Using the Braess Paradox to Teach Tacit Negotiation

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Abstract

Background. Social dilemmas are situations in which following personal interest leads to collective disasters. Pollution, tropical deforestation, and the sustainable use of natural resources, can be characterized as examples of social dilemmas. In the negotiation literature, social dilemmas are known as tacit negotiations as individuals negotiate through moves rather than verbal communication. These negotiations are difficult to manage because of the absence of binding contracts and the interdependent nature of decisions of the parties involved. Therefore, it is important for participants to learn from activities addressing these issues. Although several negotiation exercises are available, it is difficult to find educational games or simulations specifically devised to allow several participants to face social dilemmas.

Purpose. In this article, we present a negotiation game based on a well-known social dilemma, the Braess paradox. The Braess paradox has been observed in many real situations and is particularly suited to highlight the core concepts of social dilemmas.

Approach. We will review the main negotiation activities focusing on the number of participants they are implemented for. Then we will present an activity which allows to accommodate up to thirty participants and allows them to understand some interesting aspects of social dilemmas.

Findings. Through the lessons gained by experiential learning, and the discussions emerging during debriefing, this activity may provide participants with a better understanding of urgent real problems.

Keywords: Braess paradox; debriefing; negotiation pedagogy; social dilemmas; tacit negotiation, conflict, cooperation.

Social dilemmas play an important role in negotiation. Moreover, social dilemmas help providing some solution to problems as pollution, tropical deforestation, and the sustainable use of natural resources and climate change (a review on gaming addressing climate changes problems can be found in Reckien and Eisenack, 2013). In fact, they are characterized by three aspects: the absence of contract and enforcement mechanisms, the moral and ethical problems, and finally the complex and dynamic interactions. All these aspects are common to most real life negotiations. Although both Thompson (2012), Brett (2007), and Raiffa, Richardson and Metclafe (2002) devote a full chapter to this topic, it is difficult to find negotiation exercises specifically written to consider several participants facing a social dilemma. With this note, we propose a negotiation exercise focused on highlighting the core concepts of social dilemmas and providing a real-world context.

The applications of social dilemmas in negotiation abound, nevertheless the most famous and utilized exercises in negotiation related to this issues are based on a special case, the prisoner's dilemma. As it is well known, in this situation players are individually better off playing a noncooperative strategy, although they could be collectively better off playing a cooperative strategy (Malhotra & Bazerman, 2007).

However, social dilemmas with several participants are more binding and complex situations than the classical two person-prisoner’s dilemma, as the presence of a potentially larger group makes social dilemmas more complex (Thompson, 2012). First, large groups enhance competition. An explanation of this effect is due to the sense of de-individuation. It has been long argued in social psychology literature that when subjects feel anonymous, they behave in a selfish manner (Zimbardo, 1969). Furthermore, social dilemmas involve also other social processes such as conformism, social norms and social comparison (Komorita & Parks, 1996). Second, competitive choices are more likely to occur as social costs are diffused among participants. For a review on the effects of size on cooperation see Romano, Merlone, Mosso and Spadaro (2016). In fact, in two-person prisoner’s dilemmas, a decision strategy has a direct effect on both players whereas in a social dilemma a person can easily feel authorized to defect because of the minor damage perceived (Thompson, 2012). In the field of helping behavior, this phenomenon is known as diffusion of responsibility (Darley & Latanè, 1968). Third, although in the repeated two-person prisoner’s dilemma individuals cannot

communicate, they can try to interact through their previous decisions. By contrast, in social dilemmas this communication strategy cannot be employed because of the presence of several participants. Even if we are able to modify another behavior with our action, the probability to influence more than one person in large groups is very low. Therefore, Yamagishi (1986) claims that in social dilemmas it is necessary a sanctioning system having the purpose to minimize the collective disaster which can, possibly, arise.

In this article, we first analyze the relation between social dilemmas and negotiation surveying the activities which are available to large groups. Then, we present a teaching tool and discuss the learning it can provide in negotiation courses.

Social Dilemmas and Negotiation

Social dilemmas are defined as situations in which "individual rationality leads to collective irrationality" (Kollock, 1998, pp. 183). They are relevant to negotiation because they represent a theoretical framework for conflict-negotiations in which individuals make their choices independently yet their outcome is interdependent (Thompson, 2012, Raiffa, Richardson & Metclafe, 2002).

