COMPLEXITY AND 'CULTURAL GROUP SELECTION' IN A TRANSPORT EVOLUTIONARY RESEARCH

GIANROCCO TUCCI

ABSTRACT: The main consequence of the failure stemming from the device of a rational 'representative agent' is a lack of realism and accurate predictions about human behavior especially when recognition of the importance of social values is needed for the formulation of economic policies. I take here the instance of transport infrastructure planning. When there is no rational explanation for a widely observed deviation from rationality, the next best set of explanations of human preferences and behavior should be based on arguments in which they may be helpful to the individual's group. Observation of the human condition from the point of view of a renewed conception of welfare economics, based on continuous variation and on the reflection that complex systems have a nested or hierarchical structure, suggests that a cultural evolutionary method of analysis might represent an appropriate line of research.
In this editorial note it is argued that the *functional hierarchy of control* exerted at the *group* level, through social norms or *memes* as constituents of 'culture', selects the actions of the controlled system belonging to the lower level (members of the group) to contrast the establishment of favorable premises for those actions which the single members were induced to perform for self-interest purposes. As a result, higher probabilities of surviving (welfare) are given to the social system in a context of uncertainty due to the disorder generated by inefficient forms of control.
In such a background, cultural group selection appears to be a viable means to incorporate social interaction among individuals in non-traditional utility functions and for the transmission of social norms emerging out as successful in terms of enhancing collective welfare. All that by partitioning individuals in groups and through the process of evolutionary selection between them.

INTRODUCTION

I ended the previous editorial note on the 'utility of an infrastructure project' [1] suggesting that a cultural evolutionary method of analysis might represent an appropriate line of work and a promising path for further research achievements in the formulation of sustainable transport planning configurations. The perspective proper of 'complex systems' and the multi-disciplinary methods of explanation proposed in the spirit of the "Wilsonian consilience" [2] between economic theory and the best available science from other relevant disciplines were the *leitmotiv* for observing the human condition and behavior from the point of view of a renewed conception of welfare economics. The latter based on continuous variation and on the reflection that complex systems have a nested or hierarchical structure which requires a pecking order of levels of inquiry.
In the present note, I intend to elaborate on this topic and present the issue of considering in our field of research: 1) a cultural evolutionary context where the higher level of organization than the individual is represented by 'groups' and 2) the functioning and relevance of their selection process as a knowledge basis of the complex structure of a social community for economic planning which takes care of efficiency and equity matters.

Before I enter into the description of the subject of an evolutionary analysis, I believe it proper to start by bearing in mind the essential features of the general distinction between dynamics and

[1] See this *Journal*, February 2005 issue
[2] See E.O. Wilson, *Consilience*, 1999, chp. IX – The social sciences

evolution. Even conservative systems which converge to a limit cycle are dynamic but certainly do not embed the idea of evolution. The construction of so-called dynamic models - let's say of urban structure and relevant transport demand - presents a dynamic characteristic only in the sense that they use a given set of years. Dynamics does not account for the emergence of different kinds of relevant state variables, much less new entities and new structures [3], and *per se* is not sufficient to characterize evolution. Conversely, the essence of evolution may be synthesized as the self-transformation of a system over time, and the evolutionary change has an endless path notwithstanding the existence of periods of stasis. Essentially, it needs - above all - a good knowledge of existing varieties [4]. Thus, the configuration and function of every city and the behavior of individuals within that city depend essentially on their mutual and complex co-evolutionary patterns.

In exposing my point, I am inspired by the research program of the *Santa Fe Institute Studies in the Sciences of Complexity* which is synthetically and substantially centered on the principle that the evolutionary approach has a natural basis in dynamics, but diverges from it as a dynamical system generally fails to accommodate the distinction between *agent*- and *aggregate*-levels (except by concealing it through the expedient of 'representative or identical agents' whose conduct is described by a tractable utility function, as assumed in neoclassical economic theories and policies that are developed independently of institutions and particularly of social norms).
It is a tenet of the neoclassical theories that rationality should be the criterion for examining patterns of behavior and irrational or emotive factors be left outside the domain of the utility function. Conversely, according to a different concept of economic theory and policy, irrational elements should not be excluded but efforts be made to incorporate them in the utility function according to the argument that these kind of elements may be helpful to the agent's group, even at an initial disutility for the agent himself. As it is efficaciously synthesized: "When there is no rational explanation for a widely observed deviation from rationality, the next best set of explanations should be based on arguments in which this behavior is helpful to the individual's group"[5]. Briefly, due to the bounds of rationality, an individual is incapable of taking account of all the implications that the available information permits when evaluating economic relationships. It is the perennial problem of the 'social dilemma' appearing when the search of self-interest by an agent in a group leads to less than optimum collective benefits.
Then, the main consequence of the failure stemming from the device of a rational 'representative agent' is a lack of realism and accurate predictions about human behavior especially when recognition of the importance of social values is needed for the formulation of economic policies. In addition, the unique perspective of a rational individual acting at a point in time is inappropriate to represent an adequate knowledge basis for planning sustainable transport infrastructure configurations, particularly (but not exclusively) when equity issues of groups forming a

