HOW IS WATER CONTEXT IMPACTING THE RESULTS OF A ROLE-PLAYING GAME: AN EXPERIMENTAL STUDY

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Abstract

Role-playing games (RPG) are decision-making supports, developed in the field, and are used to help stakeholders' "point of view wording" in resources management situations. A particular RPG (KatAware) was built in the Kat River watershed (in South Africa), according to the ComMod approach, in order to help people in designing a shared water management plan. Only two sessions of KatAware were played, in which the players seemed to behave in a cooperative way. Unfortunately, the results obtained after having run only two sessions are ambiguous, as stationary replications of these sessions are difficult to implement. The experimental method allows such a replication by controlling all the parameters. The objective of the experimental method put in place is to assess game sessions outcomes and to reflect about general design rules and dynamics followed when building role-playing games.

Among all the parameters, the context of the game influences the outcomes. After having simplified KatAware, our study shows how the context, defined as the level of information carried by the game, could be decomposed and re-composed according to its main dimensions, i.e.: illustration of the instructions; communication; repetition of periods; players' experience. The impact on players' choices of different levels of these dimensions were experimentally tested with students (at the "Experimental Economics Lab in Montpellier", France). We assessed the impact of the two first dimensions: "illustration" and "communication", by comparing the outcomes obtained after having varied their levels with the results obtained with the referential treatment, in which neither illustration nor communication were introduced in the protocol. We showed that the addition of watery illustrative elements within the instructions, first by only introducing the sentence "*this experience is based on a water management situation*", and then by describing such a situation through a story telling, increases noise in behaviours. However, this watery context does not impact players' decisions in the same way as another context chosen - in our protocol: employees in a firm -, which provided more familiar cultural references to the players. Finally, players' argumentation of their choices - through an *ad-hoc* controlled communication treatment - improved learning outcomes: while the observed choices converge towards theoretical equilibrium faster when communication among players is allowed, the final equilibriums are not significantly different in presence or in absence of communication.

Key words : Context; Experimental economics; Role-playing games; Water management

1. INTRODUCTION

During the last decades, participatory or bargaining approaches emerged in resources management legislation. To develop these approaches, resource managers have to take into account the diversity of viewpoints in a population. A shared representation of a resource management problem is difficult to arise. Decision-making tools are made to support participatory processes. Role playing games (RPG) are one of these tools. RPG appear more frequently as artefacts that simulate a particular situation. They could be applied in many situations. RPG could be used with an educational purpose with the objective of explaining the players the complexity of the simulated system. RPG also could be used with a decision-making objective. In that case, i.e. when RPG are used as supports of a participatory initiative, they are built upon the stakeholders' point of view (ComMod 2003, Klabbers 2006).

Local stakeholders are involved in decision-making RPG as players; they face a simulated situation which is as much as possible representative to their real-life. The objective of introducing such a mimic representation of the reality in RPG is to stimulate natural reactions from the players. Through some of their behaviours when playing the game, the local stakeholders could exhibit the objectives and constraints that they face in their real-life. The scientists could obtain some indications about the stakeholders' reactions in the reality but the scientists could not conclude by extrapolating the observations they made after only one session of a RPG. The sessions have to be replicated in order to gather observations and to produce a sufficient quantity of data that could be statistically treated (Rouchier 2006). Such RPG, as a very complex experience in which the decision-making environment is built as much realistically as it is possible, is not repeatable in a controlled way without simplifying it.

This lack of repeatability for a RPG is the beginning of this study, which finally aims at understanding whether (and how) RPG could be a generic approach (i.e. a same tool for different field applications) and how RPG could be used complementarily with other decision-making tools. Our research trajectory starts with the construction of a RPG to support local participatory decision-making about water management and continues with the development of an experimental protocol to test economic hypotheses exhibited by the players involved in the original RPG.

When building the experimental protocol, we need to know how a complex tool could be simplified. There are two constraints: on the one hand a social and economic dilemma has to be maintained at stake and on the other hand the protocol has to be repeatable in a controlled way. This dichotomous issue is central in the simplification process we initiate; for each contextual element that frames the initial RPG, we have to choose whether we remove it or we keep it within the new protocol. Therefore what is the impact on decisions of each parameter of the protocol environment? This issue oriented us toward the analysis of the influence of context on players' behaviour.

Our research trajectory links two scientific cultures: research-action and experimental economics. Having crossed a somehow wide field, which ranges from two extremes which could be identified as "experience" and "experiment", has prompted us to a reflection on the similarities and distinctions between these two terms and also on the dimensions among which this diversity is expressed. We believe that there is scope for some clarification. On issues like water management, which naturally involve the contribution of various disciplines, it is important to achieve a preliminary clarification on the different meanings that the same term displays.

The emphasis in this paper will be on the explanation of the concepts and terminology defining the research framework within which our programme was developed, aiming at giving al least partial answers to the questions raised above. RPG decomposition started from the definition of the concept of "context" that groups several informational dimensions: the illustration of the instructions; communication among players; repetition of periods and players' experience. At this stage, we only assess the impact on behaviours of the two first dimensions, i.e. "illustration" and "communication".

The text is organized as follows. *Section 2* illustrates and discusses the research framework, main terms and concepts. The research trajectory is described in *Section 3.* Then the experimental protocol is presented in *Section 4*. The results are exposed in *Section 5*. *Section 6* concludes and provides the way forward of this research program.

2. CONCEPTUAL FRAMEWORK

Claude Bernard (1865) distinguishes two kinds of sciences: observational and experimental ones. Observations and experiments are both investigations and reasoning made by scientists in order to improve scientific knowledge. According to Bernard, the main difference is that *observations* are comparisons made among natural phenomena while *experiments* are comparisons made on modified phenomena. Experimental facts are provoked by the experimenter who builds a protocol, by following preconceived ideas about expected results. The experimental protocol is created in order to test theoretical hypotheses. Replications of the experimental protocol allow data gathering and, at the end of the experimental process, the comparison among the results.

Bernard however moderates this separation among observations and experiments. At the end of the process, experimental results are observed by the scientist; then Bernard specifies that experiments are not strictly different with observations: experiments could be considered as provoked observations. Therefore, observations could be seen as the central point in any scientific study, whatever the origin of the observed fact: natural or experimentally provoked.

Bernard presents what he considers to be the reasoning of a complete scientist:

1) the scientist observes a fact
2) according to this fact, an idea arises
3) about this idea, the scientist reasons, builds an experiment, imagines and realizes the protocol
4) from this experiment, new phenomena appear that the scientist has to observe, and so forth

The following figure represents Bernard's experimental reasoning scheme

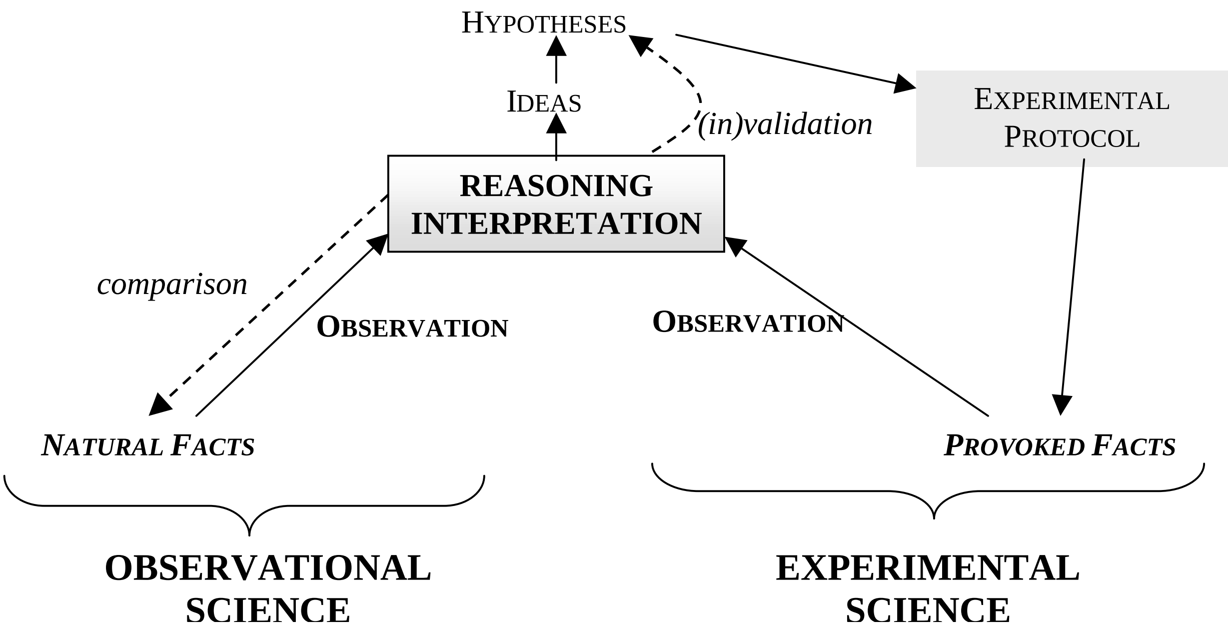

Figure 1 – Claude Bernard's distinction between Observational and Experimental Sciences

Bernard tries to define the terms "observation", "experience" and "experiments" by comparing each other. He distinguishes experiment from experience. According to him, *experience* gets the general sense of education acquired by life practicing, giving the word *experiments* the sense of provoked facts that provide such education and knowledge. Bernard also distinguishes experiments from observation. *Observation* is the basis for "mind which reasons", while *experiments* are the basis for "mind which concludes" at the end of the reasoning process initiated by the observations. As a consequence, *experience* could be obtained without doing *experiment*, particularly when experience is acquired after observing natural facts, as well as *experiment* could be conducted without improving *experience* when there is only observation of the results without comparison among observations and (in)validation of hypotheses.

