Apparition of reputation in an artificial society: a model for non-merchant exchanges.

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Abstract:
This paper describes simulations led in an artificial society in which autonomous agents exchange gifts. In that society agents perform simple acts that are looked at by the others and are analysed so that a common image is created for each agent (a reputation). The model is based on numerous descriptions of non-merchant exchange systems, which are very interested for ethnologists: they appear to be important for good circulation as well as to insure the reproduction of social links and values. In the system built the agents must make a gift at each time-step. There exist two kinds of gifts, as well as two corresponding kinds of reputation: the agents either give to share or to be prestigious, and in that case they have to give more than they consume themselves. Since gifts are received according to the status, receiving a gift is as important for the reputation as making one. Each agent is characterised by its "motivation" to acquire the reputation of being a sharing agent or a prestigious agent. It is also characterised by its "esteem", that permits to decide if it is going to be able to do the gift it wants to do for a time-step. These two characteristics of an agent can be stable along the simulation, but can also evolve according to the history. We study here the different patterns that can appear in the societies built, in terms of repartition of reputation, and of histories along the time. A huge range of these patterns can be observed, depending on the choice made for the characteristic. In some cases the agents cannot be individually distinguished, in other cases they can: but, in any case any individual behaviour that emerge has to be sustained by certain collective specification that point out more or less the way agents value each reputation.

Introduction

The work presented here was aimed at studying the apparition of reputation in an artificial society where agents perform gifts. The reputation of an agent is defined as the image that the group has of it. We decided to use multi-agent systems as a way of building our artificial society because we wanted to find a link between the action of individual agents and the society's global organisation: multi-agent simulation is widely recognized to be a good tool for that kind of research.

There are several aspects that interest ethnologists in the study of gifts exchange. First, the gift creates a link between people. It is accepted in almost all cultures that a gift has to be given back. The individual who performs it shows that he is willing to engage in a relation, and that he trusts the other to understand the message and give back to keep the interaction going. The reciprocation creates a never-ending loop of interaction that establishes a stable relation. In a lot of societies, one has to give even more than one received. In some context the relation can turn out to be real a competition, where each individual wants to prove that he cares so little about objects that he can give them away easily. This can lead to real prestige fight where each individual challenges the others to prove that his ability to give is higher (Boas, 1966).

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Another aspect is the fact that the gift is a good mean of redistribution of goods: more specifically it is very often the role of the chief and of rich people or rich members of the family to be generous so that poor people can survive. In that context, giving back is maybe not as necessary, but it is still important that the one who shares should be recognized as generous.
The gift thus structures societies in a very deep way, and is a good tool for the reproduction of habits and values.

In a previous work we tried to analyse the hierarchies that could be induced by the exchanges of gifts that would lead to interdependences in a group (Rouchier98). For that we created an artificial society where the agents had individual representations of each other, which were built thanks to personal interactions only. The debt was then the foundation of a structure, in which each agent was interested mainly in its number of dependents. We then built an "objective" observation of the group with global knowledge that could exhibit a hierarchy by comparing the number of dependents. In parallel, the agents had their own perception of a hierarchy based upon the knowledge of their own interaction only, In that case, it was interesting to discover the differences between the global hierarchy and all the individual hierarchies of the agents, all wrong and depending on their position in the group.

In the present work, we created a society where the image that the agents have of each other is common: the process of evaluation of actions is common and refers to acts that all agents perceive. What define an individual are thus its choice habits: its motivation (rather make gifts to get prestige or to share), and its esteem (the ability it has to do gifts that can be accepted by the group). In the society making gifts is the only activity, and the evolution of reputation depends on several parameters of the group that were tested here, through simulations. The agents can evolve by learning from their former results, and change their motivation or their self-esteem.
Here, the agent has internal parameters that depend on its performance in the group and what it knows of its former acts. It is also based of more "objective" information, the reputation, which is a common indicator.

The results show that it is possible to build reputation for each agent, and that there exist some societies that exhibit very stable elites (groups with reputation that are very different from the others). The individual history of each agent is not defined by the reputation only, but can be characterised by the evolution of motivation and esteem as well. Each agent has a very different and stable way of choosing. What was new in that work is that the evolution of that individual image and the evolution of the reputation in the group were successfully linked together. The association of two feedbacks, one being the local perception of success and failure, and the other a common point of view on the acts, gave to the society a real coherence whereas some surprisingly complex patterns could still be observed.

Theoretical model and implementation

Aims

To follow the idea of ethnologists who state that exchanges of goods create symbolic values in a group, we elaborate here a society where the value of individuals in the group (reputation) appears thanks to the observation of exchanges by the group. The inspiration comes from the numerous examples of societies where reputation is essential to individuals: they try to renew it through ostentation, mostly by performing gifts. Where the gift is very important, the value that the groups attribute to an individual is not related to his possessions but to his ability to give away.

In that study, we want to point out the circularity between the choices made individually and the social situation in which the agent is. The hierarchy reveals the recent history of exchanges that took place in the society, since the behaviour has an immediate impact on the reproduction of the social order; conversely each act is strictly influence by the social order. The multi-agent system was established so as to perform simulation that would enable the apparition of that circular process: hierarchy based on exchanges which rules are simply defined according to that hierarchy. We wanted then the processes for choice to evolve along the time for all the agents. All the evolutions are inspired by real societies descriptions.

The choice was to use multi-agent system to create the artificial society, since it is often recommended to build interacting agent and observe the result of the repetition of their interactions in time.
Classically, in multi-agent simulation, one defines agents as entities that are autonomous and active and have a representation of their environment. Here, the representation of an agent is of two sorts: it has an idea of its reputation in the group, since this is a common knowledge for all the agents; it also has a internal representation of itself that enables it to decide which action it wants and can perform. The evolution of the universe is a succession of periods of interaction for the agents. Here, each one of them makes one gift, followed by the evaluation of all the reputations. At each time step the agent have to choose the act they are going to perform and to analyse the results of each time step. There are two parameters for choice in an agent: its "esteem", or self-confidence (an image, or internal representation, of its ability to act like the others), and its "motivation" to get prestige or to rather show its sharing ability.

To observe a differentiation that could be analysed like a structure, the multi-agent had already proved to be a good tool, not only in our previous research project. In the EOS project (Doran94), in a society of hunter-gatherers (one of the first actually built so that to study societies), the position of chief is attributed to the one to whom the others directly ask to associate with him (Doran94), (Doran95). Some agents can be chief forever, some make different groups along the time, some groups absorb others and thus the hierarchies add to each other. The agents in that case did not consciously make the evaluation of a hierarchy.

Two evaluations exist here. The first one is based on the observation by the group of how well an agent can perform the acts he must perform. One has to recall two important aspects for the definition of that dynamics: to make gifts is compulsory and the whole group looks at all acts of each one. That constraint induces an important circulation of goods, and each agent need not worry about who their gift is going to go to or whether they will get one back, but just to participate to the system.

Model

So that the system works, there exists usually some "sharing gifts", which aim is to have goods circulate and people feeling part of a group. But quite often gifts are a way to designate one self as being not interested in possession at all; here we call them "prestige gift". These are more or less those described by Boas for the Potlatch, were society is fluid enough so that rank is mainly dependent of the ability to dilapidate. These last gifts are not of the same kind, since a prestige gift must represent an ostensible loss for the one who performs it. When a reputation is set, what is looked at is globally the ability to act with the others, but also the kind of exchange in which the person is involved.
But as integration in a dynamics is what is interesting as a value for the group, it is logical that to receive a gift should also be important to define somebody's status. A prestige gift is made to show off an ability to spend but is made to people who deserve it, and thus receiving such a gift

indicates that the group considers one as a reference of prestigious person. The prestige is reinforced by that recognition.
It is not clear that any gift can be made, though, and some agent can be considered as not having the ability to perform one. More precisely, it seem unlikely that an very badly integrated agents should be allowed to make a gift to one of the most prestigious individual. A priori, the more integrated, the more an agent may participate to social dynamics. On the opposite, an agent that do not makes or receive gifts is to be considered as unable to get into the dynamics. That feeling of being able or not to make gifts is deeply influenced by the appreciation of the group.
It is also reasonable to assume that each individual has a personal point of view that makes it turn towards getting prestige or not. Quite often it is possible to assume that that tendency is reinforce by the way the person is considered by the group.
To express all these conceptual processes, we implemented the model (using VisualWork 3.0).

