



*Dynamique des interactions sociales :  
du choix individuel au comportement collectif*

Dynamics of social interactions:  
from individual choice to collective behavior

Lecture 2: **Mimetism**

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# Mimetism

## Different types of mimetism (A. Orléan)

- ❑ **Conformity, Social norms** - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission
- ❑ **Informational influences** - private and public informations  
→ herd behavior, information cascades
- ❑ **Preferential imitation**  
externalities in agent's utility function

# Mimetism



## Different types of mimetism (A. Orléan)

□ **Conformity, Social norms** - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission

*«in Roma do as the romans do»*

*«politically correct»*

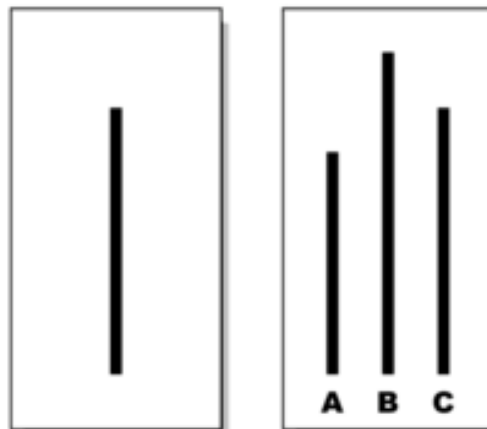
*« Penser contre son temps c'est de l'héroïsme. Mais le dire, c'est de la folie. » Eugène Ionesco*

# Mimetism

- **Conformity, Social norms** - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission

**Social psychology:** Ash conformity experiment (1951, 1955)

*When individual judgment conflicts with a group,  
the individual will often conform his judgment to that of the group*



# Mimetism

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- **Conformity, Social norms** - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission

Social psychology: **Ash conformity experiment** (1951, 1955)

*When individual judgment conflicts with a group,  
the individual will often conform his judgment to that of the group*

**Neurobiological correlates** of social conformity (*Berns et al 2005*)

<http://www.ccnl.emory.edu/greg/>

- ❑ brain regions classically associated with **perception** can be **altered by social influences**
- ❑ **independence** (non conformity) is found to be associated with subcortical activity changes indicative of **emotional** salience (amygdala activation  $\leftrightarrow$  emotional load associated with standing up for one's belief)

# Mimetism

## Different types of mimetism (A. Orléan)

- Conformity, Social norms - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission
  - ❖ **endogeneous** norm: **autoreferential** mimetism: conformity to the emerging majority

*stock markets*

« C'est bien la pire folie que de vouloir être sage dans un monde de fous » (D. Erasme)

« C'est une grande folie de vouloir être sage tout seul » (La Rochefoucauld)

# Mimetism



## Different types of mimetism (A. Orléan)

- Conformity, Social norms - peer group pressure; conforming to the prevailing conventions; tradition, culture transmission
- **Informational influences** - private and public informations  
→ herd behavior, information cascades  
(Banerjee 1992, Orléan 1995)
- Preferential imitation

# Mimetism

## Informational influences

Sequential rational decisions → information cascades  
(Banerjee 1992; Bikhchandani, Hirshleifer & Welch 1992)

Simple version

Issue: choosing between restaurant A and restaurant B

Private information (on quality of A compared to B):

« A better than B » or « B better than A »

Public information:

prior knowledge on the quality of A % B (e. g. B is likely to be better than A)

every arriving agent can see the number of customers in each restaurant

Common knowledge: reliability of private information = 70%

# Mimetism

(information cascades)

Common knowledge:

- reliability of private information = 80%
- B more likely to be better than A (say 55 % chance)

Hypothesis: actually A better than B (*unknown true state of nature*)

First agent:     let private information = B  
                  → he goes to B

Second agent: private information = A  
                  public info.: one customer in B.  
                  rational reasoning:  
                  the customer must have entered because he got 'B'  
                  his private information is as good as mine  
                  → I go to B

All the agents go to B, eventhough 70% will have received the correct private signal

# Mimetism

## Informational influences

Simultaneous decisions (Orléan 1995)

Issue: choosing between two possible behaviors / hypothesis

Exple: stock market, hypothesis **H**igh vs. **L**ow

Private information: each agent  $i$  receives a signal,

$$\sigma(i) = +1$$

«  $H$  more likely than  $L$  », or

$$\sigma(i) = -1$$

«  $L$  more likely than  $H$  »

Public information:

prior knowledge on  $H$  %  $L$  (e. g.  $H$  and  $L$  equally likely)

common knowledge: reliability of private information =  $p = 70\%$

at every time step, every agent can observe the **total number** of agents making the choice  $H$

## Mimetism - Informational influences

Assume true (unknown) state ('state of nature') is  $H$

Common knowledge: reliability of private information =  $p > \frac{1}{2}$   
prior distribution:  $\rho(H) = \rho(L) = \frac{1}{2}$

If private information alone:

**optimal (rational) decision rule** for a given agent  $i$  ?

$P(\sigma(i) = 1 | H) = p$  = proba. to receive the correct information

$P(\sigma(i) = -1 | H) = 1-p$  = proba to receive the erroneous information

$P(H | \sigma(i) = 1) = P(H | 1) = P(1 | H) \rho(H) / p(1)$  (*Bayes rule*)

similarly

$P(H | \sigma(i) = -1) = P(H | -1) = P(-1 | H) \rho(H) / p(-1)$

where

$P(1) = P(1 | H) \rho(H) + P(1 | L) \rho(L) = p/2 + (1-p)/2 = 1/2$

$P(-1) = P(-1 | H) \rho(H) + P(-1 | L) \rho(L) = (1-p)/2 + p/2 = 1/2$

Hence:  $P(H | \sigma(i) = 1) = p$ ,  $P(H | \sigma(i) = -1) = 1-p$

→ Decide ' $H$ ' if signal is  $1$ , decide ' $L$ ' if signal is  $-1$

(just as intuition tells us...)