[3] Physicist Norman Packard addressed this problem with reference to the dynamical systems approach by pointing out that: "If the set of relevant variables changes with time, then the state space is itself changing with time, which is not commensurate with a conventional dynamical systems model".
[4] See Ulrich Witt, "Bioeconomics as economics from a Darwinian perspective", *Journal of Bioeconomics* 1999, 1: 19–34.
[5] See A.E. Bernardo and I. Welch, "On the evolution of overconfidence and entrepreneurs, Cowles Foundation Discussion Paper No. 1307, Yale University, June 2001.

community are involved, as they are presently enlightened by the empirical findings and debate over *cultural group selection* [6].

An effort for efficiency and equity enhancing conduct becomes more successful in an evolutionary process if we consider one of its main characteristic - beyond the assumption of a bounded rationality - whereby agents tend to interact with those *of their own type* forming groups with progressively higher levels of homogeneity.

PREREQUISITES FOR 'CULTURAL GROUP SELECTION'

Depiction of the complex systems which suggests – as we shall see - to resort to *cultural group selection* [7] presents a series of difficulties – also at the level of mathematical treatment - related to the interactions of dispersed and heterogeneous agents, mediated by formal and informal institutions and subject to a process of continuous adaptation and dissemination of novelty. The main consequence is a diversity of variants or behaviours within a population far from any market equilibrium and social optimum. The efforts made to overcome such difficulties are directed at the *uncovering* of the social structure and the *modus operandi* through which such a structure comes out of different levels of organization.

In the example I made of urban structure and transport demand, to be conceived under the constraint of sustainability, consideration should be given to the "process of synergetic interaction and co-evolution among the sub-systems that constitute the city - namely the economic, the social, the natural and built environment - that guarantees a non-decreasing welfare level to the local population in the long run" [8].

Taking care of this process of co-evolution needs a preliminary change of the standard underlying mode of reasoning based on the idea of the existence of abstract types that characterize populations, synthetically named: "typological way of thinking". Typological thinking is a major obstacle for an adequate treatment of evolution because it assumes – according to Plato - that true knowledge is knowledge of types considered as unchanging forms that makes a species what it is. Mainly for this reason, it has been put aside in the biological realm (and subsequently in the cultural evolution milieu) to be replaced by "population thinking", which – after biologist Ernest Mayr – should be considered as a fundamental concept to deal with heterogeneous populations and their behavioral characteristics which change over time [9].

Then, it is useless to concentrate on one point of time and try to find an optimal solution for that time as the situation changes thereafter. Moreover, the peculiar perspective of a narrowly rational and selfish individuals acting at a point in time cannot adequately address collective topics like the one we are dealing with.

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[6] See J. Gowdy, I. Seidl, "Economic man and selfish genes: the implications of group selection for economic valuation and policy", *Journal of Socio-Economics*, 2004, 33,343–358.

[7] Cf. E. Sober and D. S. Wilson, (*Unto Others - The Evolution and Psychology of Unselfish Behavior*, Cambridge MA – Harvard University Press, 1998, Part I, 149-154, 186-191.

[8] See R. Camagni, R.Capello and P.Nijkamp, *Transport and communications for sustainable development*, United Nations Centre for Human Settlements (HABITAT).

[9] See Esben Sloth Andersen, Population thinking and evolutionary economic analysis, Postscript for the Japanese edition of Andersen's *Evolutionary Economics: Post-Schumpeterian Contributions.*

As I see it, what I have just depicted determines an *impasse* and hinders any effort for a more thoughtful planning of future infrastructure (locked-in) investments.

It seems to me that a way out to explore may be represented by the scientific contribution named as *metasystem transition theory*, or the conception consisting in the explanation of the evolutionary integration of systems at a low level of organization linked to the appearance of systems of superior levels (*groups*) that control them. Thus, full appreciation is given to *group* choices within a flexible framework, recognizing the importance of *within* and *between* group behavior [10].

We are in the domain of cybernetic analysis, particularly when it tries to explain systems 'organized in a complex mode' and having a *teleological* structure able to contrast any '*up settings*' through a *control* function. Due to this characteristic, I believe that the traditional cybernetic analysis, integrated by components of the evolution of complex systems, may contribute to the comprehension of the cultural evolutionary process, mainly of that part of it referring to that particular mechanism which social systems generate as a defense of their integrity.

