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Chapter 29

WATER USE STRATEGIES UNDER COMPETITION AND COOPERATION CONDITIONS

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ABSTRACT
Scarce natural common-pool resources – such as water – are often overexploited, resulting in drastic consequences for both society and the planet. An experiment was carried out in order to analyze the role of cooperation and competition in the use of water as a limited natural common-pool resource. To this end, 107 participants played the Irrigania simulation, in which they acted as farmers by deciding how to irrigate their fields over years. Before the simulation exercise, participants were randomly assigned to the experimental conditions of competition or cooperation. In the competition condition, farmers and their villages used a more selfish strategy to cultivate their fields (they used less rainfed crops and more groundwater irrigation), which produced lower benefits. Moreover, multiple regression analyses have shown that, under competition, benefits to farmers and their villages were reduced over time. Then, we discuss the relevance of providing individuals and groups with some sort of cooperative framework for environment-related decision making, perhaps by creating formative and educational programmes that allow individuals and groups to experience (a) cooperation and (b) the benefits that cooperation has at a practical level, both for themselves, and for society and the environment, which ultimately has a further impact on them.

Keywords: competition, cooperation, simulation, analytical strategies, water.

1. INTRODUCTION

On October 10, 2005, the Royal Academy of Sciences awarded the Nobel Prize in Economic Sciences to Robert Aumann (mathematician) and Thomas Schelling (economist), for their contribution to the analysis of conflict and cooperation from the Game Theory. These researchers sought to explain human behaviour in situations of war and conflict. The authors claim that, for a society to prosper, cooperative behaviour is necessary; indeed, they assert that psychology should provide more knowledge and research about how people manage to build a balance in conflict situations (Aumann & Schelling, 2005).

Currently many organizations generate situations of interdependence in which individuals try to maximize personal interests to the detriment of the group to which they belong. Environments that encourage competition make people have to face similar social dilemmas to those addressed in other sciences, such as economics, evolution, population studies, environment, ecology and urban design. For this reason, behavioural researchers have termed this phenomenon the Psychology of Sharing. Weber, Kopelman, and Messick (2004) defined social dilemmas as situations requiring decision-making focused on the question of ownership (what does a person like me do in a situation like this?). Social dilemmas are characterized by two features: (a) at any moment of decision, individuals receive a reward for making selfish choices rather than making cooperative decisions regardless of the choices made by those with whom they interact, and (b) those involved receive less reward if everyone makes selfish decisions than if they make cooperative decisions (Dawes, 1980; Messick & Brewer, 1983). In such situations, individual rationality leads to collective irrationality (Kollock, 1998). When a group has to share a limited number of resources, there is a tendency to act in a self-sufficient manner, even if they know that mutual cooperation could lead to a greater benefit for more people (Joireman, Posey, Truelove, & Parks, 2009; Steg & Vlek, 2009).

In the last few decades, social psychology has focused much of its efforts on investigating the processes that are generated in working groups. This interest reflects one of the

most important changes that have been experienced in the organizational field, the implementation of autonomous work groups. Therefore, Nadler and Tushman (1999) believe that the effective management of equipment is one of the key skills that organizations must take into the twenty-first century. Perhaps responding to these social needs, social psychology is interested in exploring the psychosocial processes that favour an individual who behaves cooperatively, valuing the group's interest more than their own self-interest.

By working in groups or teams, individual behaviour can be affected both positively and negatively. For example, classical references cited in *Journeys in social psychology. Looking back to inspire the future* (Levine, Rodrigues, & Zelezny, 2008) demonstrated that (1) the group could positively influence individual behaviour through social facilitation or mere presence (Zajonc, 1965); and on the other hand, (2) revealed that when collectivity facilitates anonymity, the individual may behave more violently or aggressively toward others than he or she would do in a situation of isolation (Zimbardo, 1969). Osofsky, Bandura, and Zimbardo (2005) argue that certain social situations could lead to an individual morally disengaging from an action just executed. Moreover, people use moral strategies to not feel morally responsible for the effect that their decisions or actions have had on those who have been affected. Thus, individuals need to categorize the situation before making a decision on how they will behave. Individuals ask: "Is this a cooperative or competitive situation?", "Is this a group or individual task?", "Is this a game or a problem to be solved?", "Is this a single election dilemma or a sequential dilemma?", "Is this a dilemma that demands an anonymous or public choice?" The definition of the situation informs the person concerned about rules, expectations, learned behaviours, skills and potential strategies that are relevant. In this chapter we show some variables that modulate the selfish behaviour of individuals in collective situations.

