# Measuring social capital with a myograph

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# MEASURING SOCIAL CAPITAL WITH A MYOGRAPH*

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# MEASURING SOCIAL CAPITAL WITH A MYOGRAPH


**ABSTRACT**

We study the behavior of 12 pairs of undergraduate students while they were involved in a simple coordination game requiring motor interaction. Three experimental conditions were defined according to whether a monetary prize was given to both or only one subject, if the couple was in successfully completing the required assignment. Electromyographic potentials (EMG) were recorded from the right first dorsal interosseus (FDI) muscle, a muscle critically involved in the motor task. We also collected written answers from a standard questionnaire from which we constructed individual measures of *Social Capital* (SC), based on *organized group interaction, religious* and *political* involvement. These measures are collected, by standard practice, to estimate individual pro-social attitudes and behavior.

Consistently with our simple behavioral model, by which EMG signals are direct measures of subjects' personal concern (call it *utility)* associated to the given task, our evidence shows that EMG is increasing in the subjects' own monetary reward. When we split the subject pool into two subsamples (according to various measures of Social Capital obtained from the questionnaire), we find that monetary incentives explain the level of subjects' EMG *only in the subsample characterized by low SC,* while, for subjects with (comparatively) higher SC, effort in the coordination task is much less sensitive to whether it is directly rewarded or not. This result is robust across the different SC index specifications. The present findings seem to support the possibility that an electrophysiological measure, such as EMG, could reveal the most profound attitudes and believes that guide social interaction, and that our relatively inexpensive and ready-to-use technology can back-up socio-economic research in a very effective way.



KEYWORDS: NeuroEconomics, Social Capital
JEL CLASSIFICATION: C91, A13


## 1. PREFERENCE REVELATION THROUGH PHYSIOLOGY

Since the seminal work of Coleman (1988), the notion of *Social Capital* (SC) has gained respect both in academic research and in the policy arena. To introduce the concept, we appeal to Putnam's (1995) definition: *"By analogy with notions of physical capital and human capital -tools and training that enhance individual productivity- "social capital" refers to features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit"*. According to this view, as for physical and human capital, investing (and preserving) SC is to be considered a priority for growth and development of a society. This is the reason why, in recent years, many institutions (take, for example, the World Bank's annual *World Values Survey*) have started to include rather diverse concepts, such as "*generalized trust*", "*civic engagement*", "*religious belief*" or *"group interaction"* within the list of the determinants for economic and social growth.

This paper is motivated by an (apparently) very simple question: *how can we measure SC?* In practice, information on SC is usually collected by way of questionnaires recording information on individual attitude to (pro)-social behavior through a treatment of carefully detailed questions.[1] This approach has often been challenged on the ground that, in case of SC, error measurements are most likely to be large, since what is measured is of an intangible nature (Barons *et* al. 1994).

The aim of this paper is to complement this standard practice by way of neuroscientific techniques. The methodological paradigm we apply here claims that much of brain activity supports so-called "automatic" (as opposed to "controlled") processes (Schneider and Shiffrin (1977), Shiffrin and Schneider, 1977 and their followers), which require very little attention and occur, in parallel, with little or no feeling of effort. In consequence, a close introspection to specific automatic processes may be able to reveal subjects' most profound attitudes and inclinations to a larger extent than explicit (i.e. more easily "controlled") investigation. In this respect, the technology usually termed as "lie detection", which makes use of a polygraph to record several physiological variables (such as blood pressure, heart rate, respiration and skin conductivity) while a series of questions are being asked in an attempt to detect lies, is certainly an application of the theory of dual processing we here appeal to. Despite the high controversy associated with their use in judicial practice,[2] it is reasonable to expect that recent advances in Neuroscientific techniques will make polygraphs (even more) popular in the near future.

Leaving to others the ambition to set up a device for unmistakable lie detection, in this paper, we set up an experimental setting by which we back-up standard practice in the measurement of SC using a technology which is conceptually very similar to that of a polygraph. To this aim, our experiment was structured in two stages. In the first stage, we asked 24 (female, normal, right-handed) undergraduate students to answer a written questionnaire taken from Putnam's *Social Capital Benchmark Survey*.[3] In the second stage, randomly matched in pairs (with a strict protocol to preserve anonymity), the same subjects had to participate to a sequence of three variants of a simple coordination game in which subjects received a monetary prize only if they were successfully completing a (very) simple task requiring motor interaction. Every precaution was taken to make, on subjects' behalf, the motor task totally painless and very easy to perform, with little attention needed to do it "correctly". By the same token, we presented the two stages of the experiment as completely independent to each other. The three experimental conditions differed depending on whether the prize was given to both or only one subject within the couple.

