Diversity of cooperation processes and contemporary industrial geography : an evolutionary game approach

Philippe BERNARD
Jérôme VICENTE

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Diversity of cooperation processes and contemporary industrial geography : an evolutionary game approach[1]

Philippe BERNARD
bernard@univ-tlse1.fr
Jérôme VICENTE
vicente@univ-tlse1.fr
(LEREP/IERT)
21, allées de Brienne
31000 TOULOUSE

Abstract :
The main purpose of this paper is to explain the spatial diversity of cooperation processes and its evolution. After a monographical survey based on Regional Sciences, which justifies this diversity, we insist on the necessity to associate spatial and industrial dynamics. For this, we expose assumptions and a model of evolutionary game showing the diversity persistence and cooperation diffusion processes. In this line, we insist on the development possibilities of bounded rationality assumption in an evolutionary context of spatial and industrial interactions. The end of the paper focuses on simulation results and discussions on the conditions of diversity existence by the study of cooperation diffusion processes and shows the relevanvce of the approach to explain the endogeneous formation of economic spaces of interactions
Key-words : cooperation, diversity, regional monographies, proximities, situated rationality, interactions, evolutionary games.

[1] We want to thank L. Jegou for his computer assistance ; JM. Dalle & G. Dosi for the stimmulating discussions anterior to this paper ; and JP. Gilly & C. Dupuy for the helpful comments on this work.

1. introduction

« Industrial cooperation takes various forms according to concerned economic sectors, original vocation, managerial and legal traditions according to concerned nations and geographical areas » (JL. Rullière & A. Torre, 1995). This quotation resulting from the conclusion of a theoritical and empirical survey on inter-firm cooperation shows the impossibility of an unified definition of cooperation. This impossibility comes from two main reasons, organizational and geographical. Beyond this check, the aim of this paper is to draw up the theoritical bases of cooperation processes diversity[2], particulary of the spatial aspect of this latter.

Cooperation researches have most of the time focused - like in economic tradition - on the basis of the coordination process optimality and according to the assumptions on economic agents[3]. In the particular case of cooperation, the bounded rationality assumption is generally used to explain cooperation emergence, for diverse reasons of information problems in agency and transaction cost economic theories, or knowledge in innovation economics.

If bounded rationality has been usefull in the determination of alternative coordination processes to market coordination, we would show here that this assumption can be developped to explain cooperation processes diversity in a spatial scale, beyond the optimality of agreement forms, and in a sense in contradiction with it. In this line, we have got to study - owing to this diversity existence - the evolution, persistence and diffusion problems of cooperation processes, in an evolutionary approach applied to industrial and spatial economics.

This is the aim of this paper which is divided as follows[4] : In a first part, a survey based on regional science researches and recent works on proximity concept[5] will be the basis on which the spatial diversity of coordination processes will be questionned. From this, the second part focuses on a set of assumptions drawn out of the first part and of recent works on interaction dynamics and learning processes. These assumptions lead to an evolutionary model of industrial and spatial interactions which allows to study the conditions of persistence and structuring of this diversity by the analysis of diffusion processes of cooperation models.

2. diversity of regional productive systems and « proximity economics »

If the spatial diversity of coordination and cooperation processes has been received a few specific works, some preliminary answer elements can be found in the synthesis of regional science works[6]. This latter shows the diversity of cooperation models, but the *« local presupposition »* of this works (JP . Gilly & A ; Torre, 1998) and the difficulty to connect with economic theories have marginalized them (JF. Thisse, 1996). Nevertheless, an other reading with the researches on proximity economics, in the intersection of spatial and industrial economics, leads to new possibilities of development. In this works, the productive space structuring becomes endogeneous to economic agent interactions. We want to show here that these researches contain the assumptions for an evolutionary model of interactions which

[2] Nowadays, the main researches on diversity concern technology. Cf. A. Kirman (1992), F. Chiaromonte & G. Dosi (1993).

[3] Cf. JL. Rullière & A. Torre (1995) ; E. Combes (1998) ; H. Defalvard (1999).

[4] This paper extends previous researches on coordination model diversity in economics, on regional specificities and on models of local trajectories of industrial development. Cf. P. Bernard (1997) and J. Vicente (1999).

