



Zatvorenikova dilema - eksperiment

Jelena Grujić

Universidad Carlos III de Madrid, Spain

Institut za fiziku, Beograd, 1.9.2010.


Sadržaj

- Zatvorenikova dilema
- Simulacije
- Eksperiment
- Zaključak

Zatvorenikova dilema



	Zatvorenika A ćuti (sarađuje)	Zatvorenik B priča (izdaje)
Zatvorenik A ćuti (sarađuje)	Obojica služe po 6 meseci	A: služi 10 godina B: ide slobodan
Zatvorenik B priča (izdaje)	A: ide slobodan B: služi 10 godina	Obojica služe po 5 godina

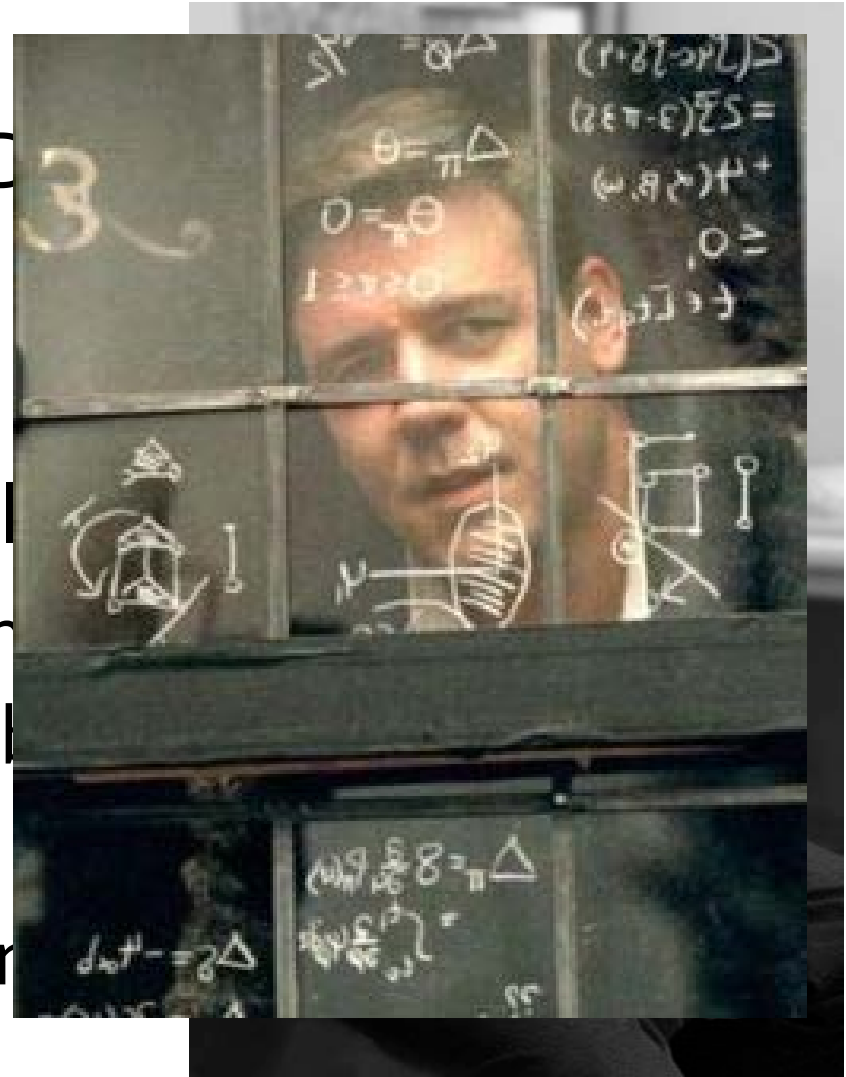


	Cooperate	Defect
Cooperete	R, R	S, T
Defect	T, S	P, P

- **T** Temptation to defect
- **S** Sucker's pay off
- **P** Punishment for mutual; defection
- **R** Reward for mutual cooperation
- $T > R > P \geq S$ or $T \geq R > P > S$
- Za iterativnu igru: $T + S < 2 R$
- Douglas Hofstadter, "Gödel, Escher, Bach"

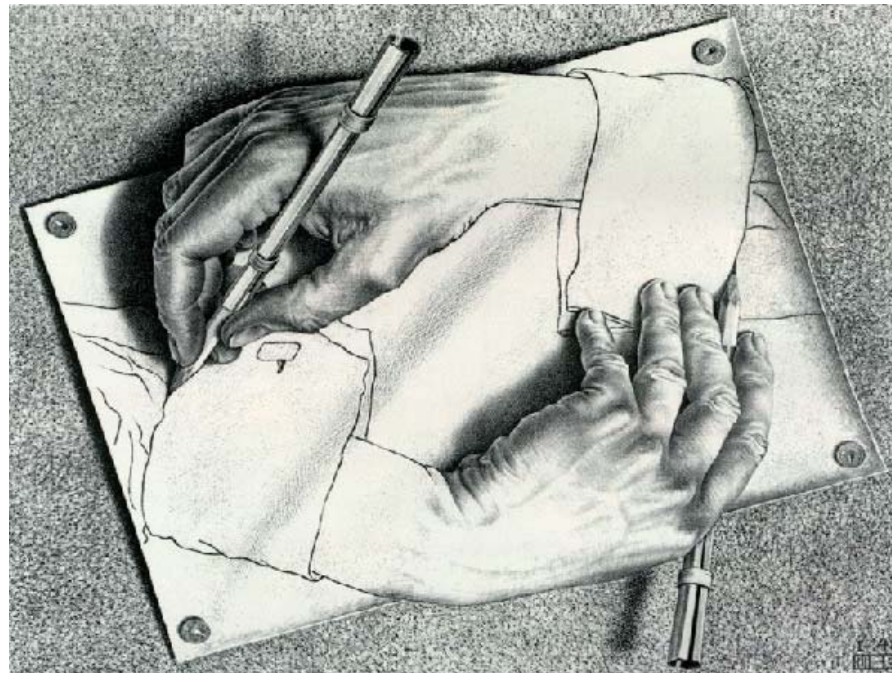
Koja je najbolja strategija?

- Protivnik C \rightarrow Ti D
- Protivnik D \rightarrow Ti
- Vodi u \rightarrow All D!!!
- Savršena racionalnost
- Našov ekvilibrijum može ništa da donese svoje strategije
- N.eq je D, ali DD r

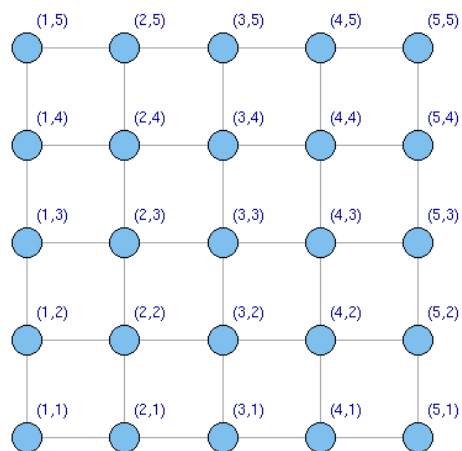
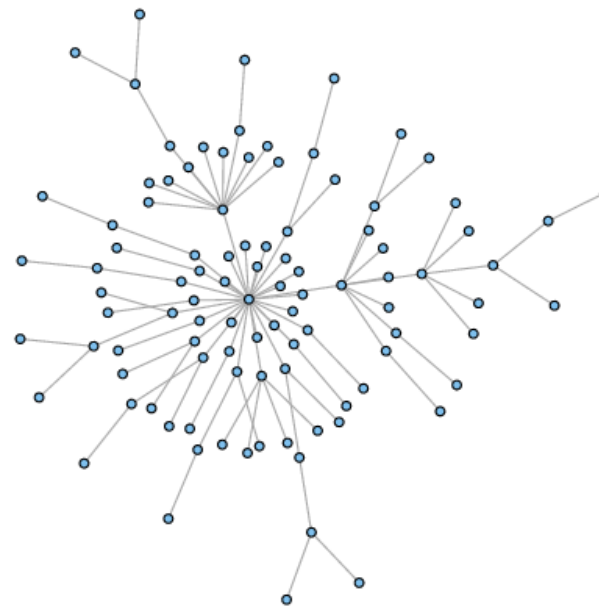
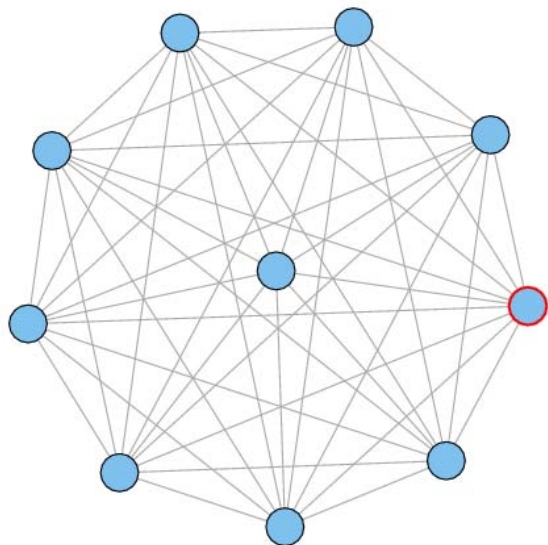


Cooperation

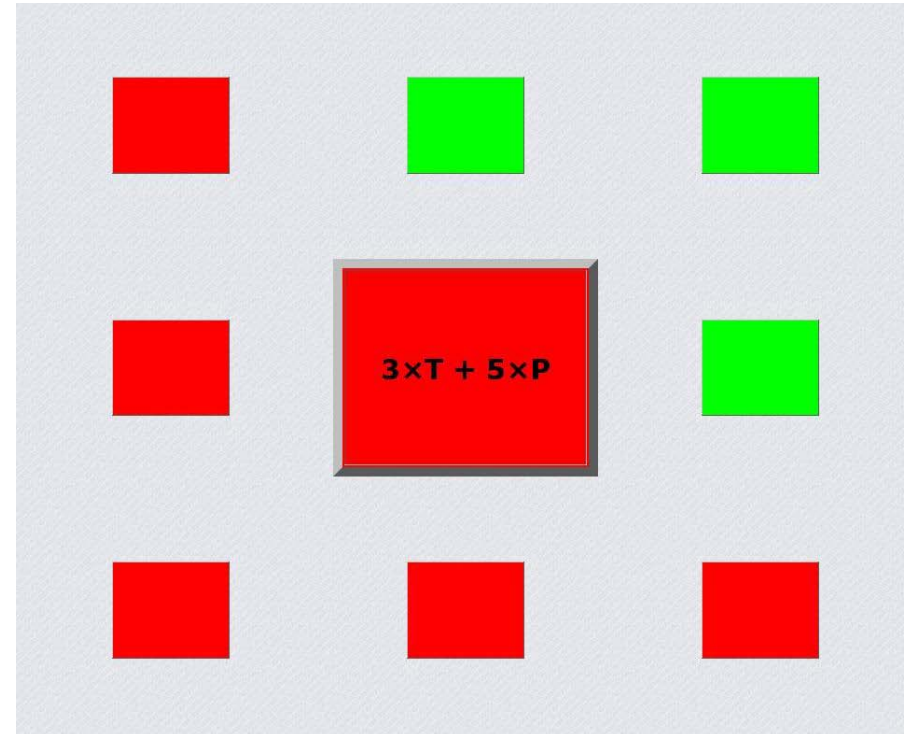
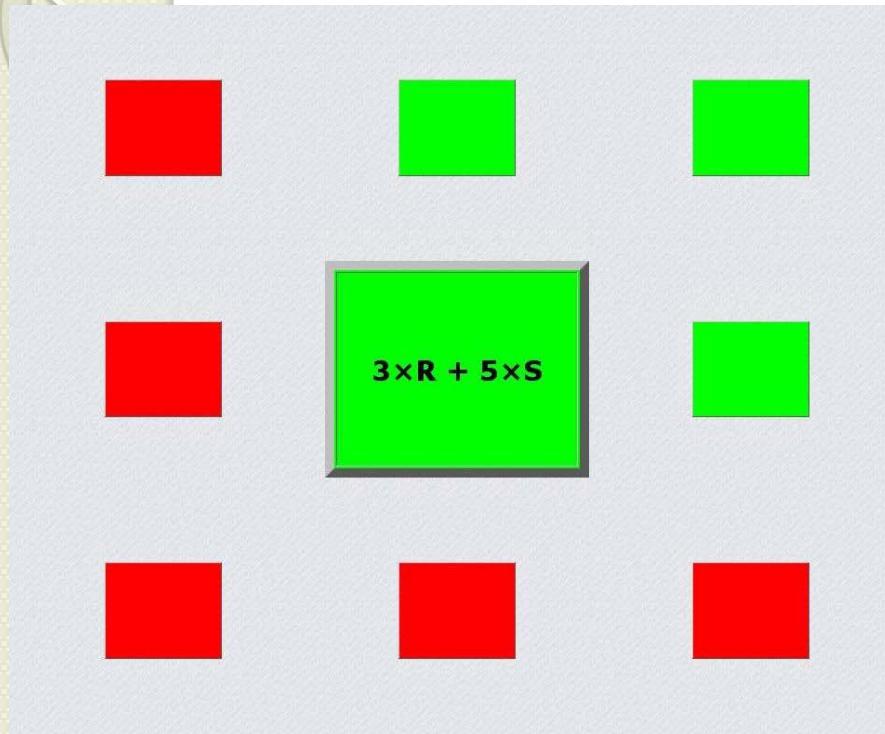
- Ljudi su sebični
- Homo economicus
- Međutim – društvo je altruistično



Prostorne igre



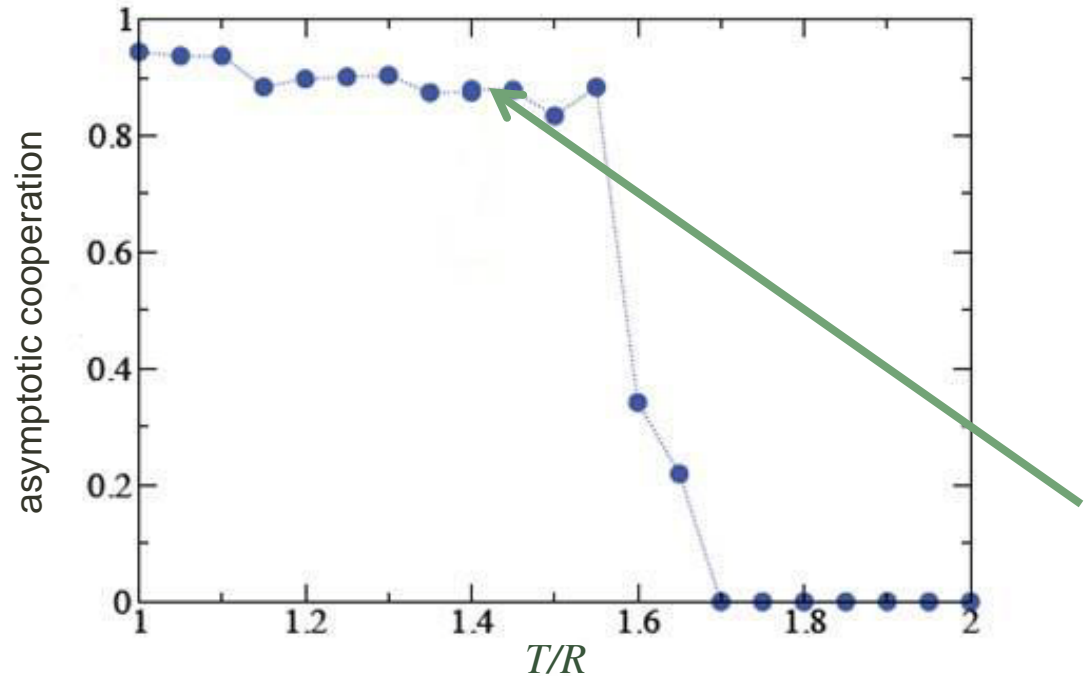
Prostorne igre



 Saradivanje

 Izdaja

M.A. Nowak and R.M. May, *Nature* 359, 826
(1992)



