Anomalous ‘retrocausal’ effects on performance in a Go/NoGo task

Dick J. Bierman & Aron Bijl

University of Amsterdam

**Abstract -** Retroactive effects were investigated in the context of a Master thesis on the effect of instruction on intuitive and rational thinkers in a Go/NoGo task. Participants were presented with a shape and instructed to either respond or not to respond dependent on the shape. In the first Go/NoGo task the subject had to respond to two shapes, randomly chosen out of 4 shapes. In the second Go/NoGo task only one shape had to be responded to. This shape was randomly chosen from the two that were used as stop-signals in the first phase. In accordance with the growing literature on retroactive influences on cognition and emotions, where future events seem to have an anomalous, retroactive influence on responses and behavior in the present, we predicted that the second Go/NoGo task would have a practice effect on performance during the first task. We also predicted that this effect would be stronger for subjects classified as ‘intuitive thinkers’ on the basis of the Human Information Processing-questionnaire.

 These predictions were confirmed. During the first session, the subjects responded ~2% faster to the (target) shape, which they also had to react to in the second session, than to the (control) shape they only had to respond to during the first session (t = 2.59, df = 66, p=0.024). The subjects with an intuitive thinking style were totally responsible for the whole effect (‘intuitive’ thinkers alone: t = 3.41, df = 34, p < 0.001). Explorations of the subscales of the HIP-questionnaire suggest that the relation between anomalous performance and Human Information Processing style is mostly due to a factor that we label ‘rigidity’. We also discuss how ‘Questionable Research Practices’ could have contributed to the current results.

# Introduction

*Retroactive influences*

Lately there have been multiple studies on retroactive influences on cognition, where future events seem to have an anomalous, retroactive influence on responses made in the present (Bem, 2011). One example of this, which has received quite some attention in the last decades, is presentiment: Multiple studies have shown that certain measures of arousal (galvanic skin response, heart rate etc.) can show an increase a short time before the actual onset of a random arousing stimulus (e.g. Bierman & Radin, 1997; Bierman & Scholte, 2002; Mossbridge et al, 2012). Such results suggest that information concerning a stimulus can actually go back in time (from milliseconds to seconds) although it might be more precise to say that the present apparently is dependent on past and, to a much smaller degree, on unknown future conditions. Another example of the same phenomenon is retroactive priming, where primes shown after the target stimulus, have an effect on the response latency for that stimulus (e.g. de Boer & Bierman, 2006; Bem, 2011).

A further example of this phenomenon, but showing said anomalous retroactive effects even earlier (multiple minutes back in time), is retroactive practice or learning (e.g. Franklin & Schooler, 2011a; 2011b). Simply put, it is conventional practice turned around. Studying for an exam is a good example: Normally, studying before an exam influences one’s performance during that subsequent exam. According to the theory of retroactive influences, it would theoretically be possible to influence one’s performance on an exam by studying for it after it has taken place.

Some of the abovementioned studies will now be described in more detail. Bem (2011) did a study, consisting of nine separate experiments, on precognition and premonition, two examples of a more general phenomenon: A retroactive, anomalous influence of a future event on a person’s current responses. All but one of these experiments yielded significant results, supporting these retroactive effects. One of these experiments for example was a reversed priming experiment: Participants judged pictures as being pleasant or unpleasant. After being shown a picture, instead of before like in a regular priming experiment, a congruent or incongruent word would quickly be shown. Participant responded significantly faster on congruent trials than on incongruent trials.