# Mimetism - Informational influences

Assume true (unknown) state ('state of nature') is  $H$

Common knowledge: reliability of private information =  $p > \frac{1}{2}$   
prior distribution:  $\rho(H) = \rho(L) = \frac{1}{2}$

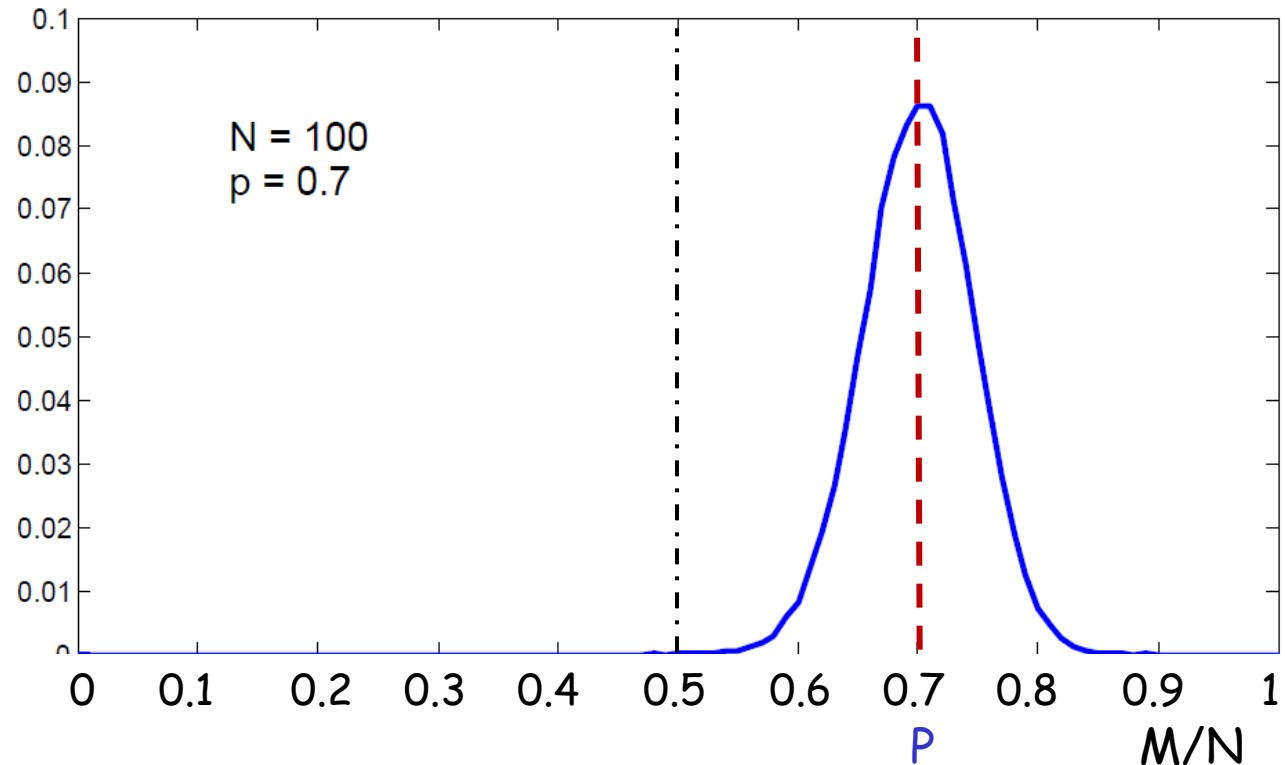
If private information alone: decide 'H' if signal is 1, decide 'L' if signal is -1

For  $N$  agents,  
probability that  $M$  agents receive the correct information