[5] Cf. M. Bellet & alii (1998), A. Rallet & A. Torre (1995), JP. Gilly & A. Torre (1998).

[6] Cf. G. Benko (1998) for an extended outline of regional sciences.

allows to explain the endogeneous formation of relevant space of interaction and to study the conditions of the exsitence and the evolution of this diversity.

2.1. industrial districts and cooperation models

Lot of Regional Science researches have focused on industrial districts and local productive systems in a monographical form. This monographical form refers to the choice of particular space, a regional area, in the contrary of orthodox macro-economic approaches which focus on nation represented by a point in the economic space. The basic aim of these regional researches is the study of social construction of markets and industries as coordination processes.

In the lines of Marshall works on « growth poles », The analysis in terms of industrial districts have received a new interest which comes from the empirical observations of post-fordist years. The industrial district can be defined as *« socio-territorial entity which is characterized by an active human community and firms population in a geographical and historical space »* (G. Benko, 1998, p.38). The district appears then as a particular form of industrial model, defined as *« a theoretical tool to analyse intermediary and meso-economic spaces, between firm and macro-economic level »* (Y. Lung, 1995, p.87).
Even some researchers have presented particular cases of districts like an universal model of industrial development, in the contrary some differences on coordination and cooperation processes can be observed according to the geographic spaces chosen for the monographical studies. This differences will be articulated according to the degree and modalities of cooperation.
The italian case of districts (F. Pyke, G. Becattini & N. Sengenberger, 1990 ; G. Becattini, 1992) is one who has received more attention by regional economists. Most of these works insist on the values which underlie organisation models of italian districts : labor and household ethics and reciprocity (G. Becattini, 1992). These values govern cooperation models and integration degree which can be observed in the italian case. As a matter of fact, italian districts are characterized by a strong autonomy degree of firms which is linked to a strong network of productive interdependencies and « face-to-face » relations. The italian districts appear few hierarchized and their model of cooperation seems nearer of market than hierarchy (in the continuum of organizational forms by O. Williamson (1985)), but with a very specific value system founded on human community and expectation convergence.
The big agglomerations of firms in the USA - as Silicon Valley or Orange County districts - constitute an other exemple of industrial districts. The main difference with the previous case is the place which is occuped by a leader firm and its influence on the others (M. Storper & B. Harrisson, 1992). A strong degree of hierarchy exists then in these structures and the autonomy degree of subcontractors seems to be weaker and the values of cooperation agreements more industrial than in the previous case. The reasons of these differences can be founded in the origins of these structures and thus to the weight of initial conditions : even italian districts take their origin in a local household tradition, the american agglomerations have emerged with the preliminary location of a big firm.
The study of the model of japenese districts, taking the form of company towns (Y. Lung & A. Mair, 1993) also reveals its specificity. The japenese cooperation processes can be distinguished from the others on the same basis than ones which M. Aoki mentions on the internal structure of the firm. As in american districts, we can observe a leader firm, but the hierarchical pressure is weaker and horizontal relations and interactions are privileged. The industrial organization is founded on *« communication logic rather than market one »* (Y. Lung & A. Mair, 1993). This logic takes the form of « just in time » production system, which

allows process quality and flexibility and long-time relations. The main reasons of the stability of cooperation processes of these districts can be justified by the japenese culture of trust between and into firms

.

This brieve analysis shows that industrial districts seem to be a very prevalent cooperative form, which bases itself - as in Marshall works - on external economic search. But this latter is based in the industrial reality on different cooperation models, which are characterized by a strong geographical specificity, a peculiar *« industrial atmosphere »*. If these conclusions can be conterbalanced by a sectorial approach, for M. Storper & B. Harrison (1992), diversity of governance models (JP. Gilly & F. Wallet, 1998) of districts are relatively independent of technological factors. The researches on transplants (Y. Lung & A. Mair, 1993), hybridization processes (R. Boyer, 1998) prove the relevance of the geographic scale on industrial dynamic. In a more agregated geographic scale, this analysis can be enforced by the specificity of national systems of innovation (RR. Nelson, 1993 ; BA. Lundvall, 1992) in terms of cooperation model adoption, science-industry links, institutional factors which regulate economic activity and so on. In this line, the researches on capitalism plurality can be mentionned (R. Boyer, 1996), which concern cooperation processes and legal and institutional aspects in a national scale.

