Individual learning in different social contests

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Preliminary version
May 2004
Comments are welcome

Abstract

This paper aims at analysing the effects of learning on the individual behaviour in an experiment that requires cooperation and coordination within teams. Using artificial agents, different social contests are created, as training environments. The results confirm previous findings (on the tendency to repeat the strategies that proved to be successful and to apply them also in other situations) and propose new hypothesis. Learning is not only based on a mechanical repetition of past choices, but also on reflection, imitation and on the attitude to build a model of the world. Besides the paper empirically tests the role of satisfaction in the routinization (this is one of the first empirical attempt of this kind). The training in an unfair and difficult environment leads some individuals to reinforce also strategies that have not been successful, but that involved emotions. Another contest seems not to determine detectable effects.

Paper prepared for the Conference "Cross-Fertilization Between Economics and Psychology", Sabe and Iarep joint meeting, Philadelphia, July, 2004
Session Number F1 "Cognitive Economics 1"
A preliminary version of this paper has been presented at the II Conference of the Italian Association for Cognitive Economics, held in Ivrea (To), March, 2004

This experiment was carried out at the Alex Laboratory in Alessandria.
I thank Guido Ortona and Marie Edith Bissey for their cooperation
The software used, in Swiee, was developed by Riccardo Boero.
Other people participated in the organization of the experiment: Paolo Parodi, Maria Teresa Servello, Alessandra Sterpone, Cesare Tibaldeschi.

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This paper aims at analysing the effects of different kinds of training on the individual behaviour in an experiment that requires cooperation and coordination within team.

From a general point of view, the present work contributes to the approach that I have elsewhere defined *cognitive experimental economics* (Novarese, 2003) that is part of the wider stream of analysis called *cognitive economics* (Egidi-Rizzello, 2003).
The attention of this area of research, posed at the crossroads of the heterodox tradition and cognitive sciences, is focused on the study of individual and organizational learning, seen as a key factor in shaping social phenomena. Because of these roots, its definition of learning differs from that of the mainstream economics. In fact, such concept, it's not used to indicate the process that lead near and near to the true knowledge but to define any modification in human behaviour related to the experience lived by the individual.
This difference is mirrored also in the experimental analysis. In fact, if in the traditional view learning is often called as the possible solution for the irrational behaviour observed, in the cognitive approach, on the contrary, it is one of the factors that can explain it.
Egidi-Narduzzo (1997), for example, shows that when individuals develop a successful routine in a given environment, they apply it also in different contests, were it can, yet, be no more efficient.
The results proposed here, from one side, allow confirming such findings, but using a new and different context. At this stage, finding similar results in different experiments is very relevant, as make it possible to give them more strength. From the other side, the present work expands the knowledge and suggests new hypothesis to be further investigated, on aspects like the effects of learning in environment characterized by different levels of fairness and difficulty and on the role of satisfaction in such processes.

The first paragraph defines the aims of the analysis and places it in within the appropriate literature that is presented in the second one. The following paragraphs describe the experiment and its results. The last section discusses the findings.

1. Aims of the analysis

The game "Sum 10", described in the next paragraph, represents a metaphor of various strategical situations characterized by the following conditions:
- there are many possible outcomes, more or less efficient for the group as a whole (for example a given good, produced by a group, can be of *first quality* or of *second choice*);
- to reach any of the possible outcomes, it is necessary a certain level of coordination;
- the division of the labour is not centrally planned;
- individuals can contribute in different ways and it is necessary that someone provide a higher level of effort than the others.

"Sum 10" presents some similarities with "Target the two", an experiment proposed by Cohen-Backdayan (1991) and then by Egidi-Narduzzo (1997), that aims to study organizational learning and the emergence of routines at team level, in a situation in which there are the same incentives among members of groups. The main novelty of "Sum 10", in its respect, is that here agents have incentives that are partly contrapposed.

Situations of this kind are widespread in the real world at social and organizational level, but are also usually neglected by the economic analysis (both at a theoretically and empirical level) because of their complexity, In fact team performance emerges from the choices of

more individuals whose behaviour is interrelated. Both coordination and co-operation are, so, involved and there are many possible outcomes.
Usually economic theory takes into account simple situations. Experimental economics uses, generally, the same approach because of the need of building environment that can be easily analysed and under the researcher's control. Besides it is strongly dependent from the theory (even when devoted at criticising it).
For this reason, experiments are generally based on theoretical situations and aim at testing or at comparing competing models.

In other papers (see Novarese 2003 and 2004a) I described the different experimental methodology proposed by some scholars of the Carnegie Mellon University (Simon, Cyert, March …). In their view, the empirical analysis represents the first step in building theories. Experiments are one of the possible tools, especially useful in the analysis of individual and team learning, where are involved mechanisms that are highly tacit and idiosyncratic and that are therefore difficult to analyse in the reality (Egidi-Narduzzo, 1997).
This paper aims at contributing at this stream, that have recently been rediscovered and developed by the *cognitive economics approach* (Egidi-Rizzello, 2004), and, in specific, by the area that I have elsewhere called *cognitive experimental economics* (Novarese, 2003).

Also the game proposed here is, obviously, a stylized situation. It is yet more complex than the usual experimental games and in this views, it aims also at studying, at an empirical level, how to *complicate Economics*. This task requires both a new approach of analysis (new variables to take into account, for example) but also new statistical and empirical tools (for example: how can we test hypothesis in emergent situations like this one, in which there is no independence among individuals?).
After having understood the basic feature of this game and how to analyse it, it will be possible to develop different and more realistic versions.

From a traditional point of view, yet, "Sum 10" can be seen as too difficult to control, as it involves both cooperation and coordination, which are generally studied in separate games. Besides, agents are allowed too many choices, in respect to usual experiments (like, for example, the classical *prisoner's dilemma*).
But one of the aims of this work is just that of testing the eventual effect of learning in a contest characterized by different levels of cooperation and of looking for the relevance of repetitive behaviour. Studying this last fact in a situation where subjects' choices are constrained to few alternatives would make no sense.

The background literature related to the many sides of "Sum 10" is extremely wide: from the theory of the firm and organization, to the studies on the evolution of focal points, to the analysis of human learning.
The attention of the empirical analysis proposed here is focused on the last aspect, so, the attention will now be focussed only in that direction.

2. The background literature: rationality, learning and fairness

This paper contributes to the cognitive approach, and so refuses the mainstream vision of individual decision-making as a maximization process.
Because of the lack of all the relevant information and because of the need to save mental efforts, individuals are, in fact, not able to take full rational decisions (Rizzello, 1999). Herbert Simon substituted the idea of optimization with that of *satisfaction*.

