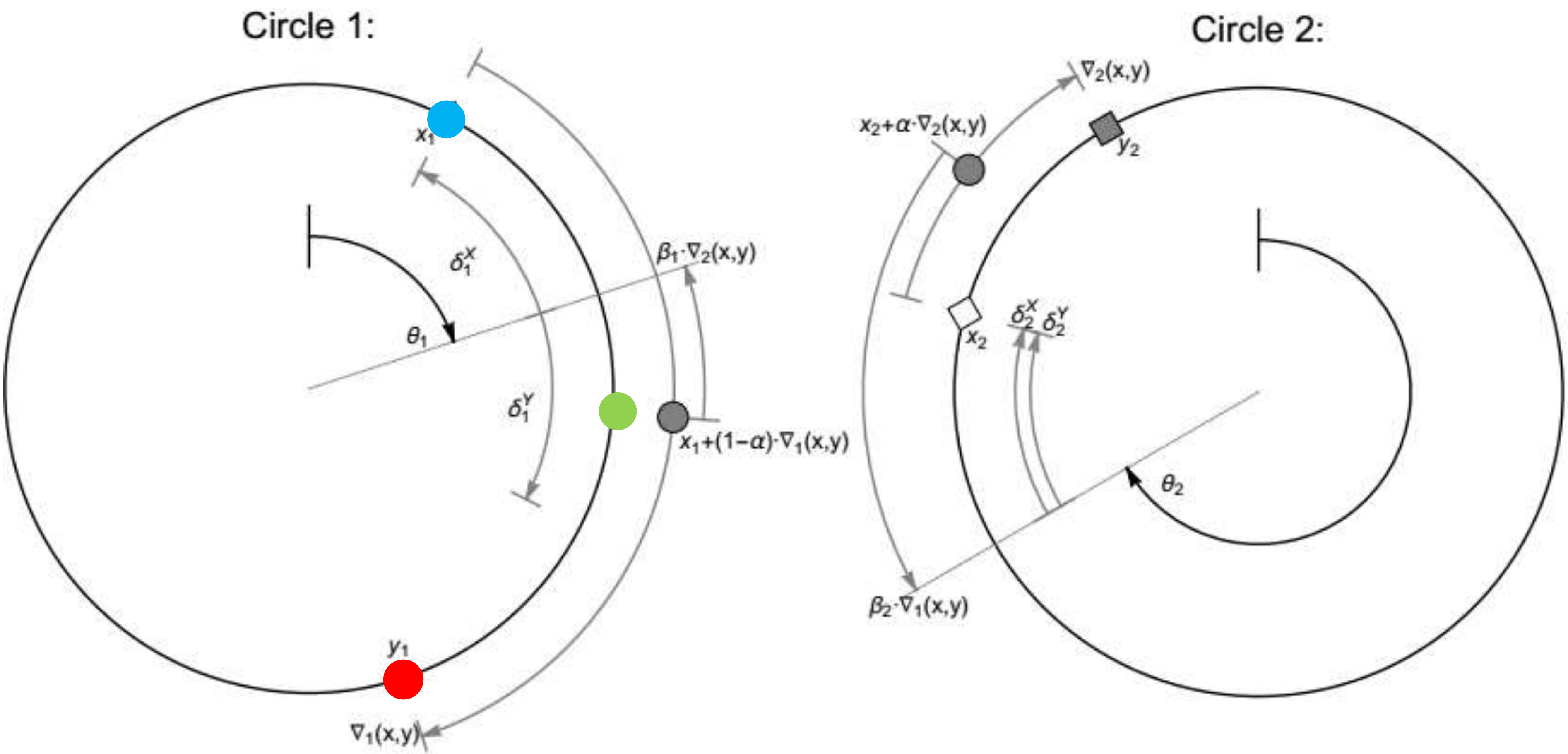
Plane -> Toroidal



Toroidal State Space



Example of Inference in Equilibrium



$$\zeta(\mathbf{x},\mathbf{y};\alpha,\beta_1,\beta_2) = \begin{pmatrix} \mathbf{x} + (1-\alpha)\cdot\nabla_1(\mathbf{x},\mathbf{y}) + \beta_1\cdot\nabla_2(\mathbf{x},\mathbf{y}) \\ \mathbf{x} + \alpha\cdot\nabla_2(\mathbf{x},\mathbf{y}) + \beta_2\cdot\nabla_1(\mathbf{x},\mathbf{y}) \end{pmatrix}$$