This specification stated by Bernard underlies the distinction we propose, made among *experiments, experience* and *real life*. We attempt to define the frontier between the three situations. It seems important to clarify the concepts and terms that back our research trajectory and that drives our steps. In what an *experiment* differs from an *experience*? What do we need to create an experimental environment? This section attempts to provide elements of clarification to these questions and sets up a research framework within which our trajectory will then be positioned.

We all make *experiences* in every day life. From experiences we learn how to behave through a "learning by doing" process. We learn, and then we improve our knowledge, i.e. our experience. *Experiences* are therefore all kind of particular situations that we daily face and who participate to our *experience* improvement..

Bernard distinguishes natural and provoked experiences, specifying that there is a frontier between *real life* and *experiences* which is the **artificiality** of the last ones: phenomena are provoked while real life actions arise naturally. A particular phenomenon can be reproduced through an *artificial experience*, in which conditions are created ad hoc in order to allow perception and observation of the "fact" (or the phenomenon). The observed fact can be measured through quantitative or qualitative analyses. However, Bernard also states that a further and crucial step towards the formalization of knowledge was made through the capacity of replicating the same experience in a reasonably controlled environment. The possibility to control (as much as possible) in a laboratory the variables used to describe a phenomenon is essential to be able to replicate this phenomenon ad libitum and to always reach the same result. We might therefore suggest that the real criterion of distinction between an *experience* and an *experiment* is **control**, as whether this is possible; replication comes as a consequence. In other terms, an experience can be reproduced, but not necessarily maintaining constant (or modified in a controlled way) its parameters. Therefore its outcomes cannot be compared one another.

This second characteristic (i.e. control) represent the discriminatory criteria that transform an *experience* into an *experiment*. Even if they both participate in knowledge improvement, *experiments* are built in order to test hypotheses while *experiences* (natural or artificial uncontrolled situations) cannot be used to achieve this objective. Then, the "learning by testing" (i.e. experimental) process differs from the "learning by doing" (i.e. empirical) process by their methodology and objectives. While in the *experiences* the observer observes the "object", i.e. the phenomenon, in *experiment* the experimenter observes the "observed object", i.e. the object manipulated for the purpose of invalidating hypotheses.

As a consequence of Bernard classification, an *experiment* has three principles:

1) It consists of setting-up a controlled environment in order to reproduce artificially theoretical conditions and parameters,
2) It insures that the study can be replicated afterwards.
3) It insures that the study can be repeated anywhere.

These three principles are consistent with the goal of experiments, which are an attempt to reach verity, i.e. an attempt to understand and to know the laws underlying the phenomenon considered by the experimenter.

The following scheme (figure 2) represents the framework of the different concepts presented above.

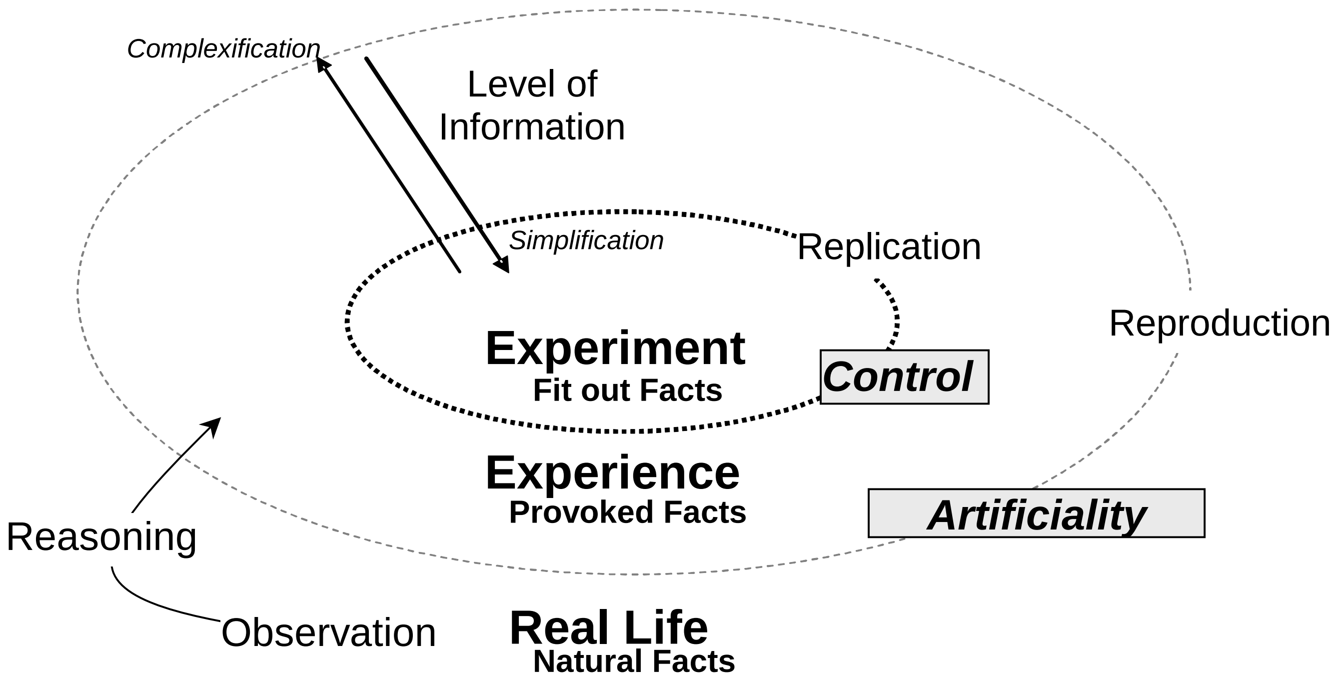

Figure 2 – Real life, Experience and Experiment domains according to the criteria of observation, artificiality, control, and level of information

Summarising (Figure 2), we are not interested here in natural facts, but only in those that, after real life observations that stimulates scientific reasoning, are artificially reproduced, through the creation of artefacts or situations. Provoked conditions in social sciences are made through protocols, using different kind of support, e.g. table games, cards, or drama that involve participants. These artificial environments allow people (those participating for instance in a game) to represent for themselves what happens, to interact each other and to measure the outcomes. Participants go therefore through a "learning by doing" process and improve their knowledge on the reproduced phenomenon.

The difference between a "real life" (natural) situation and an artificial one consists in the fact that the latter was intentionally provoked through the construction of an artificial environment and that, for this reason, can be performed. In social science, such an *experience* is usually a **"tool to tell"**, as its objective is to facilitate knowledge dissemination and people's interactions. An *experience* can also be reproduced at any time, anywhere and with any participant but with no total control on the parameters backing the representation of the phenomenon at stake. When control is possible, then we cross the boundaries between an "*experience*" and an *experiment*. *Experiments* are **"tool to test"** as they usually are constructed to test scientific hypotheses in a controlled environment and, through the replication of the same protocol, to verify statistically the robustness of results.

The nature of data and information required to construct an artificial experience is substantially different from the one required for an experiment. As experiences are tools to tell, they tend to put participants into realistic situations as much as possible, by reproducing the environment by providing information (i.e. building the context). Through these experiences, participants would be facing the phenomenon at stake in their real life. Conversely, an experiment is a tool to test hypotheses and therefore the quantity of information (i.e. the level of context) required for its construction is very specific and related to the variables to control. This information (i.e. the context) must be very precise and accurate on the aspects to be controlled and tested; it should be reduced to the minimum necessary to conduct the experiment.

Once the framework is defined, the different tools used by scientists from many disciplines that are involved in participatory approaches can be located along the frontiers. In participatory approaches, scientists could use tools like games, simulations or experiments. Each one has particular features, with advantages or limits according to the objective to be reached. Despite of this segregation among these three tools, experiments are however possible in gaming context when games are designed for a training purpose with well-defined objectives. This kind of “experimental games” are conducted in an educational objective, in which players have to follow strict rules (cf. serious games, Michel 2009, Szilas and Sutter-Widmer 2009). In other kind of games, such as participatory games which have an exploratory goal, the range of actions is wider for players who are free in their decisions. Therefore, it is more difficult to generalize the results obtained in this kind of games. The question is therefore: is it possible, in such a game, to define elements of control of the game? In other words, is it possible to establish strict rules for game-builders that allow the same controlled reproduction in different situations than in educational games, maintaining open the range of behaviours that players can usually exhibit in classical participatory games?

3. RESEARCH TRAJECTORY

The initial point of the trajectory started with the construction of a RPG built to support local participatory decision-making about water management. It continued with the development of an experimental protocol to test economic hypotheses exhibited by the RPG. The research trajectory follows the “centripetal” arrow named “simplification” of the level of information (cf. figure 2).

All along the development of the new protocol, the question of the way we have to follow in order to change the initial RPG within an experimental protocol was central. More precisely, what is the information we can remove from the RPG without impacting behaviours? Inversely, which element needs to be maintained in the new tool? Therefore, our main research issue moved from the test of Cooperative Game hypotheses toward the analysis of the influence of context on players’ behaviour.

3-1) From experience to experiments

A participatory RPG called **KatAware** (Farolfi and Rowntree, 2007) was developed within a project based on an approach called Companion Modelling (ComMod Group, 2003) to reproduce the functioning of a real catchment, the Kat River (South Africa). KatAware allowed local stakeholders (members of a Water Users Association, WUA) to play around water management. KatAware had many different objectives:

- understand the complexity of the Kat River system;
- understand the relations between agents;
- understand the impact of different water allocation strategies on the water flows, the profits, employment and domestic users’ satisfaction;
- build up a catchment strategy within the WUA.

