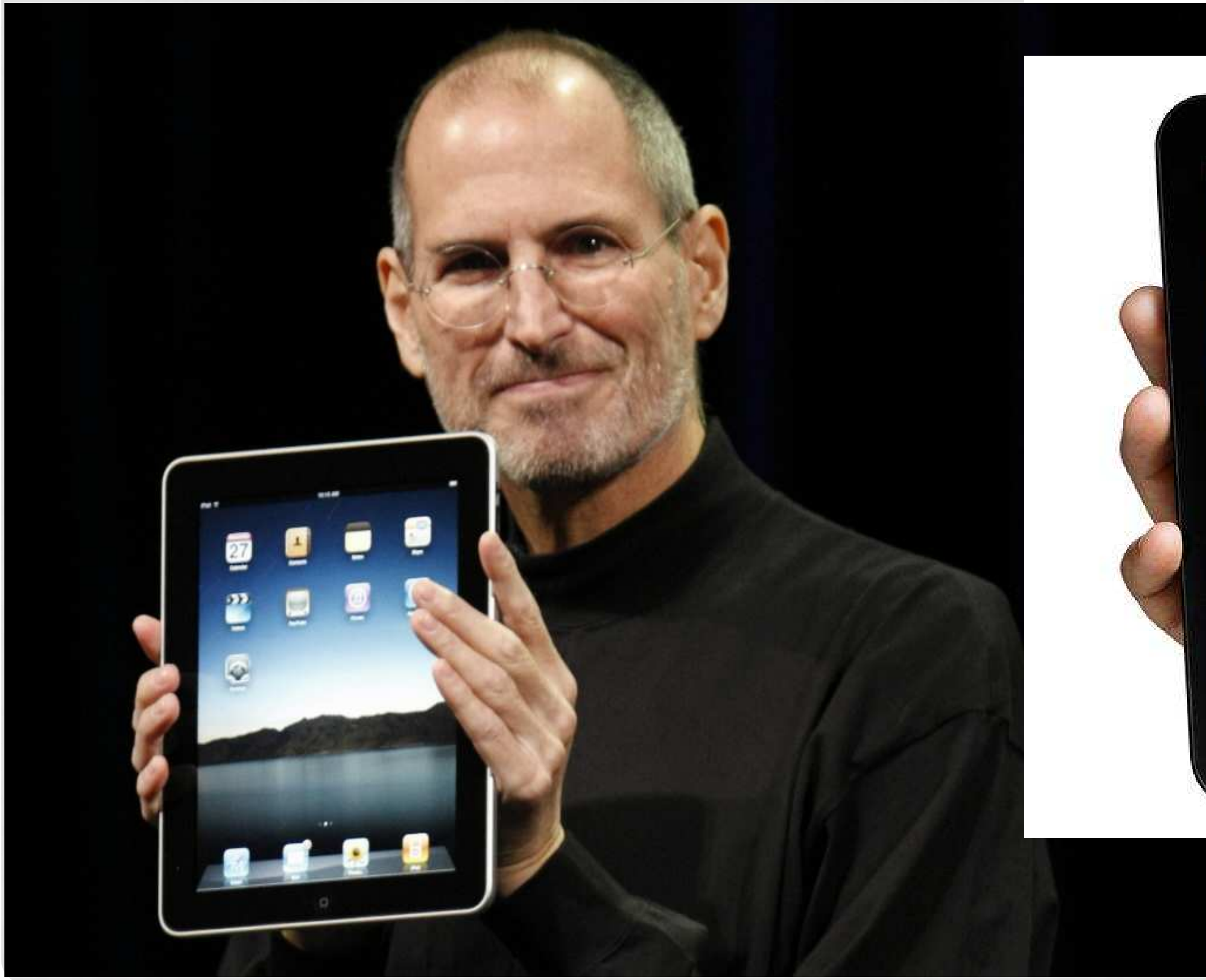
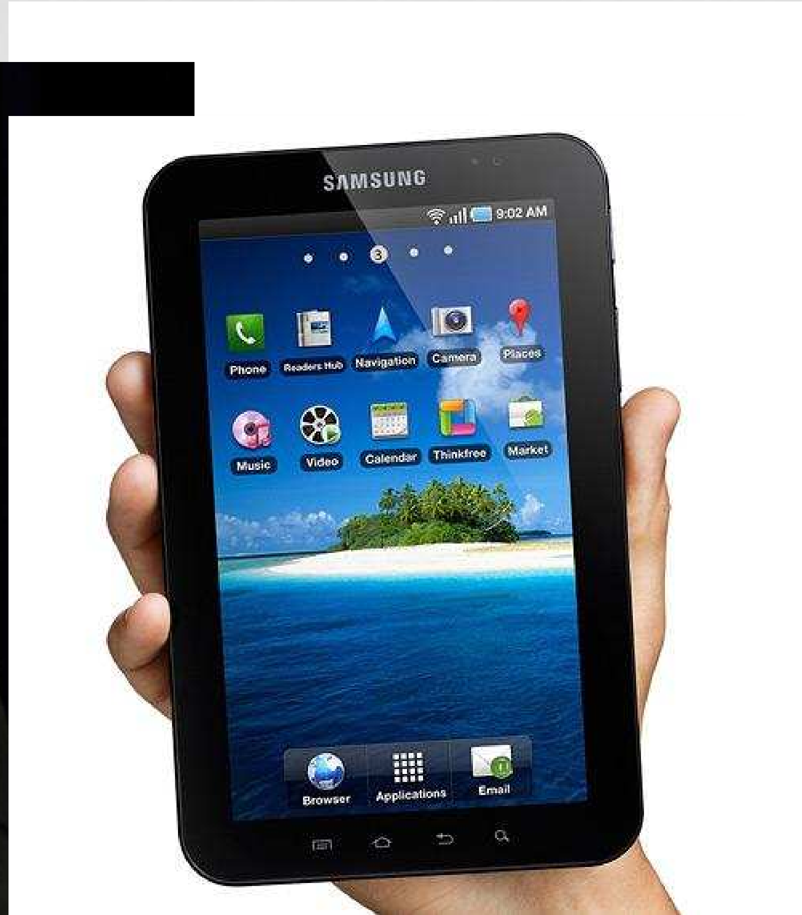
ADOPTION OF INNOVATIONS

