

**CROSSING THE BOUNDARIES BETWEEN THE NORMAL AND THE
PARA-NORMAL: FINAL REPORT ON THE PROLONGATION PERIOD
(10/05 TO 4/05) AND ON THE COLLABORATIVE PROJECT AS A WHOLE
(4/04 TO 4/06)**

**1. REPORT ON THE EXPERIMENTS PROPOSED FOR THE
PROLONGATION PERIOD (10/05 TO 4/05)**

We report in this section the results of the experiment co-funded by the Bial Foundation and designed in part to represent Experiments 2 and 3 of our original proposal to Cogito. Experiment 3 was intended to test 2 predictions. First, we predicted that in a number guessing task without feedback, guessing accuracy will be higher when target sequences are biased as compared to when they are random. Specifically, we used biased sequences that represented response biases characteristic of normal persons (“repetition avoidance” – not calling the same number twice in a row) and response biases characteristic of persons with frontal lobe lesions to the brain (“counting” – making calls displaced 1 position before or after the previous call; e.g., 1-2-3-4 or 4-3-2-1). (We will hereafter use the acronyms RA for repetition avoidance and CO for counting). The 3 runs testing this hypothesis did not provide feedback of the previous target (non-feedback runs). Second, we predicted that implicit sequence learning (ISL) would be especially efficient when the targets consist of participants’ (Ps’) own guesses on previous trials. To test this hypothesis, an experimental condition in which, starting with Trial 11, the targets consisted of the sequence of P’s guesses beginning with Trial 1 (a lag of 10) was compared to a control condition in which the target bias was opposite of that demonstrated by Ps in their preceding non-feedback runs. The single run used to test this 2nd hypothesis did include feedback of preceding targets (feedback run). We expected both predictions to be supported more strongly by believers in the paranormal than by skeptics.

To represent Experiment 2, we decided to apply the above procedure to 16 patients with frontal lobe lesions in the brain. Unfortunately, these patients have come to our clinic at a much slower rate than anticipated, and so far we have only been able to test 5 of them. We expect this rate of availability to increase in the coming months, and we aim to have this part of the experiment completed by the end of the year, at which time we will report the results to Cogito. As Dr. Palmer is now in the U.S., testing of these patients will be conducted by Dr. Brugger in Zurich.

The anomalous anticipation affect (AAE) described in our first report to Cogito was tested by comparing the response biases in the last non-feedback run (random targets) with the target biases in the subsequent feedback run. We finally came to interpret the AAE found in the previous research as skeptics correctly anticipating in the random run the target bias in the immediately following biased run. Believers, on the other hand, anticipated incorrectly. We predicted a comparable effect for the present experiment.

In our 2nd proposal to Cogito, we also proposed to test the effect on ISL of subliminal feedback of the preceding targets. To test this hypothesis, we presented half of our 64 normal volunteers in the feedback run with feedback targets that were masked, so as to render these targets, for the most part, consciously undetectable.

Finally, an additional ESP manipulation was added to the experiment. This manipulation was intended to test a model in parapsychology called “decision augmentation theory”, or DAT (May EC, Utts JM, Spottiswoode SJP, 1995, *Journal of Scientific Exploration*, 9:453-488). The theory says that Ps succeed in psi tests by selecting subsequences in a random target stream that happen, by chance, to match their own response biases. This can be done by choosing, via a button press on a computer keyboard or a mouse click, when the random stream is entered. In the 3rd (random) non-feedback run of this experiment, a hidden computer address (or, more simply, the computer) was in the “1- state” a random 20% of the time. Whenever Ps clicked the mouse to record their guess while the computer was in the 1-state, they would receive on the next trial a target matching their response bias, thereby increasing their chances of a correct guess on this trial. The prediction was that believers would click when the address was in the 1-state more than the 20% of trials predicted by chance.

METHOD

Participants

The 64 normal volunteers were recruited from the University of Zürich community and the city of Zürich. The 16 patients are to have unilateral damage confined to their frontal lobes (vascular or space-occupying lesions) and be competent to follow the instructions and persevere with the assigned tasks to completion. As an additional requirement, normal Ps had to indicate either that they have a strong belief in ESP and have had previous psychic experiences, or that they have a strong disbelief in ESP and no previous psychic experiences. This selection criterion does not apply to the patients.

The Guessing Task

P was seated in front of a computer monitor, which displayed squares containing the digits 1, 2, 3, and 4, arranged in a vertical column in either increasing or decreasing numerical order from the top to the bottom of the screen. The reason for the vertical display was to eliminate the effect of left/right response biases potentially confounding P's choice. Superimposed over the column of digits was a box containing the word "start". P clicked on this box to begin the run, at which time the box disappeared. P's task was then to guess which digit the computer would select for the ensuing trial. Ps indicated their choices by saying the digit out loud and simultaneously clicking the mouse. The experimenter (E), who was seated next to P, immediately entered P's response on the computer keyboard. P's oral responses were tape recorded, and after the session E checked the typed responses against these oral responses to check for possible entry errors.

In the feedback run, after 1 second the column of digits was replaced in the center of the screen by selected by the computer for that trial. If P's choice matched this target (a "hit"), the feedback square was colored green. In the subliminal condition, the feedback square, which was exposed for 30 ms, was masked with random line drawings, thereby making them subliminal, and the green background for hits was removed. After 3 seconds, the feedback stimulus was replaced by the array of die faces, in anticipation of the next trial. In the non-feedback, the array reappeared 1 second after P's response.

Procedure and Testing Protocol

Each P completed 2 sets of 2 runs. The 1st 2 runs (non-feedback) each consisted of 81 trials. For one of the runs, targets were assigned by an algorithm that, after the randomly selected 1st target, produced the extreme form of a CO bias. For example, if the 1st target was randomly selected as 2, the sequence was 2, 3, 4, 1, 2, 3, 4, 1, 2, 3 ...". The other run drew exclusively biased targets generated by an algorithm producing an RA bias. In this run the targets never repeated, but after the 1st target in the sequence each target appeared an equal number of times (20). Otherwise the sequence was random. The order of these 2 run types was alternated across Ps.

Following the 2nd run, P moved to a chair facing away from E and the computer screen and completed, in order, a drawing task, a 30-item tolerance of ambiguity questionnaire, and a 13-item scale called LIMBEX, which measures symptoms characteristic of temporal lobe dysfunction in the brain. At the same time, E moved to the chair in front of the computer and determined P's most marked response bias during the previous 2 runs. He considered both the probability of calling each individual target alternative (1, 2, 3, and 4) as well as the probability of calling each possible shift from a trial to the immediately following trial (0, +1, +2, +3). For example, if P called 2 on Trial 30 and 3 on Trial 31, this would count as a +1 shift; if P called the same target on Trials 30 and 31, this would count as a 0 shift.

Following completion of their respective tasks, P and E resumed the seating arrangements in effect for the 1st 2 runs. Run 3 was chosen to test the DAT hypothesis described above. During this run, an address inside the computer randomly alternated its content between 0 and 1, such that the computer was in the 1-state 20% of the time during the run, with the computer making a random decision about the status of the address every .2 seconds; the theoretical probability of a 1 was 1/5 and of a 0 was 4/5. Each time P clicked the mouse while the computer was in the 1-state, the next target was guaranteed to conform to P's most likely response bias, which was defined as his or her most extreme response bias during the 1st 2 runs. For example, if Ps had demonstrated RA previously, their target following a 1-state mouse click would never duplicate their immediately preceding response. All the other targets in Run 3, which were not affected by the DAT manipulation, were random.