After this meso-economic analysis, the necessity to understand how the economic system as a whole is generative of diversity - and how space matters - become apparent. We have got to draw up an approach of coordination and economic interactions which can allow to include space into the organizational dynamics, particularly in this macro-economic and self-organized aspects (emergence of collective structure of coordination, cumulative interactions and path-dependence processes). But we have got too to show that it seems very difficult to link *ex ante* an efficiency criterion to a coordination model. The efficiency appears *ex post* in a local and evolutive context without our knowing *a priori* on the superiority of a coordination model on the others.

The recent researches on the formation and structuration of proximity links have contributed to answer to the first query. Developped about the diversity question, they allow to set up the first answer elements to the second one with the analysis of processes by which diversity structures itself and cooperation models diffuse themselves.

2.2. industrial and spatial dynamics, proximities and diversity

This spatial diversity of cooperation models and its evolution lead to several questions : why space constitutes an important source of coordination model specificity in a meso-economic scale and then diversity in a macro-economic one ? Is the bounded rationality asumption in a industrial organization analysis sufficient to study this diversity emergence ? Finally, does the industrial dynamic generated by this diversity necessit to think in an other way firm interactions ? The reflections developped by the « proximity economics » group allow us to explain the *stylised facts* above-mentionned and draw out the assumptions of the model developped latter.

Born from the confrontation of industrial and regional economic researches, the main purpose of the proximity works[7] can be summarized as an approach of the economic dynamics which focus on the organizational and spatial aspects. The organizatioanl aspect refers to the will to extend interactions beyond market interactions. The spatial one refers to the will to avoid the

[7] Cf. note 5

« local presupposition » derived from the empirical conclusion generalizations in regional sciences. So sum up, the proximity question refers to the three queries above-mentionned by the three next points : the complex dimension of interactions, the individual rationality and the interaction dynamics.

The complex dimension of interactions is in the beginning of the proximity concept in its organizational and geographic components and then in the beginning of the will of two research subject raprochement. Economic activities are not only regulated by price but also by coordination rules, and they take place on a space, this latter being generally an improvement source of non-spatial models (JF. Thisse, 1996). On these basis, the proximity concept is mobilized to oppose itself to the general equilibrium model interactions - where the communication between isolated individuals is only made by the price system - but also to oppose itself to the standard game theory interactions where *« every player takes account of what every other player does and moreover knows that the others do so »* (A. Kirman, 1996).

In the proximity approach, the effectivity and the intensity of interactions between individuals matter and these latters define the proximity degree between economic agents (JP. Gilly & A. Torre, 1998). Then these interactions are local and lead to productive networks which take two dimensions : an organizational one where organizational proximity is correlative to the intensity of firm cooperative relations, and a geographic one, where the geographic proximity degree is correlative to the distance which separates the firms (their location). This distance is not only a physical one, it is built in social interactions (M. Bellet & T. Kirat, 1996). The industrial districts above-analysed square with the crossing of these two proximities. The firm is situated here in a double environment (JP. Gilly & C. Dupuy, 1995). Then, the interaction dynamics are dependent of the local interaction and neighbourhood dimension assumptions[8].

The specificity of districts and their diversity in coordination processes require to define others assumptions on the individual behavior. Once we have renounced to the isolated and representative agent for an approach based on the effectivity and intensity of interactions, the bounded rationality assumption takes a different sense. Psychological and individual aspects of the bounded rationality asssumptions have gived more realism to the industrial organization and cooperation processes (JL. Rullière & A. Torre, 1995). But beyond these aspects, we must have to develop this assumption, not on the individual behavior, but directly on the individual interactions. The individual bounded rationality becomes situated in the interaction (R. Boyer & A. Orlean, 1992 ; JM. Dalle, 1997). The *situated rationality* is a form of bounded rationality, but it distinguishes itself from this latter because it not concerns exclusively the individual - as in traditional economics which study the behavior complexity of the individual which faces to an action - but directly on interactions and their structuration. The individual acts according to the history and the memory of previous interactions and measures his satisfacion according to these interaction outcomes. On the side of the imperfect information criterion, the local character juxtaposes itself. This local character is included in the proximity links which the individual keeps with the others whom represent *« relevant neighbors »* (P. David, 1988).