HOW, WHY AND WHEN ARE INNOVATIONS ADOPTED

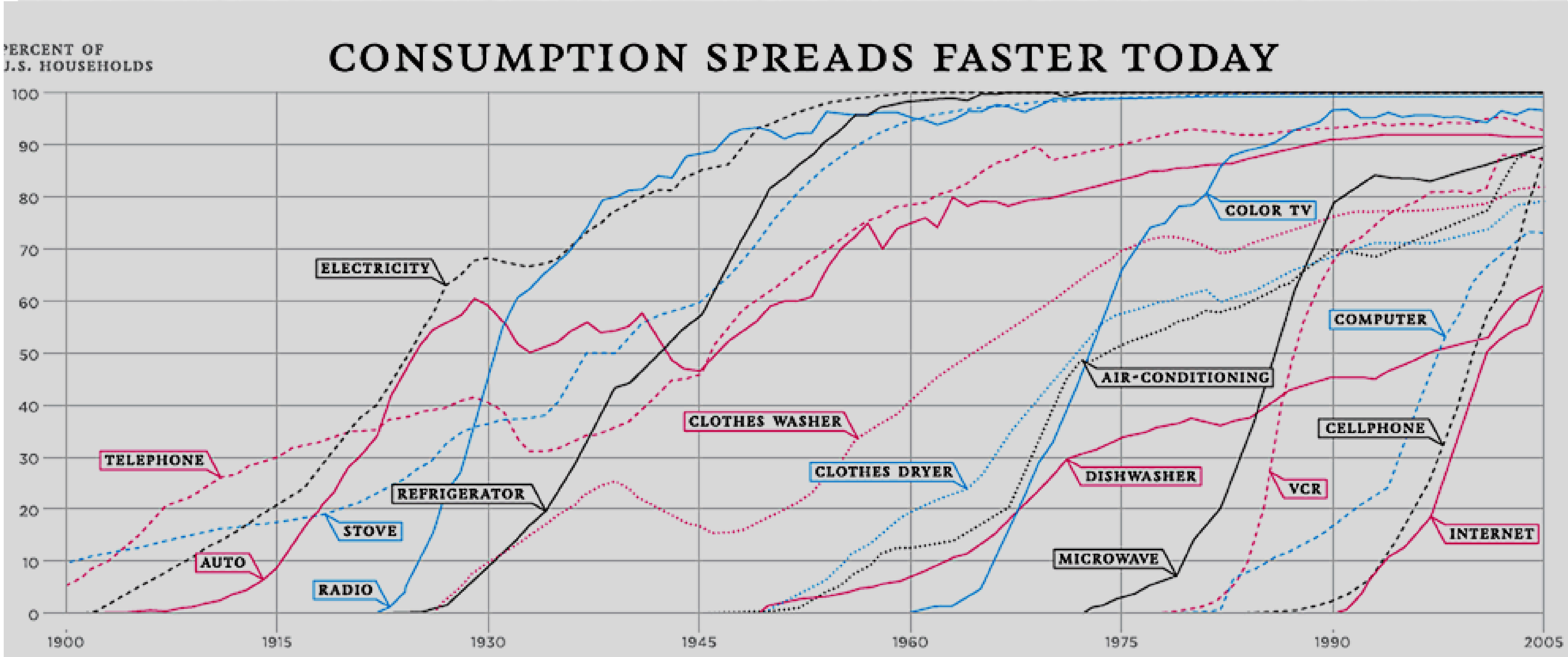
S Gonçalves, M F Laguna and J R Iglesias IF-UFRGS – Porto Alegre, Brasil
Reunião de Trabalho do INCT-SC – Rio de Janeiro - Maio 2012