Agent and definition of a time-step

The society contains one group that is characterised by the number of agents it is made of.
Here there are 50, each characterised by:

- its prestige reputation
- its integration reputation
- its rank
- its motivation to get prestige (first choice parameter)
- its esteem (second choice parameter)

All of these parameters are defined socially as well as individually, and correspond to the criteria already described.

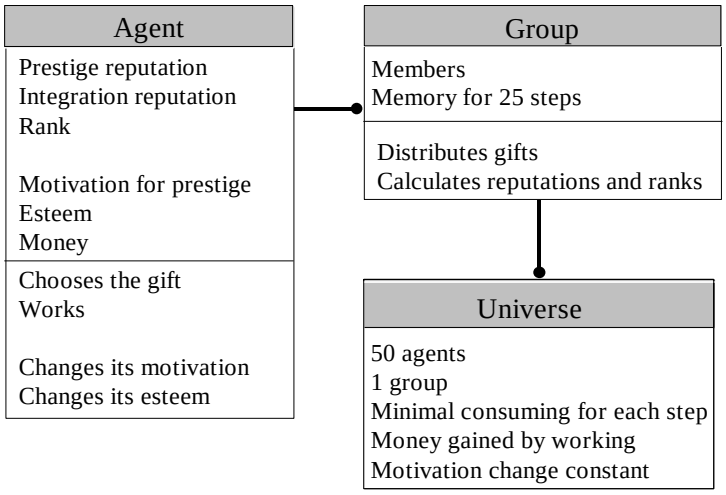

Figure 1: Attributes of the agents, of the group and of the universe to which they all belong

In that system, all agents consume the same minimal amount of money at each time step. They get that money by working (which gives twice the minimum value for consuming) and/or by receiving gifts. They choose the gift they want to perform thanks to their choice parameters (motivation for prestige and esteem) (Figure 2). The esteem is the ability that the agent feels to participate to the exchange dynamic: it is what makes it decide whether the gift is acceptable by the group or not.

They spend all their money at each step, keeping none for them. The amount and the receptor of the gift both depend of the kind of choice made; but the agent chooses the amount whereas the group itself designates the receptor:

- A sharing gift is given randomly to an agent with a rank that is less than (rank of the giving agent + 2). To choose the amount, the agent shares what it possesses in 2 equal parts and keeps half for its own consumption.
- A prestige gift is given randomly to an agent which rank is more than (rank of the giving agent - 2). To decide the value of this gift, the agent shares its money in three, two third being for the gift. An agent may do a prestige gift only if it already has enough money: if it has to work it will have to turn to a sharing gift. A direct consequence is that it must have received enough gifts at the previous time step[1].

The group distributes the gifts, and have the money pass from one agent to another. Each gift, be it received or made, gives some reputation tokens: prestige gift increases prestige reputation by one and sharing gifts increases integration reputation by one. Conversely, if the agent receives no gifts or if it can do none, its both reputations decrease by one (Figure 4).

The group calculates the new reputations: the prestige reputation (integration) is the sum over 25 time steps of all reputation (integration) tokens that are accumulated at each time step by an agent. It then updates the ranking for all the agents: the first rank has the highest prestige reputation, and the last rank has the lowest. The memory of the group and of the agents was chosen to be 25 steps for all the simulations made.

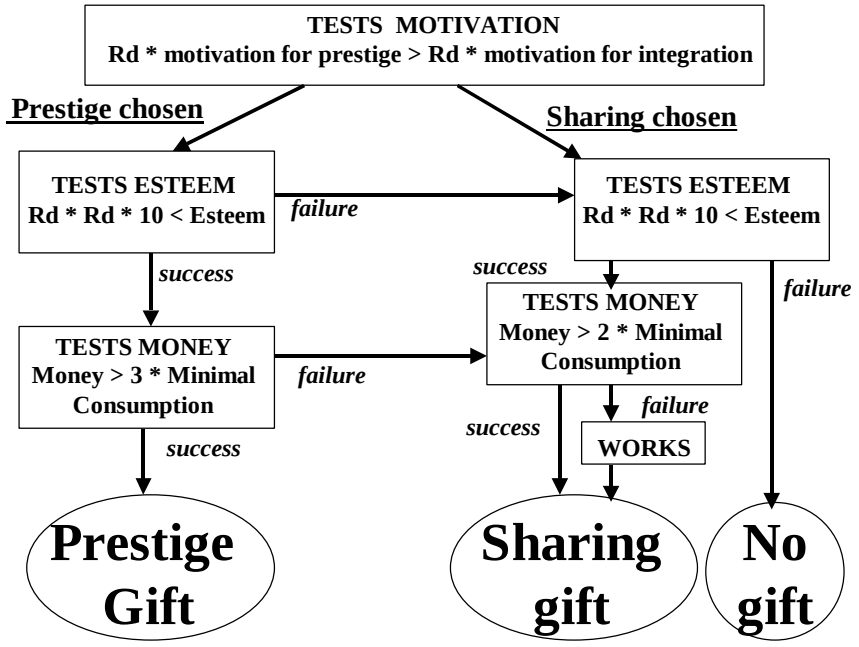

Figure 2: How the agent tests all its attributes to decide which gift it is eventually going to do. "Rd" means a random number between 0 and 1. This motivation is always such as: motivation for prestige + motivation for integration = 10. Each agent calculates it according to its characteristics.

[1] We wanted to express that it is harder to make a gift that gives prestige.

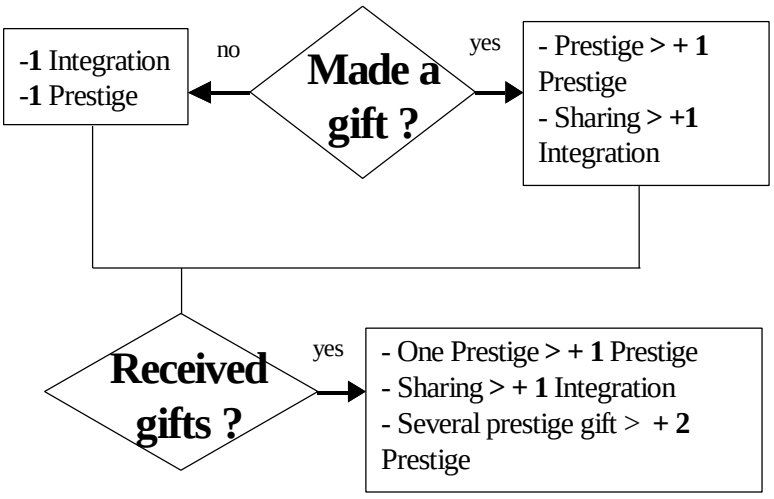

Figure 3: How the universe calculates the increase or decrease of reputation for each agent before calculating ranks

The two choice parameters can evolve along the time, since we want the agent's rationality to depend on its social position. They thus evolve depending on the acts of the time step and on the reputation:

Motivation for prestige / motivation for sharing =
(motivation change constant) * (prestige reputation / integration reputation)

Knowing that:

Motivation for prestige + motivation for sharing = 10

And the evolution of the esteem is such that:

- **if the agent makes a gift, its esteem increases by 0.1,**
- **if the agent receives no gift its esteem decreases by 0.2.**

During one simulation step, all the agents make one gift: they go through all the process of decision; then the group distributes the gifts and updates the values of all the characteristics (figure 4).

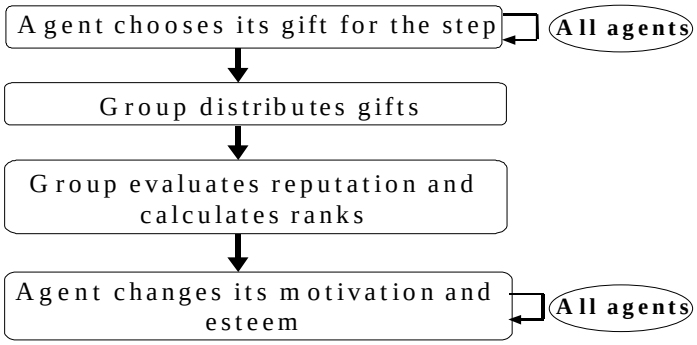

Figure 4: One time step in the universe.