Run 4, consisting of 100 trials, was the feedback run. In the experimental condition, the 1st 10 trials were random, after which the targets repeated P's own responses with a lag of 10 trials. The target for Trial 10 was thus P's response on Trial 1, the target on Trial 11 was Ps response on Trial 2, and so forth. For the control condition, Ps received a target sequence in which the most frequent bias was the mirror image of their response bias in the 1st 2 runs. For example, if a control P produced a deficiency of repeats (0 shifts) in the 1st 2 runs, there would be a comparable deficiency of +2 shifts in his or her target sequence in the feedback run.

After Run 4, normal Ps were administered 2 additional questionnaires. *The Post-Test Assessment (PTA) Scale* was developed by applicant Brugger to assess how Ps react to the test procedure in implicit learning experiments of the type conducted by himself and his associates. It asked Ps how many trials they thought each run contained, how many correct guesses they thought they had made, and what guessing strategies they

employed. The most important question asked Ps whether and, if yes, at what point in the feedback run they came to expect that a target sequence was biased, and the nature of that bias. Ps who could correctly identify the bias were classified as "detectors" and their data were discarded. *The Australian Sheep-Goat (ASG) Scale* was used to confirm Ps' self-definitions as believers or skeptics during recruitment. It consists of 18 items reflecting both belief in and experiences of various types of psychic phenomena.

While P was filling out these questionnaires, E returned to his office and printed out the results of the 4 guessing runs and entered the data on a participant feedback form that also explained the rationale of the experiment. When E returned to the testing room, and after P had completed the scales, E gave P the feedback form, which P read over. E then showed P the data sheets and answered any questions P had about the experiment or their results. Finally, P was asked not to discuss the details of the experiment with anyone who might participate in the experiment at a later time.

RESULTS

Response Bias in the Non-Feedback Runs

These analyses compared the results from the 1st 2 runs, each having biased target sequences, with those trials from Run 3 having random targets. In general, the results confirmed our expectations. In the run where the targets demonstrated RA, our Ps had a success rate of 26.4%, which was significantly higher than the chance expectation of 25.0%. P's scored almost as well on the run with targets reflecting the CO bias (26.1%), but this result was not significant. Finally, with random targets, the hit rate was very close to chance (24.8%) and nonsignificant.

In the RA run, we found a significant negative correlation between how many repeats Ps called in the RA run and their guessing success. In other words, the Ps who called the fewest repeats got the highest scores in the run in which the target sequence had no repeats but was otherwise random. In a similar vein, we found a significant positive correlation between how frequently Ps "counted" in the ascending direction (+1 shifts: e.g., 1-2, 2-3) and their success in the CO run, in which the targets also demonstrated ascending CO. There were no such significant relationships in the random trials of Run 3. The general conclusion to be drawn from this pattern of findings is that Ps can elevate their guessing success when they exhibit a response bias that matches an extreme target bias of the same kind. One might also have expected the avoidance of repeat calls to correlate with success in the CO run, as the targets in this run also contained no repeats. This correlation was, however, very close to zero.

Response Bias and Belief. We found that in the RA run believers as a group scored significantly above chance (27.2%) and higher than skeptics (25.7%), whose mean was not significant. However, the two means did not differ significantly from each other. Also, the negative correlation between how many repeats Ps called in the RA run and their guessing success was entirely attributable to believers; for skeptics, the correlation actually reversed slightly. This pattern of results supports our hypothesis that believers would do better than skeptics in the RA run, but other aspects of the

results are puzzling. We expected that believers would obtain this relative success by calling many fewer repeats than skeptics, but in fact the number of repeats called by skeptics was almost as low (11.0) as for believers (10.3), a nonsignificant difference. (Twenty repeats would be expected from a random caller.) The greater percentage of hits by believers was attributable more to the fact that their deficit of repeats translated into more correct guesses, whereas this was not true for skeptics. Why it was not true for skeptics is a mystery.

In the CO run, the means for believers (26.1%) and skeptics (26.0%) were virtually identical, as were the positive correlations between CO response bias and hit rate. Thus belief had no effect whatsoever on the results of the CO run.

ESP and Belief. In the trials of Run 3 with random targets, there was no difference in the mean hit rate of believers (24.9%) and skeptics (24.7%). Thus, as in our previous ISL experiments, there was no support for the traditional sheep-goat effect. However, the variance of the scores was significantly higher for the believers than for the skeptics. Palmer has cited other evidence that such high variance might be characteristic of extreme believers on standard card-guessing type ESP tasks (Palmer J, 1972, *Journal of the American Society for Psychical Research*, 65:373-408).

Implicit Sequence Learning in the Feedback Run

Hit rates in the different conditions are displayed in Figure 1. We found significant evidence of ISL in the feedback run it was demonstrated only by the skeptics and evident in the control condition as well as the experimental condition. Ignoring the first 10 trials of the run (because matching of targets and previous responses did not begin until Trial 11 in the experimental condition), skeptics scored slightly below chance in the 1st half of the rest of the run (24.1%) and significantly above chance in the 2nd half (28.5%). The increase from the 1st to the 2nd half was also significant. It made no difference whether the targets were subliminal or supraliminal, so our prediction of better ISL in the subliminal condition was not supported.

More refined analyses indicated that the ISL effect for skeptics did not apply to the experimental condition when the targets were supraliminal. In this condition, the percentage of hits was quite high and significant for both halves combined (29.6%) and differed hardly at all between halves. Because the 1st half mean so mean was so high, there may have been little additional room for learning to take place, what researchers call a “ceiling effect”. Comparable results were obtained by believers in this condition. It is noteworthy that this high scoring rate for believers and skeptics combined also appeared in the 1st 10 trials (30.0%), although for this small a number of trials it was not significant. This success in early stages of feedback runs with biased targets also appeared in the two ISL experiments described in our first report to Cogito. The origin of this success is puzzling, because the success is evident before Ps had the opportunity to benefit from the feedback.

