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Yoga beyond wellness: Meditation, trust and cooperation *

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Abstract. Our research aims to find out whether meditation has a positive impact on trust and cooperation. By comparing the behavior of subjects exposed to meditation before playing an investment game to others not exposed, we find that the former group shows more trust on average than the latter. Meditation seems to reduce risk aversion and “competitiveness” among people inducing agents to behave in a more cooperative (and efficient) way.

Keywords: Other-regarding preferences, trust, reciprocity, investment game, frame effect, polarization, meditation.

JEL Codes D03, C91, D83

1. Introduction

Yoga is generally perceived to be a way of keeping oneself healthy and happy. As other mind-body interventions,¹ Yoga has been shown to produce a significant benefit on well-being and in management and prevention of diseases.² Moreover, if one understands the concept of yoga as a way of life, its benefit for changing the paradigms of its practitioners can be further explored. Such a change in the psycho-motivation of

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¹ As lifestyle planning, wellness coaching, behavioral change management and other mind-body practices e.g. Tai Chi and Qigong.

² See, among others, Charness and Grosskopf (2001), Tindle *et al.* (2005), Wolsko *et al.* (2004), Charness and Gneezy (2009), Tang *et al.* (2009), Charness and Jahnke (2012).

people in fact seems to produce a positive impact on employee, business managers and organization performance.³

Psychological and clinical studies show that meditation, as a conscious mental process, induces a set of integrated physiologic changes termed the relaxation response, stress reduction, and an increase in attention. For instance, Greenberg *et al.*, (2012) show how mindfulness practices may avoid mind traps by reducing cognitive rigidity, defined as a resistance to change in beliefs, attitudes, habits or the tendency to develop and persevere in the use of mental or behavioral sets.⁴

The above findings are confirmed by recent neuro-electric and imaging studies. By using functional magnetic resonance imaging (fMRI), Lazar *et al.* (2000) show how meditation activates neural structures involved in attention and control of the autonomic nervous system, which is traditionally viewed as a source of mental conflicts and biases and also, by many recent theories, as a major component of the emotion response (for a survey, see Kreibig, 2010). Recently, using an ultimatum game, Kirk *et al.* (2011) provide evidence that Buddhist meditators are more likely to accept (low) offers compared with group control, when assessing unfairness, they activate a different network of brain areas compared to other subjects enabling them to uncouple negative emotional reactions from their behavior.

EEG-based findings on long term meditation⁵ may be interpreted as supportive of the claim that one of the primary benefits from meditative training is greater emotional stability for challenging life events (Chan and Polich, 2006). Long-term meditators in fact are able to self-induce high-amplitude gamma brainwave synchrony during mental practice, which becomes a life style leading to long-lasting changes in cognition and emotion; meditation has then been conceptualized as complex emotional regulatory training techniques developed for cultivation of well-being and emotional balance (Lutz *et al.*, 2004; 2008).⁶

By using EEG methods, Kamei *et al.* (2000) find that alpha waves increase during yoga exercise,⁷ according to Fries (2005) and Palva and Palva (2007), these waves seem to play an active role in network coordination and communication. Increases in alpha-wave activity have been also observed by many other experimenters. A review of Cahn and Polish (2006) cites among 30 studies where in alpha-wave activity (power or band) increases when meditators are evaluated during meditating compared with control conditions. The experiments include observations of EEG activity from practitioners of many different meditation traditions, including Transcendental Meditation, Zen, Yoga, Tibetan Buddhist practices and Qigong.

Even short-term meditation training has relevant effects. Tang *et al.* (2007) find that a group randomly assigned to 5 days of 20-minutes integrative meditation practice shows

³ See e.g. Lloyd (1990), Zamor and Claude (2003), Corner (2009), Hasbani *et al.* (2010a, 2010b).

⁴ See, among a large literature, Linden (1973), Davidson and Goleman (1977), Kubose (1976), Sabel (1980), Valentine and Sweet (1999), Ott (2003). Psychological and clinical effects of meditation, explicitly including yoga, are surveyed, integrated, and discussed with respect to neuroimaging data by Chan and Polich (2006).

⁵ See e.g. Aftanas and Golocheikine (2001, 2002, 2003, 2005).