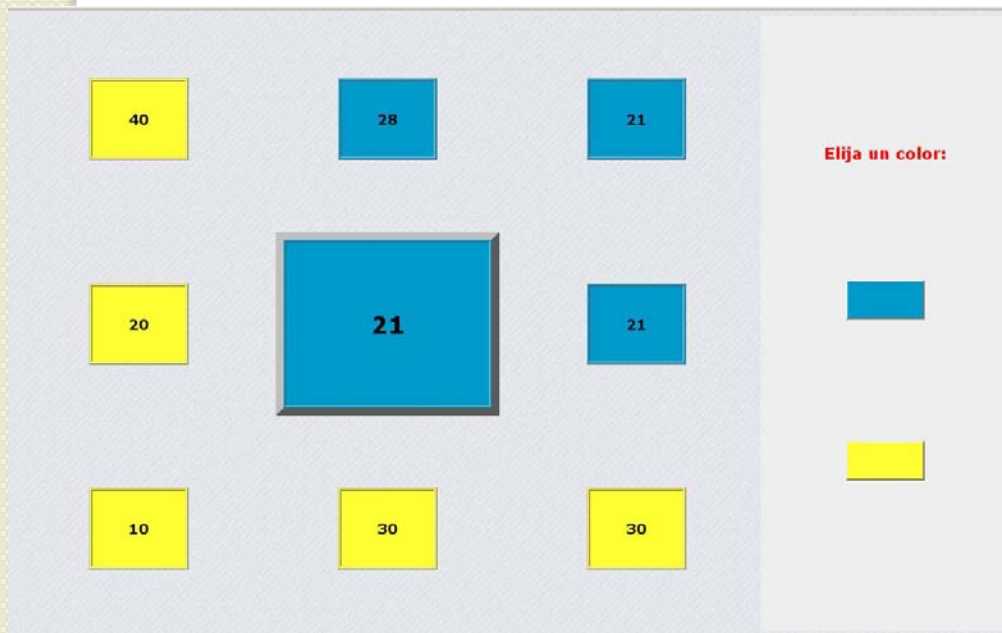
U našem eksperimentu: $T/R = 10/7 \approx 1,42857143$

Beuslovna imitacija – kopiranje najboljeg suseda

Prostorna struktura promoviše saradnju

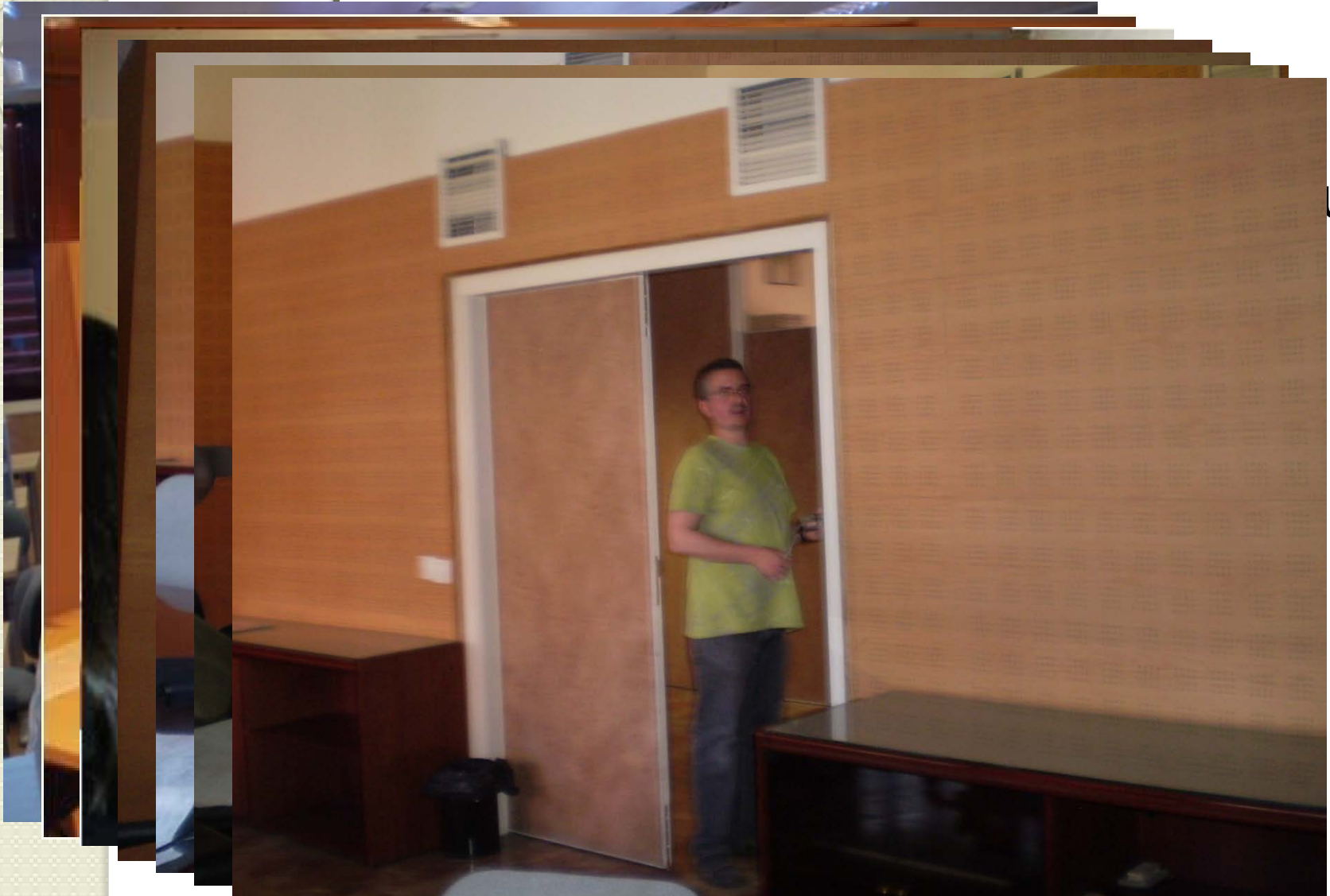
Experiment

- Rešetka 13x13, periodični granični uslovi
- Prijava → Tutorijal → Experiment → Kontrolni → Experiment → Upitnik



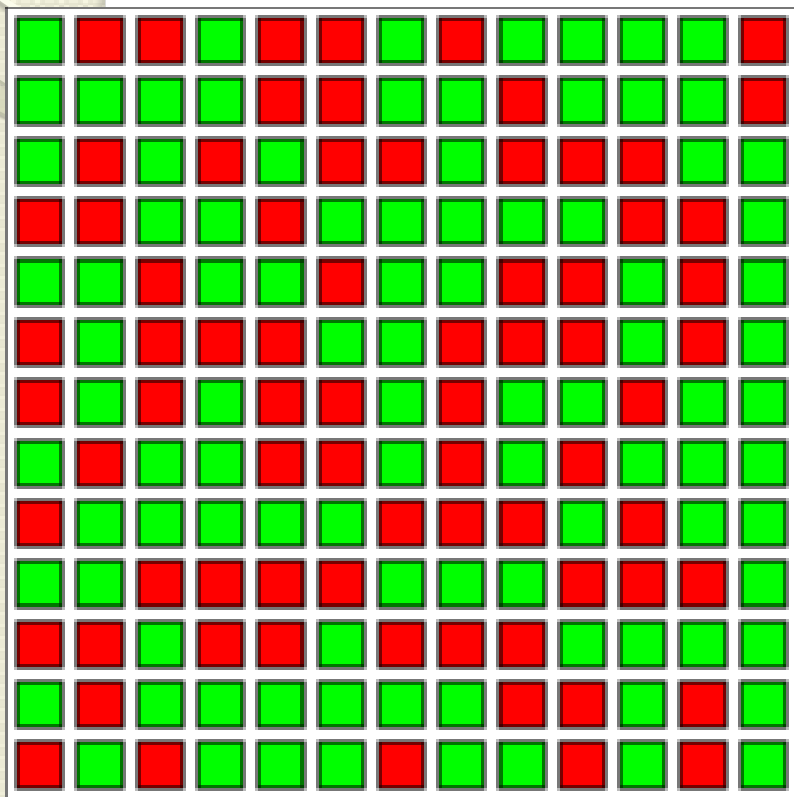
	su vecino elige	
usted elige		
	7 ¢	0 ¢
	10 ¢	0 ¢
	su ganancia	