In some ComMod experiences, local stakeholders take part in the design process of the RPG. As the players are involved in the design, it is impossible to repeat exactly the same experience with others players in order to gather knowledge. Indeed, new players that would be also involved in the design will produce a “new” RPG with new rules. As a consequence, each ComMod RPG is unique and make impossible any comparison in the results. Rouchier (2006) stresses that the first and most obvious limit of ComMod RPGs is “the lack of accumulation of a knowledge that could be generalized to more than one situation”.

During a RPG session many social phenomena may be observed and some can be seen as ‘exhibits’, consisting in empirical regularities for which, at the time, there are no well-developed theoretical explanations (Sugden, 2005). The two KatAware sessions played in the Kat allowed observing cooperation among the different players in the use of the water available from the dam situated upstream the catchment. This observation suggested an attempt of comparison between the results obtained through one of the two RPG sessions and a Cooperative Game theory model calibrated on the same data (Dinar et al., 2008). However, since there was no control of parameters in KatAware sessions, comparison between the two approaches (RPG outcomes and Cooperative Game Theory model) was impossible. Repetitions were therefore needed. Consequently, the idea (according to Bernard’s terminology) emerged to introduce control by building a “polished”, though still contextualized game derived from KatAware, to facilitate replication of experiments. The objective was to test cooperative behaviour of agents around water allocation and subsequent payoffs sharing.

The resulting new set-up, based on KatAware and called **KatGame**, aimed at testing hypotheses that lie behind the Cooperative Game theorey model results. In KatGame, many contextual features are derived from KatAware. Water is used for irrigation, domestic uses and ecological purposes. The subjects play the role of farmers. They have to make decisions implying the allocation of commonly owned water and the choice of cultivated areas. Payoffs are expressed in South-African Rands (ZAR).

The game simulates a water resource management situation. Water is stored in a dam. Unlike KatAware, where 7 different roles were played, with farmers and village managers, KatGame involves only three farmers. This simplification is a first step in the degradation[1] process. In our case, "degradation" means simplification and "de-contextualization" of the initial (and very complex) RPG, i.e. a proposition of a "coarser" or "poorer" representation of the KatAware situation, by identifying its main features as a "core" of the game and by accepting to move away from the reality that was mimicked within KatAware. The simplification from 7 to 3 players is an example of simplification. In a decontextualization purpose, the entire hydrological model is removed from the protocol in order to build a more abstract experimental protocol.

The choice of keeping 3 farmers is inherited from the Dinar et al.'s Cooperative Game theory model, where only three players interact (each one representing one subcatchment: Upper, Middle and Downstream). The three farmers in KatGame are cabbage cultivators (whereas they were either cabbage or citrus cultivator in KatAware). They can require water from the dam to irrigate more area than their initial endowment. The game is a one-shot round, like the Dinar et al's model, meaning that the farmers play only one period, corresponding to one year.

The Cooperative Game theory model with 3 players requires three coalitional situations:

1) singletons (each player is considered as one individual);
2) partial coalitions (two players group together) and
3) the grand coalition (the 3 players are part of the maximum level of coalition).

KatGame presents the same framework, with three phases. During the **first phase**, the three farmers play as singletons. They choose the area to cultivate and the corresponding water required without communication with the other farmers. During the **second phase**, two farmers play together in a partial coalition whilst the third farmer still plays alone. The farmers forming the partial coalition choose together the area cultivated by each one and the amount of water they required. The profit obtained by the partial coalition is common between the two farmers and side-payments[2] are allowed. Finally, in the **third phase**, the three players play together in a grand coalition. The same cooperative principle as in the second phase with two farmers is generalized to the group including all the farmers. The grand coalition is presented to the players as an "irrigation board", and consequently the farmers in the board manage collectively the water available from the dam. After having played the three phases, the players receive the results from each phase in terms of profit. On the basis of these results, they choose whether they prefer to be in a coalition or not and, if all the players want to be in the grand coalition, they are required to share the corresponding payoff.

The Cooperative Game theory model makes the assumption of players rationality, who are profit takers. By comparing the results of the test session[3] with the theoretical results obtained through the model, it can be observed that in some versions of KatGame, unlike in the theoretical model, the result is not super-additive[4]. Complexity of the water allocation rules could explain why players did not play "rationally", as expected in the Cooperative Game theory model. This point is central for the next step, when running experiments in a lab.

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[1] Degradation is a word used by modelists and we own it

[2] The side-payments theory is based on the assumed assumption than "the coalitional utility function is expressed in units of a divisible commodity which stores utility, and which can be transferred without losses to the players". If a coalition can obtain a total utility, this utility can be divided among the members of the coalition in any possible way. It is possible to transfer money among the players in order to reallocate the profit gained through the coalition. Such games satisfying these assumptions are called "transferable-utility games" (Parrachino et al. 2006).

[3] This game was tested in a classroom and there was no visual separation among players. The room did not get the usual characteristics of an experimental lab which normally allows anonymity among players and control for the experimenter. The participants did not receive monetary rewards at the end of the test

4 Let N be a finite set of n players in a transferable utility game. Let S and T be subsets of N (S and T are coalitions). Let v be a real-valued function defined over all the subsets of N. In the present experiment, v is the payoff obtained.

A transferable-utility game is super-additive if for all S, T included in N, with $S \cap T = \emptyset$

$v(S \cup T) \geq v(S) + v(T)$

The protocol was not completely definite to be conducted in an experimental environment. Some context aspects remain to be simplified. Firstly, the duration and the high complexity level of the game with three phases do not allow many repetitions during one session. Secondly, the experimenter has a strong role in KatGame. He is more an animator than an observer, in particular he intervenes in the design of water allocation rules, while in classical experimental environment the experimenter has to be as neutral as possible. As water allocation rules depend on the experimenter intervention, comparisons among sessions are impossible in KatGame. Thirdly, coalition formation impacts on the payoff structure (that could be "non super-additive", as stated above). Each group of 3 players can obtain different outcomes, and then the results can not be compared "ceteris paribus" (in that case, payoff structure changes among groups and sessions). These three limits of KatGame inhibit any test of hypotheses, requiring the design of a new experimental protocol, much more controlled than KatGame, which name is **KatLab**.

KatGame had still the characteristics of a partially contextualized RPG, and is considered as an experience rather than an experiment. KatGame had several phases to be played (singleton, partial coalition and grand coalition) in order to build the payoff framework. This made replication and **control** difficult and suggested to simplify further the protocol. KatLab was then constructed to be conducted in a laboratory. KatLab corresponds to a second step in the degradation process, following the centripetal arrow named "simplification" in figure 2. KatLab was built in order to cross the boundary between *experience* and *experiment*, by focusing on the main discriminatory characteristic: the **control** of parameters.

KatLab consists of a "one shot" game, where three players are given the results of a super-additive Cooperative Game theory set-up. The players choose 1) whether or not to stay in the grand coalition and 2) if they have chosen to stay within the grand coalition, the distribution among them of the payoff. This distribution (chosen by the players) is then compared with one of the theoretical reference provided by the Cooperative Game theory: the Shapley value.

The initial objective, i.e. the test of Cooperative Game theory hypotheses, remains but is relegated to the background behind the new issue that arose after the design of KatGame. The context simplification of KatAware, according to the willingness to control parameters and to import the game from the field to the lab, made central the following questions: what are the main characteristics of the context in any game? Once the main characteristics are identified, what are the influences of each one on players' behaviour? Could the scientist give prominence to a "game core", i.e. a minimalist structure that can not be modified without changing the whole nature of the game?

3-2) Context and Information

Experimental economists answer that the minimalist structure of the game has to be as simple as possible, with abstract protocols and instructions, in order to control all the parameters (Binmore 2001). The philosophy could be resumed to the following sentence: the lower the number of parameters involved in the game, the more efficient is the control. Moreover, as experiments are built in order to test hypotheses derived from theory (or from a preconceived idea, using Bernard's terminology), and since theory is universal and described in absolutely abstract terms, then abstract protocols provide the possibility to test hypotheses in "theoretical conditions".

However, Sugden (2005) stressed that from the beginning, experimenters have been criticized for their methodology, and more particularly for the 'artificiality' of the laboratory experiments, unlike field experiments, which are more concrete. Laboratory environments exclude features of the world that are crucial for the workings of real economic institutions. In other words, abstract context of experimental tasks removes cues that, in the field, help people to orient themselves, and the social norms that guide interaction in the field are not adequately reproduced in the laboratory (Faravelli 2007). In spite of the experimental economics methodological requirement, context is then introduced by scientists in protocols. This context introduction is motivated by different objectives (or needs):

- Evaluation of context impact on agents' behaviour.
- Willingness to be closer to the players' reality by introducing context cues.
- Willingness to make the actions at stake in the game more complex, while abstract instructions does not allow "fun" tasks.
- Context gives legitimacy to the game and allows appropriation by the players (when stakeholders) by facing realistic situations.

By introducing context, the experimenter seeks to go toward realism or tries to introduce a kind of control on players understanding and motivation that he loses when tasks are too abstract.

Harrison and List (2004) describe an auction experiment in which agents tend to pay goods they buy at a higher level than expected by auction theory. They speak about "winner's curse". This deviation from theoretical predictions disappears if the experiment is conducted with experienced agents (traders). Harrison and List define the notion of "*context-specific experience"*. They conclude that the highlight of the winner's curse phenomenon in student sample (without "auction-specific-experience") has not to be generalized out of this specific situation, because context influences behaviour by itself. Therefore, this result stresses that when studying behaviours, context has not to be totally removed, rather it has to be understood.

