An Agent-Based Modeling of Drinking Behavior: A Preliminary Model and Potential Applications to Theory and Practice

Gimel Velasco, Paolo Sandoval

Agent-Based Modeling of Drinking Behavior: A Preliminary Model and Potential Applications to Theory and Practice

Article *in* American Journal of Public Health · December 2006

DOI: 10.2105/AJPH.2005.063289 · Source: PubMed

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Authors:

- Dennis M. Gorman, PhD
- Jadranka Mezic, MS
- Igor Mezic, PhD
- Paul J. Gruenewald, PhD

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- Observes the consequences of manipulating key input variables on attitudinal and behavioral outputs.

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Two aspects of alcohol studies that benefit from ABM

- Answering "What if" questions.
- Spatial Dynamics and person-environment interactions.

Objective

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To develop a preliminary agent-based simulation model designed to examine agent-environment interactions that support the development and maintenance of drinking behavior at the population level.

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- Second Model
  A "bar" was added to the 1-dimensional lattice to attract Current Drinkers.

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  Drinkers who have stopped drinking in the present.
- Note: Current Drinkers and Former Drinkers transition to each others state during the whole duration of the model. This movement into and out of heavy drinking is strongly affected by interpersonal influences and social context.

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- Else, it will move like that of any other agent.

Agent Conversion: Interpersonal Influences & Social Context

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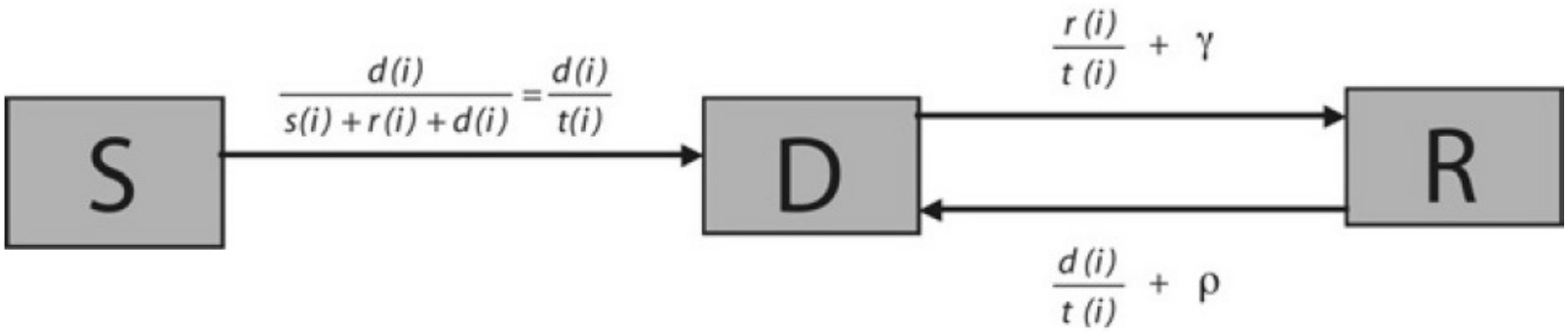

Note. Susceptibles (S): each agent examines the site it is residing on, counts current drinkers *d(i)*, and converts to being a drinker with probability $\frac{d(i)}{s(i)+r(i)+d(i)} + \frac{d(i)}{t(i)}$, where *t(i)* = *s(i)*+*r(i)*+*d(i)* is the total number of individuals at site *i*. Current drinkers (D):each agent examines its site, counts former drinkers *r(i)*, and converts to nondrinker status with probability $\frac{r(i)}{t(i)} + \gamma$, where γ is a bias defined as a probability that a drinker would stop drinking even if there were no former drinkers at this site (e.g., as a result of broader socioenvironmental influences such as the price of alcohol). Former drinkers (R): each agent examines its site, counts current drinkers, and converts to a current drinker with probability $\frac{d(i)}{t(i)} + \rho$, where ρ is a bias defined as the probability that former drinkers would resume drinking even if there were no drinkers around (e.g., with relapse caused by genetic predisposition).