Eksperiment

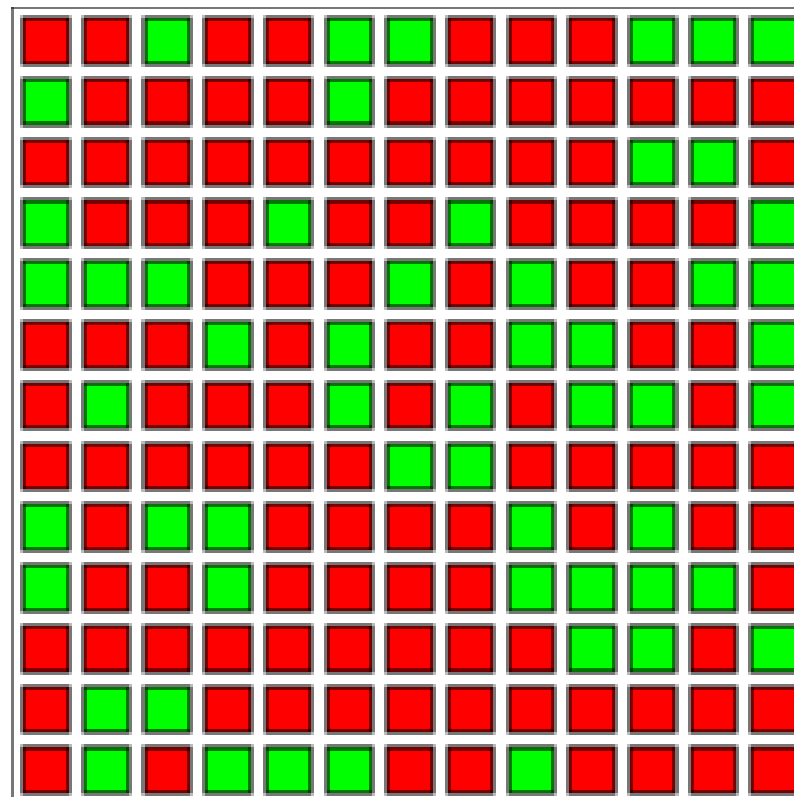


US

Filmovi

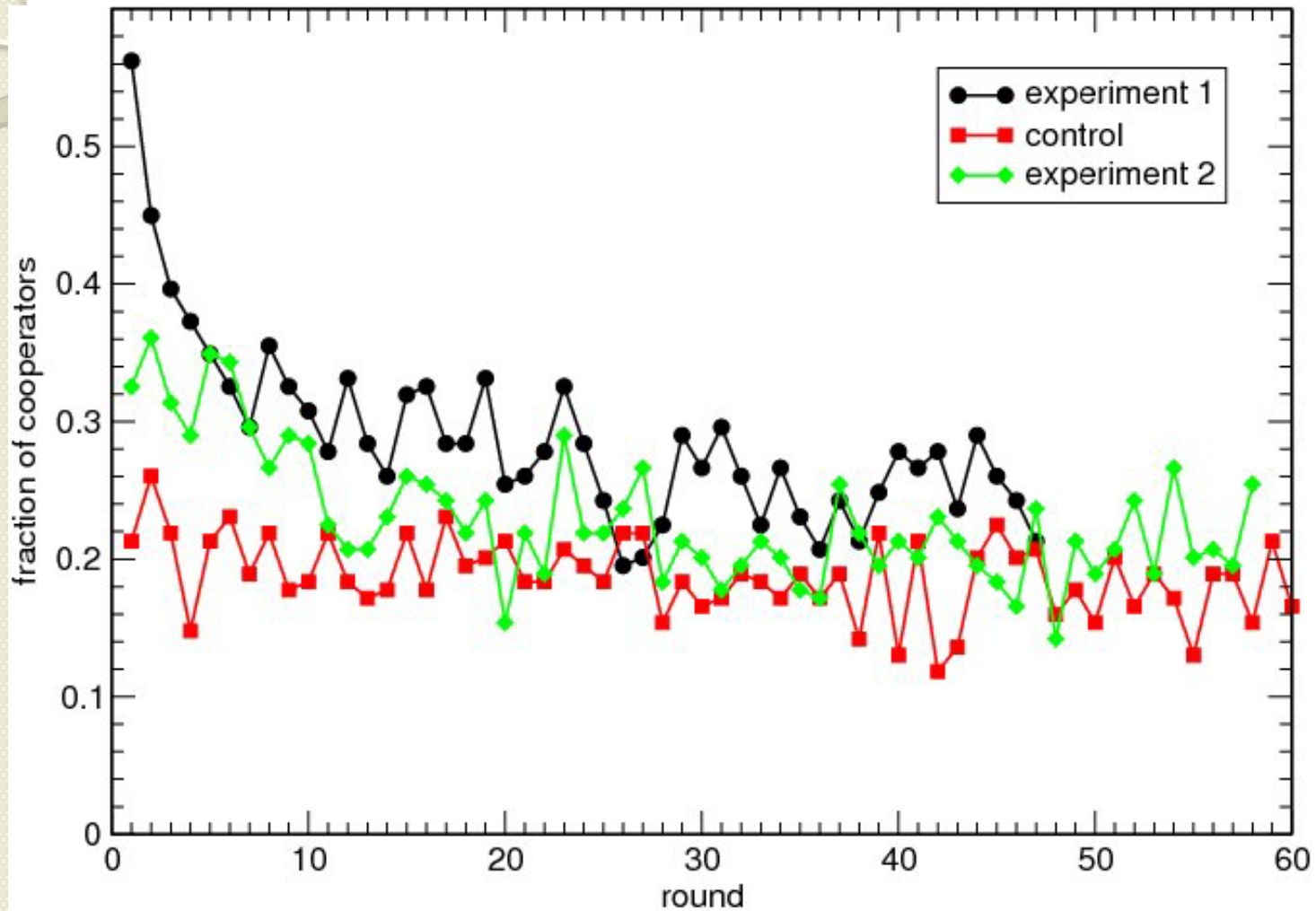


01 of 47

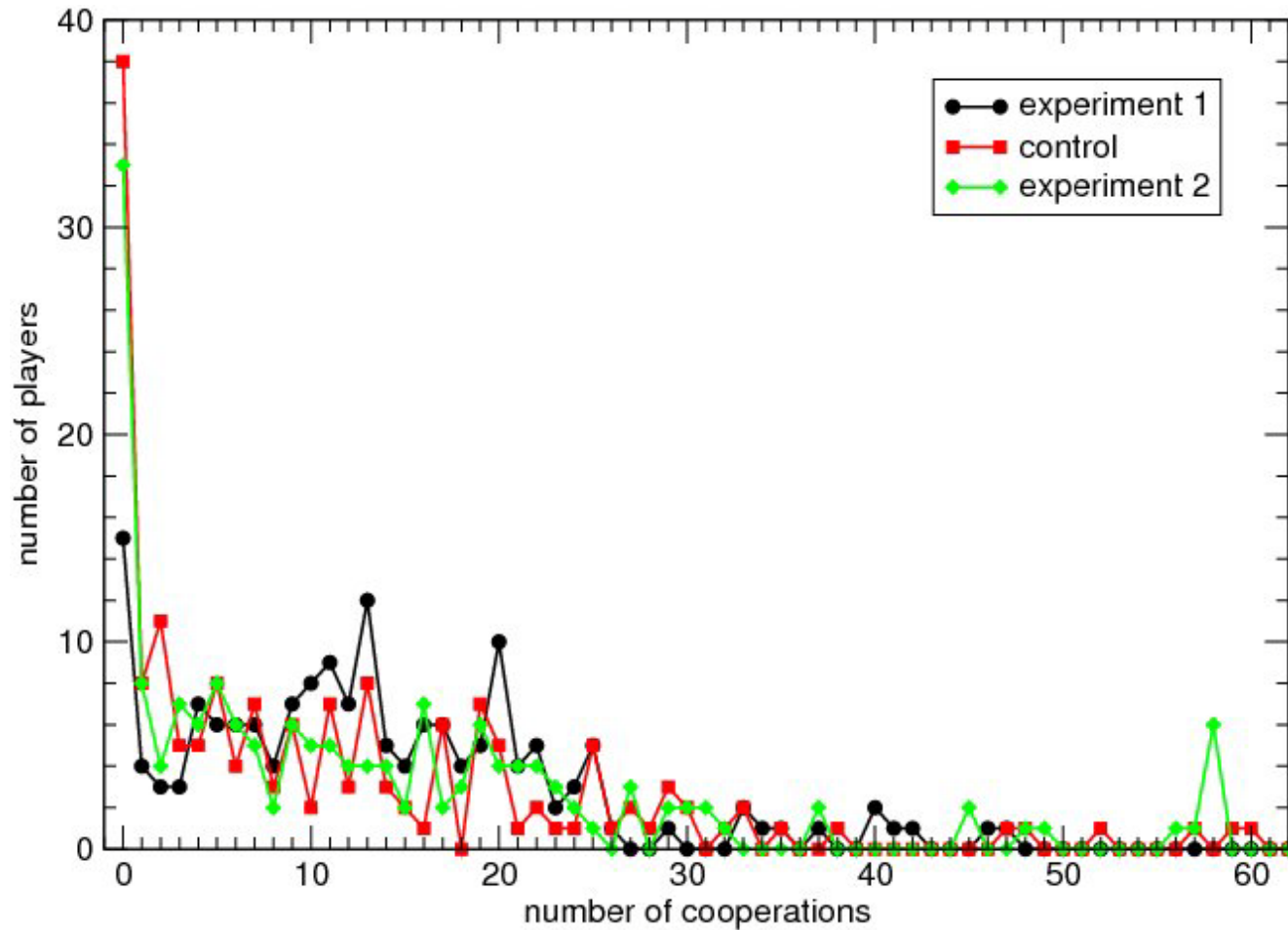


01 of 58

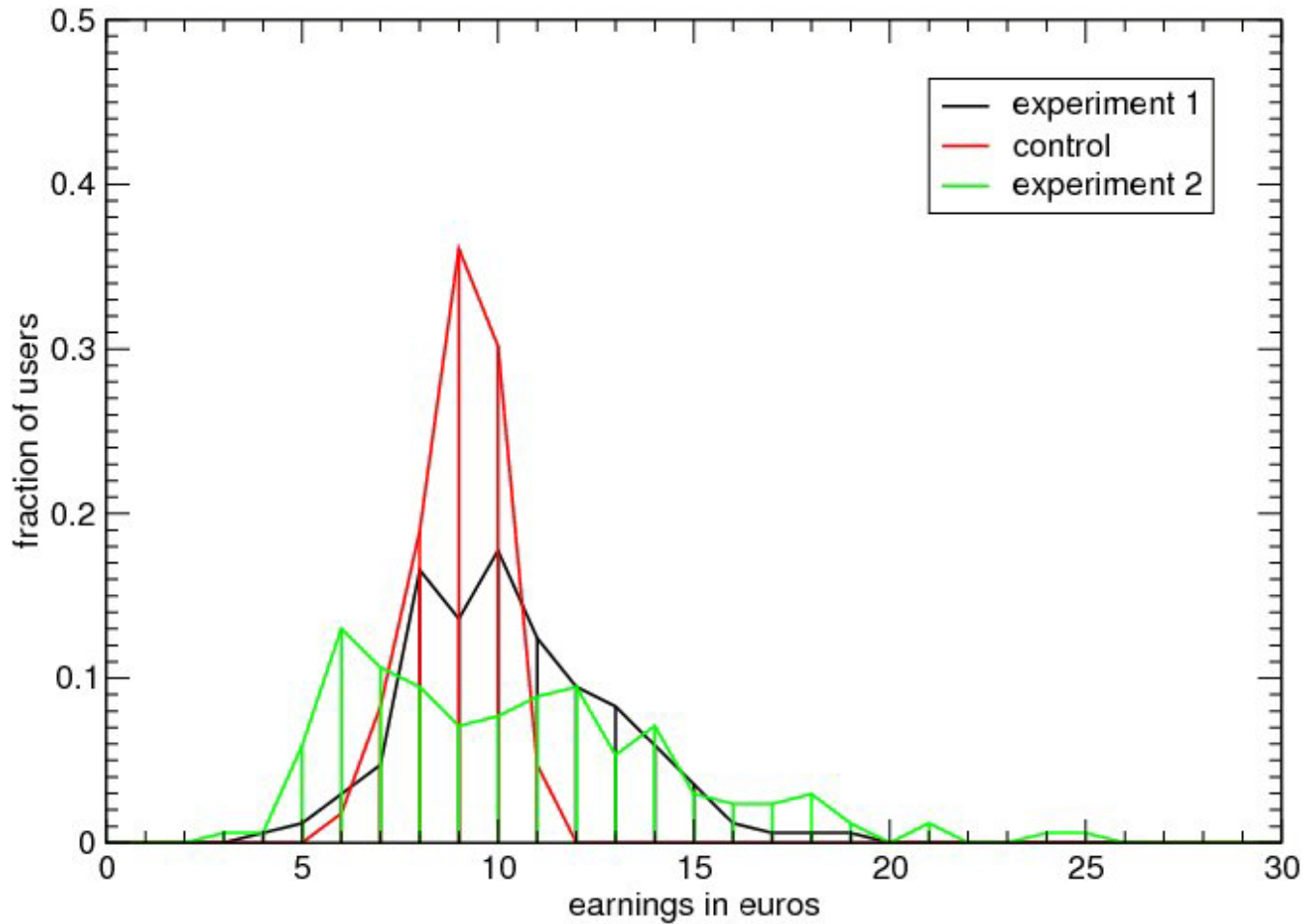
Procenat saradivanja



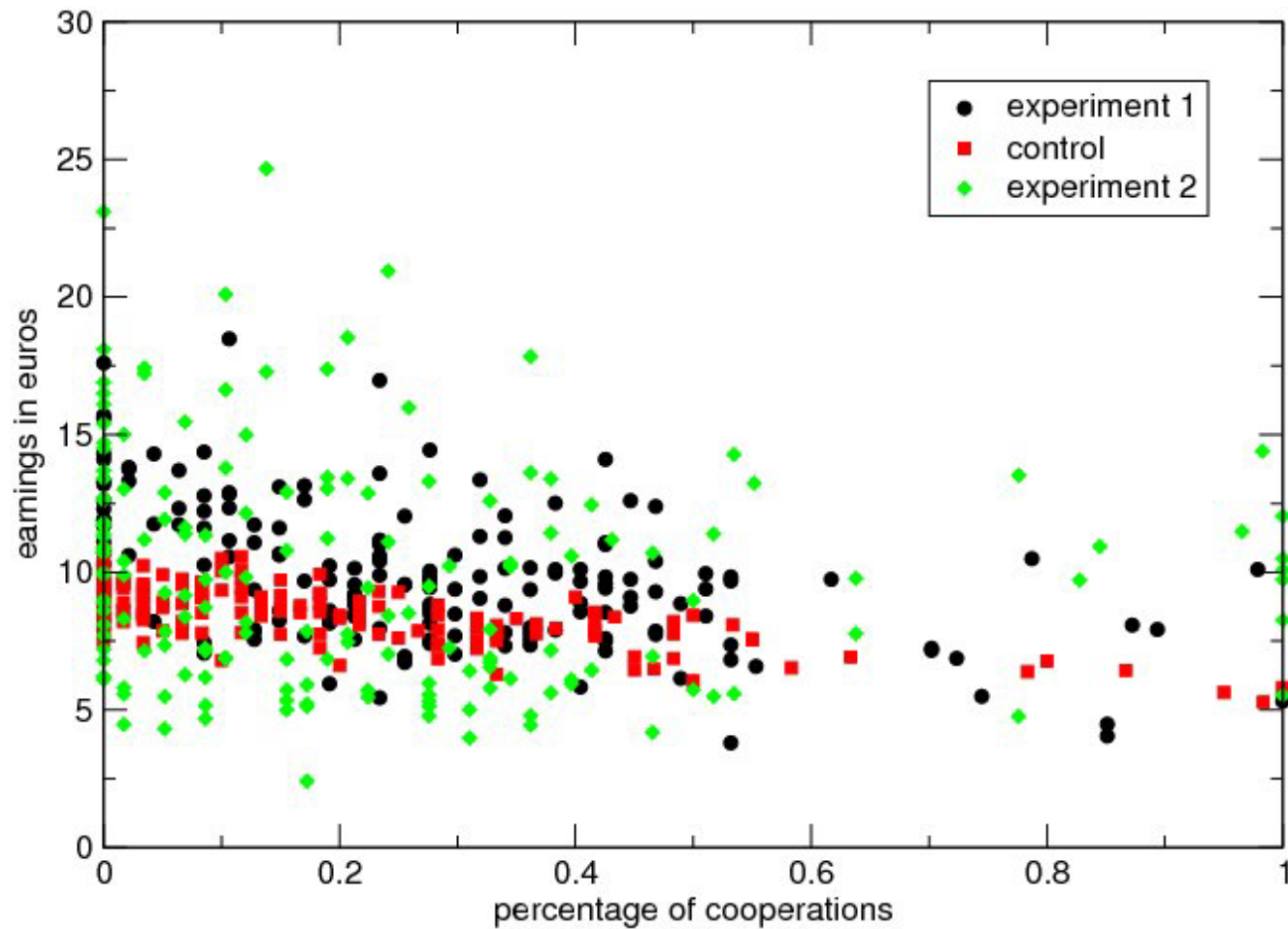
Histogram saradnje



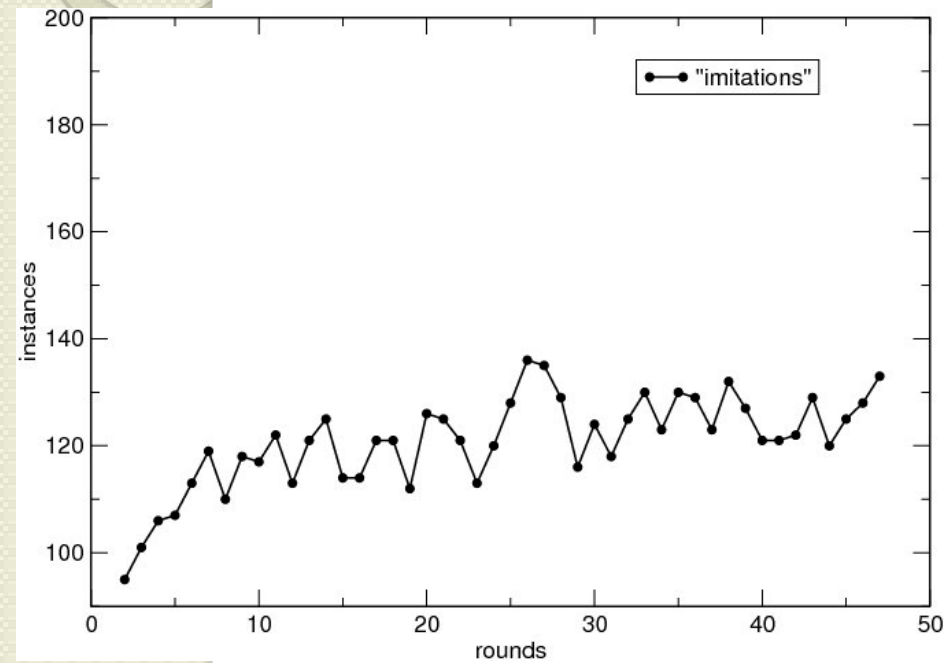
Histogram zarade



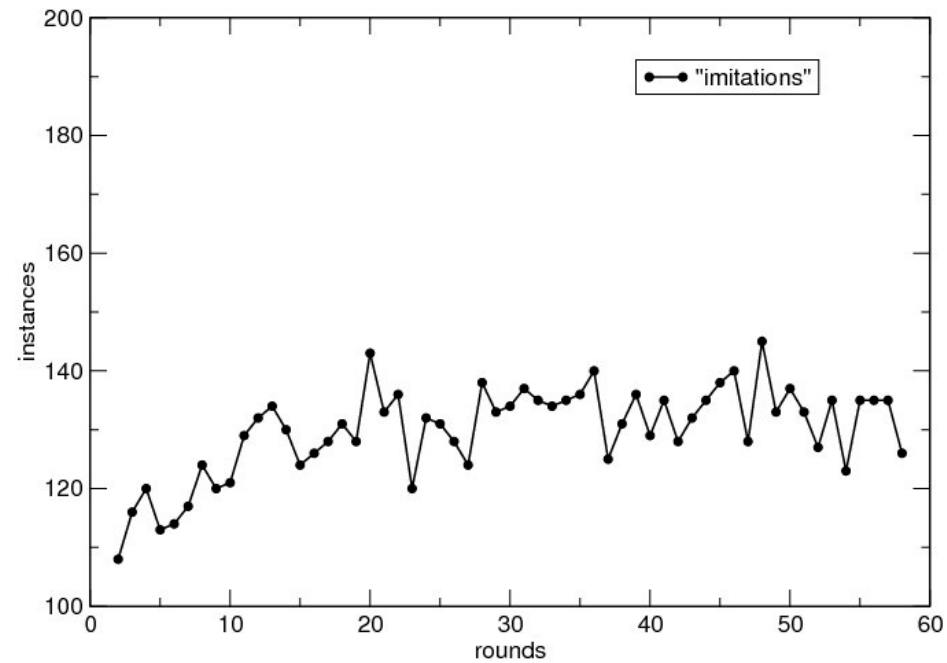
Zarada vs. Saradnja



Bezuslovna imitacija

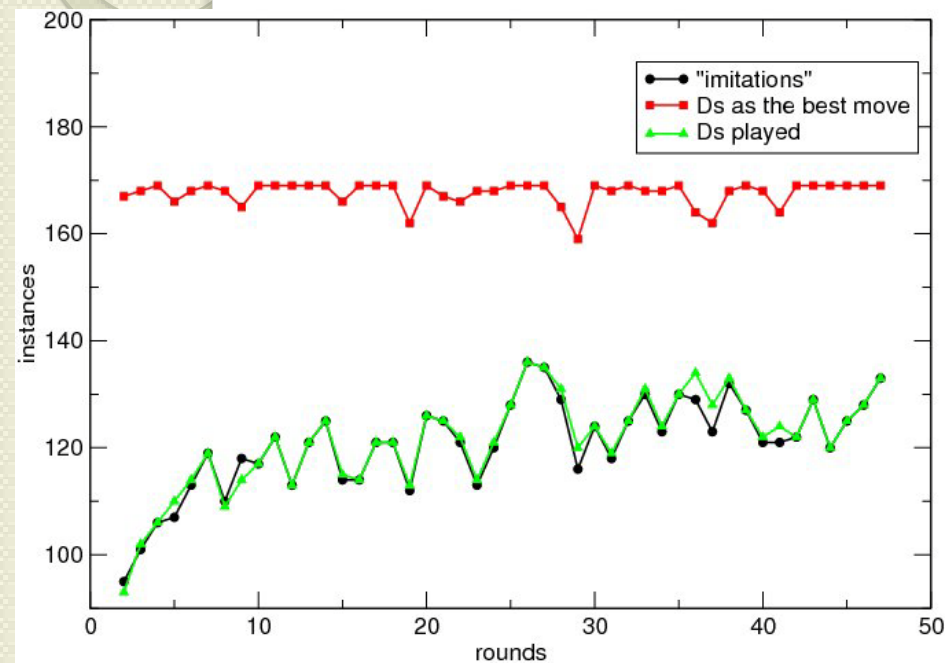


Experiment 1

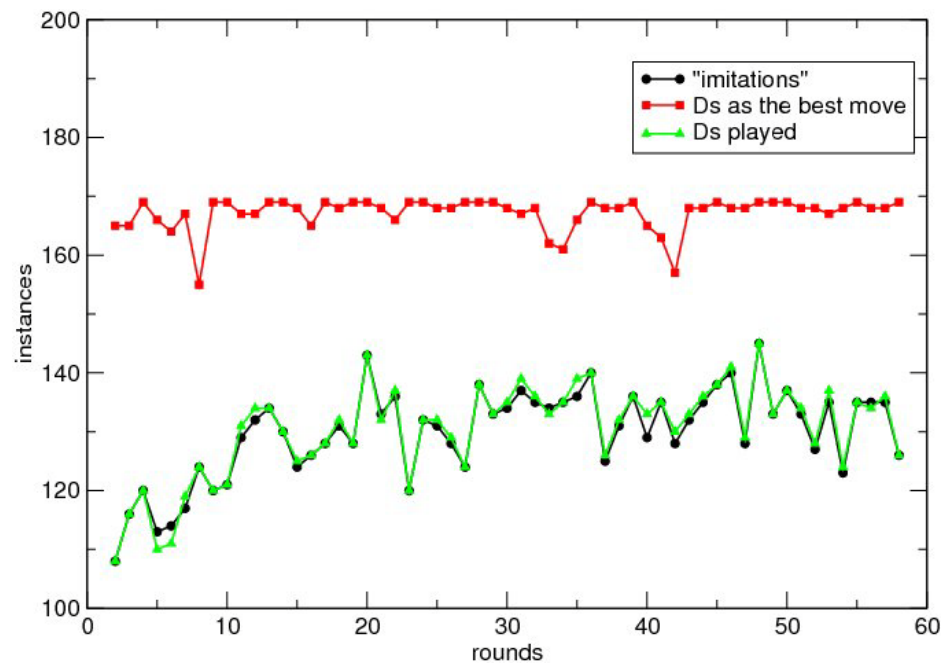