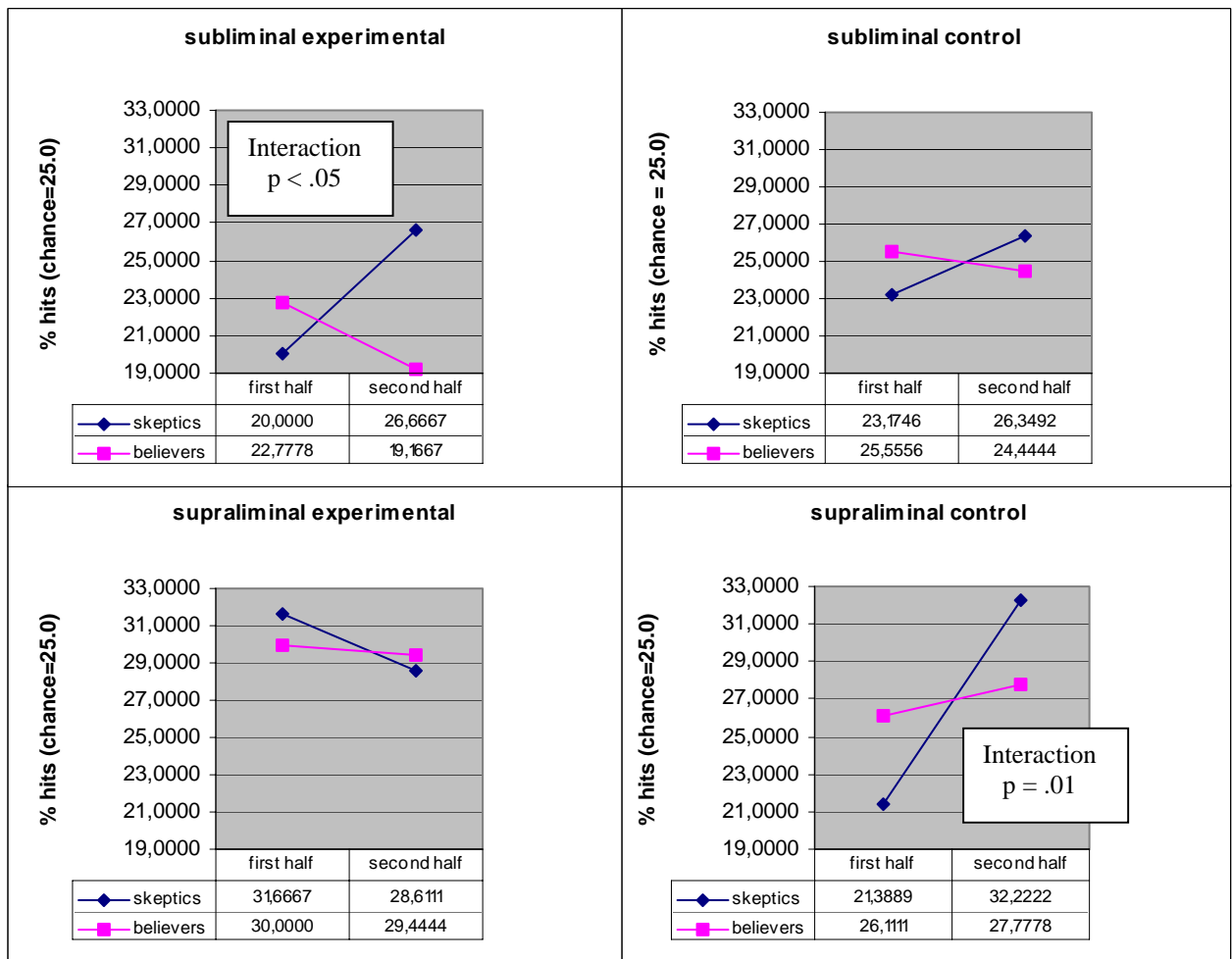


Figure 1: Hit rates in the guessing task with feedback. Top two panels are the subliminal feedback, bottom two the supraliminal feedback conditions. Left row reflects experimental, right row control conditions. For the skeptics, the increase from first to second half of the guessing task is significant in the subliminal experimental ($p < .03$) and supraliminal control condition ($p < .01$).

A possible explanation for the superior ISL by the skeptics comes from the results with the LIMBEX scale, which as noted above measures tendencies toward temporal lobe dysfunction. First, believers scored significantly and substantially higher than skeptics on the LIMBEX. Second, there was a significant negative correlation between LIMBEX scores and the increase in hits from the 1st to the 2nd half of Run 4 among believers, but not skeptics. These two findings together implied that ISL was inhibited among Ps who scored high on the ISL. To check this, an analysis was conducted comparing ISL among Ps whose item scores on the LIMBEX averaged 3 or above on the 0-5 scale to lower scoring Ps. The high LIMBEX group consisted of 13 believers and no skeptics. Irrespective of test condition, the 51 low LIMBEX Ps scored slightly below chance during the 1st half of Run 4, excluding trials 1-10

(24.7%) , but produced a significantly positive mean hit rate in the 2nd half (28.0%). The increase from the 1st half to the 2nd half of the run was also significant. The high LIMBEX Ps showed a comparable but nonsignificant decline from the 1st (26.7%) to the 2nd (22.2%) half. These results are illustrated in Figure 2.

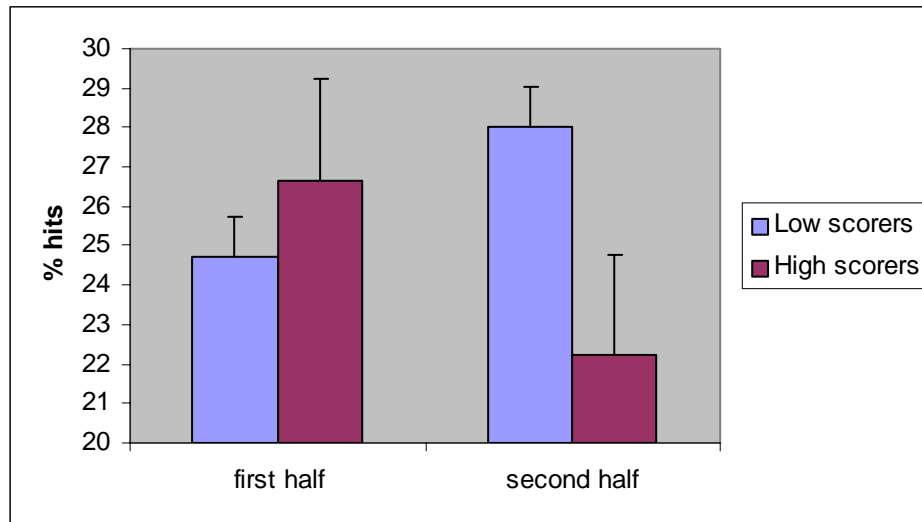


Figure 2: Hit rates (split-half analysis) for high and low scorers on the LIMBEX scale, an inventory quantifying a participant's limbic excitability, i.e. his or her proneness to display behavior characteristic of temporal lobe epileptic patients.

The Anomalous Anticipation Effect

The AAE was only a minor consideration in the design of this experiment, and one consequence of this fact is that the design with respect to the AAE differed from that of the previous ISL experiment in 3 key respects. First, the random run in the present experiment (Run 3) did not include feedback of the targets. For this reason, we could not define the response bias as the relationship between the response and the previous target, as in the previous experiments. We thus defined it as the relationship between each response and the immediately succeeding response. Second, the time interval between the random run and the biased run was longer than in the previous research, because in the present experiment this was the period in which E calculated P's response bias and P was filling out questionnaires. Third, whereas in the previous experiments the two opposite target biases in the feedback run always involved a relatively large and fixed number of either clockwise or counterclockwise relationships between successive targets, the opposite biases in this experiment were geared to each P's individual response bias.

To test for the AAE, we applied the same bias analysis to the targets of Run 4 as we had applied to the responses in Runs 1 and 2 during the session break (see above). This analysis allowed us to determine for which target or target pair the bias was greatest. We then calculated the relative pro-bias responding in Run 3 by determining the number of responses anticipating the target bias in Run 4 minus the number

representing the opposite bias. For example, if the target bias in Run 4 was an excess of 3s, we would calculate for Run 3 the number of 3 calls minus the number of 1 calls. Because the number of trials considered in these analyses differed widely among Ps, these difference scores were converted to z -scores, with an expected value of 0 by chance.