⁶ See also Jackson *et al.* (2000), Ochsner *et al.* (2002), Ochsner and Gross (2005), Eippert *et al.* (2007).

⁷ Alpha waves are brain waves originated from the occipital lobe during wakeful relaxation with closed eyes.

significantly better attention and control of stress than a similarly chosen control group.⁸ Specifically, Tang *et al.* (2007) use a standard computerized attention test to measure orienting, alerting, and the ability to resolve conflict (executive attention). They show greater improvement in conflict scores on the Attention Network Test, lower anxiety, depression, anger, and fatigue, and higher vigor on the Profile of Mood States scale, a significant decrease in stress-related cortisol, and an increase in immune reactivity.

Short-term mind-body effects are further investigated by Tang *et al.* (2009), who explores the underlying mechanisms of attention and self-regulation induced by meditation. They focus on the alteration of the interaction between central and autonomic nervous system and report that meditation induces positive changes in physiological indexes.⁹

Along the above lines, we expect that meditation can regulate emotional and social considerations, and therefore, it might affect personal behavior and the ways one interacts with others by affecting emotion, attention (reducing biases) and personal stress. We aim to provide an empirical assessment of the impact of meditation on cooperative behaviors. To test its impact on cooperation and trust, we perform a controlled experiment based on Berg *et al.* (1995) investment game. Specifically, we compare the behavior of agents exposed to meditation before playing the game to others not exposed.

The rest of the paper is structured as follows. Section 2 describes our experiment and methodology. Section 3 illustrates and discusses the main outcomes of our experiments. Section 4 concludes.

2. Experiment

2.1 Design

The baseline experimental task is an investment game (Berg *et al.*, 1995). Two subjects are endowed with 10 tokens. A subject (called A) can transfer to the other (called B) part of her/his endowment (i.e., from 0 to 10 tokens). Any amount transferred is multiplied by 3 before being delivered to B. Then, B could return part, all or none of the tripled amount received from A.

Treatment T1 examines the decision to give when there is no meditation session before the investment game is played. In treatment T2 subjects are instead involved in a yoga-meditation activity before making their choices. The yoga-meditation activity is discussed in detail below.

2.2 Hypothesis

Our claim is that meditation affects the subjects' behavior. By regulating emotional and social considerations, as shown by empirical literature, it affects the ways one interacts with the others by reducing cognitive rigidity, biases, personal stress and increasing emotional stability and attention. We expect that subjects, both in group A and B, send larger amounts when exposed to meditation with respect to standard treatment. Because

⁸ See also Farb *et al.* (2007).

⁹ The group exposed to meditation exercises showed significantly better physiological reactions in lower heart rate and SCR, increased belly respiratory amplitude, and decreased chest respiratory rate, and skin conductance response than the relaxation control.

these subjects well understand the game dynamics and are less influenced by emotional biases, stress and fears. Thus, they might have larger expectations that the other will reciprocate or lower emotional costs if they do not.

We consider the difference between the averages sent in T2 and T1 as a measure of the effects of meditation on trust. If this difference is zero, meditation has no effect on average. Formally, we test the existence of effect of meditation by considering the outcomes of T2 and T1 on trust as follows:

$$H_0: \quad \text{Meditation's effect } T2_A - T1_A > 0;$$

where X_Y is the amount sent by subjects Y in treatment X.¹⁰ As $T2_A - T1_A$ is a measure of the effects of meditation on trust, if $T2_A - T1_A = 0$, meditation has no effect on trust.

In order to verify the existence of differences in abilities of forecasting in the two treatments, we test the difference between the expected and actual payback of subjects A in T1 and T2. Formally,

$$H_1: \quad \text{Expected vs. actual payback in T1 } E_A(T1_B) - T1_B = 0;$$

$$H_2: \quad \text{Expected vs. actual payback in T2 } E_A(T2_B) - T2_B > 0.$$

We expect that meditation is more likely to support evidence for smaller expectation errors.

It is worth noticing that if a meditation effect emerges, it improves efficiency as it increases the size of the full cake distributed by the experimenter (see Stanca *et al.*, 2009).