 It should be mentioned that this study has attracted strong criticism. A good example of such criticism is from Wagenmakers et al. (2011), who call upon Bayesian statistics in an attempt to weaken Bem’s results. The points they and others have raised are either incorrect or applicable to statistics in experimental psychology in general. An issue that has hardly been raised in the discussion of Bem’s and similar anomalous results is whether the use of ‘questionable research practices’ can account for these results. A number of meta-analytic results in the field of experimental Parapsychology show consistent and very significant effects (often larger than 6-sigma). Small effects, induced by questionable research practices in individual studies, however can of course build up to large meta-analytic effects. Recent simulations of so-called Ganzfeld telepathy experiments show that about 40% of the reported meta-analytic effect-size can be accounted for by these practices. (Bierman & Bijl, 2014, in preparation)

In studies such as mentioned above, where anomalous retroactive influences are tested, it is essential that the future condition that is supposed to ‘influence the past’, is chosen randomly. If that condition is not met, then normal inferential processes about the future might have caused the current performance in the present. In studies such as mentioned above (and in the current experiment as well), the selection of the future condition is generally based upon the outcome of an electronic or software-based random number generator. Franklin & Schooler (2011a; 2011b) however conducted multiple experiments (yet to be published) where they used the abovementioned retroactive practice effect to predict real world events (in this case: the spin of a roulette wheel). To do this they used a setup quite similar to the one used in the current experiment: During two subsequent Go/NoGo sessions, subjects had to respond to a stimulus appearing on the screen. During the first session, subjects had to press a button for two shapes (the Go-shapes) randomly selected from four. For the two other (NoGo) shapes subjects had to withhold a response. During the second session subjects only had to react to one of these two Go-shapes from the first session. This shape is also referred to as the target shape. The choice of the target shape was determined by the spin of a roulette wheel.

If their response during the first session was quicker for Go-shape A than for Go-shape B then the experimenters assumed that shape A would be the one that would be chosen by the random decision of the roulette wheel (to be used again as target shape during the second Go/NoGo session). In this manner they were able to infer the future outcome of the roulette wheel by just looking at the results during the first Go/NoGo session. Their results were a bit less straight forward than a superior performance in the first session for the shape exercised in the second session. During the final experiment they achieved a success rate of 57 percent (N=111, p=0.062) in predicting these roulette-outcomes.

The Consciousness Induced Restoration of Time Symmetry model (CIRTS; Bierman, 2010) is based upon the fact that time-symmetry is intrinsic in almost all formalisms in theoretical physics. Apparently this symmetry has been broken for most physical systems. It is assumed that under specific information processing conditions this symmetry is partly restored. In that case one would expect correlations that appear to be retrocausal. The particular context that restores the symmetry is that information is processed by an extremely coherent multi-particle system like our brains. This also introduces the single parameter that can account for individual differences, namely the coherence of the brain. It is argued that intuitive participants have a more global and spontaneous type of information processing than more rational (serial thinking) participants and therefore CIRTS would predict a larger retrocausal effect for ‘intuitive’ participants.

 The current experiment was originally designed to test mainstream hypotheses on the effect of speed vs accuracy instructions on task performance by participants with an intuitive or rational thinking style (see Bijl, 2012). Since the setup of this study was quite comparable to the setup used by Franklin & Schooler (2011a; 2011b), we decided to test separately the anomalous retroactive practice effects that were reported by Franklin and Schooler.

## *Research Question*

We investigate whether future practice can affect performance in the present. We will compare this effect for intuitive and rational thinkers, expecting the effect to be larger for the intuitive ones.

## *Hypotheses*

We used the same design as in the Go/NoGo experiment by Franklin and Schooler described above, with the exception that we didn’t use a roulette wheel as a randomizing device but the built in random function of ‘Visual Basic’.

•  Hypothesis I: The second Go/NoGo session will have a training effect on performance in terms of response times during the first Go/NoGo session. More specifically, assuming the two Go-shapes in the first session are ‘A’ and ‘B’ and assuming that the Go-shape in the second session is ‘A’ (aka the target shape), we predict that subjects will respond faster on A than on B during the first session (and vice-versa for subjects who have to respond to target shape B in the second session).

 • Hypothesis II: Subjects with an intuitive thinking style show a larger retrocausal effect than subjects with a rational thinking style.