According to Thompson (2012), a social dilemma is a situation in which a person, a company, a nation can choose between two ranges of behavior: either follow the personal interest or the collective one. The problem with social dilemmas is that if all the actors behave in a selfish manner, then collectivity will face a disaster. According to Dawes (1980, 1991), social dilemmas are interactive decision-making situations, which satisfy two necessary properties:

1) The presence of a dominating strategy. For each individual, the payoff related to defective choice is higher than the cooperative one, independently from what the others decide.
2) The presence of a dominated equilibrium. The payoff when all choose to defect is less than the one if they had cooperated.

Mak and Rapoport (2013), argue that the definition provided by Dawes is very strict because a wide range of situations in which we can see a conflict between maximizing personal interest and collective one would not be considered. Indeed they claim that "in social dilemmas the presence of dominant strategies is not specifically required" (2013, pp. 143).

Furthermore, according to Van Lange et al. (2013, pp.126) “this definition also does not include the temporal or time dimension”. According to Van Lange et al. (2013), social dilemmas can be divided in *social traps* and *social fences*. Social traps are situations in which a benefit in the short term leads to a huge loss for the collective in the long term whereas in social fences a short-term cost would lead in the long-run to benefits for the collectivity.

According to Kollock (1998), the most famous metaphor of social trap is the *tragedy of commons* (Hardin, 1968). In the tragedy of commons, N herders share a land where their cows graze. It is in personal interest of each herder to lead to the pasture as many cows as possible. Nevertheless, if each herder follows his/her own personal interest, the common source will be soon overgrazed, leading to a collective disaster (Hardin, 1968). Examples of tragedy of commons are overfishing, pollution and global warming. For this reason social dilemmas are well-suited to deal with one of the most urgent problems for human beings: climate change (for the importance of simulations and games on climate change see Crookall, 2013). The tragedy of commons can also been categorized as *take-some* game because individual decision consists of exploiting a common pool (Van Lange et al., 2013).

The most famous metaphor of social fence is *public good* (Kollock, 1998). “A public good is a commodity for which use of a unit of the good by one agent does not preclude its use by other agents” (MasColell Whinston & Green 1995, pp.359). In public goods, the temptation to enjoy the common good without contributing to it is known as the free rider problem (Kollock, 1998). In the provision of the public good, the free rider problem has been studied thoroughly, because of the possibility to be used by everyone “once it has been created” (Roth 1997, pp.30). Examples of public goods are public radio and television, paying taxes or voting (Thompson, 2012). Public goods can also been categorized as *give-some* game because the choice consists of contributing to a public resource (Van Lange et al., 2013).

The presence of more than two parties leads negotiation to be more difficult to control because it consists of “multiple differentiated parties, involve coalitions, span cultural boundaries, or be steeped in emotion” (Weber & Messick, 2004, pp.388).

Social dilemmas can be found in many political decisions. An example is the United Nations Kyoto protocol. In 1997, in order to fight global warming it was asked to developed countries to cut their emissions by 5%. To reach this goal, it was important that each country ratified the protocol. However, cutting emissions did not correspond to pursuing the personal interest of nations due to other aspects such as economic competition. Therefore, even though at the beginning some cooperation was observed, over time nations as Japan, Canada and China did not follow the treaty (Thompson, 2012). This shows how difficult is to control the

negative consequences of competitive behavior in situations involving several parties, great interests, and complex dynamics.

In business world as well, instances of social dilemmas abound. In fact, according to Thompson (2012), business competitors routinely face social dilemmas; see Brett (2007) and Thompson (2012) for some interesting examples which illustrate how self-interests and collective interests must be balanced in order to be effective in negotiating cooperation.

In this section, we have presented the main characteristics of social dilemmas, focusing our attention on different issues between the two-person prisoner's dilemma and social dilemmas with several individuals. Moreover, from the examples provided, we have seen as these differences are likely to make social dilemmas more difficult to manage. Therefore, Negotiation courses would benefit from exercises specifically designed for several individuals, underling the issues of social dilemmas, and at the same time easy to run.

A Review of Social Dilemma Exercises

Several negotiation exercises are available: it is possible to find about 213 exercises at Dispute Resolution Research Center at Northwestern University's Kellogg School of Management and 200 at the Clearinghouse of Harvard's Program on Negotiation (PON). For a review on simulation and gaming in the last 40 years see Chin, Dukes, and Gamson (2009). Furthermore, we rank them according to the number of participants. The statistics is presented in Figure 1. When the same exercise was available at both websites, it was counted only once. We do not consider those provided in Asherman and Asherman (1995) because they are aimed to only one or two roles.