While subjects were playing several repetitions of our game under the different treatment conditions, their muscular effort in completing the task was continuously recorded by a myograph, a (relatively low-tech) device used to measure the force generated by a contracting

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[1] This is, for example, the methodology employed by Putnam's *Social Capital Benchmark Survey*, (Bobo *et al.,* 1996) on which our questionnaire is based.

[2] See, for example, VV. AA. (2003).

[3] Subjects were normal, female, right-handed aged 20 to 30, undergraduate students coming from the Economics and Law Departments of the University of Ferrara, with no prior exposure to game theory or similar neurological experiments. All of them were requested to give their informed consent and to preliminarily fill the questionnaire whose content is reported in the Appendix. To ensure anonymity, subjects were divided in two subgroups of 12 (the *green* and the *yellow* subgroup), with subjects of different subgroups never crossing each other during the entire experiment.

muscle. The novelty here is that, since the task required minimal and painless effort, the recorded signal can be directly used as a measure of an idiosyncratic, unobservable feeling in performing the coordinating action (i.e. the higher the signal, the higher the willingness to coordinate). In other words, *we use the recorded signal as an indirect measure of subjects' utility.*

Our experiment yields the following conclusions. First, we find that subjects were able to coordinate their efforts successfully virtually in every round, independently on the treatment conditions. This reflects the relative simplicity of the motor task. On the other hand, we also see that average effort is indeed sensitive to treatment, i.e. incentive, conditions, being higher when the subject is directly receiving the monetary reward. We also confirm (and refine) this evidence by estimating a dynamic panel regression in which the subjects' recorded muscular effort is explained by both electrophysiological (such as the lagged effort of the couplemate) *and* sociological (SC indicators built upon the questionnaire's answers) variables. Interestingly enough, here we find that sensitivity to incentives is significant *only for those subjects characterized by a relative lower SC,* while for subjects with higher SC, muscular effort (i.e. personal involvement in the coordinated task) is independent on the incentive profile. This result is robust across different SC index specifications.

The remainder of this paper is arranged as follows. Section 2 describes in detail the experimental setting. Section 3, devoted to the experimental results, is divided in three parts. Section 3.1 introduces the (somehow unconventional, for Economic research) structure of our (panel) database. In Sections 3.2-3 we present our experimental evidence in detail. Final methodological remarks are contained in Section 4, followed by an Appendix containing the full text of the Questionnaire (translated into English), and a detailed description on how we built the SC measures used in the regressions.

## 2. EXPERIMENTAL DESIGN

We shall now describe the experimental conditions in details.

*Stage 1: the Questionnaire.* In designing our questionnaire, we followed closely Putnam's *Social Capital Benchmark Survey*, both when setting the questions and building the SC indicators used for successive data analysis.[4]

*Stage 2: the Coordination Game.* Once completing the questionnaire, randomly paired subjects were engaged in a coordination game in which they were asked to direct a small sphere to one of two containers placed 30 cm below their hands (Fig. 1). If the ball ended elsewhere (either in the other container, or outside the box), this would imply no prize for anyone for that round. The *target* container (i.e. the one subjects had to direct the sphere to get the prize) was assigned in a deterministic fashion, alternating it at every round. This was repeated 30 times ("rounds"), divided in three *treatments* of ten rounds each. The order of treatments was pseudo-random and

[4] See the Appendix for details.

balanced across pairs. Treatments differed in the way a monetary prize of € **1** was distributed across subjects in case they were successful in the required task. Precisely,

- $T_1$: *strong coordination.* In this treatment, putting the sphere in the target container would yield a prize of € **.50** *for both subjects.*
- $T_2$ and $T_3$: *weak coordination.* In these treatments, putting the sphere in the target container would yield a prize of € **1** *for one subject only.* In treatment $T_2$ the prize would go to the subject whose right hand was opposite to the target container (i.e. the one who should have *pushed* with her finger to direct the sphere to the target); in treatment $T_3$ the prize would go to the subject who should have *pulled* with her finger to direct the sphere, while the pushing subject would not get anything. These two treatments were designed to test subjects' ability to *coordinate intertemporally*, that is, to realize that helping the couplemate to put the sphere correctly in odd rounds (i.e. helping her out to get the prize with no reward) could induce the couplemate to reciprocate in even rounds (when is the couplemate who is supposed to "help for free" to put the sphere in the target container).