$$= C_N^M p^M (1-p)^{N-M}$$

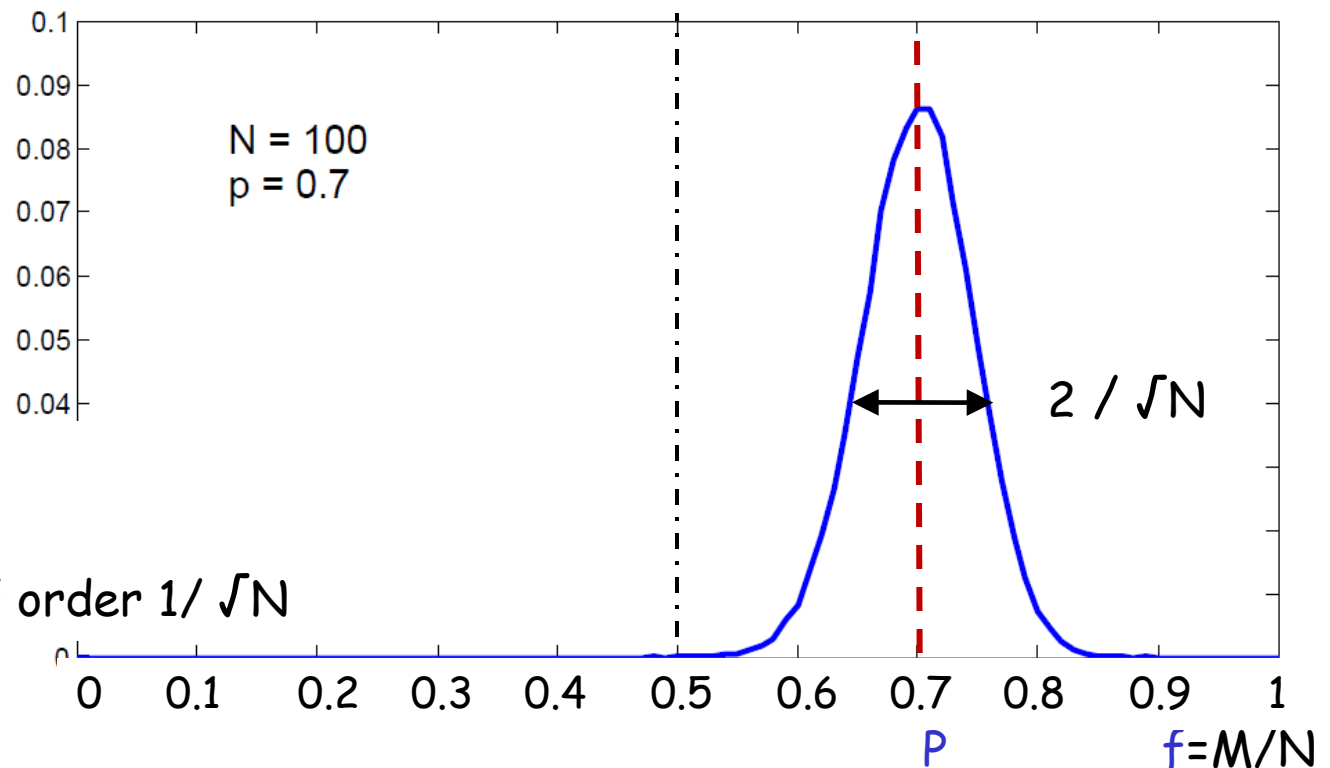
where

$$C_N^M = \frac{N!}{M! (N-M)!}$$



# Mimetism - Informational influences

probability that, among the  $N$  agents,  
a fraction  $f$  receive the correct information



For large  $N$ ,

$$f \equiv M/N$$

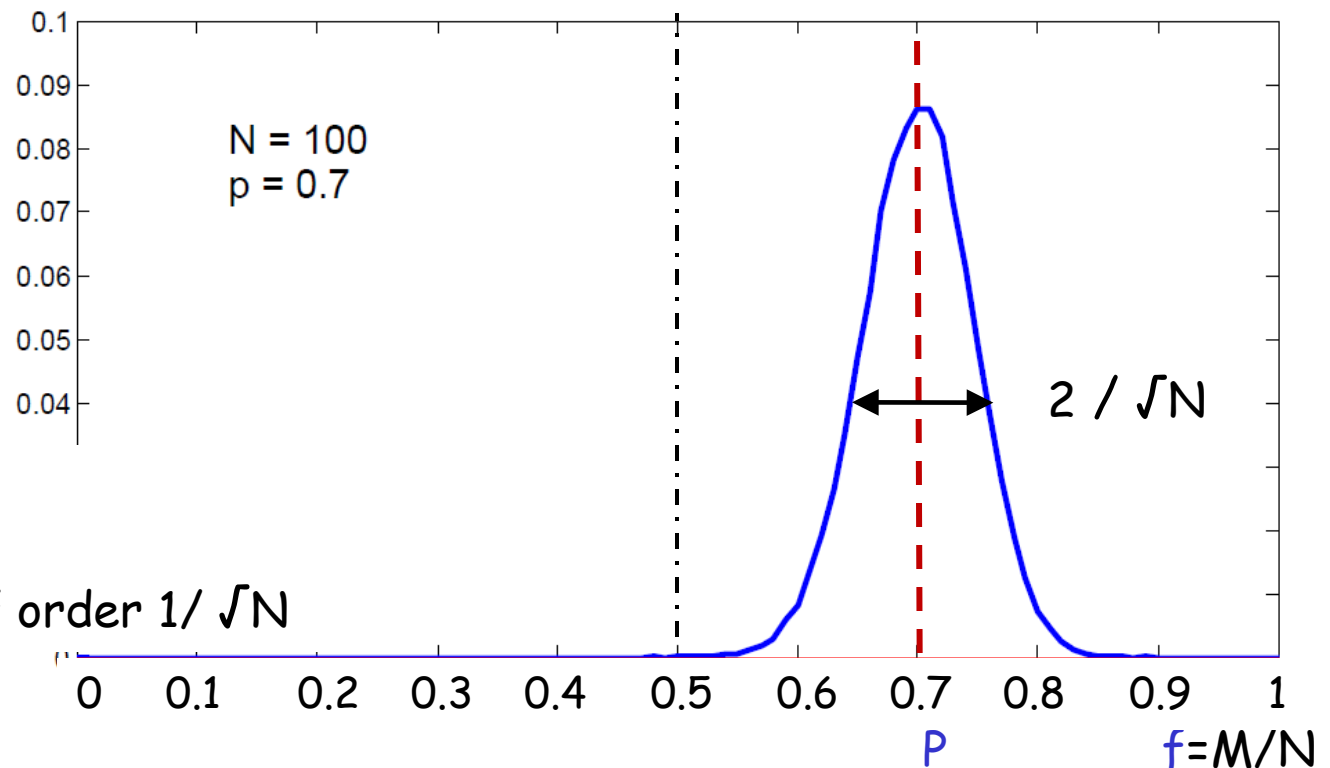
$$= p + \text{fluctuations of order } 1/\sqrt{N}$$