INSERT FIGURE 1 ABOUT HERE

At a first glance, more than 50% of exercises are intended for three or less participants while those for more than seven are less than 5%.

Looking more closely at the graph, we can see the exercises requiring two participants are the most common among negotiation activities. Among these types of exercises, we can find those based on two-person prisoner's dilemmas. Although for these exercises it is possible to consider two groups rather than two persons, the dynamics remains related to a

two-person interaction. By contrast, we can see a dramatic decrease in exercises for several individuals, with just few exercises set for nine and more than ten participants.

The few negotiation exercises requiring more than ten participants are the *Family FOUNDATION AND WESTBROOK REGIONAL SCHOOL DISTRICT* (in the following FRANKLIN FAMILY) created by Catherine Preston and Lawrence Susskind (2006); the *GLOBAL MANAGEMENT OF ORGANOCHLORINES* (in the following MANAGEMENT OF ORGANOCHLORINES) created by Lawrence Susskind, Sarah McKearnan, Mike Gordon, Adil Najam, Joshua Secunda, Granville Sewell, Parag Shah and Andrea Strimling (1996); and *NATIONAL ENERGY POLICY SIMULATION* created by Eric Jay Dolin, Daniel Greenberg, and Lawrence Susskind.

FRANKLIN FAMILY involves several different roles, needs three rooms to be run and, ideally, requires a long preparation. MANAGEMENT OF ORGANOCHLORINES as well is a highly intensive exercise with several parties, considerable logistical requirements, and takes four hours in its shortest version. The NATIONAL ENERGY POLICY SIMULATION is an highly multi-complex party, presents multi-issue of negotiation and requires 7 hours to be run.

As these well crafted large number of participants exercises explore some interesting aspects such as multiple issues and role differentiation, they cannot be run with short preparation and in quick rounds as WIN AS MUCH AS YOU CAN (Wheeler, 2006a). This activity consists of a 4-person prisoner's dilemma game, and can be played in 10 rounds and lasts less than 20 minutes. For these reasons, it presents more complex dynamics than the two-person prisoner's dilemma, and, at the same time, it is convenient to run. However, the dynamics in a four-person prisoner's dilemma are still quite close to those in two-person prisoner's dilemma.

The tool analyzed in this article aims to fill the gap of the scarcity of social dilemmas exercises programmed for several participants and, at the same time, being manageable enough to be used in Negotiation courses with little preparation.

The Braess Paradox

The negotiation exercise we discuss is presented in this issue and is based on the well known Braess paradox (1968). The Braess paradox is the counterintuitive phenomenon in which

adding a new route in a traffic network worsens the congestion rather than increasing it (Braess, 1968).

Consider the simple network represented in Figure 2. Following Gisches and Rapoport (2012), we call this structure the *basic network*.

Now assume 30 individuals have to travel from vertex HOME to vertex OFFICE with the goal to minimize their individual travel time.

INSERT FIGURE 2 ABOUT HERE

Commuters have two possibilities, going through the Lake road or going through the River road. Both routes consist of a link with a constant travel time and one depending on congestion. For the first link, travel time is 28 minutes, and for the second one travel time increases linearly with the number of commuters, as illustrated in Table 1. In this situation, rational commuters will equally distribute between the two routes. Thus, the travel cost for the commuters in this situation will be 40 minutes.

Now assume a new link is added between the Lake road and the River road and assume that the travel time for this new link is 1 minute. This network is called the *augmented network*. (Figure 3). Thus, we can see a new possible route, consisting of the links HOME-Lake-River-OFFICE (Bridge road). Once the new link is built, a new equilibrium is reached, and all commuters will converge into the new route involving the new link. Therefore, the travel cost will be 49 minutes, with the paradoxical result of increasing both congestion and travel time (Rapoport et al., 2009).

INSERT FIGURE 3 ABOUT HERE

The Braess paradox can be compared to the Tragedy of Commons (Bazzan and Krugl, 2007; Hardin, 1968). According to Arnott and Small (1994), in the Braess paradox, commuters are not aware of the social consequences of their actions, which may lead to the exploitation of the common pool.