Put Fig. 1 about here

*Monetary payoffs.* Subjects received, on average, € 22, for a 60' minutes experiment (all included).

## 3. RESULTS

### 3.1 STRUCTURE OF THE EXPERIMENTAL DATASET

In this section, we provide a brief synopsis of the source, and successive manipulation, of the physiological variable used in our regression. When a somatic motor neuron is fired, all of the muscle fibers it innervates respond to the neuron's impulses by generating their own electrical signals that lead to contraction of the activated muscle fibers. *The higher the impulse, the higher the contraction.* The muscle fibers generate and conduct their own electrical impulses that ultimately result in contraction of the fibers. Although the electrical impulse generated and conducted by each fiber is very weak (less than 100 microvolts), many fibers conducting simultaneously induce voltage differences in the overlying skin that are large enough to be detected by a pair of surface electrodes. The detection, amplification, and recording of changes in skin voltage produced by underlying skeletal muscle contraction is called *electromyography.* The recording thus obtained is called an *electromyogram* (EMG).

Because the raw electric signal is biphasic, its mean value is zero. By ***rectification*,** we allow current flow in only one direction, and so "flips" the signal's negative content across the zero axis, making the whole signal positive.

EMG is actually a composite of many signals, as well as some noise. These voltages also rise and fall at various rates or frequencies, forming a frequency spectrum. Circuits filter the composite signal and eliminate unwanted and meaningless electrical noise like movement artifact. Because most EMG exists in a frequency range between 20 and 200 Hz, and because movement artifacts have frequencies less than 10 Hz, that is the cutoff frequency frequently employed in "high-pass" filters. Integrating the area under the linear envelope, a quantity analogous to electrical work or energy is thus obtained.

In Fig. 2 we provide a graphic sketch of a typical data sample, that is, the EMG trace recorded from a single round.

Put Fig. 2 about here

Our data set is distributed along five dimensions: *sessions*, *treatments*, *rounds*, *time*, and *subjects*. As the figure shows, our experimental setting yields a dataset in which data are intrinsically coupled (Green *versus* Yellow). Since we are interested in testing *individual* subjects' behavior, we double the data set considering, as dependent variable, each individual effort time series, regressed against (among others) the lagged effort of her couplemate. This yields a panel dataset with 24 subjects in which the effort of subject $i=G,Y,$ when she pushes and that of her couplemate $j=Y,G$ when she pulls are the only variables which vary by every dimension.

All the indicators obtained from the questionnaire vary only on the subject dimension. In this paper, where we look only at the evidence from treatments $T_1$ to $T_3$, our data set contains 86,138 observations. Moreover our data set is distributed along five dimensions: *sessions*, *treatments*, *rounds*, *time*, and *subjects*.

Since the recorded muscle (FDI) is agonist for pushing the sphere, we are only interested in the case when subject *i pushes* the sphere to perform the task (i.e. when the target container in opposite to her hand). Thus, we cut all the observations when this is not the case.  Finally, since each round has a different number of observations (i.e., each round has a different time length), and most of the observations at the beginning of the round are of no interest, because subjects were not yet involved in the critical part of the motor task (inserting the ball into the target container), we decided to balance the panel, by synchronizing all rounds with respect to the EMG peak of the pushing subject, keeping only 27 observations before this point in time (see the shaded area of Fig. 2). These two rules allow us to construct a balanced panel dataset of a total of 9,720 observations.

## 3.2 Evidence # 1: Incentives matter

We begin by looking at our experimental results from a *distributional* point of view in Fig. 3. Figure 3*a)* reports the outcome distribution disaggregated for treatments. As Figure 3*a)* shows, subjects were able to coordinate almost perfectly across treatments $T_1$ to $T_3$, with only a negligible proportion of inefficient outcomes (3.3% of total observations), uniformly distributed across treatments. *In other words, if we looked at the induced allocation distribution from the perspective of a mechanism designer, we were not able to detect any significant difference in behavior associated with the different incentive protocols.* This conclusion is in stark contrast with the evidence from Figure 3*b),* where we present a box plot of average EMG of the pushing subject *i* (the one for which FDI is more active, and therefore, more accurately measured by EMG) disaggregated for treatment. As Figure 3*b)* shows, average effort is higher in treatment $T_1$ and $T_2$, when *i* is rewarded if the sphere is falling in the target container, rather than in treatment $T_3$, when she is not.