Therefore, the behavior of the individual which is endowed with a situated rationality can not be linked to an optimisation program, even with imperfect information, but this behavior is linked to learning and adaptation processes which are based on previous interactions and satisfaction measure. This behavior takes two forms developped in evolutionist researches (RR. Nelson & SG. Winter, 1982 ; T. Brenner, 1998). Whether the individual adopts an imitation behavior, when his experience of previous interactions gives him enough satisfaction.

[8] Lot of works have used local interaction model with interaction neighbourhood (JM. Dalle, 1997 ; R. Cowan, 1998 ; G. Umbhauer, 1998a), but using one dimension of it, whether organizational, via technology, whether spatial. These models lead generally to standardization phenomenon or enclaves. Cf. J. Vicente (1999).

This situation is not irrational and means that it will be costlier to search new partners - then new informations (A. Orlean, 1998) - and more beneficial to proceed with the same individuals, that means that individuals found an advantage to proximity links. Whether, he adopts a mutation behavior, which takes form of an information search process on the rule which it is adopted in his neighbourhood, process which starts with an insufficient satisfaction on previous interactions. This learning process takes account of the possibility of judgement of the individuals, in opposition to the pure replication dynamics of biological processes (T. Brenner, 1998).
On the dynamic of these interactions, on the contrary to network analysis where interaction structures are given, the dynamics of proximity links between individuals in interaction seem more complex, because of the double dimension of the neighbourhood and the duality of individual behaviors. Micro and macro-economic levels and equilibrium are questionned because the relevant interaction spaces are not fixed and the trajectories of proximity links are to be studied to observe the evolution of local specifities of cooperation models, and so, the endogeneous formation of relevant spaces of interaction in the opposite of models where interaction spaces are given.

The proximity concept which focuses on organizational and spatial aspects and the relational dimension of interactions can allow us to understand the specficities of districts in terms of cooperation and governance models, and then their diversity. But assumptions above-mentionned can allow us to set up a model which can help to understand the persistence of this diversity by the study of processes by which cooperation models diffuse in the economic system.

3. an evolutionist model of spatial diversity of cooperation processes

The main purpose of this model is to explain this diversity in terms of evolution and structuration of cooperation processes. The assumptions are presented in a more formal way and are both deduced from the previous analysis and from recent evolutionary models of interactions and learning (JM. Dalle, 1997 ; G. Dosi & alii, 1998 ; H. Tordjman, 1998, G. Umbhauer, 199b) in order to show self-organisation properties of meso-economic system.. This model is inspired by evolutionary game models developped by A. Orlean & R. Boyer (1992), SK. Berninghaus & U. Schwalbe (1996) or C. Dupuy & A. Torre (1997), the main difference is in the introduction of a double neighbourhood dimension of interactions in order to study interaction network evolution (A. Kirman, 1997) in a less deterministic way than spatial neighbourhood model. Because of the interest of trajectory forms, the model is simulated in order to study the persistence and spatial diffusion of cooperation processes factors.

3.1. spatial and industrial interaction assumptions and model

We consider two cooperation models C and C’ and we study their diffusion in a finite population of *n* individuals characterized by the assumptions under-mentionned. For this, we go back T. Schelling (1960) researches on pure coordination problem situations characterized by multiple equilibria.

	C	C’
C	1.1	0.0
C’	0.0	1.1

a- local interactions

Definition 1 : suppose the bounded rationality of individuals, the local interaction assumption traduces the fact that individuals can communicate only with a subset of the economy as a whole.

Formally, in a finite population $N=\{1,...,n\}$, each player $i \hat{I} N$ have an interaction network $m<N$.

b- double interaction neighbourhoods

Definition 2 : the interaction neighbourhood is the straight outcome of local interactions. The neighbourhood of an individual is characterized by a set of other individuals from which their actions are to be taking into account in the decision algoritm of the individual.