1.1. Social dilemmas in researches

In many cases, an individual's reasonable and justified behaviour leads to a detrimental outcome for the group. Such situations are called social dilemmas and are behind many of the social problems we cope with (Weber et al., 2004). Social dilemmas entail a conflict between maximizing one's individual benefit and the benefit of the collectivity (Parks, Joireman, & Van Lange, 2013; Zhong, Xu, Shi, & Qui, 2013). Perhaps the best-known social dilemma, and the most widely used in research, is the famous "Prisoner's Dilemma". When putting "Prisoner's Dilemma" into Google and Google Scholar, approximately 1,030,000 and 105,000 results are found, respectively. This type of social dilemma begs raises the need to choose between acting self-sufficiently and cooperating for the good of the collective. In 1968, Hardin analysed another social dilemma called "the tragedy of the commons", in which individuals have to choose between (1) acting according to their own self-interest and contrary to the long-term interest of their community by depleting some common resource, and (2) acting according to the interest of the community and agreeing with a more sustainable development. According to Hardin (1968), these kinds of situations are very similar to those raised today with the use and abuse of natural common-pool resources. Probably an entrepreneur will consider what to do about the possibility of gaining more benefices or lowering the production level in order to generate lower CO2 emissions; similarly, a citizen will wonder whether he or she would prefer to decrease the speed of his or her car to produce less pollution or to arrive early at his or her destination. As we see, these are social dilemmas in which individuals have to choose whether the self-interest or the collective interest will prevail. But when someone cannot be excluded from the benefits that others provide, each person will be motivated not to contribute to the effort of the whole, but to take advantage of the efforts of others. But if everyone chooses not to cooperate, it will be impossible to achieve the collective benefit. The question is to what extent can the group regulate themselves?

1.2. Cooperation, competition and water as a limited natural common-pool resource

Scarce natural common-pool resources are often overexploited, resulting in drastic consequences for both society and the planet. Water is a scarce and precious common-pool natural resource essential to human life. Shortages of water – mainly due to the climate – result

in problems for society and for the environment (Madurga, 2005). Thus, there is a relevant scientific and human interest in the study of the psychosocial variables related to pro-environmental behaviour (Markowitz, Goldberg, Ashton, & Lee, 2012). In this regard, it has been shown that competitive situations (Reeson & Tisdell, 2010) and situations of scarcity of resources (Gifford, 2011; Van Lange, Joireman, Parks, & Van Dijk, 2013) lead individuals to use more selfish and competitive strategies, whilst they tend to be more prosocial in cooperative situations. And similarly, prosocial individuals tend to show more self-interested behaviour in competitive contexts than in cooperative ones (Reeson & Tisdell, 2010).

From a social dilemma perspective, the decline in natural common-pool resources happens because individuals try to maximize their own interests without taking into account the negative community and planetary impacts (Joireman et al., 2009; Steg & Vlek, 2009). In conditions of scarcity, behaviour becomes more selfish (Gifford, 2011; Van Lange et al., 2013). However, cooperating implies laying aside our self-interest to protect the interests of others (Tomasello & Vaish, 2013). Moreover, Barker, Barclay, and Reeve (2012) have recently shown that, when submerged in competitive situations, the cooperation and profits of in-groups are reduced. Analysing the role of situational factors (competition or cooperation) in the selection of water use strategies when water is a limited resource is therefore of potential interest.