Put Fig. 3 about here

A caveat here. Fig. 3*b)* implicitly assumes that difference in EMG between treatments $T_1$ and $T_3$ can be used as direct measure of the difference in subject's individual concern when performing the coordinating task under the two incentive protocols (i.e. the only perceivable difference between the two experimental conditions). In other words, we use EMG as a direct measure of subjects' *utility*, that is, an ordinal scale that represents individual preferences under the different experimental conditions. This is the methodological paradigm we use to read the experimental evidence. This is an assumption neuroscientists are very comfortable with (the higher the signal, the higher the brain response associated to the given stimulus). With this premise, we can interpret the evidence from Fig. 3*b)* as follows: average behavior is sensitive to the experimental conditions, insofar individual effort (proxied by EMG) is higher when the reward is *directly linked to the action of pushing the sphere.* As we noted previously, this average behavior seems to neglect the simple fact that, if subjects were successful in coordinating at every round (as they basically were, throughout the experiment –see Fig. 3*a)*, *they would receive the same aggregate reward* (€ 5 each) in every treatment.

## 3.3 Evidence # 2: *SC matters*

In Fig. 4 we partition our subject pool into two groups of equal size according to the estimated level of one of the SC measures (namely, SC1) derived from the questionnaire. By analogy with Fig. *3b)* average effort distributions are calculated for each subsample. As Fig. 4 shows, difference in effort across treatments is higher for subjects characterized by a (comparatively) lower level of SC.

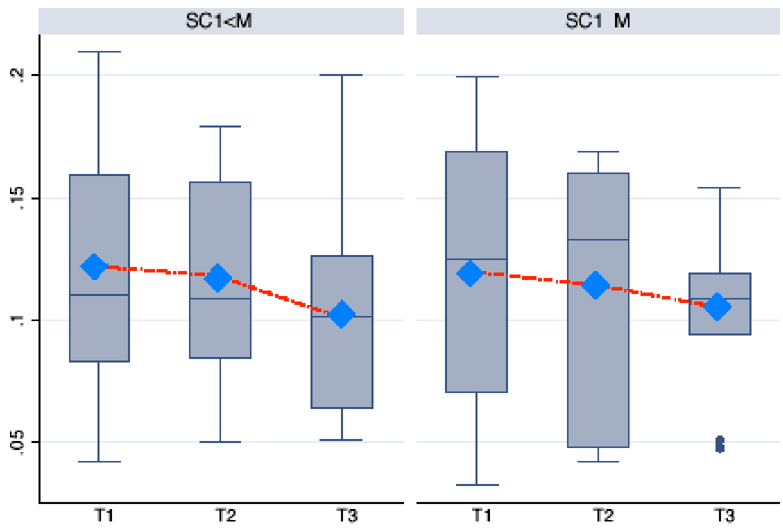


**Fig. 4.** Partitioning the subject pool using SC1

A caveat here. Like in Fig. 3*b),* in Fig. 4 difference in average EMG is only a rough measure of difference in effort, insofar it does not control for many sources of variability (take, for example, the effort of subjects' couplemates, individual fixed effects, treatment order effects, round sequence effects, the point in time within the round in which the measure is taken, etc…) that may influence this result. This is why, in Fig. 5, we carry out the same exercise by way of a much more careful statistical procedure, regressing EMG of pushing subject $i$ against lagged EMG of $i$ (EMGiL2 and EMGiL5), lagged EMG of $i$'s couplemate $j$ (EMGjL2 and EMGjL5), treatment dummies (T2 and T3), also controlling for round, time within the round and individual fixed effects. Lags are fixed in 2 and 5 time periods (corresponding respectively to a time lag of $\frac{2}{40}=\frac{1}{20}$ and $\frac{5}{40}=\frac{1}{8}$ of a second, corresponding to average reaction time recorded in the literature for physical stimuli of a similar nature.