Experiment 2

Bezuslovna imitacija



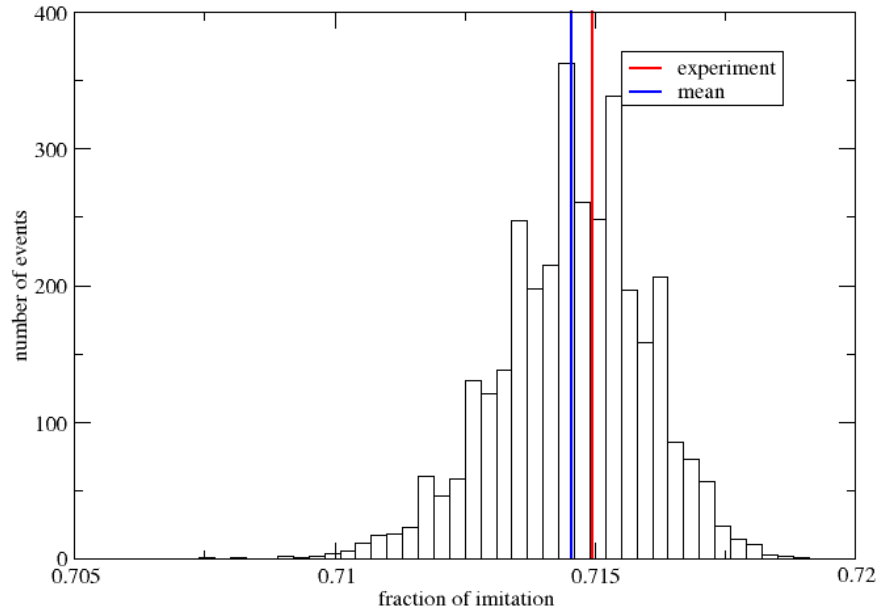
Experiment 1



Experiment 2

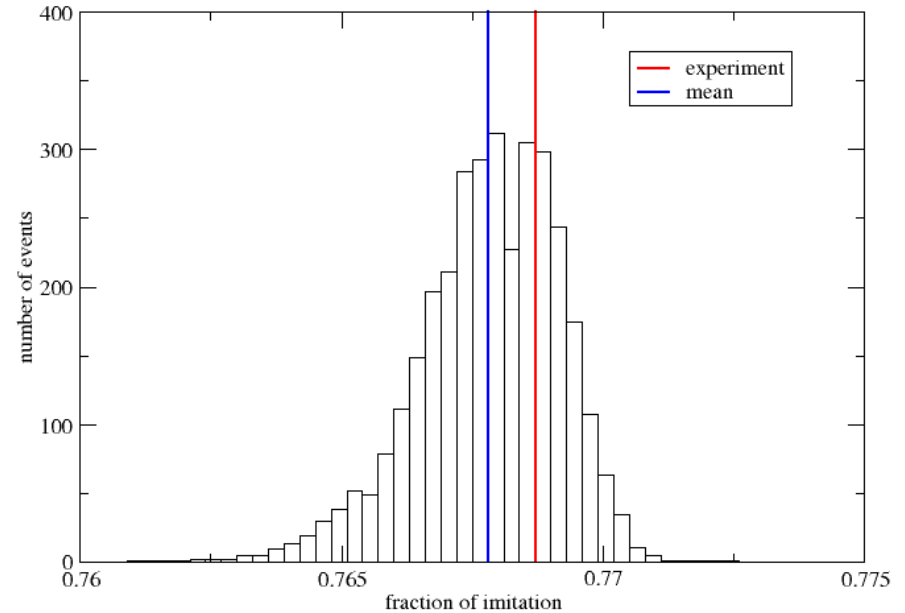
Bezuslovna imitacija

Experiment 1



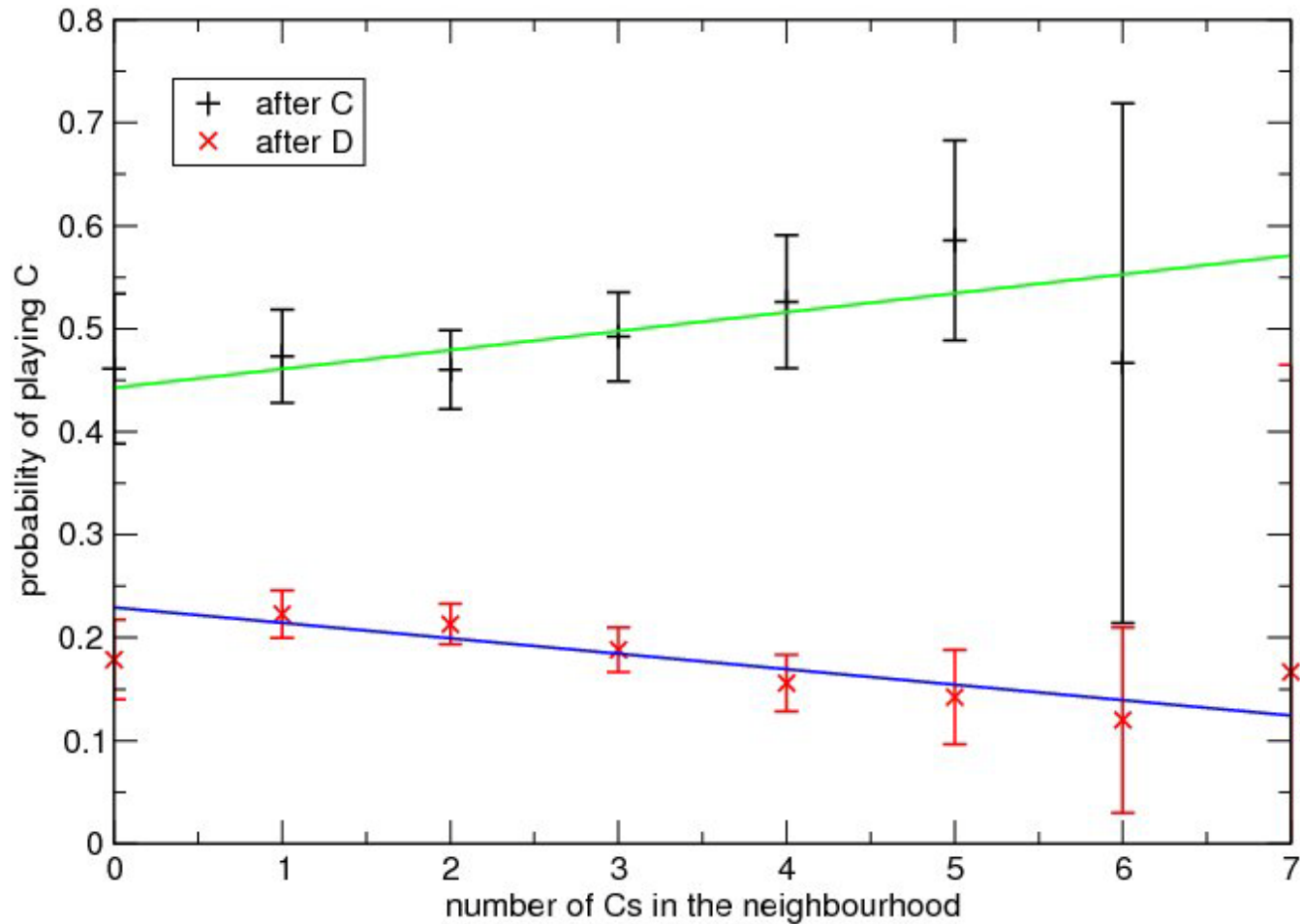
experimental = 0.7149
random = 0.7145 ± 0.0014
p-test = 0.425

Experiment 2

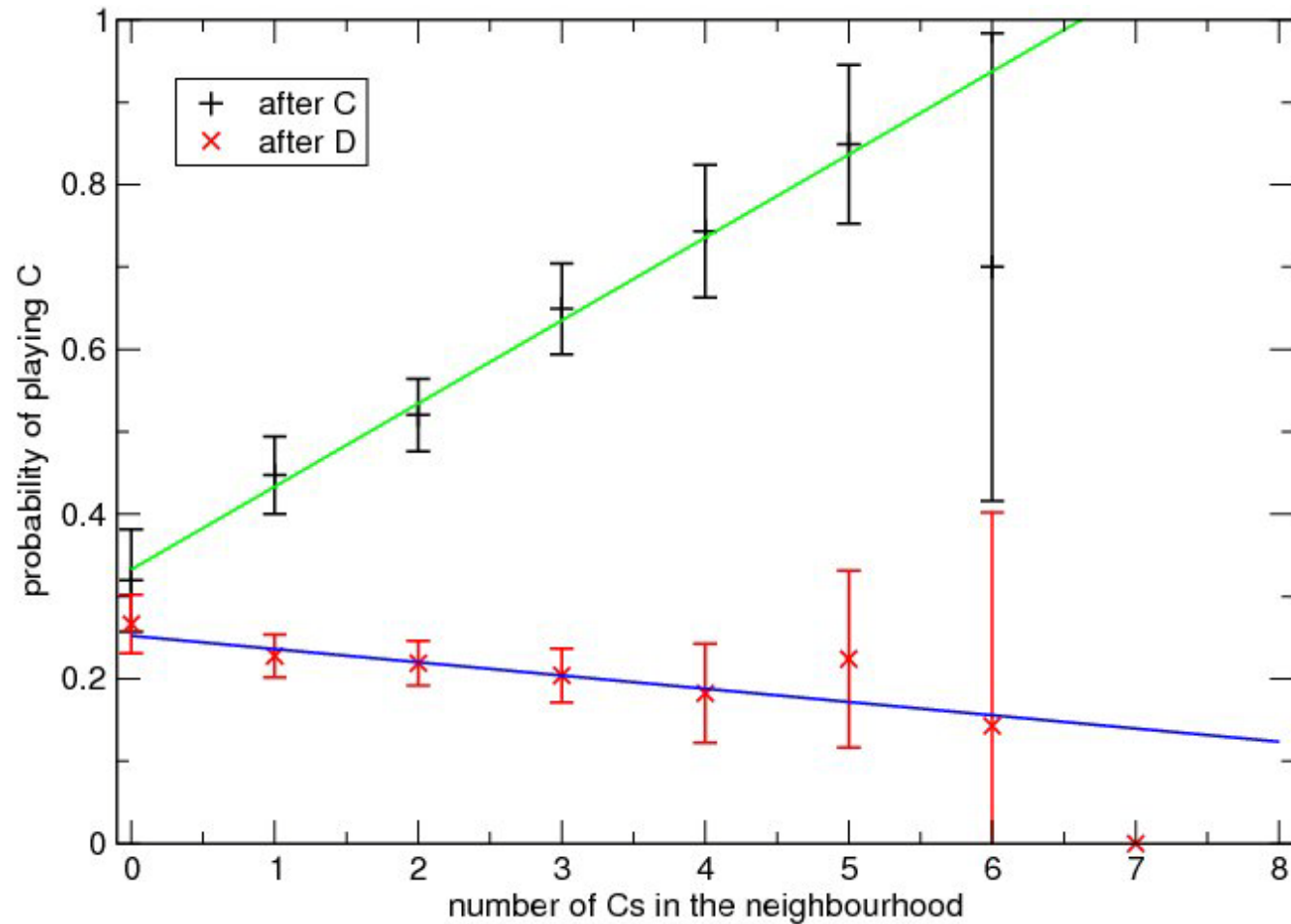


experimental = 0.7687
random = 0.7678 ± 0.0013
p-test = 0.282

Verovatnoća saradnje Exp 1

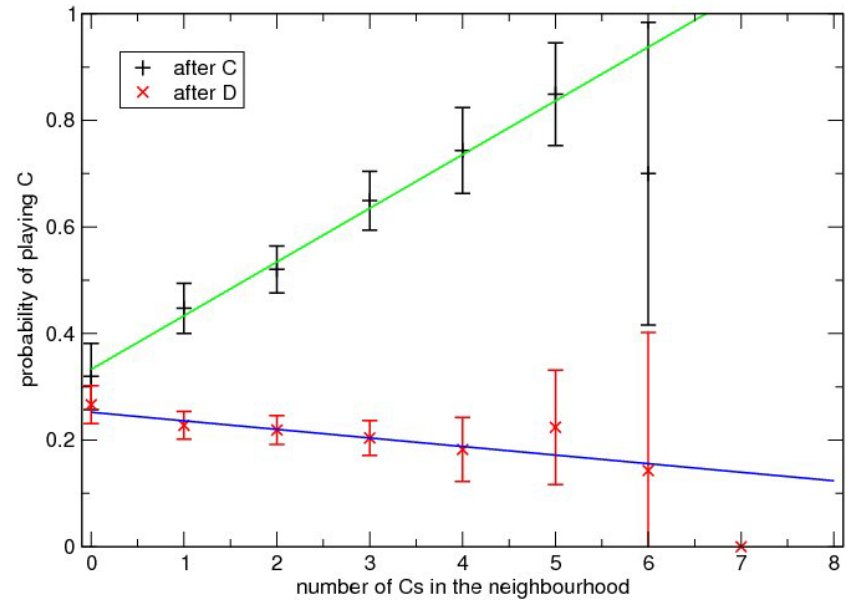
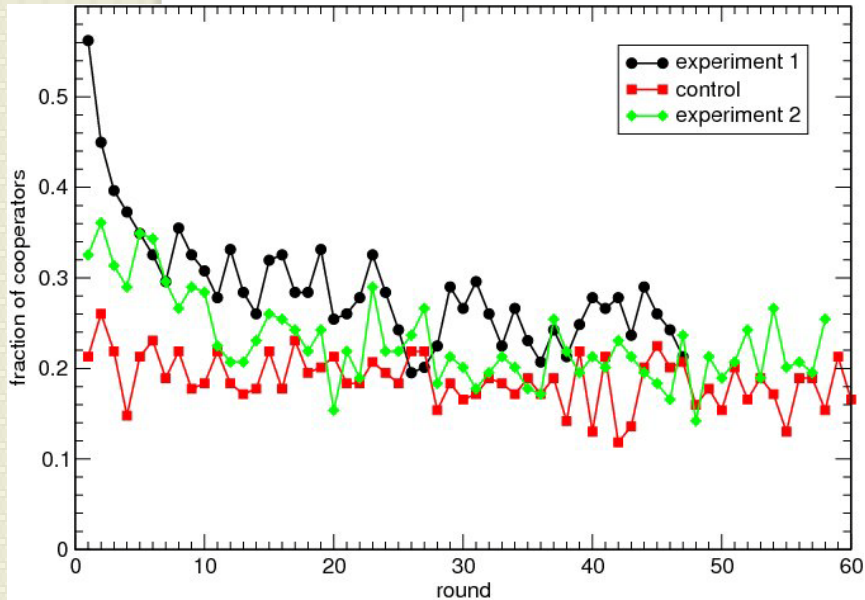