2. OBJECTIVES AND HYPOTHESES

The main objectives of this study were to examine: (1) the behaviour associated with water consumption from both an individual and a collective perspective; and (2) how certain situational variables (cooperation and competition) influence pro-environmental behaviour, indexed as water use strategies (selfish or prosocial).

2.1. Hypotheses

H1. Incomes will be higher for farmers and their villages in situations of cooperation than in situations of competition.

H2. Profits of farmers and villages in competition situations will be reduced over time, whilst profits of farmers and villages in cooperation situations will increase over time.

H3. In the simulated competition condition, farmers and their villages will use a more selfish irrigation strategy in the competition condition, whilst in the cooperation condition farmers and their villages will use a more prosocial irrigation strategy.

3. METHOD

3.1. Participants

A total of 107 students from the University of Córdoba (Spain) took part in the study: 70.5% were women and 29.5% men (*M* age = 21.28 [18 to 27]; SD = 2.18).

3.2. Procedure

First phase: Randomization of participants in the experimental conditions of cooperation (N = 52) or competition (N = 55). Cooperation condition: participants could talk to each other about strategies and income at the end of years 3, 6 and 9. Competition condition: no interaction was allowed; at the end of years 3, 6 and 9 they could see the recent annual incomes of their group members.

Second phase: Irrigania simulation (Seibert & Vis, 2012): a web-based game about the shared use of water. There are different villages, each comprising a number of farmers (participants) who have to maximize their net income by deciding how to use their 10 fields each year (the simulation ran for 10 years). Three irrigation options are available, each with different associated costs and revenues reflecting some aspects of reality: rainfed agriculture, river water irrigation and groundwater-based irrigation.

3.3. Measures, analytical strategies and decision making

Decision making was measured through the Irrigania simulation: 1) rainfed agriculture: lowest costs, but lower revenue; 2) river water irrigation: fixed cost, but revenues may be reduced if the river water has to be distributed among too many fields in a village; and 3) groundwater-based irrigation: fixed income, but the costs increase if the depth of the groundwater increases. *Selfish irrigation* was indexed as the difference between the number of fields under groundwater irrigation and the number of fields under rainfed agriculture (groundwater irrigation – rainfed agriculture), as the most extreme strategies, selfish and prosocial respectively. *Income* depended on weather conditions during the previous year, the mode of irrigation chosen and the use of water resources of the other farmers. *Village data:* to analyse village outcomes the individual matrix was transformed by using aggregated measures for 107 farmers from to 37 villages. We obtained good support for aggregation.

4. RESULTS

The ANOVAs performed showed that the benefits for both farmers and their villages were higher in the cooperative condition than in the competitive condition (See Figure 1 and 2); (2) both farmers and their villages used a more selfish strategy by irrigating a higher number of fields with groundwater in the competition condition than in the cooperation condition (See Figure 2); (3) both farmers and their villages used a more prosocial strategy by irrigating a higher number of fields with rainfed agriculture in the cooperation condition than in the competition condition (See Figure 3).

Figure 1. Accumulated income across the 10 years of the simulation at individual and village level for cooperation condition, competition condition and for the general sample (cooperation and competition conditions together).