2.3 Procedures

Subjects were recruited from the undergraduate student population at the University of Teramo, in Italy. Subjects were randomly selected from the database and assigned to group T1 or T2. Participants were 54 in meditation treatment and 76 for standard investment game, for a total amount of 130 subjects.

Subjects selected in T2 ran four meditation meetings in four consecutive days, at the same time, at the same place. The duration of meditation was 30 minutes. The first day an additional 30 minutes were used to explain the exercises to the participants. All the participants were beginners, with little or no meditation experience. The meditation session was guided by an experienced meditator in Raja Yoga and based on a combination of Yoga exercises, including the Superbrain Yoga (brain synchronicity) as described by Kok Sui (2005: Chapter 2), and basic meditation as taught by the Self-Realization Fellowship, founded by P. Yogananda in 1920 in Los Angeles.

Each meeting was characterized by the same sequence of exercises:¹¹

1. Brain Synchronicity (6 minutes);
2. Affirmation (3 minutes);
3. Chanting (3 minutes)
4. Concentration (15 minutes);

¹⁰ Henceforth we omit the sub-indices as they are trivial.

¹¹ Exercises are briefly described. A technical appendix available upon request provides full details about them.

5. Chanting (3 minutes).

The goal of exercise sequence is to release tension in the body and synchronizing the left and right sides of the brain. The affirmation and chanting are preparatory for the one regarding concentration. The former works on the sub-consciousness level of the brain. The latter allows going very fast to a meditative state of mind. The concentration exercise brings the attention on the breath; the expert meditator guides with soft voice through the breathing, with incrementally longer pause. Finally, chanting again the activity of the brain is calm to the alpha brainwaves.¹²

After the meditation meetings (for T2) or at the beginning of the experiment (for T1), all the participants were randomly divided in two groups (to play as subject A or B) and placed in two different rooms by random sampling. Each subject in group A was matched to a subject in group B in a random and anonymous way. All the decisions made during the experiment were anonymous; anonymity was guaranteed by using identification codes, names remain unknown to all – including experimenter and monitors. During the experiment, two monitors checked that the instructions were correctly followed by participants. However, the monitors could not answer any questions from subjects as they had the same information (double blind procedure). Therefore, if participants had doubts, they could only read the instructions again. Participants were not allowed to talk each other during the entire experiment.

The incentive scheme we implemented was based on a between-subject random-lottery incentives system.¹³ Specifically, in our experiment only two of all participants for each treatment (T1 and T2) were randomly drawn by a lottery and rewarded by an electronic MP3 device (the value of the device is 35 euro). Accordingly, subjects who were not selected for the reward in the between-subject random-lottery incentives treatments earned nothing.

During the experiment, participants were requested to answer to some questions.¹⁴ Information is collected twice: after decision have been taken (intermediate) and before the lottery (final questionnaire). Clearly decisions are unaffected by questionnaires, as they are always compiled after participants have played. In the intermediate questionnaire, to investigate the effects of meditation on the participants' beliefs, we also elicit participants' payback expectations by a paid-incentive scheme (as Coricelli, *et al.*, 2006).¹⁵ Subjects do not write their names on the questionnaires but use their codes.

¹² The sequence of exercises is designed to reduce brainwaves activity from beta to alpha waves. We did not to measure the effect by the EEGs, but, according to the experienced meditator's opinion, the largest majority went deep. This was manifested after the last chant, when it took three to five minutes of silence before the students came out of the meditation state.

¹³ In dynamic-multi-task environments, between-subjects random lottery incentive system might induce some biases in risk aversion (because a carry-over effect); however, in single task context, as our case, it performs well. For a detailed discussion, see Starmer and Sudgen (1991), Beattie and Loomes (1997), Cubitt *et al.* (1998), see Baltussen *et al.* (2011).

¹⁴ The information collected have three functions to provide additional data to: i) interpret the observed behaviors; ii) check for subject confusion about decision tasks; iii) checks for recording errors by the experimenters and counting errors by the subjects.