According to this alternative vision, individuals are likely to take a decision *if it allows reaching a given level of satisfaction.* Later, they will repeat the same action *if it has proved to be successful* in the past, and to change it, if it has not. In this way, when a problem is solved in a satisficing way, behaviour tends to become routinized.
So, the processes of learning, that arises from the described mechanism, cannot be seen as *a walk towards optimality* (as, for example, in Sargent, 1993) but as an attitude of the individuals to *modify their behaviour, in a more or less permanent way, whenever new experience is acquired*.
Routinization, as a result of learning processes, it is an inborn characteristic of human being, useful to reduce mental effort and to lower the uncertainty of the environment, but that can lead to sub-optimal strategies (see Egidi-Narduzzo, 1997 for an example).
This kind of mechanism has been analysed and modelled in different ways, through various types of reinforcement and path dependent mechanisms. It's not possible to analyses and review them here (see, for example, Egidi-Rizzello, 2004; Roth-Erev, 1998; Charness-Levin, 2003 and Slembeck, 1999). In relation to the cognitive view, it is, yet, necessary to propose some notes.
a) Individuals differ in regard to different behavioural traits. Personality variables matters in explaining the behaviours held in different situations (especially in `weak' as opposed to `strong' ones, as showed by Weiss and Adler, 1984).
This fact, even if should still be studied in detail, results, more or less directly, from many papers.
In relation to the experiment proposed here two individual differences should be held in mind: the attitude towards self and others opportunism, and the tendency to held routinized behaviours.
b) Human learning cannot be reduced to a simple repetition of successfull actions, as human being have also the attitudes to reason on what happened, to imitate others, to compare their situation with that of their neighbours, but also the capacity of reflecting on the possible choices of the partners involved in strategic situations …
Individuals tend, in fact, to build models of the world.
Learning should be seen as the wide process that conducts to the definition of such representation of the reality. These models are then applied to various different contests, beyond the one in which they have been developed (Egidi, 2003). For this reason it can, often, arise the repetitiveness empirically observed in many experiments. Yet, in other cases, there could be more complex reactions that cannot be modelled by simple reinforcement algorithms.
The construction of such a (cognitive) models is not easy and requires additional empirical evidence. This is one of the aims of the present paper.

The picture of the world created by human beings — in strategic situations like "sum 10" — is necessarily linked to their idea of fairness and justice, which is an important determinant of their behaviour.
There is a very wide literature on this issue (see Novarese 2002a and b for more details). There are, yet, few definite conclusions. Empirical studies present, in fact, dissimilarities that make it difficult to draw a general picture and that are probably caused by:
- the wide variety of factors that influence reciprocal trust and the decision of being egoist or altruist;
- the role played by the differences in personal characteristics (see Boone et al, 1999) and in the perception of the situations.
So, according to the situation and to the player, when facing opportunism, individuals can react in different ways.

- In many cases they can be disposed to accept losses (or low payoffs) to punish free riding of the others. In this case, emotions seem to play an important role (Frank, 1988).
- If the disparity is not too big (or the absolute value of the pay-off sufficiently higher), some players manifest a more rational behaviour: it's better winning less that nothing.
- Unfair solution can, also be accepted for different and specified reasons, like the fact that the unfair solution represents a *focal point* in a problem of coordination (Schelling, 1958).

All these ideas will be considered in building some hypothesis on the results of "Sum 10" and in analysing its data.

3. Method: The "Sum 10" experiment

3.1 Presentation of the experiment

Team of three players are anonymously and randomly built among participants. The game has 36 rounds. See the appendix 3 for the instruction distributed to the participants.
Each of the players has a set of numbers. This set remains unchanged in every round and is composed of the values: 0, 1, 3, 4, and 10.
In every round players have to declare one of the numbers in their set.
The numbers of the three people playing together are then summed.
According to the sum, each player receives a payoff, following this rule:
* if $S(i) = 10$, $I(i)=40 - D(i)$
* if $S(i) > 10$, $I(i)=30 - D(i)$
* if $S(i) < 10$, individual payoff=$0 - D(i)$
where
$S(i)$= sum of the team I, of which player i is a member
$I(i)$= player i: individual payoff
$D(i)$: number declared by player i

The game is divided into two parts. In the first part (rounds 1-26) the players are coupled with artificial agents. In the second one, the groups consist in permanently coupled human beings.
Players do not know that they are playing with artificial agents. They are told that in the first part they will be coupled with two players, and in the second one with two others.
Players do not know the number of rounds.

There are the following three kinds of artificial agents.
1) *Group one*
- one agent always plays "3";
- one agent starts to play "3" (first choice) and repeats the same number if in the preceding round the human player chooses "4"; otherwise it plays "0".
Thus, in order to obtain a sum equal to ten, the human player should declare "4".
2) *Group two*
- one agent always plays "4";
- one agent starts to play "3" (first choice) and repeats this number if in the preceding round the human player chooses "3", otherwise it chooses "10".
This way, the human player is presumably urged to choose "3".
3) *Group three*
Both artificial agents always choose "0" (only in the first round, for technical reason, they play a different number: "3" or "4"). Therefore, in order to obtain a sum equal to ten the players should play "10".

In each round the players are asked to choose the number, and state (with a number from zero to ten) their satisfaction for the result obtained in the preceding round.

A note on terminology is useful. *Groups* and *treatments* are used as synonymous. I'll refer to the number chosen by the players as *declared, played* or as *choices*. The first part is sometimes called "training period". Section is used as synonymous of part (of the experiment), and "game" of "experiment". The number between inverted commas indicates a choice.

The experiment was carried out in the November 2002 at the *Centro Alex* of the *Università del Piemonte Orientale* in Alessandria, managed by the *Centre for Cognitive Economics,* by means of the software Swiee (Boero, 2001). Twenty-four first-year law students, attending an introductory course on economics, participated in it. On the basis of the score obtained they were granted credits for one of the four part of the exam (they could raise their grade of three points on thirty, according to a rate of conversion that were not specified to stimulate each individuals to get the higher pay-off as possible).

3.2. Aim of the experiment and preliminary hypothesis

As analysed in Novarese (2003) the strategy performed by a player in "Sum 10" depends on many factors, related both to individual characteristics and to the effect of the interaction with the others during the game.
One of the main purposes of the present paper is that of looking at eventual effects of the first twenty-six rounds on the behaviour in the following of the game. In this view, the first part represents a kind of *training period* (such expression is, yet, never used with the participants), that differs according to the treatment (because of the fairness of the partners faced and of the strategy that should be held in order to get a positive score) but also in relation to the way in which players react to the same conditions (as the response to the artificial agents is related to the individual behavioural traits, the learning effect will probably be dependent on the personal characteristics).

So, starting from the previous analysis and from the findings of pilots' version of this experiment, the following hypothesis can be proposed:
- the reaction to the artificial agents, faced in the first part, will be different among agents; especially in the first and third treatment, some of the participants could refuse the opportunism of the partners playing low numbers as a reaction;
- as individuals manifest a tendency to shape their behaviour according to their experiences, in the second part of the game, we should find different behaviour among players trained in the various treatments;
- a person getting an high score (or, best, an high satisfaction) in the first part, thanks to a given strategy, should maintain it also in the following rounds, according to a reinforcement mechanism, even if in the new situation, it proves to be no more efficient.