All that is based on the recognition that 'groups' possess an outline of their own which in a statistical parlance shows a distribution of characteristics according to a "bell curve" and to a mean around which individuals gather. The concept of "population thinking" tries to take care of that and from biology is progressively expanding also in the sphere of the social sciences – particularly economics when it considers an economy as an evolving complex systems and is solicited by the cultural evolutionary approach to enter into the analysis of the properties of 'structured populations [11], where selection is supposed to take place at several levels including 'groups'. As Vromen efficaciously puts it: "Even if we were to conclude that human groups are not entities *sui generis*, this does not imply that groups need not be taken into account in analyses of economic processes. Human groups can be ephemeral. Yet the ways in which 'populations' are structured in groups and in which groups interact with one another may have a profound impact on how economic processes unfold" [12].

As Darwin asserted, in the human sphere the different forms of social aggregation may be subject to selective pressures that act more at a group level than at the individual one. Due to the conviction of the existence of social cognition among humans, *group selection* can be particularly explicative of the evolutionary process related to specific adaptive characteristics [13].

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[10] Through the Price's covariance equation of evolutionary change an analytical tool is given to ascertain the conditions under which the between-group selection overcomes the within-group one for the achievement of benefits to the group. (See Price G., "Selection and Covariance", *Nature*, Vol. 227, August 1970, pp. 520-521 and "Extension of Cavariance Selection Mathematics", *Annals of Human Genetics*, Vol. 35, pp. 485-490. On this matter see also J. Gowdy, I. Seidl, *op.cit.*, 2004.

[11] A given population may be structured according to different criteria: age, size, location and so on and a structured population model is a summary of rules specifying how the number and distribution of individuals within a population changes over time.

[12] J. Vromen, "Stone Age Minds and Group Selection – What Difference Do They Make?", *Constitutional Political Economy*, 2002, 13, 173– 195,

[13] J. C.J.M. van den Bergh, J. M. Gowdy suggest that group selection in human populations and thus in economic systems may be more significant, due to the fact that possible individual behavior is elicited or suppressed by culture. (See their "The Microfoundations of Macroeconomics: An Evolutionary Perspective", Tinbergen Institute Discussion Paper, March 13, 2000

A SYNTHETIC VIEW OF THE 'GROUP SELECTION' MECHANISM

As a premise, according to the theory of natural *group selection* and following the precepts of biology, systems are represented as a series of units arranged in a hierarchy: *individuals* (genes) are at the base tier, then individuals are collected together in *groups,* which are in their turn inserted into *meta-populations*. In each of these units the process of selection takes place on the basis of the criterion of the greatest *fitness*, which has an influence on the degree of 'adaptation' of each hierarchical level.

The *group selection* mechanism operates also in the cultural domain; its features differ from those of the natural evolutionary sphere, although they have in common the fact of being 'hereditary' (or transmissible) and based on variation. At the core of cultural evolutionism there is the idea that people imitate other people, according to the *conformist transmission rule* explained in a mathematical model by pioneers of the study of the cultural evolutionary process such as Boyd and Richerson [14].

The *conformist transmission* rule states that it is advisable 'to imitate the behavior which is most common or successful within a group'; this implies that all groups will become internally uniform, while those groups - where different forms of behavior were initially widespread - will begin to differ one from the other.

The structure of the mathematical model of *conformist transmission* entails that minimal differences in the initial distribution of 'beliefs' between different groups gradually increase through the mechanism of feedback inherent in this type of transmission: all it takes is for an increasing number of individuals to share a certain 'belief' until it predominates over all others. Thus, small differences *between* groups tend to be strengthened, while variations *inside* groups tend to vanish. The uniformity which results *inside* groups and the persisting differences *between* groups allow the *cultural group selection* to operate. The group whose possession of 'beliefs' is more beneficial is more likely to prevail over groups with less 'adaptive beliefs'. By 'beneficial beliefs' I mean those convictions which favor the setting up of a synergic or co-operative behavioral model inside the group for the purpose of safeguarding and increasing its welfare.

Culture, expressed with reference to *social norms*, is the crucial component of this selection process and operates through the imitation mechanism of the *conformist transmission* of the 'adaptive' variation, thus carrying out a form of *control* of individual behavior egoistically inclined to *free riding*. This course of action increases the frequency of synergic behavior by enlarging the variation between groups compared to the variation found *inside* the group and conferring stability to the evolutionary process because the behavior of the individual is subjected to 'control'.

The control function, therefore, takes a leading role in the passage from 'simpler' hierarchical levels to more complex ones, and the necessary condition for such a mechanism to evolve is the passage from individual selection to group selection.

Culture allows such a transition and stands for the form of control which encourages individuals to act according to a behavioral model that brings advantages to the social system (the group) to which they belong, rather than to actions they would be inclined to carry out if they did not have this form of conditioning.