The assumption of double interaction neighbourhood means that the individual interacts according to two neighbourhoods characterized by :

- a fixed spatial neighbourhood : the individual can interact only with a limited number of individuals which are spatially situated around him :

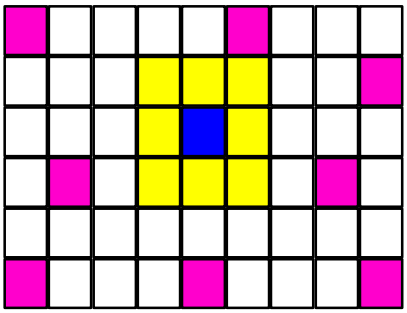
Let $\sum_{a=1}^{n} 8a$ be the number of individuals which represents the spatial interaction network of the individual *i*.

- an organizational neighbourhood which can change in time and space : the individual can interact with a limited set of individuals which are relevant productive neighbours :

Let $\sum_{b=1}^{n} 8b$ be the number of individuals which represents the productive interaction network of the individual *i*.

Then, let $\sum_{a=1}^{n} 8a + \sum_{b=1}^{n} 8b$ be the whole local interaction network of the individual *i*, which can be represented by a graph[9] :

[9] Some individuals j whom interact with the individual i can belong to the two neighbourhoods. The dynamic of the organizational neighbourood will be specified latter.



c- situated rationality and individual behavior

Definition 3 : the situated rationality is a form of bounded rationality which is endogeneous to the local interaction dynamics. It traduces the fact that the individual adopts a decision algorithm which is fonction of the learning process which is based on the previous interaction valuation.

According to this definition, the selection between cooperation models is dependent on the satisfaction of the individual which has adopted one of the cooperation model. In an evolutionary environment, the behavior of an individual which wants to achieve a sufficient level of satisfaction is characterized by two distinct processes above-mentionned : mutation and imitation behaviors (RR. Nelson & SG. Winter, 1982 ; H. Tordjman, 1998 ; T. Brenner, 1998) :

Definition 4 : a mutation process traduces for an individual the decision to change its coordination model. This process is engaged by the dissatisfaction on the outcomes which are given by the coordination model adopted, this process depends in part of the choice of the individuals which are situated in the neighbourhood.

Formally, The probability per unit of time for the individual *i* to go up from C to C' $(p_V(c/c', t))$ dépends on three factors[10] : the capacity for the individual *i* to change $m_i(t)$, the adoption rate in the neighbourhood of a rule $u_V(c/c',t)$, and the experience that the individual *i* has made with the rule C' until time *t* $[\Psi(h_i(c',t))]$[11].

Definition 5 : an imitation process traduces for an individual the research of a conformity effect on a coordination model which is adopted by the others individuals situated in the interaction neighbourhood.

Formally, the probability per unit of time for an individual *i* to adopt the behavior of the individuals *j* which belong to the neighbourhood and play C' $(p_I(i/j_c; t))$ depends on three factors : the general likelihood of imitation $v_I(t)$, the individual capacity to change $m_i(t)$, the

[10] Cf. T. Brenner (1998)

[11] Formally, we suppose that the accumulated experience of the individual squares with the learning process which takes the following form : $f(x) = \frac{(x_{t-1} + a(1 - \frac{x_{t-1}}{\bar{x}}))}{\bar{x}}$ with $x_{t=1} = 1$ and $\bar{x}$ the maximal threshold of learning.

experience and satisfaction accumulated with he others individuals in the previous interactions $[\Psi(h_i(i_{jc'},t)).\Phi(s_{jc'}(t))]$[12].

d- the model

According to these assumptions, the decision algorithm for each individual $i \hat{I} N$ can be describe as follows : in each period, the individual i has a set of rules which allow him to :

(i) *choose his interaction network ;*
(ii) *choose the cooperation model for the next period*

(i) *the individual i, which has a situated rationality, will interact into the two neighbourhoods above-mentionned.*

- further assumptions on the productive interaction network which evolves in time and space :