Experimental Design

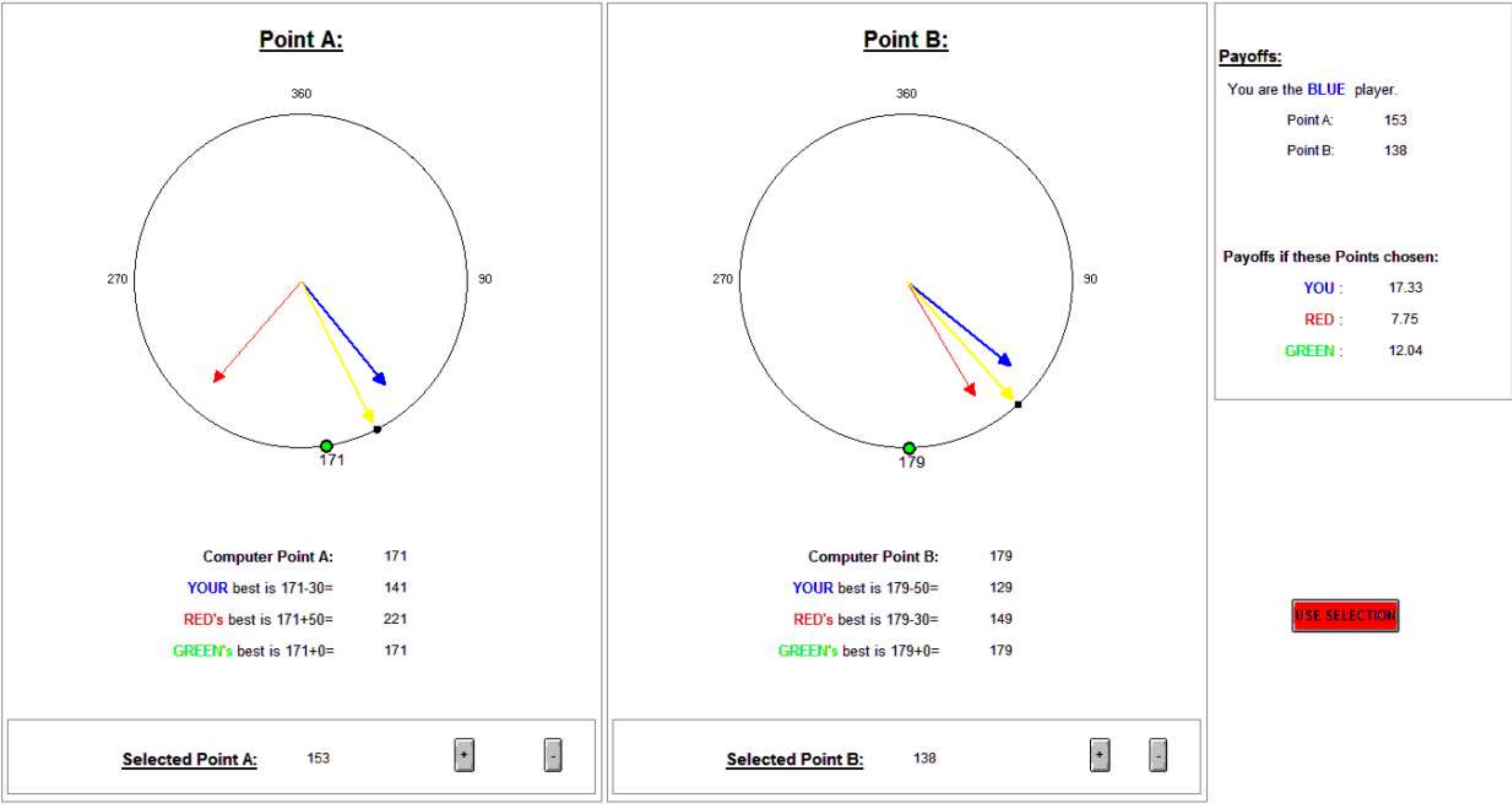
examine whether or not the Battaglini FRE is selected

