

Salience & Focal Points

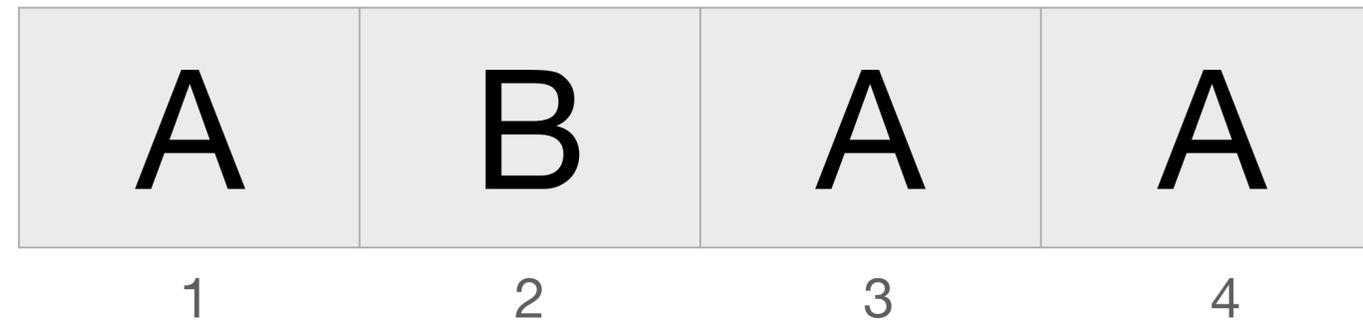
CMPUT 654: Modelling Human Strategic Behaviour

Crawford & Iriberry (2007)
Burchardi and Penczynski (2014)

Lecture Outline

1. Fun Game!
2. Crawford & Iriberry (2007)
3. Burchardi and Penczynski (2014)

Fun Game: Hide and Seek



- One player is the **Hider**, the other is the **Seeker**
- Each player simultaneously writes down a box number
- If they match, the Seeker wins
Otherwise, the Hider wins

Crawford & Iriberri (2007)

Why?

Extends existing models to explain further anomalies

- Extend level-0 type in level- k models to be attracted to **salience** rather than uniform randomization
- Apply model to **guessing games** like the fun game
- **Compare** to (a small set of) alternative models

“[Level- k models] have strong experimental support, which should allay the concern that once one relaxes equilibrium, anything is possible”

Model

- L0 cares about **salience**, not payoffs
 - **Edges** are salient
 - Box labelled **B** is salient
- L0 constraints:
 - Assumed not to actually **exist**
 - Make symmetric choices in both **Hider** and **Seeker** roles
- L1 best responds to L0
- L2 best responds L1, etc.

Alternative Models

1. Nash Equilibrium
2. Quantal Response Equilibrium
3. NE and QRE with **perturbed payoffs**
 - Add e to edges, f to B-box for Seekers
 - Subtract e, f for Hiders

Stylized Anomalies



1. "**Central A**" is modal choice for both Hiders and Seekers
2. "Central A" is **more prevalent for Seekers** than for Hiders

Model Fit

TABLE 3—PARAMETER ESTIMATES AND LIKELIHOODS FOR THE LEADING MODELS IN RTH'S GAMES

Model	Ln L	Parameter estimates	Observed or predicted choice frequencies				MSE	
			Player	A	B	A		A
Observed frequencies (624 hidiers, 560 seekers)			H	0.2163	0.2115	0.3654	0.2067	—
			S	0.1821	0.2054	0.4589	0.1536	
Equilibrium without perturbations	−1641.4		H	0.2500	0.2500	0.2500	0.2500	0.00970
			S	0.2500	0.2500	0.2500	0.2500	
Equilibrium with restricted perturbations	−1568.5	$e_H \equiv e_S = 0.2187$ $f_H \equiv f_S = 0.2010$	H	0.1897	0.2085	0.4122	0.1897	0.00084
			S	0.1897	0.2085	0.4122	0.1897	
Equilibrium with unrestricted perturbations	−1562.4	$e_H = 0.2910, f_H = 0.2535$ $e_S = 0.1539, f_S = 0.1539$	H	0.2115	0.2115	0.3654	0.2115	0.00006
			S	0.1679	0.2054	0.4590	0.1679	
Level- k with a role-symmetric $L0$ that favors salience	−1564.4	$p > 1/2$ and $q > 1/4, p > 2q,$ $r = 0, s = 0.1896, t = 0.3185,$ $u = 0.2446, v = 0.2473, \varepsilon = 0$	H	0.2052	0.2408	0.3488	0.2052	0.00027
			S	0.1772	0.2047	0.4408	0.1772	
Level- k with a role- asymmetric $L0$ that favors salience for seekers and avoids it for hidiers	−1563.8	$p_H < 1/2$ and $q_H < 1/4,$ $p_S > 1/2$ and $q_S > 1/4,$ $r = 0, s = 0.66, t = 0.34,$ $\varepsilon = 0.72; u \equiv v \equiv 0$ imposed	H	0.2117	0.2117	0.3648	0.2117	0.00017
			S	0.1800	0.1800	0.4600	0.1800	
Level- k with a role-symmetric $L0$ that avoids salience	−1562.5	$p < 1/2$ and $q < 1/4, p < 2q,$ $r = 0, s = 0.3636, t = 0.0944,$ $u = 0.3594, v = 0.1826, \varepsilon = 0$	H	0.2133	0.2112	0.3623	0.2133	0.00006
			S	0.1670	0.2111	0.4549	0.1670	