Verovatnoća saradnje Exp2

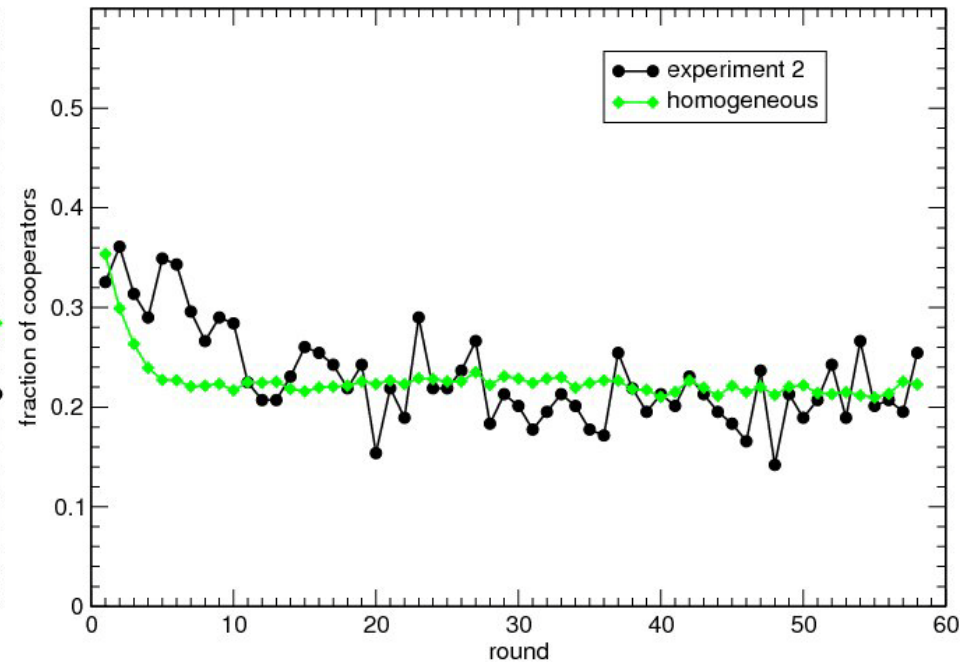
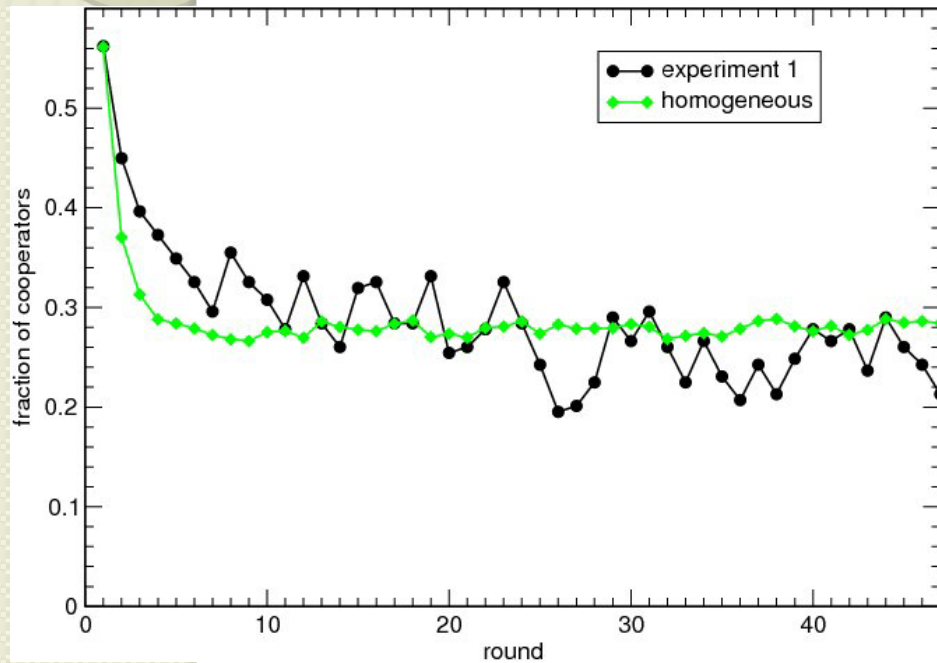


Homogen model

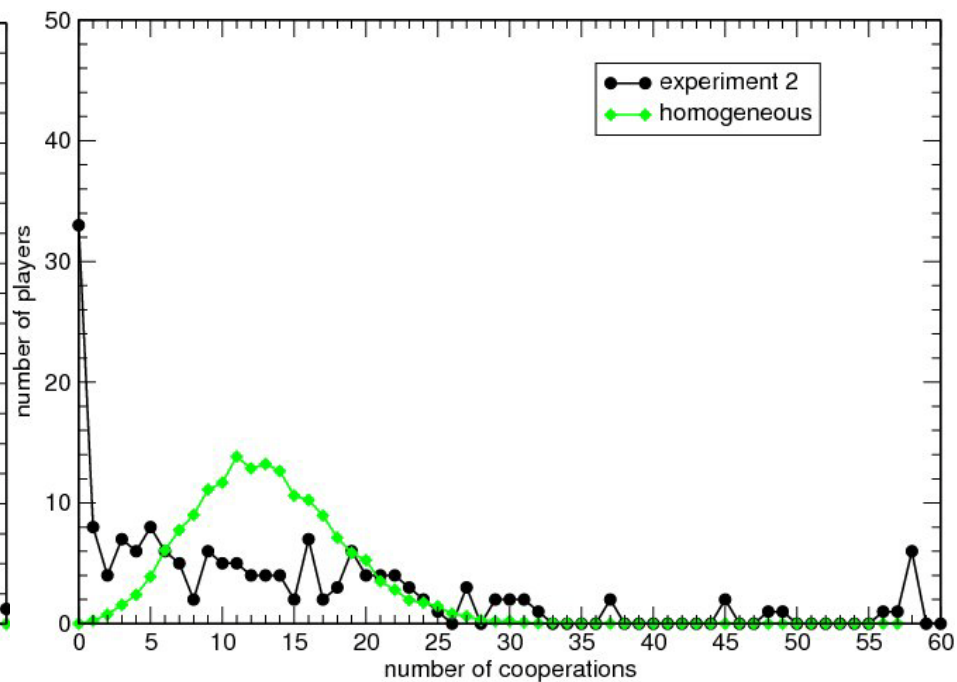
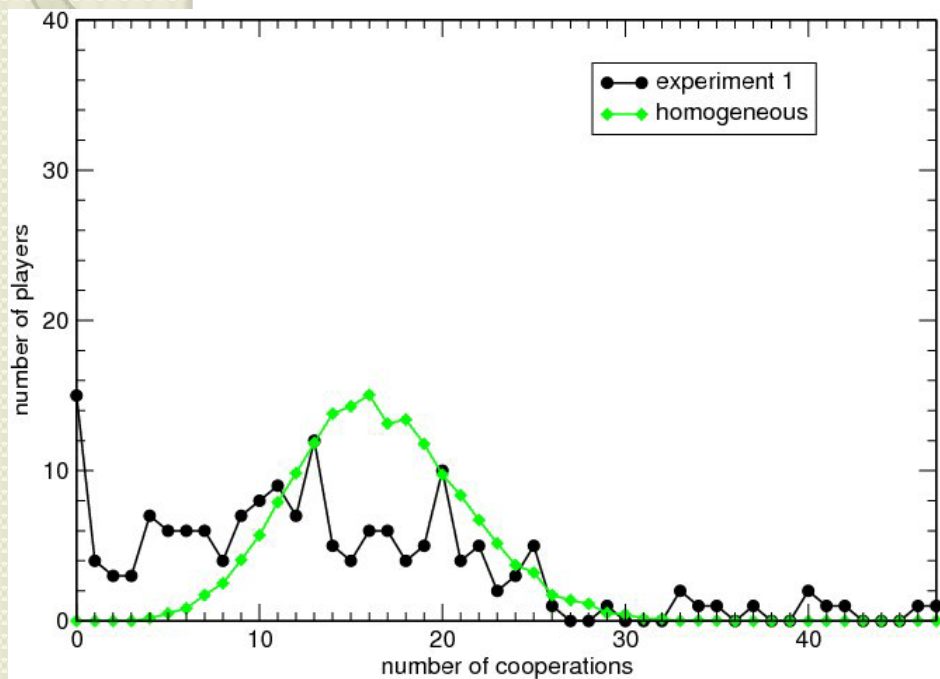
- Prvi potez: C sa verovatnoćom P kao u Exp
- N -ti potez:
 - Potez igrača u $N-1$
 - Broja suseda sa C u $N-1$



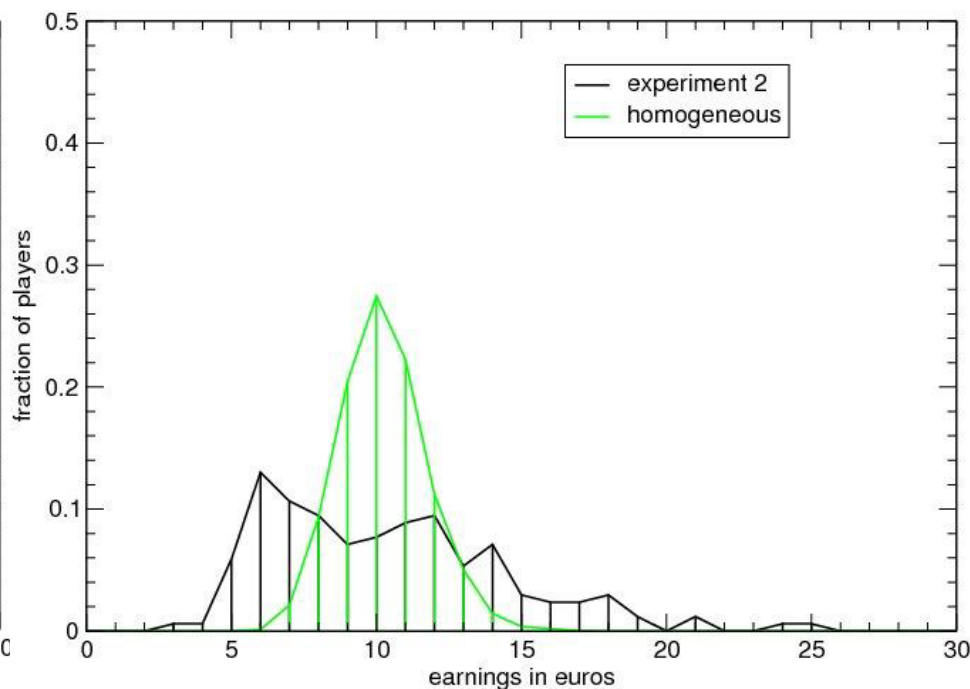
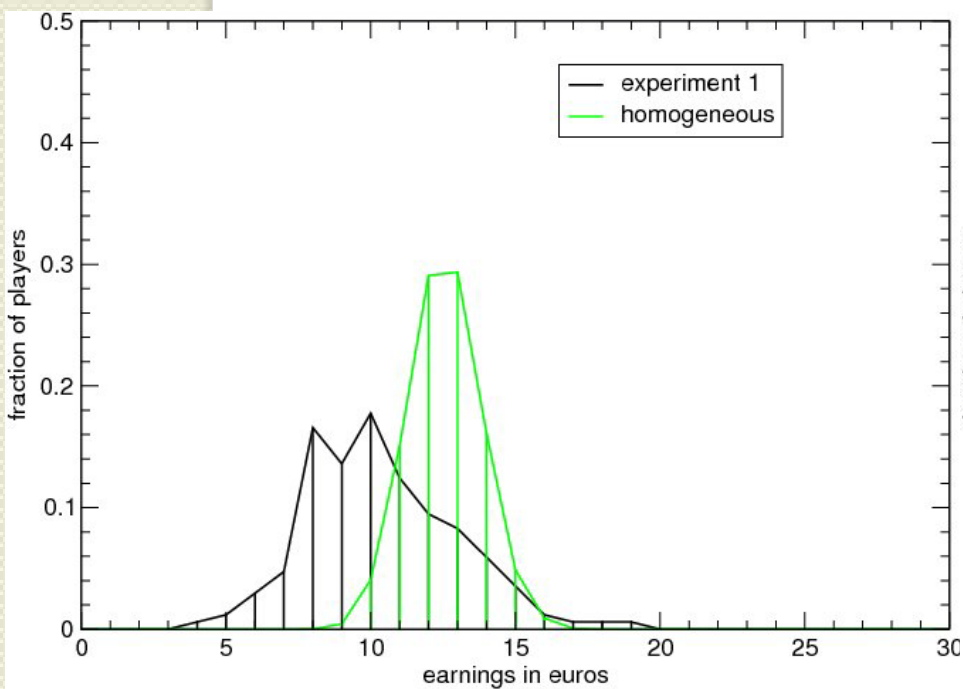
Homogen model – procent saradnje



