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# Mental interaction at a distance with an electronic device: a pre-registered proof-of-concept study.

**Patrizio Tressoldi*, Luciano Pederzoli °*, Elena Prati°*** and **Luca Semenzato***
*Science of Consciousness Reserach Group, Dipartimento di Psicologia Generale, Università di Padova, Italy
°EvanLab, Firenze, Italy

Corresponding author:
Patrizio Tressoldi
Email: patrizio.tressoldi@unipd.it

# Abstract

This study was aimed at verifying the possibility of mentally influencing from a distance an electronic device based on a True Random Number Generator (TRNG).

Thirteen adult participants contributed to 100 trials, each comprised of three samples of data each of 15 minutes' duration: one for mental pre-interaction, one for mental interaction, and one for mental post-interaction.

For each of these samples, at the end of each minute, the data sequence generated by the random number generator was analysed with two specific tests called "Frequency" and "Runs", in order to determine the degree of randomness of the sequence.

The only evidence of an effect of distant mental interaction is an average increase of approximately 50%, with respect to control data, of the number of samples within which the pre-determined statistical threshold was exceeded in both tests.

Although the effect of distant mental interaction is still weak, we believe that the results of this study represent a proof-of-concept for the construction of electronic devices susceptible to distant mental influence.


Key Words: mind-matter interaction, mentally-controlled devices, RNG.

# Introduction

Distant mental activation of electronic equipment– that is, without direct contact or electromagnetic means – seems impossible but it becomes possible if we consider the ability to mentally alter from a distance the activity of random number generators, for example, the 0 and 1 sequences produced by a True Random Number Generator (TRNG).

Testing of the possibility of mentally altering the function of random event generators began in the 1970s with the work of Helmut Schmidt, and later became one of the main lines of research within the Princeton Engineering Anomalies Research (PEAR), directed by Robert Jahn and Brenda Dunne (Duggan, 2017; Jahn, Dunne, Nelson, Dobyns, & Bradish, 2007).

Even though a meta-analysis of 380 studies related to this phenomenon up to 2004 showed a small effect and a large heterogeneity of the studies themselves (Bösch, Steinkamp, & Boller, 2006; Radin, Nelson, Dobyns, & Houtkooper, 2006), and was the object of criticism (Varvoglis & Bancel, 2016; Kugel, 2011), by modifying the interaction procedure and the type of data analysis, we believe that it is possible to exploit this small effect for practical applications and, specifically, to activate from a distance an electronic device interfaced with a TRNG.

This device, which we have called MindSwitch 2, is described in detail in the 'Electronic Device' section. In contrast to almost all previous experiments, which required participants to mentally generate an increase in 0 or 1 states and then comparing them to a baseline, we simplified the procedure by asking participants to alter the normal random flow of 0 and 1 towards an excess of either 0 or 1.

The efficacy of this procedure was confirmed in a study by Tressoldi et al., (2014) and a possible explanation for it was posited in the study by Pederzoli, Giroldini, Prati, & Tressoldi, 2017. In an initial pilot experiment, and later in a pre-registered experiment, the participants were asked to alter from a distance the function of a TRNG to reach the threshold level, fixed at $\pm$ 1.65 z-score with respect to the theoretical average value. The number of mentally-altered samples in the confirmatory study was 82.3%, versus 13.7% with no mental interaction.

To verify a reduction in randomness, in this study we applied the Frequency Test and the Runs Test present in the array of tests provided by the National Institute of Standards and Technology (Bassham et al., 2010), as well as a calculation of the standard deviation of the absolute difference between the number of Ones (1) and Zeros (0) in each sample within a sequence of binary data (see Methods).

The Frequency Test calculates the proportion of 1 and 0 states in a sequence and determines the probability of the calculated value's deviation from what would be expected if the sequence itself were totally random. The Runs Test, on the other hand, calculates within a sequence the randomness of the probability of obtaining sequences of either 0 states only or 1 states only, irrespective of its length.