To confirm the AAE, there must be a significant difference between the mean z -scores for skeptics and believers, with the mean for skeptics being more positive. The mean z -score was indeed more positive for skeptics (.382) than for believers (-.304). However, these two means did not differ significantly from each other. So despite a trend in the predicted direction, the hypothesis cannot be considered confirmed. We also predicted that the AAE would be significantly stronger in the subliminal than in the supraliminal condition. This was in fact the case, with the mean z -score for goats being significantly more positive for skeptics than for believers in this condition (1.076 vs -0.714). In the supraliminal condition, the believers scored a bit higher than the skeptics (0.106 vs -0.268), but this difference was far from significant.

Decision Augmentation Theory

As described above, this hypothesis was tested by examining how frequently Ps clicked the mouse when the computer was in the “1-state” in Run 3 -- 20% of the time by chance. In this case, the prediction was confirmed in its entirety. The percentage for believers was significantly high (21.75%) and significantly higher than the percentage for skeptics (19.85%). The latter percentage did not differ significantly from chance.

It is also worth mentioning that on trials in which Ps received targets consistent with their response biases in the preceding runs – trials in which the computer was in the 1-state for the preceding trial – the hit rate was indeed quite high and strongly significant (30.92%). Thus, Ps were rewarded for clicking the mouse when the computer was in the 1-state.

Post-Test Assessment Scale

Finally, we will report some interesting results from the PTA scale. In the final 3 runs, Ps on average predicted a hit rate greater than the 25% expected by chance, although the magnitude of the effect was not large (range of 28.2% to 29.9%). As one would expect, in all 4 runs the predicted success was greater for believers than for skeptics. The difference was significant in Runs 2 and 3, and suggestive in Run 4. Although there was high variability among Ps in the number of trials they estimated for each run, the averages in the 4 runs ranged from 58.5 to 62.3. These are marked underestimates, and they occurred despite the fact that the written instructions mentioned that the number of trials per run would vary between 80 and 120.

Although estimates by Ps of the presence of particular kinds of response biases in Run 4 were generally quite low, believers estimated the likelihood of 3 of these to be significantly greater than did skeptics. Only 1 P, a believer, had to be eliminated because she detected the target bias (repetition of own responses in the feedback run) in the experimental condition.

For Ps in the control condition, there was a significant positive correlation indicating that the higher proportion of hits they expected in Run 4, the more hits they actually obtained. The corresponding correlation in the experimental condition was nonsignificantly negative. For Run 3, the prediction of success correlated negatively with success in the random trials of this run to a significant degree among all Ps.

DISCUSSION

This experiment was much more successful than the previous 2 ISL experiments in confirming the experimental hypotheses. Results with the non-feedback runs established that if Ps' target biases matched corresponding strong biases in the target sequence, the result would be an increase of hitting of more than 1% compared to chance expectation. The increase in success was somewhat greater for RA than for CO, but this might merely reflect the fact that, as expected, RA was much more prevalent than CO bias among our sample of normal volunteers. For both the RA and CO runs, the greater the response bias, the greater the increase in hitting. In the feedback run, we obtained our first clear example of ISL in the 3 experiments. (The significant ISL effect among believers that we described in our first report was later found to be an error.)

The most surprising outcome of this experiment was that the ISL effect in Run 4 was restricted to skeptics. Further analysis revealed that this difference could be explained by the fact that our skeptic sample included no one who scored high on the LIMBEX scale, whereas 13 believers did. In other words, the primary conclusion to be drawn from our analyses is that ISL is inhibited by symptoms characteristic of temporal lobe dysfunction in the brain.

This is the third experiment in which skeptics demonstrated positive scoring with respect to the AAE and believers negative scoring, in contrast to the standard sheep-goat effect. The significant AAE in the present experiment occurred only if the target feedback in Run 4 was subliminal. Although a stronger AAE in the subliminal condition was predicted, the failure to also find any AAE in the supraliminal condition is disappointing, because the feedback was supraliminal in the two previous experiments in which the AAE was demonstrated. So in this sense, the current experiment failed to replicate the earlier ones. Dr. Palmer has noticed this pattern in other ESP experiments where a manipulation was added to increase the strength of previously found effect, only to discover that the added manipulation, rather than building on the previous effect, replaced it. It is as if there is a ceiling that these anomalous effects cannot exceed.

Nonetheless, the reversal of the sheep-goat effect is puzzling. In most of the experiments that have provided support for the sheep-goat effect, the Ps knew they were being tested by a believer in psi. Given the context in which our ISL experiments took place (a psychology research laboratory), Ps might well have assumed the experimenter was a skeptic. A belief that the experimenter is a skeptic could have increased the comfort level of the skeptics and decreased the comfort level of the believers, thus causing the scoring reversal. The last few Ps in the present experiment were asked to predict at the end of the session the attitude of E toward the paranormal; they tended to assume that his attitude was the same as theirs. Although

this sample is too small to draw any firm conclusions, this result does not support the above speculation.

The reversal of the AAE with respect to belief did not apply to the DAT test or the RA run, on both of which believers outscored skeptics. Can this be accounted for by the discomfort hypothesis? Although both the AAE and the DAT effect fall under the rubric of implicit psi, the DAT effect is more strongly implicit. According to our interpretation of the AAE, Ps were responding to the targets in Run 3 just as they would in an explicit psi task. They simply were getting information about the Run 4 targets and mistakenly assumed that this information applied to the Run 3 targets. The DAT test was completely implicit in that Ps had no awareness that that the timing of their mouse clicks was of any relevance whatsoever to their scores. It may be that implicit psi in the strong sense of the term is less susceptible to discomfort than explicit psi; in other words, it is only the conscious mentation that the discomfort affects. This conclusion at least seems intuitively plausible. Although it is not entirely clear what mechanisms were operative in the RA Run for skeptics, for believers the mechanism seems to involve calling a small number of repeats, which is simply a maintaining of their natural bias. Discomfort would be expected to actually stabilize this bias; it is the spontaneity necessary to break the bias that discomfort would more likely compromise.

The confirmation of the DAT for believers provides additional evidence in these experiments for the anomalous outcome commonly referred to as ESP. Dr. Palmer finds that he obtained such effects much more reliably in Dr. Brugger's laboratory in Zurich than in the previous laboratories where he had worked, all of which were much more positive about the existence of psi. This outcome may be partly attributable to the fact that in the Zurich experiments Dr. Palmer focused on what he calls *implicit* psi, i.e., psi effects resulting from contexts in which Ps are not aware that psi is being tested. In all 3 ISL experiments, believers and skeptics obtained almost identical proportions of hits in the random runs, which correspond to the standard intentional, or overt, ESP tests, on which the conclusion of a positive belief-ESP relationship is based. The fact that Ps were not aware of the DAT manipulation, in contrast to their awareness of the learning task in Run 4, might explain why the hypothesized discomfort based on perception of experimenter belief did not affect the DAT result.

2. REPORT ON THE CONTINUATION OF TESTING / ANALYSES / PUBLICATION ACTIVITIES DESCRIBED IN THE FIRST YEAR REPORT

2.1. Implicit learning and anomalous anticipation of sequential bias in a guessing task

Under this title, we have submitted the experiment on ISL and the anomalous anticipation of target bias. It has been favorably reviewed and we are about to hand in a revised version of our report. As the draft (original submission) accompanies this report, we will not summarize the experiment here (but see Appendix I).