| | POOL | SC1>MED | SC1<MED | SC2>MED | SC2<MED | SC3>MED | SC3<MED |
|---|---|---|---|---|---|---|---|
| EMGiL2 | .524 | 0.043 | 0.049 | 0.040 | 0.050 | 0.040 | 0.050 |
| | (18.33)** | (2.02)* | (2.02)* | (1.90) | (2.09)* | (1.91) | (2.09)* |
| EMGiL5 | .046 | 0.526 | 0.506 | 0.544 | 0.493 | 0.543 | 0.496 |
| | (2.86)** | (13.43)** | (12.10)** | (15.12)** | (11.04)** | (15.15)** | (11.03)** |
| EMGjL2 | -.009 | 0.070 | 0.163 | 0.082 | 0.150 | 0.084 | 0.146 |
| | (.43) | (1.99)* | (4.22)** | (2.20)* | (4.52)** | (2.24)* | (4.45)** |
| EMGjL5 | .105 | -0.034 | 0.023 | -0.021 | 0.009 | -0.021 | 0.008 |
| | (4.09)** | (1.09) | (0.73) | (0.68) | (0.29) | (0.68) | (0.25) |
| T2 | .0002 | 0.0003 | -0.002 | -0.0002 | 0.0003 | -0.0003 | 0.0004 |
| | (.1) | (0.11) | (0.69) | (0.09) | (0.10) | (0.11) | (0.18) |
| T3 | -.0038 | -0.003 | -0.006 | 0.00002 | -0.009 | -0.001 | -0.008 |
| | (2.23)* | (1.26) | (2.68)** | (0.01) | (3.67)** | (0.31) | (3.27)** |
| Cons | .033 | 0.051 | -0.002 | 0.042 | 0.007 | 0.042 | 0.026 |
| | (6.69)** | (7.35)** | (0.28) | (6.07)** | (1.21) | (6.09)** | (3.96)** |
| Obs. | 8091 | 4066 | 4025 | 4089 | 4002 | 4066 | 4025 |
| R-sq. | .51 | 0.49 | 0.55 | 0.52 | 0.51 | 0.51 | 0.51 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

**Fig. 5.** OLS linear regression with subjects, round, time fixed effects (coefficients omitted in the table). The complete set of estimated coefficients not included in Figure 5, is available upon request.

In the first column ("POOL") of Fig. 5, all observations from the experiment are used to estimate the impact of the experimental conditions on EMG. In this respect, Fig. 5 confirms the evidence of Fig. 2*b)*: only the estimated coefficient of $T_3$ is negative (-0.038) and significant ($t$=2.23). In words, in performing the coordinating task, our subjects, on average, were exerting more effort when the prize was directly assigned to them, than otherwise. In the other six columns of Fig. 5, we split the subject pool into two sub-samples of equal size of *pro social* (SC$i$>MED,$i$=1,…,3) and *not pro social* (SC$i$<MED) subjects, using three alternative SC indexes, SC1 to SC3, analogous to those used for similar purposes in related literature.[5] Again, also in this case, the evidence of Fig. 4 is confirmed: only the estimated coefficient of $T_3$ are negative and significant, showing that difference in effort is more pronounced for those subjects characterized by a (comparatively) "lower" level of estimated SC.[6]

[5] See the Appendix for details.

[6] It may be argued that homogenous effort across treatments may not be considered as a good proxy for SC, since it is perfectly compatible with the hypothesis that agents are "perfectly rational" and realize that the "value" of each treatment is exactly the same. However, remember that this difference in effort has no impact on outcome distribution -see Fig. 2*a*). Therefore, it may be used as a signal of each subject's inclination to achieve the efficient, cooperative, outcome.

## 4. CONCLUSIONS

In this paper, a physiological measure backs up our SC questionnaire results by way of a totally different technology (and probably, exactly as it happens with a lie detector, a technology which is more robust to conscious attempts to untruthfully reveal subjects' individual level of SC than standard surveys). In this sense, this paper applies a novel methodology in which both socio-economic *and* neurophysiologic variables complement each other to provide consistent (and extremely accurate) measures of SC by looking at some unobservable (and profound) characteristics of our subjects. Despite its accuracy, the technology employed is relatively simple, inexpensive, and ready-to-use, which is in contrast with most of the research currently done in the new field of the so-called *Neuroeconomics*. By the same token, the behavioral paradigm we employ (roughly speaking, higher EMG=higher utility) is perfectly understandable by social scientists and less controversial for a neurophysiologic point of view. Also, the experimental setting is completely new and can be applied to study more complex strategic environments, allowing researchers to work with a much richer dataset, compared with what is the standard practice in Experimental Economics.