The standard deviation of the absolute value of the difference between the number of 1 states and 0 states of each sample within a sequence of binary data is a rough measure of entropy, indicating how far this difference is from reference conditions. The smaller the standard deviation's value, the smaller the absolute value of the difference between the number of 1 bits and 0 bits.

The decision to implement these measurements derives from the theory that distant mental interaction may favour order where there is disorder, and therefore be able to reduce the randomness of data acquired from mental interaction or increasing the number of 1 states (or of 0), or increasing the sequences of identical values (Burns, 2012) or both.

As a control, for each test three sets of data, all the same duration of time, were gathered – one before, one during, and one after the mental interaction – so as to control possible environmental interferences, for example temperature or electromagnetic emissions, even though in normal conditions these factors appear to have no effect on the TRNG's activity.

As a further control of experimental conditions, mainly on the same days as the experimental data-gathering and at least one hour before and after with respect to the latter, another 100 tests were recorded, each comprised of three 15 minute samples of data, exactly like those done with mental influence.
Lacking sufficient information regarding both the ideal interaction duration and the most effective mental interaction strategy to use, for each test within the 15 minutes dedicated to the attempted mental influence, we left it to the participants to decide on the most suitable mental strategy for themselves and to choose the duration of influence as either 5, 10, or 15 minutes.
The main hypothesis on which this study is based is that the data obtained during distant mental interaction – for the Frequency or Runs tests – contains a higher number (with respect to the control number) of samples with a probability (p-value) of $\leq 0.05$ and/or the standard deviation of absolute differences between the states 0 and 1 is greater during the mental interaction phase than in the pre-interaction and control phases.
Amongst the data collected immediately after the mental interaction phase is some evidence suggesting that the effect of mental interaction itself may continue for a certain period of time even after the termination of the voluntary interaction (Stanford & Fox, 1975; Tressoldi, Pederzoli, Matteoli, Prati & Kruth, 2016).
The confirmatory hypothesis presupposes that during the post-influence stage the same effects observed during the voluntary mental influence stage will be obtained.
There are no confirmatory hypotheses regarding the possible differences between results obtained under these two conditions.

## Methods

### Study pre-registration

Before any data were collected, the methods on which this study is based as well as statistical analyses of confirmatory hypotheses were pre-registered at: https://osf.io/3g95p.

### Participants

Experienced and non-experienced participants were recruited amongst subjects known to the authors. Only those whose previous experience with this type of experiment was known to the authors were considered as experienced.
The participants were 5 men (average age of 48 years; SD = 15) and 8 women (average age 46 years; SD = 13), of whom 3 were experienced and 10 were non-experienced.
As specified in the pre-registration, 100 trials were carried out in blocks of 5. Seven participants chose to contribute with 10 trials each, and the remaining 6 each made 5 trials.

### The electronic device

The device named MindSwitch 2, including its software, is described at https://github.com/tressoldi/MindSwitch so that it can be easily reproduced. In a nutshell, it is comprised of a single-board Raspberry PI mini-computer, a Power Bank, a TrueRNG® and a Pendrive.
During the study, parameters for analysis of the TrueRNG® remained fixed: 100 bits/sec for one minute, for a total of 6000 bits, collected 15 consecutive times corresponding to each of the three phases (PreMI, MI and PostMI).
After each minute, the programme analysed the data using the Frequency Monobit Test and the Runs Test from the NIST (Bassham et al., 2010) and, if the statistical analysis gave a p-value $\leq 0.05$, a visual and auditory signal was activated (an LED was lit for 5 seconds and a 1 second acoustic signal was emitted).

The results of each of the 15 measurements were recorded on the Pendrive to be exported and analysed offline. A copy of the raw data is available at ................