Simulations and observation

As well as doing simulations where the esteem and the motivation evolve (which interested us the most), we did a few simulations where the choice parameters were fixed, called here "Basic simulations". It gave us the opportunity to find good characterisation of the patterns in the society and find the most interesting element to observe.
Most of the simulations were successions of 1000 steps, if there were to be more, it would be said. They were defined as follow:

Type of simulation	**Motivation for prestige**	**Esteem**
Basic	The same for all agents, motivation for prestige between 0 and 10	The same for all agents, value between 2 and 8
Motivation evolves	Motivation evolves with reputation	The same for all agents, value between 2 and 8
Esteem evolves	The same for all agents, motivation for prestige between 0 and 10	Esteem evolves with gifts made and received

Type of simulation	**Parameters stated at the beginning**
Basic	esteem, motivation
Motivation evolves	esteem, motivation change constant, initial motivation
Esteem evolves	initial esteem, motivation

The aim in building the system was to be able to build reputation and to see if it could characterise one individual agent itself. We thus observed differences between the agents in terms of reputation, and the regularity of the ranking. We were also interested in studying globally the number of gifts and their type, for each turn, interests us, to be able to characterise a society with a lot of exchanges or on the opposite societies with little good circulation. The criteria used could thus be individual or global.

Individual criteria:

- Evolution of both reputations and rank
- Evolution of the motivation, the esteem
- Number of gifts received in 25 steps
- Number of gifts made in 25 steps

One can note that studying the number of gifts received by an agent is an indication of the stability of its rank. In the system the repartition of the gifts is indeed decided in a randomised way, and:

- if an agent receives a number of prestige gifts that is much higher than the others' it means that his rank was higher than most of the agents for the last five steps.
- conversely, if it receives much more sharing gifts, it means that it had quite a low prestige reputation

Global criteria:

- Number of agents that possess each given value of reputation
- Integration reputation as a function of prestige reputation (this helps us to identify agents that would have results and rank very different from the other at a given time step).
- Number of gifts of each category at each time step

To characterise an agent, we wanted to capture not only its reputation but its choice parameters as well, since they are what we regard as its representation of itself. We defined an agent as being attracted by prestige if its motivation for prestige is higher than 6 and to be not interested by prestige whenever motivation for prestige is less than 5. Since the esteem is a social criteria that helps to decide if one is able to perform an act or not, an agent that has an esteem higher than 5 is said to be "self confident ".
We also considered that a society is a society that "goes well" if there are a lot of exchanges.

The elements were observed for 1000 steps. For each case, a direct observation was performed for all the criteria, and then some of simulations were repeated 30 or 50 times to make averages. The results were almost always of the same kind for the same initial settings, except for some cases that are indicated.

Patterns of reputation repartition: types of societies and differentiation

For the cases where the esteem and the motivation are fixed, we do not describe the simulations precisely, but only some of the very clearly recognisable patterns that we shall use latter. There exist three main types of societies that appear depending on the initial conditions:

- either the prestige reputation is equivalent for all the agents that can hardly be distinguished
- or a group is clearly identified, that we call an elite and where the agents have a prestige reputation that is much higher than the rest of the group
- or an elite does appear, but there exists also another separated group where the agents are either entering the elite or going out of it.

The society can then be globally characterised by:

- the difference of reputation between the highest ranks and the lowest,
- the time during which an agent can stay in the elite,

	Esteem >= 6	**Esteem <= 5**
Motivation for prestige <= 5	No elite, prestige reputation and sharing one quite high and variable. A lot of gifts.	Very few gifts, all reputation values are low
6 <= Motivation for prestige <= 9	Well separated elite, quite stable	Elite well separated often changed
Motivation for prestige = 10	Continuity between a group with no reputation to the elite	Small differentiation for an unstable elite

In the case when the esteem and the motivation are stable, the motivation is the main parameter that determines the kind of society that will appear. If the agents do not want to be prestigious, the population is homogenous in rank, although there can be a lot of gifts circulating. If the motivation increases, the elite that appears can be very stable. If the motivation is high, the mobility among agents gets really high and the elite is not stable anymore: there is continuity for the value of the rank between the elite and the group of agents that have a low prestige reputation.
For these simulations, the esteem does not precisely structure the repartition of gifts in the group, it is more a limiting variable. A minimum of esteem is necessary in the group to have the gifts actually performed according to the agents will, and thus so that to see a differentiation occur. As

the esteem decreases, all exchanges slow down, and 6 seems to be a significant value below which one cannot go so hat there is still some dynamic in the exchange.
There exists simulation with no real differentiation between agents:

- If there is not enough exchanges to have differences in reputation we talk here of “fixated society”.
- If agents do not want prestige and most of the gifts made are sharing gifts, one talks of a " sharing society ".
- If all agents want to be prestigious and have an esteem that is high enough to have a lot of gifts circulate, no hierarchy ever stabilises and one gets an " enthusiastic society ".

Conversely, one can also be observe quite heterogeneous societies:
For certain initial conditions, the apparition of an elite of about four agents, more or less separated from the rest of the population. The agents that are in it have a much higher prestige reputation than the rest of the group. Since they are those who receive the main part of the prestige gifts, their situation is well established and constantly reaffirmed.
The elite does anyway change, but the speed of change depends at the same time of the motivation and of the esteem of the whole population.
The mobility of the agents going between the elite and the rest of the population is what creates an intermediary group going in both direction in the order: we call it the " passage group " The group is sometimes so important that the elite can not be properly distinguished anymore.
Stability here is what designates an order that can be observed for more than 50 steps. The time scale can vary a lot between the different simulations.

Simulations where the esteem evolves

We defined the esteem as the self-attributed ability of the agent to make gifts. It is linked by its integration in the group, its evolution depending on the gifts made and received. In the simulation, populations are homogenous at the beginning, and defined by the motivation of the agents and the initial value of the esteem. Different dynamics appear for the value of the esteem and for the order in the society: these two elements are deeply linked.

Evolution of esteem

If agents are not interested in getting prestige, all have quickly the same esteem, either very low or very high. The homogeneity is settled very quickly.

- If all the esteems are less than 4 some agents have a maximum esteem for a few steps while the one of others' decreases but at last the differentiation disappears (Figure 5),
- If all esteems is higher than 6 at the beginning, very few agents will have a low esteem for a while as the others' will be maximum. Quickly they all have a high esteem (Figure 6),
- There exists one situation with a rather different result that appears only for very special initial values: the esteem drops for almost no agents and never values 8, but oscillate for all of the agents in the same way. That phenomenon sometimes collapses (for about one out of 20 simulation), and then all the esteems are very low. In any case, all agents have analogous evolution of esteem (Figure 7).

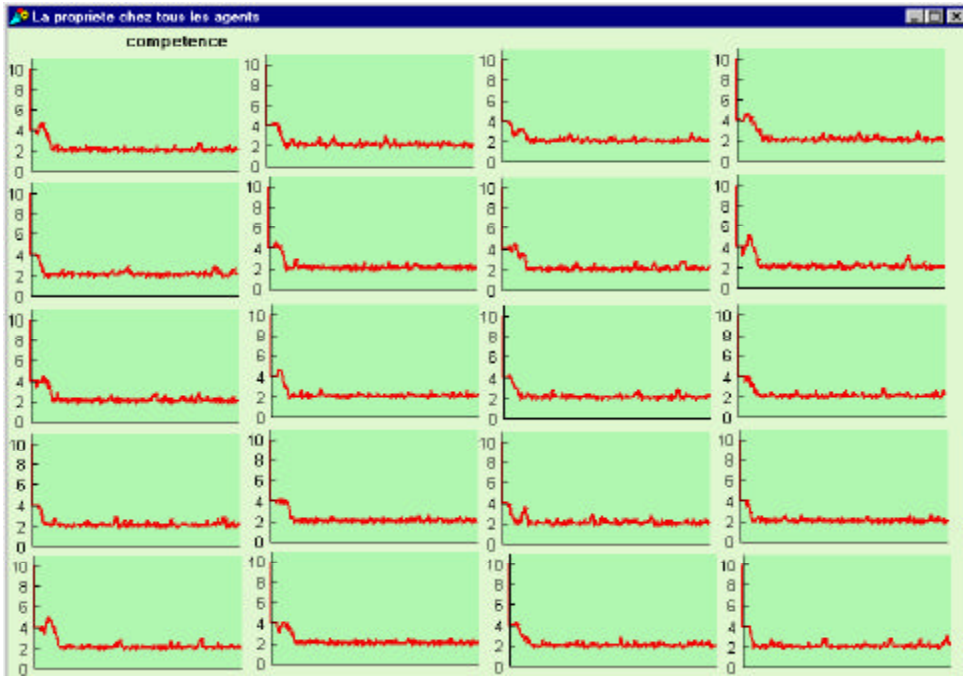

Figure 5: Esteem of the 20 agents with highest ranks when the esteem is less than 4 at the beginning

