QUIZ

- Approximately what percentage of subjects fail to best respond against a computer in the ”Computer” treatment?
  a) 10%
  b) 30%
  c) 50%
  d) 70%

- TRUE or FALSE: A large (>30%) percentage of subjects provided non-monotonic responses in the Combo treatment

- TRUE or FALSE: The distribution of Levels-k in the “Control” treatment was similar to the distribution of Levels-k in previous papers, for example Nagel (1995).

Beliefs and endogenous cognitive levels: An experimental study

Marina Agranov, Elizabeth Potamites, Andrew Schotter, Chloe Tergiman

Games and Economic Behavior (2012)

Summary

- **Basic idea**: to see if information about other people can shift players' beliefs in a beauty contest game
- **Classroom experiments**: envelopes handed out before class, instructions read, envelopes collected, payment at the end
- "All the experiments lasted less than 10 minutes in total, including reading the instructions."
- 3 **between-subjects** treatments:
  - Control
  - Computer
  - Graduate
- One within-subjects treatment (Combo)

- **Control:**

"Choose a number between 0 and 100. You will be put into groups of 8 people. The winner is the person whose number is closest to $\frac{2}{3}$ times the average of all chosen numbers of the people in your group. The winner gets a fixed prize of $10. In case of a tie the prize is split among those who tie."

- **Graduate:**

"Choose a number between 0 and 100. You will win $10 if your chosen number is closest to two thirds times the average of all chosen numbers of the people in your group.

Your group: 8 graduate students in the Department of Economics, who have training in these types of games, played this game a few days ago. You will replace one of them. So your group is YOU and 7 of those graduate students.

You will win $10 if your chosen number is closest to $\frac{2}{3}$ times the average of all chosen numbers (yours and 7 graduate students). In case of a tie the prize is split. Notice you are not playing against people in this room. Each of you is playing against 7 graduate students. So, all of you may earn $10 and none of you may."

- **Computer**

"Choose a number between 0 and 100. You will win $10 if your chosen number is closest to $\frac{2}{3}$ times the average of all chosen numbers of the people in your group.

Your group: Your group consists of you and 7 computers. Each of those computers will choose a random number between 0 and 100, each number being equally likely. So your group is YOU and 7 computers.

You will win $10 if your chosen number is closest to $\frac{2}{3}$ times the average of the numbers in your group (yours and the 7 random numbers chosen by the computers). Notice you are not playing against people in this room. Each of you is playing against 7 computers. So, all of you may earn $10 and none of you may."

- **Combo**

Strategy method: a choice made for each possible X, where X is the number of computers and 7-X the number of graduate students in your group.

X=0, 1, 2, 3, 4, 5, 6 and 7

At the end of the experiment, one X chosen for payment

Hypotheses

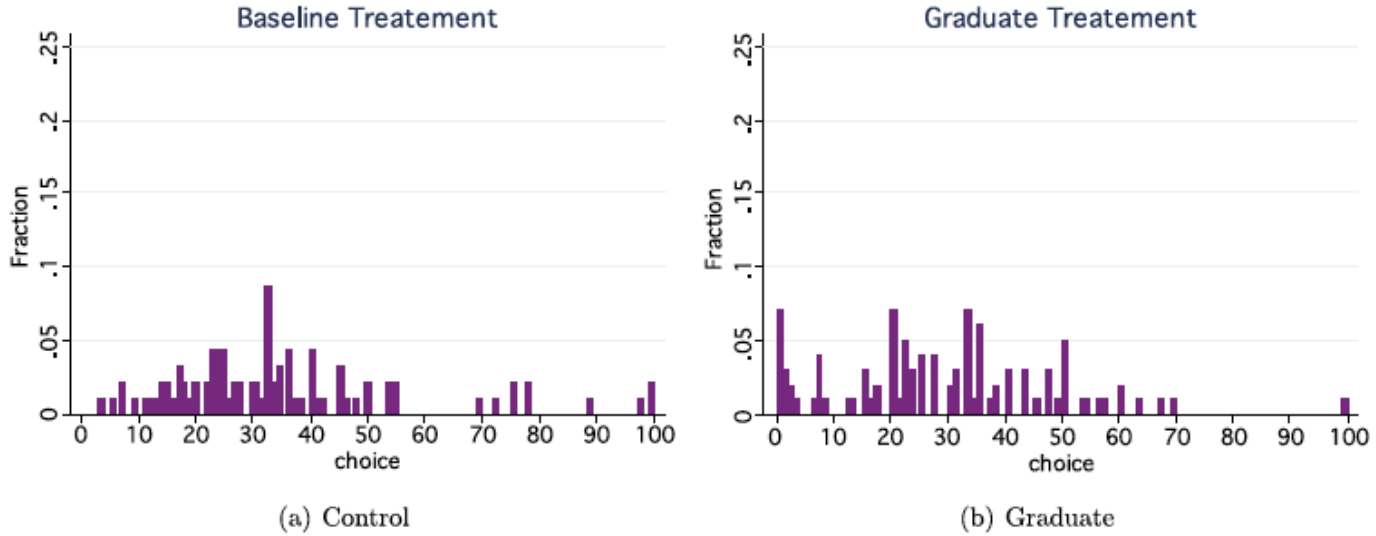
Hypothesis 1. As the population of opponents faced by any subject in our experiment becomes more sophisticated (i.e., moves from being composed of all computers to all graduate students) the distribution of choices observed in our experiment should shift to the left.