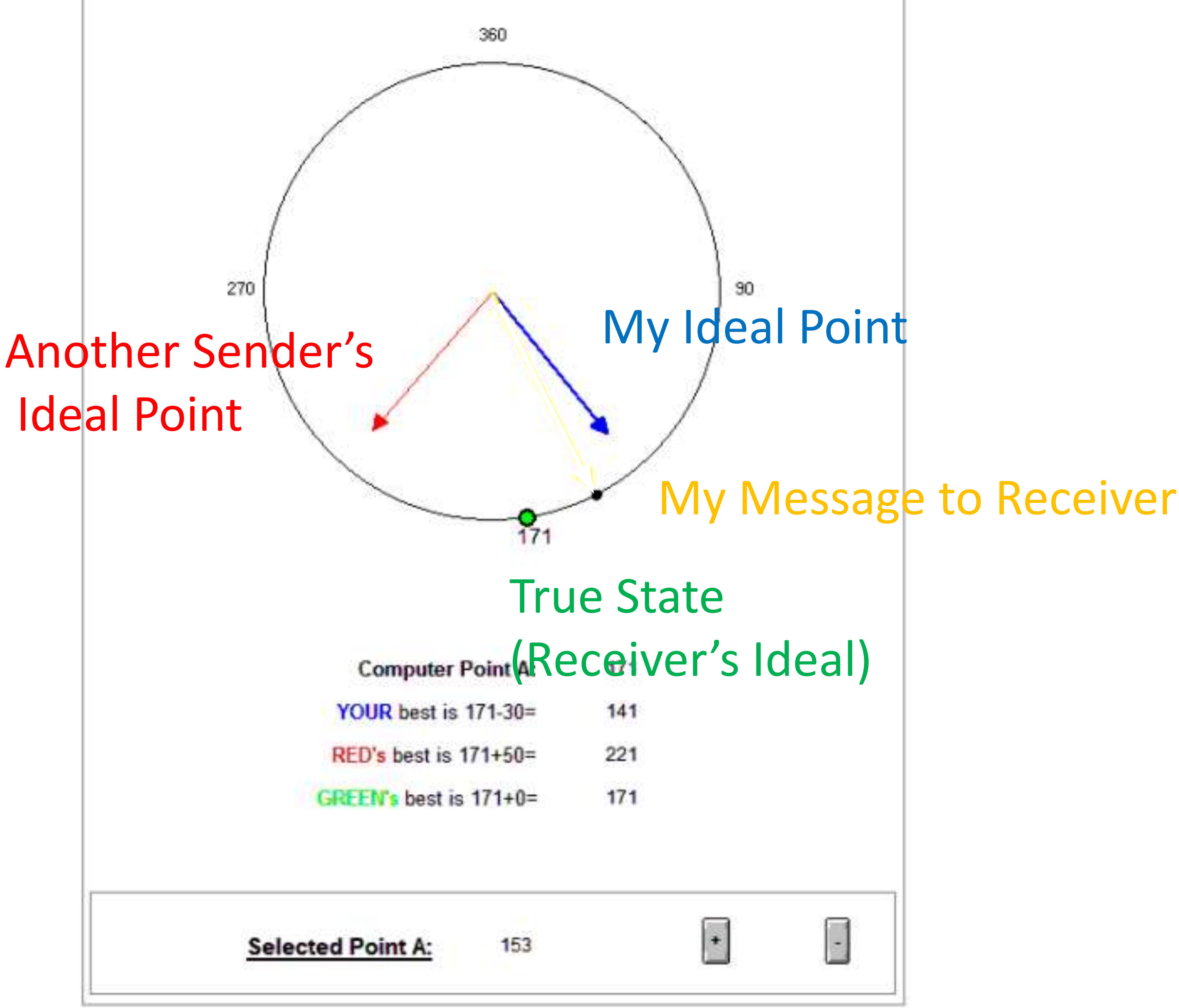
Laboratory Environment

- θ_1 and θ_2 are drawn independently from $\{1^\circ, 2^\circ, \ldots, 360^\circ\}$
- Subjects are assigned as Sender X Y, Receiver Z in Round 1-15
- All play as receiver in Round 16-20
- Payoff:

$$\max\left\{\$5, \$20 - \$8\frac{\sqrt{(\text{Degrees from Ideal}_1)^2 + (\text{Degrees from Ideal}_2)^2}}{45^\circ}\right\}$$