INNOVATIONS

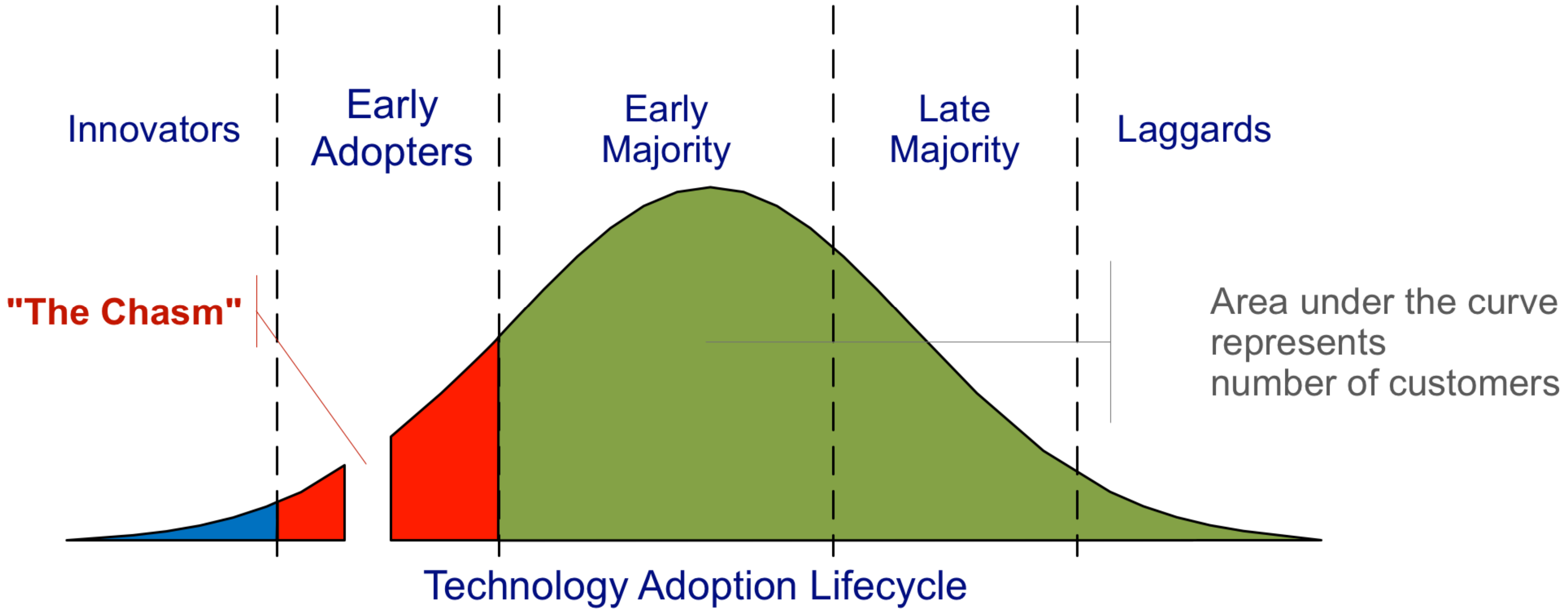




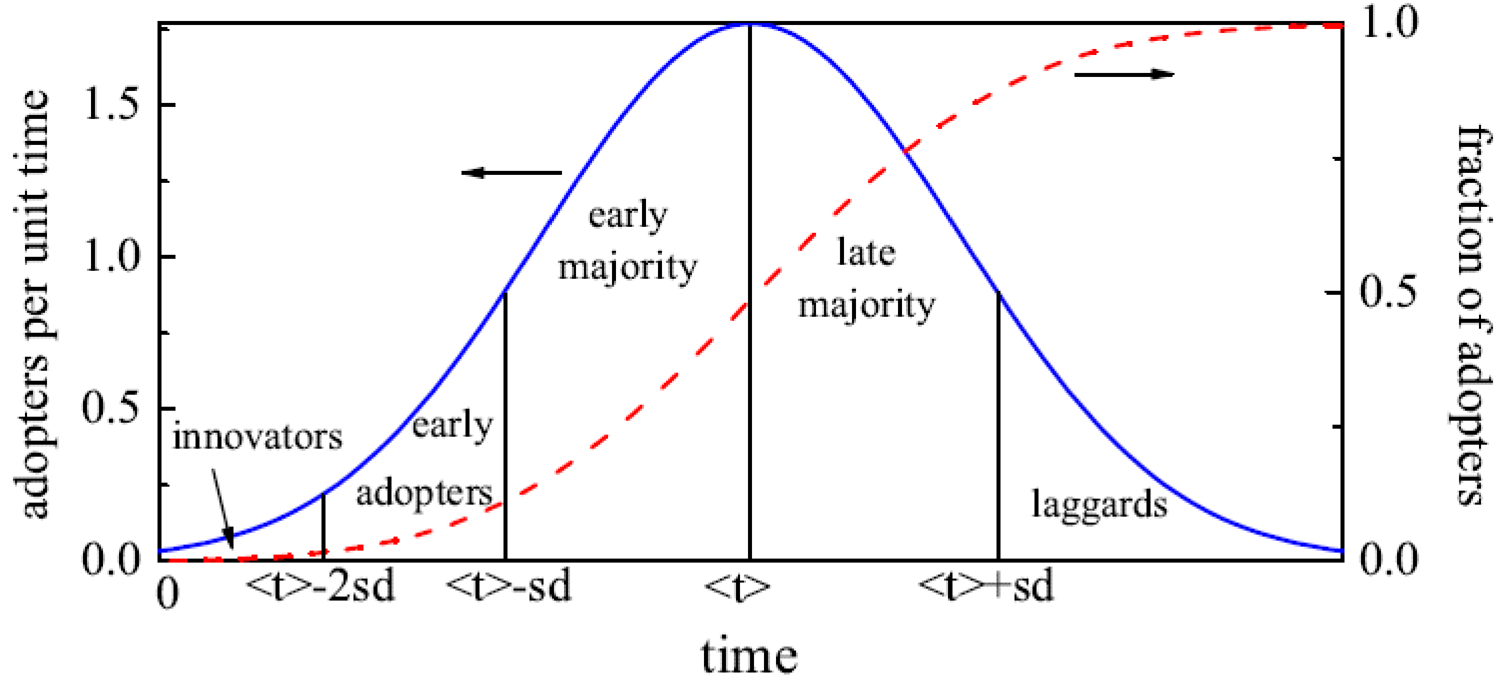
ADOPTION OF INNOVATIONS ALONG THE 20TH CENTURY



ROGER'S HYPOTHESIS



ROGERS HYPHOTESIS



THE MODEL

- There is an external pressure (field) inducing to adopt the new technology A. $0 < A < 1$
- Each agent has an idiosyncratic resistance to change to the new technology, u_i. (This resistance is a random value: $0 < u_i < 1$
- There is a social influence proportional to the number of adopters: $J.n$. ($n = N_{adopters}/N$.)
- Na agent (selected at random) will adopt the innovation if:
- $Payoff = A - u_i + J.n > 0$

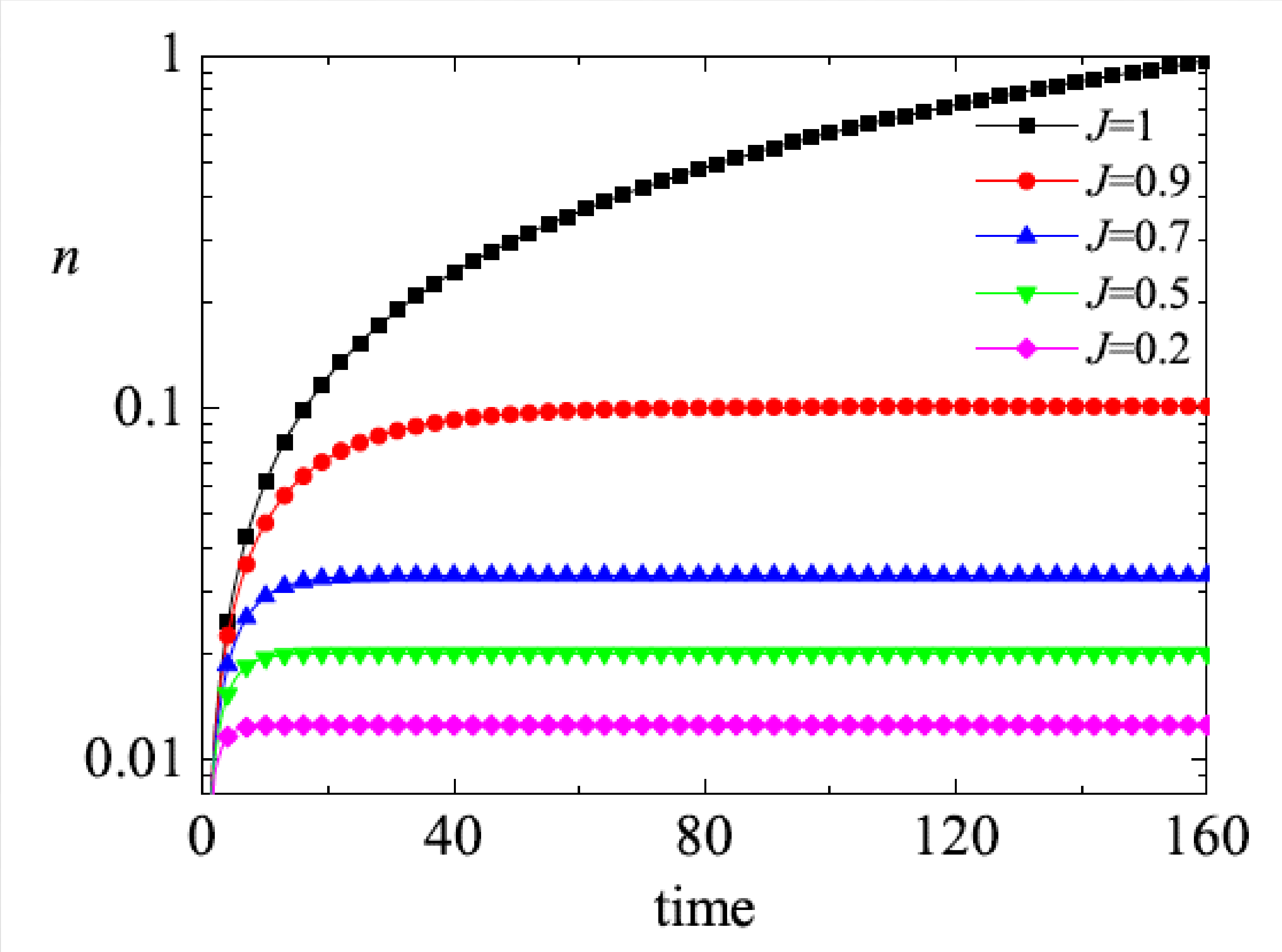
CONTRARIANS

- We have added a second feature: the presence of a certain percentage of agents with **Ji <** 0 which act against the innovation, being the opposition stronger the higher the number of adopters. We denominate these agents, following Galam
- Thus, for a contrarian:
- *Payoff* $= A - u_i - J.n$
- This means that after a transient no contrarian will adopt.
- We all also consider groups of influence.