## Mimetism - Informational influences

Hence, if one observes  $f$ , one can make the correct choice with very small probability of error:

if  $f > \frac{1}{2}$ , decide 'H', if  $f < \frac{1}{2}$ , decide 'L'

But if everyone does the same, instead of using his private information, there is no more any information in the collective behavior (in the value of  $f$ )  
→ **paradox** (Grossman & Stiglitz 1980)



For large  $N$ ,

$$f = M/N$$

$$= p + \text{fluctuations of order } 1/\sqrt{N}$$

## Mimetism - Informational influences

Model (Orléan 1995): propensity to imitate  $\mu$

As before: private signal  $\sigma(i)$   
public information:  $f$  = fraction of agents making choice 'H'

Behavioral rule:

If private and public information are in favor of the same hypothesis  
( $\sigma(i) = +1$  and  $f > \frac{1}{2}$ , or  $\sigma(i) = -1$  and  $f < \frac{1}{2}$ )  
decide accordingly  
(decide 'H' or decide 'L')

Otherwise:

$\mu$  = probability to follow the majority:

$\sigma(i) = -1$  and  $f > \frac{1}{2}$ ,  $P(\text{make the choice 'H'}) = \mu$ ,  $P(\text{make the choice 'L'}) = 1 - \mu$

$\sigma(i) = +1$  and  $f < \frac{1}{2}$ ,  $P(\text{make the choice 'L'}) = \mu$ ,  $P(\text{make the choice 'H'}) = 1 - \mu$

# Mimetism - Informational influences

## Dynamics

At each time  $t$ :

- ❖ new private signal  $\sigma(i, t)$   
for each agent  $i$ , randomly chosen, (+1) with proba.  $p$ , (-1) with proba  $1-p$
- ❖ public information:  $f(t)$  = fraction of agents having made the choice 'H'
- ❖ Behavioral rule: applied by all the agents in parallel

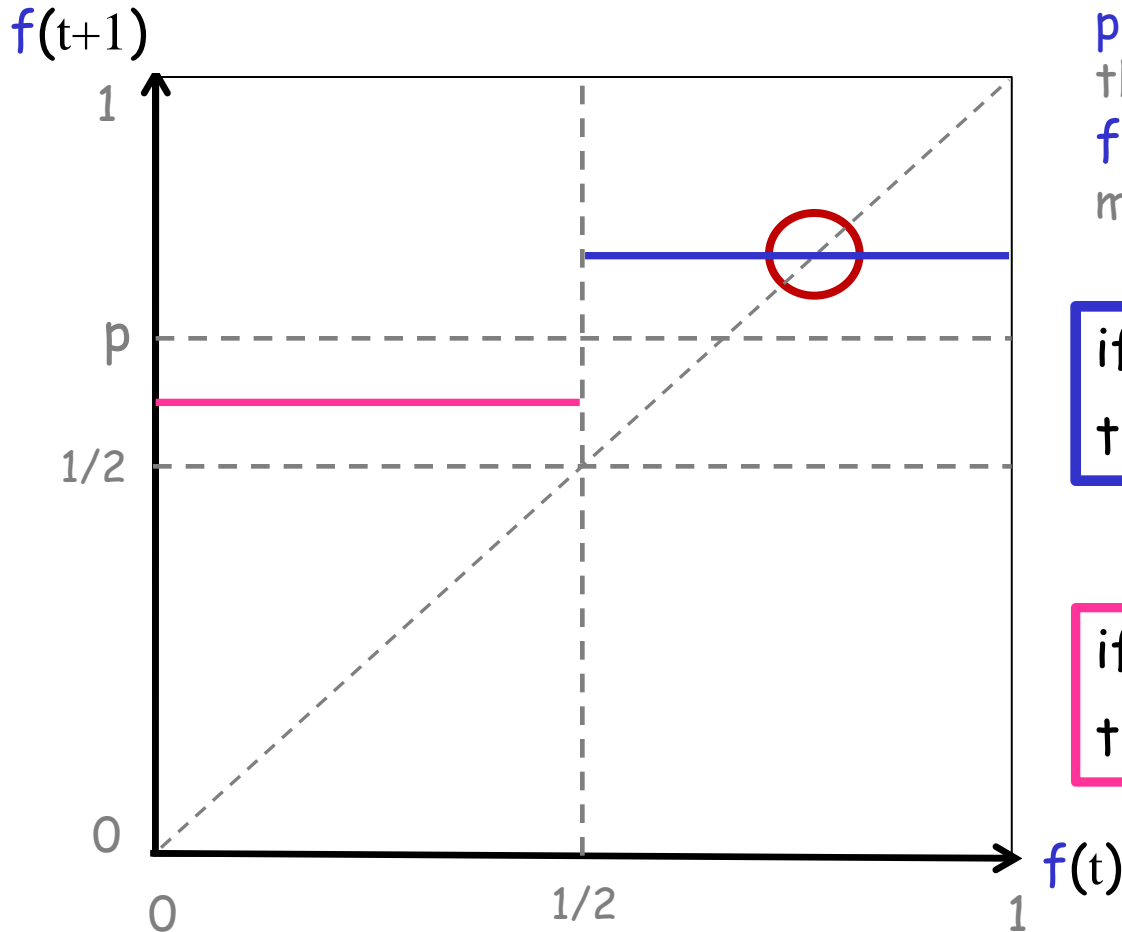
For large  $N$  (assuming that 'H' is the true, unknown value)