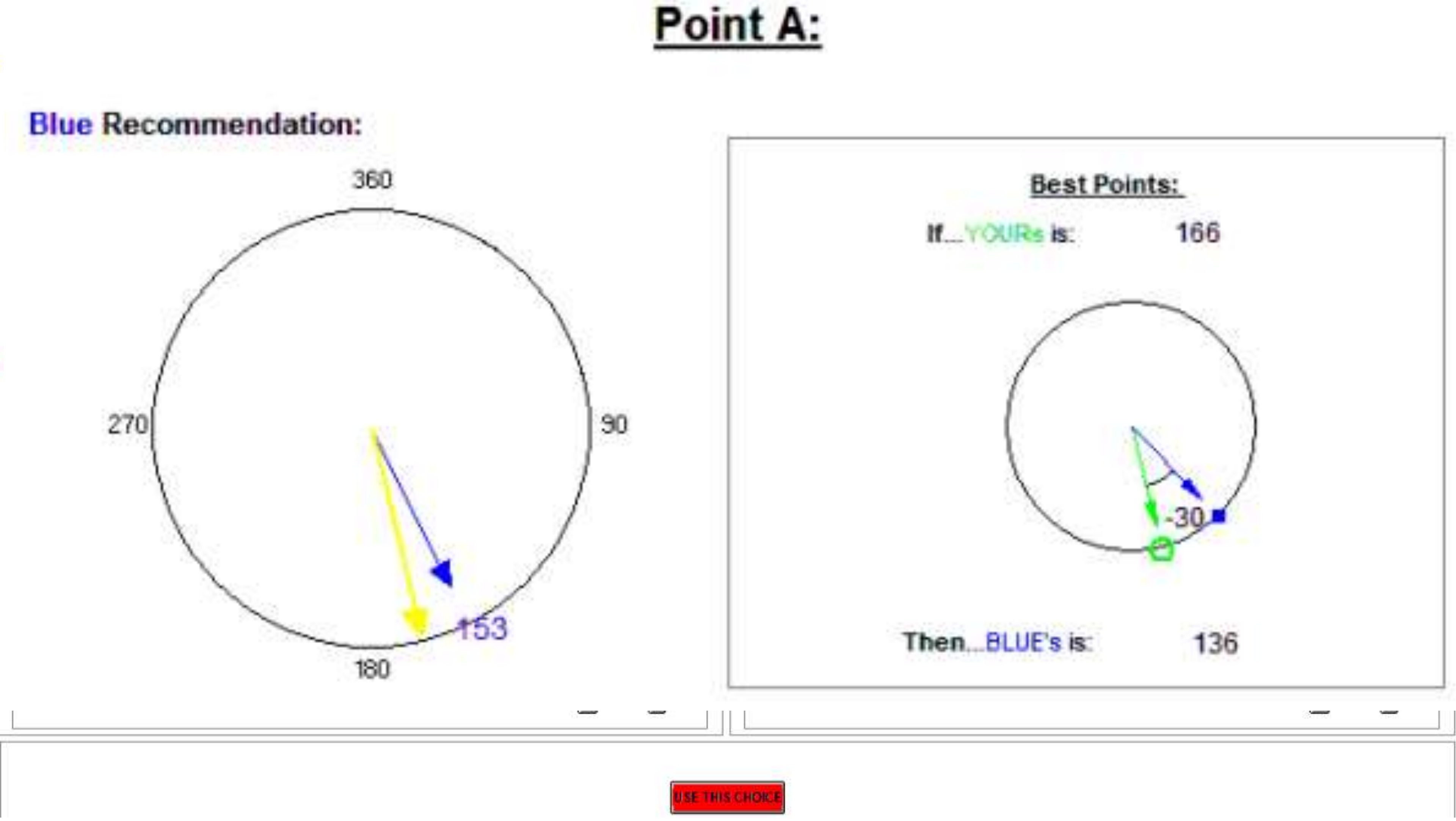
Sender’s Interface





360
270
90
My Ideal Point
Another Sender's Ideal Point
My Message to Receiver
171
True State (Receiver's Ideal)
Computer Point A: 171
YOUR best is 171-30= 141
RED's best is 171+50= 221
GREEN's best is 171+0= 171
Selected Point A: 153
+
-

