Available online at www.sciencedirect.com
SCIENCE DIRECT®
Neuroscience Letters 379 (2005) 1–6
Neuroscience Letters
www.elsevier.com/locate/neulet

Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak complex magnetic fields

Pehr Granqvist[a,*], Mats Fredrikson[a], Patrik Unge[a], Andrea Hagenfeldt[a], Sven Valind[b], Dan Larhammar[c], Marcus Larsson[d]

[a] *Department of Psychology, Uppsala University, P.O. Box 1225, SE-751 42 Uppsala, Sweden*
[b] *Department of Clinical Physiology, Malmö General Hospital, Lund University, Sweden*
[c] *Department of Neuroscience, Uppsala University, Sweden*
[d] *Children's Hospital, Lund University, Sweden*

Received 21 August 2004; received in revised form 19 October 2004; accepted 22 October 2004

Abstract

Transcranial magnetic stimulation (TMS) with weak (micro Tesla) complex waveform fields have been claimed to evoke the sensed presence of a sentient being in up to 80% in the general population. These findings have had a questionable neurophysiological foundation as the fields are approximately six orders of magnitude weaker than ordinary TMS fields. Also, no independent replication has been reported. To replicate and extend previous findings, we performed a double-blind experiment ($N = 89$), with a sham-field control group. Personality characteristics indicating suggestibility (absorption, signs of abnormal temporal lobe activity, and a "new age"-life-style orientation) were used as predictors. Sensed presence, mystical, and other somatosensory experiences previously reported from the magnetic field stimulation were outcome measures. We found no evidence for any effects of the magnetic fields, neither in the entire group, nor in individuals high in suggestibility. Because the personality characteristics significantly predicted outcomes, suggestibility may account for previously reported effects. Our results strongly question the earlier claims of experiential effects of weak magnetic fields.

Keywords: Magnetic fields; Sensed presence; Mystical experiences; Suggestibility

It has been claimed that up to 80% of the general population experience the presence of a sentient being from the application of weak complex magnetic fields to peoples' temporal lobes [12,18,19]. It has also been asserted that this experience strikes at the core of religious experiences, many of which are characterized by a sensed presence of God or some other figure. These findings have attracted enormous media attention, with coverages by major TV channels, such as CNN, BBC, and Discovery Channel, as well as innumerable citations in popular science journals. Moreover, a derivative of the magnetic field device has recently been commercialized on the internet where it can be purchased by the general public.

The claims naturally evoke reactions from atheist-skeptics and spiritualists alike. For the skeptic it may be tempting to argue that because the purported experience of God's presence is possible to elicit through brain stimulation, these findings cast a shadow on the ontological accuracy of religious experiences. Spiritualists, on the other hand, may now finally have found a fairly cheap device that may help promote their spiritual experiences.

Before a reaction of either kind is warranted, the findings reported are in need of replication by an independent research group. This is important not only because of the potentially far-reaching implications of the results, or the commercialization and wide media attention, but also because of the ambiguities of the experimental designs utilized (see the following). The aim of the current study was a replication and extension using a double-blind protocol. We also assessed personality characteristics to determine if traits indicative of suggestibility might predict the experience of a sensed presence and related phenomena.

* Corresponding author. Tel.: +46 18 4712113; fax: +46 18 4712123.
E-mail address: pehr.granqvist@psyk.uu.se (P. Granqvist).

0304-3940/$ – see front matter © 2004 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.neulet.2004.10.057

Transcranial magnetic stimulation (TMS) is a well-established clinical technique to trigger activity in, e.g., the motor cortex by inducing currents in the brain leading to neuronal activity. Typically the fields are in the 1 T range and are delivered in short pulses (200–600 μs) [27]. TMS using weak (μT) complex waveform fields have been reported to induce various psychic experiences among exposed participants [18,19]. Such weak fields are considered unable to induce currents strong enough to depolarize neurons. Thus, the mechanism through which weak complex field TMS may work remains obscure, but the waveform of the field has been suggested to be crucial [18].

Persinger and co-workers have identified specific waveform patterns that elicit biological responses in a high proportion of participants. Some of these patterns are based loosely on the "burst-firing" behavior of amygdaloid-hippocampal neurons [26]. The fields have been applied over one or both temporal lobes.