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[14] See R. Boyd, P.J. Richerson, *Culture and evolutionary process*, The University of Chicago Press, 1985

The 'sociality' of the control resides in the fact that the whole accumulation of knowledge and belief that makes up the core of 'culture' is transmitted from one individual to another, through cultural replicators: 'memes', defined by Richard Dawkins as the 'constituent bricks' of mind and culture, like the *genes* which are the 'basic element' of the biological life [15], and provided that their identity is preserved during the transmission. A method of communication is just that proposed by Boyd and Richerson with their idea of '*conformist transmission'* previously mentioned.
Then, I come to this kind of synthesis: the *functional hierarchy of control* exerted at the *group* level, through social norms or *memes* as constituents of 'culture', selects the actions of the controlled system belonging to the lower level (members of the group) to contrast the establishment of favorable premises for those actions which the single members were induced to perform for self-interest purposes. As a result, higher probabilities of surviving (welfare) are given to the social system in a context of uncertainty due to the disorder generated by inefficient forms of control.
In such a background, cultural group selection appears to be a viable means to incorporate social interaction among individuals in non-traditional utility functions and for the transmission of social norms emerging out as successful in terms of enhancing collective welfare. All that by partitioning individuals in groups and through the process of evolutionary selection between them.

IMPLICATIONS FOR ECONOMIC POLICY

In a manner of an ending note, I wish to express a final thought stemming from the idea of the economy as an evolving composite system. As pointed out, single agent-based models cannot encapsulate properly the complexities of human behavior. Consequently both economic theories and policies should allow for consideration of hierarchical levels of organization and interaction within a society, primarily *groups* of agents in a framework of *within* and *between*-group diversity [16].
Now, the process of *group selection* previously discussed has important suggestions for economic policies and I intend to consider here one of its main implications strictly related to their formulation: the one whereby the impersonal *market* conception of mainstream economics is not the best vehicle for the expression of human preferences and choices on which economic policies are based. The reason is that – although preferences are made with no coercion and are established according to coherent use of information – they are devoid in that context of any regard to institutions in the kind of Douglass North's *informal norms* and thus lack any consideration for social values.
In another occasion, discussing the role of social institutions, [17] I had the opportunity to express the view that the *market* represented an ideal place to find the incentive to defect, that is to say, by 'loading' on the other party the risks involved in a transaction and seeking the maximum advantage without bearing the costs. This is a 'rationally' valid form of behaviour for the transience and

[15] Cfr R. Dawkins, *The selfish gene*, 1976
[16] See on this topic J.M. Gowdy, Altruism, evolution, and welfare economics, Discussion on Joseph Henrich's "Cultural group selection, co-evolutionary processes, & large-scale cooperation" *Journal of Economic Behavior & Organization*, Vol. 53 (2004) 69–73J.M. Gowdy, I. Seidl, "Economic man and selfish genes: the implications of group selection for economic valuation and policy", *Journal of Socio-Economics*, 2004, vol.33, 343-358;
[17] G.Tucci, "Envy Reduction in Economics: Equity, Altruism and 'Cultural Group Selection'", *Journal of Public Finance and Public Choice,* 2003, vol. 21, No. 2-3.

anonymity of the interactions and would be so only if neo-classical theories on the operation of markets were realistic. In markets that are not ideal, with asymmetrical information and incomplete contracts, the need for reciprocal trust becomes increasingly important. Here, one assumes that long-term contacts are set up between agents with the result that, - from fear of reprisal or from the need to establish a reputation for trustworthiness - signs of a truly cooperative attitude tend to appear.

Since markets, which differ from the ideal one described by the neo-classics, are rather frequent, one has to consider that an important form of social control is only the exchange mechanisms found in these markets. However, it is a form of control that operates at the level of the individual: it is not the social conditions which impose cooperative traits, but instead the need to make secure exchanges, and thus personal interest, that encourages individuals to behave 'socially'.

In a hypothesis of a perfectly competitive market, the selected traits are not cooperative because of the presence of strong incentives towards defection; while in the second, the accidental coincidence of individual *fitness* with collective *fitness* ensures that the market, in this particular context, acts as a form of control but at lower levels in the hierarchy. Then, in frequent cases of failure, in the non-existence of a market and in cases of a necessary reference to *groups* as I have tried to point out, other forms of control have to be referred to. Arrow remarks that norms of social behaviour, including ethical and moral codes, can be the reaction of society to the failure [18] and inappropriateness of the *market*, thus paving the way for other forms of *control* – specifically *culture* - and for the consideration of *group selection* as the basic reference mechanism in public policy settings as in the of assessing the 'utility of an infrastructure project'.

[18] Cf. K.J.Arrow, "Political and economic evaluation of social effects and externalities", in Michael D. Intriligator *Frontiers of quantitative economics*. Amsterdam, North-Holland Pub. Co., 1971, p. 22.