2.2. Hemispheric differences in the detection of contingencies: the input side (Exp. 5 in original proposal)

The Kramer flash task is a tachistoscopic task which requires Ps to detect the presence of a contingency between laterally presented symbols and a central symbol (see Fig.4 in the first year report for a depiction of the 8 symbols used). The detection is “implicit” in the sense that the Ps are entirely guessing; only rarely, according to verbal report, is there a conscious awareness of the presence of a contingency. In actuality, either the left-sided symbol (primarily analyzed by the right hemisphere; RH) shows some consistent relationship with the central one, or the right-sided (analyzed by the left hemisphere; LH). Responses are provided by key-press (left key for left-sided contingency; right-side key for right-sided contingency; spacebar for no contingency at all).

Testing of 24 Ps was originally planned, and in last year's report we presented preliminary analyses of the first 14 Ps tested. We have in the meantime collected data of the remaining Ps and briefly present here the main findings (note that belief in the paranormal was assessed by the Australian Sheep-Goat Scale, and the median scale score for the population was 74.4; “believers” had scores between 76.2 and 146.0, “skeptics” between 18.6 and 72.6).

We first calculated each P's sensitivity to detect contingencies for each visual field/hemisphere separately. This was achieved by subtracting the number of false detections from that of correct detections. Sensitivity values were then subject to an ANOVA with belief group as the between-P factor and visual field as the repeated measure. This analysis revealed a significant main effect of belief group, believers being more sensitive than skeptics (Fig.3). There was a tendency for higher sensitivities in the LVF compared to the RVF, but the interaction between belief group and visual field/hemisphere was clearly not significant.

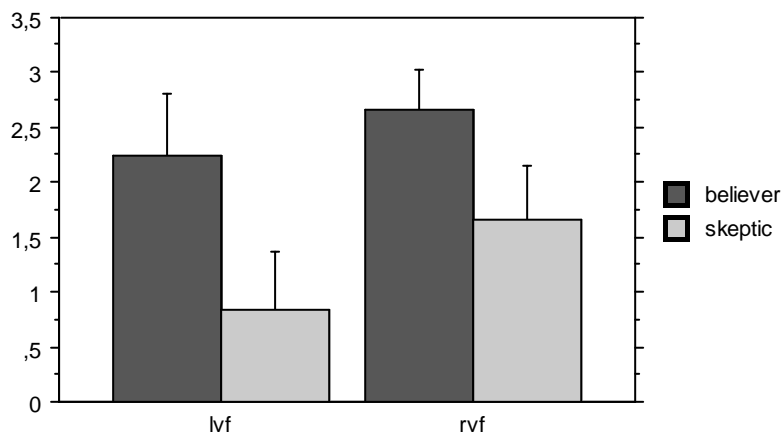


Figure 3: Performance on the Kramer flash task as a function of paranormal belief in 24 right-handed Ps. The y-axis represents the sensitivity to detect systematic contingencies (calculated as the difference between correct decisions and false alarms); “lvf” designates left-visual field stimuli, “rvf” right-visual field stimuli. The effect of paranormal belief is significant. Displayed are means and standard errors.

Single comparisons showed that believers' sensitivity to detect contingencies was significantly better than that of the skeptics in the LRV by one-tailed testing (note the clear prediction we had), but not in the RVF. We note, however, that from Fig.2 this interaction is not really conspicuous, and we refrain from making a case out of the merely statistical significance in one, but not the other hemifield/hemisphere.

Finally, a correlational look at the data (Pearson's r) showed that, over both visual fields, contingency detection was positively correlated with paranormal belief (Fig.4). The analogous correlation was significant in RVF/LH, but not in the LRV/RH. Thus, although overall detection was better in the LRV/RH, the correlation with belief was significant in the hemifield *not* dominant for the task.

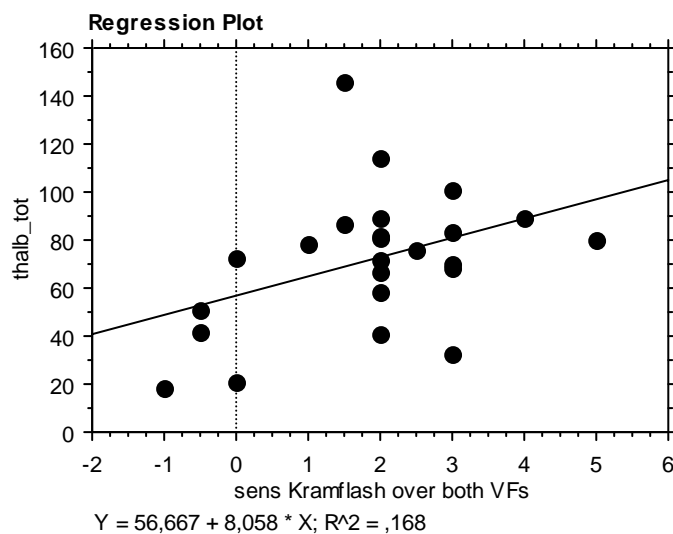


Figure 4: Sensitivity of contingency detection (averaged over both visual fields/hemispheres) is merely but significantly correlated with an individual's belief in the paranormal (ordinate; max. possible = 160).

To summarize these findings, we conclude that this experiment provided clear support for the predicted superiority of believers in the paranormal to detect contingencies between statistically associated events. Note that this contingency detection was "unconscious" in the sense that its quality was not available to verbal report (data from confidence ratings also collected not shown here). The broadest conclusion one can draw from the findings is that, in daily life, believers might retrieve more information about statistically associated events than skeptics. This information, as it is received unconsciously, will then be more readily attributed to "extrasensory" channels by the believers. It would then be this pronounced susceptibility to pick up correlational information that may ultimately give rise to the belief in the paranormal.

We could not confirm the hypothesized superiority of the RH in contingency detection. However, we note the strong trend in the predicted direction and emphasize that it is opposite to what has been proposed by other authors (Wolford G et al., 2004; *Canad.J.Exp.Psychol.* 58:221-228). Together with the results of the experiment to be reported in the next paragraph, we think we can make a strong case in falsifying the purported role of the LH for implicit pattern detection.

From a host of further findings from this experiment (we also collected data on the Kramer test in its classical way; confidence-of-judgment data, Ps' magical ideation according to a well-known schizotypy scale, etc.), we only mention a finding from the careful medical history we obtained from all Ps: Asked about previous drug consumption (THC, psilocybine, cocaine), 8 of the 12 believers indicated a positive history, only 4 had never taken any drugs. Conversely, among the 12 skeptics only 2 had a positive history of drug consumption. This highly significant (Chi square test) difference confirms similar findings reported in the literature on schizotypy (Nunn JA et al., 2001, *J.Nervous and Mental Disease* 189:741-748) and its relevance to schizophrenia (Drewe M et al., 2004, *Swiss Medical Weekly*, 134: 659-663), and would seem to deserve a short communication in a psychopathology journal.