4. Results

4.1.The first part of the experiment

Table 1 proposes the mean values of a series of variables in the first part of the game, so to compare the behaviour of the players in each of the treatments. Two statistical tests were carried out to prove eventual differences among them: the analysis of the variance and the

Kruskal Wallis test for the Wilcoxon *Rank Sums* non-parametric analysis; they allow similar conclusions in all cases.

The main results are the following.
- The mean individual *total score* differs significantly among the treatments; the second has the highest score, as expected. The lowest score is, surprisingly, that of group one.
- The percentage of "4" in treatment one is lower than that of "3" and of "10" in treatment two and three respectively (these are the numbers necessary to get a sum equal to ten in each group, according to the strategy performed by the artificial agents); players in group one failed more than the other in understanding their task, as proved also by their score.
- Group one declares a higher percentage of "0" than group three; it has the lower mean number of sum equal to ten, but the highest of sum major of ten.
- Treatments are not homogeneous in regard to the *mean differences between individual's score and the score of the other players in the same team* (this difference is expressed by the variable DISP1; it assumes positive values when the subject gains a higher score than the others in the same team; a value equal to zero means that the score is equal among all members; a negative value means that the individual get a lower score)[1].

Table 1. The results of the first part of the experiment by treatment

	tr 1	tr 2	tr 3	p value t test	p-value Kruskal-Wallis
mean of total score	**205.5**	**854.6**	**407.7**	0.00	0.00
mean number of rounds in which S(i)=10	**3.2**	**20**	**13.2**	0.00	0.00
mean number of rounds in which S(i) > 10	**5.5**	**3.9**	**0.0**	0.00	0.03
mean number of rounds in which S(i) < 10	**17.7**	**2.3**	**12.3**	0.00	0.00
mean number of rounds in which players chose "0"	**11.0**	**0.9**	**9.0**	0.01	0.00
mean number of rounds in which players chose "3"	**2.3**	**22.0**	**1.4**	0.00	0.00
mean number of rounds in which players chose "4"	2.8	1.8	2.6	0.45	0.52
mean number of rounds in which players chose "10"	**5.5**	**0.0**	**13.3**	0.00	0.00
mean of DISP1	**-1.4**	**0.78**	**-5.1**	0.00	0.00
MAX1	**16.8**	**22.4**	**16.0**	0.01	0.05
VARMAX	**40.5**	**82.5**	**34.8**	0.00	0.03

A bold type indicates that the value is significant at a level of the 10%

While a lower score and a stronger opposition to the artificial agents' strategy could be expected in the third treatment, at the contrary, players in group one the lowest adaptation to the environment and performance.
How is it possible to explain such finding? This experiment requires both the capacity to cooperate and collaborate. Coordination is easier in treatment three, as the artificial agents choose always the same numbers. In the first, on the contrary, one of the artificial agents changes its behaviour, according to the number declared by the human in the previous round, it is so more difficult to understand the best number to choose.
The lower score and percentage of sum equal to ten in treatment one is then probably related to coordination problems, as it would be strange that players accepted to play "10" but not "4". The difficulties of coordination are confirmed by the fact that treatment one has the higher percentage of sum superior to ten (showing that individuals do not refuse to declare high number, but that they are not able to propose the right one).

[1] Human players in treatment three can make points only with negative values of DISP1 and the variable can be equal to zero only if player declare always "0"; for treatment one the situation is similar, but human players can reach a positive value playing always "0"; for the last group the index can assume positive, null, or negative values.

So, in this game, declaring "0" is probably a *self-protecting behaviour* ("as I'm not able to make a positive score, I save points, declaring 0") or a way to *punish partners for not being clear* in their strategies and not (only) a way to contrast free riding.

The Individual tendency to maintain stable choices

An important dimension of the individual behaviour in this game, that is both cause and effect of the performance, is the stability of the choices, i.e. the fact that a player declares many times the same number.

When a team get a successful routine and maintain it, the choices of its members are obviously stable. In this situation, players can, yet, decides to change their choices for different possible reasons (see Novarese 2003a and 2003d which analysis other versions of "Sum 10" using also interviews to the players): (a) they can desire an higher score (or to increase their relative score in respect to that of the other members); (b) they can try to be fair towards the others and therefore stop to play a low number; (c) they can change the choice just for the whish of novelty.
When the equilibrium is still to be reached, the level of stability of the choices indicates the strategy used by the players, who can, in fact, tries to adapt to the numbers declared by the others (or to the related expectations that will be based on how they played in the preceding rounds) or to impose their own preferences (in this case, probably, they will maintaining the same number for many rounds).

The attitude under exam can be analysed with different indicators. The first appendix discusses them and explain why the attention is focused on MAX1 (the "one" indicates that the index is computed on the first part of the experiment) computed as the frequency of the most declared numbers (so, for example, if in the first part, a player choose one time "0", two times "2", fifteen times "3", four times "4" and "10", MAX1 will be equal to fifteen).
Group two has the highest value of this index, as obvious, given the previous findings.

4.2. The second part of the experiment

In the second part, we have to deal with team composed entirely by human agents.
The performance of the human agents is, so, strongly dependent with that of their partners. The score is, in fact, highly related among members of a given team (even if within the group there is a negative correlation). It is, therefore, almost impossible (at least with relatively few observations) to evaluate eventual differences in the performances.
Also the analysis of the individual behaviour, in term of numbers played and stability of the choices is more difficult and it is preferable to study the two aspects separately[2].

Number declared in the second part

In the training, players in treatments one and three declared a higher number of "0"; those of the last group declared also more times "10"; those of the second group showed a higher frequency of "3".
Table 2a shows that in the second part, subjects trained in the group two, continues to declare "3" more than the others.

[2] The variable MAX is computed on the frequency with which the given numbers are declared and then is strictly related to the choices. We cannot, yet, use only this last indicator, because of the variety of possible choices and situations (for example: few players declare a lot of times "3"; many have an high value of MAX). It is besides interesting and useful to look for general tendencies that can go beyond the number chosen.

Yet, the test of the hypothesis on the differences in the frequency of any choice by the three sets has the problem anticipated: the numbers declared by the players of the same teams are, in fact, dependent.
Even if the training had some effects, the choice, in fact, will be determined also by the behaviour of the partners faced (only very rigid-minded individuals will not be influenced by their partners). For example, when a team reach a stable successful routine, an individual plays always "4" because the others propose a sum equal to *six*. When a routine should still be established, a person could, plays, let's say, "0" because the sum of the others' number is lower than a given amount.
Not all the individuals are, yet, in the same team: only two couples coming from treatment one, two from treatment one, and two tern from treatment three interact in the second part. Besides, while their scores are obviously strongly related, it is more questionable that the frequency of "3" of an individual is high because that of one of the partners is also high. In fact, there are different ways to reach the best results and in the team there is a third member (trained in another situation) that allows a degree of freedom.