The magnetic field has been proposed to interfere with the electromagnetic activity between the left and right hemispheres with the right hemispheric activity being "projected" and intruding into the left hemisphere "awareness" leading to the sense of a non-self presence or entity [18]. Findings such as these have led to the proposal of a neurobiological foundation for paranormal experiences. Recent findings in functional neuroimaging studies also suggest a correlation between spiritual experiences and specific neurophysiological activation [1,2,7,25,28].

Persinger and co-workers have published a large number of articles on direct or indirect psychological effects of complex magnetic fields. Some studies concern the correlates and events occurring in relation to naturally fluctuating geomagnetic activity. Various wave patterns have been documented in relation to naturally occurring "haunted" houses, religious experiences, wars, alien abductions, reports of seeing UFOs, and various paranormal experiences [20]. More indirect evidence indicating effects of abnormal activity in the temporal lobes comes from a series of studies showing that people with partial epileptic signs (e.g., sensory enhancement, affective dissociation) have a higher occurrence of paranormal and mystical experiences, including that of sensed presence [21]. Causality cannot be inferred from these correlational findings.

A series of somewhat more controlled laboratory studies have yielded convergent results [18]. For instance, in a study with a low number of participants, Cook and Persinger [6] found that those who had been exposed to the magnetic fields reported a sensed presence to a larger extent than participants exposed to sham-fields. However, the effects of the magnetic fields interacted with complex partial epileptic signs, such that 75% of the participants who scored high on the Temporal Lobe Signs Inventory (TLS [16]) reported sensed presence (six out of eight participants), while none of the below average TLS scorers reported a presence.

It is difficult to evaluate the reliability of these results, because no information on experimental randomization or blindness was provided. This is particularly problematic given the wide scope and occasional vagueness of the experiences reported. Hence, it is possible that the experiences are artifactual, resulting from differential interactions with participants across conditions, expectancy effects, and/or participant suggestibility. In case of differential treatments, suggestibility could work as a potent alternative explanation. Therefore, it is important to investigate if the basic findings can be reproduced in a double-blind, randomized experiment.

An additional methodological problem with the studies cited is that they consistently used an outcome measure (the EXIT scale), constructed inductively and with unknown reliability and construct validity. Many of the experiences listed on the scale are rather vague ("tingling sensations", "felt odd"), and their relations to the paranormal and mystical experiences, to which the findings are generalized, remain disputable. Thus, it is important to investigate if the findings can be reproduced with measures with well-documented reliability and validity, such as Hood's [14] Mysticism scale.

It is possible that previous findings resulted from participant suggestibility, either directly or in interaction with the magnetic fields. A widely used indicator of suggestibility is Tellegen's absorption scale [31]. Absorption is a trait referring to openness to self-altering experiences and other indices of an altered state of consciousness. Besides indicating suggestibility, e.g., to hypnotic induction, absorption has been linked to paranormal and mystical experiences [9,15,29,32]. Hence, absorption shares many of the correlates of TLS. Given that the experiences indicated in TLS interact with complex magnetic fields in the prediction of the experiences reported, absorption should also do so.

"New age" attitudes and practices have recently been related to absorption, magical ideation, and a tendency to infer patterns in randomly distributed dots [8,10]. In conjunction with their reports of paranormal experiences, this suggests that new agers may be high on suggestibility.

In the present study we attempted to replicate and extend the findings on sensed presence and similar experiences in a controlled, double-blind experimental setting. The study was part of a larger research project, including a follow-up in which we planned to assess the brain activation of magnetic field responders by means of positron emission tomography.

Based on previous research and theorizing, we hypothesized that the application of weak complex magnetic fields over participants' temporal lobes would lead to a higher degree of sensed presence of a sentient being as well as the other somatosensory experiences described by Persinger, as compared to a sham-field condition. In addition, given the presumed link between these events and mystical experiences, we expected increased occurrence of mystical experiences in the magnetic field group. Besides these anticipated main effects of experimental manipulation, we expected interaction effects between magnetic field condition and personality characteristics (predictors), such that participants high on suggestibility would be particularly likely to show the anticipated effects. In addition, we explored whether there would

be any statistical main effects of the predictors, in which case a partial suggestibility interpretation of the findings seems warranted.

Participants were undergraduate students at Uppsala University, Sweden, drawn from the theology ($n = 46$) and psychology ($n = 43$) departments. Twenty-five (27%) of the participants were male. The mean age of the sample was 24 years (S.D. = 4.77; range 18–41). Theology students were compensated with two cinema vouchers worth approximately US$ 21. Psychology students participated for course credit. Eligible for inclusion were participants who had never experienced an epileptic seizure or psychotic phase.

Participants were recruited during class, and were informed of the anonymous and voluntary premises for participation. The project had been approved by the ethics committees at the medical faculties of Uppsala University and Lund University. In accordance with the guidelines from the committees, presumptive participants were informed that the project was about the influence of complex, weak magnetic fields on experiences and feeling states. No information pertaining to spiritual or other paranormal experiences was provided. We emphasized that the magnetic fields were quite weak and harmless, e.g., in comparison to the fields surrounding mobile phones. They were not told that there was a sham-field control condition. In case of an interest in participating, the students were asked to write their names and telephone numbers on a sheet of paper. They were contacted by phone a few days to a few weeks later, and appointments were scheduled.

Upon arriving in the laboratory, participants were randomly assigned, by sex and subject of study, to the magnetic field or sham-field condition by a non-blind experimenter (P.U.) who never interacted with the participants. When eligible for inclusion, they were asked by a blind experimenter (A.H.) to fill out a pre-experiment questionnaire in an adjacent room, containing demographic information and the predictor measures, which took approximately 15 min to mark. The experimenter then led them to the laboratory room, placed them on a comfortable office chair in the center of an isolation chamber, which was approximately 2 m^2 in size. Both the laboratory room and the isolation chamber were set up to be neutral in terms of affective induction. There were no items present besides the relevant stimulus equipment, an EEG device, and two computers. Participants were told that they could communicate through an intercom in the chamber. The magnetic field device was then attached, with two magnetic field blocks placed bilaterally, horizontally to their temporal lobes, just above and in front of the ears. They received ear plugs, and were told to relax, after which the experimenter left the room, closed the door, and switched off the light.

After 30 min, the experimenter entered the isolation chamber and instructed participants to fill out the post-experiment questionnaire, containing the outcome measures. These were filled out in the isolation chamber during approximately 10 min. Finally, participants were debriefed verbally and received a debriefing letter, containing contact information to the investigators. The debriefing included information on whether the participant belonged to the magnetic field or sham-field group.

A custom built TMS device [18] with associated controller software (Complex 1.15) was run on a PC compatible computer with a Pentium Pro processor, 64 Mb RAM and Windows 95 (SPC Datorer, Uppsala, Sweden). The software and TMS hardware were programmed and constructed by Persinger's collaborator, Stanley Koren. The digital waveform signal generated by the computer program was sent to the TMS device where it was passed through a digital to analogue converter, thereafter amplified and sent to the two headboxes, each containing an array of four solenoids. The waveform signal was cycled in a circular fashion between the solenoids at a rate of 2 Hz, i.e., each solenoid was active for 0.5 s, after which the signal was routed to the neighboring solenoid. Dr. Persinger was consulted with regard to the stimuli patterns and solenoid array placement to make our experimental set-up optimal for replication of previous works on sensed presence experiences and related phenomena. The field strengths were measured using a BMM3 magnetic field meter (Radians Innova AB, Göteborg, Sweden) and fields were between 3 and 10 μT at distances from the solenoids that were estimated to correspond to the intracranial distance. Participants received either sham-field for 30 or 15 min "Thomas waves" (specific program parameters were 3 ms pixel duration and 3 ms cycle interval) over the right side immediately followed by 15 min of "burst waves" (3 ms pixel duration, 3000 ms cycle interval) bilaterally [18].

The Temporal Lobe Signs Inventory (*TLS* [16]). The TLS was originally constructed to tap psychological experiences which indicate a temporal lobe activity pronounced for individuals with electrical foci in the temporal lobes, such as temporal lobe epileptics, but normally distributed in the general population. These include déjà vu and paranormal experiences, formed visual hallucinations, unusual smells, and circumstantial and stereotyped thinking. The scale consists of 30 items, scored in a True (1)–False (0) format, and summed to reach a summary score ($M = 10.28$; S.D. = 4.20). Sample items include, "Sometimes an event will occur that has special significance for me only" and "People tell me I 'blank out' sometimes when we are talking". The internal consistency of the TLS has been established [16], and was found to be adequate also in the present study ($\alpha = .73$). The construct validity of the scale has been supported, e.g., in moderate associations with EEG-assessed temporal lobe activity, and elevated TLS scores in clinical populations, particularly in patients diagnosed with temporal lobe epilepsy [16,21–23].

The Tellegen Absorption Scale (*TAOS* [31]). The TAOS is a 34-item measure originally constructed to predict susceptibility to hypnotic induction. The term "absorption" refers to a tendency to have one's attentional system fully absorbed, which causes an altered state of consciousness. Items were scored on a 1 (Strongly Disagree [SD]) to 6 (Strongly Agree [SA]) scale, and summed to reach an average score ($M = 3.39$;

S.D. = .75). Sample items include, "Sometimes I feel as if my mind could envelop the whole world" and "Sometimes I 'step outside' my usual self and experience an entirely different state of mind". The reliability and validity of the TAOS are well-established, as evidenced in, e.g., high internal consistency and associations with hypnotic susceptibility, dissociative experiences, and hallucinations [9,15,31,32]. The internal consistency was found to be high also in the present study (α = .91).

The New Age Orientation Scale (*NAOS* [11]). The 22-item NAOS was constructed to assess individual differences in the adoption of a new age life style orientation, with respect to broad systems of thought, as well as more specific beliefs, interests, and activities. Sample items include, "Compared to most religious and non-religious people, I am probably somewhat of a spiritual seeker with an unusually open mind" and "Everything that happens in an individual's life has an underlying meaning that it is important to try to comprehend". In spite of the seeming heterogeneity of new age phenomena, across three Swedish samples of new agers, religious adults, and adolescents from the general population, NAOS has been shown to be both unidimensional in factor analyses and highly internally consistent in reliability analyses [10,11]. Therefore, the mean score (M = 2.62; S.D. = 1.02) on the entire scale was used in the present study, where internal consistency was also found to be high (α = .94). The construct validity of NAOS was supported in analyses showing higher scale scores in participants drawn from new age settings (e.g., alternative bookstores and medical centers) compared to religious adults and adolescents from the general population.

The EXIT Scale [24]. The 20-item EXIT scale describes various somatosensory sensations that, according to Persinger and co-workers, may be experienced following the application of weak, complex magnetic fields to peoples' temporal lobes. These sensations include dizziness, felt presence of a sentient being, tingling sensations, vivid images, vibrations, ticking sounds, odd smells and tastes, sexual arousal, out-of-body experiences, feelings of de-realization, and various emotional states, such as anger and sadness. Items were scored on a 3-point scale for frequency of occurrence during the experimental session, where 0 = never, 1 = occasionally (or at least once), and 2 = frequently. The reliability and validity of the EXIT scale are, to the best of our knowledge, unknown. Persinger and co-workers have typically analyzed the outcomes at the item-level. However, when statistical analyses are used, this leads to a potential mass-significance problem. As the internal consistency across items was sufficient (α = .71) we created average scores at the scale level (M = .30; S.D. = .21). Also, given the strength of past effects specifically on sensed presence, we performed additional analyses separately on the sensed presence item (M = .32; S.D. = .53).

The Mystical experiences scale [14], as translated to Swedish [13]. The 30-item "M-scale" is the most frequently used empirical measure of mystical experiences [30]. Items and scoring instructions were modified in accordance with our focus on mystical experiences occurring specifically during the experimental session, rather than in participants' lifetime. Sample items include, "I had an experience in which ultimate reality was revealed to me" and "I had an experience in which I realized the oneness of myself with all things". Items were scored on a 6-point scale where 1 = S.D. and 6 = SA, and summed to create average scores (M = 1.88; S.D. = .69). The reliability and validity of the M scale are well-established, e.g., in adequate internal consistency, relations to other assessments of mystical experiences, and ego permissiveness [30]. The internal consistency was found to be high also in the present study (α = .92).

A double-blind, between-subject experimental design was used. Participants were randomly assigned to experimental conditions (magnetic fields activated, n = 43; sham-field condition, n = 46). Temporal lobe signs, new age orientation, and absorption were used as predictors, and mystical experiences and the EXIT scale as outcome variables. The laboratory session was individual for each participant.

Independent group t tests were used as a first test of main effects of experimental manipulation. Cohen's [4] effect size formula (d) was applied to calculate the strength of effects. Cook and Persinger [6] found a highly significant effect with N = 16, indicating a large effect size. However, with the current sample size, a d as small as .30 would be sufficient to obtain a *Power* of .80. Finally, multiple regression analyses were performed to test for interactions between experimental condition and continuous predictor variables, with explained variance (R^2) as the effect size estimate. We employed regression analyses instead of ANOVAs to retain all variance on the predictor variables [5].