¹⁵ Experimental evidence in eliciting subjects' expectations or beliefs show that effort and accuracy in the presence of a flat fee are comparable with the results obtained by implementing the quadratic scoring rule

3. Results

The outcomes of our experiment are described in the following table, which reports and compares average outcomes of the two treatments. The first two rows display the average amounts sent in T1 and T2 by subjects A (send) and subjects B (return). Standard deviations are indicated by squared brackets. Means are based on 27 and 38 observations, respectively. The last row compares the amount sent in different treatments (T2 and T1) to evaluate the effect of meditation on amounts sent.

Table 1 – Parametric and nonparametric tests of first-and second-mover data¹⁶

	Send	Return	Mean tests	F-test	MW
T2 (27)	4,44	5,07			
	[3,14]	[6,71]			
T1 (38)	3,21	3,34			
	[2,06]	[3,47]			
T2 vs. T1 (meditation effect, H ₀)			1,91	2,34	1,63
			{0,03}	{0,01}	{0,05}

The average amounts sent by A subjects is 4,44 tokens in T2 against the 3,21 in T1.¹⁷ Therefore, we observe an effect of meditation on trust (T2 vs. T1) that is large (1,23) and statistically different from zero—as shown by the *t*-test on the mean, and Mann-Whitney test. As a result, H₀ can be accepted.

Meditation seems to improve efficiency by promoting cooperation. In the treatment with meditation senders send and received more than senders in the treatment without meditation. More trust and reciprocity are observed. Thus, meditation seems to induce subjects to (successfully) invest higher amounts.

Results from elicitation of expectations of subjects A are reported in Table 2.

Table 2 – Parametric and nonparametric tests of expected and actual paybacks¹⁸

	Expected	Actual	Mean tests	MW
H ₁ : T1 (38)	4,70	3,34	1.84	2,41
	[2,92]	[3,47]	{0,07}	{0,02}
H ₂ : T2 (27)	7,04	5,07	0.96	1,24
	[8,18]	[6,71]	{0,34}	{0,22}

We find a significant difference between the expectations in mediation (7.04) and control group (4.70). Moreover, in the case of meditation, by comparing expected (7.04)

(Sonnemans and Offerman, 2001). See Bardsley *et al.* (2010) for a more detailed discussion about expectation elicitation.

¹⁶ The column reports the means (and standard deviations between square brackets), *F*-test, and one-tail, difference mean test based on a *t*-test assuming independent sample and parametric Mann-Whitney median-difference test (*p*-values are reported between brace brackets).

¹⁷ The average amounts sent by B subjects is 5,07 tokens in T2 against the 3,34 in T1.

¹⁸ The column reports the means (and standard deviations between square brackets) and two-tails, difference mean test based on a *t*-test assuming independent sample and parametric Mann-Whitney median-difference test (*p*-values are reported between brace brackets).

and actual (5.07) average payback (H_2), we find that expectations are ex post correct, i.e. they are not significantly different from the amounts sent back by subjects B. By contrast, in the case without meditation (H_1), average expectation (4.70) is statistically greater than actual average (3.34) payback.

Subjects exposed to meditation have high expectations that the other will reciprocate and, probably, low emotional costs if they do not. These expectations are ex post correct. Thus, cooperation works. By contrast, when meditation is not considered, expectations are low and are not ex-post verified.

The rationale observed behaviors can be related to the effects of meditation in regulating emotional and social considerations about rewards and interplay. In line with the neuroscience evidence cited in the introduction, by reducing cognitive rigidity, biases, personal stress and increasing emotional stability and attention, meditation induces subjects to better understand the game dynamics (the final result is an increase in efficiency) and to be less influenced by emotional biases, stress and fears. Moreover, understanding the effects of yoga in a broad way, meditation might reduce the risk aversion of agents inducing them to invest higher amount or, in other words, it could increase harmony among people, supporting a sort of collective mind, increasing the beliefs for cooperation.

Further outcomes of our experiment are described in the following two figures, which report relative and cumulative frequency of amounts sent by investors (first movers). Figure 1 shows the relative frequency of amounts sent by first movers in treatment with meditation (gray bar) and without meditation (black bar).