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- 1 Susceptible Drinker in every site.
- 1 Current Drinker in the middle of the lattice.

Results & Discussion

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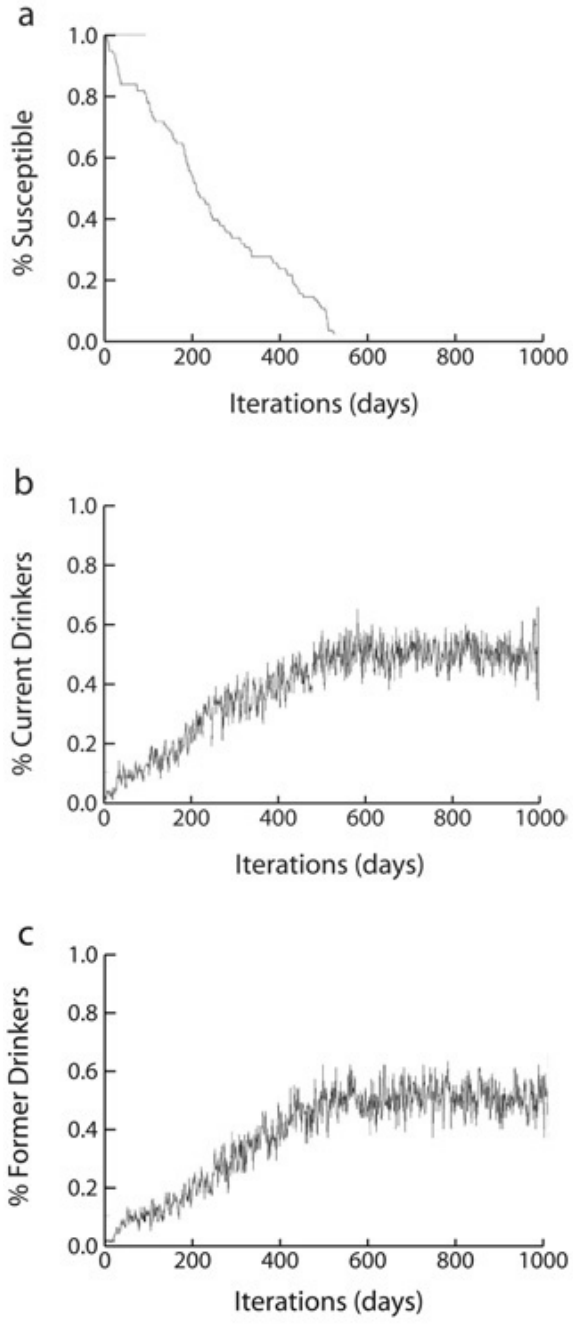

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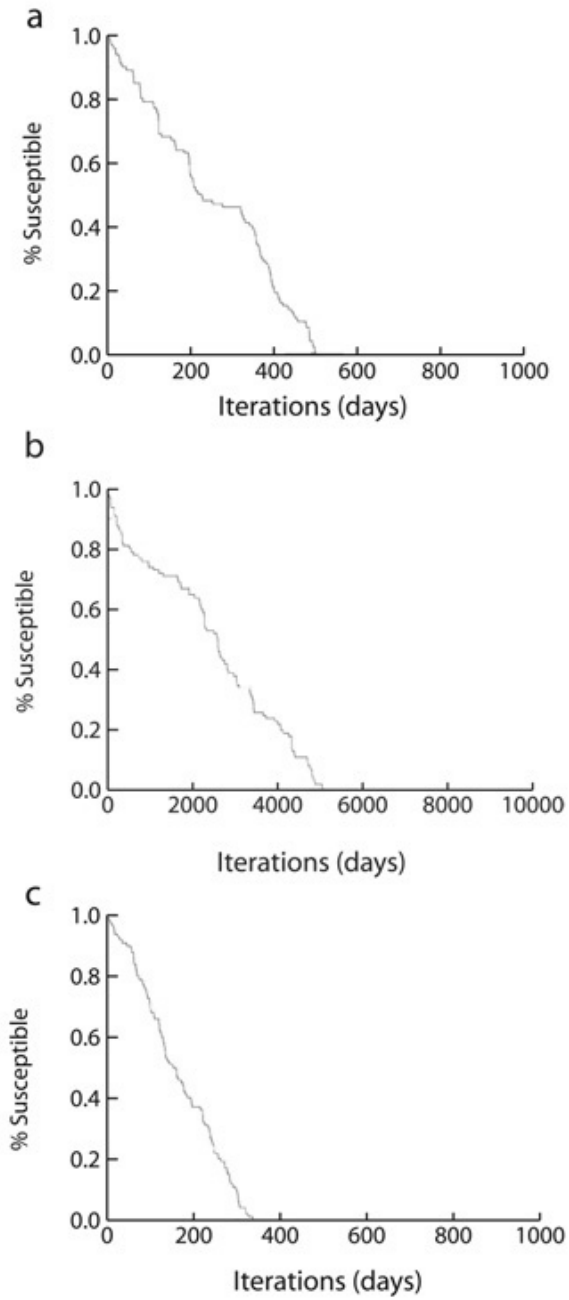