2.3. Hemispheric differences in the detection of contingencies: the output side (Exp. 5 in original proposal; with additional research questions)

Introduction, Methods and Results

This experiment investigated, in 32 healthy right-handed men, possible hemispheric differences in ISL by comparing visuo-motor reaction times (RTs) of the left and the right hand. In the first year report, we described the details of the task and the specific hypotheses, especially those not described in the original research proposal. We reiterate this description here, in order to allow a better understanding of the results and their interpretation.

The task consists of 144 presentations of a single digit 1 to 6 in the center of a computer screen in random order, "as produced by consecutive rolls of a die". The randomization is constrained such that each digit and digit repetition appears an equal number of times. The inter-stimulus interval (ISI) is 1000 ms, and the exposure time is determined by the the P's response, but maximally 1500 ms, after which a response is no longer counted and a new trial initiated. P's key press automatically disrupts stimulus presentation and initiates the 1000 ms ISI. The numbers are displayed against a black background. Crucially, 50% of the stimulations are in white print, whereas 25% are in red and blue print respectively.

The P must provide a rapid motor response: a left hand key press ("F" on keyboard) for the "small" digits 1, 2 and 3, and a right hand key press ("J") for the "large" digits 4, 5 and 6, respectively. The coloring (white/red/blue) changes pseudorandomly over trials but is equally distributed among small and large numbers. Every P is tested with the same stimulus sequence (with the exception that first and second halves are exchanged for 50% of Ps as a counterbalancing precaution; see above).

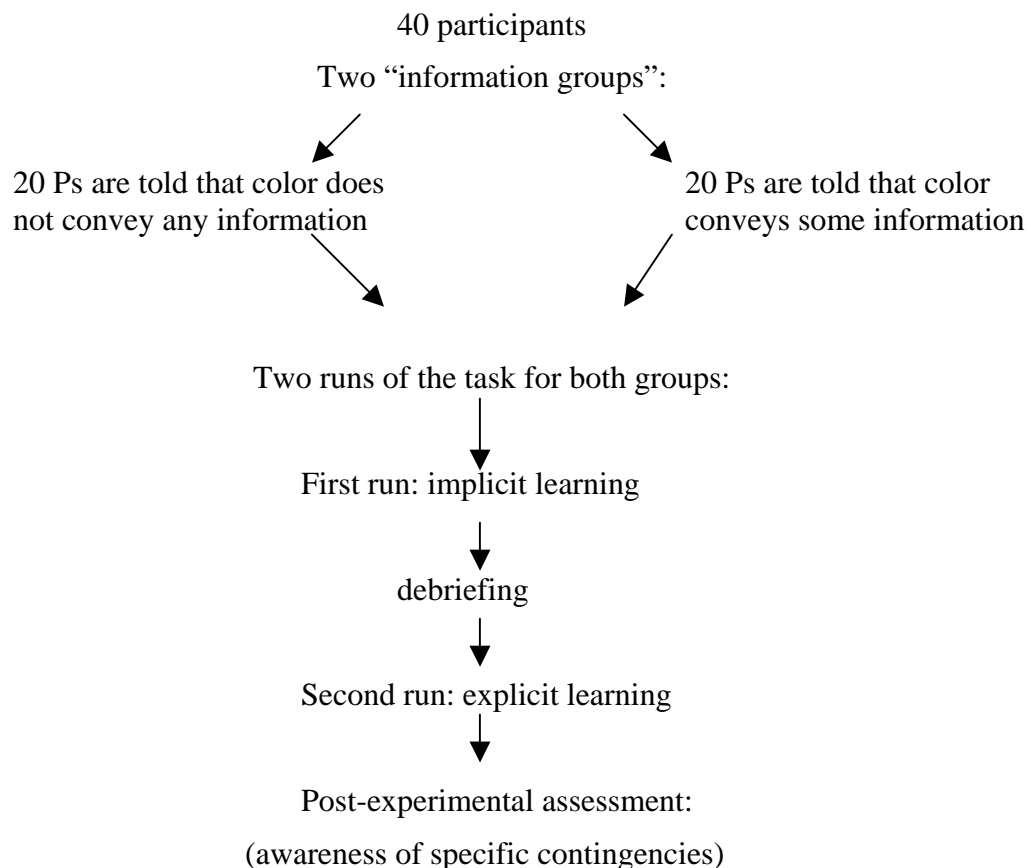
Hidden contingencies:

Importantly, unbeknownst to the Ps, color is a predictive cue for number size: for half the Ps, red predicts a small number (i.e., left hand response) and blue a large number (i.e., a right-hand response). For the other Ps, the color – number size assignments are reversed.

Soon before we started testing, a research report was published that indicated poorer implicit learning for Ps made aware that a rule could be learned (compared to those who did not know that anything could be learned at all). This report, entitled "On the benefits of not knowing..." (Fletcher PC, et al., 2004; *Cerebral Cortex* 15, 1002-1015) led us to introduce an additional manipulation into our design: half the Ps were told that color was entirely meaningless, the other half that color and number

size were somehow related, and that we would later ask them in what way. We will refer to these two groups as “information groups” (informed vs. uninformed).

Data collection has been completed and the primary analyses performed. The present report will focus on four major aspects of the data: (1) assessment of Ps’ (potential) awareness of the contingencies; (2a,b) analyses of percent correct decisions and RTs in the first, implicit run; (3a,b) analyses of percent correct decisions and RTs in the second, explicit run (after debriefing took place); (4) other findings. To better understand the design, the flow chart below illustrates the different stages of the experiment:



(1) Assessment of participants’ (potential) awareness of the contingencies

In any experiment on ISL it is crucial to know to what extent learning was indeed “implicit”, in the sense that Ps are not consciously aware of the cues to be learned. Awareness of the 100% dependency of side of response (left or right hand) on the color of the preceding digit was carefully quantified with a post-experiment questionnaire of the type published by Martin N & Alsop B, 2004 (*Behavioural Processes*, 67, 157-165). The results were clear-cut: not one single P showed an even rudimentary hunch as to the contingency. In particular, irrespective of information group all 40 Ps explicitly stated that they had not noted any contingency between color and response hand (item 7 in the questionnaire given as Appendix II). This allows all learning effects described immediately below (paragraphs 2a and 2b; implicit run) to be interpreted as fully implicit.

(2) *Analyses of percent correct decisions and RTs in the first, implicit run*

(2a) *Percentage of correct responses*

An ANOVA of the percentage correct responses included 4 between-P factors: (1) belief group (above vs. below the median of 67.0 on the ASGS; note the value relatively close to that in the experiment Kramerflash, above, i.e. 74.4), (2) information group, (3) hand (left vs. right), and (4) predictive quality of the stimulus number (colored vs white). The ANOVA revealed a significant hand effect: the left hand yielded more correct responses than the right (Fig. 5, left). Belief was not a significant factor, although it approached two-tailed significance. Believers tended to be more correct than skeptics (Fig. 5, right).

The information group factor also was not significant. There was, however, a tendency toward more correct responding by those Ps who did *not* expect that anything could be learned during the task. No other main effects or interactions were significant.