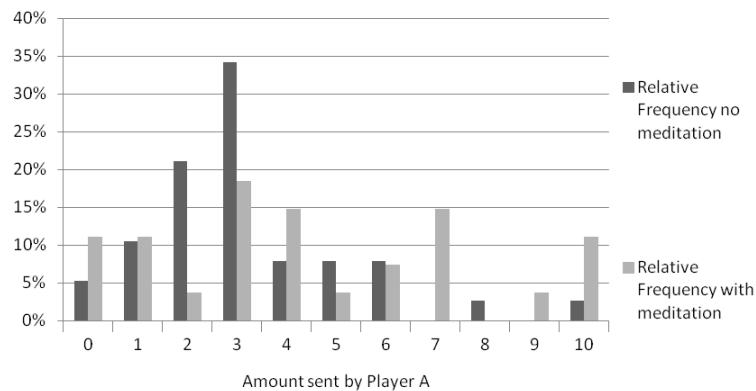


Figure 1 – Relative frequency in two treatments.

Subjects behave differently in the two treatments. In the treatment without meditation, 34% of first movers sent three tokens to the paired second movers and 55% of first movers chose to send two or three tokens to the paired second movers. By contrast, in the treatment with meditation 19% of first movers sent three tokens to the paired second movers and only 23% of first movers chose to send two or three tokens to the paired second movers. Choices of subjects in meditation treatment are more polarized. In the non-meditation sample the amounts of tokens sent are more concentrated around the

mean (have smaller variance) than in meditation treatment, where instead the variance is greater and the choices are more dispersed.¹⁹

Figure 2 displays the relative cumulative frequency of amounts sent in treatment with meditation (gray line) and without meditation (black line).

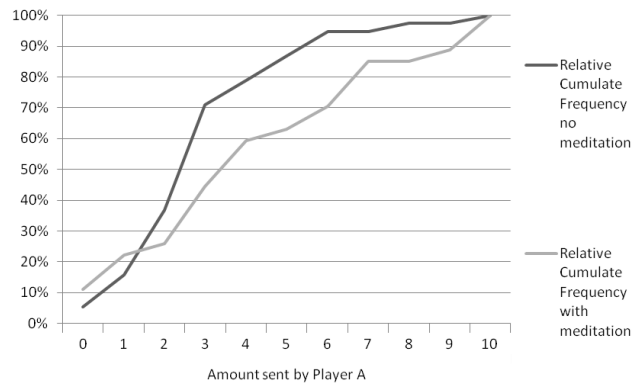


Figure 2 – Relative cumulate frequency in two treatments.

The figure shows that subjects that experienced meditation seem to be more likely to cooperate. For instance, without meditation the 70% of overall first movers chose to send a low amount (an amount varying from zero to three tokens), whereas with meditation only the 44% of overall first movers chose to send a low amount of tokens.

4. Conclusions

By using a simple investment game, we find that participants demonstrated more trust on average compared to situation where they have not experienced any meditation before playing. Meditation induces subject to (successfully) invest higher amounts. Moreover, subjects exposed to meditation have high expectations that the other will reciprocate. As these expectations are ex post correct, cooperation works (efficiency increases). By contrast, when meditation is not considered, expectations are low and are not ex-post verified.

In line with the neuroscience evidence, a possible explanation for our findings is that meditation in experimental game positively affects emotional and social considerations about rewards and interplay by reducing cognitive rigidity, biases, personal stress and increasing emotional stability and attention. It induces subjects to better understand the game dynamics and to be less influenced by emotional and mental biases, stress and fears.

Meditation also supports expectation matching, probably reducing the emotions related to competitiveness among participants, putting them in touch. It reduces the risk aversion of agents inducing them to invest higher amounts or, in other words, it could increase harmony among people, supporting a sort of collective mind, increasing the beliefs for cooperation. As a result, in addition to promote well-being and to efficiently

¹⁹ As also Table 1 shows.

manage interpersonal relationships, meditation supports the growth of a collective mind as a way to stimulate subjects to behave more cooperatively and to be more confident and thus to induce efficiency.

It is finally worth noticing some limitations of our approach, which need further attention in future developments of our research agenda. There is a concern that same results may be obtained by subjecting the counterfactual sample to a kind of social interaction that reinforces their social identity. In fact, results can be driven by the mere effect of being together during the meditation meetings instead of by meditation itself. Moreover, regarding the result robustness, the sample used is small and the incentive system used is the random-lottery incentive system. We leave these points to future researches.

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