In the line of A. Kirman & G. Weisbuch (1998), in each period, the interactions between individuals follow the probalility *(P_j)*. This former comes directly from a preference coefficient *(J_{ij})* which evolves according to the outcomes of previous interactions as follows :

$$P_j = \frac{\exp(bJ_{ij})}{\sum_{j=1}\exp(bJ_{ij})} \qquad (1)$$

with $J_{ij}(t) = (1-e)J_{ij}(t-1) + \Pi(t)$ (2)

and $\Pi(t) = 1$, if individuals *i* and *j* play the same strategy at *t*

$\Pi(t) = 0$, if individuals *i* and *j* do not play the same strategy at *t.*

Moreover :

1) At the beginning, we suppose the indifference of individuals on the choice of productive interaction network. Each individual *i* assignes a same preference coefficient to the others individuals *j* :

$$J_{ij} = \frac{1}{\sum_{b=1}^{n} 8b}$$

2) When the P_j are equal, the matching process is random.

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[12] $[\Psi(h_i(i_{jc'},t)).\Phi(s_{jc'}(t))] = \sum_{jc'=1}^{\max\sum_{a=1}^{n}8a} \frac{(x_{t-1}+(a(1-\frac{x_{t-1}}{\bar{x}}))f_t}{\bar{x}} \Big/ \sum_{jc'=1}^{\max\sum_{a=1}^{n}8a} jc'$, with $\Phi_t = 1$ si $i_c = j_{c'}$ or $\Phi_t = 0$ if $i_c \neq j_{c'}$ and with $x_{t=1} = 1$ and $\bar{x}$ the maximal threshold of learning.

(ii) evolution rules of cooperation models

The choice of cooperation model $[p_i(c/c', t)]$ is done at the level of each individual which is characterized by a situated rationality and two decision processes above-mentionned.

- further assumptions :

1) The mutation process has a spatial dimension, the search of alternative cooperation model is limited to the $\sum_{a=1}^{n} 8a$ which are spatially situated around the individual *i*. This process is defined by the following probability :

$$0< pv(c/c',t) = uv(c/c',t).m_i(t).\Psi(h_i(c',t)) \leq 1 \qquad (3)$$

2) The imitation process has an organizational dimension and then it is linked to the productive interaction network, which evolves according to (1) and (2). This process is defined by the following probabality :

$$0 < p_I\left(i/j_{c'},t\right) = v_I(t).m_i(t).\Psi(h_i(i_{jc'},t)).\Phi(s_{jc'}(t)) \leq 1 \qquad (4)$$

The decision algorithm of the individual *i* $[p_i(c/c', t)]$ which is characterized by a situated rationality in both interaction networks - a fixed spatial one and evoling productive one - can be defined with (3) and (4) as follows :

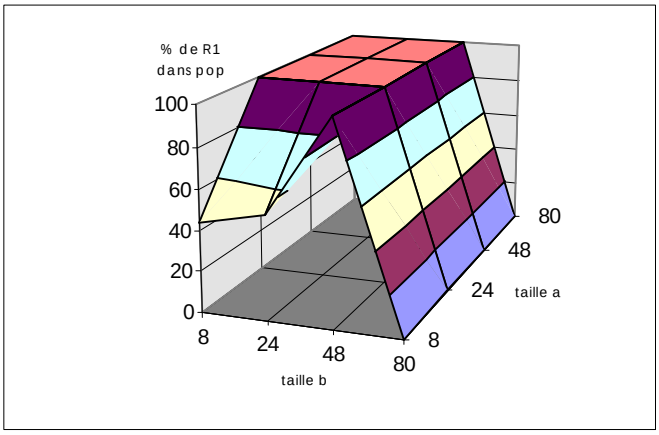
$$p_i(c/c',t) = \frac{p_V(c/c',t) + p_I(i/j_{c'},t)}{2} \qquad (5)$$

3.2. some results on spatial conditions of diversity persistence and cooperation model diffusion

In order to test this model, a computer applying has been developped on *Visual Basic*. The simulations allows to confront the diffusion of cooperation models to three factors : The initial condition consequences, the neighbourhood scope and individual characteristics (learning speed, memory, capacity to change). Three strong results appear :

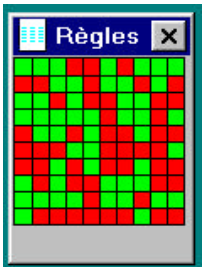
Result 1 : The diversity degree of cooperation models in the population depends on the spatial and organisational local interactions. As in spatial evolutionary games, a rule can be adopted even if it is not pareto-optimal, particularly if this rule is played by a small subset of individuals. The addition of an organizational form of interactions allows to relax the initial condition constraint which has a strong weight on the spatial dimension alone, and the neighbourhood sizes have a strong influence on the diversity existence.