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- For any p,ρ,$\gamma \neq 0$, the population of S agents went to 0.
- The population of D agents and R agents oscillated around the equilibrium γ/ρ (1:1 or 2:1 or 1:2 ratio).
- Higher p makes S agent population drop faster.
- Lower p makes S agent population drop slower.

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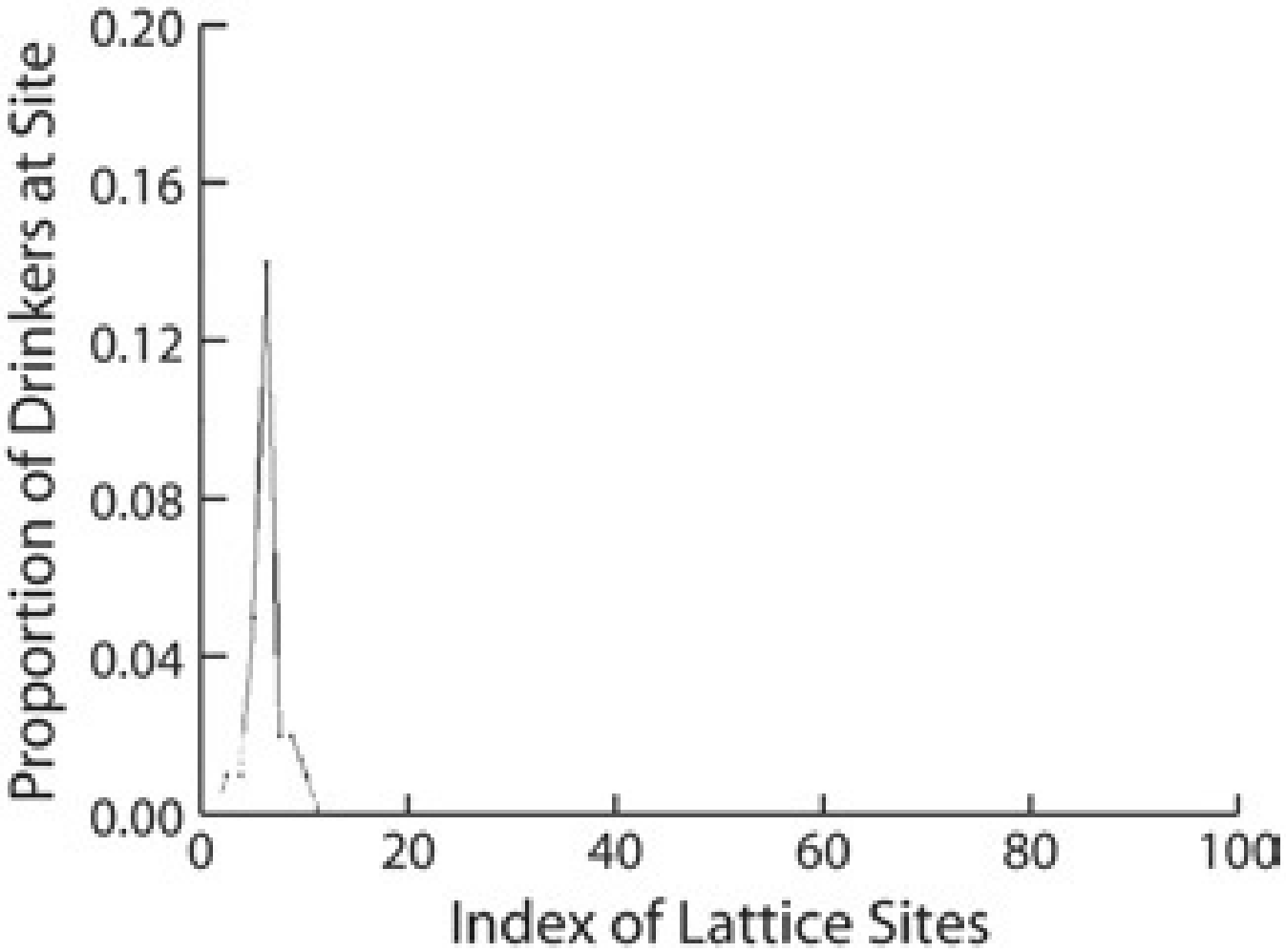