Table 2a. Mean value of some indicators in the second part of the experiment by treatment

	treatment 1	treatment 2	treatment 3	P- Value F test ANOVA	p-value Kruskal-Wallis Test
mean number of 0 declared	3	1.6	2.6	0.69	0.48
mean number of 3 declared	1.5	4.3	0.3	**0.01**	**0.02**
mean number of 4 declared	6.4	1.8	2.3	0.14	0.76
mean number of 10 declared	0.9	0.9	2.4	0.32	0.39

A bold type indicates that the value is significant at a level of the 10%

Table 2b. Estimations on the number of "x", declared in the second part, controlling for the numbers declared by the other members of the team

	dependent variable: numbers of x declared in the second part			
	x=0	x=3	x=4	x=10
number of 10 declared in the second part by the other members of the team	0.74 (0.04)	-	-	-
number of 7 declared in the second part by the other members of the team	-	0.75 (0.00)	-	-
number of 6 declared in the second part by the other members of the team	-	-	1.05 (0.00)	-
number of 0 declared in the second part by the other members of the team	-	-	-	0.94 (0.00)
dummy for training in treatment 1	1.11 (0.47)	0.50 (0.61)	0.39 (0.45)	-0.55 (0.55)
dummy for training in treatment 2	0.29 (0.85)	2.03 (0.08)	0.43 (0.62)	-0.79 (0.39)
P value F test	0.15	0.00	0.00	0.00
R^2	0.23	0.62	0.75	0.48

"-" indicates a variable not included in the estimation; the value in parenthesis under the parameter estimates is the p-value of the t-test

Anyway, because of its nature, the dependence among the numbers declared can, be included in the model and controlled, as in Table 2b that proposes four OLS estimations. The dependent variables are respectively the number of "0", "3", "4" and "10" played in the second part. The regressors are: two dummies on the treatments, and a variables that assumes a value equal to the absolute frequency of the rounds in which the other members of the team declared a sum equal to ten minus "0", or "3", or "4" or "10" respectively.
So, for example, when the dependent variable is the number of "3", the second of the regressors is the frequency of cases in which the partners declared a sum equal to *seven*.

This variable allows accounting for the main possible cause of dependence among the observations of the individuals in a given team. Table 2c in appendix 2 proposes a similar analysis with a different control variable: the number of ten gets by the team. Results are the same.

The control variable is always significant (there is an higher chance that players declare more times "3", for example, if their partners' sum is frequently equal to seven).
The attention is, yet, to be focused on the dummies that measure the effect of the training. Table 2b confirms the results of table 2a. Only the dummy for the treatment two, in the estimations of the number of "3" played, has a significant and positive value. Players coming from that set, in the second part, declares more times "3", independently from their partners.

In the second group, playing "3" is a good strategy allowing to get the best score. On the contrary, "0" is proposed as an emotional reaction and "10" is chosen as a rational strategy, that involves a low satisfaction because of the unfair distribution of the payoff. This explains why only in one case the same strategy of the first part is maintained.
While all players of group two declared many times "3", besides, not all the individuals in the other treatments chose "0" or "10". So a statistically detectable effect among the groups can hardly emerge, and a different kind of analysis is necessary.

Table 3 shows the results of the estimation performed to explain the number of "0" declared in the second part in relation to: the frequency of the same choice in the first period and to the functioning of the team (this table, as the following, presents also estimations with only the single variables, as a benchmark).
This second aspects is measured with the number of sums equal to ten get by the group. Such variable is linked with the dependent variable in two ways: (1) as it is not possible to reach a sum equal to ten, individuals can decides to punish the others or to protect their selves; (2) if the sum of the numbers declared by the partners is equal to ten, a person can, rationally, chooses "0".
The model so tests if the frequencies of the given number in the two parts are related, controlling for the effect of the interaction with the others.
Treatment two is not taken into account, as almost nobody declared "0". Other control variables have been tested, with the same result (see table 3b in appendix 2).

Table 3 Estimation with the number of "0" declared in the second part as dependent variable, by treatment

	tr1	tr1	tr1	tr 3	tr 3	tr 3
number of 0 declared in the first part	-	0.25 (0.04)	0.29 (0.01)	-	0.07 (0.79)	0.03 (0.90)
number of sum=10 in the second part	-0.49 (0.36)	-	-0.67 (0.06)	-0.40 (0.37)	-	-0.40 (0.44)
P value F test	0.36	0.44	0.02	0.37	0.01	0.69
R^2	0.14	0.52	0.77	0.13	0.79	0.14

"-" indicates a variable not included in the estimation; the value in parenthesis under the parameter estimates is the p-value of the t-test

There are significant differences between the two treatments. For the first one, the number of "0" declared in the first part affects positively the choice of the same number in the second. No significant relation can be found for the third.
The persistence of this choice can hardly be explained with mechanisms of reinforcement learning, as in the first part, it does not lead to a positive result (even if it sometimes give a

positive satisfaction related to punishing partners' free-riding, see Novarese-Rizzello, 2004). A possible hypothesis is that there is persistence in the perception of the environment, maybe fixed by the emotions experienced.

The negative and significant sign of the variable related to the number of ten in the second part, for treatment one, implies that the team get such result only if nobody chooses "0" (in other words: the more the team get a sum equal to ten, the less an individual declares "0"; sequences composed by two "0" and one "10" are not present). These equilibria, on the contrary, are sometimes possible in the third treatment.

Table 4 proposes the estimations on the number of "10" declared in the second part (see table 4b in appendix 2 for specifications with different control variables, leading to similar conclusions).
Even in this case, for the first set of individuals there is a significant relation among the number of "10" played in the two periods. Again, for the third treatment there are no significant results (the second group is again excluded as nobody declared "10" in the first part).

Table 4. Estimation with the number of "10" declared in the second part as dependent variable, by treatment

	tr1	tr1	tr1	tr 3	tr 3	tr 3
number of 10 declared in the first part	0.16 (0.01)	-	0.16 (0.01)	-0.19 (0.45)	-	-0.14 (0.59)
number of sum=10 in the second part	-	-0.11 (0.40)	-0.11 (0.14)	-	-0.47 (0.25)	-0.42 (0.33)
P value F test	0.01	0.40	0.02	0.45	0.25	0.47
R^2	0.67	0.12	0.80	0.10	0.22	0.26

see the notes to table 3

Table 5. Estimation with the number of "4" in the second part declared as dependent variable, by treatment

	tr1	tr1	tr1	tr 2	tr 2	tr 2	tr 3	tr 3	tr 3
number of "4" declared in the first part	0.16 (0.30)	-	0.30 (0.00)	0.64 (0.04)	-	0.05 (0.71)	1.01 (0.25)	-	0.13 (0.50)
number of sum=6 by the partners in the second part	-	0.81 (0.05)	1.12 (0.00)	-	2.26 (0.00)	2.16 (0.00)	-	1.06 (0.00)	1.03 (0.00)
P value F test	0.30	0.05	0.00	0.04	0.00	0.00	0.25	0.00	0.00
R^2	0.17	0.48	0.98	0.54	0.94	0.94	0.21	0.97	0.97

see the notes to table 3

Table 5 presents the estimations on the number of "4". In this case the variable that account for the team effect is *the frequency of cases in which the sum of the choices of the partners is equal to six* (estimations with a different values are shown in table 5b in appendix 2; the main conclusion are the same).
Also in this case, the variable related to the first period is not significant for the third group, as for the second. Players chose "4" just in response to the behaviour of their partners. For the first treatment there is a positive link between the number of "4" declared in the two periods.