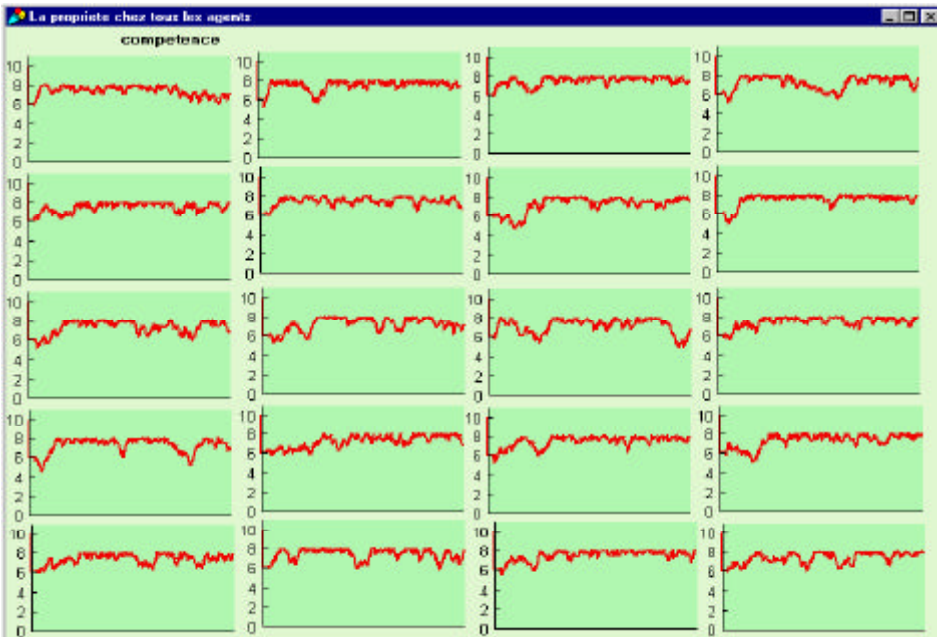

Figure 6: Esteem of the 20 agents with highest ranks when the esteem is higher than 6 at the beginning of the simulation

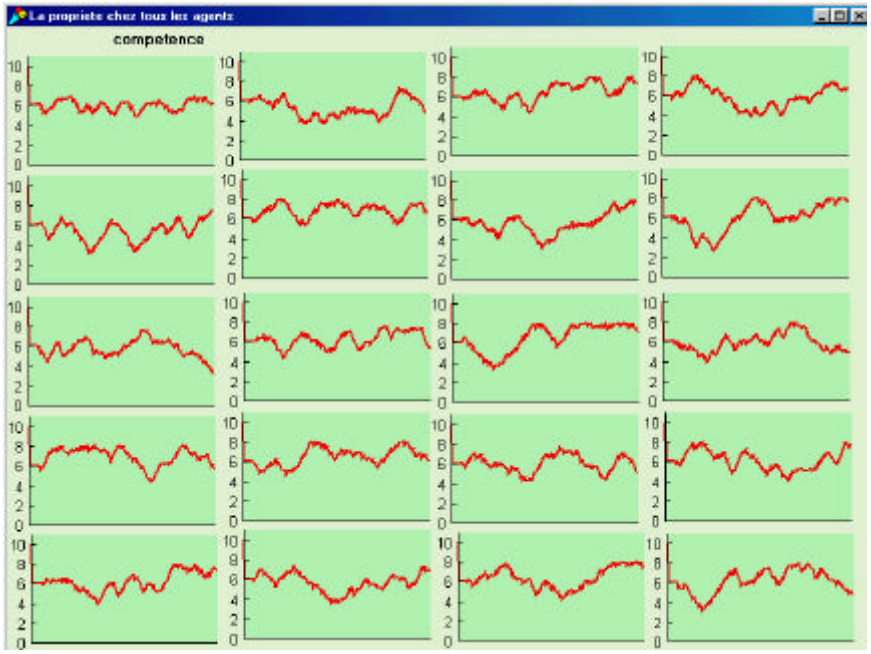

Figure 7: The esteem of the 20 first agents for 1000 steps when the esteems begin at 6 with motivation for prestige at 4

In that situation it is not possible for the agents to differentiate themselves regarding their esteem. The way the feed-back is defined can explain that result: if a majority of agents have a low esteem they do few gifts and a lot of agents will not get any and thus see their esteem decrease, even if it was initially high. Conversely when a lot of gifts circulate, agents always get a few, that are sufficient to have their esteem grow.

Initial esteem	**Esteem after 200 steps in a simulation with motivation for prestige of 5**
< 6	Esteem almost homogenous and less than 3 for all
= 6	Esteem oscillates for all agents between 2 and 8
> 6	Esteem almost homogenous and more than 7 for all agents

If agents are interested to get prestige, one notes that differentiation is easier: a small group has a higher esteem than the rest of the population, and actually gets the maximum value.

Initial esteem	**Esteem after 1000 steps in a simulation with motivation for prestige of 8**
< 3	Esteem falls: almost homogenous, less than 3
3-4	Esteem increases for a small group, whereas the others have a low esteem
> 4	Esteem increases for all: almost homogenous, more than 7

The higher the motivation for prestige, the more the esteem will globally increase from a low level (which is a direct result from the feed-back definition and the way the agent chooses: any time an agent tries to do a prestige gift, if it fails, it has the opportunity to try to do a sharing gift and has thus twice more chance to succeed and then not to loose any esteem).
For two special values of the esteem it is possible to identify a new phenomena. All agents do not have the same esteem after a while. At the origin these agents had a higher rank, and had since the beginning the opportunity to receive more prestige gifts in a group where a lot circulate, which enhanced their chance of keeping their esteem quite high. Their reputation stays very stable in that case and no other agent, thought motivated, succeeds in getting into the elite and

then receiving prestige gifts, and their esteem can drop easily as son as they do not succeed in getting a sharing gift: if ever their esteem increases, it decreases almost right away (Figure 8).

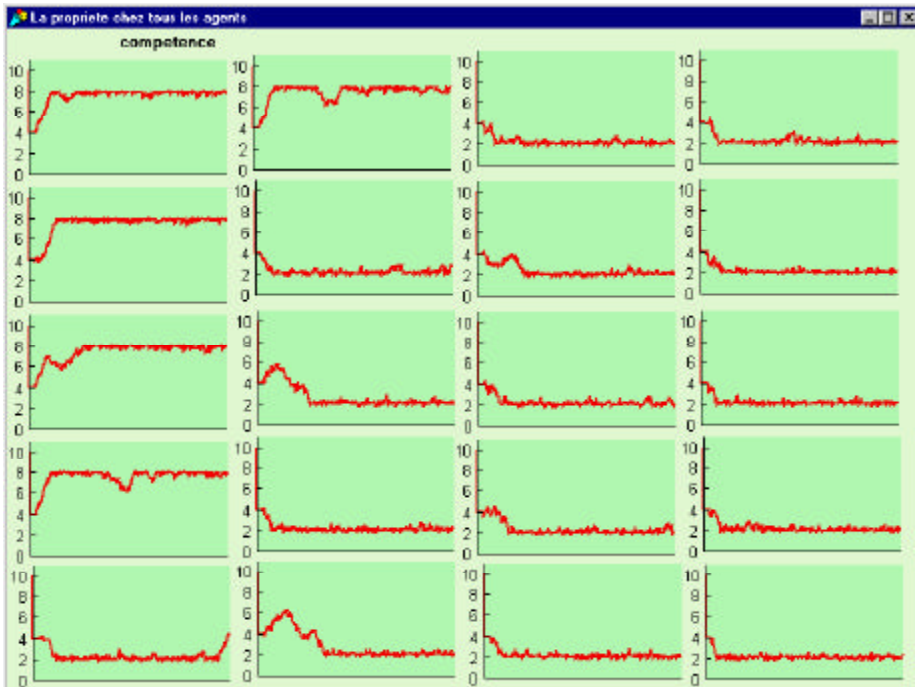

Figure 8: Esteem of 20 agents with highest ranks in a simulation where motivation for prestige is high

Order in the society

If the esteem falls down for all agents the society is like one with very low esteem at the beginning. Whatever is the motivation for prestige, very few gifts circulate and there is neither differentiation nor stabilisation.

If agents have a high esteem, and motivation for prestige is low, a lot of gifts circulate and agents' ranks vary a lot. If they have high esteem with high motivation for prestige, an elite does appear, that is usually quite stable. They are anyway more stable when there is reinforcement in the motivation than when we have the equivalent esteem and motivation in population would be the same in average. Some agents have a very high prestige for 200 steps, rarely more (Figure 9, Figure 10).

