

BIAL FELLOWSHIP PROGRAMME 61/00  
FINAL REPORT

- Prof. John Gruzelier

Changes in MisMatch Negativity during Hypnosis as an Indicator of Paranormal (Unreality Experiences).

The fellowship funded a postdoctoral psychologist Graham Jamieson. We conducted three studies, one in collaboration with a Psychology BSc medical student, Adam Bennion.

## Experiment I.

The first study set out to replicate the relation found with psychometry which was fundamental to our hypothesis, namely that there would be an association between hypnotic susceptibility and unreality experiences of which paranormal experiences were part of the syndrome. This was measured with the Personality Syndrome Questionnaire (PSQ) which consists of activated, withdrawn and unreality syndromes (Gruzelier et al, 2002).

Jamieson and Gruzelier (2001) had found such a relation when testing 83 participants with the Harvard group scale of hypnotic susceptibility: Form A (abbreviated HGS: A), a scale which provides a measure of hypnotic susceptibility and which stresses motoric suggestions. The abbreviated HGS correlated significantly with 15 PSQ items (Cronbach's alpha 0.77,  $r = 0.43$  with susceptibility).

In the replication study conducted with BIAL support we analysed data collected in Rome by De Pascalis with 74 participants. On this occasion the cognitively oriented Stanford hypnotic susceptibility scale: Form C (SHSS: C) was administered (report, in preparation). The SHSS: C correlated, even more significantly, with 12 predominantly unreality syndrome PSQ items (Cronbach's alpha 0.75,  $r = 0.56$  with susceptibility).

From those unreality items endorsed with the cognitively loaded hypnosis scale a strong affinity can be seen with susceptibility to paranormal experiences (5/12 items): -

I believe in telepathy (mind reading)

I have sensed some person or force around me when alone.

I believe in clairvoyance (fortune telling).

I have had an experience with astrology, seeing the future, UFO's, ESP or a sixth sense.

I have felt that I am communicating with another person telepathically (mind reading).

In summary we found strong support for the hypothesis that lead our Bial fellowship investigation, namely that hypnotic susceptibility was associated with unreality experiences, paranormal experiences in particular.

# Bial

These results were presented at the joint meeting of the British Society of Experimental and Clinical Hypnosis and the British Society of Medical and Dental Hypnosis, June, 2001 and are to be written for publication.

## Experiment II.

This was the first of two psychophysiological experiments examining the relation between auditory event-related potentials, measured with a MisMatch Negativity (MMN) paradigm, for both hypnotisability level and the effect of hypnosis.

Eleven highly hypnotisable subjects (SHSS: C score of 9-12) were compared with 12 subjects with low hypnotisability scores (SHSS: C score of 0-3). With a dichotic listening procedure participants were instructed to ignore right ear tones (2600Hz) and to attend to left ear tones (1500Hz) in order to discriminate randomly presented (average ISI 0.23s) louder tones (deviant; 90dB; 10%) from softer tones (standard; 70dB; 90%). The task was repeated in baseline, neutral hypnosis, and hypnotic deafness conditions. Responses were calculated at Fz and Cz electrodes to standard and deviant tones for time windows of 100-150, 150-200, 200-250 and 250-300 ms post stimulus onset.

While no effects were disclosed at the frontal electrode (Fz) in the MMN 100-150 ms time window (perhaps due to the attentional manipulation which produced relatively weak MMN), subjects high and low in hypnotisability differed in the two subsequent time windows. Firstly, there was evidence of more efficient early processing (P3a) of attended stimuli in high scoring subjects ( $F(1,21)=8.63, p<.01$  at Cz). Secondly, there was a greater response (P3a) to irrelevant distracting stimuli in low scoring subjects ( $F(1,21)=4.70, p<.05$  at Cz).

Regarding the influence of hypnosis, this was observed in the later 250-300 ms window. Across hypnosis conditions there was an increase in late positivity (P3b):- hypnotic deafness > neutral hypnosis > baseline conditions. However, because subjects both low and high in hypnotisability shared this, it could not be attributed to hypnosis per se.

Before discussing the theoretical implications of the results the second psychophysiological experiment will be described which set out to extend the first.

## Experiment III.

This experiment incorporated important modifications to the experimental design. Firstly, MMN was measured using duration deviants with a roving standard paradigm, a procedure previously developed in the laboratory (Baldeweg *et al.*, 1998). Secondly, during EEG recording participants viewed a Necker cube and pressed a response button whenever they experienced a reversal in the appearance of the figure. Thirdly this procedure was administered 3 times to each participant in an ABA design:- immediately before hypnosis in a pre hypnosis baseline; after a hypnotic induction procedure and arm levitation suggestion; finally post hypnosis. Fourthly, in order to minimise the effects of

# Bial

relaxation which may explain effects of hypnosis condition when they are common to both high and low hypnotic susceptibility groups, as found in the first experiment, the hypnotic induction procedure was worded so as not include either a relaxation procedure or suggestions of relaxation, and the post hypnosis testing occurred after both de-induction and several minutes of deliberately alerting conversation fostered by the hypnotist.