# Method

*Subjects*

In total, 69 people (35 female; 34 male), with a mean age of 20.8 (range 18-64, and a standard deviation of 8.3), completed the experiment. The subject pool consisted of some first-year psychology students participating for credits as a mandatory part of the curriculum at the University of Amsterdam and for the most part of students from a local high-school in Alkmaar who were in the last year before entering the university. This was due to a low availability of participants at the university.

*Procedure & Materials*

### The study was approved under number 2011-BC-2019 by the Faculty Ethics Review Board. After arriving at the test room, participants were asked to read an information brochure informing them about the nature of the experiment. Before taking part in the experiment, each participant provided written consent after reading this brochure.

Subsequently they were introduced to the tasks and the shapes that were used during the two Go/NoGo sessions (see shapes in figure 2) and informed that they were free to quit the experiment at any time. The experiment had 3 phases.

In the first phase, preceding the two Go-NoGo tasks (phase 2 and phase 3), subjects did an initial baseline reaction time task (see figure 1). They had to respond to an “X” appearing center screen on a computer at random intervals, ranging from 1000 to 3000 milliseconds, during 20 trials by pressing the enter button on the keyboard. The mean baseline reaction time measured in this way for each participant was later used to normalize the experimental response times and thereby reduce inherent inter-subject variability.

Figure1: Flow Chart of the several phases of the experiment

Baseline

Reaction Time Test

First

Go/NoGo task

Second

Go/NoGo task

Phase1

Phase2

Phase3

After this subjects were given the first Go/NoGo task (phase 2), with the instruction to simply do the best they can. The task was made up as follows (see figure 2): Participants were, in each of the 64 trials, randomly shown one of four predetermined shapes on a computer screen at random inter-stimulus intervals uniformly distributed from 1500 to 3500 milliseconds. The screen size of the shape was 3,5 cm by 3,5 cm on a 30,8 cm x 23 cm computer screen, at a resolution of 1024 x 768 pixels.



Figure 2: The 4 shapes used in the Go/NoGo tasks

Participants had to press the Enter button if a Go shape appeared on the screen. In the first Go/NoGo task there were two Go shapes. *For instance* the participants had to respond when either shape A or shape B appeared on the screen and not respond to the two others (shapes C and D). Note that for each participant the assignment on which shapes to respond was random. That is important in order to avoid effects due to the intrinsic recognition of the shapes. After this phase they entered a second Go/NoGo task. In this task participants had to respond to only one of the four shapes. The shape they had to respond to in phase 3 was randomly chosen from the two they had to respond to in phase 2 (i.e.: in this example: shape A *or* B).

For the sake of the psi-hypothesis, the shape subjects had to respond to during *both* phase2 and phase3, will be referred to as the ‘target-shape’ for that specific participant. The shape to which the participants only had to respond during the first Go/NoGo task and hence doesn’t get further training in the second Go/NoGo task will be referred to as the ‘control-shape’.

 The program used during the experiment was written with ‘Visual Basic’ programming language, using ‘Real Studio 2011’, version 4.3. It can be downloaded from: https://www.dropbox.com/s/akv3k5p2ihwidlv/GNG.rb

 Finally, using the HIP-questionnaire (Human Information Processing, Taggart & Valenzi, 1990), subjects’ tendency towards rational or intuitive reasoning was assessed. This was done after the actual Go/NoGo tasks to avoid an effect of this questionnaire (and the resulting reflection on one’s thinking style) on subjects’ natural style and resulting performance. Subjects are given statements concerning their thinking style. They have to rate how much the statement applies to them, from ‘always’ to ‘never’ on a 6-point Likert-scale. An example of such a statement is “When solving problems I prefer to use proven methods over trusting my first intuitive impressions.”

**Dependent Variables**

The dependent variables that we will use in the analyses have been operationalized as follows.