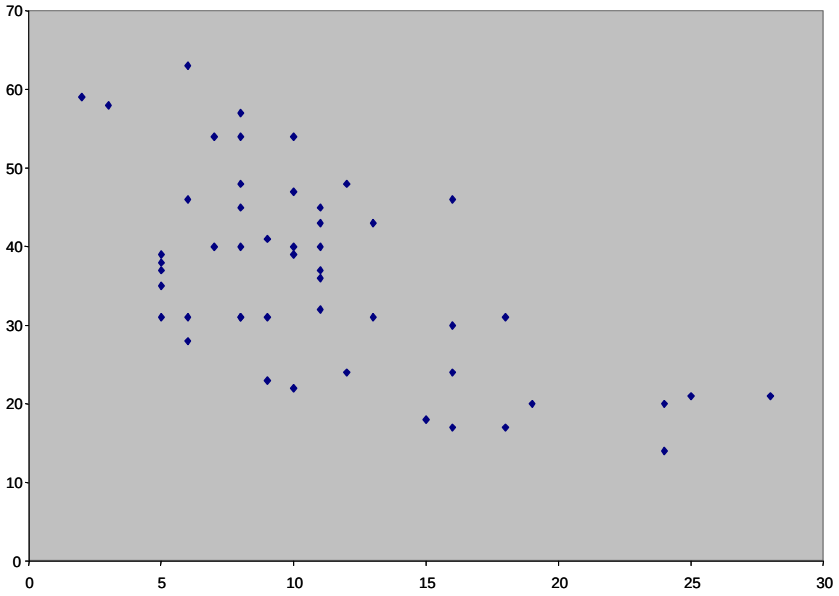

Figure 9: Reputation of prestige and integration for agents that all have a high esteem. An elite can be distinguished with 4 agents (not necessarily the same all the time).

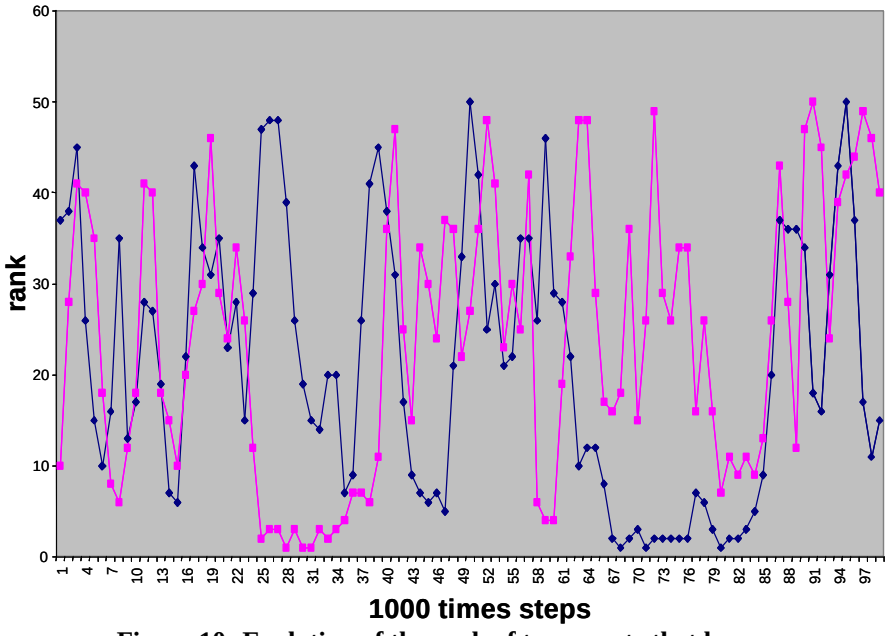

Figure 10: Evolution of the rank of two agents that have an evolving esteem beginning at 6 in a society where motivation is 5. There is not an important stability.

In the only case where the esteem is not stable, the society exhibits no differentiation in prestige, like for any population with low motivation for prestige. The oscillation in the ranks is the highest we have ever witnessed.
Then there are a few simulations in which the esteem is in itself a differentiating element for the agents. Whenever it happens, it is only if the agents are tempted by prestige. The elite are more stable for the societies where esteem is fixed: there are very few big changes in status whereas there was a lot for a fixed esteem of an equivalent global value. It is then very rare that the agents that have enough status should be more than 6 and they are easy to identify (Figure 11, Figure 12). One can understand that the elite is here reinforced by the whole group, constituted by agents that are all willing to get prestige: the gifts that they make go most of the time to the highest rank agents and thus helps them keeping their esteem (Figure 13).

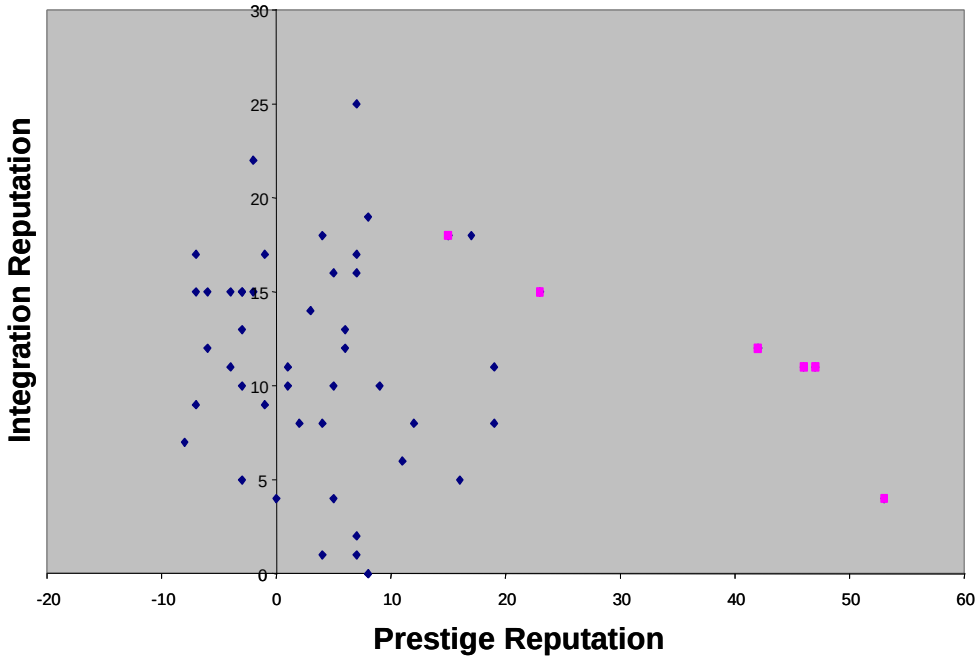

Figure 11: Integration reputation as a function of prestige reputation in a simulation where esteem evolves from 4 and where motivation for prestige is 8. The agents with high esteem are in pink: there are 6 of them. A very clear elite can be identified with 4 agents, and it is very stable.

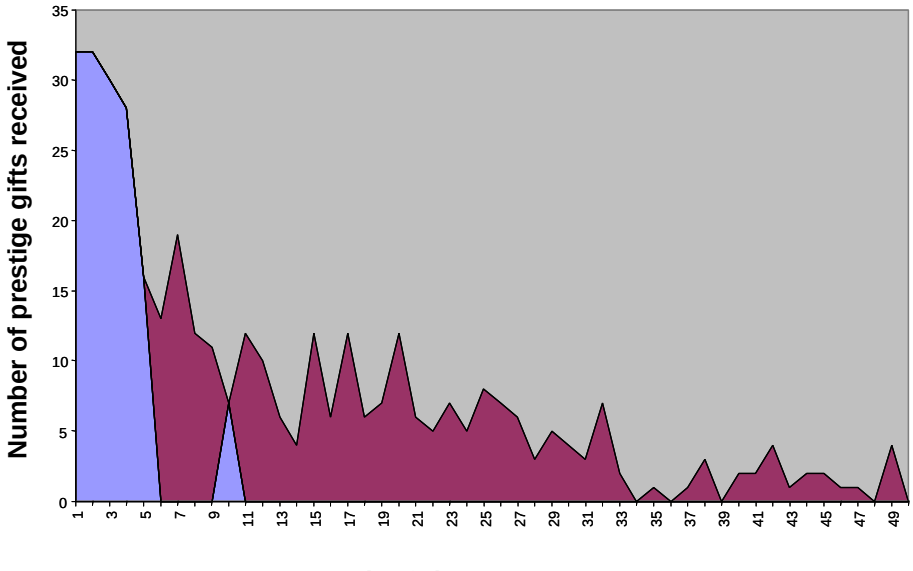

Figure 12: Evolution of the rank of three agents during one simulation where esteem varies beginning at 4 with a motivation for prestige of 8. Two of the agents are among the 6 ones that have a high esteem (here in blue and pink): they stay in the elite forever as soon as they got in. The yellow agent (with low esteem) can get in the 10 first ranks for a while but never stays in.