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- The conversion from S agent to D agent was linear and very rapid at first, but then considerably slowed.
- The population of S agents did not go to 0 after 1000 iterations but appeared to level off at a constant nonzero value.

Effects of the Bar

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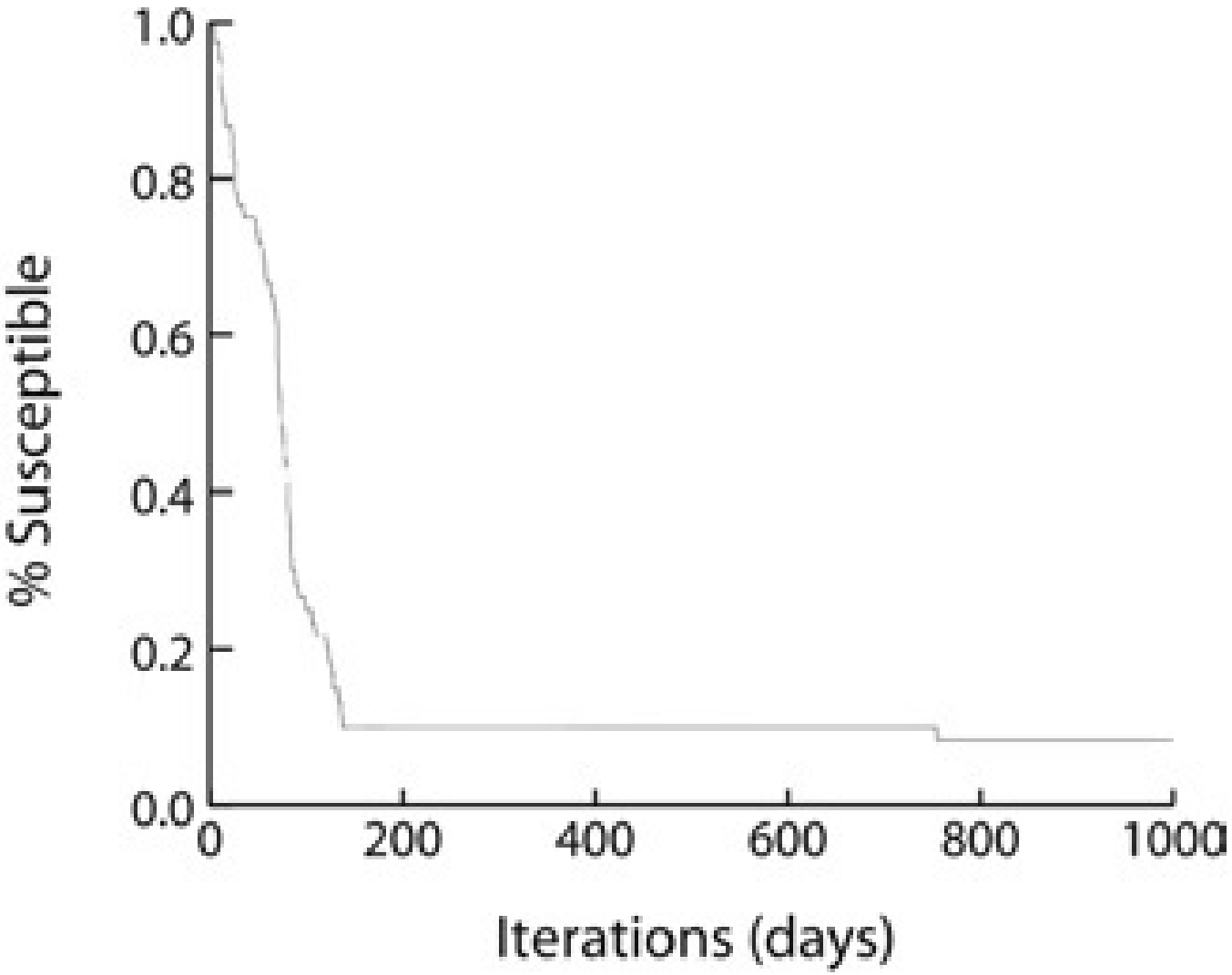