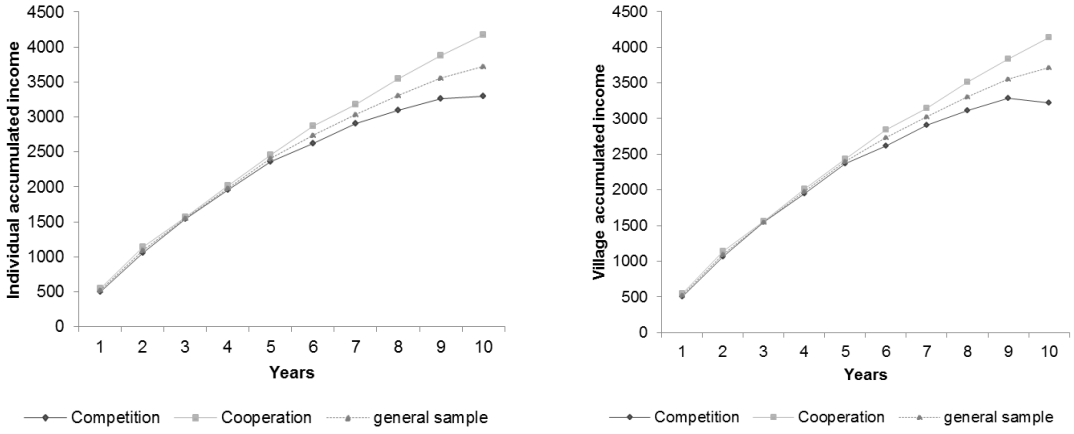
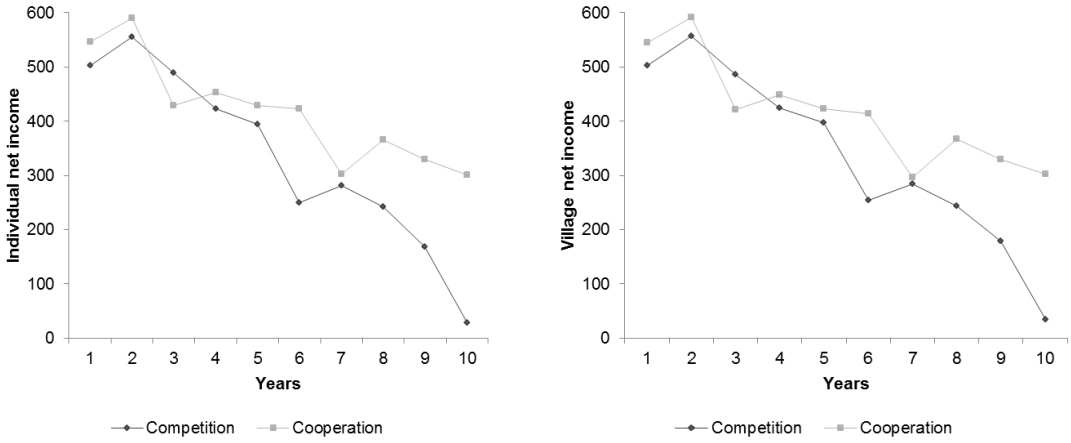
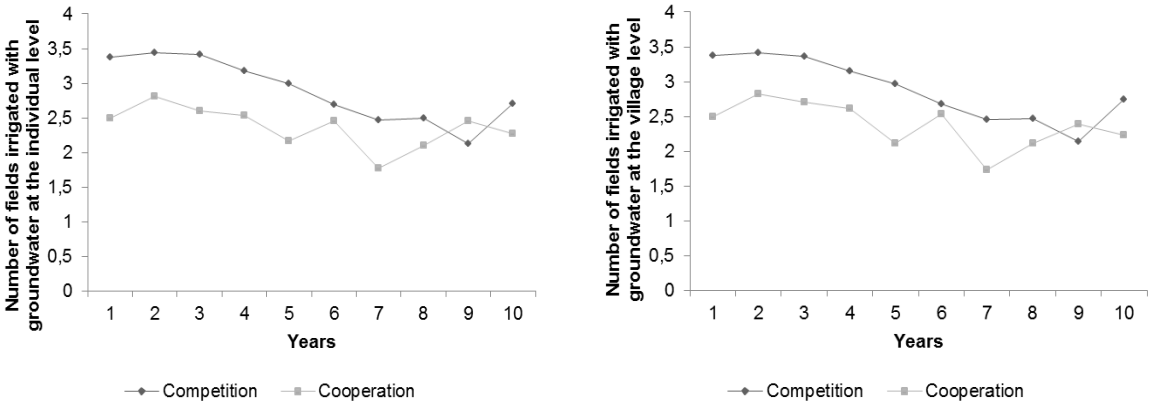


Figure 2. Net income across 10 years of the simulation at individual and village level for both cooperation and competition conditions.