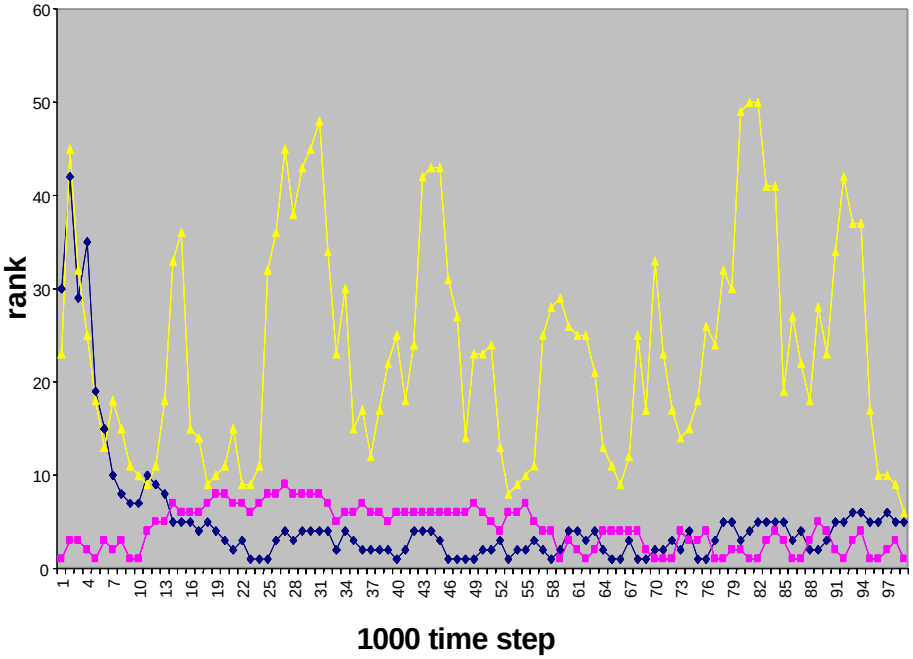

Figure 13: Prestige gifts that are received by agents in 25 steps. In blue are represented the agents with high esteem, and in red are those with low esteem. The difference of gift received is very clear between these two groups.

Simulations where the motivation evolves

In these simulations the agents can change motivation at each step, the motivation change constant being chosen at the beginning of the simulation:

motivation for prestige / motivation for sharing) = ((motivation change constant) * prestige reputation / integration reputation)

Evolution of motivation

Each simulation is characterised by two parameters: the motivation constant and the esteem of agents. One identifies several patterns in the society regarding the repartition of the motivation for the agents and these patterns influence then the order that appear in the society and thus the dynamic of exchanges. For different value of the esteem, we get:

If the esteem is 8 (maximal value):

Constant	**Evolution of motivation for prestige**
<= 5	Motivation of all agents falls, until the average is 2 after 800 steps. Individually, the motivations can increase and decrease for a while, but eventually none is above 6 after 900th step.
6 - 7	Only 10 agents keep a high motivation for prestige. After 800 simulation steps there are only 10 candidates to prestige, but this group changes: some are replaced and all agents see their motivation oscillate. The average of motivation in the group in less than 3.
>= 8	All motivations for prestige are above 6. For all agents, it is maximal and falls very occasionally. The average is very stable, slightly less than 9.

If the esteem of the agents is less than 5:

Constant	**Evolution of motivation for prestige**
<= 9	Motivation for prestige falls for all agents. It takes about 1500 steps so that no agent is tempted by prestige anymore.
10 - 13	A minority always has a very high motivation, and those can be replaced every 100 steps. (The situation takes about 1500 steps to be stable. If constant is 10, there are only 5 to 10 agents that want prestige. If it is 13, they are about 20-25.)
>= 14	All agents want prestige almost since the beginning. All motivations fall and go back to maximum.

If the esteem is very low, no agent is ever motivated for prestige for a long time. Even if at one step an agent might be willing to get prestige, it never lasts, it is only a sign that this agent had a very low integration reputation, but it does not influence deeply its actions in a long term.

One sees that not only the value of the constant, but also the one of esteem is very important to keep a high motivation for prestige (Figure 14, Figure 15).

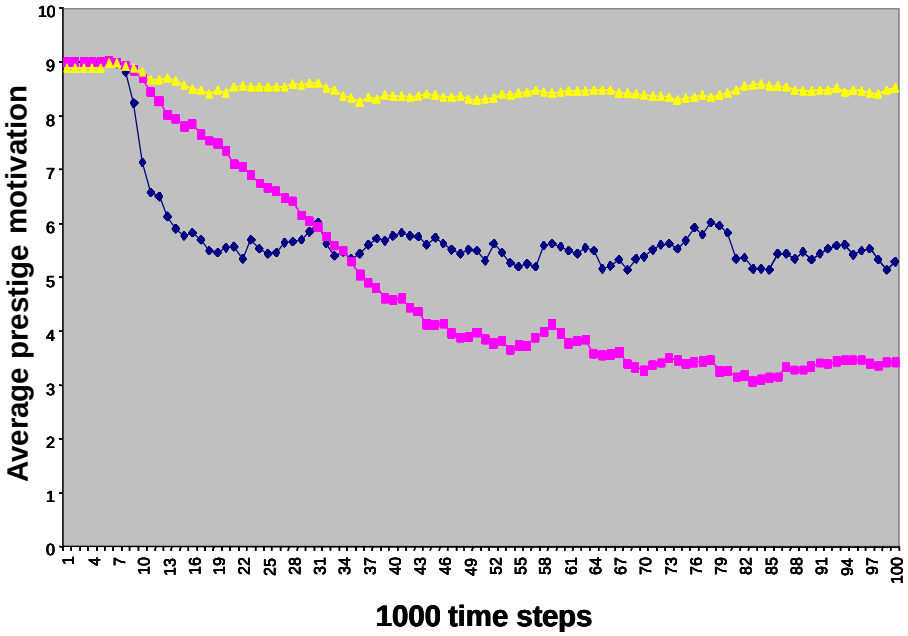

Figure 14: Average of the motivation for prestige in a simulation where constant is 9, depending on the esteem. To see the motivation stay high the esteem needs to be minimal (in yellow the esteem is 8, in blue it is 5 and in pink 2).

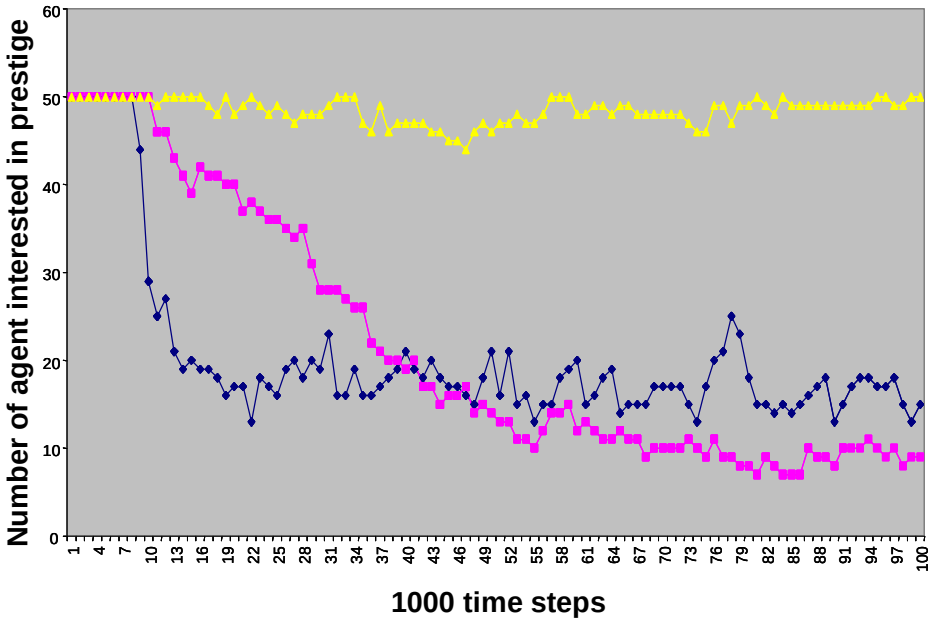

Figure 15: Number of agents that are tempted by prestige (having a motivation higher than 6) when the constant is 9 in a 1000 step simulations. The result is depends on the esteem in the group: in yellow the esteem is 8, in blue it is 5 and in pink 2 .