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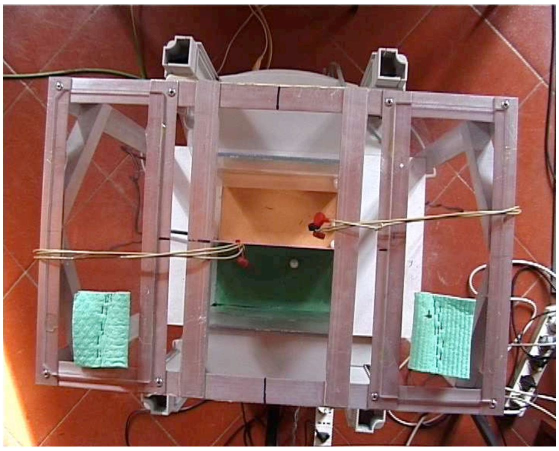
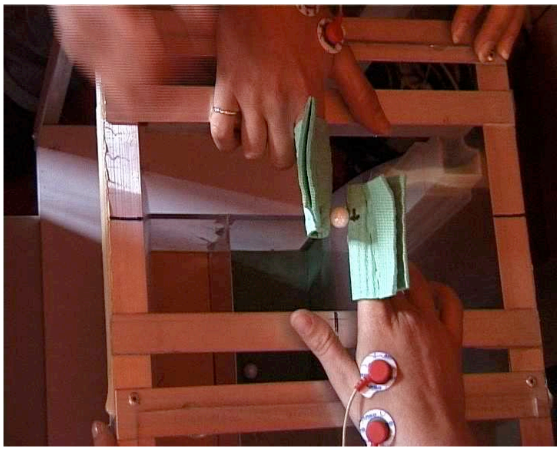


1*a)*



1*b)*

**Fig. 1.** *Stage 2.* Two subjects, one for each subgroup *yellow* and *green*, entered the experimental room from two different door, standing one in front of the other, with their faces and trunks completely hidden by a curtain. Subjects were strictly prohibited to speak during all the session, to exclude voice recognition. Unlike in Fig. *1b),* taken off-session for descriptive purposes only, we also asked subjects to take off rings or other recognizable objects. Subjects' hands were leaning on a metal support placed 30 cm over a box with two adjacent containers of equal size placed on a load cell (Fig. 1*a)*. We placed two colored sheets, yellow and green, at the bottom of each container to help subjects to identify the target container for that round. Subjects had to grasp firmly the metal support with the index finger extended. At the beginning of each round, a small glass sphere was placed between the two index fingers and subjects had to cooperate in maintaining the sphere lifted until the go signal. In this position, the sphere was exactly above the border between the two containers (Fig. 1*b*), with the two fingers perfectly parallel to the border. Once the monitor indicated the target container for that round, motor interaction (and EMG recording) would begin.

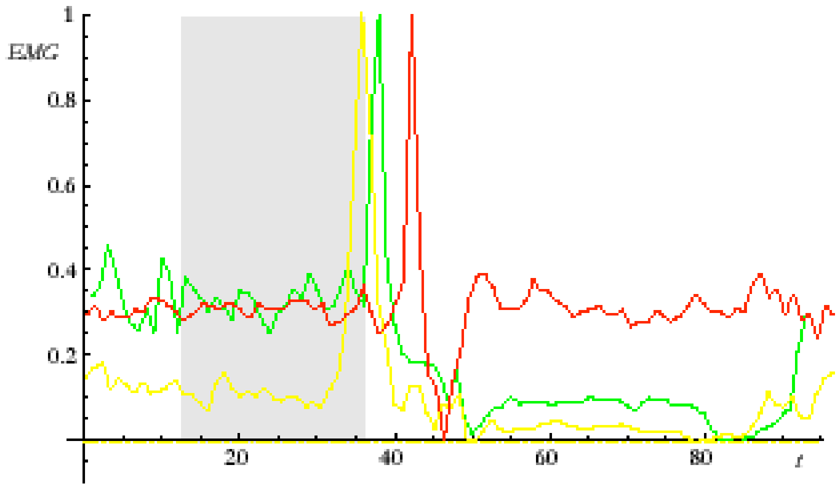
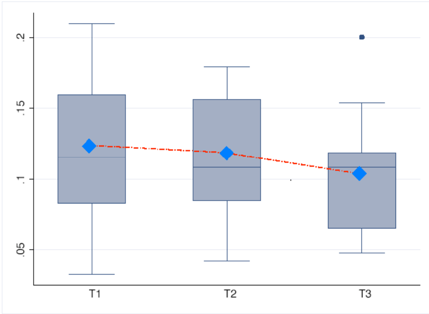