**Procedure**
The dates and times of each test were agreed upon between the participant on duty and the first author. On the agreed day and time, the first author contacted the participant via Skype. After at least one practice attempt to acquire confidence with the procedure, the formal series of tests began at one or at most two per day (e.g. morning and evening), so as to ensure the participant's best mind-body efficiency. .
Each test consisted of three successive 15 minute phases: before (PreMI), during (MI), and after mental interaction (PostMI).
The first author activated MindSwitch 2, located at least 5 metres from him in a room with a constant temperature of about 20˚C and far from any electromagnetic energy sources. During the mental interaction the first author, after having given the participant the go-ahead to begin the distant interaction, moved away from the monitor for the entire duration of the session and returned to it after the elapsed time to terminate the session.

**Score**
As described in the pre-registration, the dependent variables were represented by the number of samples giving a p-value ≤0.05 for the Frequency Monobit and Runs Tests, and therefore a minimum value of 0 and maximum of 15 for each of the three series, as well as from the average of the Standard Deviations of the absolute differences between the 0 and 1 states of each of the three series of data from each test.

## Results

Table 1 shows the number of samples from the Pre-MI, MI and Post-MI series that had a p-value ≤0,05 (preset threshold) for the Frequency Test, the Runs Test, and both tests simultaneously. Although they are raw values, since the total number of the data set is 100, they can be considered as percentages.

**Table 1**: Number of samples from the Pre-MI, MI and Post-MI series that had a p-value ≤0,05 (preset threshold) for the Frequency Test, the Runs Test, and both tests simultaneously. The numbers obtained from the three control series are in square brackets.

| | **PreMI** | **MI** | **PostMI** |
|---|---|---|---|
| **Frequency Test** | 61 [54] | 54 [60] | 62 [57] |
| **Runs Test** | 56 [65] | 56 [56] | 53 [60] |
| **Frequency & Runs Tests** | 3 [4] | **9** [4] | 5 [2] |

**Standard deviation of the absolute differences between 0 and 1 states**
The number of times in which the standard deviation of the absolute differences between the 0 and 1 states exceeded the threshold was: PreMI > MI = 50; MI > PreMI = 50; PreMI > PostMI = 48; PostMI > PreMI = 47; Same = 5.

## Comments

With respect to the confirmatory hypotheses the only favourable result was related to the surpassing of the preset statistical threshold of 0.05 for both statistical tests within the same set of data.
In short, in favour of the MI phase we see a difference of 6 samples with respect to the PreMI phase; a difference of 4 with respect to the Post-MI phase, of 5 with respect to the first and second control phases, and of 7 with respect to the third control series.
Even if, as described in the pre-registration, these differences can be analysed from a statistical point of view, we believe that applying inferential statistics to these data is inappropriate, in that it is not possible to generalise the observations to other participants and experimenters.
In every case the results of a statistical comparison between 9% of observed events in MI, 3% of observed events in PreMI, and 4% observed in control conditions gives values of Z = 1.78, $p$ = 0.036 (one-tailed) in the first, and Z = 1.43, $p$ = 0.07 (one-tailed) in the second.

**Exploratory analyses**
We wanted to analyse the trend in absolute differences between 0 and 1 states recorded in all sample data in phases PreMI, MI, and PostMI, and compare them to control phases. Remember that the greater this value, the lower the entropy (randomness) of the sequences of 0 and 1 states generated by the TRNG.
We therefore counted the number of times in which these differences exceeded the threshold value of 150, which corresponds to p-value = 0.05 in the Frequency Test, after which we also did it for those above threshold values of 160, 170, 180, 190 and 200. Results are illustrated in Fig 1.