Order in the society

In all these simulations, the stabilisation of the motivation takes a very long time, the history for the building if a society and see an order appear is longer that in previous simulations (a global and stable structure could be seen after 400 steps, here it needs at least 800). If the esteem is less than 5, the society is totally fixed; without gifts and thus no differentiation. We shall thus be interested by cases where the esteem is more than 5. If the esteem is less than 5, the society is a fixed one in any case. The order depends directly on the evolution of the motivation.
If the motivation for prestige is low for all, we get a “sharing society”.

If a small part of the agents are interested by prestige there appears an elite of three agents (Figure 16) which is rather stable (Figure 17). The less agents there are that are tempted by prestige, the more stable the elite. If there are more than 15 of those, the variability is very for the elite. The number of prestige gifts received is very different and the society is divided in two groups for that criteria. Some are among the 10 highest ranks for a long time.

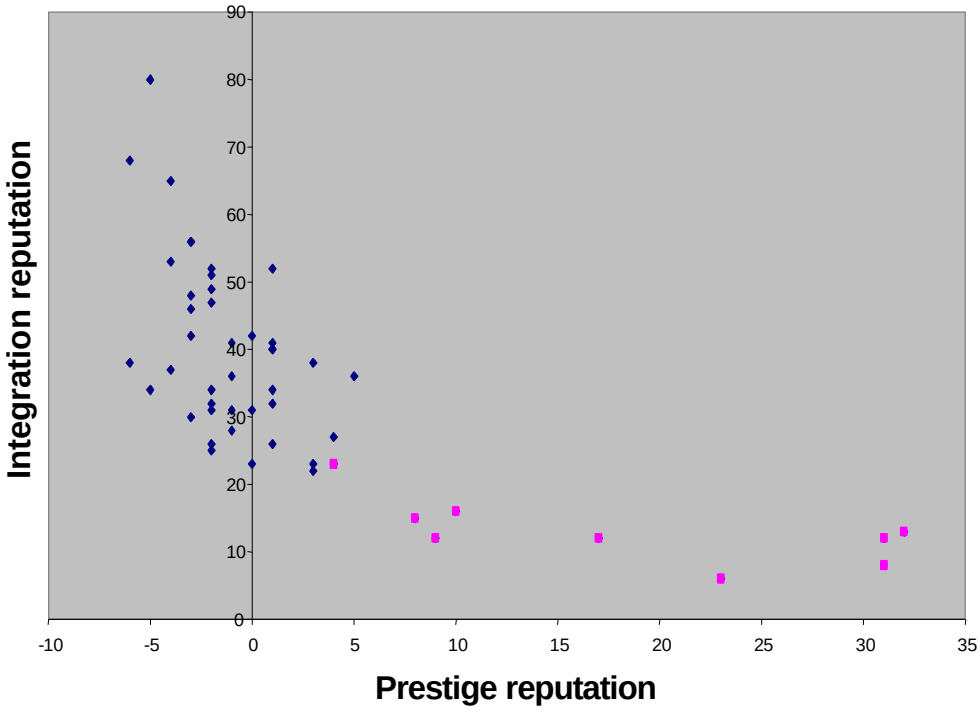

Figure 16: Sharing reputation as a function of prestige reputation in a simulation where the esteem is 5 and the variable constant is 9. A minority of agents is tempted by the prestige for a long time (in pink), during which they constitute a stable elite. In blue: the agents that prefer to share.

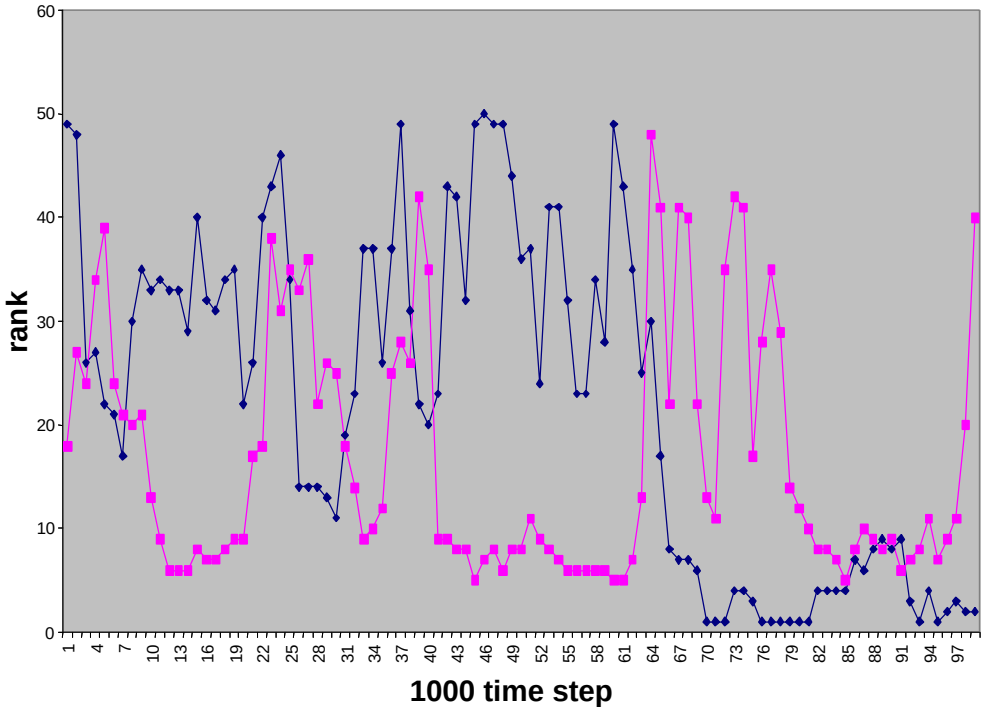

Figure 17: Evolution of the ranks of two agents. Both have a high rank for long period, during which their prestige is high and then falls.

What is quite amazing is that, contrary to the case when a minority has a much higher esteem than the rest of the group, here, there exists in no case perfectly stable elite where the agents would stay forever. Any agent that is motivated for prestige can reach the elite.

If the number of agents who want prestige is high, an elite appears (Figure 18) in which agents stay for a long time (Figure 19). The order society is very close from this of a society in which all the agents are motivated by prestige and have enough esteem so that they can try to get to the highest rank. Here we can notice, and that is totally new, is that the minority that do not care about prestige constitute a rather small group, very distinguishable, very stable on long periods. They all have a very low reputation for prestige. On the opposite, the groups of agents that look for power are rarely stable, and their agents change all the time. It is the first time that such a group appears: the feedback on motivation can thus exclude some of the agent of the dynamic of getting prestige in a way that is more efficient than the stabilisation of a group that looks for prestige.

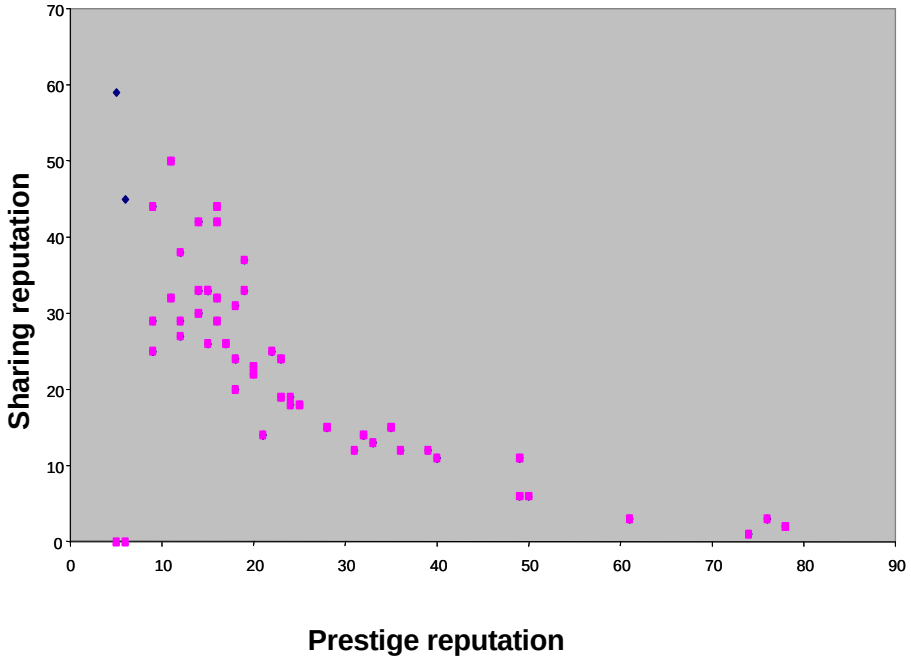

Figure 18: Sharing reputation as a function of prestige reputation among the agents in a simulation where they have a high esteem and have there motivation vary with constant 10. The elite of 4 agents is pretty clearly distinguishable.