if  $f(t) > \frac{1}{2}$ , then  $f(t+1) = p + (1-p) \mu$

if  $f(t) < \frac{1}{2}$ , then  $f(t+1) = p (1- \mu)$



# Mimetism - Informational influences



true 'state of nature' is  $H$   
 $p$  = fraction of agents receiving the correct information ( $p > \frac{1}{2}$ )  
 $f(t)$  = fraction of agents making the choice 'H'

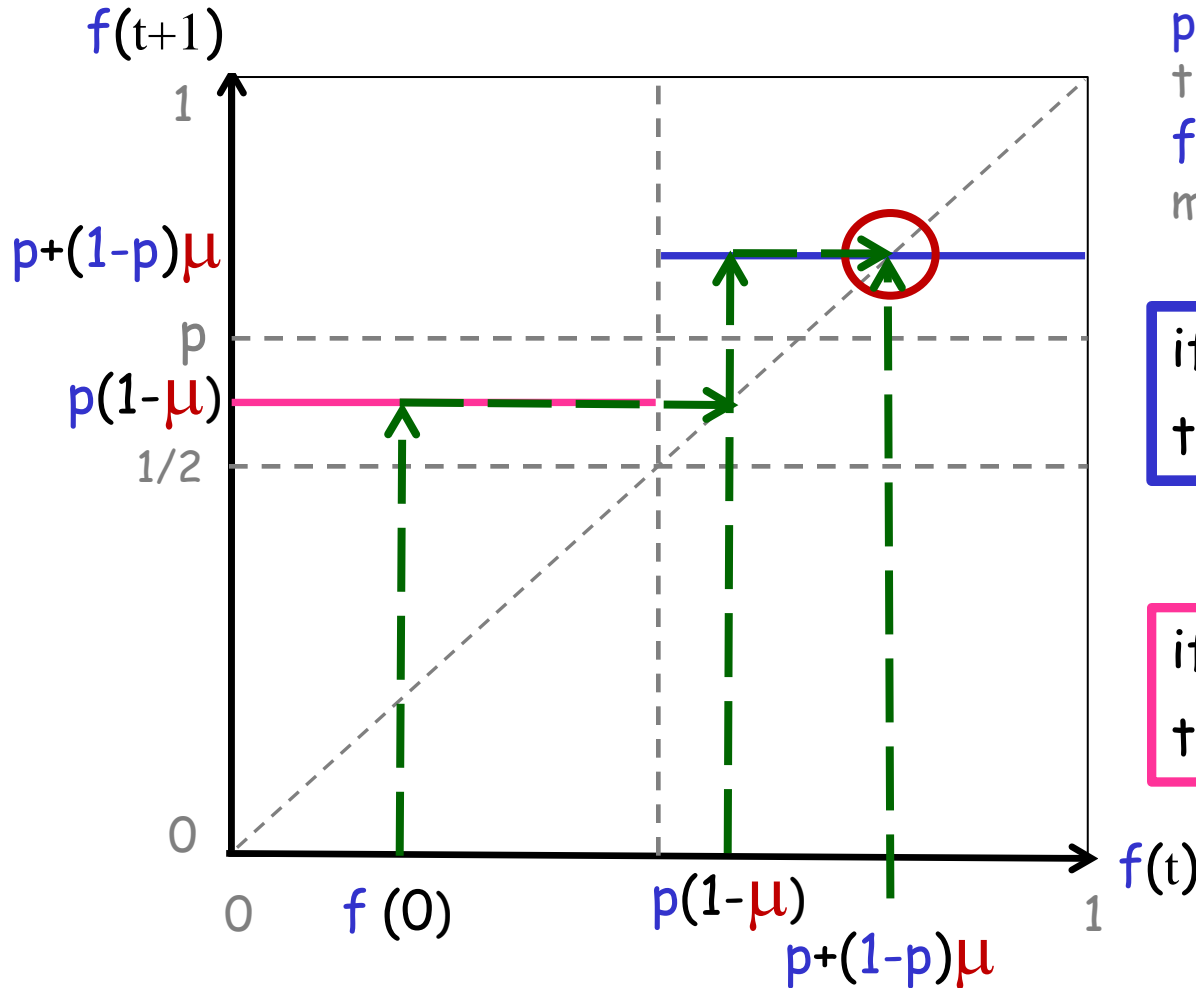
if  $f(t) > \frac{1}{2}$ ,  
then  $f(t+1) = p + (1-p)\mu$

if  $f(t) < \frac{1}{2}$ ,  
then  $f(t+1) = p(1-\mu)$

Fixed point?