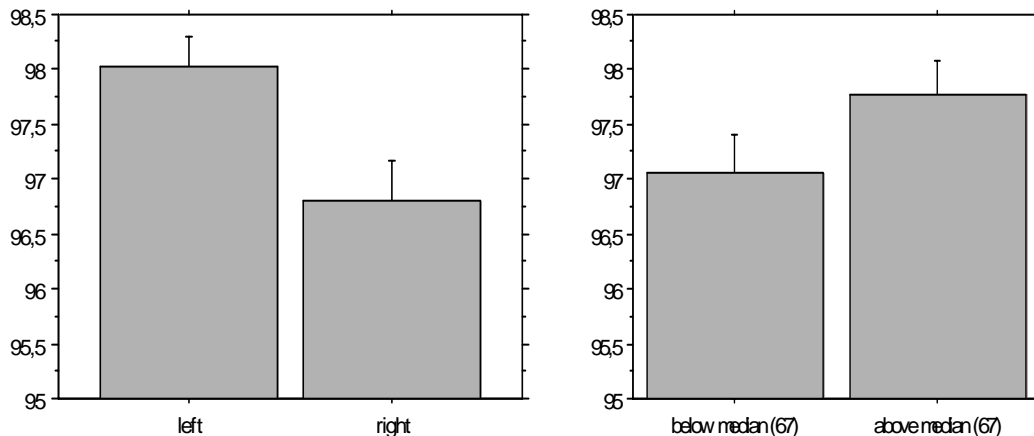


Figure 5: Implicit learning of the predictive value of color on unimanual responding to number magnitude: more correct responses of the left compared to the right hand (left) and tendentially more correct responding of believers compared to disbelievers in the paranormal (right). Displayed are means and standard errors of the mean.

(2b) *RTs of correct responses*

An analogous ANOVA of the RTs of correct responses revealed a highly significant main effect of the predictive value of a stimulus. Opposite to our prediction, RTs were *longer* after predictive than after control (non-predictive) trials. The interaction between predictive value and hand was significant as well; RT differences between predictive and non-predictive trials were significant for the left, but not the right hand (Fig. 6). The main effect of information group and the interaction between predictive value and belief both approached significance. Uninformed Ps and believers tended to have longer RTs than informed Ps and skeptics, respectively.

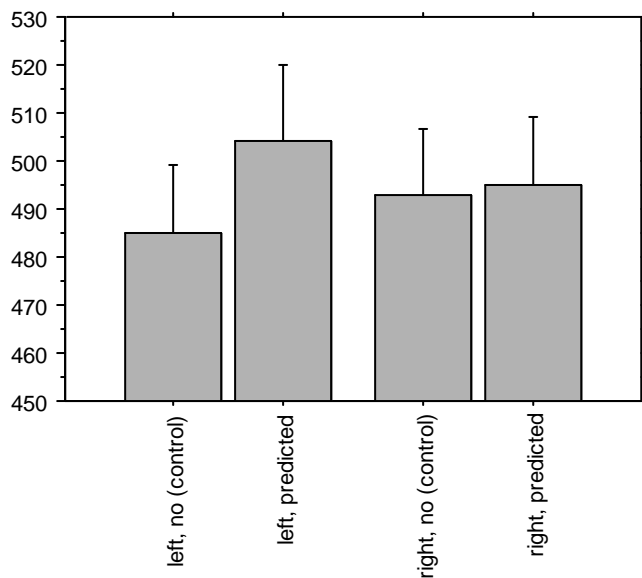


Figure 6: Implicit learning of the predictive value of color on unimanual responding to number magnitude is significant only for the left, but not the right hand. Note the overall longer (rather than shorter) RTs for the predictive trials. Displayed are means and standard errors of the mean.

(3) Analyses of percent correct decisions and RTs in the second, explicit run

All Ps were debriefed after having filled in the questionnaire to assess awareness of the predictive character of the colors red and blue. Immediately after, they were asked to perform the task a second time, this time, of course well aware of the correlation between color and response hand. We introduced this second run in order to compare implicit and explicit learning and to be able to show, in the case of no effects in the implicit run, that explicitly the contingency can be learned at all.

(3a) Percentage of correct responses in the explicit run

The only significant main effect in the ANOVA on explicit trials (second run; same factors as described under 2a) was belief group. Believers had more correct decisions than skeptics.

(3b) RTs of correct responses in the explicit run

An ANOVA analogous to the one described under 2b was also performed for the second, explicit run. Again, a highly significant main effect for predictive value was evident; this time the RTs after predictive trials were *faster* than after non-predictive trials (Fig. 7).

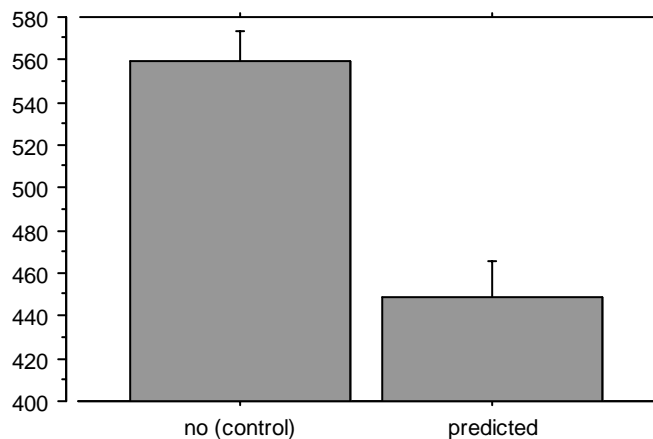


Figure 7: Explicit learning is faster after predictive than after non-predictive trials. Note that this is a pattern opposite to the one found for implicit learning (cf. Fig 6). Displayed are means and standard errors of the mean.

(4) Other effects

Some important non-effects need to be mentioned, for instance, the absence of any differences in the explicit learning run between RTs of the left and right hands and the similar absence of an interaction between hand and predictive value. This emphasizes that the left-hand RT advantage was specific to *implicit* learning.

Correlations of raw scores on the ASGS (assessing a P's belief in the paranormal) with the parameter of implicit learning did not reveal any significance, neither for left or right hands nor for the percentage correct responses or the RTs of correct decisions.

The same correlations on the analogous parameter of explicit learning (second run) showed a tendency for higher paranormal belief to be associated with longer RTs specifically of the left hand and the trials immediately following *predictive* trials (Fig. 8).

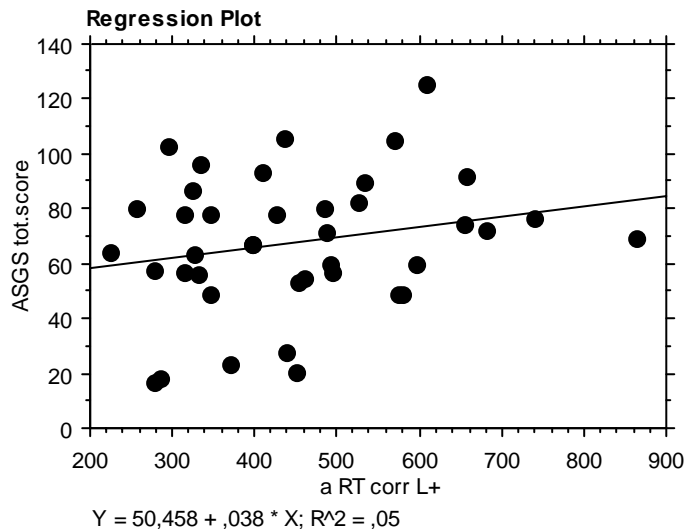


Figure 8: Left (but not right) hand RTs that followed predictive trials (but not control trials) tended to be correlated with an individual's belief in the paranormal (ordinate; max. possible = 160).