*Normalized response times*

From the data of the initial simple reaction time task, mean ‘baseline’ reaction times were calculated for each subject. In addition, mean reaction times were calculated for each Go shape during the two Go/NoGo tasks per subject (two during the first and one during the second session). We normalized these reaction times by dividing a participants’ reaction time on a shape, by their mean baseline reaction time measurement. Error rates were also calculated per session per subject. Averaged normalized response times were calculated using only the correct responses.

*Intuition score and categorization*

For the HIP scores, the three scores related to a rational thinking style were added per subject. The same was done for the three scores related to an intuitive style, resulting in two scores for each subject: One signifying the amount of rational thinking (R= rational score) and one the amount of intuitive thinking (I = intuitive score). The intuitive scores were subsequently divided by the rational scores, resulting in a thinking style-score IR, varying between 1.5 and 0.7, the first indicating a very intuitive thinking style, the latter a very rational one. Subjects were categorized as ‘Intuitive’ if their IR was larger than the median and as ‘rational’ if their IR was smaller.

**Results**

*Subjects & Data*

The data of one subject had to be disregarded because the number of errors was so large that it was clear that subject hadn’t understood the instruction. For one subject there was data-loss due to computer failure. The analyses therefore have been performed on the remaining 67 subjects.

*Hypothesis I: retrocausal training effect*

To test our prediction, that the second Go/NoGo session (phase3) will have a training effect on performance during the first Go/NoGo session (phase2), the reaction times to both Go-shapes during phase 2 (the target - and control-shape) were compared to each other, to inspect whether the future Go/NoGo task in phase 3 had a retroactive practice effect on the first session. The normalized reaction times are always larger than 1 because the normalization factor was obtained in a simpler reaction time task in phase 1 of the experiment. A paired samples t-test was performed, comparing the normalized reaction times to the control - and target-shape during the first Go/NoGo session. The reaction times to the target-shape proved significantly lower than the reaction times to the control-shape (t= 2.59, df= 66, p= .012 one-tailed, Cohen’s effect size d = 0.22), suggesting a retroactive practice effect of the second session on the first (see table 1).

Data are available at: <https://www.dropbox.com/s/j44lvj0c561o5in/Main%20datafile.sav>

Table 1: Baseline reaction times in msec and normalized reaction times on target & control shapes for rational and intuitive thinkers for the first Go/NoGo session (\* = p < 0.02, \*\* = p< 0.01)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Baseline (msec)** | **Target shape** | **Control shape** | **Diff (t)** |
| **Group** | Mean RT | N | Std. Dev. | Meannormalized | N | Std. Dev. | Meannormalized | N | Std. Dev. |  |
| Intuitive thinkers | 354.46 | 35 | 31.98 | 1.73 | 35 | 0.23 | 1.80 | 35 | 0.25 | 3.4 \*\* |
| Rational thinkers | 353.35 | 32 | 29.25 | 1.79 | 32 | 0.2 | 1.79 | 32 | 0.22 | 0.3 (ns) |
| **Totals** | **353.9** | **67** | **30.48** | **1.75** | **67** | **0.21** | **1.795** | **67** | **0.23** | **2.59\*** |

*Hypothesis II: individual differences*

To test whether this effect was more pronounced for subjects with an intuitive thinking style, we performed an one-way ANOVA with thinking style as a between-subject factor, comparing the difference in normalized reaction times between the target - and control-shape during the first Go/NoGo session for rational and intuitive thinkers. A main effect for thinking style was found (F(1, 66 = 4,477, p= 0.038). We also repeated the paired samples t-tests comparing normalized response time for target-shape and control shape for intuitive and rational thinkers separately. Now, only the intuitive group showed a significant difference in the expected direction (t= 3.41, df=34, p= 0.001, one-tailed, Cohen’s effect size d= 0.40)

*Exploration of the HIP*

The Human Information Processing questionnaire has 30 items resulting in 6 subscales, called rat1, rat2, rat3, int1, int2 and int3. The authors of the HIP labeled these subscales as ‘Logic’, ‘Planning’, ‘Rituals’ for rat1, rat2, and rat3 respectively and ‘Insight’, ‘Vision’ and ‘Sensing’ for int1, int2, and int3.