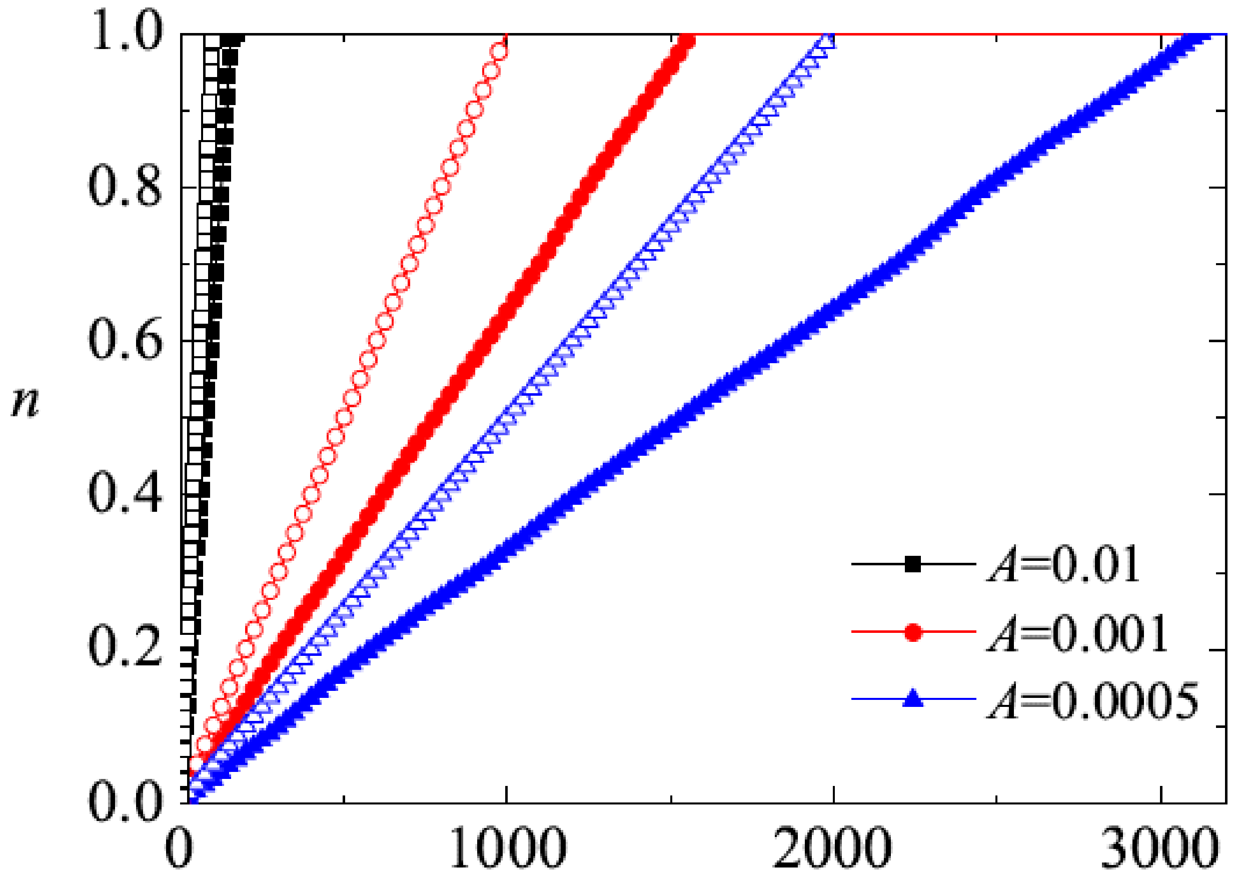
BASIC RESULTS

- Consider a initial situation where no agent is in possession of the new technology.
- The "early adopters" will be the ones with $u_i \leq A$, then n≈A
- In the second time step agents with $u_i \leq A+JA$ will adopt.
- If $J=1$ adoption increases linearly in time and full adoption will happens after $1/A$ steps.
- If J<1 the number of steps is $s(t) = A \, \Sigma_k \, J^k$ and the assymptotic value is $n(\infty)=A/(1-J)$ i.e. There is never full adoption.

NUMERICAL SIMULATIONS



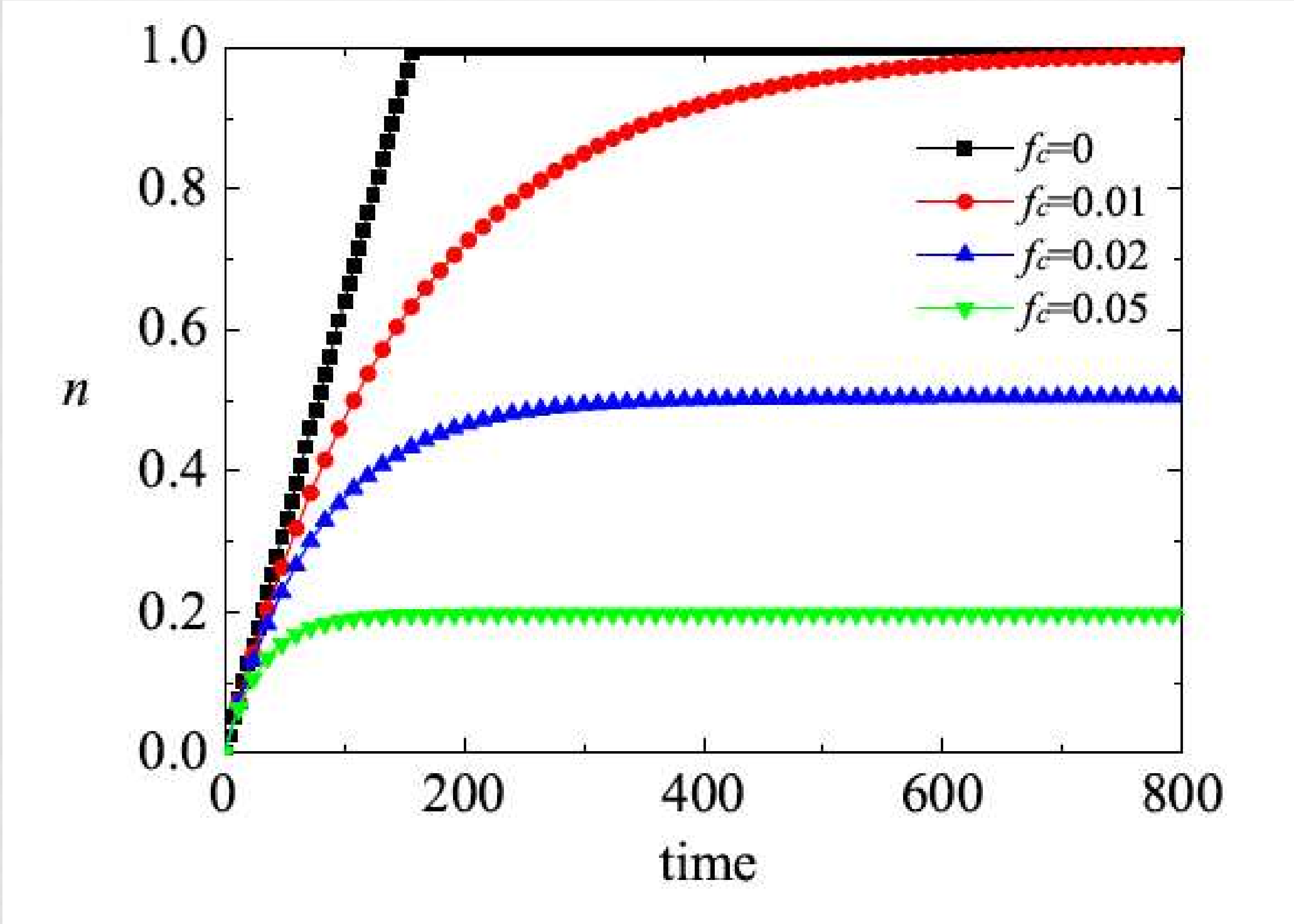
SPEED OF ADOPTION



namics. The probability of an agent not to be chosen in a MC step is $(1 - 1/N)^N$, which in the limit of large N is equal to $\exp(-1)$; then the fraction of chosen agents