- Since the D agents clustered at the bar, they have less chances of interacting with S agents. Thus, yielding the results showed above.

Conclusion

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The models demonstrate that the basic dynamics underlying social influences on drinking behaviour are shaped by contacts between drinkers and focused by characteristics of drinking environments.

References

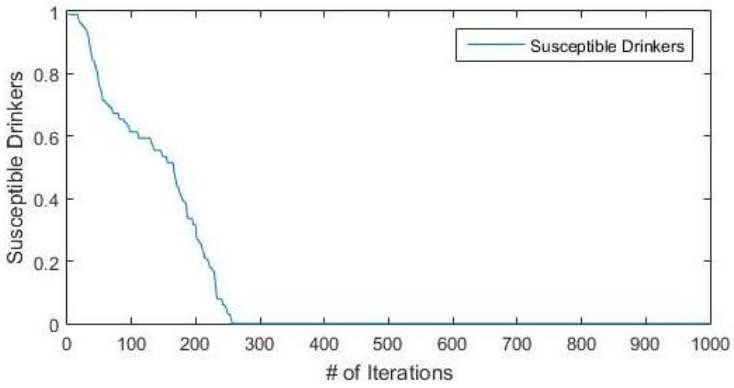
References

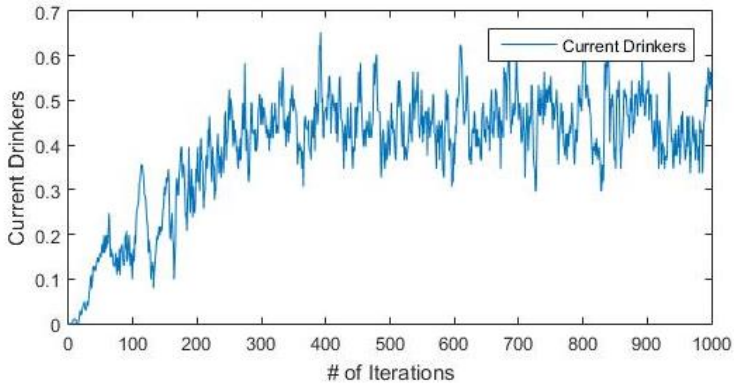
D. M. Gorman, J. Mezic, I. Mezic, and P. J. Gruenewald, "An agent-based modeling of drinking behavior: A preliminary model and potential applications to theory and practice," *American Journal of Public Health*, December 2006.