$\mu < \mu^* \equiv 1 - 1/2p$ , a unique fixed point,  $f = p + (1-p)\mu$

# Mimetism - Informational influences



true 'state of nature' is  $H$   
 $p$  = fraction of agents receiving the correct information ( $p > \frac{1}{2}$ )  
 $f(t)$  = fraction of agents making the choice 'H'

if  $f(t) > \frac{1}{2}$ ,  
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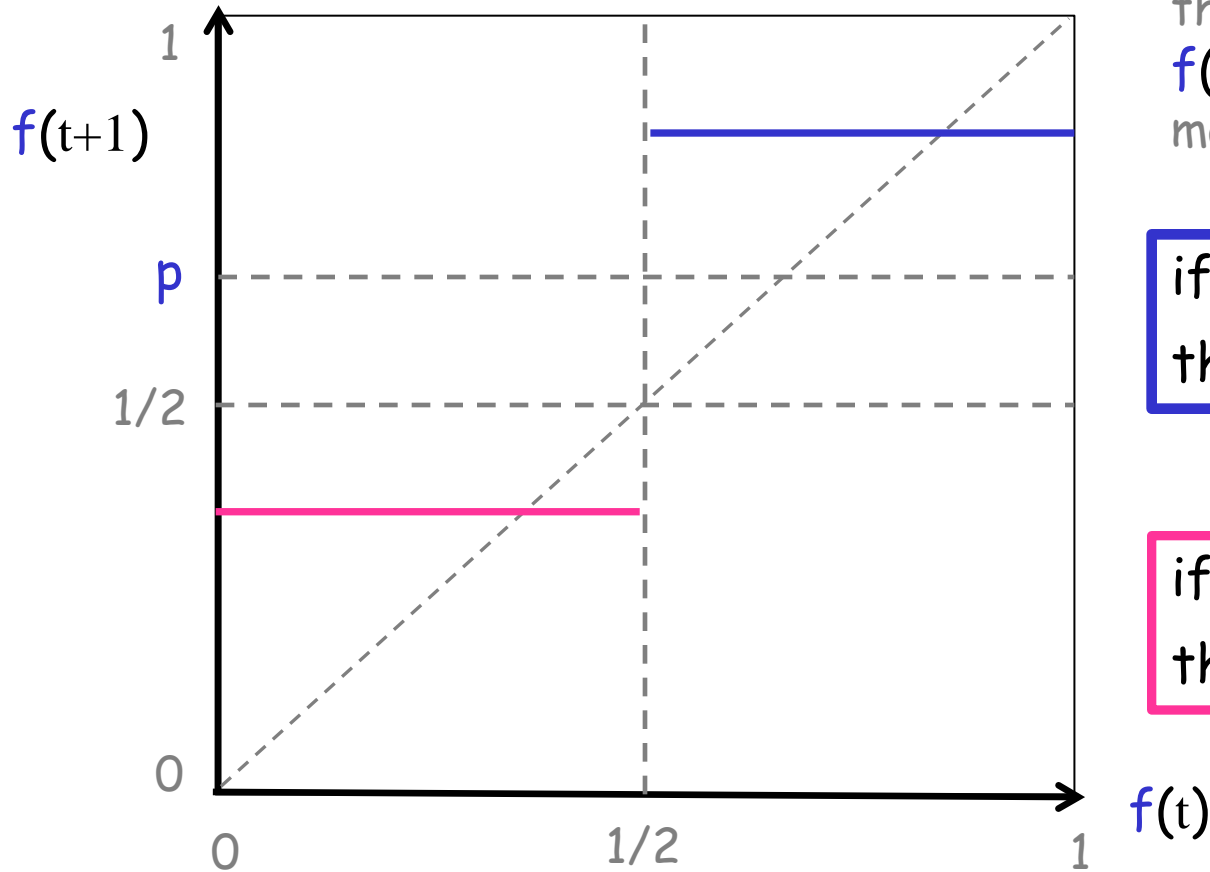
if  $f(t) < \frac{1}{2}$ ,  
 then  $f(t+1) = p(1-\mu)$

Fixed point

$$\mu < \mu^* \equiv 1 - 1/2p,$$

a unique fixed point,  $f = p + (1-p)\mu$

# Mimetism - Informational influences



true 'state of nature' is  $H$   
 $p$  = fraction of agents receiving the correct information ( $p > \frac{1}{2}$ )  
 $f(t)$  = fraction of agents making the choice 'H'