Commuters on the link	Travel time		Commuters on the link	Travel time
1	0’ 48”		16	12’ 48”
2	1’ 36”		17	13’ 36”
3	2’24”		18	14’ 24”
4	3’ 12”		19	15’ 12”
5	4’ 00”		20	16’ 00”
6	4’ 48”		21	16’ 48”
7	5’ 36”		22	17’ 36”
8	6’ 24”		23	18’ 24”
9	7’ 12”		24	19’ 12”
10	8’ 00”		25	20’ 00”
11	8’ 48”		26	20’ 48”
12	9’ 36”		27	21’ 36”
13	10’ 24”		28	22’ 24”
14	11’ 12”		29	23’ 12”
15	12’ 00”		30	24’ 00”

Table 1. Travel time on links HOME-Lake and River-OFFICE, depending on the commuters using the link

Possible implementation and educational value

In this section, we outline how the Braess paradox can be used to highlight essential features of tacit negotiation in an easy to manage large group activity. Therefore, present how the Braess paradox features are used to run the activity.

The activity we propose is based on the Braess paradox and can be played from four to virtually an unbounded number of participants. For numbers larger than 30, we suggest to use a z-Tree version of the game (Fischbacher, 2007). In order to simplify the explanation we will refer to a version with a number of participants equal to 30. In this case, the size of the group ranges from 4 participants to as many as 30. The necessary material consists of a projector to show instructions, a set of slips, a spreadsheet to compute the payoff and a blackboard to report results (Merlone, Mosso, & Romano, 2015). The total time for the activity depends on the number of participants and the number of turns the activity is run for; based on our experience 30 minutes are enough when considering eight participants for 20 turns.

Motivating participants in experiments is a well-known problem (Smith, 1991). Economists and psychologists do not usually agree on whether monetary incentives improve performance in laboratory experiments (Gneezy & Rustichini, 2000). For example, Frey and

Oberholzer-Gee (1997) argue that monetary rewards may have a negative effect on intrinsic motivation; for further discussion see Dal Forno and Merlone (2012). According to Ryan and Deci (2000), the quality of experience and performance can be very different when one is behaving for intrinsic versus extrinsic reasons. Although intrinsic motivation has emerged as an important phenomena for educators, we believe that in experiments and learning activities also extrinsic motivation may play an important role and provide participants further incentives. Furthermore, we believe that the presence of a prize can enhance competitive behavior. In our experiences, we used either additional grades or a prize to be assigned to participants depending on their performance. The activity is articulated in four phases: instructions, interaction on the basic network, negotiation and interaction on the augmented network. During the instructions phase, the basic network is either showed on a whiteboard or projected on a screen, then the situation is explained and several examples provided. Some training sessions are introduced in order to "make sure that subjects understand what is in their 'real' interest, what 'ought' to be done rationally, or what 'really' to expect from others" (Guala, 2007, pp.144). Participants are told that the goal is individual, underlying the fact that the chances to win the prize depends on the amount of points accumulated.

Most of the participants usually converge to the new route, i.e., the Bridge road. This is common in social dilemmas: the new collective resource is depleted and a collective disaster happens (Kollock, 1998). Furthermore, as in prisoner's dilemma like games, which allow for negotiation, contracts are not enforceable. In this case, having several participants, even a tit-for-tat strategy (Axelrod, 1981) is not effective.

An activity based on the Braess paradox has crucial aspects that illustrate the differences between a two-person and a *N*-person prisoner's dilemma. First, it allows several participants to participate. With the few exceptions exposed in the previous section, we have seen as most of games used in negotiation courses are intended for two participants. Second, it involves group processes, which increase competition such as a sense of de-individuation, the presence of social norms, and social comparison. Third, negative social costs of individual behaviors are spread out. Fourth, individuals have less control over the situation. As pointed by Gisches and Rapoport (2012, pp.291) the Braess paradox is different from other dilemmas since "altruism, reciprocity, and punishment, which play a major role in dyadic interaction have no effect on route choice with a relatively large number of players in each group". Therefore, understanding the Braess paradox means to have a better appreciation of the reward structure leading to social dilemmas. Furthermore, the Braess Paradox has concrete applications to real life situations. Examples of concrete applications have been illustrated by

Murchland (1970) and Youn (2008). Muchland analyzed how in the city of Stuttgart the construction of new routes failed to obtain the expected outcome; Youn studied more than 200 routes in Boston, and pointed out that the Braess paradox is not just a theoretical issue.