Hypothesis 2. Subjects who adhere to either a Level-K model of behavior or Cognitive Hierarchy theory and have a level of sophistication of at least one should choose 31.8 in the Computer treatment.

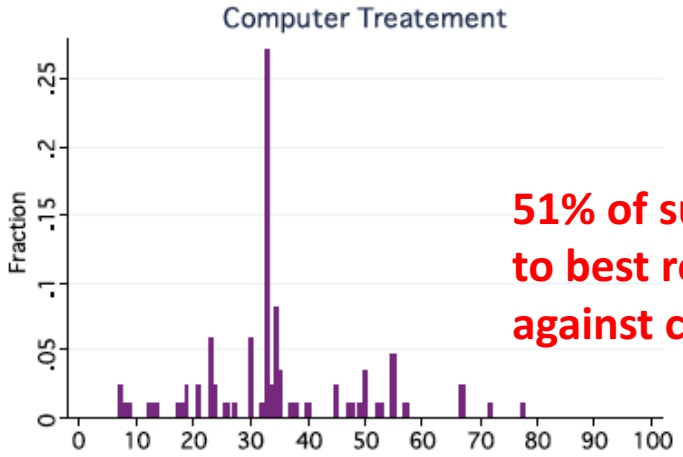
- **Level-k predictions**
  - Level-0: Random in [0,100]
  - Level-1: 31.8181 (notice subject's number is counted in the average)
  - Level-2: 20.236364
  - Level-3: 12.877686
  - Etc

- **Nagel's classification (for human-human treatments)**
  - Level-0: 45 to 50
  - Level-1: 30 to 37
  - Level-2: 20 to 25
  - Level-3: 13 to 16

Results (between):



(a) Control (b) Graduate



51% of subjects fail to best respond against computer

Table 3
Summary statistics of the Control, Graduate and Computer treatments.

	Mean choice	Median choice	Std. dev.	# Obs
Control treatment	35.1	33	21.02	91
Graduate treatment	28.6	27	18.93	99
Computer treatment	34.3	33	14.07	85

Distributions of levels

Table 2
Level classification according to Nagel (1995).