Receiver’s Interface



Treatment

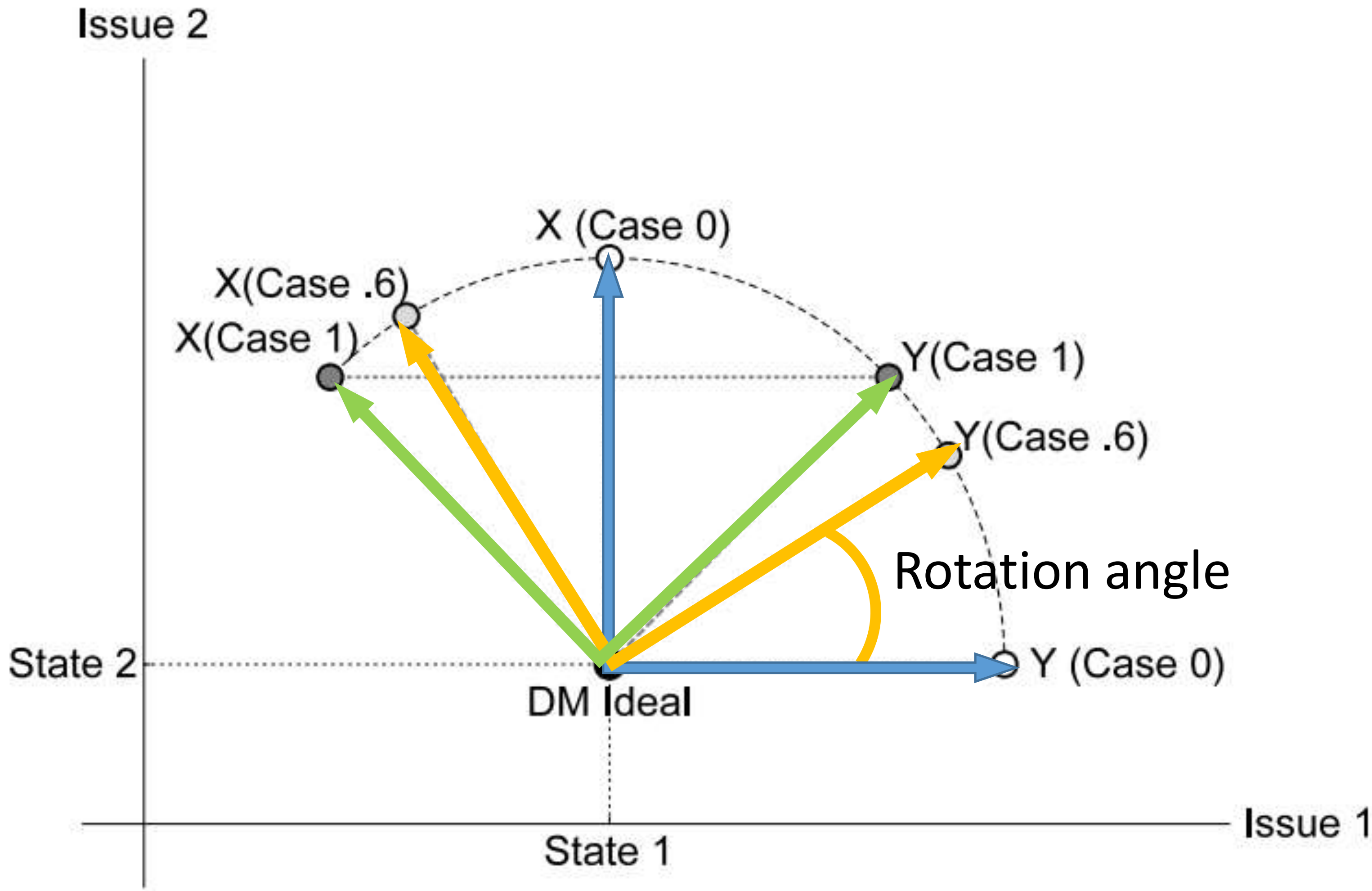


FIGURE 1. Experimental Treatments

Treatment

TABLE I. Treatments

Treatment	Biases		Within	Across	Babbling/Revealing Payoff	
	$\boldsymbol{\delta}^X$	$\boldsymbol{\delta}^Y$	$\alpha^\star$	$\beta^\star$	Senders	Receiver
R(0), P(0)	$(0°, 60°)'$	$(60°, 0°)'$	1	0	\$5.86/\$9.33	\$5.86/\$20.00
R(.6)	$(-30°, 50°)'$	$(50°, 30°)'$	$^{25}/_{34}$	$-^{15}/_{34}$	\$5.86/\$9.63	\$5.86/\$20.00
R(1), P(1), E(1)	$(-45°, 45°)'$	$(-45°, 45°)'$	$^{1}/_{2}$	$-^{1}/_{2}$	\$5.86/\$8.68	\$5.86/\$20.00

Result, discussion and conclusion

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Do receivers understand to use two senders' within issue bias to find the ideal points?

- Yes, when the context is simple, but when the rotation angle increases, most receivers reduce their understanding of ideal points.

Treatment	Biases δ^X	Biases δ^Y	Within α^*	Across β^*
R(0), P(0)	$\begin{pmatrix} 0° \\ 60° \end{pmatrix}$	$\begin{pmatrix} 60° \\ 0° \end{pmatrix}$	1	0
R(.6)	$\begin{pmatrix} -30° \\ 50° \end{pmatrix}$	$\begin{pmatrix} 50° \\ 30° \end{pmatrix}$	$\frac{25}{34}$	$-\frac{15}{34}$
R(1), P(1), E(1)	$\begin{pmatrix} -45° \\ 45° \end{pmatrix}$	$\begin{pmatrix} 45° \\ 45° \end{pmatrix}$	$\frac{1}{2}$	$-\frac{1}{2}$

$$Y = \frac{\text{babbling distance} - \text{observed distance}}{\text{babbling distance} - \text{fully revealing distance}}$$

Rotation	Y
R(0), no rotation	77%
R(0.6), 30 degree rotation	56%
R(1), 45 degree rotation	39%

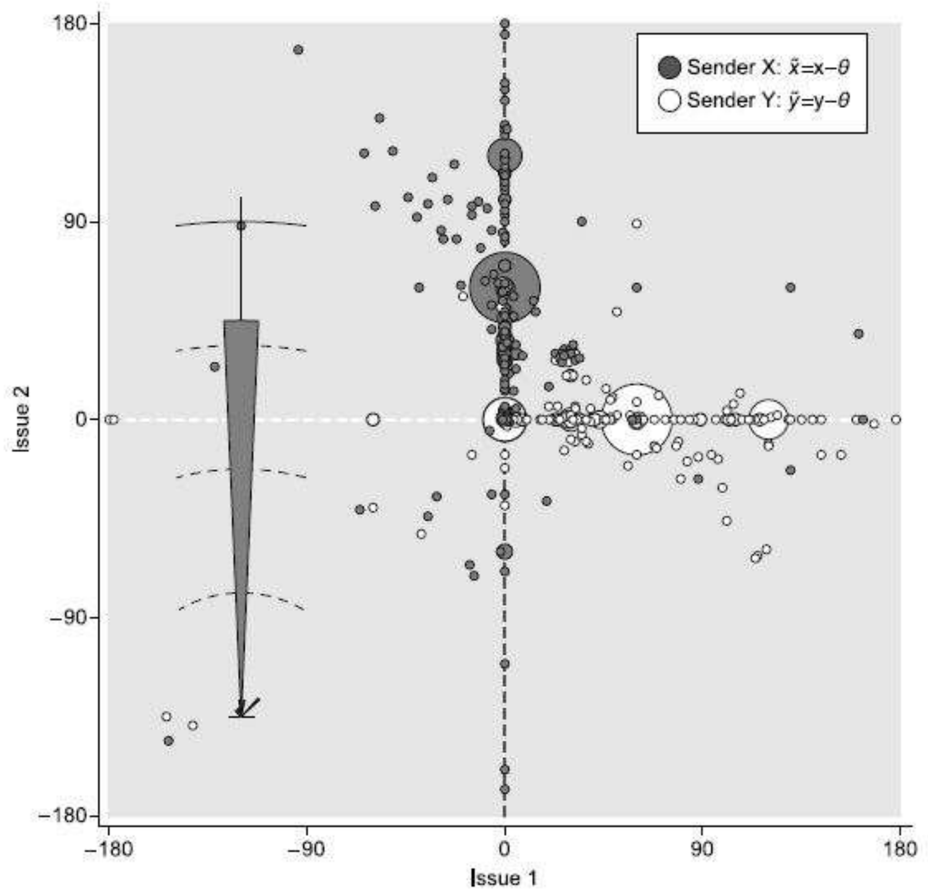
How do senders exaggerate?