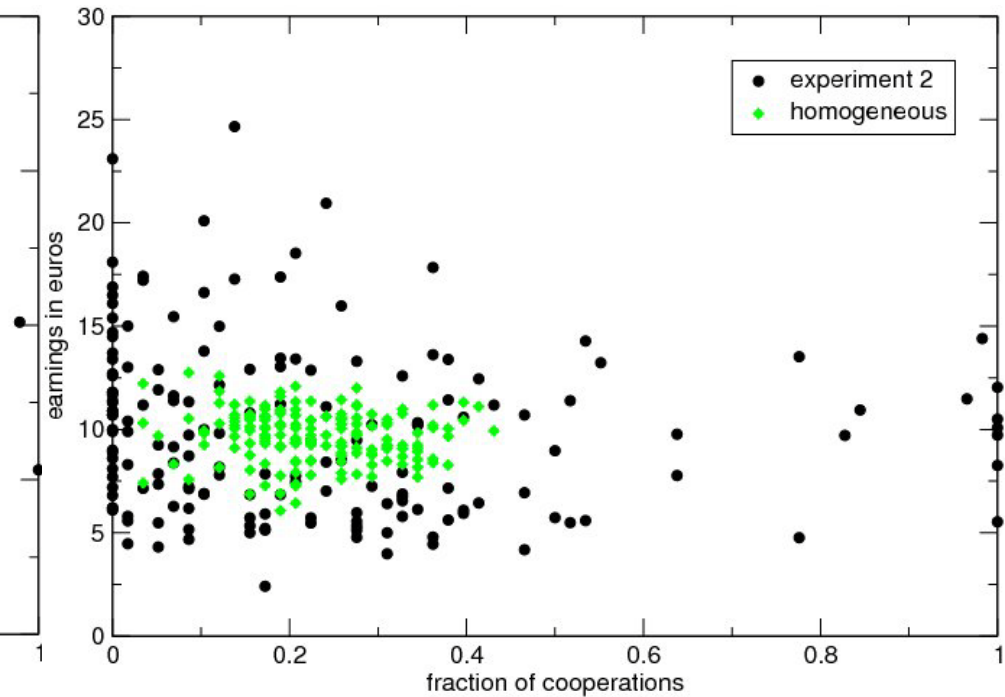
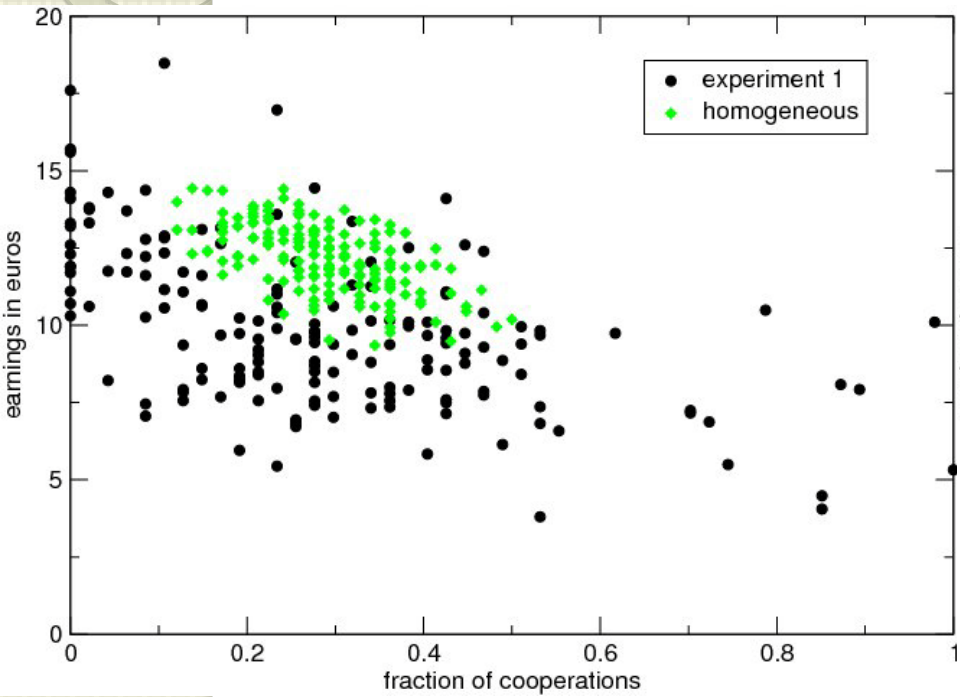
Homogen model – histogram saradnje



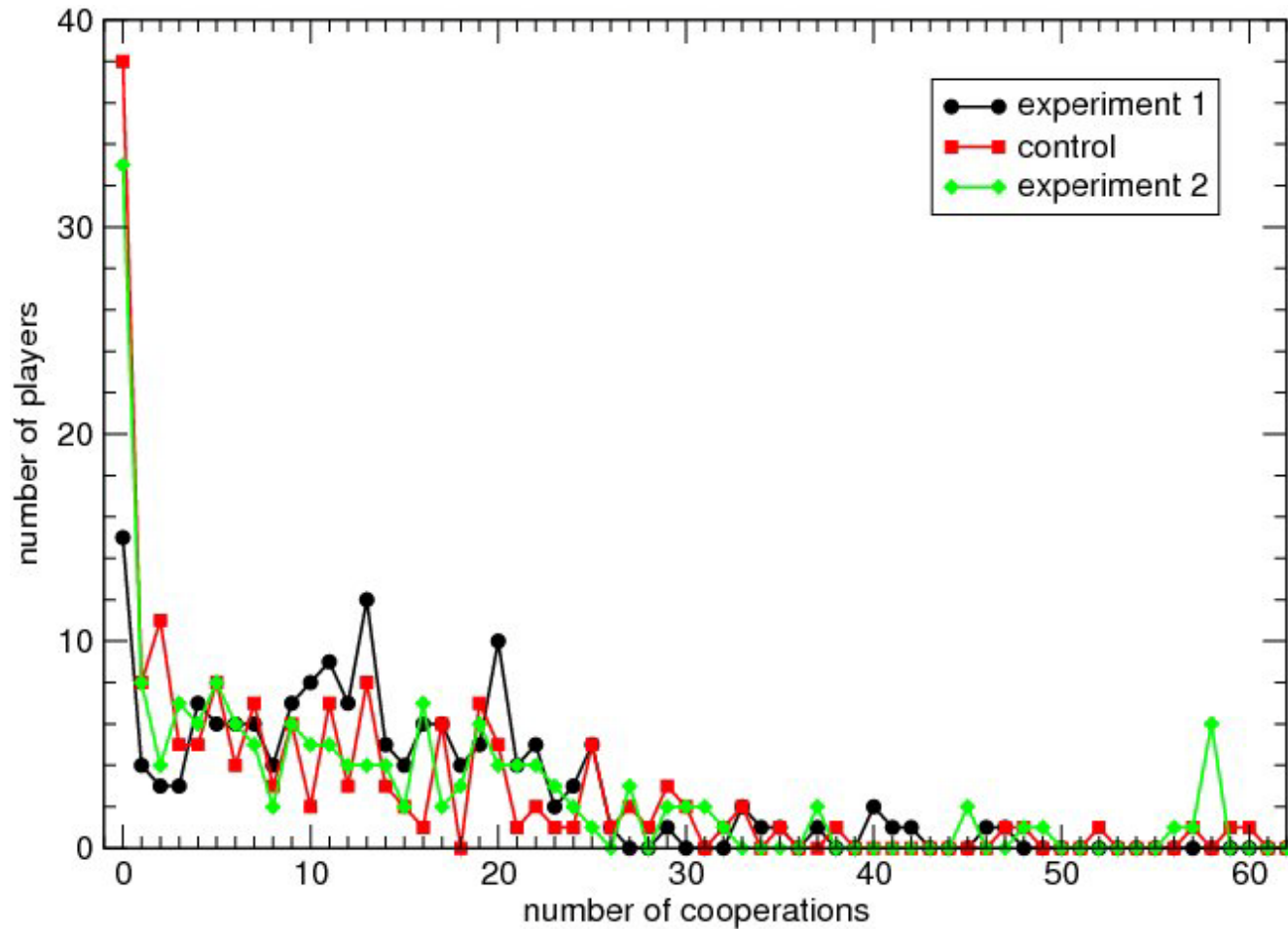
Homogen model – histogram zarade



Homogeneous model – earnings vs. cooperation



Potruga za novim modelom



Potruga za strategijama

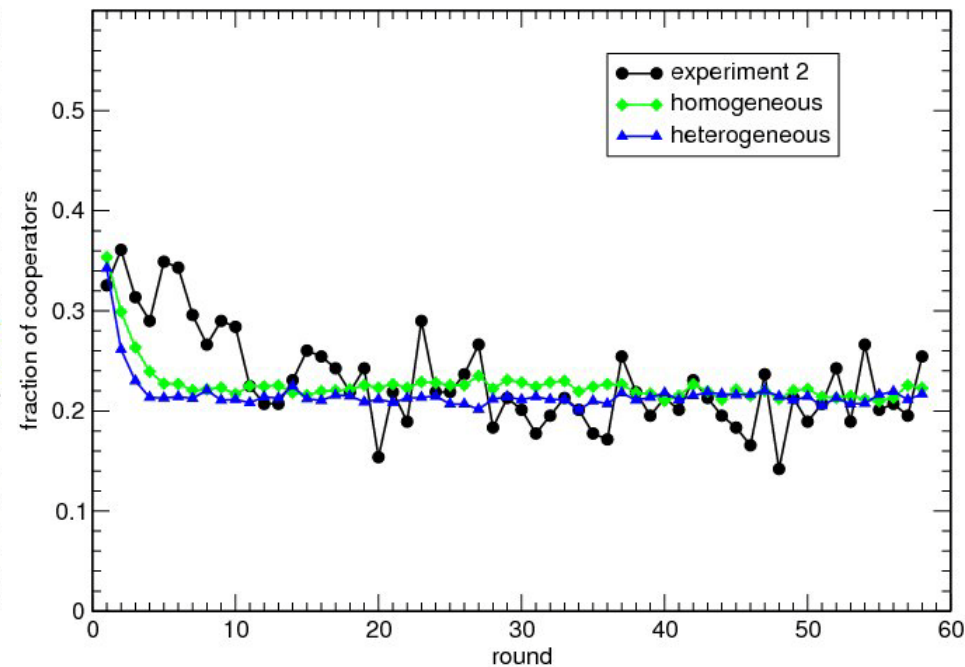
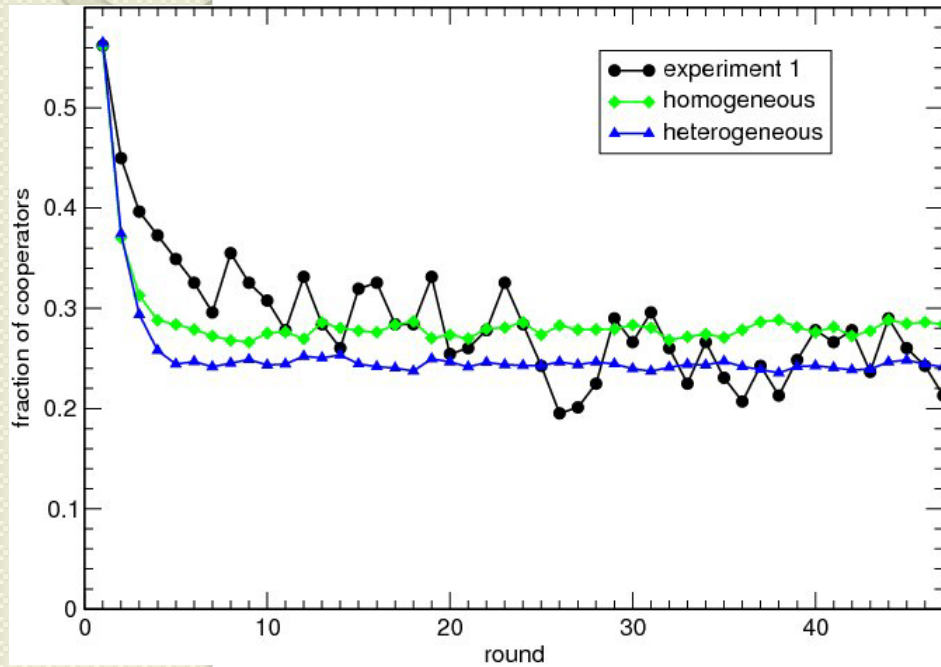
Type of player	Experiment 1	Control	Experiment 2
Pure defector	22	44	39
Mostly defector	38	40	37
Pure cooperator	2	1	6
Mostly cooperator	1	2	3
The Rest	106	82	84

Heterogen model!

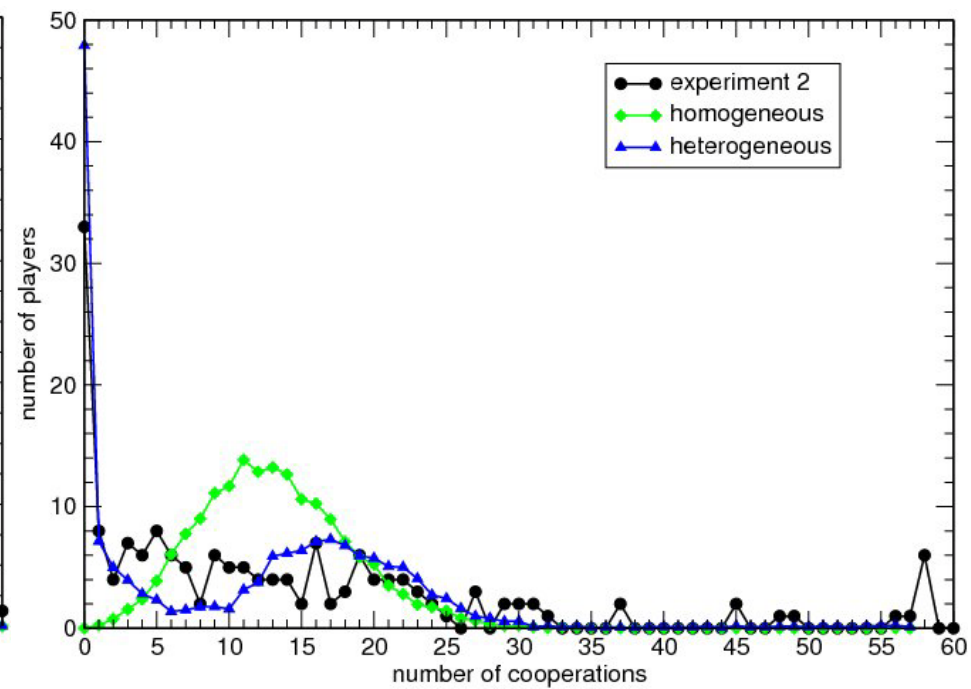
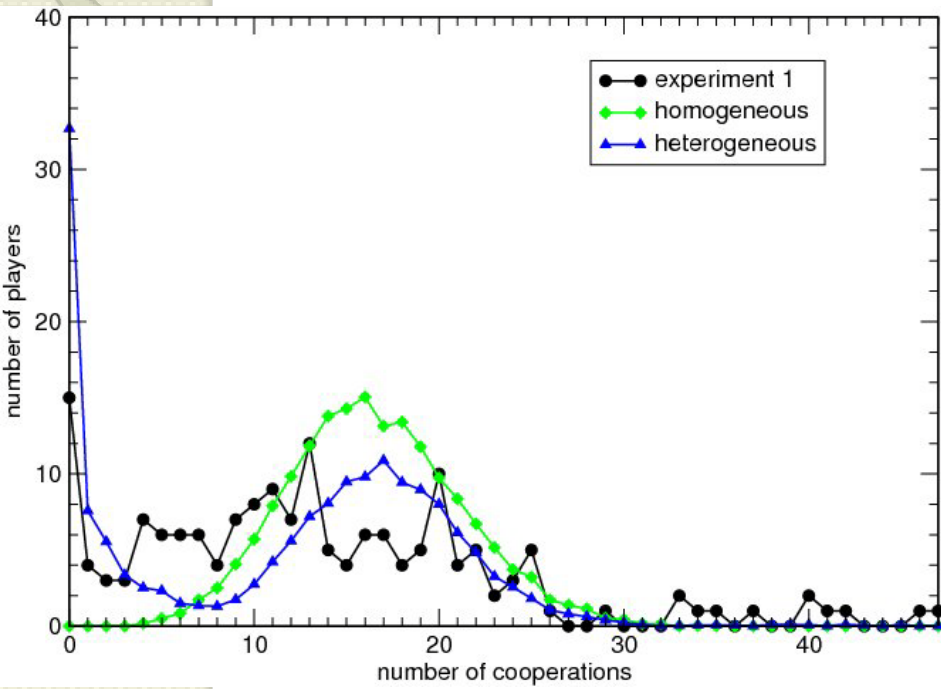
Heterogen model

- Isključivi izdajnici – uvek izdaju
- Većinski izdajnici – D sa $P > 2/3$
- Isključivi saradnici – uvek saraduju
- Većinski saradnici – C sa $P > 2/3$
- Ostatak – kao u homogenom modelu