if  $f(t) > \frac{1}{2}$ ,  
 then  $f(t+1) = p + (1-p)\mu$

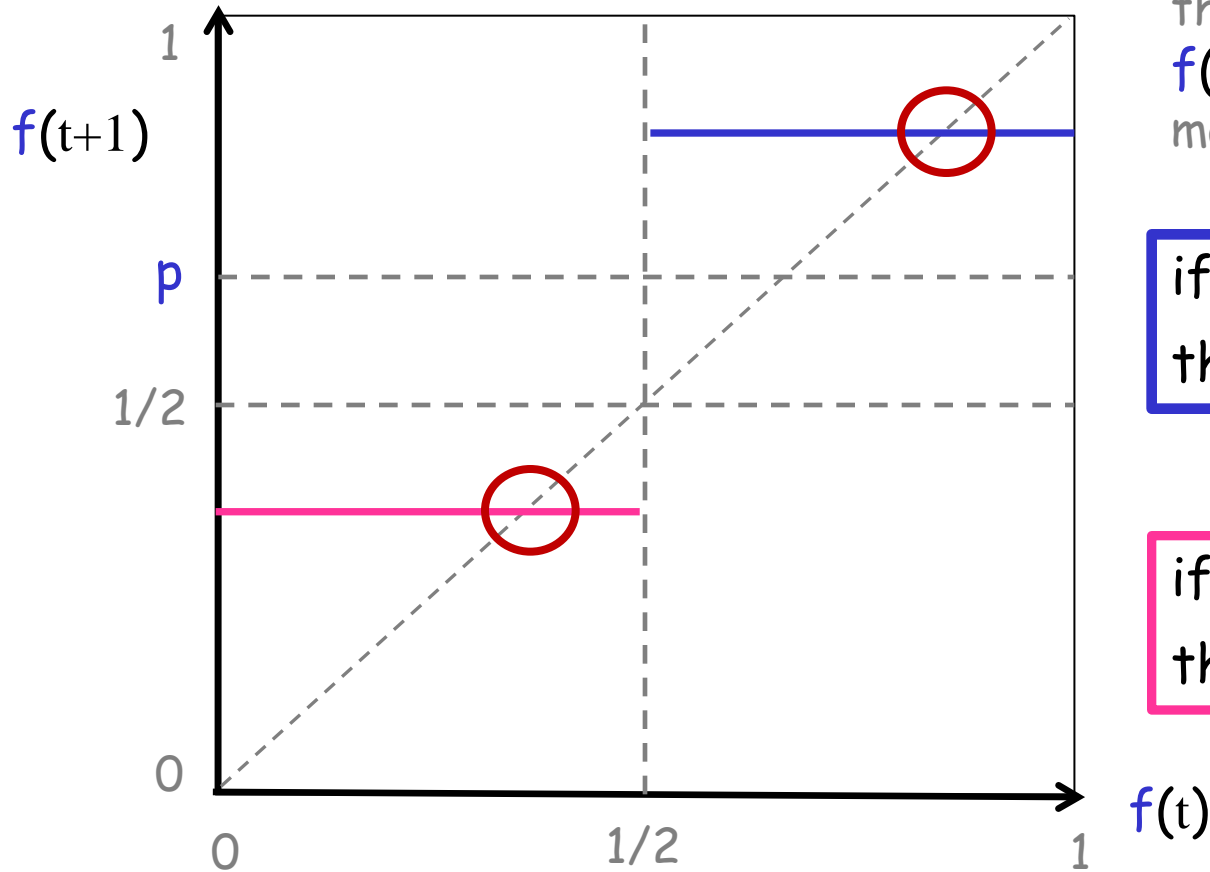
if  $f(t) < \frac{1}{2}$ ,  
 then  $f(t+1) = p(1-\mu)$

Second case:

$\mu > \mu^* = 1 - 1/2p$

(then  $p(1-\mu) < \frac{1}{2}$ )

# Mimetism - Informational influences



true 'state of nature' is  $H$   
 $p$  = fraction of agents receiving the correct information ( $p > \frac{1}{2}$ )  
 $f(t)$  = fraction of agents making the choice 'H'

if  $f(t) > \frac{1}{2}$ ,  
then  $f(t+1) = p + (1-p)\mu$

if  $f(t) < \frac{1}{2}$ ,  
then  $f(t+1) = p(1-\mu)$

Fixed point?