The formal test of our hypothesis, that intuitive subjects would show the anomalous training effect more than the rational one’s, was tested using the compound measure IR = (int1+int2+int3)/(rat1+rat2+rat3).  The IR scores are normally distributed (Kolmogorov-Smirnov: 0.073, df= 67, p=0.20). The correlation between psi effect and the global intuition score, IR, was a marginal R= 0.20 (p < 0.052, one-tailed).

In this section we *explore* which of the subscales that go into IR attributed most to the effect. First we performed regular and partial correlational analyses using each subscale separately while controlling for all others to predict the performance of the subjects. The correlation data are given in table 2.

Table 2: Regular and partial correlations between psi performance and subscales of the HIP, controlled for all other subscales, and regular correlations between the subscales themselves. (\* p<0.05, \*\* p < 0.01)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Psi score | Rat1 | Rat2 | Rat3 | Int1 | Int2 | Int3 |
|  | regular | partial | regular | regular | regular | regular | regular | regular |
| Rat1: Logic | - 0.17 | -0.23\* | 1 |  |  |  |  |  |
| Rat2: Planning | - 0.02 | -0.16 |  + 0.37\*\* | 1 |  |  |  |  |
| Rat3: Rituals | - 0.36\*\* | -0.37 \*\* | + 0.05 | - 0.33 \* | 1 |  |  |  |
| Int1: Insight | - 0.01 | -0.02 | - 0.33\*\* | - 0.38 \*\* | - 0.11 | 1 |  |  |
| Int2: Vision | - 0.13 | -0.20 | - 0.42\*\* | - 0.46\*\* | +0.13 | + 0.47\*\* | 1 |  |
| Int3: Sensing |  + 0.12 | +0.15 | + 0.1 | + 0.25 | +0.06 | - 0.38\*\* | - 0.01 | 1 |

The component rat3, ‘Rituals’, correlates strongest with the psi score (R= -0.36, N=67, p = 0.002). In spite of the label ‘rituals’ the subjects scoring high on this attribute do not engage in spiritual traditions but stick to rules and procedures. It could be argued that ‘rituals’ here implies a lack of spontaneity and creativity. We prefer to label this scale as ‘rigidity’.

It can further be observed from the table that some of the subscales show strong correlations amongst themselves. Therefore we also calculated partial correlations where we controlled for all the remaining subscales. The *partial* correlation of psi score and ‘rigidity’ happens to be near identical to the regular correlation (Rpartial(rat2, psi) = -0.37, N=67. P=0.003). The other rational subscores also had a negative partial correlation with the psi scores, though not as strong as rat3. (R(rat1, psi) = -0.23; R(rat2, psi) = -0.16)

From the partial correlations of the int-scales with psi performance only int2 (vision) was marginally significant (Rpartial(int2, psi)= -0.2, p < 0.06), but surprisingly this was in the negative direction. The int2 factor is labeled ‘vision’ and most items seem to measure some aspect of creativity. As we mentioned before, the rat3-subscale which we re-labeled as ‘rigidity’, can be interpreted as representing a lack of creativity. However there is a minor positive correlation between rat3 and int2 (R(int2, rat3) = 0.13, n.s.). This is what we would expect for two subscales, both correlating in the same direction with psi performance. One subscale however, rat3, measures ‘rigidity’ and the other, int2, measures ‘aspects of creativity’. One would expect them to have a negative correlation. It is unclear why both subscales that appear to measure opposing personality aspects both correlate in the same direction with the psi performance. It should be remarked that neither of the int-scales have a significant contribution to psi performance so we shouldn’t take the apparent paradox too seriously. Basically the only aspect that really counts is the ‘lack of rigidity’, rather than the amount of intuitive processing, as it is measured by the int-subscales. This cautious conclusion fits with the finding in literature that psi performance correlates positively with the ‘openness factor’ in the Neo Personality Inventory (Zingrone et al, 1999). If we forget about the Int subscales and only use the ratio scales the correlation of psi performance with Rat=rat1+rat2+rat3 is - 0. 32, (N=67, p=0.004 one-tailed).