Burchardi and Penczynski (2014)

Why?

- Neat experimental setup
- Taking the possibility of L0 agents seriously instead of just assuming them away

Aims to answer 3 questions:

1. **How many** players are level-0?
2. What do level-0 players **do**?
3. What do other players **believe** that level-0 players do?

Experimental Design

Players in teams of 2 play the Beauty Contest:

1. Each teammate simultaneously sends a one-time textual message to the other player advocating for an action
2. After they've read each others' messages, each teammate chooses an action
3. With 50/50 probability, one of the teammates choices is used as the team's action
4. Teammates each get the same reward based on their action

RAs estimate upper and lower **bounds on level of reasoning** from the textual arguments!

Structural Estimation

- Estimate the parameters of a pretty standard level- k model from action choices
- Level-0 plays a Gaussian distribution whose parameters are learned
- Probability of each agent being level k is forced to 0 whenever k is outside the estimated bounds

Results: Doing and Thinking

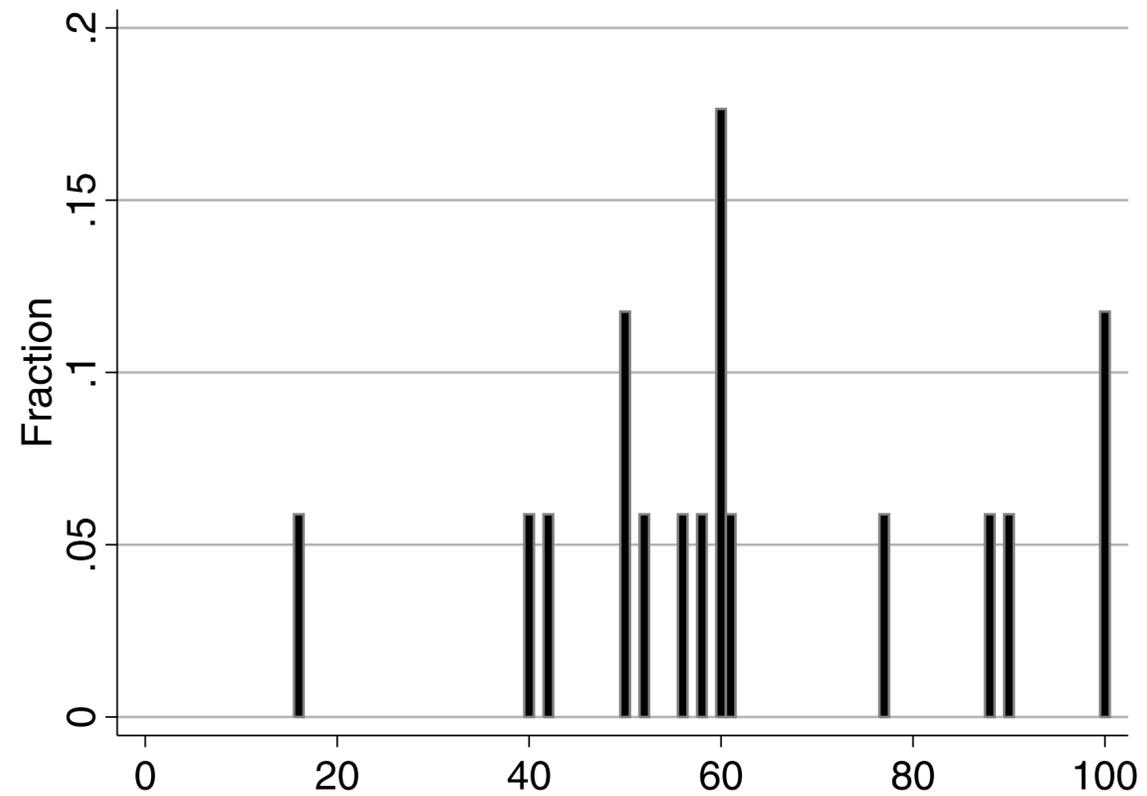


Fig. 2. Suggested decisions of level-0 players ($N = 17$).