Table 6 shows the results of the estimations on the number of "3" (the treatment three has not been included because only two players declared, few times, it). The effect of the choices of the others is evidenced here by the variable *number of sum equal to seven declared by the partners* (see table 6b in appendix 2 for another specification).

For the second group no correlation can be found between the two periods. Such result is not strange, as it can appear. All the players of this treatment, in fact, declared many times "3" in the first part and all of them, have the tendency to declare again it in the second part (it seems that if players repeat the choice over a given level, the effect establishes). Only in some cases, yet, this is possible, because of the partners.
The most interesting result is related to treatment one where there is a correlation among the frequency of "4" in the first part and that of "3" in the second, as if player were imitating the behaviour of the artificial agents faced in the training period.

Table 6 Estimation with the number of "3" declared in the second part as dependent variable, by treatment

	tr1	tr1	tr1	tr1	tr1	tr 2	tr 2	tr 2	tr 2
number of "3" declared in the first part	0.06 (0.88)	-	0.07 (0.87)	-	-	0.12 (0.62)	-	0.12 (0.52)	-
number of "4" declared in the first part	-	-	-	0.12 (0.07)	0.12 (0.10)	-	-	-	-0.04 (0.92)
number of sum=7 by the partners in the second part	-	0 (1)	0.04 (0.94)	-	0.05 (0.86)	-	0.89 (0.03)	0.88 (0.04)	0.89 (0.05)
P value F test	0.62	1	0.99	0.07	0.22	0.88	0.03	0.09	0.12
R^2	0.04	0	0.01	0.45	0.45	0.00	0.58	0.61	0.58

see the notes to table 3

Tendency to maintain a stable choice

This section proposes a series of estimations performed to explain the value of the variable MAX2 in relation to the individual strategy of the first section. The analysis is conducted separating the treatments, so to detect, again, eventual differences.
Table 7 reports the results of a series of estimations. MAX2 is always the dependent variable. The regressors are many values just proposed in the previous tables. Among them there is also the mean individual satisfaction get in the first part. For general remarks on this variable, see Novarese-Rizzello (2004), that discusses the related methodological problems and test its validity.

The variable MAX2 is, again, not independent among the members of a team. The problem can be solved controlling the effect of the group, with the variable measuring *the number of sum equal to ten in the second period*.
If a team gets a sum equal to ten for a given period, for that set of rounds, all of its members will have the same value of MAX2. In the estimation, this relation will be kept by the control variable, so allowing eliminating the dependence. Similarly, if a group is not able to coordinate, and players change always their choice, MAX2 will be low, as their number of sum equal to ten. The control variable will again account for this dependence.

The results are presented separately for each treatment, starting from the second one, taken as a benchmark.

Treatments two. The value of MAX2 is best explained by the variables related to the training period than by the number of sum equal to ten in the second.
All the variables measuring the performance in the first part (score, number of sum equal to ten, satisfaction, DISP1, MAX1) are related among them and then have a similar effect on MAX2. The fit of the model is best increased by two of them: the total score and the mean satisfaction (which determine the same significance and value of R-squared).

Table 7. Estimation with MAX2 as dependent variable, all observations, by treatment

	tr2	tr2	tr2	tr2	tr2	tr2		tr1	tr1	tr1	tr1	tr1	tr1		tr3	tr3	tr3	tr3	tr3	tr3
number of sum=10 in the second part	0.29 (0.17)	0.25 (0.16)	0.21 (0.20)	0.26 (0.18)	0.27 (0.15)	0.23 (0.19)		0.50 (0.15)	0.48 (0.21)	0.46 (0.31)	0.63 (0.06)	0.45 (0.04) (0.02)	0.44 (0.21)		0.72 (0.00)	0.73 (0.00)	0.75 (0.00)	0.54 (0.00)	0.71 (0.00)	0.66 (0.00)
number of sum=10 in the first part	-	0.13 (0.09)	-	-	-	-		-	-0.05 (0.76)	-	-	-	-		-	-0.04 (0.70)	-	-	-	-
DISP1	-	-	-	-	-1.1 (0.16)	-		-	-	-		0.79 (0.05)	-		-	-	0.21 (0.45)	-	-	-
MAX1	-	-		0.15 (0.16)		-		-	-	-	0.24 (0.15)	-	-		-	-	-	-0.48 (0.11)	-	-
mean satisfaction in the first part	-	-	1.00 (0.08)	-	-	-		-		-0.14 (0.87)		-			-	-	-	-	-	0.21 (0.27)
total score in the first part	-	-	-	-	-	0.18 (0.08)		-	-	-	-	-	-0.11 (0.34)		-	-	-	-	-0.04 (0.66)	
P value F test	0.17	0.10	0.08	0.14	0.14	0.08		0.15	0.37	0.38	0.13	0.05	0.24		0.00	0.29	0.01	0.06	0.28	0.01
R^2	0.29	0.60	0.64	0.54	0.54	0.64		0.31	0.32	0.31	0.56	0.70	0.44		0.78	0.78	0.80	0.87	0.79	0.82

number of observation=8

Table 8. Estimation with MAX2 as dependent variable, on the sample of individual who get at least one sum equal to ten in the first part

	tr2_1	tr2_2	tr2_3	tr2_4		tr3_1	tr3_2	tr3_3	tr3_4		tr1 and 2 /1	tr1 and 2 /2
number of sum=10 in the second part	0.25 (0.17)	0.23 (0.19)	0.28 (0.16)	0.17 (0.30)		0.73 (0.00)	0.73 (0.01)	0.74 (0.00)	0.66 (0.00)		0.43 (0.01)	0.44 (0.05)
number of sum=10 in the first part	0.13 (0.09)	-	-	-		-0.04 (0.70)	-	-	-		0.12 (0.02)	-
DISP1	-	-	-1.1 (0.16)	-		-	-	0.21 (0.45)			-	-
SOD101 (mean satisfaction when a sum equal to ten is get in the first part)	-	-	-	0.92 (0.05)		-	-	-	0.20 (0.30)		-	0.08 (0.72)
total score in the first part	-	0.18 (0.08)	-	-		-	-0.04 (0.66)	-	-		-	-
P value F test	0.10	0.08	0.14	0.06		0.02	0.02	0.02	0.01		0.01	0.12
R^2	0.60	0.64	0.54	0.68		0.78	0.78	0.80	0.82		0.65	0.37

number of observation=8 for the first height column and 12 for the last ones

1)" -" indicates a variable not included in the estimation; 2) between parentheses you can find the parameters that are not significant at a 90% level; 3) the value in parenthesis under the parameter estimates is the p-value of the t-test;
tr1 indicates the estimation performed on the first treatment, tr1 on the first and tr3 on the last, tr 1 and 2 on the first and second joined