Diffusion degree of a rule in a population of 100 individuals with a and b variables

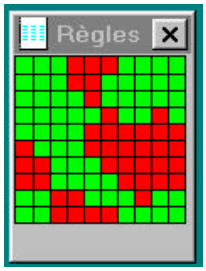


Result 2 : the cooperation model diffusion takes a spatially self-organized form. The spatial order is the result of the endogeneous formation of relevant sapces of interactions and depends both on initial conditions, local interaction number and form. This structuration is the outcome of a collective learning process which can be traduced by the capacity of the individuals to find in their neighbourhoods individuals which play the same rule.

Diffusion of cooperation models in a population of 100 individuals with a=b=8



t=1



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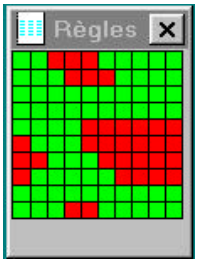

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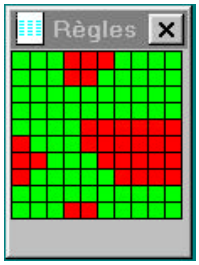
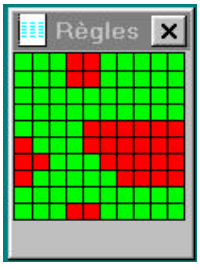


t=5



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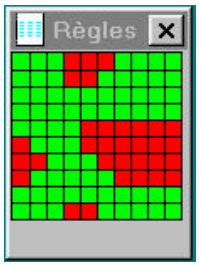

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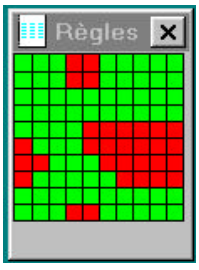

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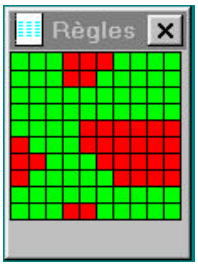

t=9

Result 3 : The individual features or the form and speed of learning processes and the experience have a little influence on the fact that cooperation model diversity is an intrinsic property of local interaction models. Nevertheless, these features have an influence on the diffusion speed of cooperation models.

4- Conclusion

The visible spatial diversity of cooperation models could be generally explain only by a synthesis of regional sciences monographies. We have try to give in this paper a set of assumptions and a model which allow to show how the economic system as a whole can engender diversity by self-organization processes. For this, space has been introduced as a strong criterion of local interactions (T. Schelling, 1960), but in a less deterministic way than in pure spatial model because of the introduction of an organizational interaction network. So we manage to an explanation of diffusion and persistence of diversity, which is strongly dependent of the size of interaction networks (R. Boyer & A. Orléan, 1992).
The introduction of a complexity degree of neighbourhood in interaction dynamics allows to give more relevant explanation of industrial dynamic and particularly on the contemporary industrial geography (M. Storper, 1997). Several *« stylised facts »* of industrial and spatial dynamics (A. Rallet & A. Torre, 1995) - such territorial crisis (JP. Gilly, 1997), industrial reconversion processes (P. Bernard & F. Wallet, 1996) or the difficulties of technological and organizational transferts - can be explained by the analysis above-developped, which shows thatthe formation of economic spaces is endogeneous to complex interactions between firms.
Nevertheless, some limits are typical of this approach. If we succeed to show the spatial diversity of coordination processes, the model gives a poor explanation of the evolution of industrial models in the long run. Particularly, we do not succeed in showing the hybridization of cooperation models (R. Boyer, 1998 ; JP. Gilly & F. Wallet, 1998), but this is in the diversity of this models that these phenomenons have their sources.

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