Subjects were staff and students who were doubly screened for hypnotic susceptibility with the Harvard Group Scale (Shor & Orne, 1962) and then individually with the SHSS: C (Weitzenhoffer & Hilgard, 1962). Low hypnotic susceptibles ( $n=11$ ) obtained a score of 0 to 3 on both occasions and high hypnotic susceptibles ( $n=12$ ) obtained a score of 9 to 12 on both occasions. EEG was recorded continuously from Fz and mastoids bilaterally.

MMN magnitudes were of higher amplitude than in the previous paradigm; a likely consequence of the simpler attentional demands with this more traditional MMN paradigm where MMN is elicited to nonattended stimuli while here the subject is fully engaged on the visual central task. A significant effect for hypnosis condition was obtained ( $F(2,42)=3.69, p<.04$ ), together with an interaction between susceptibility and hypnosis ( $F(1,21)=4.53, p<.05$ ). Whereas MMN increased overall from baseline to hypnosis in those low in hypnotic susceptibility and then reduced following hypnosis, MMN increased with hypnosis and then remained high post-hypnosis in the highly susceptible subjects.

## Discussion.

The outcome of the results obtained in the first experiment relating to hypnotisability is of particular relevance to the aims of the BIAL funded fellowship.

These concerned the P3a component, which reflects an orienting to novelty process and is generated in the frontal cortex. The larger response was in the hypnotisable participants which is in keeping with more efficient and task-relevant processing in what was a high attentional demand, dichotic listening task placing a high load on attentional control processes in the frontal lobe.

Similarly the larger response to the irrelevant standard stimuli in the nonhypnotisable subjects is in keeping with poor attentional control and distractibility, features that are incompatible with the induction of hypnosis which requires focussing of attention to all but the instructions of the hypnotist (Gruzelier, 1998).

As such these results provide support for the neurocognitive model of hypnosis and hypnotic susceptibility that we have evolved based on a series of experiments in the laboratory published over 15 years (Gruzelier, 1998;2001). The model posits more efficient and responsive frontal executive control mechanisms in hypnotisable subjects, whereas in those low in susceptibility, the weakness of such control processes militate against the induction of hypnosis and lead to distractibility, perhaps due to anxiety about

undergoing hypnosis, and they are unable to narrow their attention to the instructions of the hypnotist.

More difficult to explain are the results about the influence of hypnosis in augmenting mismatch negativity, which was found in experiment III in all participants regardless of hypnotisability. An important clue is provided by the finding that effects were sustained after hypnosis only in the highly hypnotisable subjects, in a study where an attempt was made to alleviate any relaxation after-effects. The same pattern of results was found in slow wave theta activity in an earlier EEG study (Williams and Gruzelier, 2001). In that study the explanation required a process incidental to hypnosis, but one which was prolonged in highly hypnotisable subjects. The best candidate appeared to be relaxation, supported by established associations between relaxation (and sleep) with slow wave theta activity.

Relaxation is also the best candidate here. Certainly it is not uncommon after de-hypnosis for hypnotisable subjects to feel pleasantly relaxed for a long time afterwards. Furthermore relaxation will have the consequence of reducing cortical arousal levels. This will increase signal to noise ratios, one consequence of which is that MMN would be enhanced, as found here. The interpretation of an increase of signal to noise ratios was invoked earlier to account for the enhancement with hypnosis in brightness discriminations, estimated with the psychophysical measure of  $d'$  (McCormack & Gruzelier, 1991).

Notwithstanding, further research clearly is required to elucidate the effects of hypnosis on auditory event-related potentials.

## Conclusion.

We have provided strong support from psychometric studies for our first hypothesis that unreality experiences are associated with hypnotisability. This has been demonstrated in two investigations.

Furthermore, when hypnotisability includes a high cognitive loading, as distinct from motoric loading, there is a striking relation with paranormal experiences.

As personality correlates of hypnotic susceptibility have proven to be elusive, and at best weakly correlated, this replicated result is of considerable importance to the field of hypnosis studies.

The first psychophysiological investigation succeeded in providing additional support for our neurocognitive model of hypnotic susceptibility and the hypnotic process. This posits efficient and flexible, frontal executive control systems, here manifested by attentional control, a requirement which is fundamental to initiating and sustaining the induction of the hypnotic process.

# Bial

Two separate strands of evidence involving on the one hand, responses to the relevant target stimuli, and on the other, responses to the irrelevant standard stimuli, provided support for differential involvement of frontal, attentional control systems in high and low hypnotically susceptible individuals.

This result and other findings in support of the model provide us with insights into the neurophysiological basis of unreality experiences. The unreality experience involves flexible and responsive frontal control systems.

In fact by virtue of the evidence of efficiency and flexibility in response to task demands, the propensity for unreality and paranormal experiences can be considered as a superior cognitive ability. This thesis will be developed at the Bial symposium in April 2002.