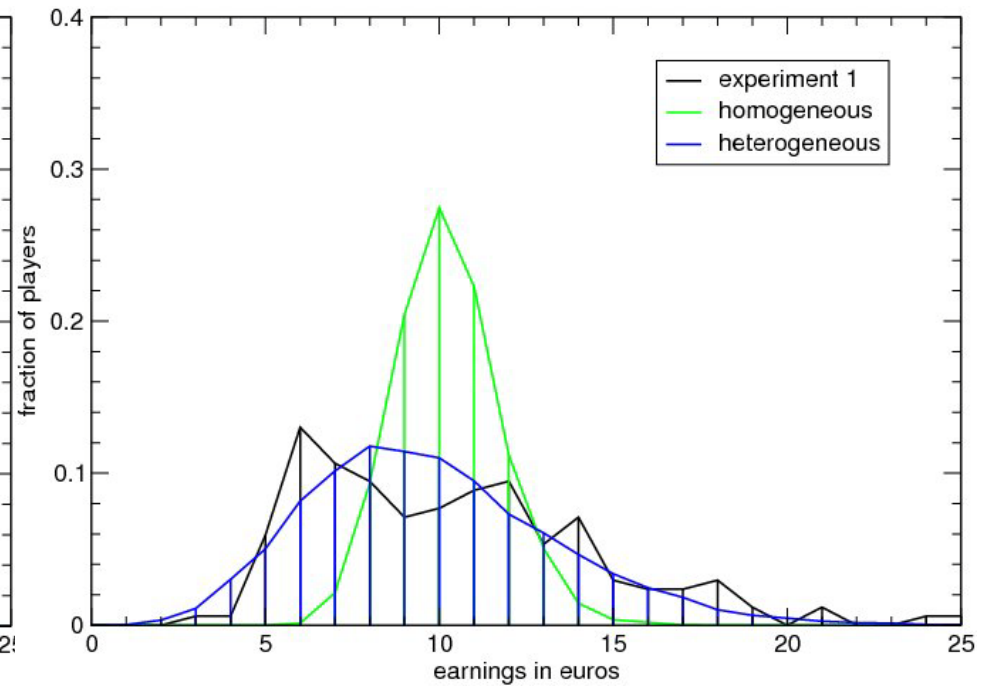
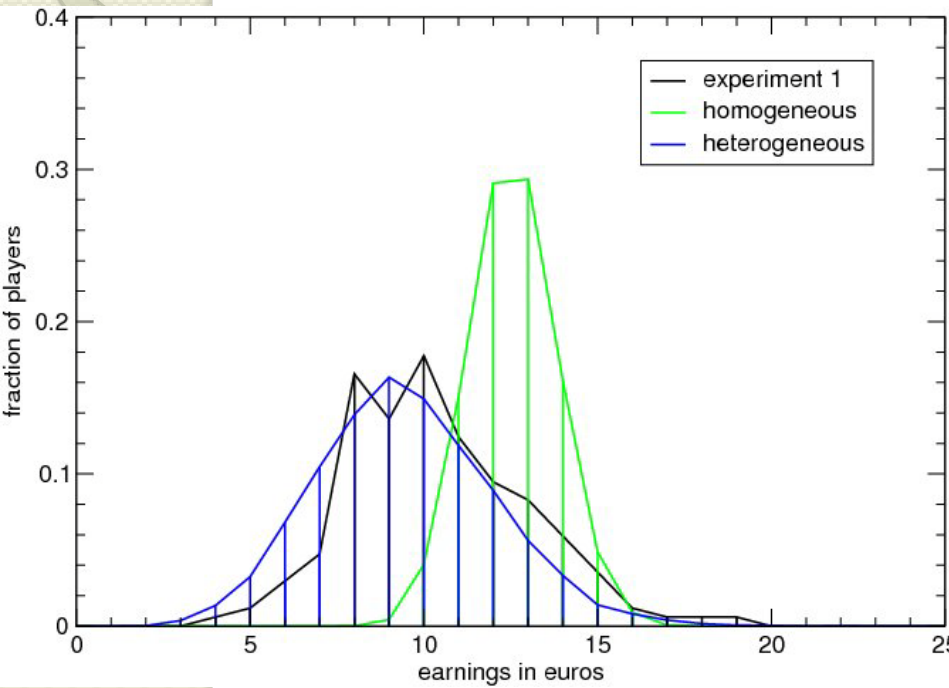
Poređenje



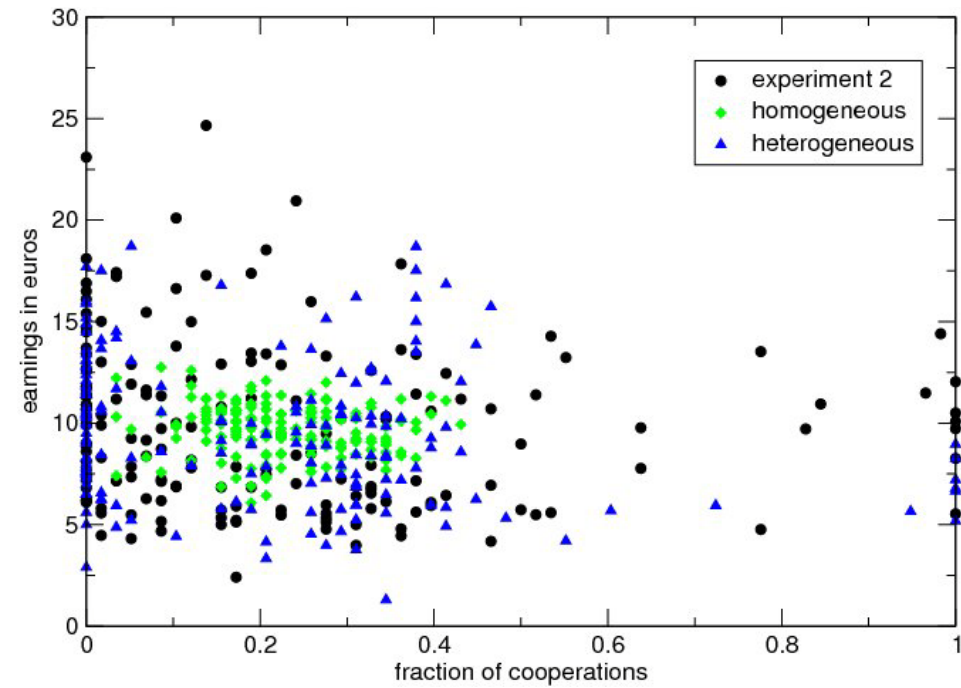
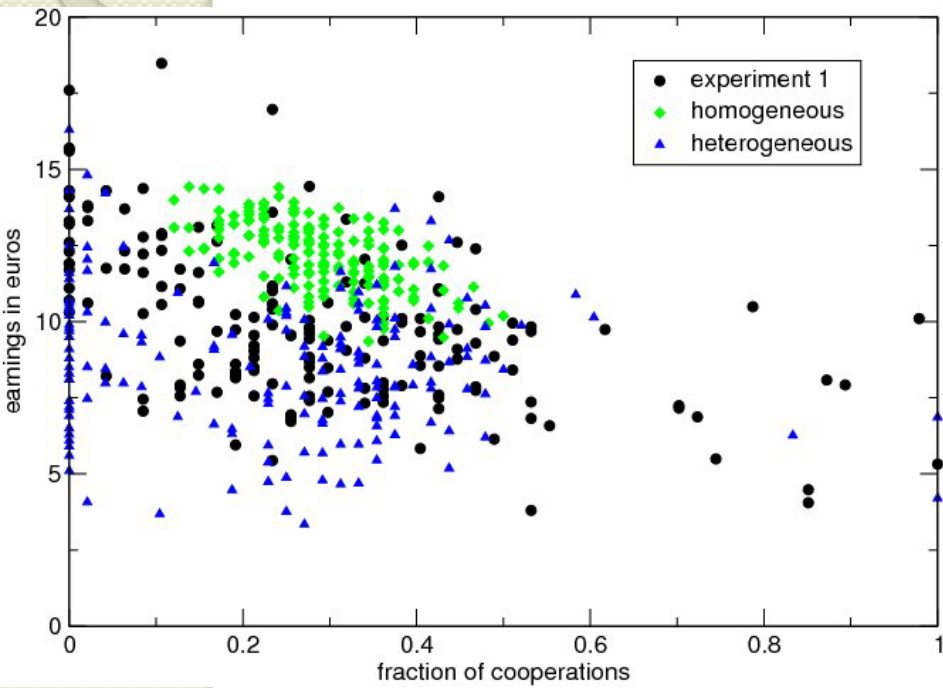
Poređenje



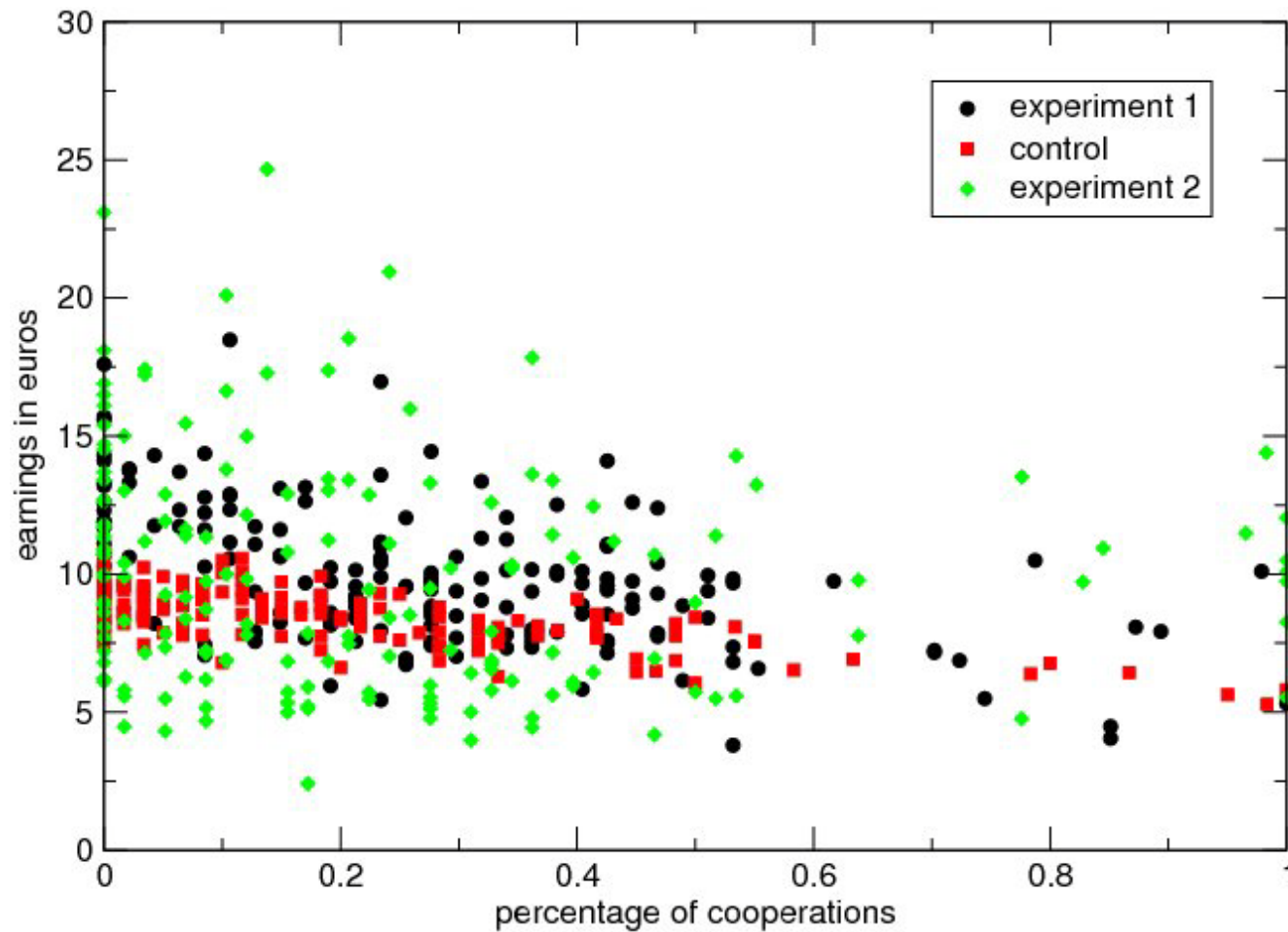
Poređenje



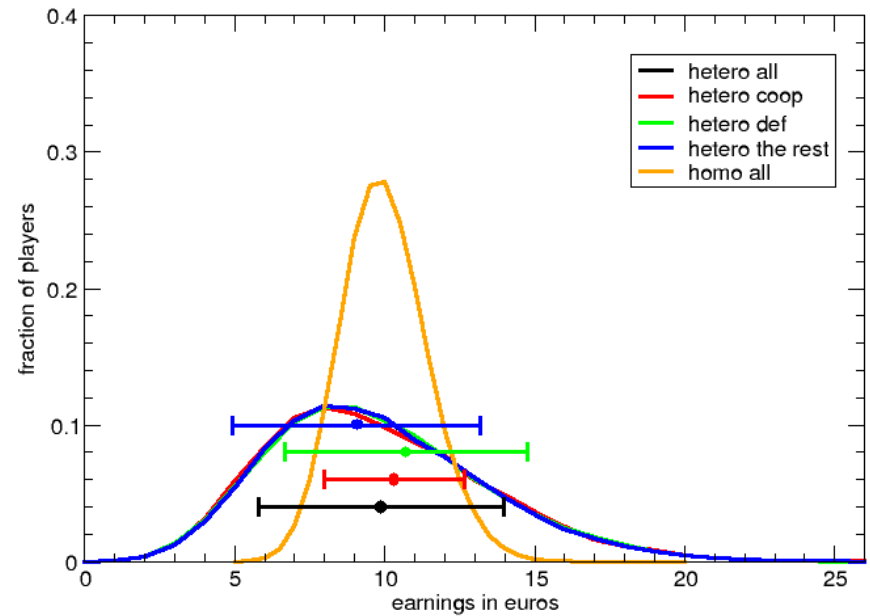
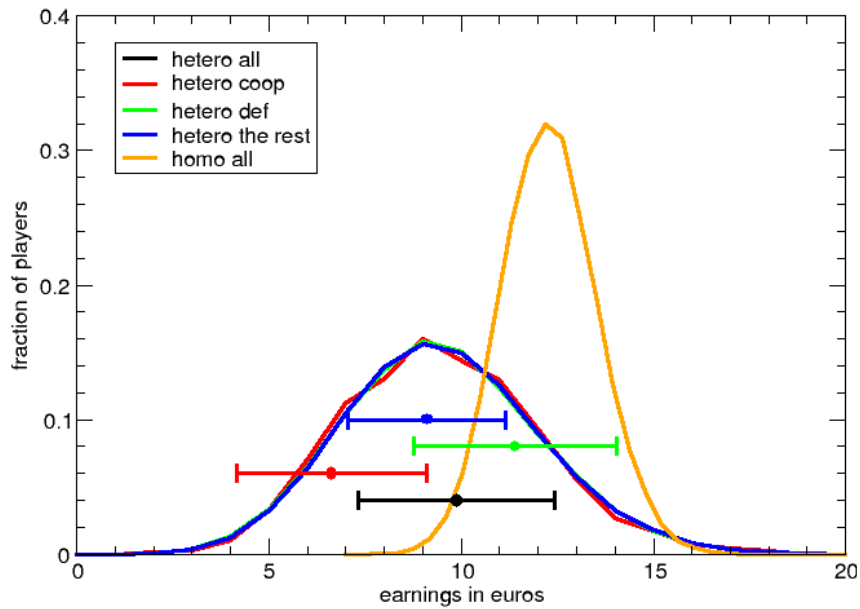
Poređenje



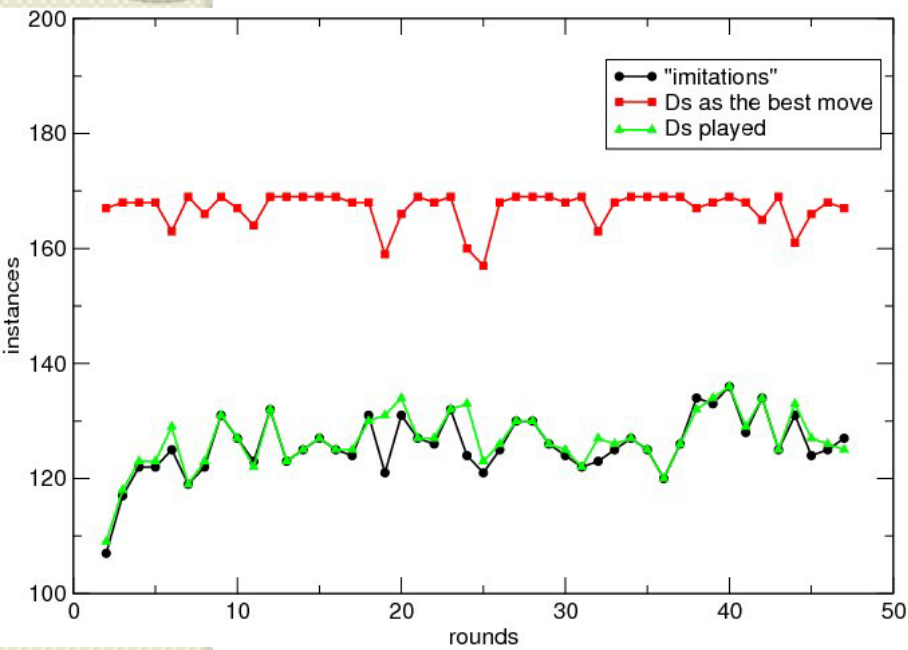
Zašto je tako?