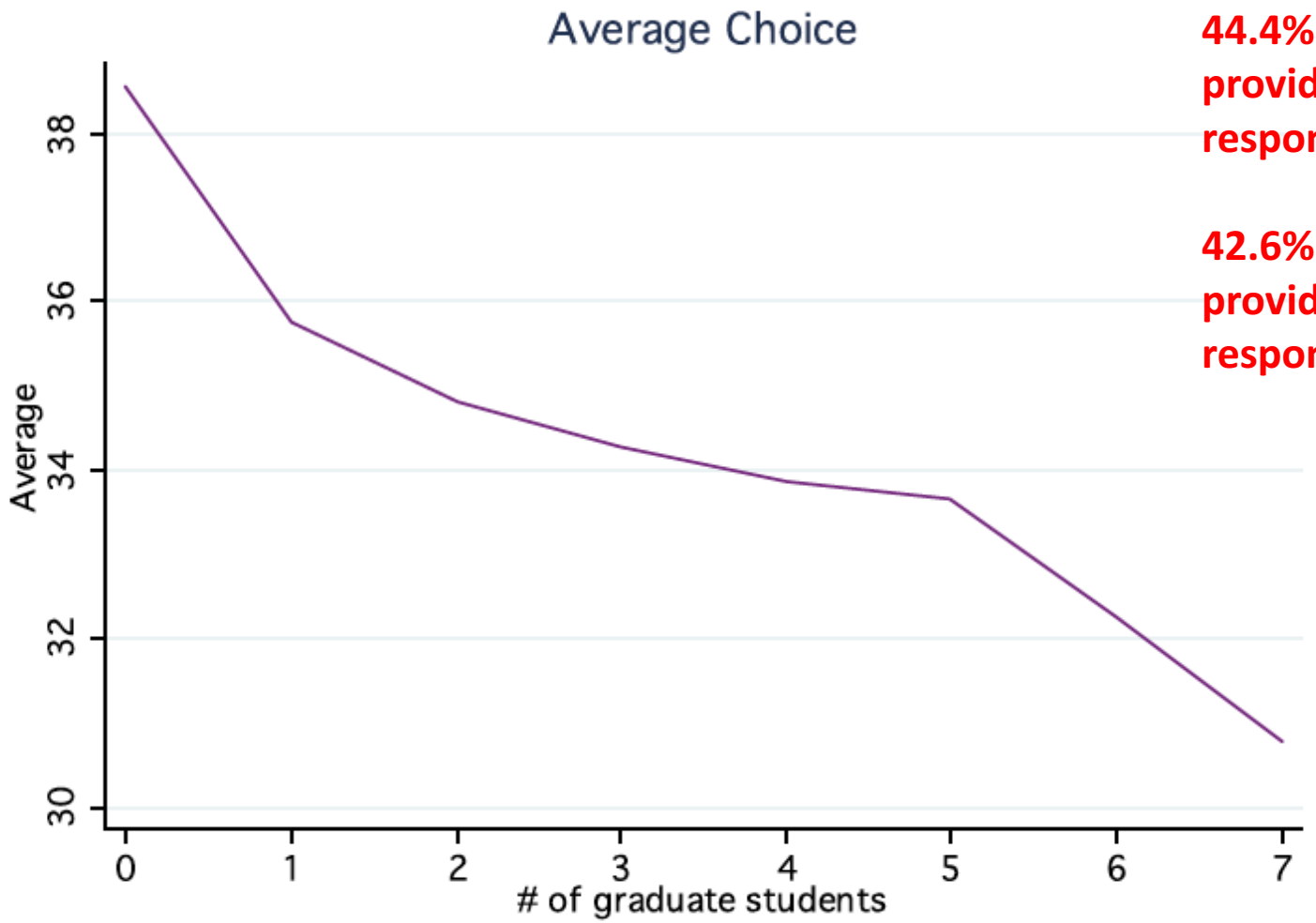
	Control treatment	Nagel's data
Level 0	8%	7.5%
Level 1	25%	26%
Level 2	18%	24%
Level 3	8%	2%
Fraction captured by Nagel's classification	59%	59.5%

Table 4
Level classification of Nagel (1995) in the Control, Graduate and Computer treatments.

	Control	Graduate	Computer
Level 0	8%	10%	9%
Level 1	25%	20%	49%
Level 2	18%	20%	
Level 3	8%	5%	
Level ∞	0%	10%	
Fraction captured by Nagel's classification	59%	65%	58%
Fraction not classified	41%	35%	42%

By far not everyone realizes graduate students are different

Combo treatment



44.4% of subjects provide non-monotonic responses

42.6% of subjects provide decreasing responses

Summary

- Contrary to GHW (2015), the authors find that providing subjects with information about their partners affects behavior in a guessing game
  - **People think strategically**
  - The problem in GHW (2015) might be that the authors were providing subjects with the wrong information
- But **how** do they think?
- A K-level model can always be fit to the data (using MLE or simpler tools), but doesn't seem to be a good model of the cognitive process