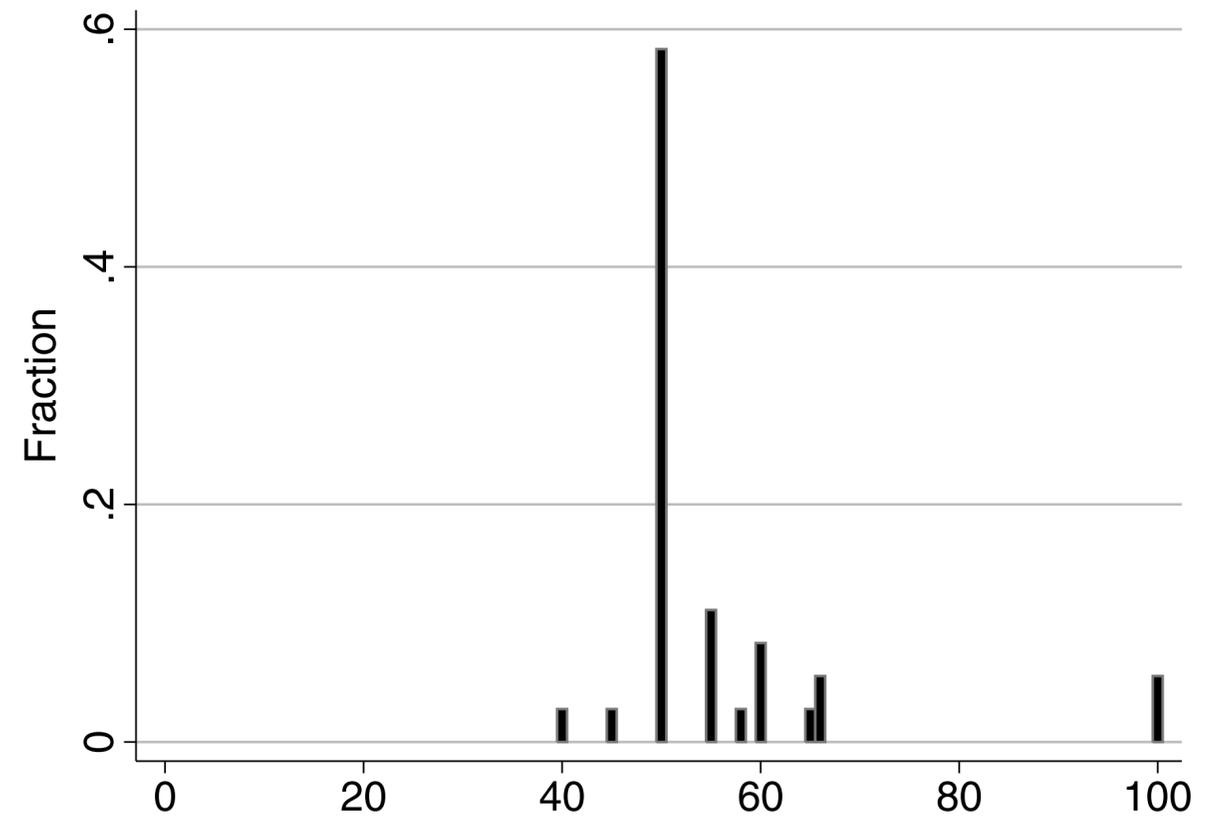


Fig. 3. Communicated level-0 beliefs ($N = 36$).

Results: Proportions

Table 2
Level classification results.

		Level upper bounds					Total
		0	1	2	3	NA	
Level lower bounds	0	17	11	1	0	6	35
	1		26	3	0	2	31
	2			6	5	0	11
	3				1	0	1
	NA					6	6
Total		17	37	10	6	14	84

Notes: The cells in this table indicate the number of subjects that were classified with the respective combination of lower and upper bound.

Table 3
Estimated level- k distribution.

Parameter	l_0	l_1	l_2	l_3
Estimate	0.37	0.47	0.15	0.01
	(0.057)	(0.058)	(0.042)	(0.016)

Notes: The table presents the results from a maximum likelihood estimation of the structural model as outlined in Section 5.1. This table only presents the results for the level- k distribution, but the level-0 action and belief distribution were estimated simultaneously. Those results are reported in Table 4. Bootstrapped standard errors are given in brackets. These are obtained from 200 iterations of our estimation when sampling 84 observations from our data.