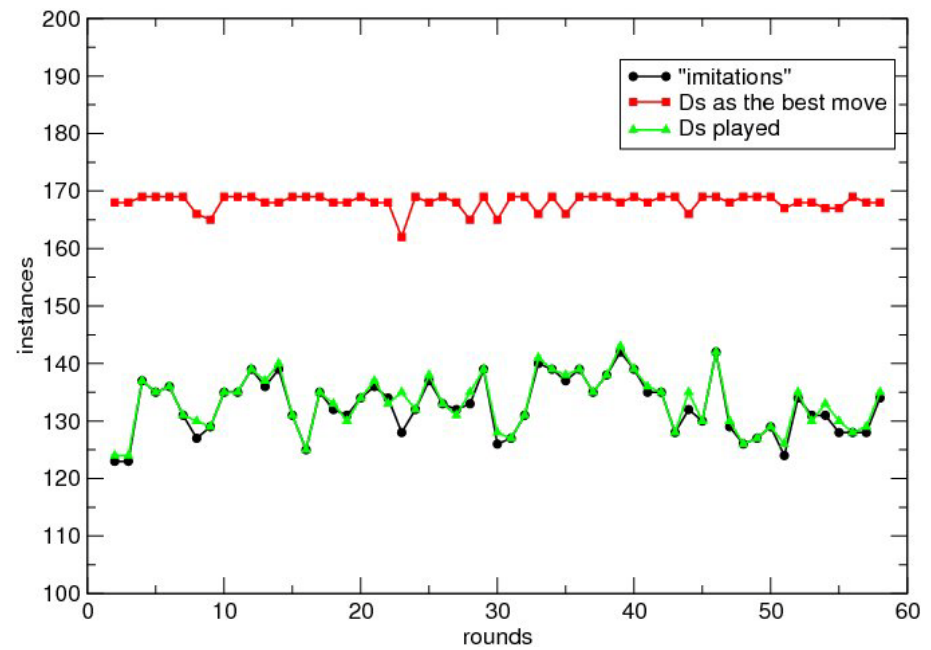
Zarade za različite vrste igrača



Bezuslovno imitiranje Exp 1 heterogen model

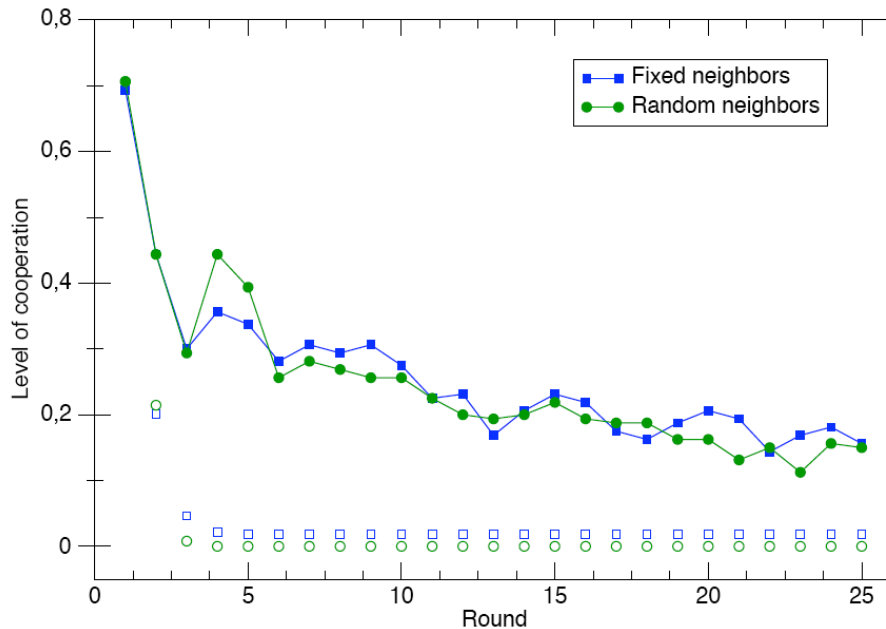


Eksperiment 1

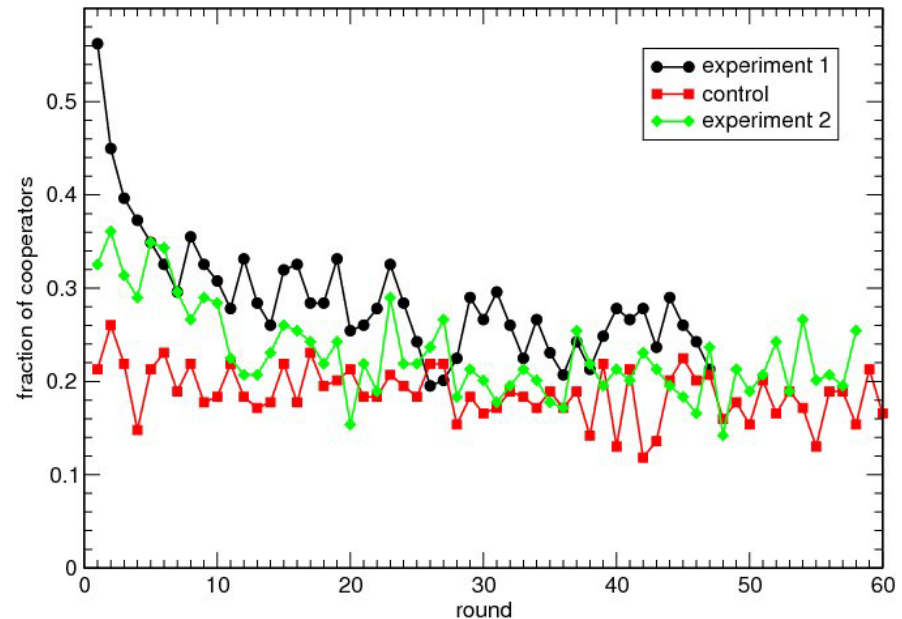


Eksperiment 2

Ostali eksperimenti

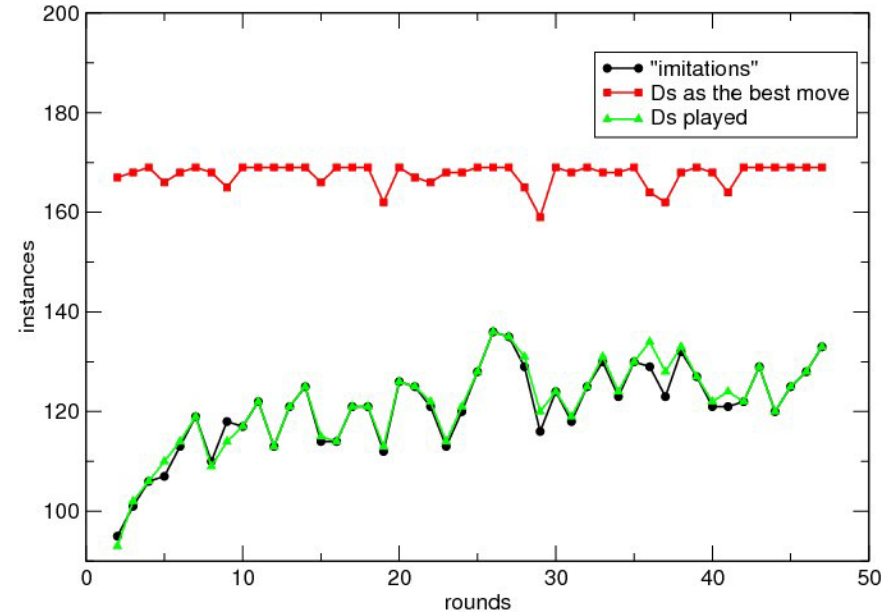
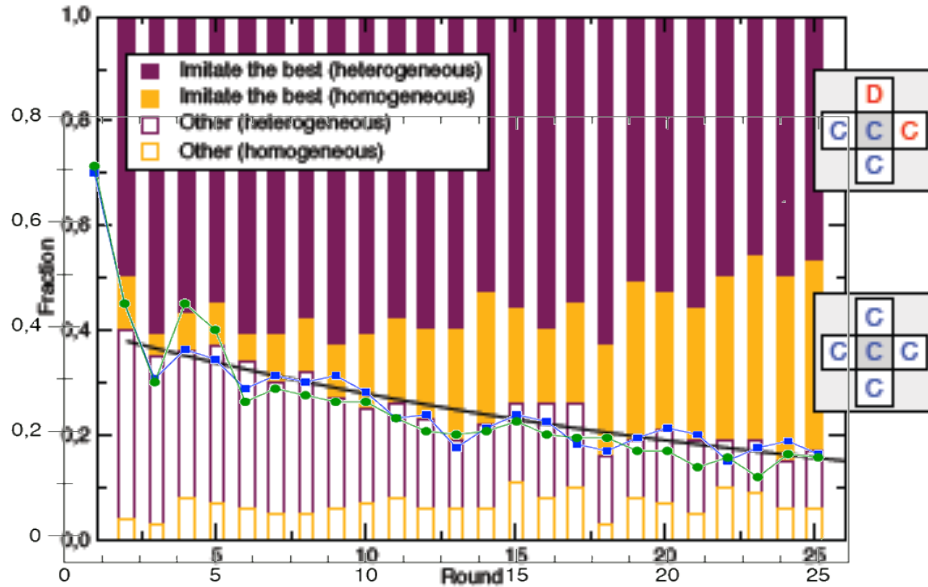


A. Traulsen, D. Semmann, R. D. Sommerfeld,
H.-J. Krambeck and M. Milinski,
Humans Playing a Spatial Prisoner's Dilemma.
(PNAS, January 2010)
4x4 lattice, 4 neighbors, true Prisoner's Dilemma

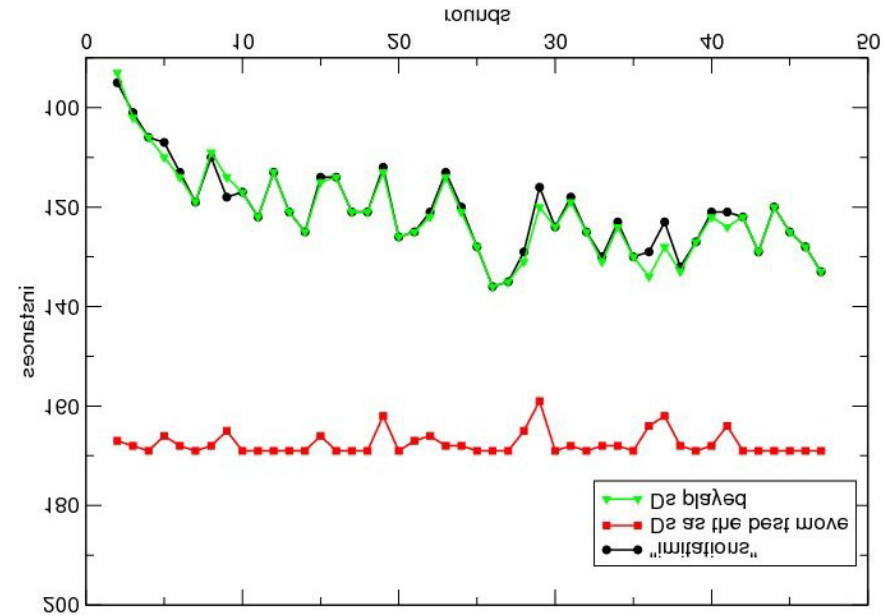
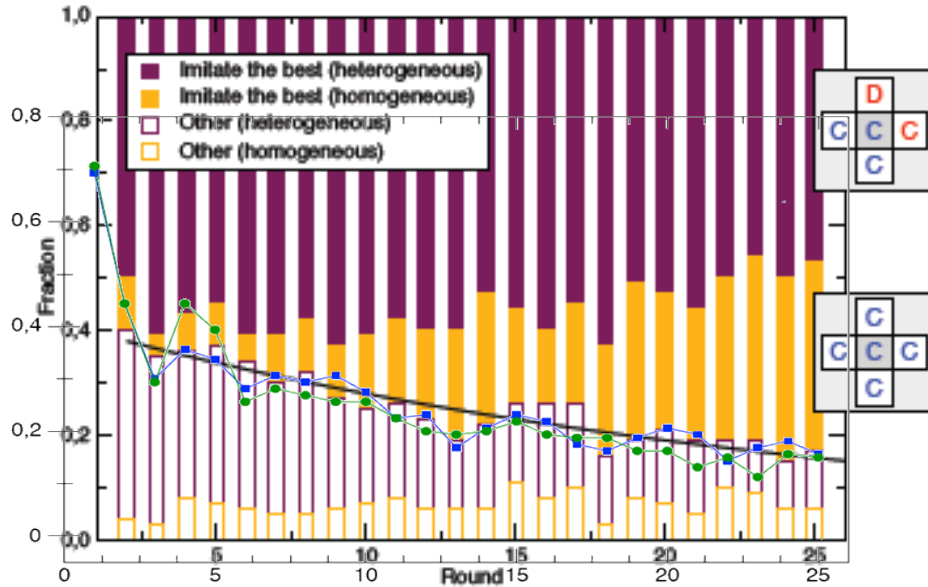


J. G., C. Fosco, L. Araújo, J. A. Cuesta and A.
Sánchez, (In preparation)
**13x13 lattice, 8 neighbors, weak Prisoner's
Dilemma**

Da li ima imitiranja?



Da li ima imitiranja?



Zaključak

- Najveći eksperiment do sada
- Mala ali nenulta saradnja
- Nema bezuslovnog imitiranja
- Posle C rastuća verovatnoća za C
- Posle D opadajuća verovatnoća za C
- Homogen model, nije dovoljan
- Heterogen model
- Sve strategije ekvivalentne
- Potezi, ne zarada

¡Gracias!

- Jose Cuesta & Anxo Sánchez
- Constanza Fosco, Lurdes Araújo
- Informatics department
- Svima koji su pomogli u testiranju
- Na pažnji