Discussion

(a) Right hemisphere involvement in implicit learning.

The most surprising finding of this experiment is that RTs after predictive trials were *longer*, rather than shorter, compared to those after non-predictive control trials. We have double-checked the data in order to make sure that the direction of this statistically clearly significant effect is not due to a failure in coding. We will have to consult the previous literature (including that to the controversial issue of “perceptual defense” and, within parapsychology, its analogue, i.e. “PSI-missing”) to reach an unambiguous interpretation of the apparent paradox. In the meantime we take the direction of the implicit learning effect as indicative of some top down interference delaying an otherwise highly automatized response. If conscious thought is predominantly mediated by the LH, a prolongation of automatic processes are not that counterintuitive as it might seem. Such an interpretation is also compatible with the finding that the “implicit prolongation effect” was larger for the Ps who were informed that color had “some predictive value” (but who could nevertheless not verbalize the exact contingency).

This experiment could then clearly confirm the hypothesized advantage of the left hand /right hemisphere for the implicit learning of the predictive value of color for a decision with one or the other hand. Red numbers were always followed by small numbers (that required a left hand response) and blue by large numbers (right hand response; opposite color-hand assignment for half the Ps). That this advantage of the left hand, and, by inference, the right hemisphere, is specific to implicit learning of contingencies is further suggested by the fact that no similar advantage was evident for the second run, where all Ps had been debriefed and knew about the predictive value of color.

Together with the findings of the experiment on input lateralization (“Kramer flash”), this experiment, which lateralized the effectors, but not the information to be learned,

appears to provide strong evidence for a superiority of the right hemisphere for the learning of contingencies that cannot be verbalized (i.e. that remain “unconscious”).

(b) Paranormal belief

Less strong conclusions can be drawn with respect to paranormal belief. Although there were tendencies for better implicit learning (in the sense of longer RTs), the difference between believers and skeptics was not significant. Either this finding indicates that paranormal belief modulates contingency detection on the input rather the output side (cf. the clear effect of paranormal belief in the Kramer flash experiment, paragraph 2.2.), or the present paradigm is simply not sensitive enough to uncover the effects of Ps’ attitudes toward the paranormal.

(c) “On the benefits of not trying”; the nonreplication of a newly discovered effect (Fletcher et al., 2004)

In addition to the issue of hand / hemisphere differences in the accuracy of implicit predictions, this experiment allowed the empirical assessment of the role of Ps’ knowledge that “something” is to be learned. Presence or absence of such knowledge may be crucial. According to very recent work (Fletcher PC, et al., 2004; *Cerebral Cortex* 15, 1002-1015), implicit learning can only be demonstrated for those Ps who do *not* know that they are taking part in a learning experiment. As soon as they are informed about the learning character of the experiment, any ISL disappears. We therefore tested an “informed” and an “uninformed” group of Ps, quite as Fletcher et al. (2004) did. Although there was a clear tendency for uninformed Ps’ to show better ISL, it fell short of statistical significance. Interestingly, this was mainly due to the complete absence of an effect for right hand responses; for left hand responses the tendency was rather marked. The reason why we did not find an overall effect of information status could, on the one hand, be due to the fact that we had introduced “statistical noise” by too many variables in the experiment (hands, belief groups). On the other hand, the interaction between hand and information status (predicted trials were significantly faster than not predicted, control trials for the left, but not the right hands) could well have considerable biological significance: the “benefits of not trying” could manifest themselves primarily for those response effectors that are not subject to verbal awareness in the first line, i.e. left hands...

A write-up of these findings and thoughts is currently in progress. As this experiment was run in partial fulfillment of a medical dissertation (University of Zurich), its first author will be the medical student. The draft by A. Anagnostopoulos, J.Palmer, and P.Brugger carries the working title "A left-hand superiority for implicit sequence learning" and will be submitted to a leading neuropsychology journal.

3. OTHER ACTIVITIES OF THE INVESTIGATORS DURING THE PROLONGATION PERIOD (10/05 TO 4/05)

At the beginning of April 2006, applicant Palmer presented a poster and invited address at a conference of the Bial Foundation in Porto, Portugal. The poster reported an experiment attempting (unsuccessfully) to remotely influence (by

psychokinesis) the hemolysis of red blood cells in test tubes. This research, conducted at the Rhine Research Center in the U.S., had been funded by Bial. The invited address was a review of experimental research exploring the relationship between ESP and memory. A written version of the paper is to be published in full in the Conference Proceedings.

Applicant Brugger has contacted Prof. S. Ertel (Göttingen), who published an article questioning the proposed significance of ISL for experimental parapsychology (Ertl S, 2005, Are ESP test results stochastic artifacts? Brugger and Taylor's claims under scrutiny, *Journal of Consciousness Studies*, 12, 61-80). The reason for the contact was that Ertl has based his critique on newly collected guessing data. PB asked for a critical reanalysis of this data set, and a marked zero-order bias was found that could explain the above-chance results reported by Ertl, also in other publications (e.g., Ertl S, 2005, in Thalbourne MA & Storm L (eds.) "*Parapsychology in the 21st Century*", Jefferson, MacFarland, 90-123), by ordinary means (specifically by reference to what is called a "pseudoneglect in number space"). Should these analyses be written up in a joint paper with Ertl, we will acknowledge financial support by the COGITO foundation.

A draft on the findings mentioned in the first year report (section 4, "other activities"), which resulted from a student project under supervision of both investigators, is in preparation. It is entitled "Randomizing vs. guessing: subtle differences", coauthored by Brugger and Palmer, and will be submitted to "*Acta Neuropsychologica*". The MS deals with differences in sequential response bias due to explicit vs. implicit instructions to randomize.

Finally, during the funding period, PB was offered to comment on an authoritative and comprehensive review article on autoscopic phenomena (Bradford D, 2005, *Acta Neuropsychologica*, 3, 120-189). He accepted the offer, and profited from JP's help on shaping his critical evaluation. As mentioned in the original proposal, one further area of common interests between the applicants is reduplicative experiences of body and self. In the acknowledgment section of Brugger's comment (*Acta Neuropsychologica*, 3/2005, 190-201), JP as well as the COGITO foundation are therefore mentioned. See Appendix III.

We conclude this report by expressing our sincerest thanks to the COGITO foundation for realizing the collaboration. Perhaps it is still too early to evaluate the work accomplished so far with respect to its potential to bridge the gap between parapsychology and the cognitive neurosciences. Many analyses still remain to be finished, and the experiments have certainly generated more data than we could introduce to the literature up to now. We will of course inform you of any future publication that will result from this collaboration. To conclude, the two of us agree that there still exists a gap between "paranormal" and "normal " accounts on extra-chance guessing, but we are certain that our collaboration has at least significantly reduced its width.

Prof. John Palmer, PhD.

Dr. Peter Brugger

Durham

Zürich, June 2006

Enclosures:

Appendix I: Original submission to *Consciousness & Cognition* (revised version currently under review); see paragraph 2.1.

Appendix II: Post-experiment questionnaire to assess participants' awareness of the contingencies to be learned in the Experiment described in paragraph 2.3.

Appendix III: Invited comment on Bradford, 2005.