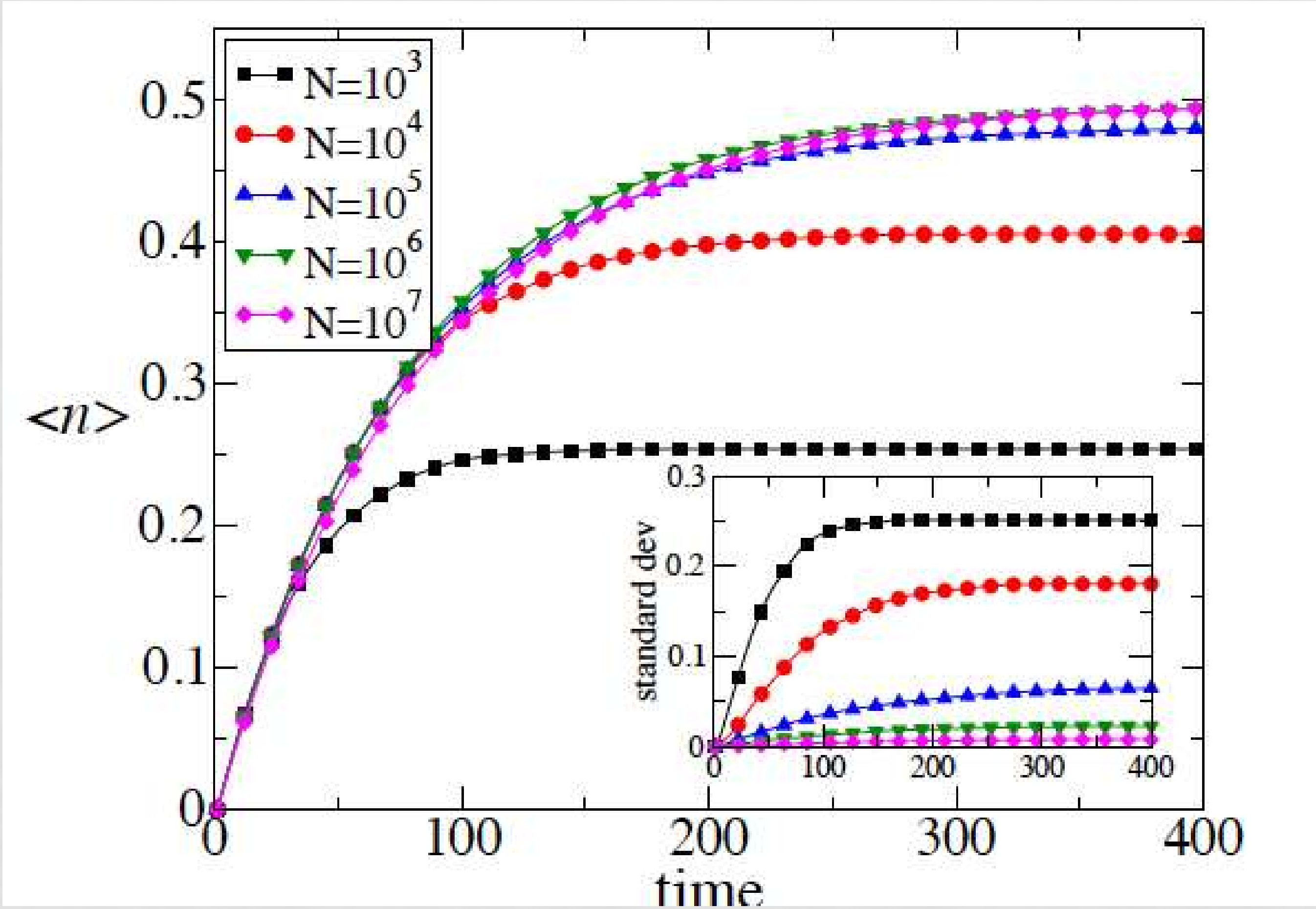
EFFECT OF CONTRARIANS

A=0.01
N=10^7



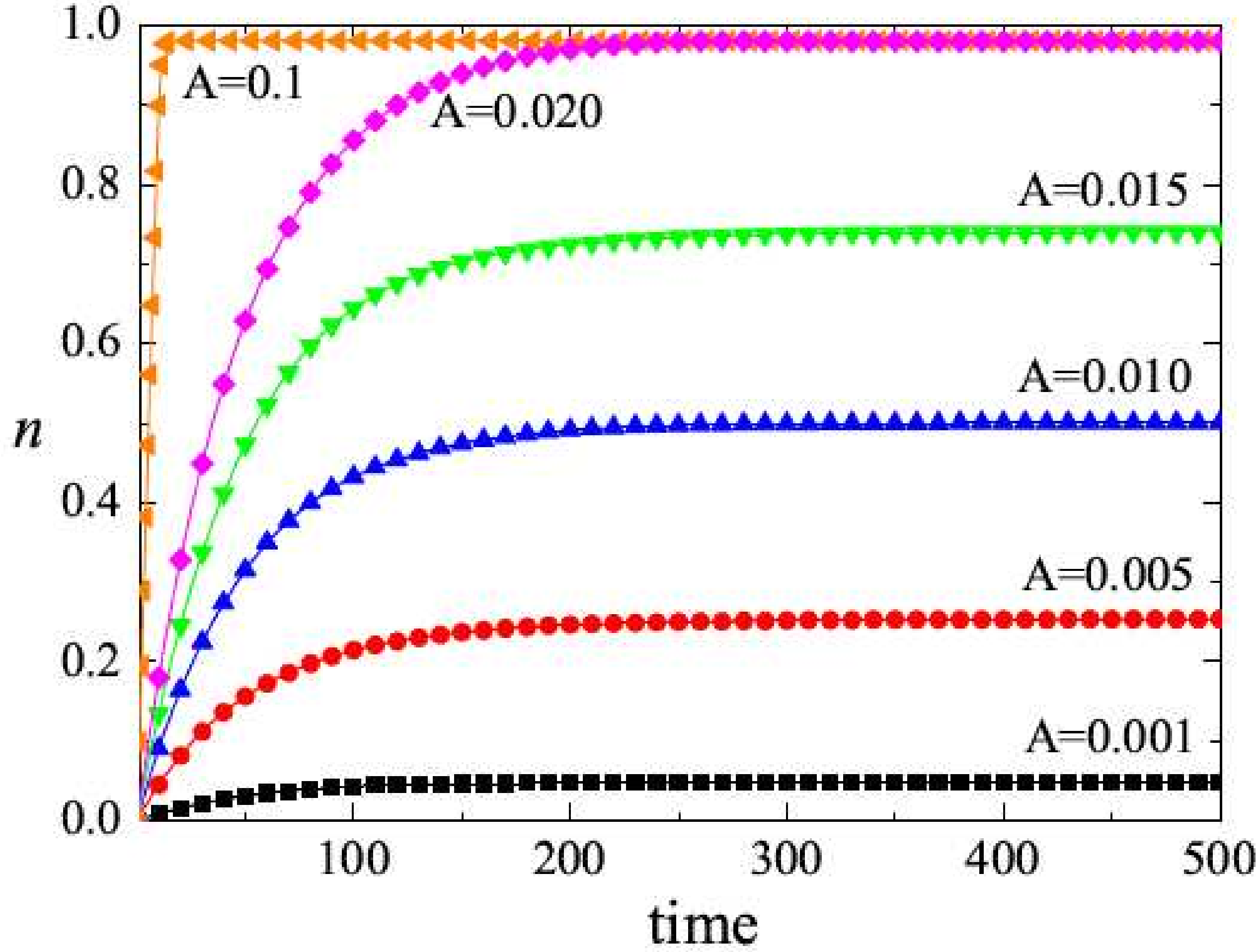
FINITE SIZE EFFECTS WITH CONTRARIANS