Other issues related to a Braess paradox game that can be discussed are both some core aspects of prisoner's dilemma and the differences from other social dilemmas. First, some rationales behind the collective disaster of non-cooperative games: the tension to minimize the loss and maximize gains, the differences between competitive strategies and cooperative ones, and personal biases such as the attempt to earn more than others. Second, a discussion about possible ways to implement cooperative behavior in social dilemmas. Third, the inefficacy of communication in social dilemmas, cheap talk contracts and not enforceable contracts. These issues may be discussed in the debriefing phase. For details about the importance of debriefing see Crookall (2010).

Figures 4a and 4b show the choice patterns of two sessions of the game, which were conducted with 9 and 29 participants of University of Turin and University of Chile respectively. As we can notice, with the basic network we can see a situation of equilibrium in the choice of the two routes available. On the contrary, once the new route is introduced, participants converge to it, no matter of the number of participants, the period of communication provided and different cultures in which the game is played.

INSERT FIGURE 4a ABOUT HERE INSERT FIGURE 4b ABOUT HERE

In both examples, a period of communication between the two interactions has been provided. According to our expectations, all the deals made during this period have been violated once the second interaction started.

After the end of the exercise, we presented a graph underlying the difference in point obtained between the first and the second phase. After the results have been illustrated, we highlighted how participants had fallen in the social trap, presented the main features of social dilemmas, and showed the applications to real world negotiation.

The time spent for these exercise was 20 minutes with 9 participants and about 90 minutes with 29 participants. More recently, in order to make easier the implementation of the game, we prepared a z-Tree (Firschbacher, 2007) version of the game. Playing in this setting, the time spent for the activity decreases by the 30%. The time for a complete run with 24 participants was about 30 minutes.

Over our years of implementation of this tool, participants' reaction has always been positive: this activity provides a way to experience the complex dynamics of large group negotiation while stirring great interest and curiosity. It is useful to show how, when only two players are considered, the activity we have presented is similar to a well known mid-1990 negotiation involving American Airlines, United Airlines, and USAir. In fact, when USAir made public the fact that it was for sell, business journalists speculated that the two industry leaders, American Airlines and United airlines, would end up in a bidding war. As the value of USAir was higher to an acquirer than as a stand-alone company, the states for both American and United Airlines were enormous. The sale of Usair to any of American or United would result to be a major setback for the other.
Yet, we can read [1]

American Airlines sent a subtle message Thursday to United Airlines, in effect, telling its chief rival to forget about buying USAir, thereby avoiding a possible bidding war for the struggling airline.

In a letter to American's employees, Robert Crandall, chairman of Ft. Worth-based American, said the carrier won't make a bid for Arlington, Va.-based USAir, the nation's fifth-largest airline, unless United makes an offer first.

"We continue to believe, as we always have, that the best way for American to increase its size and reach is by internal growth-not by consolidation," Crandall told American's 118,000 employees.

"So we will not be the first to make a bid for USAir," he said. "On the other hand, if United seeks to acquire USAir, we will be prepared to respond with a bid, or by other means as necessary, to protect American's competitive position."

Although the letter was addressed to American's employees, several analysts and industry insiders speculated that the contents were directed at United officials, who are in the process of considering whether to recommend a buyout of USAir to the board of directors of UAL Corp., United's parent.

According to Malhotra and Bazerman (2007, pp.182), Crandall's message to United was "Keep things as they are, or we will both end up losing a lot of money."

The analogy with the activity we present when considering two commuters only, is striking: each of them represents one of the acquires and choosing the new link represents starting the bidding war for USAir. Therefore, when considering the Braess paradox, Crandall's message translates into "Keep things as they are, or we will both end up losing a lot of time". Sometimes, as the activity involving the Braess paradox is meant for several participants, we first present the American and United case. Then, we have the participants to take part to the Braess paradox based exercise. Finally, in the debriefing we illustrate the similarities between the two situations and highlight how more difficult is to obtain an agreement when participants are more than two.

Another possibility is to introduce the ABC problem [2], then discuss the American Airlines, United Airlines, and USAir and finally participate in the Braess paradox based activity.

Another possibility–when several TAs are available–is to have several smaller groups taking part to the Braess paradox separately and then provide a unique ranking of times. This way, the participants are involved into a team games, i.e. a game which incorporates both intragroup and intergroup levels of conflict (Bornstein, 2003).

Conclusion

According to Wheeler (2006b) the first step in teaching negotiation is acknowledging the educational challenges. In this article, we identified the importance of teaching tacit negotiation and the challenges it poses.