How can this result be explained?
- As it poses a relation among the strategy hold in the two parts, it should depend on an individual attitude to maintain a repetitive behaviour during all the game.
- A different justification could refers to the well known learning effect, according to which it is more probable that the strategy "repeat the same number" be used by the players that proved its usefulness in the first part: *the more individuals repeat with success the strategy X, the more they will internalize it*.
These two explanations are related: to get a higher score an individual should understand that repeating "3" allows the best results; this fact can be understood only starting to repeat "3".

In the first part, to make a high score, it is necessary to declare as many times as possible the number "3" in following rounds. An indirect, but efficient (and general), way to measure this fact is the total score. It is higher, in fact, if the individual declared many times, in repetition, the same number.
If the score is high, the variable MAX1 should be high too; but MAX1 can be high even if a player repeated the same number in not following rounds[3]. In this case, the score will be lower, because of the reaction of the second artificial agent (that instead of playing "4", will choose "10"). For this reason, the score is the best indicators of the way in which the first part was played.

So, if the result found in table 7 would depend just on a personal attitude, we should find a stronger link between MAX1 and MAX2 than between MAX2 and the performance[4]. Besides, the correlation between MAX in the first and second half of the training is equal to 0.79. For the same group the correlation between the number of sum equal to ten in the first part and MAX2 is, again, higher: 0.97.
The correlation between the number of ten in the first half of the training and MAX in the last round of it is 0.82, again higher than 0.79.
The analysis on the satisfaction confirms this interpretation[5].

Table 9 allows excluding a third possible explanation: the relation under exam is not mediated by the correlation between the performance in the first and second part. So, we can't say that there are some individuals more intelligent or more able to play this game, making a higher score in the first and second part (and then having a good score in the first and in the second part and so a related high number of ten).

It is important to say that not for all individuals the mode in the number declared is equal to "3". So, some players used the strategy "repeat the same number" also with different choices, like "4" or "10". So the present results do not coincide with that presented above. A successfull training created, so, a rigidity that go beyond the tendency to repeat "3". Because of the low number of observation is, yet, not possible to analyse in detail this fact that could hide different effects.
The repetition of "0" could be a reaction to the difficulties faced with the new partners, given high expectations created by the training.

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[3] We cannot distinguish if MAX2 is high because of choices made in following rounds or not. Yet, it should be considered that in the second period the total number of rounds is low and than a high value of MAX2 requires necessarily that a player repeated a choice in following rounds. In fact, with ten rounds, a value of MAX2 higher than six (get by six on height individuals in this groups, while the other two have both a value equal to five) requires at least three following repetition of it.
[4] And the same correlation should appears in the other treatments too.
[5] Even the higher significance in the specification with the score (than in that with the number of sum equal to ten) is coherent with the idea of the existence of a kind of reinforcement mechanisms. The difference between the information given by the score and by the number of ten is due to the rounds in which the sum is not equal to ten. A human player get a sum lower than ten only when chosing "0" or "2" after having declared "3" or more and then when maintaining again a variable behaviour. In other words, a stable choice is more successful, also when ten is not reached, and so, probably more self-reinforcing.

Treatment 1. The mechanism found for the previous group does not work here. In fact, the level of MAX2 is now more affected by the number of sums equal to ten in the second part. The score in the first part doesn't have significant effects.
There is, yet, still a relation with the individual behaviour in the first part of the game. In fact, MAX2 is significantly affected by DISP1, but the relation is now contrary to those of the previous treatment: where DISP1 is high (i.e. for people declaring many times "0", and so having also MAX1 high but a lower score), MAX2 is high. As seen, in this treatment there are some individuals who declare many times "0" in the first part (DISP1 higher), and continue to do the same also in the second (MAX2 higher).
The estimations have now lower fit then before, because in this set there are players who follow different models of behaviour: some of them learned the strategy of the artificial agents (and then play "4" or "3"), other refused or didn't get it.

Treatment 3. The variables related to the strategies in the first part are not relevant. MAX2 is explained mainly by the behaviour of the team in the second part.
Only MAX1 increases the fit of the estimation. It has a negative sign (and a very low significance). In the first part, MAX1 high is related to the strategy: *play always "10"*. In fact, the correlation between the number of "10" declared and MAX1 is equal to 0.50, that between the number of 0 and MAX1 is equal to -0.60. Such strategy is not maintained in the second part (in fact there is also a low correlation between the frequencies of "10" in the two periods).

Table 9. Correlation of the score and of the number of sum equal to ten in the first and second part, by treatments

	all	treatment 1	treatment 2	treatment 3
score in the first part - score in the second part	0.04 (0.86)	-0.37 (0.36)	0.02 (0.95)	0.28 (0.50)
number of sum=10 in the first part - number of sum=10 in the second part	0.17 (0.41)	-0.20 (0.62)	0.13 (0.75)	0.18 (0.67)

In parenthesis is reported the p-value of the Pearson's test

The effect of satisfaction on choice

Table 8 presents other specifications of the model, including the variable SOD101: *the mean satisfaction of the rounds in which the individual gets a sum equal to ten* (the table re-proposes also some of the estimations shown in table 7 so to make easier a comparison with the new results*)*.
For the treatments one there are only four individuals who get at least one time a sum equal to ten in the first part, and so the regression is not performed.
Table 8 explains that the high is the satisfaction individuals gets from a sum equal to ten during the training, the higher is the probability that they have an high value of MAX2.
This specification has the best fit among all. Using the individual satisfaction as a measure of the reward (instead of the score or of the number of sum equal to ten) we have, therefore, a better forecast of the individual choice.
This finding is coherent with the idea that satisfaction plays a central role in determining behaviour and reinforcement effects.

This result is partially true also for treatment three, where SOD101 is the most significant variable among those related to the first part and the one that increases more the fit of the estimation (in fact the specification tr3_4 has the higher value of R squared).
If we join the observations of the treatment one to those of treatment two, SOD101 reduces its capacity to explain the dependent variable and its significance. For this sub-sample the number of ten in the first part is less useful, but it's, again, the variable that allows the higher fit.

Some players of the first and of the last group express a high satisfaction when punishing their partners. Others express a high satisfaction in getting a good score or a sum equal to ten. That's probably the main reason for the low relevance of such variable.