$A=0.01$
$f_C=0.02$

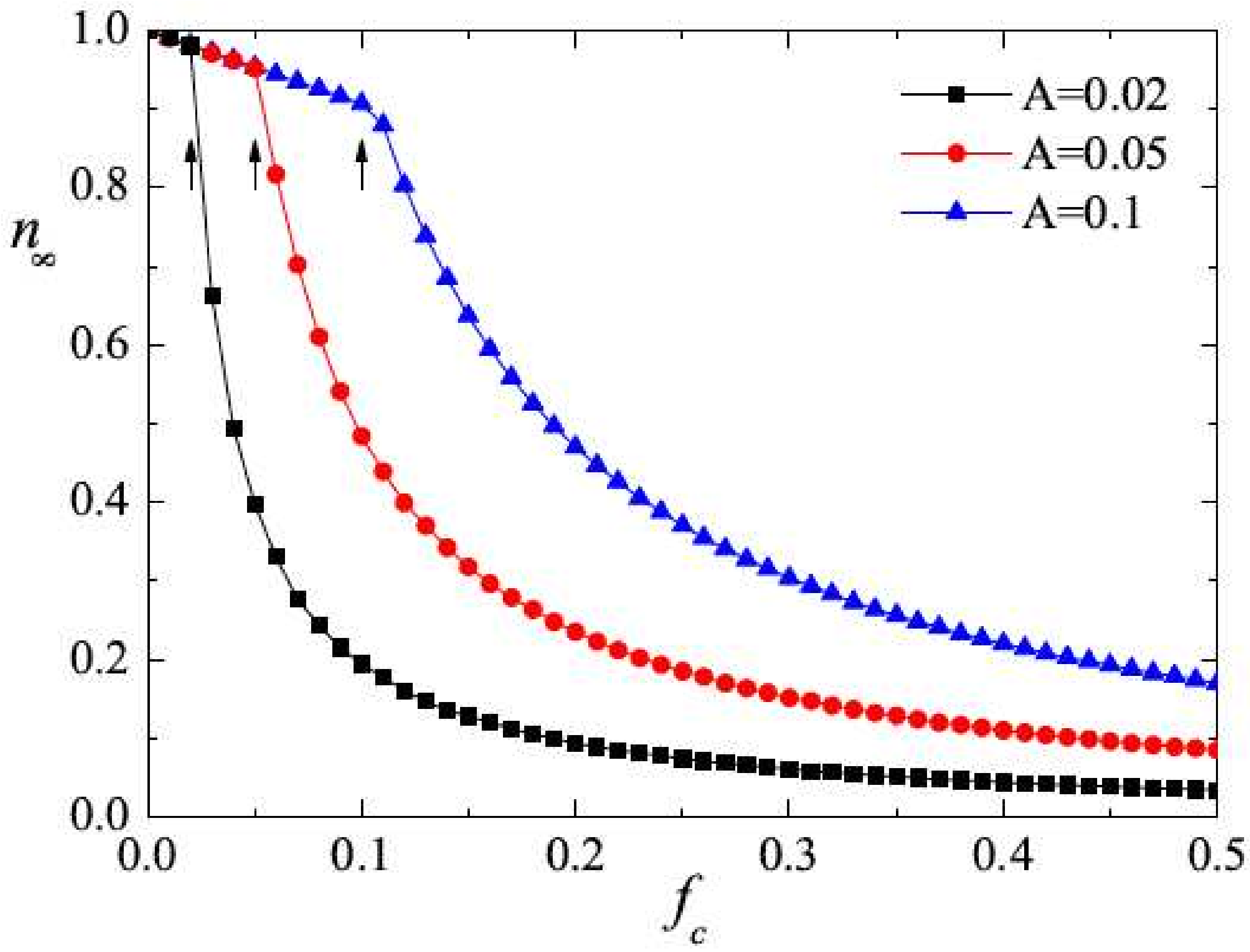


EFFECT OF ADVERTISING AND CONTRARIANS

f_C=0.02
N=10^7



EFFECT OF CONTRARIANS (3)