- On unrotated state R(0), almost no exaggeration on the unbiased issue and ~50 degree exaggeration on the opposite issue from true state; many senders follows equilibrium exaggeration
- On rotated state R(0.6), R(1), many senders do not exactly follow the equilibrium strategy from restriction A, B, C

Restrictions and Equilibrium

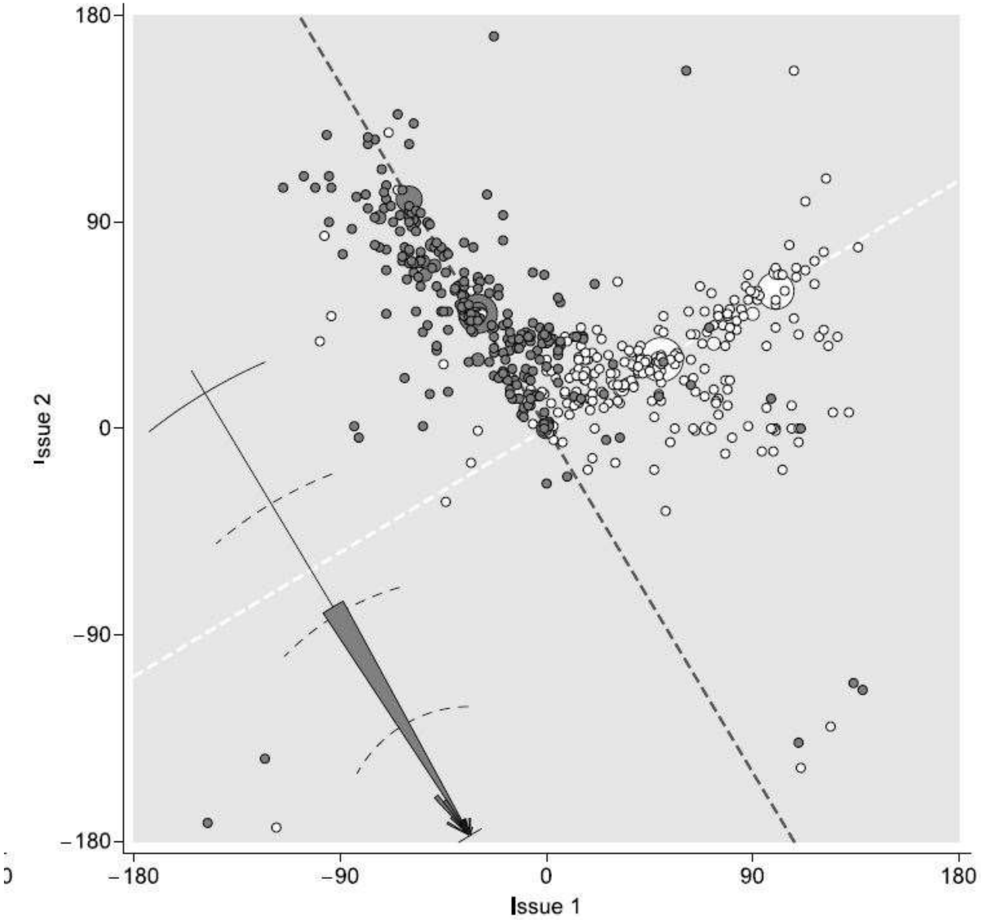
- Restriction A: No dependence between exaggerations and realized state
- Restriction B: Deviation comes from linear exaggeration
- Restriction C: Best Response exaggeration level for each set of senders is orthogonal