$$\mu > \mu^* = 1 - 1/2p$$

two fixed points

# dynamics

LEÇONS DE MICROÉCONOMIE ÉVOLUTIONNISTE

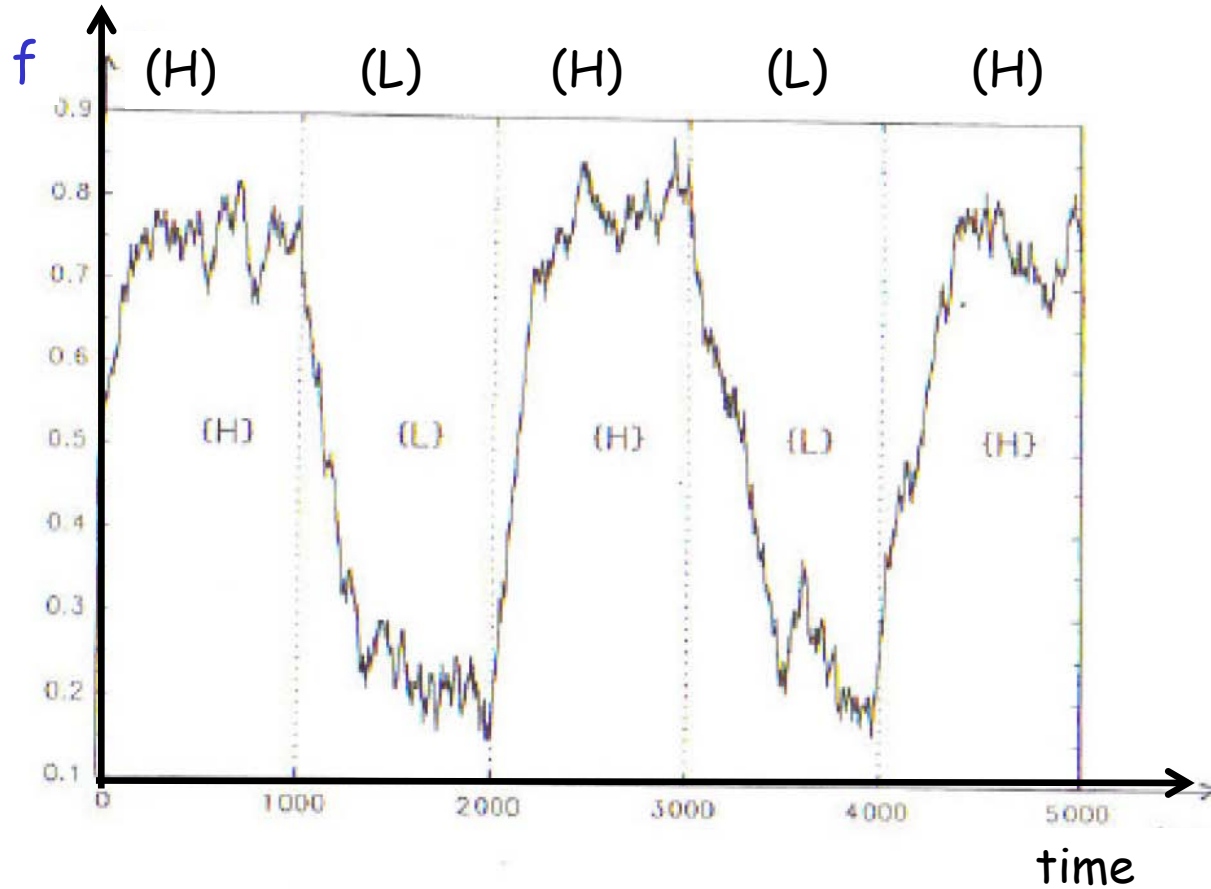


Figure 5. Évolution de  $f$  au cours du temps ( $\mu=0.2$  et  $p=0.7$ ).

$$\mu < \mu^*$$

# dynamics

144

LES INTERACTIONS MIMÉTIQUES

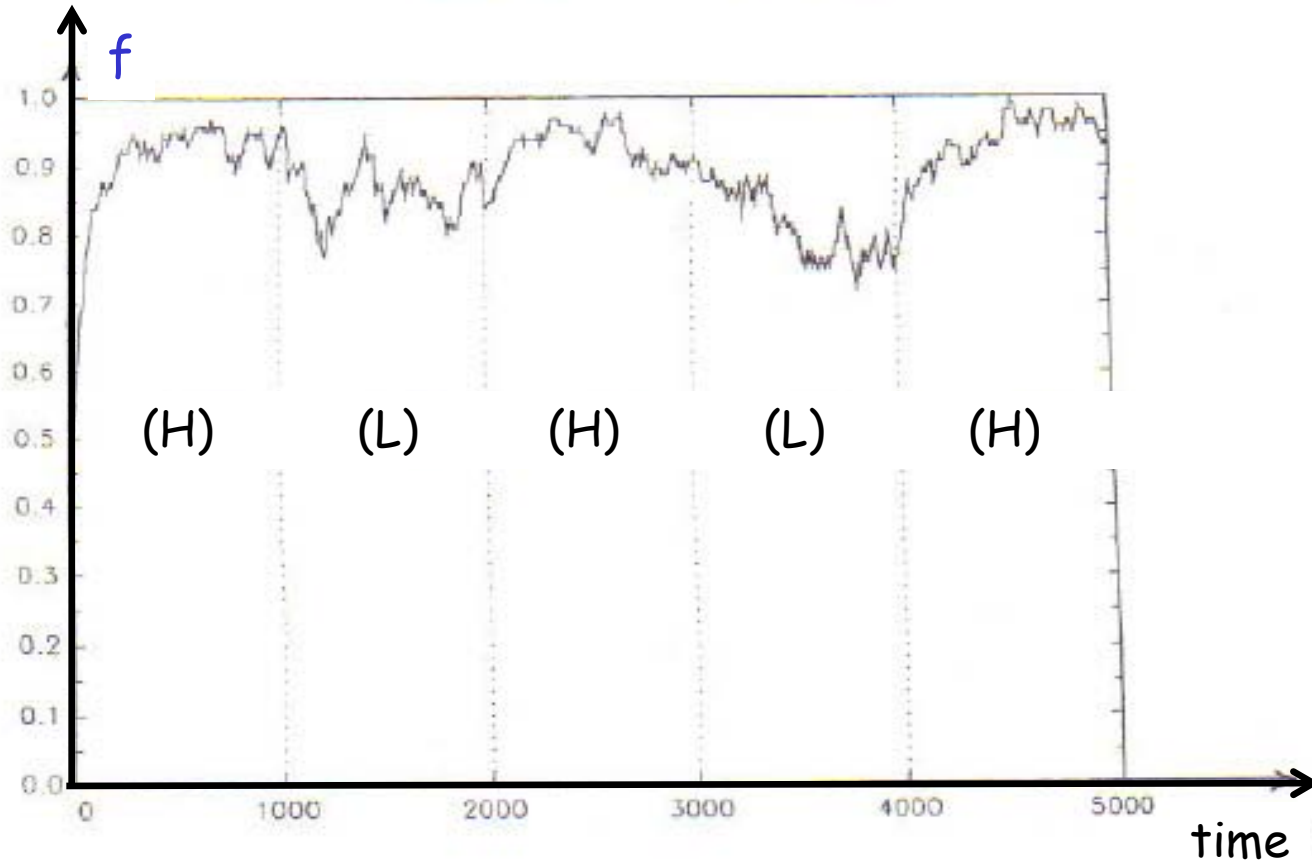


Figure 6. Évolution de  $f$  au cours du temps ( $\mu = 0.8$  et  $p = 0.7$ ).

$$\mu > \mu^*$$

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Schelling, Granovetter