EFFECT OF ADVERTISING AND SOCIAL INTERACTION

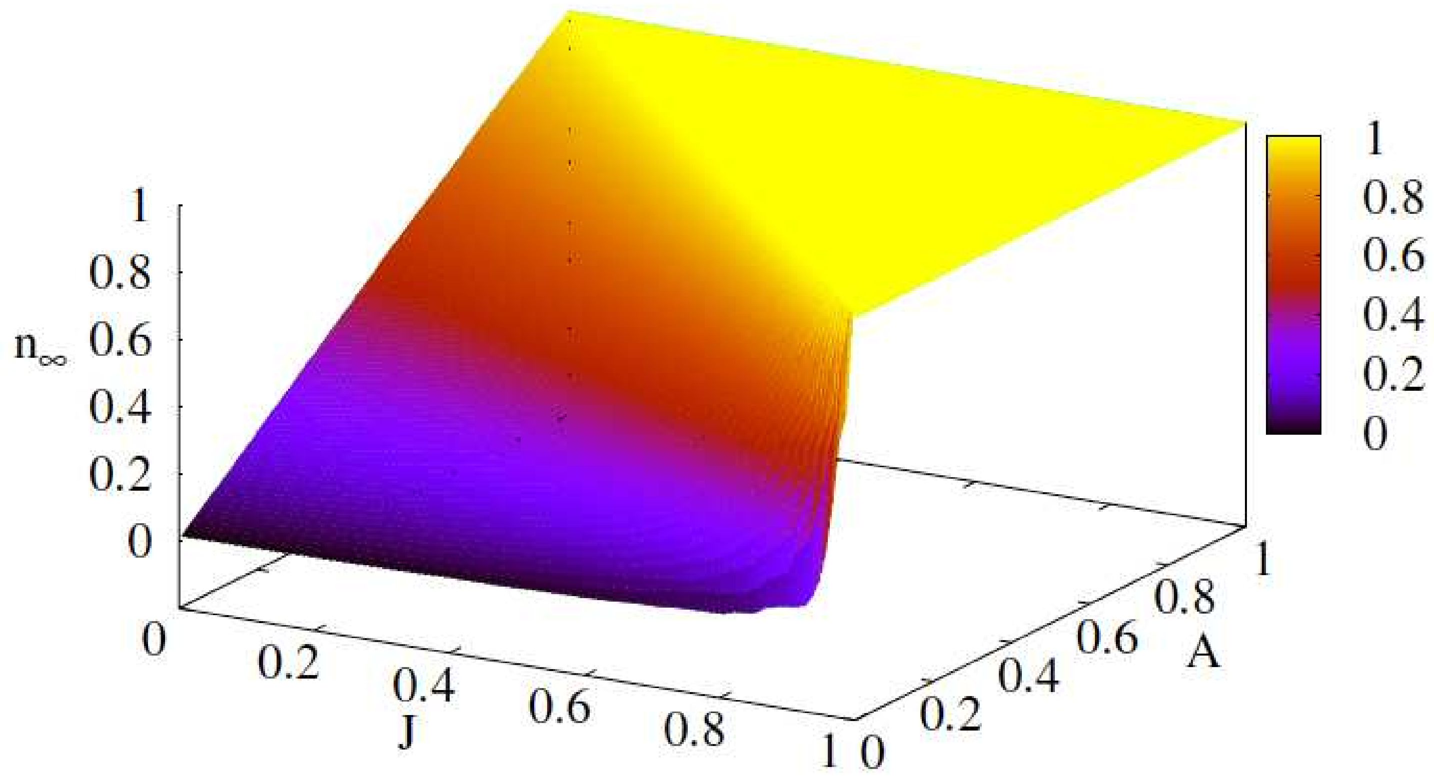
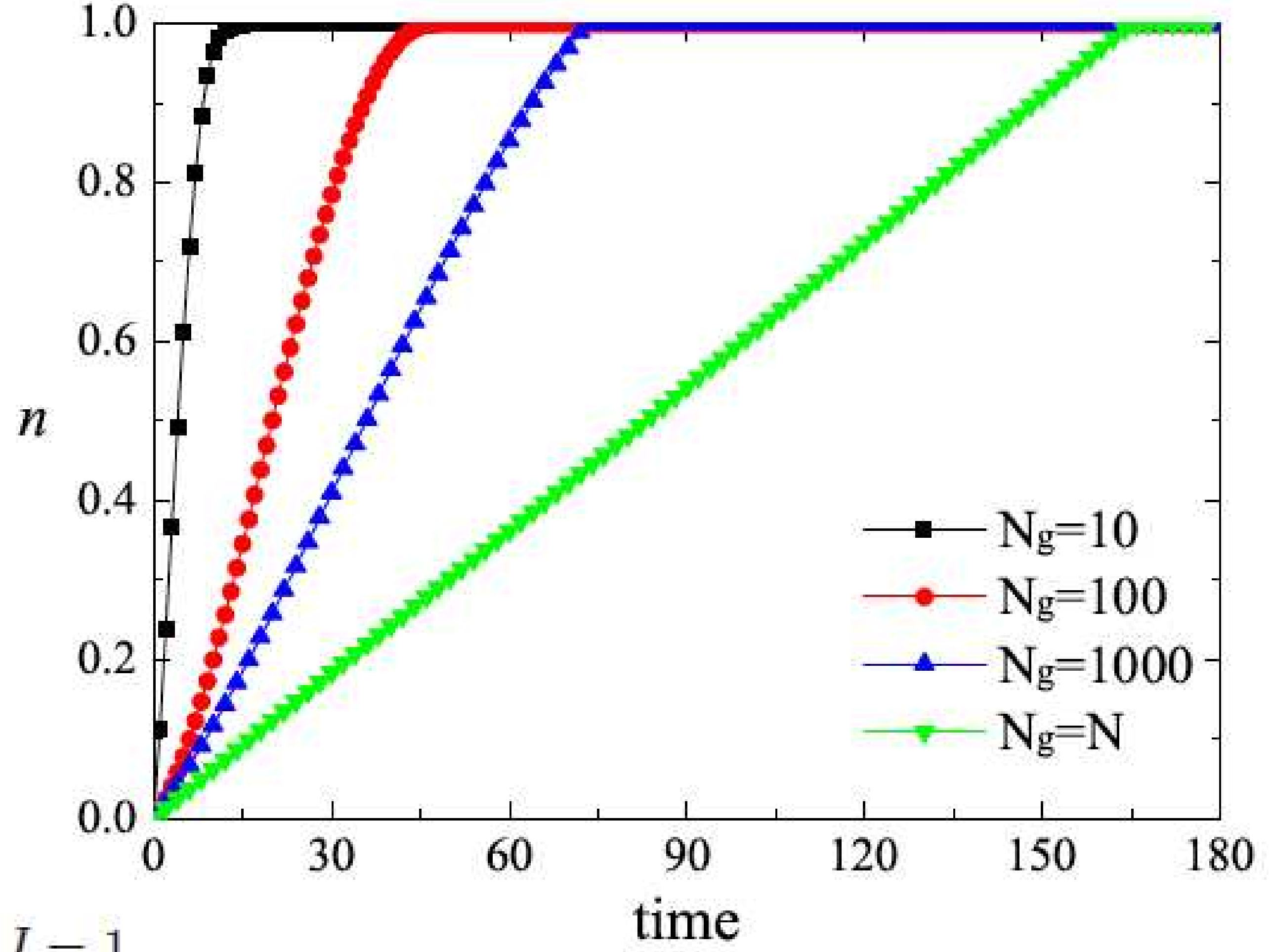


Fig. 9. (Color online) Final fraction of adopters as a function of J and A, for $f_c = 0.02$

GROUPS OF INFLUENCE



$N = 10^7, A = 0.01, J = 1,$

GROUPS OF INFLUENCE AND CONTRARIANS

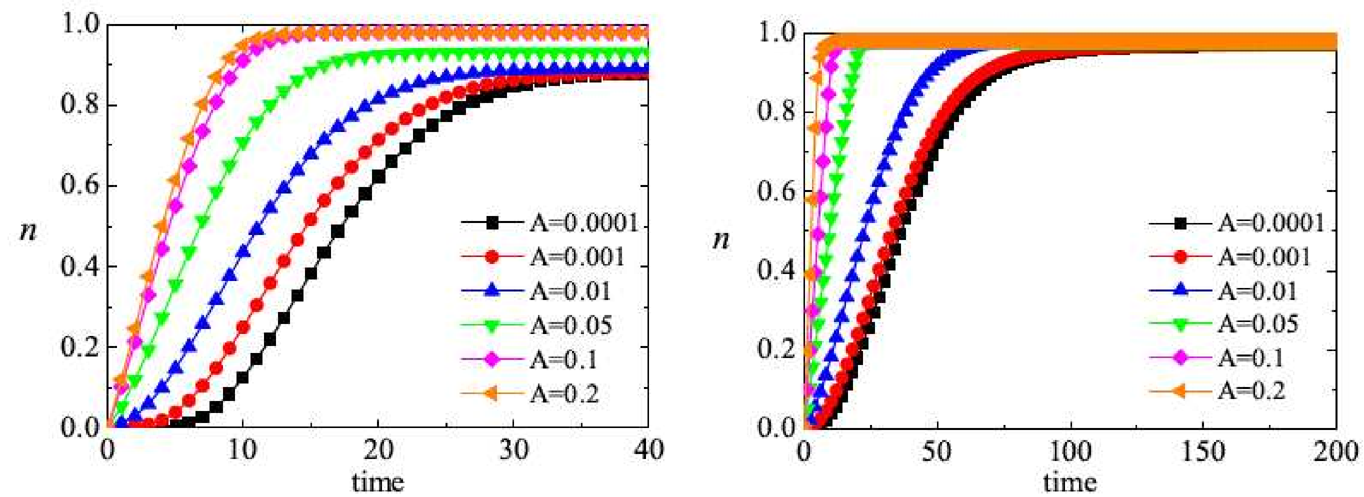


Fig. 11. (Color online) Evolution of the number of adopters for $J = 1$, $f_c = 0.02$, and $N = 10^7$, for different values of the advertising A and for two groups of influence: $N_g = 10$ (left panel) and $N_g = 100$ (right panel). Notice that the time scale is different in the two panels, although the final fraction of adopters is, in all the cases, $n = 1 - f_c = 0.98$.