Harrison and List (2004) stated a classification of experiments according to the context level introduced in the protocol. They distinguish:

- *Conventional lab experiment that* is the classical experiment used in experimental economics, basic level, in which protocols and instructions are abstract, run in a lab, with students.
- *Artefactual field experiment, which* is a first contextualized level, keeping some *Conventional lab experiment* features: protocol and instructions remain abstract, but are not run in the lab with students. It takes place in the field with local stakeholders.
- *Framed field experiments that* are played in the field, with stakeholders, like an *Artefactual field experiment*, but protocol and instructions are contextualized.
- *Natural field experiment*. Agents are observed in their natural environment without realizing that they are participating to an experiment.

At this point, the question is to define what is the context of a game. We could define the context in terms of information, quantity but also quality of this information, characterized by:

» **information hold** by the agents ("past life", or experience), or *informational storage*,
» **information provided** to the agents in the game instructions, or *informational flow* from the experimenter to the agents,
» **information exchanged** among agents through communication, or *informational sharing*, depending on the media features, and based on the information contained within the instructions.

While experimenters have a full control on information provided by the instructions, they cannot fully manage nor the information hold by the agents neither the one exchanged among them (when communication is allowed). Agents' experience could be interpreted as a prism, which deviates initial information flow sent by the experimenter through the instructions. Each agent has her own prism, and then the same initial information contained within the instructions could provoke different interpretations. Context introduction in economic protocol can create heterogeneity in players' behaviour if compared with conventional lab experiment results, conducted with abstract protocols (Velez et al. 2009).

Gilboa and Schmeidler (1997) propose a representation of information hold by agents. According to their model, knowledge is a database which stores the history of the whole situations lived in the past. Within his personal database (represented by a matrix), each agent selects the situations (i.e. the vectors) which are similar to the situation the agent is facing. In front of each situation, the agent acts, and each action produces a result. The agent chooses the action which has led to the best result in similar situations lived in the past. By reducing the quantity of information in game instructions, and by controlling its quality, experimenters limit agents' experience interference in the results. Heterogeneity of behaviours derived from different interpretations of a same context is then managed.

However, Harrison and List's concept of "context-specific-experience" stresses the existence of some homogeneity of behaviours in front of context cues. By running the game with stakeholders from the same field, who usually face the same situations and have the same perception of simulated situations which reproduce their everyday life, this heterogeneity in behaviour is limited. Information provided by the experimenter is deviated by similar prisms.

The decomposition of the context in a protocol (as a quantity and a quality of information) leads to identify four elementary attributes:

1. The first attribute "**INSTRUCTIONS**" is the level of information ***provided*** by the instructions. The influence of this information (when they are present within the instructions) is usually treated in the literature under the name of "framing effect" (Tversky and Kahnemann 1981, Wang 1996, Eber and Willinger 2005, Kuhberger and Tanner 2010).

2. The second attribute "**COMMUNICATION**" considers the fact that the players can ***exchange*** information about the instructions, using a media (via face-to-face communication around a table, or through computerized exchange), and then the players modify their understanding of the game (Cardenas 2003, Carpenter et al. 2004, Ostrom 2006). Communication, which is essential in RPG design whatever the objective is (participatory or educational), can be strictly controlled in a laboratory. The lower level of information for this attribute is obtained in laboratory: players are located in boxes, without any possibility neither to see each other nor to speak together. Under this strict condition of “no-communication”, the observation of the decisions made by the others at the end of each experimental period is the only “indirect way” of communication among players.

3. The third attribute "**REPETITION**" takes into account periods repetition, which participates to the ***learning*** process (i.e. information acquisition). By accumulating information on other players’ behaviour, one player could modify his own behaviour all along the game repetition (Roth and Erev 1995). The one-shot game provides the lower level of information that can be acquired through a learning process. Inversely, by repeating several times the exactly same periods or by building dynamic games (i.e. situation of the game at period *n* depends on the results obtained during the previous period *n-1*), players can store information about the game and the others and then they can improve their experience.

4. Finally, the fourth attribute "**PLAYERS**" considers the level of information brought by the participants when coming into the game. Players’ ***experience*** (i.e. the information hold, or already acquired in “similar” past situations) conditions the interpretation they made about the information provided in the three other contextual attributes (information provided in instructions, exchanged through communication or acquired periods after periods). As stated above, experience has an impact on behaviour (Selten 1988, Gilboa and Schmeidler 1997, Harrison and List 2004, Brañas Garza 2006, Velez et al. 2009).

Each attribute participates to the complexity of the game (cf. figure 3).

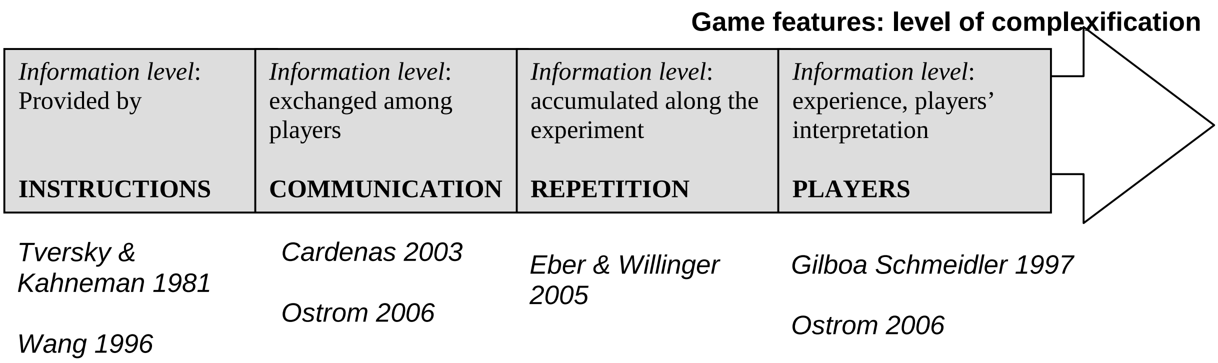

Figure 3 – Decomposition of context on few basic components (attributes)

The influence on agents’ behaviour of each attribute could be assessed experimentally. We make the hypothesis that an experiment can have different levels of contextualization (Wang 1996). The influence of each contextual attribute has to be tested separately, by isolating each one from the others. By considering a game in its minimal level of contextualization, more complexity could be obtained by changing some features of each contextual attribute of the game. Comparison of results from playing the different versions (with different context levels) of the experimental protocol is likely to provide elements of response to the research questions.

4. THE EXPERIMENTAL PROTOCOL

4-1) KatLab features

The problem treated is based on KatGame context (itself resulting from the degradation of KatAware). It concerns the allocation among users of a resource that we shall identify (in the more contextualized version of KatLab instructions) as available water stored in a dam. To handle this problem, we take as a reference the results of Cooperative Game theory with transferable utility, as used from the beginning of the degradation process.

Within the group of 3 players, various situations are possible, as indicated in table 1 below:

Each member of the group remains independent	Player A earns 75 000 ecus Player B earns 100 000 ecus Player C earns 200 000 ecus
The players A and B join together	A-B association earns 175 000 ecus Player C earns 200 000 ecus
The players A and C join together	A-C association earns 275 000 ecus Player B earns 100 000 ecus
The players B and C join together	B-C association earns 350 000 ecus Player A earns 75 000 ecus
The 3 members of the group join together	A-B-C association earns 500 000 ecus

Table 1 – KatLab frameword.

We suppose that the grand coalition is automatically formed (while in KatGame, the players were placed successively in all coalitional situations). In order to simplify the game, the intermediate situations (i.e. the partial coalitions) are not possible. Then automatically at the beginning of each period, the 3 players play together within the grand coalition. Information related to partial coalitions is given only for mutual knowledge. The instructions ignore the term "coalition" to whom we refer as "association" or "group".

To facilitate the playability of the experiment, various choices for the grand coalition payoff sharing (i.e. the 500 000 ecus) are proposed through cards. At each period, the players have to choose among the seven following propositions:

	Card 1	Card 2	Card 3	Card 4	Card 5	Card 6	Card 7
Player A	498 000	117 000	1 000	100 000	166 666	1 000	75 000
Player B	1 000	142 000	1 000	150 000	166 666	498 000	100 000
Player C	1 000	241 000	498 000	250 000	166 666	1 000	200 000

Table 2 – The cards proposed to the players.

Cards numbers are randomly defined and remain always the same whatever the treatment, the group of three players involved in the sessions and the period they play. Card 7 does not propose a grand coalition payoff sharing. It is the status quo card, letting the choice to the players to not participate to the grand coalition and then to remain independent. Thus the choice of card 7 is the non-cooperation choice. Cards 1 to 6 are based on different sharing rules for the grand coalition payoff (500,000 ecus):

- Selfish criterion in cards 1, 3 and 6

One player offers the two others the minimum payoff (1,000 ecus) and keeps the rest for himself (498,000 ecus). This proposition neither depends on the role (player A, B or C) nor on the values the players receive as singletons. Each player could be selfish, therefore three symmetric cards are proposed: cards 1, 3 and 6 in favour of players A, C and B respectively.

- Strictly equalitarian criterion in card 5

This criterion appears very frequently in experimental results despite the hypotheses that are tested in the experiments do not take it into account. Gamson (1964) proposes a equalitarian theory that makes the following hypothesis: agents in coalition prefer minimizing conflicts emergence and maintaining social interactions within their group in spite of maximizing their earnings as classical economic theory states. In card 5, each player receive exactly the same payoff, i.e. 166 666 ecus[5].