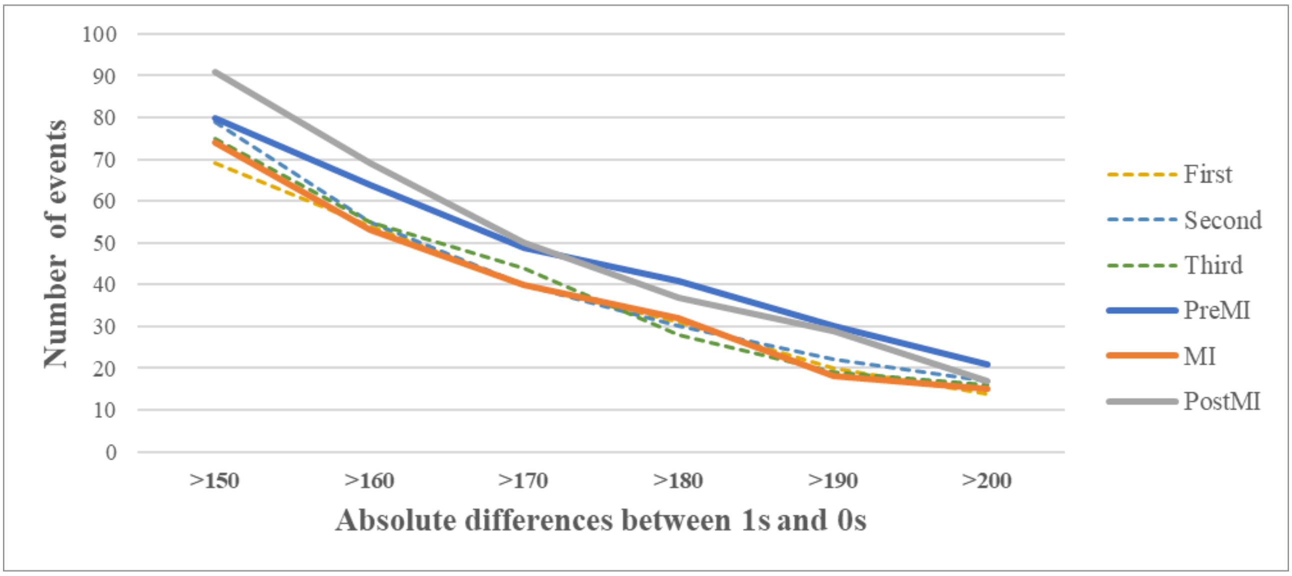


**Fig 1**: Tendency of number of samples that show differences between 0 and 1 values that range from >150 to >200 in PreMI, MI, and PostMI phases compared to three respective control phases.

As Fig 1 demonstrates, the number of samples indicating less entropy, and therefore a larger difference between 0 and 1 values, is greater in the PostMI condition, followed by PreMI, but the variation disappears when the differences are >170. However, the number of samples observed in the MI phase is comparable with what is seen in the three control phases.
While in the PostMI phase this datum was expected by positing a type of "tail effect" of the MI phase, the observations from the MI and PreMI phases were unexpected and will be dealt with in the Discussion section.

## Discussion

For the time being, mentally influencing MindSwitch 2 from a distance does not seem as easy as manually flipping a switch on whichever type of electronic equipment.
In this experiment the only parameter that appears to be influenced by distant mental interaction is that one that exceeds the statistical threshold of 0.05 in both Frequency and Runs Tests within the same data set. Even though the absolute value of this event IS NOT HIGH – 9 events out of 100 – it is however almost twice as much as the PreMI, PostMI, and reference phases.

Do the results of this experiment represent proof-of-concept of the possibility of creating electronic devices able to be mentally controlled from a distance? We believe so, because from these data it is possible to improve the mental-signal/noise ratio of the random number generator.

To reduce the random number generator's noise, apart from seeking those with highest sensitivity, new more efficient algorithms could be tested. Furthermore we still don't know the ideal length of string bits that maximises the mental signal's effect.

Moreover, how can the mental signal be strengthened? The answer to this question is unfortunately still vague. For example is there a dose-effect – that is, will the signal improve as the interaction's duration is extended? Of the eight participants who altered the data flow by simultaneously exceeding the statistical thresholds of the two tests, 4 of them had an interaction of 10 or 15 minutes and the other 4 for only 5 minutes. Therefore this experiment does not seem to highlight a dose-effect linked to the duration of interaction.