**Alternative explanations for the ‘retrocausal’ effect**

As stated in the introduction in experiments of this kind, where a future condition is claimed to have a ‘retrocausal’ influence on present behavior, it is mandatory to ensure these future conditions are properly randomized with replacement so that it is impossible to infer the future condition. For instance, in so-called presentiment research the claim is that actual physiological behavior of a participant is dependent on a future (randomly selected neutral or emotional) stimulus. However in the current experiment the relevant future condition (which shape will be the target-shape) is only determined once. Even if the randomization is weak the participant isn’t able to infer anything that could be used in the next trial.

However the alternative explanation of conscious or non-conscious learning of the randomization is replaced in the current experiment by another potential explanation. Actually this explanation occurs because the choice of the target shape from the possible four shapes is random and not counterbalanced. This may result in an over- or underrepresentation of a specific target-shape in the whole experiment. If and only if the participants have biases in response times for specific target-shapes (for instance if it is intrinsically easier to respond to a specific shape, and that shape is over-represented as a target) we can expect that overall participants will show faster response times for the target shapes. In table 2 the mean response times for the different shapes are given in the relevant column.

To check whether the four shapes used in the Go/NoGo tasks were actually equally difficult to remember and to respond to, a one-way ANOVA comparing the different shapes was performed with these normalized reaction times. There were no significant difference in response times for each of the 4 shapes (when the shape was the target: F3,66 = 0.28, p=0.99, nor when the shapes were the controls F3,66 = 1.512, p = 0.22).

Of greater importance for this potential alternative explanation is to check if the frequency distribution for the Go shapes significantly deviates from a random distribution. This does not appear to be the case: chi-square = 0.588, df=3, n.s. for the target-shape frequency distribution, and chi-2= 3.41, df=3, n.s. for the distribution of control-shapes).

Table 3: Frequencies of the different shapes with mean normalized response times.



In order to assess if the actual non-significant deviations from the perfect distribution could have produced an artificial differential response time effect between target-shapes and control-shapes, we ran a simulated t-test for each subject, using the shapes that were actually used in his/her experiment, while using the subject’s average response times for those shapes.

This simulation results in a small artificial effect, the mean normalized target-shape response time is 1.782 and the mean normalized control-shape response time is 1.785 (t=1.07, df = 66, p = 0.22). The difference being only 0.005 while in the actual experiment the differential effect is about 10 times larger. So these results show that the artificial effect, due to deviations in frequency distribution of shapes and their respective mean normalized response times, is able to explain only 0.15% of the total 2% effect. The fact that the difference in reaction times between the control - and target-shapes was only found for intuitive thinkers, further renders this alternative explanation, based upon different difficulties and different frequencies, unlikely.

**Discussion**

**T**he prediction that the second Go/NoGo task (phase 3 of the experiment) would have a training effect on performance during the first Go/NoGo task (phase 2), and that this effect would be more pronounced for subjects with an intuitive thinking style, was supported by the results. During the first Go/NoGo task, intuitive subjects reacted significantly faster to the target shape than to the control shape. The only difference between the target and control shape being that the target shape would be trained in the future (second Go/NoGo task), while the control shape wouldn’t. Rational subjects did not show this difference at all. This suggests that for subjects with an intuitive thinking style, the second Go/NoGo task had a retroactive practice effect on their performance during the first Go/NoGo task. When this difference was compared for the entire subject pool, it was still significant, with an effect size *d* of 0.25, which is comparable to what Franklin & Schooler (2011a; 2011b) found in their experiments. Potential alternative (normal) explanations for this anomalous finding were excluded. However, given the impact that has been reported of Questionable Research Practices on psychological research findings, we will discuss this issue separately. The potential role of Questionable Research Practices has been simulated for the meta-analytic database of Ganzfeld-telepathy experiments and from those simulations a conclusion is reached that these practices, if they indeed are used, might be able to account for at least a fraction of the anomalous results (Bierman & Bijl, in preparation).