**Fig. 2.** *Data sample.* Time is on the *x*-axis (measured by "takes", with a sampling frequency of 25-takes per second), EMG signals on the *y*-axis (green and yellow for the two subjects, red for the load cell). Electromyographic potentials (EMG) were recorded from right *first dorsal interosseus* (FDI) muscle by using Ag-AgCl surface electrodes (diameter 6 mm) glued to the subjects' skin according to a tendon-belly configuration. After online rectification and integration (time constant 0.05 s) EMG signal was continuously recorded during the experiment and fed to a personal computer for the successive analysis. The acquisition software sampled the EMG signal recorded from the two subjects at 25 Hz. The instant at which the ball touched the bottom of the container was detected by means of a load cell supporting the container itself. The load cell

signal, appropriately amplified, was continuously acquired during the experiment by the same acquisition software used for EMG recordings (at the same sampling frequency). We also keep trace of the outcome of each individual round (this is shown by the color of the *x*-axis, yellow indicating that, in this round, the sphere ended up in the yellow container). Physical synchronized data are normalized over the entire dataset. If $y_i^{(T,r)}(n)$ denotes the EMG signal of subject *i*, in round *r* treatment *T* recorded at time *n* of the round, our regressions uses the rescaled signal $x_i^{(T,r)}(n) = \frac{\hat{y}_i - y_i^{(T,r)}(n)}{\hat{y}_i - \breve{y}_i}$, with $x_i^{(T,r)}(n) \in [0,1]$, where $\hat{y}_i$ ($\breve{y}_i$) denotes subject *i*'s maximum (minimum) EMG signal calculated over subject *i*'s entire experimental history. This normalization, which helps to interpret the absolute values of the coefficients, does not affect their statistical significance, since both the normalization method and the estimation technique (OLS) are both linear.

| T\win | G | Y | NO W. | TOT |
|---|---|---|---|---|
| T1 | 58 | 59 | 3 | 120 |
| T2 | 59 | 58 | 3 | 120 |
| T3 | 59 | 59 | 2 | 120 |




3*a)*

3*b)*

**Fig. 3.** *Outcome distribution and average EMG per treatment.* Figure 3*a)* reports absolute frequency of outcomes for each treatment. In Fig. 3*b)* the rectangle contains 50% of the observations. The lower end of the rectangle is the 25th percentile and the upper end of the rectangle the 75th percentile. The horizontal line in the box indicates the median. The vertical line outside the box indicates the adjacent values. Dots outside the adjacent lines are outliers. The broken line connect treatment means.

**APPENDIX**

## A.1 THE QUESTIONNAIRE

In what follows we report the text (translated into English) of the questionnaire.

**Please answer to the following questions**

1. Which, if any, of these things have you done in the past year?
   - q1.1 Served as an officer of some club or organization
   - q1.2 Worked for a political party
   - q1.3 Served on a committee for some local organization
   - q1.4 Attended a public meeting on town or school affairs
   - q1.5 Attended a political rally or speech
   - q1.6 Made a speech
   - q1.7 Signed a petition
   - q1.8 Wrote a letter to the paper
   - q1.9 Wrote an article for a magazine or newspaper

2. Which, if any, of these things have you done in the past week?
   - q2.1. Discussed politics
   - q2.2. Had dinner in a restaurant
   - q2.3 Had friends in for the evening
   - q2.4 Went to the home of friends
   - q2.5 Saw a movie
   - q2.6 Made a personal long distance call
   - q2.7 Read a book
   - q2.8 Went to church
   - q2.9 Watched a sports event on TV
   - q2.10 Went out to watch a sports event
   - q2.11 Went to club, disco, bar or place of entertainment
   - q2.12 Spent time on a hobby
   - q2.13 Wrote a personal letter or e-mail
   - q2.14 Received a personal letter or e-mail

3. How many times, if any, did you do any of these activities in the past month?
   - q3.1 Made a contribution to charity
   - q3.2 Did volunteer work
   - q3.3 Donated blood
   - q3.4 Went to friends' house for dinner or evening
   - q3.5 Had friends in for dinner or evening
   - q3.6 Went to church social function
   - q3.7 Went to meeting of club or civic organization
   - q3.8 Went to dinner at restaurant
   - q3.9 Went to night club, disco, bar
   - q3.10 Went to live theater, opera, concerts
   - q3.11 Went to sporting event

- q3.12 Went to the movies

4. Which of the following things are part of "the good life" in your opinion?
    - q4.1 A home you own
    - q4.2 A yard and lawn
    - q4.3 A second car
    - q4.4 A vacation home
    - q4.5 A swimming pool
    - q4.6 A happy marriage
    - q4.7 No children
    - q4.8 One or two children
    - q4.9 A job that pays more than average
    - q4.10 A job that is interesting
    - q4.11 A job that contributes to the welfare of society
    - q4.12 College education for my children
    - q4.13 Travel abroad
    - q4.14 A second color TV set
    - q4.15 Really nice clothes
    - q4.16 A lot of money