TRIANGULAR DISTRIBUTION OF IDYOSINCRASY

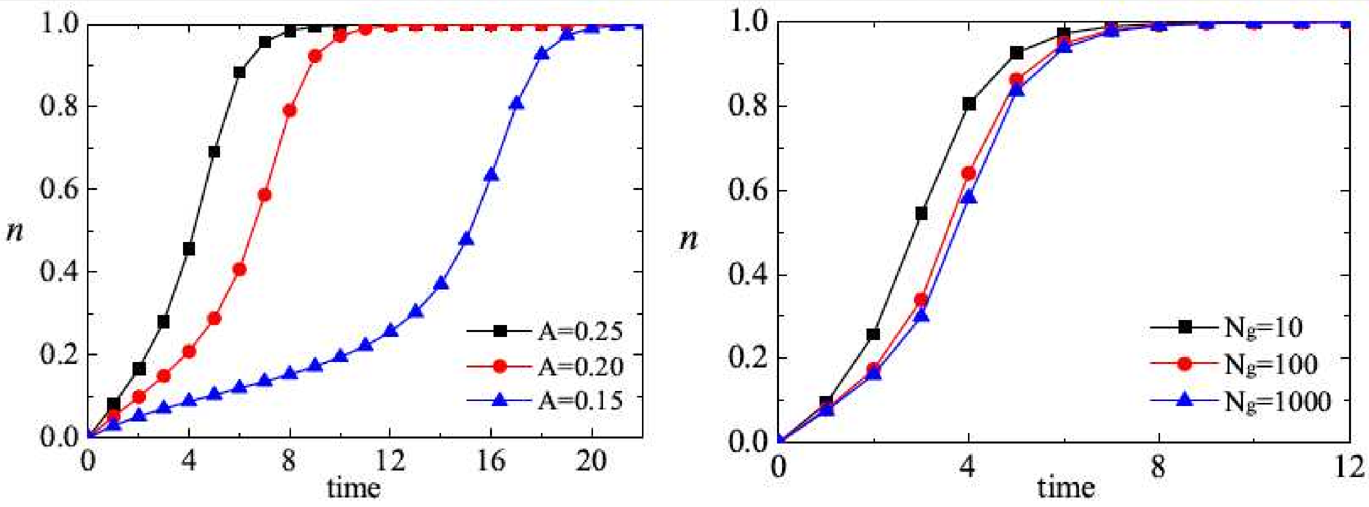
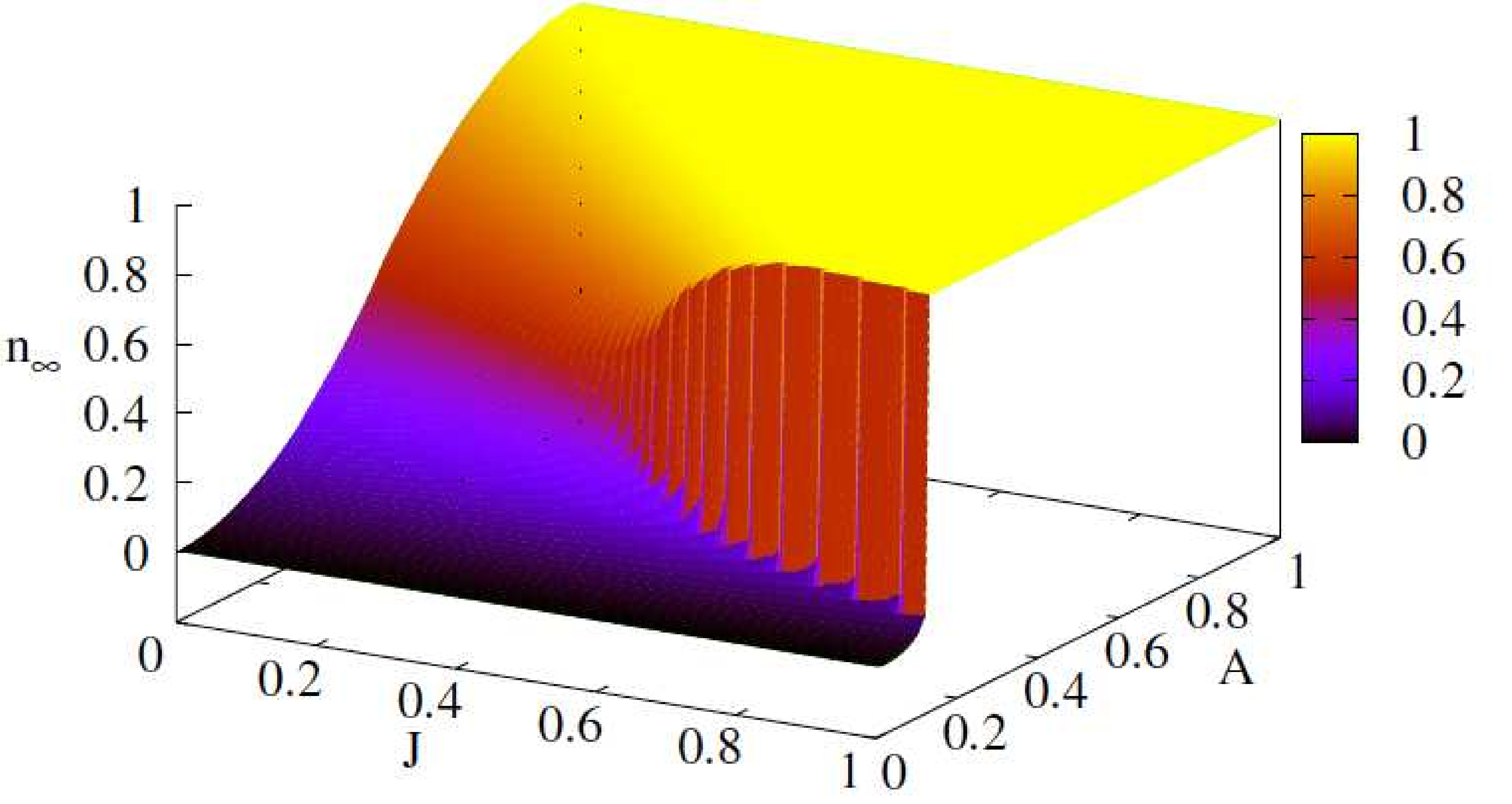


Fig. 12. (Color online) Evolution of the number of adopters for a triangular distribution of idiosyncratic resistance to change and for $J = 1$, $N = 10^7$, and no contrarians. Left panel: different values of the advertising A without groups of influence. Right panel: different sizes of the groups of influence for $A = 0.2$.

3D PLOT WITH TRIANGULAR DISTRIBUTION



CONCLUSIONS

- A weak social interaction (either because of a low value of the interaction parameter J or by a low advertising A), can impede the adoption of the new technology by the full society.
- The inclusion of a small concentration of contrarians is enough to reduce the fraction of adopters by a significant fraction
- Small groups of influence may be a determinant factor in the speed of adoption and in the final percentage of the population adopting the new technology
- A triangular distribution of the idiosyncratic resistance to change can also result in adoption curves with profiles similar to the empirical results.