5. Discussion and conclusion

This paper proposed an explorative experiment, just driven by some general hypothesis.

1) The first is that individual behaviour in experimental decision-making tasks is heterogeneous.
The higher variability in the training is found when persons face opportunistic partners and a difficult environment. In such cases, some of them choose the rational behaviour. Others do not and behave according to a different model (coherent with other experimental findings) that seems to involve emotions. Comparing treatments one and three, it seems, yet, possible to think that players could be more willing to protect from a behaviour difficult to understand than to punish opportunism or, that they are more able to face accept opportunism than a complex interaction.

2) The training, influences significantly how people play in the final part, confirming the second hypothesis on the effect of learning, defined in a wide sense. Dissimilar trainings cause different effects in the behaviour of the final rounds.
As in the first part players in the same treatments behave in different ways, their conduct in the second period cannot be identical and it's then not correct just to compare groups as if they were composed by homogeneous agents.
So the strategies of the second part should be linked to the performance and choices of the training, given the treatment. Taking into account heterogeneity create more difficulties but strongly enrich and improve the analysis (Novarese, 2003).

3a) Given some conditions of the environment (low difficulties and fair partner) and some characteristics of the individuals, this experiment confirms previous findings on the human tendency to replicate the choices that initially proved to be successful, so proposing new evidence on the reinforcement mechanisms, and on the individual origin of the organizational "success trap" (see Bonini-Egidi, 1999).
Participants, in fact, tend to repeat the same strategies developed initially also when the conditions have changes (i.e. when they face new partners who would require different behaviour).
Obviously, their choices are not completely pre-determined but the experience acquired results relevant to determine team performance and the kind of interaction. So, team composition (in term of the training in the first part of the group's members) matters (as shown in Novarese, 2004b, that confirms also the present findings on individual learning, using a similar but not identical experiment). The number that any individual expect to play represents, in fact, the first step in the mechanism of reciprocal adjustment. So the process of team and individual learning become strongly *path dependent*, as it is affected by the way in which any persons played the first part (it is not sufficient to know their treatment) and by the reciprocal interrelation.

3b) Other conditions seem to stimulate players to reinforce also behaviour that are not been successful, but that involved emotions (in relation to the need of protecting from a difficult environment and from the unfairness of the partners). So, changes in behaviour occur also in relation to bad results and not only to satisficing ones, probably because of a variation in the expectations.

3c) In the last treatment, no strong learning effect seems to emerge (both in term of the numbers played and of the stability in behaviour). This suggests that particular conditions cannot induce person to change their way of looking at the world.

This last two points represent new findings that should be further tested and studied because could have a great impact on the understanding of learning processes.
Individual behaviours in the second part of players trained in different contests are not different because the successful strategies were not the same, but because the first period has different effects on how individuals perceive the functioning of the game.
So the need of a broad definition of learning, as proposed by the cognitive approach, is confirmed.

In respect to the simpler reinforcement models, the present results suggest also other possible improvements. If, given certain condition, the relevance of mental routines in individual decision-making is, confirmed, that doesn't mean that agents behave always in a simple and mechanical way. In fact, learning is based also on the attitude to build models of the game; it implies a reflection on the world faced, that can induce, for example, in some cases, to change the strategies performed, imitating the others.
Experience can induce individuals to well defined expectations on the choices of the other persons and to behave according to them, even if they are (initially) denied by the reality. After some rounds, they could, probably, update their ideas, but in interactive situations as the one here proposed, the initial choices can have a strong impact because of the reaction of the partners.

4) A last elements of novelty of this paper is related to the empirical analysis of the role of satisfaction in the process of mental routinization. Given the score, a higher satisfaction proved to determine a stronger rigidity in behaviour.
To my knowledge no other experimental analysis is available in the literature on the relation between satisfaction and decision. So, these are preliminary but very important results. In fact they represent another confirmation of the relevance of satisfaction in the development of routinized behaviours (see Novarese-Rizzello 2004).
The mechanism linking satisfaction and learning, yet seems no to operate (or to operate in a different manner) when emotional factors intervenes and/or when individuals should face a difficult (or unfair) environment.
To understand what happens in treatment one and three it would be necessary to take into account other factors: the levels of aspiration, the expectation and, more generally, the perception of the environment. The final decision can, in fact, be the result of various impulses, operating in different directions: emotions can stimulate a kind of reaction, rationality another one …
In Novarese-Rizzello (2004) we have seen that in the second part of this same experiment, individuals in treatment one has an higher level of satisfaction, given the score, as an effect of their training. It is also possible that such fact is related to lower expectations in term of the possibility to get a sum equal to ten, and less trust on the behaviour of their partners. They could think that the second part will be as the first and that they'll have to deal with opportunistic and chaotic partners as in the first one, and their behaviour can results consequently affected.

In conclusion it is therefore possible to state that this experiment confirmed some theoretical ideas and some empirical findings of other studies (but in a different environment), suggesting new hypothesis to be further investigated.

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Appendix 1: measuring the attitude to maintaining a stable behaviour

The attitude under exam can be analysed with different indicators. Table 1 presents two of them. The first is the variable MAX1: the absolute frequency of the most declared numbers[6].
As expected, players in treatment two show the strongest tendency to the stability in their choices (it is the easiest environment). Treatment one and three don't differ in this regard.

The second index, VARMAX, is defined as the variance among the frequencies of the possible different choices. If a player chooses always the same number, in this experiment, VARMAX assumes the value 116.6[7]. If a player chooses all numbers with about the same frequencies, VARMAX takes a value near to zero.
VARMAX confirms that in treatment two, players tend to have more stable behaviours.
This variable gets yet also a different aspect. While MAX1 focuses on the eventual "equilibria", VARMAX1 gives a more general view of the search strategy, i.e. of the behaviour before reaching a possible stable choice.

It's then interesting to look at the variance of this variable. It assumes the lower value in treatment three (6.8 versus 26.2 and 36.6) where there are the more homogeneous situations among players. Such differences are highly significant according to the Levene's test (p-value equal to 0.005).
The differences of the variances of the variable MAX1 go in the same direction, but are not statistically significant.
In treatment three, in the first part, almost all players declare both "0" and "10" (and also other numbers). Later they converge on one of these two alternatives. In the first treatment, some players convergence quickly to one of the alternatives and then there is more variance in this search variable.

Another index could be the weighted variance of the choices made during the game. This index could seem more natural, as the variance is the most used indicator of dispersion. In this context, yet it is not a good choice as it can be strongly affected by a few choices very different from the others (a player choosing always "10", and declaring "0" just in one round, can have an higher variance than another one who chose always "3" or "4").