5) For each of the following, indicate how important it is in your life. Would you say it is:

1. Very important
2. Rather important
3. Not very important
4. Not at all important
5. I don't know

- q5.1 A home you own Family
- q5.2 A yard and lawn Friends
- q5.3 A second car Leisure time
- q5.4 Politics
- q5.5 Work
- q5.6 Religion
- q5.7 Service to others

6) Taking all things together, would you say you are:

4. Very happy
3: Quite happy
2. Not very happy
1. Not at all happy
. Don't know

7) With which of these two statements do you tend to agree? (CODE ONE ANSWER ONLY)
A. Regardless of what the qualities and faults of one's parents are, one must always love and respect them
B. One does not have the duty to respect and love parents who have not earned it by their behavior and attitudes
7.1 Tend to agree with statement A
7.2 Tend to agree with statement B
7.3 Don't know

8) Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?
8.1 Most people can be trusted
8.2 Need to be very careful

8.3 Don't know

9) Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?
9.1 Would take advantage
9.2 Would try to be fair
9.3 Don’t know

### A.3 SC INDEXES

Following Bobo *et al.* (2001), we use questionnaire to construct the six indicators, as follows.

**Civic participation** (*cp*). This indicator (see index CIVPART in Bobo *et al.* (2001)) is constructed as the average of three different questions, meant to measure individual involvement in civic and political activity, such as working for a political party in the past year (q1.2), attending political meetings in the past year (q1.5) and signing petitions in the past year (q1.7):

$$cp=(q1.2+q1.5+q1.7)/3.$$

We also build an alternative index *cpext*, by adding subjects’ answer to a specific question, namely question q5.4, which asked how important was politics in their personal life (answered ranked from 4=“Very important” to 1= “Not important at all”):

$$cpext=(q1.2+q1.5+q1.7+(q5.4-1)/3)/4.$$

**Faith-based Social Capital** (*fbsc*): This indicator (see index FAITHBAS in Bobo *et al.* (2001)) is constructed as the average of two questions, designed to measure participation in the life of the local religious community such as going to church in the past week (q2.8), or going to church social function in the past month (q3.6):

$$fbsc=(q2.8+q3.6)/2$$

By analogy with *cpext,* we also consider the following:

$$fbscext=(q2.8+q3.6+(q5.6-1)/3)/3$$

**Organized Group Interactions** (***ogi***): This indicator (see index ORGINTER in Bobo *et al.* (2001)) is constructed as the average of four questions, designed to measure participation in the life of the local community such as serving as an officer of some club organization in the past year (q1.1), or on a committee for some local organization in the past year (q1.2), attending a public meeting on town or school affairs in the past year (q1.4) and going to meeting of club or civic organization in the past month (q3.7):

$$ogi= (q1.1+q1.3+q1.4+q3.7)/4$$

**Informal Group interaction (*igi*):** This indicator (see index SCHMOOZ in Bobo *et al.* (2001)) is constructed as the average of six questions, designed to measure participation in the informal social network such as having friends in for the evening in the past week (q2.3); going to the home of friends in the past week (q2.4); going to club, disco, bar or place of entertainment in the past week (q2.11); going to friends' house for dinner or evening in the past month (q3.4); having friends in for dinner or evening in the past month (q3.5); going to night club, disco, bar in the past month (q3.9):

$$isi=(q2.3+q2.4+q2.11+q3.4+q3.5+q3.9)/6$$

Bobo et al. (2001) also considers five additional indexes, based on social trust (STRSTCAT), group involvement without church participation (GRPINCAT), group involvement with church participation(GRP2CAT), diversity of friendship network (DIVRCAT), and composite racial group trust (RACETCAT). Due to a almost null variability in the subjects' answers (probably due to a higher homogeneity of our subject pool with respect to the relevant dimensions) we could not make any use of these additional indexes.

**SC Indexes**

In Bobo et al. (2001), no further aggregation is made to project all the relevant dimensions to a single scale. As we previously explained, we needed instead to rank our subject pool with respect to a composite scale that would comprise all the aspects highlighted by the literature. This leads to the construction of the three composite measures used in the regressions, as follows:

*SC1*=(cppolitica+fbscreligione+ogi+isi)/4
*SC2*=(cppolitica+fbscreligione+ogi)/3
*SC3*=(cp+fbsc+ogi)/3