- Equalitarian sharing of the "surplus[6]" in card 2

Gamson (1964) considers that the strictly equalitarian criterion for the grand coalition payoff sharing is rejected in games in which initial endowments are not symmetric (as in KatLab where the initial endowments, i.e. the singletons payoffs, are heterogeneous). Conflicts could emerge strongly when one player's interest is below a particular threshold which could be his initial endowment. Therefore, an intermediate form of the equalitarian theory consists in dividing equally the surplus of the grand coalition instead of dividing the grand coalition payoff as a whole[7].

- Shapley values in card 4.

The ethical and efficient criterion usually used by economists in Cooperative Games theory is the one proposed by Shapley (1953). Shapley values are calculated for each player i as the mean of their marginal contributions to each coalition in which they participate, i.e. what one player "brings" when he comes into the coalition (Parrachino et al. 2006).

All the players play simultaneously and take one decision: each player of the group chooses only one card. If the 3 players choose the same card, they receive the amount indicated on the card. If there is no coordinated answer on the same card, they receive the values obtained as singletons (reminded in card 7). A session is comprised of 15 identical periods. At the end of each period, the individual choices and the card "solution" which fixes the individual earnings are provided to the 3 players of the group (but not the results of the other groups), before beginning the next period.

4-2) Stability of the grand coalition

The three players in a grand coalition have to make a coordinated decision on different alternatives. Among the seven cards that are proposed to the players (cf. table 2), only cards 2 et 4 are in the Core, which represents the set of allocations of the grand coalition payoff that respect the conditions of rationality and efficiency (Gillies 1953). Since cards 1, 3, 5 and 6 do not respect the rationality conditions[8], then the players would probably choose one of the two cards 2 and 4.

Each card is not acceptable to the three players in the same way. The stability of the grand coalition depends on what is allocated to each player. Therefore each one could have a particular incitation to remain within the grand coalition or to break it down. Gately (1974) introduces the concept of player i's *propensity to disrupt* a coalition: it is a ratio of what the other players lose if player i disrupts the coalition, to what player i would lose himself. High values appear when there are great losses for the others if player i disrupts the coalition, if compared with player i's own ones. In such a case, player i gets a strong propensity to disrupt the coalition (Straffin and Heaney 1981, Dinar and Howitt 1997). Gately values for each card are presented in table 3.

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[5] in that case, the total amount of the three players' earnings is 166 666 * 3 = 499 998 ecus; we consider negligible the difference with the grand coalition payoff (500 000 ecus).

[6] v(A) + v(B) + v(C) = 375 000 ecus ; v(ABC) = 500 000 ecus ; the surplus of the grand coalition with respect the singletons is S = 500 000 – 375 000 = 125 000 ecus

[7] The surplus S is equally shared among the 3 players, i.e. 41 666 ecus for each one, added to the singleton payoff, that is v(A) + 41 666 = 116 666 ecus rounded to 117 000 ecus for player A, v(B) + 41 666 = 141 666 ecus rounded to 142 000 ecus for player B and v(C) + 41 666 = 241 666 ecus rounded to 241 000 ecus for player C.

[8] The conditions of rationality (individual and coalitional) and efficiency are well presented by Parrachino et al. (2006). In KatLab, cards 1, 3, 5 and 6 propose lower earnings than status quo's ones, therefore there is no incitation for the players that lose money to remain within the grand coalition : two players receive 1,000 ecus through cards 1, 3 and 6 while their earnings are all higher when they are singletons and card 5 allocation proposes 166,666 ecus to player C whose payoff as singleton is 200,000 ecus.

	Card 1	Card 2	Card 3	Card 4	Card 5	Card 6
Player A	-0.82	0.79	-2.01	2	-0.18	-2.01
Player B	-2.26	1.98	-2.26	1.5	0.87	-0.69
Player C	-1.63	2.05	-0.58	1.5	-4.75	-1.63

Table 3 - Gately values for the six different alternatives

Negative values appear when there is a “negative loss” (i.e. a gain) for one part (for player i or the others) in disrupting the coalition: cards 1, 3, 5 and 6 propose agreements that make the grand coalition very unstable. This observation is not surprising due to the fact that such allocations are not in the Core (as stated above).

We can observe in table 3 that players B and C have higher propensities to disrupt grand coalition when card 2 is allocated than player A, who has a strong interest in maintaining an agreement on card 2 (GA = 0.79 < 1). Inversely, players B and C have lower propensities to disrupt card 4 than player A has. Players B and C’s symmetric propensities, different from player A’s ones, could be explained through the framework of the payoffs: the partial coalition {BC} is strictly super-additive, i.e. v(BC) > V(B) + v(C) while the partial coalitions they form with player A are only additive, i.e. v(AB) = v(A) + v(B) and v(AC) = v(A) + v(C). Player A’s weakness appears at two levels: firstly at the singleton level in terms of individual payoffs and secondly in partial coalitions. Due to this weakness, player A has a weaker power when he has to negotiate with players B and C. Moreover, while player A prefers card 2, card 4 is a better alternative than card 7 (which is applied in case of disagreement among the players) therefore the three players theoretically coordinate on card 4.

4-3) Experimental design and hypotheses

Each attribute of context reported in figure 3 is tested through KatLab, keeping constant the three others, in order to assess its impact on behaviours. Six treatments are built, based on KatLab (cf. table 4). The abstract treatment (treatment 0.0) only asks the players to choose among the seven cards (cf. table 2) the one which is closest to the favourite allocation, for themselves and for their partners within their group of 3 players. For the five other contextualized treatments, the protocol basis is exactly identical. The difference is firstly situated at the level of the instructions, to which additional information is added, and secondly by allowing communication.

<table>
<tr><td colspan="2" rowspan="2"></td><th colspan="4">Instructions</th></tr>
<tr><th>Abstract</th><th>Water : sentence only</th><th>Water : farmers</th><th>« no-Water » : salaries</th></tr>
<tr><th rowspan="2">Communication</th><th>Without</th><td>Treatment 0.0</td><td>Treatment 0.1</td><td>Treatment 0.2</td><td>Treatment 0.3</td></tr>
<tr><th>With</th><td>Treatment 1.0</td><td></td><td>Treatment 1.2</td><td></td></tr>
</table>

Table 4 – Number correspondence for each treatment of KatLab

Each treatment is played in two sessions. Each session gathers together 18 players, then there are 18 players * 2 sessions = 36 subjects per treatment. We follow the between-subject procedure, i.e. players participate only to one session and thus play only one treatment; therefore 36 subjects * 6 treatments = 216 subjects are mobilized for the whole experiment. The 18 players who participate to a session are distributed into 6 groups of 3 players, in a partner procedure, i.e. the group composition remains fixed during all the session. We obtain 6 groups of independent data per session (and then 12 per treatment). The players are paid in euros (€) at the end of the session according to their performance, which depends on the choices they have made throughout the game.

The participants are chosen in a base of "subjects" supplied by the Experimental Economics Laboratory from Montpellier (L.E.E.M). The students (Bachelor’s degree) who are registered in the base come from the different universities of Montpellier. We consider that students’ samples are homogeneous and composed by subjects with same experience about the context we are studying: water management issues.

Instructions at treatment 0.1 contain only one additional sentence when compared with instructions at treatment 0.0: "the experiment is articulated around a water management issue". Instructions at treatment 0.2 have a more important level of contextualization. The explanation of the sentence introduced in treatment 0.1 is provided. Players know that they are farmers who irrigate their superficies. Their environment reminds the KatGame (and KatAware) context, under degraded shape, with presence of a dam and the possibility to form coalitions in order to optimise the stored water uses. The asymmetric roles of players A, B and C are explained by differences of specific production functions for three different types of farmers. The context gradation between treatments 0.0, 0.1 and 0.2 allows us to measure the impact of water evocation within the instructions (via the “intermediate” treatment 0.1), and to measure the influence on players’ behaviour of the information provided in the instructions (via treatment 0.2).

Treatment 0.3 has the same level of contextualization than treatment 0.2, but refers to a firm organization context. Treatment 0.3 is a comparison session, in order to assess the influence of water evocation on behaviour, by contrast with another context chosen out of renewable resource management references. In treatment 0.3, players are described as salaried employees, who have possibility to cooperate in order to optimise their earnings. The asymmetric roles of players A, B and C are explained by efficiency differences related to their “seniority” and experience.

KatLab is built to provide elements of response to understand the influence on behaviour of contextual game attributes (illustration and communication), focusing on water context impact. Five hypotheses are tested to answer this question.

The first hypothesis concerns the impact of illustration on behaviours. Schelling (1950) introduces the focal point concept, stating that two agents can coordinate each other without communication, by tacit negotiation and according to a common cultural basis. Each agent identifies the most obvious solution that the partner would also choose because such a solution is remarkable for everybody among any other alternatives. We make the assumption that this kind of focal point also exists in KatLab and that the players will coordinate on it.