Furthermore, it is well known that experiencing a simulation has stronger educational effects on participants than merely discussing theoretical issues (Holtom, Gagné & Tinsley 2010). Nevertheless, we could not find large group activities that were easy to run without a long preparation. Therefore, we offered a way to implement a large group negotiation activity, which can be run with groups with sizes from four to about forty participants. The activity we presented derives from a well know paradox which not only inspired theoretical reflections but also was observed in real life.

End notes

Ziemba, Chicago Tribune B1 (1995, November 10), American to United: Avoid Bidding War Carrier Won't Draw First in USAir Fight.

2 The ABC problem is how Malhotra and Bazerman (2007) introduce "blind spots in negotiation" in executive negotiation classrooms.

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Author contributions

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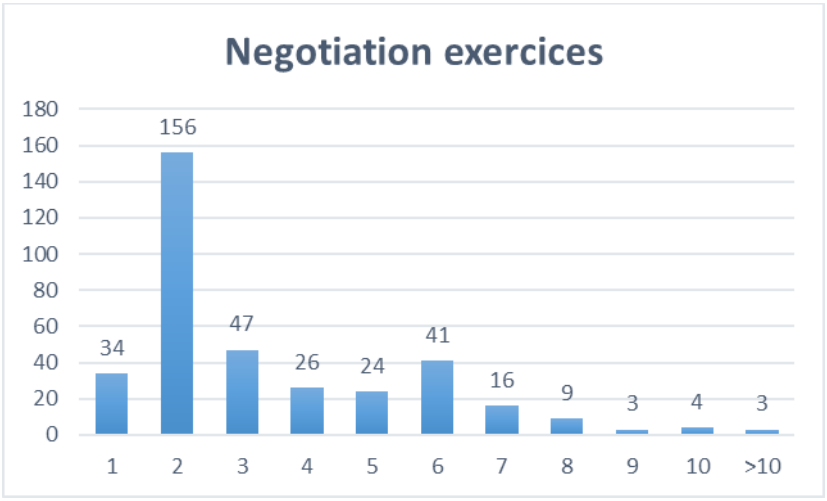

Fig.1. Negotiation exercises ranked according the number of participants available through Harvard Law School's Program on Negotiation Clearinghouse, and the Dispute Resolution Research Center at Northwestern University's Kellogg School of Management. Retrieved on March 15, 2014 from http://www.pon.harvard.edu/shop/home/; http://www.negotiationexercises.com.

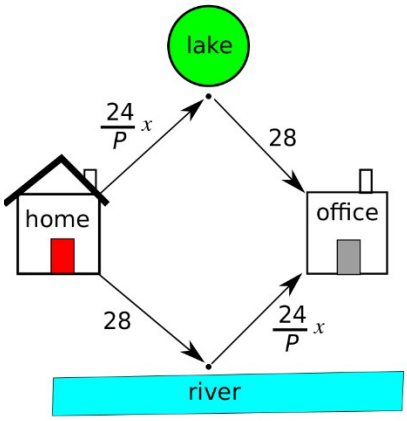

Fig.2. Basic network

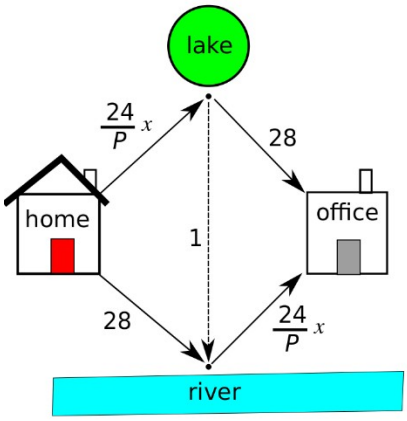

Fig.3.Augmented network

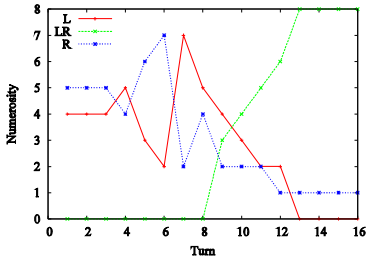

Fig. 4a. Choice patterns of 9 participants of Negotiation-course at University of Turin

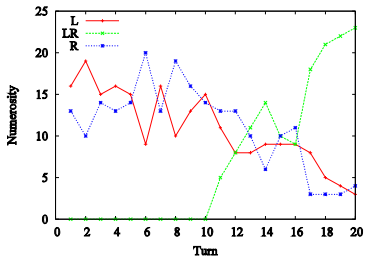

Fig. 4b. Choice patterns of 29 participants of Negotiation-course at University of Chile