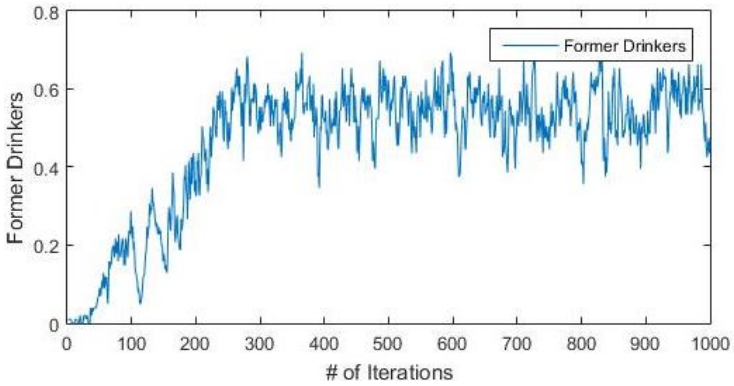
Replication

The following results were collected from running the model w/o the Bar

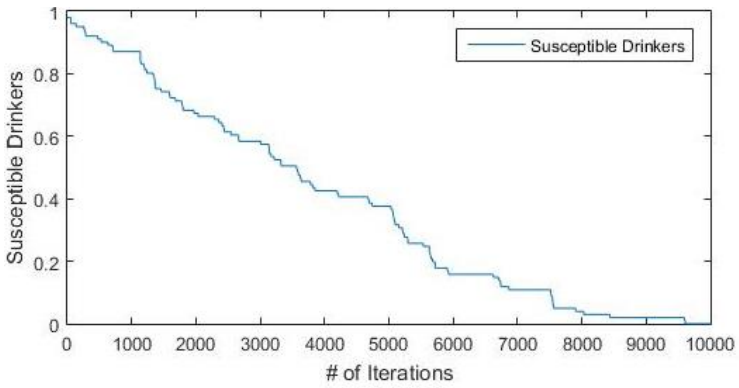
Parameters: p=.5, γ=.3, ρ =.3

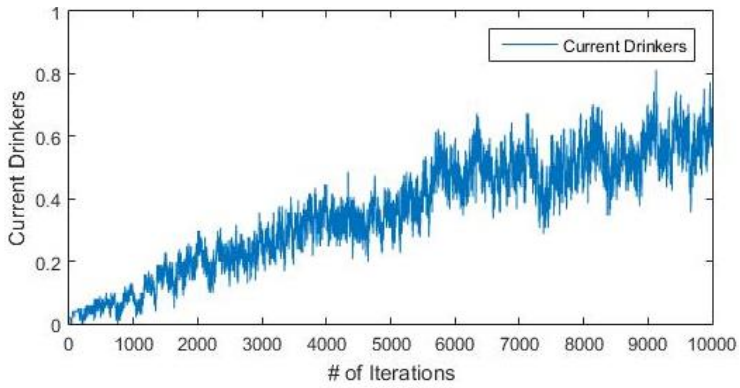


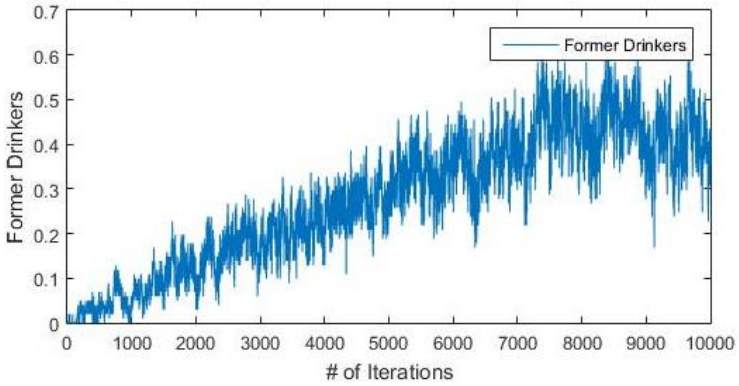




Parameters: p=.01, γ=.3, ρ =.3







Parameters: p=.2, γ=.3, ρ =.3