As the illustration of the issue at stake could be considered as a perturbation of the decisional environment, we suppose that illustration increases the uncertainty on decisions and that the players move away from the focal point. The first hypothesis is formulated as follows:

(H1). ***Illustration of the instructions induces a “noise” on players’ perception and on their behaviour: choices are concentrated on the same card in treatment 0.0 while they are dispersed on several cards in illustrated treatments.***

The two illustrations introduced in treatments 0.2 and 0.3 describe situations that explain the existence of the grand coalition and the asymmetric framework of the payoffs. They are not different in terms of “framing” (Tversky and Kahnemann, 1981), i.e. they do not introduce neither positive nor negative aspects with respect to cooperation; they are as much neutral as possible. Consequently, the same dispersion of the choices (as predicted by hypothesis H1) is observed with the same proportion in the two illustrated treatments. The second hypothesis is formulated as follows:

(H2). ***H1 does not depend on the contents of illustration***

Among the seven cards that are proposed to the players, the third hypothesis H3 identifies what is the focal point, as predicted by H1. As presented above (cf. part 4-2), card 4, built upon Shapley values, is the reference which determines what is the theoretical solution of KatLab. The third hypothesis becomes:

(H3). ***Grand coalition payoff sharing according to the Shapley value is the majority choice in KatLab.***

Communication is introduced in treatments 1.0 and 1.2. It allows players to exchange information with their partners within the grand coalition and facilitates the emergence of an agreement. Bicchieri and Lev-On (2007) states that communication improves cooperation in public good games; we consider that the same effect is observed in KatLab. The “dispersion” effect of illustration without communication, as predicted by H1, is corrected by communication which allows players to converge on the same card (card 4 as predicted by H3). The last asuumption about the effect of communication is as follows:

(H4). ***Communication improves coordination: in watery illustrated situations, communication (in treatment 1.2) prevents the noise that appears without communication (in treatment 0.2)***

5. RESULTS

5-1) Impact of illustration

The results are observed at the last period (the 15th one), at the end of the learning process the players develop by repeating the same decision-making action. We assume that there is no "last period effect", due to the cooperative framework of KatLab: super-additivity is an incitation to cooperate and the unanimity rule implies that the players have to reach an agreement. Consequently, if players coordinate on a same alternative during the previous periods, they have no objective reason to modify their choices at the last period.

As we can observe in graph 1 (cf. annex), at period 15 in treatment 0.0 the players converge on card 4 (Shapley), as predicted by H3. Therefore **H3 is not rejected**.

When instructions are illustrated in treatments 0.1, 0.2 the choices are not focused on card 4, rather they are distributed among cards 2, 4 and 5. Consequently, **H1 is not rejected**: the players do not converge on a focal point when the instructions are illustrated. However, in treatment 0.3, the players focus on cards 2 and 5 and reject clearly card 4. H2 predicts that H1 does not depend on the illustration contents, i.e. the distribution of choices must be the same at period 15 in treatments 0.2 and 0.3. The chi2 test measures the differences among two distributions of choices.

Table 4 below presents the Chi2 values[9].

	Cards								
Per. 15	**7**	**1**	**3**	**6**	**5**	**2**	**4**	Chi2	**prob**
0.0	0	1	0	2	10	6	17	12.8157	**0.9949**
0.1	0	1	6	1	9	9	10		
Per. 15	**7**	**1**	**3**	**6**	**5**	**2**	**4**	Chi2	**prob**
0.0	0	1	0	2	10	6	17	7.4490	**0.9411**
0.2	1	0	2	0	12	11	10		
Per. 15	**7**	**1**	**3**	**6**	**5**	**2**	**4**	Chi2	**prob**
0.1	0	1	6	1	9	9	10	4.5694	**0.7938**
0.2	1	0	2	0	12	11	10		
Per. 15	**7**	**1**	**3**	**6**	**5**	**2**	**4**	Chi2	**prob**
0.0	0	1	0	2	10	6	17	25.8039	**1**
0.3	1	0	0	0	15	15	5		
Per. 15	**7**	**1**	**3**	**6**	**5**	**2**	**4**	Chi2	**prob**
0.2	1	0	2	0	12	11	10	6.0379	**0.8902**
0.3	1	0	0	0	15	15	5		

Table 4 – Chi2 values (at period 15)

Treatments 0.1, 0.2 and 0.3 have different distributions of choices than treatment 0.0 with high probability (respectively 99%, 94% and 100%) enforcing the non-rejection of H1. However treatments

[9] The selfish cards (1, 3 and 6) and the status quo card (card 7) correspond to non-cooperative criteria, therefore we consider that they are not independent and we grouped them together. The Chi2 we obtained is calculated on the basis of 4 alternatives ("group 1-3-6-7", card 2, card 4 and card 5) with 3 degrees of freedom.

0.2 and 0.3 are different with high probability (89%) while treatments 0.1 and 0.2 seem to be closer one another (prob = 79%); the illustration contents (water vs. non-water) seem to impact players' choices stronger than the level of illustration (only one sentence vs. story telling). These observations allow us **to reject H2**: players' choices depend on the contents. This result questions about the influence of the narrative contents which seem to modify the representation the players have about the choice they have to make. Two interpretations are possible:

1) *Different perception of equivalent contents: the players are the deviation prism*

The cultural background, homogeneous within the sample (composed by students in KatLab), implies a shared representation in treatment 0.3 of a well-known illustration. The non-choice of Shapley (card 4) in treatment 0.3 and the focus on cards 2 and 5 suggest that maybe the students identify a focal point on equalitarian alternatives when the issue at stake is illustrated through "salaries" situation. "Salaries" situation in a firm could be closer to their own personal experiences than the "farmers" one, which could result too much specific for them. In the "farmers" case, the students do not identify the focal point. Maybe the results are different with other category of players, e.g. real farmers who know very well the situation described in treatment 0.2 illustration.

2) *Good perception of different contents: the different illustrations are the deviation prism*

Students could assume that salaries' tasks and status in the firm do not justify non-equalitarian solutions, by considering that all the salaries are equals and must really stand together within the firm. They could estimate that the Shapley allocation is more applicable among "farmers" who irrigate their cultures, and then they choose more frequently card 4 in treatments 0.1 and 0.2, whatever the level of illustration of the instructions. Therefore, through this interpretation we should consider that the players identify clearly the differences among the contents of illustration.

5-2) Impact of communication

Treatments 1.0 and 1.2 have exactly the same illustrations than treatments 0.0 and 0.2 respectively. The only difference between treatments 0.0 and 1.0 (as the one between 0.2 and 1.2) is the fact that the players are allowed to communicate each other in treatment 1.0 (and 1.2). The results are observed at two moments: firstly at the beginning of the session (period 1), just after the first phase of communication and just before the players learn about the experiment; and secondly at the last period (the 15th one), at the end of the learning process.

As we can observe in the graphs (cf. annex 2), at period 15 the players in treatment 1.0 converge on card 4 (Shapley), as predicted by H3. Therefore H3 is not rejected. In treatment 1.0 communication without learning (at period 1) allows the players to focus quickly on Shapley than in treatment 0.0 (cf. annex 1). However, Shapley has almost the same level at period 15 in the two treatments whom distributions of choices, evaluated through chi2 values, are very close (cf. table 5). This observation could be due to a strong illustration effect on decisions, which determines the final equilibrium within the choices. Communication could allow faster emergence of such equilibrium.

Periods	Cards								
Per. 1	7	1	3	6	5	2	4	Chi2	**prob**
0.0	0	3	2	1	22	4	4	19.3258	**0.9998**
1.0	0	4	0	0	19	1	12		
Per. 15	7	1	3	6	5	2	4		
0.0	0	1	0	2	10	6	17	4.6588	**0.8014**
1.0	0	3	0	3	6	6	18		
Per. 1	7	1	3	6	5	2	4		
0.2	1	1	1	0	23	6	4	8.6304	**0.9654**
1.2	0	5	2	0	16	7	6		
Per. 15	7	1	3	6	5	2	4		
0.2	1	0	2	0	12	11	10	9.5894	**0.9776**
1.2	0	0	0	1	5	17	13		
Per. 1	7	1	3	6	5	2	4		
1.0	0	4	0	0	19	1	12	41.7237	**1.000**
1.2	0	5	2	0	16	7	6		
Per. 15	7	1	3	6	5	2	4		
1.0	0	3	0	3	6	6	18	25.8889	**1.000**
1.2	0	0	0	1	5	17	13		

Table 5 – Chi2 values

In treatment 1.2, which is the most contextualized version of KatLab (instructions are illustrated and communication is allowed), the players choose the Shapley allocation more frequently than in treatment 0.2 (without communication). Communication reduces the noise but it does not eliminate it completely: card 2 is the majority choice instead of card 4 in treatments 0.0 and 1.0. The players do not focus on card 4 in treatment 1.2, they move away the theoretical solution: illustration, even if communication is allowed, still induces noise in the results. Therefore, **H4 is rejected.**

6. CONCLUSION

The interest of this paper consists in the attempt to provide a first conceptual framework within which the various steps of the research trajectory could be identified. The definition and clarification of concepts and terms required for the construction of the framework might be useful to produce at term a common basis for researchers involved in social experiences and experiments in the field of common pool resources management.

Our research trajectory can be introduced in this conceptual framework as indicated in figure 4.

