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Experiments in economics and psychology on the logic of collective actions and network cooperation

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This research program aims to use experimental economics to analyse cooperative behaviours on Internet networks. The experiments will be carried out jointly at the LABEX (experimental laboratory, CREM, University of Rennes 1) and at the ENST Bretagne (LUSSI).

Research issue: Internet networks as free cooperation places.

The success of the Internet is due to its technical and economical characteristics. The Internet is a group of interconnected networks which enable any user in the world to access instantly a shared basis of information and most often for free. Each user can download information; broadcast it to other users but also upload his or her own information and hence, contribute to enrich the content of the Internet. Thus, the Internet is defined by a strong degree of interactivity between users and flexibility in relation to a rather decentralized architecture.

Some interesting economical features add up to these technical characteristics: free exchanges are predominant on the Internet, whether they occur between non-merchant actors or between merchant ones. Numerous phenomena of cooperation are observed on the Internet: cooperation between network providers, interconnection agreements, software developments in order to operate the Internet (Free/Libre Open Source Software, FLOSS), cooperation among non-merchant websites (files exchange within Peer-to-Peer communities), but also on merchant websites (shared opinion about products on the Website of FNAC or Amazon, rating of sellers and buyers on e-Bay). Is this tendency to cooperation and voluntary and free contribution linked to the technical features of the Internet? Could it be explained by the origins of the internet as a research network based on peer sharing? Has this cooperation any chance to last and resist against the fact that networks and communities are becoming denser and denser?

The objective of this project is to study the characteristics and dynamics of behaviours in the context of network interaction, as it happens on the Internet. It aims in particular to improve the understanding of logic of collective action on the Internet. It will also study how collective action could be valued by merchant actors, whether they are companies that deal exclusively on the Internet or that have mixed activities (on the Internet and outer).

Internet: an essentially public good.

The Internet displays the characteristics of a pure public good, that is to say that most of the services and software on the Internet (and in first place informational services) are non-rivalrous and non-excludable. The Internet is non-rivalrous because consumption or use of the Internet (of services, software hold on the Internet) by someone does not deprive others of consuming or using it. The Internet is also, for most of it, non-excludable since most of the services are in open-access and free. Finally, the Internet depends strongly on net surfers contributions which satisfy the three conditions to define pure public goods:

- they are voluntary;
- they impose a cost to the contributor;

- finally, they bring a benefit for each member of the community.

The production of public goods such as the Internet constitutes a major issue in the way that nobody has any interest in producing it on his or her own, whereas the existence of these goods enhance everybody's situation collectively. Rationally, nobody would have interest to contribute to the public good Internet: since exclusion is difficult, each net surfer has individually interest to count on financing by other users. These are free riders behaviours. Economic theory, based on the hypothesis of maximisation of individual winnings predicts generalised free-rider behaviours that imply a sub-optimal supply of these public goods (non Pareto efficient) that could lead to the disappearance of these public goods therefore, how shall we explain that in real life net surfers do not hesitate to cooperate, providing information, services and software? To highlight this issue resorting to experimental economics proved to be very interesting. We will aim in particular the following applications:

- analysis of cooperative development of services such as FLOSS in network;
- analysis of the cooperative systems of reputation implemented by merchant websites such as e-Bay and which enable to stimulate online merchant exchanges;
- analysis of the phenomena of online exchange such as peer-to-peer and hacking (transformation of private goods or services into public ones using the Internet);
- analysis of the impact of network forms upon cooperation levels on the Internet.

These four applications tackle the issue of the relationship between collective action and collection valuation. Through these four applications, the objective is to understand the technical, behavioural, institutional factors that could encourage or destabilize collective action and to study the role of merchant actors in this collective dynamics. In the following parts, we are going to develop each application by defining a little the methodology we plan to use and providing some bibliographical elements.

1.Cooperative development of services within online communities.

The importance of cooperative development of services within online communities (such as for instance FLOSS) represents at first sight an anomaly in comparison with economic theory (and in particular with public goods theory). Thus, FLOSS has all the standard characteristics of public goods: indivisibility of use and high exclusion costs. However, more and more software are developed under open source mode. It meets here interestingly experimental outcomes about public goods games: subjects' contributions in experimental public goods are always significantly different from zero even if they remain sub-optimal and decrease as time flies. Beyond altruistic behaviours that could explain a part of these non-zero contributions, experimental economics underlines more fundamental explanations such as phenomena of reputation or reciprocity in iterated games. Once again, comparison with a quick analysis of online community phenomenon is interesting: a significant part of cooperative developments within these communities is done in order to acquire a good reputation, eventually valuable subsequently in financial terms. Besides, reciprocity plays a surely essential role within communities such as FLOSS ones: by contributing, I expect from my neighbour to respond to this signal and contribute himself. Conversely, I can choose to respond or not to a sub-contribution from my neighbour, retaliation consisting of reducing my own contribution.

In the context of experimental economics, we want to study cooperative developments of a service within an online community (comprising individual that don't know each other and interact at distance by a network). We will then introduce two kinds of incentives mechanisms: a private mechanism that consists in remunerating the ones who contribute to the development of the service and a public mechanism consisting in publishing (in open source sense) every development and contribution made by any member of the community. The objective is to examine how incentive mechanism at the basis of cooperative development of services can emerge within a community. Will we

assist to the appearance of mixed incentive mechanisms (both public and private) and how will these two mechanisms be combined (as complementary ones or as substitutes)?