R(0) Senders



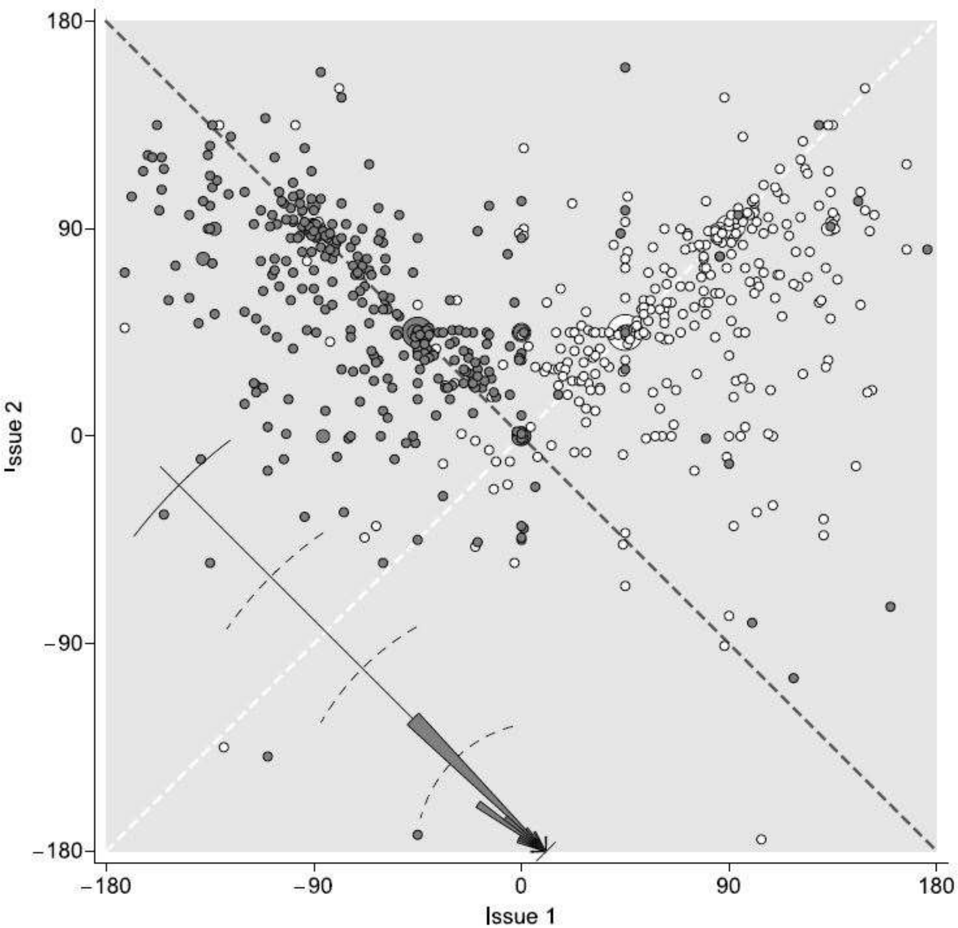
(a) R(0)

R(0.6) Senders



(b) R(.6)

R(1) Senders



(c) R(1)

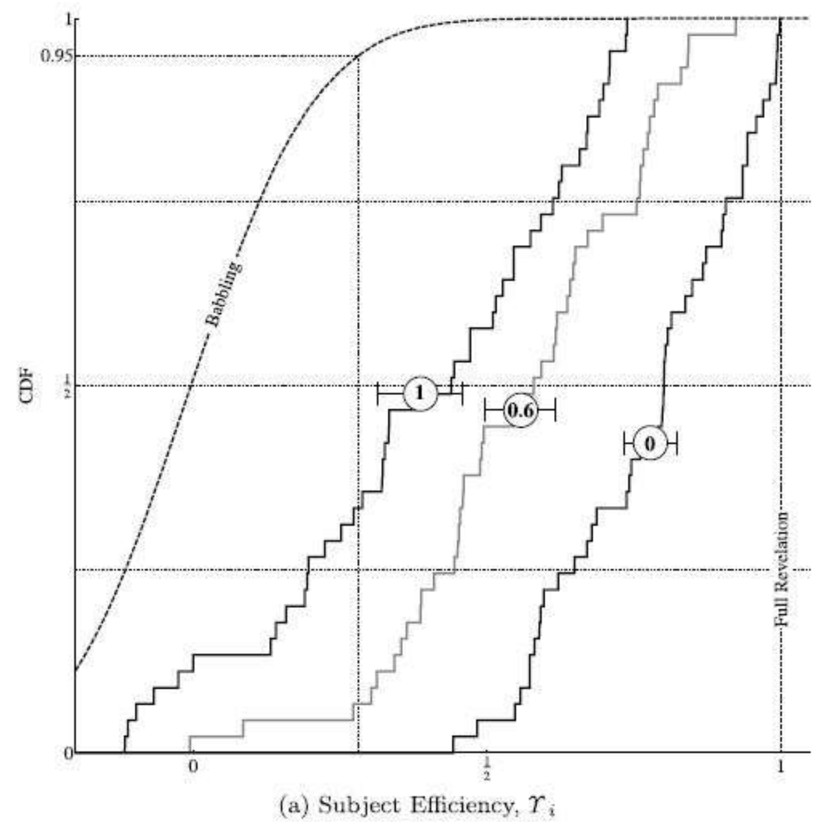
How many senders follow equilibrium Best Response?