Appendix 2: other estimations to explain the number declared in the second part

Table 2c. Estimations on the number of "x", declared in the second part, controlling for the numbers of ten get by the team

	dependent variable: numbers of x declared in the second part			
	x=0	x=3	x=4	x=10
number of sum = 10	-0.43 (0.06)	0.25 (0.16)	0.36 (0.14)	-0.27 (0.10)
dummy for training in treatment 2	-1.93 (0.24)	4.05 (0.00)	-0.11 (0.95)	-2.07 (0.07)
dummy for training in treatment 1	-0.99 (0.56)	2.05 (0.14)	1.24 (0.49)	-2.30 (0.06)
P value F test	0.23	0.01	0.45	0.16
R^2	0.18	0.40	0.12	0.21

see the notes to table 2b

[6] It would be the same if we take the relative frequency of the most frequent choice, instead of the absolute frequency.
[7] In this case we have, in fact, an observation equal to twenty-six and four with a value of zero.

Table 3b Estimation with the number of "0" declared in the second part as dependent variable, by treatment

		tr1		tr 3
number of 0 declared in the first part	0.28 (0.04)	0.22 (0.06)	0.29 (0.44)	0.13 (0.51)
number of sum = 0 in the second part by the other players		1.96 (0.14)	-0.77 (0.39)	
number of sum = 10 in the second part by the other players	0.36 (0.66)			0.85 (0.05)
P value F test	0.10	0.05	0.65	0.12
R^2	0.60	0.70	0.16	0.57

see the notes to table 3

Table 4b. Estimation with the number of "10" declared in the second part as dependent variable, by treatment

	tr1	tr1	tr 3	tr 3
number of 10 declared in the first part	0.16 (0.03)	0.19 (0.01)	0.42 (0.11)	0.27 (0.56)
number of sum = 0 in the second part by the other players	0.02 (0.96)		1.77 (0.01)	
number of sum = 10 in the second part by the other players		0.18 (0.30)		-0.21 (0.45)
P value F test	0.06	0.03	0.03	0.64
R^2	0.67	0.74	0.75	0.16

see the notes to table 3

Table 5b. Estimation with the number of "4" declared in the second part as dependent variable, by treatment

	tr 1	tr2	tr 3
number of "4" declared in the first part	0.25 (0.01)	0.66 (0.04)	0.96 (0.25)
number of sum=10 by the team in the second part	1.1 (0.00)	-0.25 (0.32)	0.57 (0.24)
P value F test	0.00	0.08	0.26
R^2	0.89	0.63	0.41

see the notes to table 3

Table 6b Estimation with the number of "3" declared in the second part as dependent variable, by treatment

	tr1	tr1	tr 2	tr 2	tr 3	tr 3
number of 3 declared in the first part	0.09 (0.81)		0.07 (0.70)		0.06 (0.53)	
number of 4 declared in the first part		0.11 (0.11)		-0.10 (0.80)		0.03 (0.53)
number of sum = 10 in the second part by the team	-0.24 (0.34)	-0.15 (0.42)	0.90 (0.06)	0.92 (0.05)	-0.13 (0.00)	-0.13 (0.00)
P value F test	0.60	0.15	0.13	0.14	0.02	0.01
R^2	0.18	0.52	0.55	0.54	0.81	0.81

see the notes to table 3

Appendix 3: Instructions for the experiments distributed among the participants

Game sum 10

The game is divided into two parts. Each part is subdivided into a number of rounds.

The computer randomly and anonymously couple 3 players.

In each turn you have number 0, 2, 3, 4, 10 (included) at your disposal and you have to declare one of them.

Your number will be added to that of the two players coupled with you.

On the basis of the sum obtained, the score will be determined by this rule, identical for the three players:

- if the sum is 10,

score= 40 – the number declared

for example: if you declared 4, the first player coupled with you declared three and so did the second player, the sum is 10; you gain a score of 40-4=36, the other two players gain 40-3=37.

- if the sum is higher than 10

score = 30 – declared number

for example, if you declared 4, the first player coupled with you declared 4, and the second declared 3, the sum is 11; your score is 30-4=26; the second one gains 30-4=26, the third one gains 30-3=27.

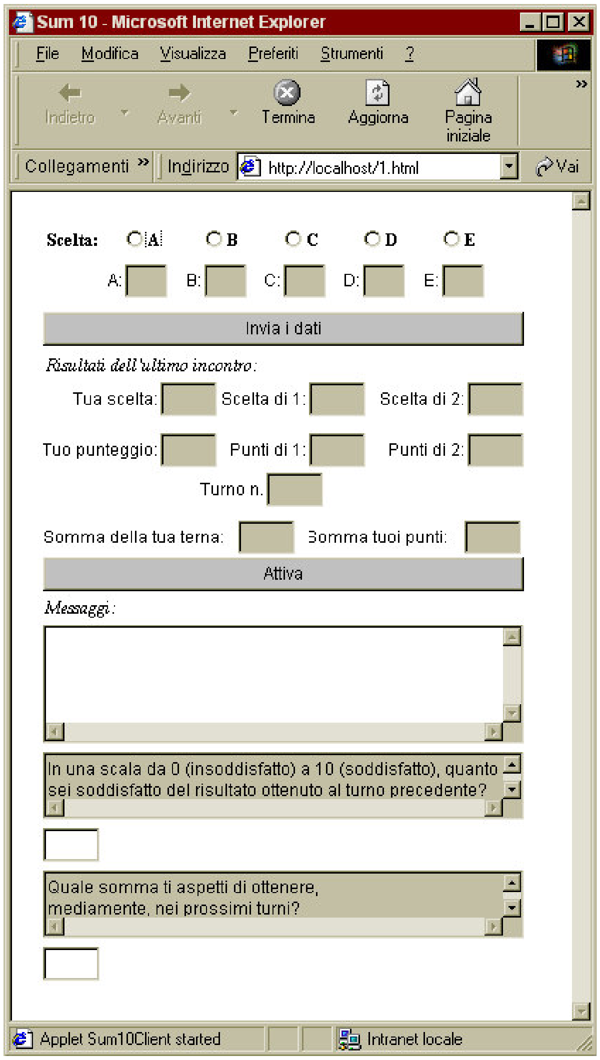
- if the sum is lower than 10,

score = 0 – declared number

for example: if you declared 4, the first player coupled with you declared 0, the second declared 3, the sum is 7; you gain 0-4=-4 (you lose 4); the second player gains 0-0=0; the third one 0-3=0 (he/she loses 3)

All through the first part you will be coupled to the same two players.
In the second part (your computer will inform you when the second part starts) you will be coupled to two other players, who will be the same until the end of the game.

This is the page you will see on your computer.



At each round, you will be asked to answer to the following question:

- in a 0 (unsatisfied) to 10 (satisfied) scale, what is your level of satisfaction for the results you obtained in the preceding round?
- What is the mean sum you expect to gain in the following rounds?

Before going on to the next round it is necessary to wait until all players (not only the ones coupled with you) have answered. You might have to wait. Be patient!

The computer will pass to the new page automatically, as soon as it is possible to continue.