*Questionable Research Practices and pre-registration*

The current experiment was described in detail before starting the experiment. This proposal was submitted in part to the ethical committee to obtain permission and, in full, to an independent staff member who had the obligation to check if the final product (report and presentation) corresponded with the plan. This can be seen as equivalent to a formal pre-registration. It practically is intended to prevent post hoc selections without explicitly mentioning that such is an exploration. For instance, in the current experiment, we did not plan to do an analysis on the HIP-subscores and hence this was reported in the section ‘explorations’.

We asked an independent researcher, who is responsible for checking pre-registrations at the KPU-registry (<http://www.koestler-parapsychology.psy.ed.ac.uk/TrialRegistry.html>), to compare our research-plan, with the current intended publication as if it were a pre-registration, assuming that we did stick to the original plan. He pointed out that the original research plan did not explicitly state that the main hypothesis (retroactive training) was a confirmatory hypothesis. That could have given us a post hoc option to declare the study as exploratory, which would have given us the freedom to try out several different analyses of the main hypothesis. More importantly, the normalization procedure of reaction times was not specified. It is obvious that such an omission leaves the door open for various data transformations and adjustments, like outlier corrections. The compound variable that determines the processing style of the participants from the sub-scores of the HIP also was not specified. He concludes that there still were too many ambiguities that offer degrees of freedom that could have been exploited post hoc. Although we didn’t actually use this freedom and the normalization procedure that we eventually used is logical in terms of having scores that are around 1, we conclude that pre-registration is a good practice *only when followed up by an independent comparison of the pre-registration with the final publication*. Preregistration with a public, openly accessible, registry is already standard practice in medical and pharmaceutical research. It should be mentioned that in the 1980’s the *European Journal of Parapsychology* required researchers to pre-register their experiments and the acceptance of a publication was solely dependent on the quality of the pre-registration and not on the results. On the other side some of the more prolific researchers in Parapsychology, and perhaps psychology in general, for some time opposed to preregistration, claiming it would prevent ’discovery’. All that preregistration does however, is prevent post hoc exploration of data from being presented as planned analyses. As several authors on pre-registration stress, it is very important in this respect to make a clear distinction between exploratory and confirmatory research (KPU, 2014 and forum discussions on OpenScienceFramework.com) and there is nothing against exploration of data obtained in a pre-registered experiment.

*Subscales of the HIP*

Looking at the exploratory results of the analysis of the subscales of the HIP-questionnaire, psi performance would appear to correlate negatively to rational thinking. The expected positive correlation to intuitive thinking could not be confirmed. These *exploratory* results seem to suggest that a too rigid way of information processing hampers the psi effect significantly, while being more intuitive has a much smaller positive effect. Further research is needed to unravel the relation between intuition and psi performance.

**Conclusion**

The results of the present experiment are consistent with other experimental data suggesting the presence of anomalous correlations between present behavior and future random conditions. Interestingly there is a growing attention in fundamental physics for ‘retro-causality’, often expressed in the form that the present is basically a ‘handshake’ between present and future conditions (where the contribution of future conditions in most contexts are negligible). (Aharonov et al, 2013). Although rather rudimentary efforts have been published to integrate these findings in a psychological and a physical model, it is clear that more breakthroughs in both fields, physics and psychology, are needed before we can begin to truly test and comprehend the workings behind these anomalous findings.

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