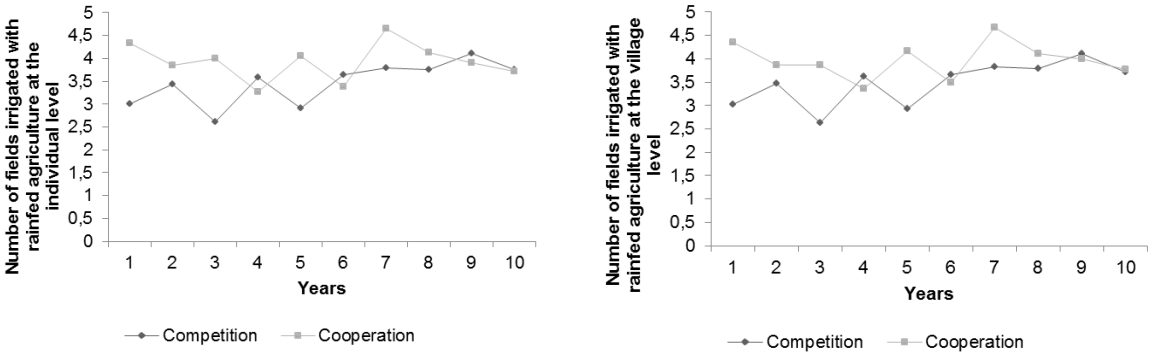
Moreover, the results of the ANOVAs showed that both farmers and their villages used a more selfish strategy by irrigating a higher number of fields with groundwater in the competition condition than in the cooperation condition (See Figure 3).

Figure 3. Number of fields irrigated with groundwater across the simulation.



Finally, the ANOVAS performed showed that both farmers and their villages used a more prosocial strategy by irrigating a higher number of fields with rainfed agriculture in the cooperation condition than in the competition condition (See Figure 4).

Figure 4. Number of fields under rainfed agriculture across the simulation.



5. DISCUSSION AND CONCLUSIONS

The present study showed that in a simulation, farmers and their respective villages working under competitive conditions earned consistently lower incomes; This is consistent with the statement that natural resources become depleted because individuals – especially in a competitive situation—try to maximize their own interests regardless of the repercussions this has for society or the planet (Steg & Vlek, 2009). In a cooperative situation both individuals and groups obtain higher benefits, both net and accumulated, than in a competitive situation, a result in accordance with previous studies (Barker et al., 2012).

Our results seem to corroborate the theories which hold that selfish and self-sufficient behaviors are increased in competitive situations (Weber et al., 2004), and that such self-sufficient behavior has a negative impact in the long-term, not just for the planet and for society in general when considering natural common-pool resources, but also for the individuals and groups which act self-sufficiently.

The results suggest that when individuals and groups are submerged in competitive contexts, they cannot escape the vicious circle in which they are caught, the conflict becoming increasingly destructive (Deutsch, 1990). In contrast, cooperation situations seem to protect individuals and groups against the conflict escalation resulting from the scarcity of natural common-pool resources, in line with previous researches (Gifford, 2011; Van Lange et al., 2013). Moreover, when exposed to competitive contexts, both individuals and groups tend to earn lower incomes, seeing their benefits reduced compared with individuals and groups submerged in cooperative contexts (Barker et al., 2012). Thus, some sort of cooperative framework for environment-related decision-making should be provided to individuals and groups. In this regard, it would be interesting to create formative and educational programmes that allow individuals to experience (1) cooperation and (2) the benefits of cooperation – both for themselves, and for society and the environment.

Thus, our results imply that pro-environmental educational programmes would benefit from taking into account the influence of cooperative and competitive contexts in students and adults. It should be emphasized that our results suggested that participating in cooperative actions could foster the development of a cooperative framework, constituting relevant previous experience that would promote more pro-environmental behaviours at both the individual and collective level, which in turn would benefit the planet.

Accordingly, in future researches, it would be interesting to measure performance on pro-environmental educational programmes and to evaluate whether the educational outcomes of such programmes are superior when education of cooperative contexts are applied in comparison with education of competitive contexts.

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