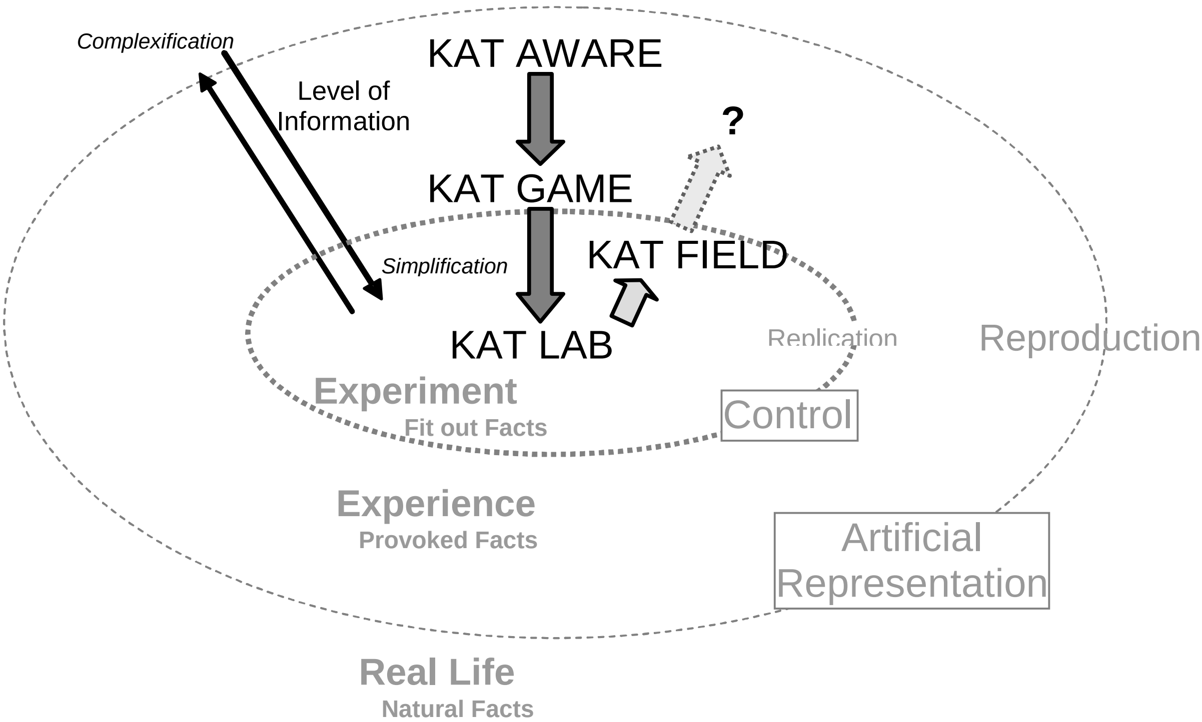

Figure 4 – Our research trajectory within the proposed conceptual framework

It is interesting to observe that the objectives of the three tools (KatAware, KatGame and KatLab) are different and reflect the evolution of the research questions emerged all along the programme: KatAware was a RPG aimed at improving stakeholders' knowledge and negotiations; KatGame was a first attempt to simplify the RPG into a laboratory tool to test hypotheses emerged during the RPG sessions and previously formalised into a Cooperative Game Theory model; KatLab is a further step into the experimental environment, the protocol is extremely simplified and does not only aim to test economic hypotheses, but also (and rather) to understand the impact of context into players' behaviour by comparing results of sessions played in the abstract set-up (treatment 0.0) with results of sessions played in contextualized ones.

Answering this question can have heavy consequences in the near future on the development of tools to facilitate stakeholders' water governance and common decision-making. The study of the influence of context may allow understanding whether the management of the commons requires dedicated protocols or, conversely, a "universal" and generic protocol exists. If protocols about the management of the commons (e.g. water) can be de-contextualized, then standard methods could be transferred from one place to another and at different times. Conversely, results could show that methods are strictly dependent from the issue at stake.

But whatever the conclusions arose at this stage, results are obtained with students whereas the tools we want to improve involve stakeholders. Therefore, after having tested the attributes "Instructions" and "Communication", the attribute "Players" has to be studied, in the field, by using a new protocol version. This protocol run in the field will be named KatField, and will be composed by the same six treatments than KatLab.

Until this stage, the research trajectory remained centripetal. The transition from KatLab to KatField is a new (reverse) direction, as Harrison and List (2004) have already proposed, starting from a conventional lab experiment to a framed field experiment through an transitive step: the artefactual experiment. The originality consists of passing by a different transitive step between the conventional lab experiment and the field experiment. By comparison with Harrison and List's approach (cf. figure 5), we also start from a conventional lab experiment (KatLab, treatment 0.0) but the artefactual experiment (i.e. the 5 other KatLab treatments) does not remain abstract in term of instructions and is not conducted in the field with stakeholders as Harrison and List's one. Rather, the artefactual experiment is developed in the lab with students in order to maintain control when testing contextualization influence. Once this influence evaluated, the protocol is transferred to the field, leading to the framed field experiment (KatField) with same characteristics as Harrison and List's one.