We wonder if there is a test of some sort that will allow us to determine the most efficient direct mental influence strategy, such as the following:
*"I mentally created a flash of light forming a connection cable to MindSwitch"* (Participant #11)
*"I 'asked' and 'hoped' for it to turn on and mentally repeated the request."* (Participant #5)
or direct influence, such as:
*"I attempted, with the aid of spiritual music, to create a field of positive emotion surrounding MindSwitch."* (Participant #8)
*"I cleared my mind of random thoughts."* (Participant #1)
For now we have no answer to this question too.
If we look at the information in Fig 1, that lower entropy events are more common during the PreMI phase than the MI phase, more doubts arise as to the ideal strategy for distant mental influence.

We remind readers that the PreMI phase occurred in the 15 minutes preceding the MI phase, therefore during a time when the participants were certainly not attempting any voluntary influence of MindSwitch 2, but they were indeed preparing to do so by planning the mental strategy to be used after forming a clear image of the end goal.

Obviously these comments are only applicable to the observations from this experiment. More precise answers will only come forth from further data collection using other participants, other experimenters, other types of random number generators, and analytical algorithms to assess the reduction in entropy of their emitted bit sequences.

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# References


Bassham, L. E., Rukhin, A. L., Soto, J., Nechvatal, J. R., Smid, M. E., Barker, E. B., … Vo, S. (2010). *A statistical test suite for random and pseudorandom number generators for cryptographic applications*. Gaithersburg, MD. https://doi.org/10.6028/NIST.SP.800-22r1a

Bösch, H., Steinkamp, F., & Boller, E. (2006). Examining psychokinesis: The interaction of human intention with random number generators--A meta-analysis. *Psychological Bulletin*, *132*(4), 497–523. https://doi.org/10.1037/0033-2909.132.4.497

Burns, G. E. (2012). The Action of Consciousness and the Uncertainty Principle. *Journal of Nonlocality*, *1*(1), 1–9.

Duggan, M. (2017). Psychokinesis Research. Retrieved from http://tinyurl.com/y6l9zznz

Jahn, R. G., Dunne, B. J., Nelson, R. G., Dobyns, Y. H., & Bradish, G. J. (2007). Correlations of Random Binary Sequences with Pre-Stated Operator Intention: A Review of a 12-Year Program. *EXPLORE*, *3*(3), 244–253. https://doi.org/10.1016/J.EXPLORE.2007.03.009

Kapogiannis, D., Barbey, A. K., Su, M., Zamboni, G., Krueger, F., & Grafman, J. (2009). Cognitive and neural foundations of religious belief. *Proceedings of the National Academy of Sciences of the United States of America*, *106*(12), 4876–4881. https://doi.org/10.1073/pnas.0811717106

Kugel, W. (2011). A Faulty PK Meta-Analysis. *Journal of Scientific Exploration*, *25*(1), 47–62.

Radin, D., Nelson, R., Dobyns, Y., & Houtkooper, J. (2006). Reexamining psychokinesis: Comment on Bösch, Steinkamp, and Boller (2006). *Psychological Bulletin*, *132*(4), 529–532. https://doi.org/10.1037/0033-2909.132.4.529

Stanford, R. C., & Fox, C. (1975). An Effect of Release of Effort in a Psychokinetic Task. In J. D. Morris, W. G. Roll, & R. L. Morris (Eds.), *Research in Parapsychology* (pp. 61–63). Metuchen, NJ: Scarecrow Press.

Tressoldi, P., Pederzoli, L., Caini, P., Ferrini, A., Melloni, S., Richeldi, D., … Duma, G. M. (2014). Mind-matter interaction at a distance of 190 km: Effects on a random event generator using a cutoff method. *NeuroQuantology*. https://doi.org/10.14704/nq.2014.12.3.767

Tressoldi, P., Pederzoli, L., Matteoli, M., Prati, E., & Kruth, J. G. (2016). Can our minds emit light at 7300 km distance? A pre-registered confirmatory experiment of mental entanglement with a photomultiplier. *NeuroQuantology*, *14*(3). https://doi.org/10.14704/nq.2016.14.3.906

Varvoglis, M., & Bancel, P. A. (2016). Micro-Psychokinesis: Exceptional or universal? *Journal of Parapsychology*, *80*(1), 37–44.