2. Cooperative behaviours in network and reputation.

How can individuals that do not know each other and interact by a network such as the Internet trust each other? E-Bay case is interesting in this perspective; indeed this website has implemented mechanisms aiming to increase trust between its users and dissuade opportunist behaviours. Auction websites such as e-Bay are particularly exposed to free riders problems (DangNguyen and Pénard, 2004) [1]. In order to solve this problem, e-Bay has provided to its users a tool enabling to assess their partners. At the end of a transaction, each partner can proceed to a positive, neutral or negative assessment of the other partner. Beyond this reputation aspect generated by such a mechanism, this method is similar to a mechanism of penalties/rewards inasmuch as the assessment is expressed by a score attributed to each evaluated person: +1 for a positive evaluation, 0 for a neutral one and -1 for a negative one. Experimental economics enable to test the efficiency of such mechanisms in the context of a controlled environment enabling to isolate the influence of variables we want to test. The game that will be used is a public goods game with penalties/rewards. We can also test the impact of anonymity of decisions on individual behaviours. More precisely, is anonymity a sine qua non to the efficiency of such mechanisms? Although a certain amount of research work has taken interest into the effect of penalties and/or rewards when they are attribute exogenously (Yamagishi, 1986; Dickinson, 2000; Falkinson, Fehr, Gächter and Winter-Ebner, 2000), few research has studied the possibility for subjects to penalize and/or reward each other.

The carried out experiments will seek to demonstrate the actual efficiency of such mechanisms by separating monetary and non monetary consequences of penalties/rewards imposed to free riders. This experiment will aim also to put into light negative externalities of such mechanisms. Thus, for instance, what role does anonymity play in the efficiency of these mechanisms? What are the risks of retaliation? We will start from an investment game at the end of which partners will have the possibility to assess themselves simultaneously or sequentially. The point of these experiments will be to measure differences in efficiency of reputation mechanism in relation to their design (sequential, simultaneous, in one go or two).

3. The Internet as tool of public exchange of private goods and services.

The Internet presents the singularity to transform some private goods and services into public goods. Thus, the Internet facilitates the reproduction and diffusion of informational or numerical goods. Copyrights protection of these goods or of their owners has become technically difficult or very expensive. The expansion of peer-to-peer (P2P) networks illustrates well this problem. Music industry reckons to be victim of music files exchange practices within these P2P communities. Disc companies see in these practices the first cause of the decrease of their sales [2].

On a theoretical point of view, artistic creation appears as a particular kind of information that, until soon, was limited to an essential private sphere (copyright mechanisms, physical information support...). The advent of the Internet provides to informational and numerical goods its characteristics of indivisibility of use and high exclusion costs. It obviously constitutes an issue for the owners and distributors of these goods who find themselves deprived from an increasing part of their operational incomes and which motivates from them strategies of goods protection, increasing repression of hackers or diversification of the audiovisual offer (not free downloads websites, DRM implementation).

That being the case, a dilemma rises; the internet is a space of public goods production (collective production of information and services), but it is also a space which seems to threaten private goods production (through hacking, free-riding behaviours). This well-organised hacking system among net surfers occurs thanks to the intermediary of Internet providers. Hence, it brings the issue of the responsibility sharing between Internet providers and hackers in this system. Do first-order free riders have to be penalised (the ones that are downloading for free merchant media

through offering mechanisms such as peer-to-peer) or have we got to sue second-order free riders (Internet providers which enable this hacking)? The planned experiments should therefore imply a principal-agent structure with intermediaries and it will be possible to test different contractual mechanisms of price setting or penalties.

4. Structure of the interaction and cooperation network between net surfers.

Economists and sociologists published at the beginning of the 1960's a number of theoretical results that suggested adoption of individual behaviours of free riders would prevent public goods production from happening on a cooperative and self-organised basis.

However, taking into account the emerging effects that could be associated with the dynamics of social interactions within organisations structured as in informal social networks leads us to think that it would be possible to identify more precisely the requirements to see appearing cooperation incentives. The study of social network comes to complete the one of individual motivations. This debate could be compared with a number of discussions setting entirely decentralized production against centralized and/or hierarchical forms of organisations. This debate is at the centre of the opposition between the 'telecommunications' conception (centralized) and the 'computer networks/Internet' one (decentralized); once again it falls within the debate about software production on the model of 'bazaar' against the one of ['cathedral' initiated by Eric S. Raymond](#). This question is also found through architecture forms of management and information exchange such as centralized system or peer-to-peer system. Some studies on multi agents systems has shown that structure acts non-neutrally on the quality of the exchanges (May and Novack, Cohen, Masuda and Aihara). Hence, organisation may constitute another driver that enables to act on the quality of an exchange system.

How do information exchange and quality of cooperation between individuals depend on network structure? We suggest in this research to compare three structures that seem relevant in comparison with actual systems: a radial structure (representing a centralised system), a small universe network representing a structure of community P2P exchanges and finally, a fixed and strongly connected structure representing a system such as company Intranet. For each of these systems, identical hypotheses will be formulated regarding available information of agents and their operating methods.

[1] 78% of the complaints concerning fraud on the Internet registered by the National Consumer League in the US in 2000 concerned on line bids (Hooser et Wooders, 2001).

[2] According to CNC Médiamétrie, French people freely and illegally download 1 million pictures per day, one third being French productions.