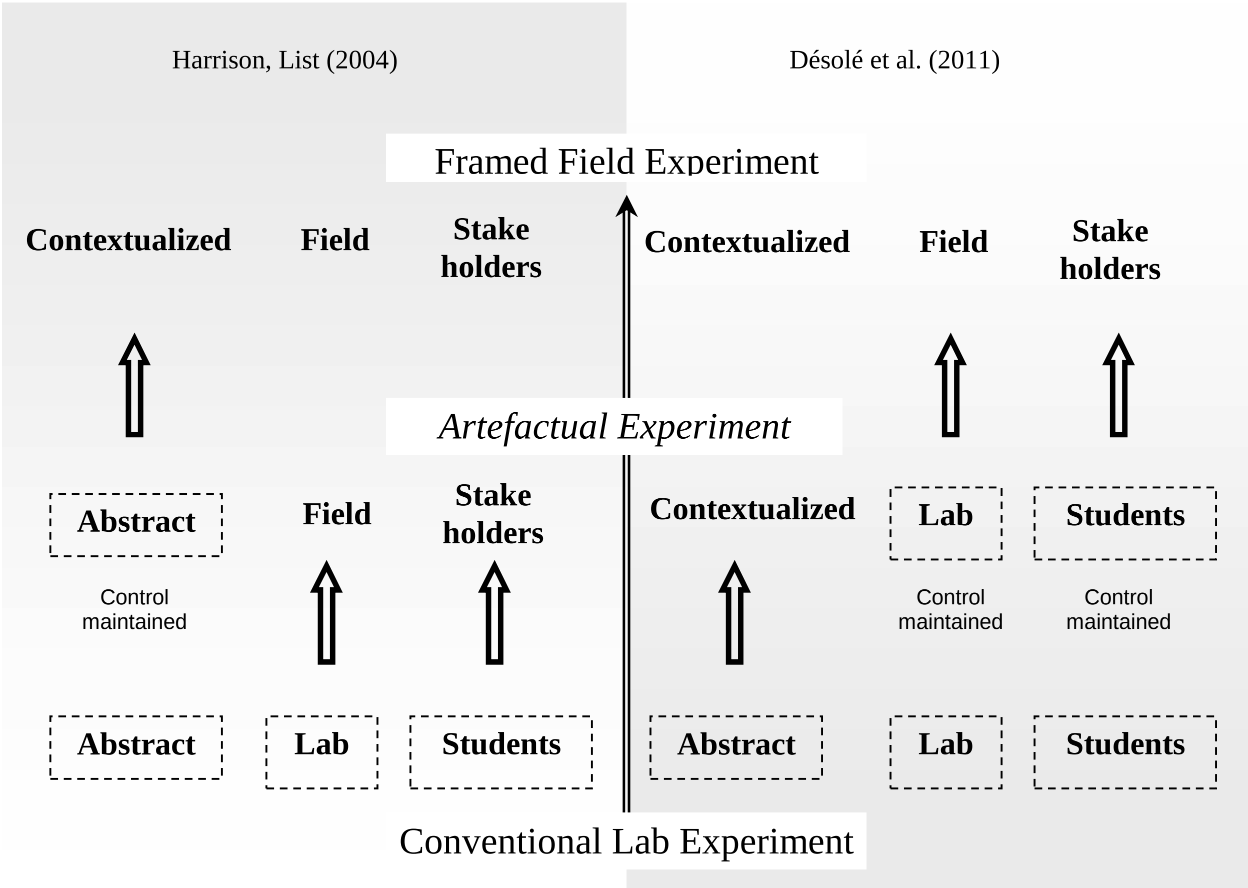

Figure 5 – Comparison between two different transition from the lab to the field

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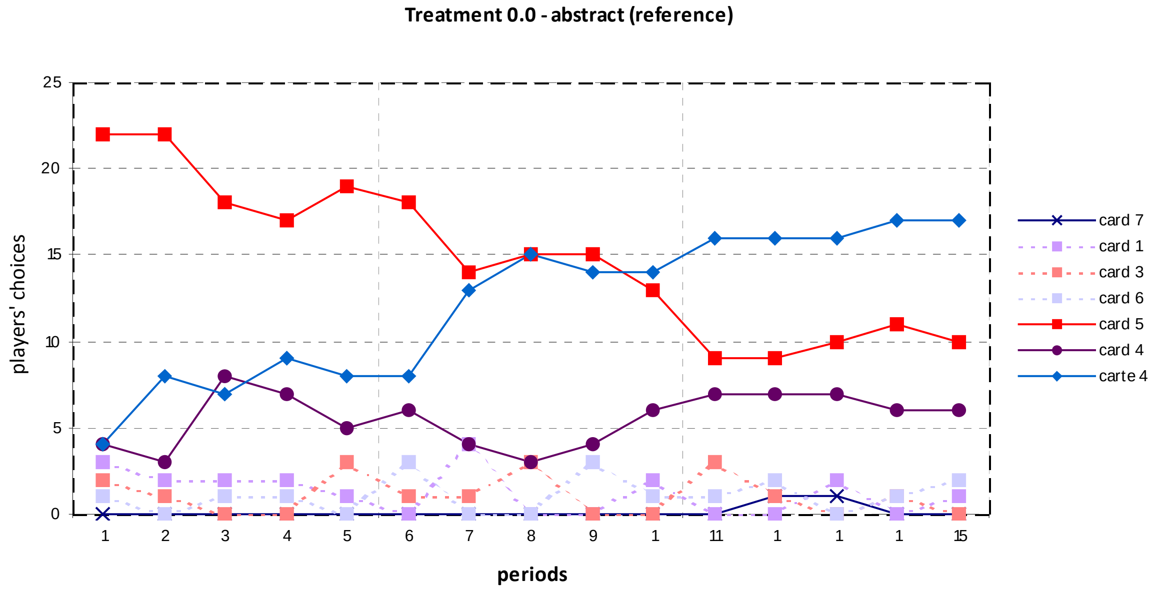
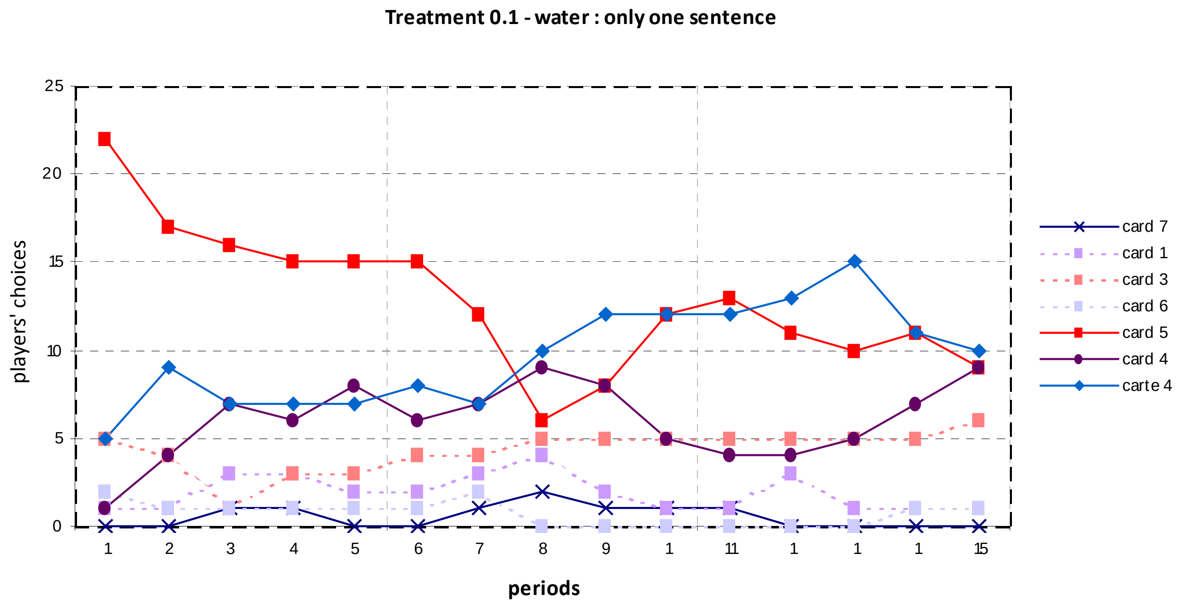
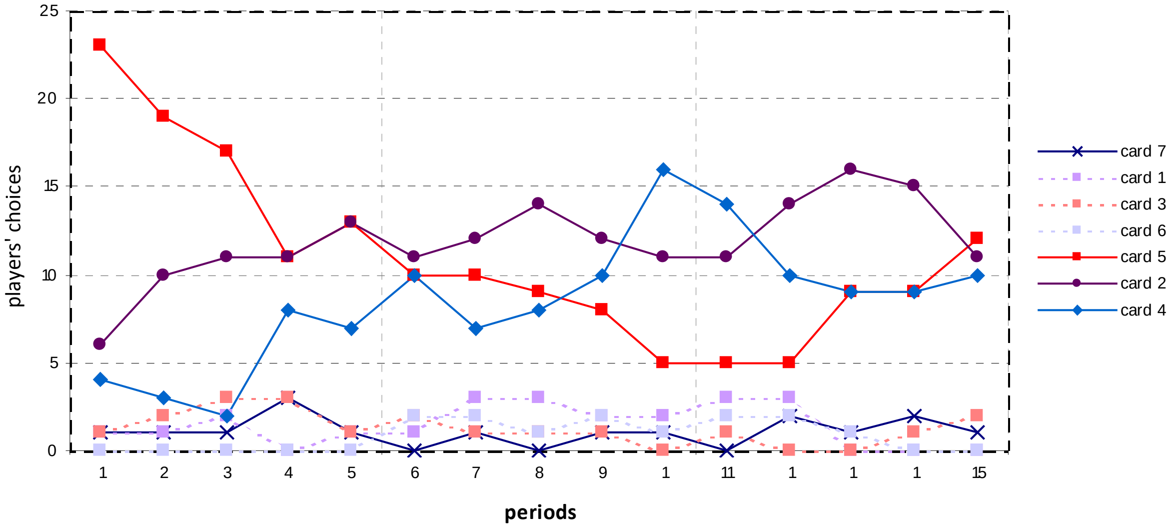
ANNEX 1

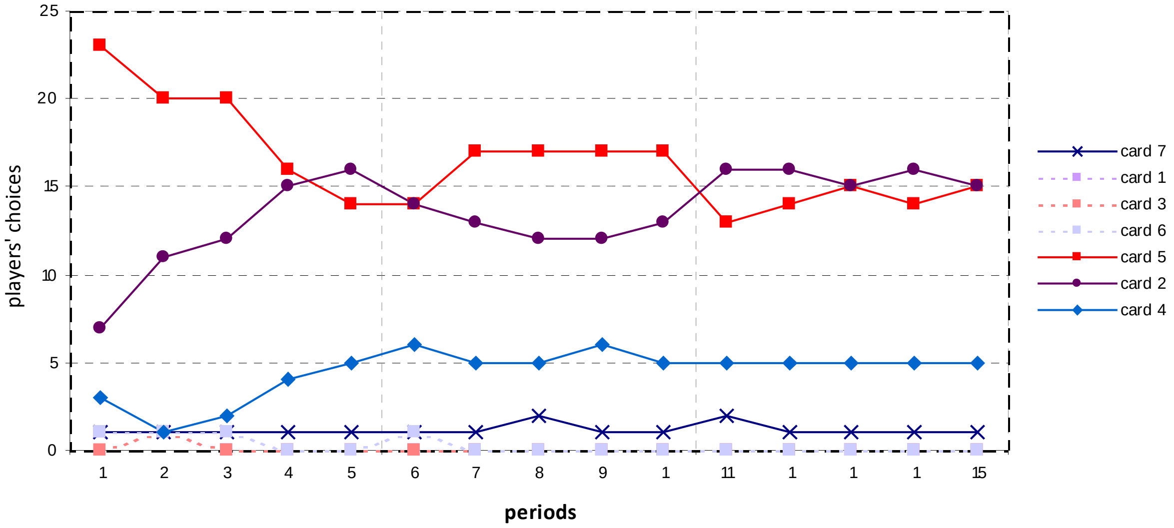

Treatment 0.0 - abstract (reference)
25
20
15
10
5
0
players' choices
1
2
3
4
5
6
7
8
9
1
11
1
1
1
15
periods
card 7
card 1
card 3
card 6
card 5
card 4
carte 4


Treatment 0.1 - water : only one sentence
25
20
15
10
5
0
players' choices
1
2
3
4
5
6
7
8
9
1
11
1
1
1
15
periods
card 7
card 1
card 3
card 6
card 5
card 4
carte 4

Treatment 0.2 - water : farmers

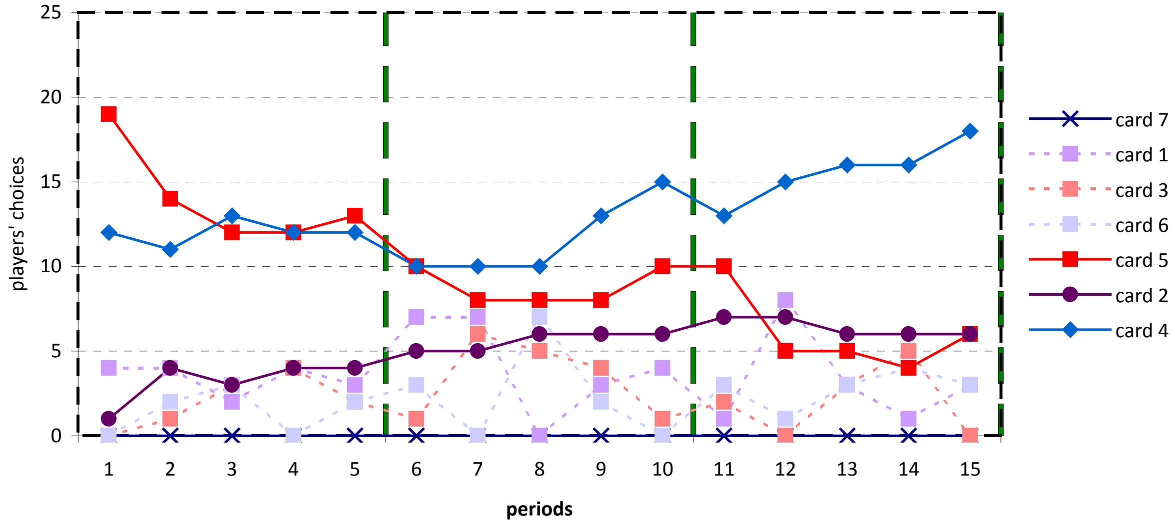


Treatment 0.3 - no-water : salaries



ANNEX 2

Treatment 1.0 - abstract, with communication



Treatment 1.2 - water: farmers, with communication