Rotation	Exact BR	10% white Noise to BR
R(0)	69%	82%
R(0.6)	13%	59%
R(1)	10%	49%

Restriction	Evidence
A	Support
B	Linear exaggeration account for nearly half; more rotation, more noise
C	@ R(1), exaggeration quite noisy

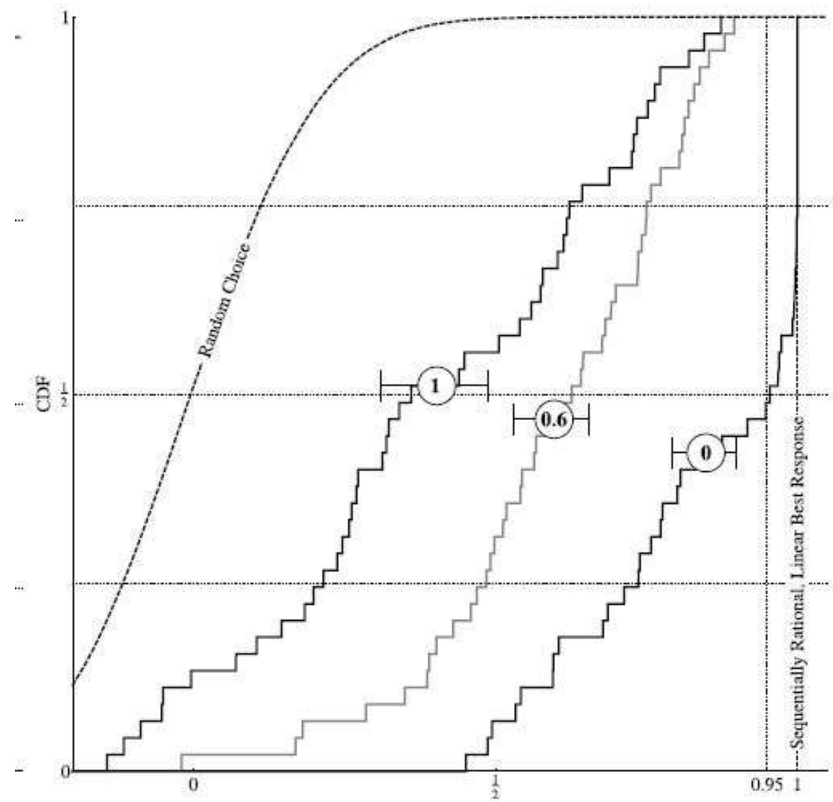
Construction of pessimal and optimal

- Sender
  - Babbling, where sender sends out random message
  - Full revelation, where senders know the best message to send knowing the other sender and receiver's response



Construction of pessimal and optimal

- Receiver
  - Random choice, where the receiver select whatever point without consider sender's message
  - Sequentially rational linear best response,



(b) Receiver Efficiency, $\hat{\Upsilon}_i$

Unsettling Results and future experiment

- Senders and receivers in rotated environment do not give best response, FRE difficult to obtain
- Training with computerized receiver may help senders learn about best message to give
- Sender experiment can be conducted to investigate LIBOR scandal (bank collusion)

How do receiver improve decision making?

1. Most receiver fail to understand ‘conditional expectation’ at a certain dimension (hyperplane)
   - Learn about the background of the senders to know about the level of within and across issue bias
   - Learn about the rotation level, meaning how much the senders (experts) are biased in opposite direction

Understanding within and across

	Within Issue		Across Issue	
	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\beta}_1$	$\hat{\beta}_2$
R(0)	0.87 [1.0]	0.88 [1.0]	0.00 [0.0]	0.07 [0.0]
	(0.04)	(0.05)	(0.02)	(0.03)
R(.6)	0.65 [0.74]	0.63 [0.74]	−0.11 [−0.44]	0.02 [−0.44]
	(0.07)	(0.07)	(0.07)	(0.06)
R(1)	0.38 [0.5]	0.54 [0.5]	0.02 [−0.5]	−0.05 [−0.5]
	(0.08)	(0.07)	(0.08)	(0.03)

tation: instead of assessing $\mathbb{E}(\theta_a|\mathbf{y}-\mathbf{x})$ in each dimension a (conditioning on the vector difference $\mathbf{y}-\mathbf{x}$), many subjects act as if calculating $\mathbb{E}(\theta_a|y_a - x_a)$.[32]

How do receiver improve decision making?

2. When the topic is rotated, receiver have a hard time understand the relative position of senders and instead use a simple average to find ideal point
   - Know that the senders can have asymmetric biases so that a weighted average is more appropriate
   - Reframe the discussion back to R(0), meaning ask smarter questions (issue) to identify an unbiased sender (expert)