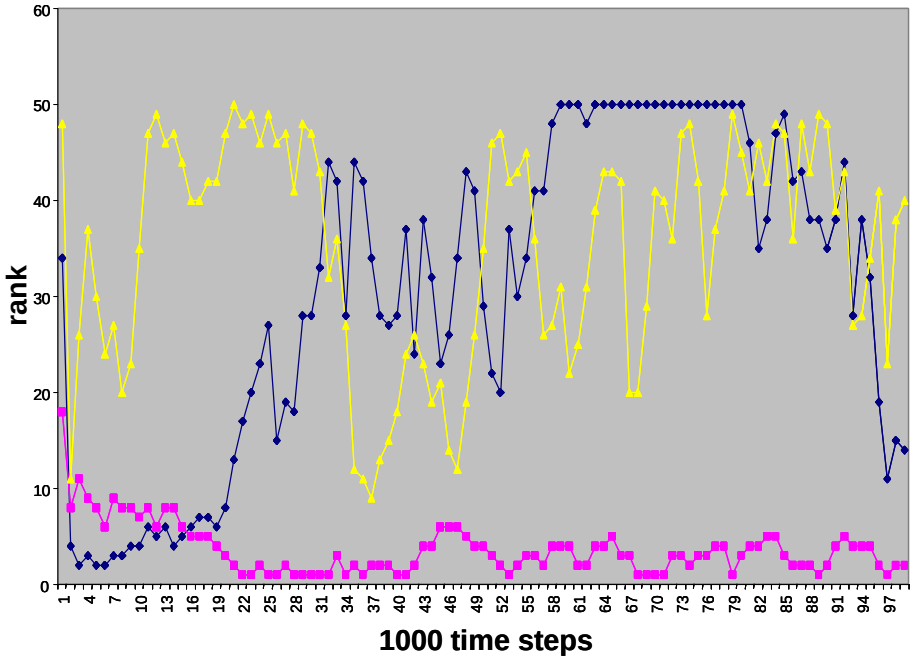

Figure 19: The ranks of three agents in a simulation where motivation varies and where esteems are high. As seen before, agents can be part of the elite for a long time. What is new here is the possibility for an agent to be in the latest ranks for a long time

Discussion

Results

To do the work presented her, we translated different elements about non-merchant exchanges (described in the introduction) to build our artificial exchange system, and represent at the same time the way the agents would understand each other's acts.
To enable the evolution of each individual agent, two feedback loops have been defined. The first one transforms the agents' esteem that evolves according to the gifts made and received. The other is motivation for prestige that is calculated with the motivation change constant of the universe and the reputation. Some others loops can be logically deduced from the dynamics of the system:

- agents with a high prestige reputation get more prestige gifts, which helps keeping their reputation high,
- agents with a high esteem make gift easier, which keeps their esteem high,
- motivation for prestige of the agents is defined proportionally to their reputation of both kind.

What we see is that these global loops logically reinforce the dynamics, and we could believe that a lot of dead locks would thus be created, with two main situations:

- a high stability of hierarchy, fixed because they repeat themselves,
- a total randomness, in which it is impossible to interpret any results.

But what was actually possible to detect was a great range of situations among which some were not always interesting for our questions. The main phenomenon is that, most of the time, motivation for prestige and esteem have dynamics that go together. Both help the circulation of gifts, and then the apparition of reputation of prestige.

	No differentiation	**Two groups: an elite and others**
Clear stability of agents in the first ranks	Stable: Motivation <= 5 - Variable: Motivation <= 5 / Evolving esteem	
Stability for some agents in the first ranks for 20 steps	Variable: Motivation >= 6 / Evolving esteem < 3 a the beginning	Stable: Motivation = 9-10 / Esteem <= 5 - Variable: Motivation >= 9/ Evolving esteem > 7
Stability of some agents in the first ranks for 20 to 200 steps	Stable: motivation = 9-10 / Esteem >= 6 - Variable: Motivation >= 6 / Evolving esteem > 5	Stable: Motivation = 7-8/ Esteem <= 5
Stability of some agents in the first ranks for 500 steps or more		Stable: fixed motivation = 6-8 / esteem >= 7 - Variable: motivation >= 6 / Evolving esteem 3-4 at the beginning

Influence of parameters

Influence of memory

Agents' memory is of 25 steps. This choice is the one that allows us to distinguish between close features among orders: between an "enthusiastic society") and one where we identified an elite

that was very unstable, the difference is sometimes very small, of a few time steps. The length of the memory is a necessary base to define these criteria, and thus it also constitutes an important parameter for the structure of our societies, as well as for the observation of its dynamics.

A necessary motivation for prestige

To get differences in terms of reputation for the agents, it is necessary to have agents that specifically look for prestige in the group. If the agents have the same motivation, we can indeed find a minimum value for motivation for prestige, below which there are not enough prestige gifts to get a differentiation. If agents have different motivation, a minimum of them looking for prestige is important. This is a reassuring element of our model: it proves that one of the main loop that was build in that system gives global results in this ostentation society, as well as local. It is only because prestige is a value that is shared and searched for by the agents, that there is a meaning for us to try to capture its apparition.

Two implications for the esteem

In the system the agents' self-confidence has a key role to define their individual actions. Globally it can be noticed that few gifts circulate without a minimum level of esteem in that population, and thus no differentiation appears.

The order in the society cannot be stable if the whole population wants to get some prestige and feels able to get it. That result is pretty clear when only a part of the group is tempted by prestige: when the number of such agents increases, the stability of the elite disappears. If the whole population want the prestige, there is no way to reach any stability at all.

Autonomous agents and " social representations "

Individuals

In each societies built, each agent is defined by some attributes. The two that make them choose their acts can be here associated to their “personality”, since it is what helps them to make individual choices: the esteem and the motivation. This latest could be seen more or less as the preferences often identified by economists. These two criteria is as much a way of distinguishing itself for an agent as the reputation. In a more social way we even identified some “function” for an agent, when its acts takes an identified place in the others' reputation evolution in the long term. For example, we see that effect in the case where some agents that cannot be part of the elite, although they want to, and make gifts that help another one to be part the elite.

Collective dynamics

In the societies built it had been possible to identify some individual behaviours that could be related to special “personalities” at the end. But in no case an evolution of an agent has been possible without considering the whole group.

If esteem evolves, it is almost impossible that one agent could have a high esteem in the long term when other agents all have low esteem: at least a few of the others must be self-confident as well. As an average value, the esteem has to get to a minimum level so that no exchange occurs.

When only a part of the group is motivated by prestige, these agents are not necessarily those that have the highest rank: some of these agents are thus taken into that elite by the reception of prestige gifts emitted by others. The others’ motivation can directly influence an agent position.

Hence, even if one individual agent has autonomous choices, there is no independence concerning its belonging to the elite or to the value of its own esteem or motivation.

For example, it is here possible to interpret the motivation change constant as the value that the society gives to prestige compared to sharing. If the idea of getting prestigious is not very important in the group, the agents will do their best to make a lot of sharing gifts but will not necessarily try regularly to do prestige gifts, which is what we find in the evolution of our societies.

Describing processes

The evolution of the representation is here not due to a diffusion process or to the averaging of representation, as it is quite often the case in social simulation. Here, the act of exchange is the only way that the agents have to communicate with the others, and to create a common representation. The values of the group help the whole to interpret the act and engender a common understanding. It is a strong assumption about how the agents can put intentions to the others that we picture here: the gift has its place in a process where it delivers a message accessible to all. It exists in no way as an individual relation and yet helps the individual to define his or her own place in the group.

Here, the ways the agent change their perception of themselves (esteem), of the other (reputation) and their preference (motivation) along the time is defined quite strictly by different loops of feedback. This sometimes induces very predictable results, but that are not so usual. It was particularly interesting to see that in most cases the agent's rationality depends highly on its social position, although it was not directly defined in a strict way in the system.

But, it is to be noticed that some very unexpected results could appear. The same processes, with slight differences in the parameters would give highly different results in the global organisation of the society. This leads us to point out an important issue: the context into which any strategy has to be described, be it learning or norm obedience, can certainly not be taken into account without the more general background, that makes all the dynamical processes possible to happen or not.

References: