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A controlled investigation of right hemispheric processing enhancement after restricted environmental stimulation (REST) with floatation

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SYNOPSIS Two groups of 16 subjects, 8 of each gender, were examined on two occasions, one group before and after restricted environmental stimulation with floatation, and the other group without floatation was the control group. They were examined with a tactile object discrimination task carried out with each hand separately while blindfolded, and with a recognition memory test for words and unfamiliar faces, a test validated on neurological patients with left and right hemispheric lesions respectively. Consistent with both tasks the floatation group showed a significantly greater enhancement of right hemispheric processing after floatation than was found when retesting the controls. The results were distinguished from previous research on hypnosis where the same relative state of hemispheric imbalance was achieved with the same tasks, but largely through inhibitory influences on the left hemisphere.

INTRODUCTION

Restricted environmental stimulation (REST) has been advocated as a stress-reduction therapy, one which requires little training in a particular technique to facilitate relaxation. In this regard it contrasts with biofeedback, progressive muscle relaxation, and autogenic training, all of which require practice and instruction from an experienced practitioner. Also, it is not beset with problems of susceptibility, as hypnosis is. Hypnotic susceptibility has in fact been shown to be enhanced by REST (Barabasz, 1982; Barabasz & Barabasz, 1989), though floatation REST and chamber REST may differ in this regard (Barabasz, 1990). Floatation REST is obtained by having the subject float in a tank in a solution of Epsom salts and water that is heated to a constant body temperature and set in a light-proof, sound attenuated chamber (Floatation REST). Alternatively, in the absence of a floatation tank, subjects may sit in a reclining chair in a sound attenuated chamber (Suedfeld, 1980).

While studies have been undertaken to evaluate the efficacy of REST in the treatment of various disorders such as chronic pain, alcohol addiction (Suedfeld & Baker Brown, 1987; Cooper *et a!.* 1988) and essential hypertension (Fine & Turner, 1982; Kristeller *et a!.* 1982; Suedfeld *et a!.* 1982; McGrady *et a!.* 1987) and while some consideration has been given to the processes involved (Suedfeld, 1980; Budzynski, 1990; Turner & Fine, 1985, 1990, 1991; Barabasz *et a!.,* 1992) little research on mechanisms has been reported in scientific journals.

We set out to examine subjects before and after Floatation REST with neuropsychological tests chosen because they disclosed changes before and after hypnosis (Gruzelier *et a!.* 1984, 1990; Cikurel & Gruzelier, 1990; Crawford & Gruzelier, 1992). In a series of investigations with measures including EEG power spectra, auditory event-related potentials, divided-visual field brightness discriminations, tactual discriminations, bilateral electrodermal orientating activity to auditory stimuli, neuropsychological tests of frontal lobe functions, dichotic listening and cerebral blood flow, we have shown in subjects susceptible to hypnosis, that hypnosis has the effect of predominantly inhibiting left

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and releasing right hemispheric processes, in combination with producing a shift from anterior to posterior brain processing (for reviews see Gruzelier, 1988; 1990; Crawford & Gruzelier, 1992; Gruzelier & Warren, 1993). Here we predicted that like hypnosis floatation would produce an improvement in right, relative to left, hemispheric processing. Whether there would be a reduction in left hemispheric processing, as has been shown in hypnosis, was also examined.

METHOD

Subjects

The subjects were 32 male and female social science students aged between 19 and 29 years, and they were dextral for handwriting. Subjects were selected on the condition that they had never previously floated or had any degree of prior knowledge on hemisphere specialization. The subjects were randomly divided into two groups in which the sexes were equally represented, the experimental/float group *(N*= 16), and the control/non-float group *(N*= 16).

Haptic Processing test

The task involved sorting letters and numbers by touch while blindfolded, for a total of 16 stimulus items. After familiarization the items were sorted randomly into two piles so that a mean movement time was obtained for each hand. Items were then sorted according to class with each hand separately. The mean movement times were subtracted from the mean sorting times for each hand to obtain hemispheric processing times (Kugler & Henley, 1979; Gruzelier *et a!.* 1984). As the task involved active touch, which is contralaterally mediated, as distinct from passive touch which is bilaterally mediated, each hand indexed the contralateral hemisphere.

Warrington Recognition Memory test

The Warrington Recognition Memory test for words and unfamiliar faces has been validated on patients with unilateral lesions. It distinguishes between left and right temporal and parietal lesions (word *versus* faces memory deficits respectively), and fulfils double dissociation criteria (Walsh, 1988). The test is sensitive enough to detect minor degrees of memory deficit across a wide range of the adult population (Warrington, 1984). As such, it was applied in the present study to distinguish the degree of proficiency of processing in each hemisphere. Each test involved presenting the subject with 50 stimulus items, with the requirement that the subject decided whether they liked or disliked the word or face. Here presentation rate was one item every 2 s rather than the standard practice of one item every 3 s; a modification that was done to help to reduce ceiling effects with the verbal task, which can occur with university students. Retention was tested by two choice recognition, immediately after the presentation of the test stimuli, and the subject was required to distinguish the stimulus item from the distracter item. These tests were then repeated after an interval of 90 mm for both the floaters and non-floaters.

Floatation questionnaire

The questionnaire was used to monitor what was experienced during floatation. It was constructed on the basis of a large pilot study of mental experiences characteristic of REST and included the inability to follow a logical line of thought, decreased ability to maintain attention, a loss of conception of time, and the onset of various mental events such as unwilled vivid imagery, sudden insights, and unusual memories.

Procedure

Each subject was administered the Haptic Sorting test and then the Warrington Recognition Memory test. The experimental group then floated for 90 min. This involved lying naked in a floatation tank heated to 93.5 °F in total darkness and silence. The controls also returned, having received instructions not to eat or drink during this time. Each subject was then re-administered the Haptic Processing and Warrington tests. Finally, the experimental group received the floatation questionnaire to complete. Order of subtest – left or right hand and word or faces task – was counterbalanced across subjects within groups.

RESULTS

Haptic Processing test

The groups were compared by MANOVA with Session and Hand as within subject variables.
The results are shown in Fig. 1. No difference

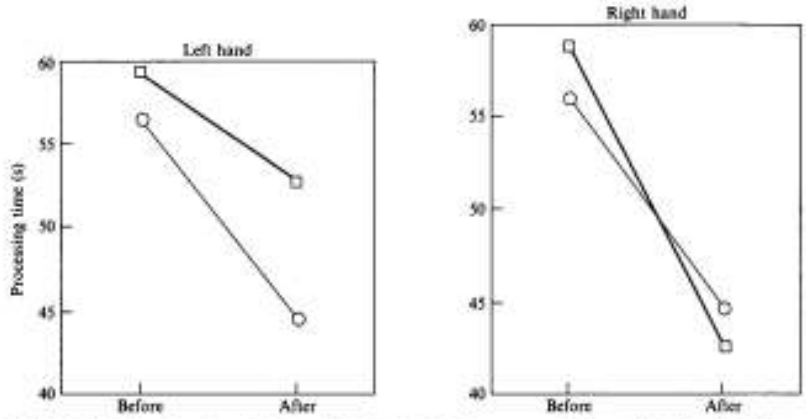

FIG. 1. Left and right hand processing times before and after floatation for floaters compared with controls. □, Controls; ○, floaters.

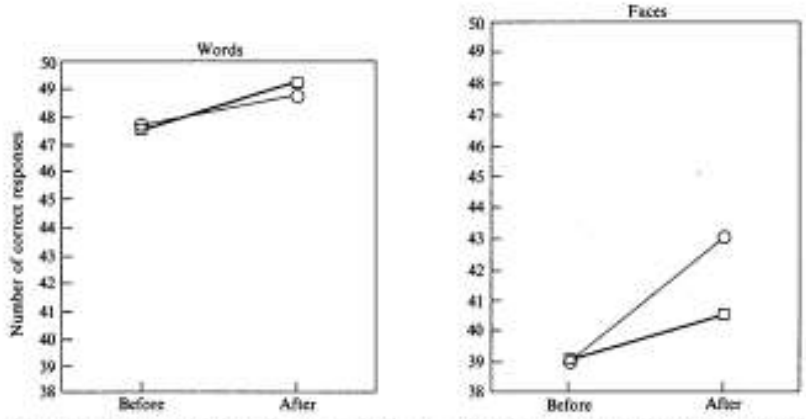

FIG. 2. Recognition memory for words and faces before and after floatation for floaters compared with controls. □, Controls; ○, floaters.

was found between the groups in the first session ($F = 0{\cdot}17$). Performance improved on retest ($F = 30{\cdot}16$, df 1,30, $P < 0{\cdot}007$) to a similar extent for both groups (Group × Session $F = 0{\cdot}02$), but to a greater extent for the right hand (Session × Hand ($F = 6{\cdot}54$, df 1,30, $P < 0{\cdot}02$). However, there was an interaction between Group, Session and Hand ($F = 8{\cdot}50$, df 1,30, $P < 0{\cdot}007$). The left-hand–right hemisphere processing times of the floatation group showed almost twice the improvement ($\bar{X} = 12{\cdot}06$ s) of the control group ($\bar{X} = 6{\cdot}75$ s) ($P < 0{\cdot}01$), whereas for the right-hand–left hemisphere processing times the groups did not differ, and in fact the floatation group showed only about two-thirds of the improvement ($\bar{X} = 11{\cdot}44$ s) of the control group

(X = l6.3l s). Thus, it was left-hand—right hemisphere processing that differentiated the groups on retest, with floatation producing a greater impact on the right hemisphere.

Recognition Memory
Results are shown in Fig. 2. The groups were examined by MANOVA with Session, and Memory modality as within subject factors. There was no difference between the groups in performance in the first session *(F*= 0.00). Performance for both groups improved on retest *(F*= 53.46, df 1,30, *P* < 0.000l). There was a highly significant interaction between Group, Session and Modality *(F= 1l.5,* df 1,30, *P*< 0.002). Whereas the groups did not differ in memory for words *(F* = 0~02; Group x Session *F*= 2.42), floaters showed a four-point increase in memory for faces compared with a one-point increase in the control group *(F*= 7~23, df 1,30, *P* < 0~01). Thus, again the right hemisphere (memory for faces) distinguished the effects of floatation.

Questionnaire
Validation of the REST experience at a subjective level was confirmed by the results of the questionnaire; these were in line with those reported by Lilly (1977) and Suedfeld (1980). In all, 81 % of subjects found concentrating on a particular line of organized thought more difficult or impossible while floating, and described their thoughts as more diffuse and day-dreamy than usual, while 94% of subjects reported losing all conception of time. Subjects experienced unusual mental experiences within the tank, the most common being spots or flashes of light, unwilled vivid imagery, unusual memories, sudden insights, disorientation of where they were and feelings of timelessness. All subjects reported the experience to be physically and mentally relaxing and refreshing.

DISCUSSION

The results support the hypothesized right hemispheric processing enhancement after restricted environmental stimulation with floatation. This effect was consistent for both neuropsychological tasks. Floatation was not distinguished by producing any advantage for left hemispheric processing over and above that found in the control group, though in the case of the verbal memory task the high level of performance of both groups makes evaluation of improvement on the task inconclusive. More to the point, however, floatation did not produce any significant deleterious effects on the left hemisphere as has been found with hypnosis; here, there was only a slight reduction in right-hand sorting times with repetition when compared with the control group.

While hypnosis, like floatation, has been shown to reflect a shift in hemispheric balance to favour the right hemisphere, and while REST has been shown to facilitate hypnotic susceptibility, the short-term effects of REST on cerebral laterality may in fact be distinguished from those of hypnosis on a number of counts.

1. Hypnosis is induced by specific techniques designed to have inhibitory influences on the brain, such as the narrowing of attention by focusing on a small object. This is coupled with suggestions of drowsiness and eye closure. In fact, hypnosis has been likened by some to a sleep-like state, though scientific evidence has differentiated sleep from hypnosis (Crawford & Gruzelier, 1992). Floatation, while making most subjects feel day-dreamy, on the other hand produced reports of feeling mentally refreshed.
2. Hypnosis is an interactive process between the hypnotist and the subject who gives over the planning function of behaviour to the hypnotist, an effect hypothesized to coincide with inhibition of frontal lobe functions. Floatation involves no such interaction and the subject is always in full command of behaviour.
3. In hypnosis the effects, both phenomenological and neuropsychophysiological, are attributable only to hypnotically susceptible subjects and not to low susceptibles. This is in contrast to the effects with floatation, which pertained to a group rather than subgroup (susceptibility) effect.
4. Both neuropsychological tasks included in this experiment have been applied to investigations of hypnotically induced relaxation, and the results with floatation were dissimilar. In view of the scientific objectivity of this evidence it will be considered in detail.

With hypnosis the Haptic processing test has shown a shift in hemispheric balance in susceptible subjects largely through inhibitory influences on the left hemisphere, exemplified by

increases in right-hand processing times, results have been demonstrated on several occasions (Gruzelier *et at.* 1984; Cikurel & Gruzelier, 1990). Furthermore, in one of the two studies scores of hypnotic susceptibility monitored throughout the experiment correlated with the slowing in right-hand—left hemispheric processing; hypnotic susceptibility was unrelated to left-hand—right hemisphere processing times. Thus, hypnosis is characterized by changes in *right-hand* performance and these are in the direction of *reductions in processing speed.* Floatation is characterized by changes in *left*-hand performance and these are in the direction of *reductions in processing time.*

Also, the Warrington Recognition Memory test has disclosed, in hypnotically susceptible subjects, a reduction in memory for words (left hemisphere) and no change in recognition memory for faces (right hemisphere) (see Crawford & Gruzelier, 1992, Fig. 9.4), in contrast to the effects in floaters, which consisted of an improvement in memory for faces and the little change in memory for words; though the high level of performance on the words task (Fig. 2) makes measurement of possible improvement on this task inconclusive. Interestingly, low hypnotic susceptibles showed an improvement in memory for words at retest, together with no change in recognition memory for faces; again these are effects that may be differentiated from those in floaters.

While neuropsychological tests provide only indirect evidence of functional lateralization, and few if any tasks are strictly lateralized, the results from the two domains of measurement (tactual processing and recognition memory) are consistent with one another, both in the studies of floatation and the studies of hypnosis, yet the nature of the changes differs with the two therapies or tasks. Accordingly, it is our view that while both floatation and hypnotic relaxation produce a shift in functional lateralization to favour the right hemisphere, and both induce deep states of relaxation, they appear to achieve these effects through different mechanisms that influence lateralized functions.

Both REST and hypnosis are reported to be beneficial for stress-related disorders. Stress-induced anxiety has been shown to alter cerebral laterality (Gruzelier, 1987, 1993; Gruzelier & Phelan, 1991). Trait anxiety may also reflect imbalances in hemispheric activity (Reiman *et a!.* 1986; Conway & Gruzelier, 1994). We believe that research on the mechanisms underlying and distinguishing different stress-reduction techniques, coupled with research on the neuropsychophysiology of anxiety, will ultimately elucidate the scientific basis of stress deduction techniques like REST floatation and hypnosis, and enrich their therapeutic applications.

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