There were no significant differences between experimental and control group participants on age or any of the predictor variables, all ps > .10.

Independent group t tests were performed on the EXIT and Mysticism scales, as well as separately on the sensed presence item (see Table 1). In spite of high power for detecting differences between groups at a small effect size level, there were no significant differences between experimental and control group participants on any of the dependent variables. Thus, the application of weak complex magnetic fields did not have any statistically discernible effects on the outcome measures. However, as suggested by Persinger's findings, it is still possible that the interaction of experimental

Table 1
t-tests and effect sizes (d) of differences between magnetic field (E) and sham-field (C) groups on the dependent variables (N = 89)

Dependent variables	E-group, M (S.D.)	C- group, M (S.D.)	t (87)	d
EXIT	.33 (.22)	.27 (.21)	1.35	.28
Sensed presence	.32 (.51)	.33 (.56)	−.09	−.02
Mysticism	1.80 (.58)	1.96 (.77)	−1.04	−.23

Sensed presence and EXIT were drawn from Persinger's EXIT scale [24]; mysticism: The M-scale [13].

condition and predictors explain unique variance on the dependent variables.

A series of multiple regression analyses were run on each of the dependent variables (the EXIT and Mysticism scales, as well as specifically on the sensed presence item). In each equation, dummy-coded experimental condition, a centered predictor and the interaction terms (cross-products) of experimental condition and centered predictor were utilized. The overall equations were in all cases significant on the EXIT and Mysticism scales, range of Fs (3, 85) = 3.17–9.71, range of R^2s = .10–.26, range of ps = <.05 to <.00001. In each of these equations, the predictors made a significant contribution, range of βs = .33–.53, range of ps < .05 to <.0005. Higher temporal lobe signs, absorption, and new age orientation were associated with higher EXIT and Mysticism scores. However, the contributions of experimental condition and the interaction terms were in all cases non-significant, indicating that the application of the weak complex magnetic fields, or its interaction with predictors, had no discernible effects. In other words, the application of the fields did not induce any experiential effects either on those high or low in suggestibility. In addition, none of the equations for the sensed presence item was significant, range of R^2s = .03–.06, n.s.

We tested whether the application of the magnetic fields might have any discernible effects within or differential effects across the sub-samples of theology students, many of whom are religiously active, and psychology students, most of whom are not actively religious. Results from a two-way (sample × experimental condition) MANOVA on the sensed presence item, the EXIT and Mysticism scales showed no significant effects of sample, experimental condition, or their interaction.

Unlike previous studies in this area we did not find that the application of weak complex magnetic fields caused the sensed presence of a sentient being, mystical or any of the other somatosensory experiences described by Persinger and coworkers. However, personality characteristics indicative of suggestibility consistently predicted the mystical and somatosensory experiences in both religious and non-religious participants. These characteristics included absorption to mind-altering experiences, the adoption of a "new-age" lifestyle orientation, and signs of anomalous temporal lobe activity, which individually explained approximately 10–25% of the outcome variance.

How could the discrepancies between our results and those produced by Persinger and co-workers be explained? A key may lie in considering the methodological differences between study designs. Whereas blindness, including double-blindness, of previous studies is questionable (or at least was not reported), we took great care to set up and adhere to a double-blind experimental protocol. Hence, in Persinger and co-workers' studies, highly suggestible individuals may not have been affected by the application of the magnetic fields but may simply have been more prone to pick up on and respond to the experimenter's potentially differential treatments across groups. Presupposing even subtly differential treatments, this does not seem unlikely considering the nature of the suggestibility trait in connection with the vagueness and wide scope of experiences covered in the EXIT form. Also, the experiences might have been further potentiated by having participants fill out the pre-test questionnaires (e.g., the Temporal Lobe Signs Inventory), which contain items referring to various anomalous experiences.

Rather than indicating a higher degree of suggestibility in new agers and individuals high on absorption and temporal lobe signs, our results could be interpreted as simply showing that individuals with a high degree of openness to unusual experiences in fact had more unusual experiences when placed in a sensory deprivation context. Such an interpretation cannot be ruled out on the basis of our findings, but it would fail to account for why participants in the magnetic field groups of Persinger and co-workers' studies were more prone to have these experiences than participants in the sham-field conditions.

Besides the attempted induction of religious-like experiences, recent studies have examined the neurophysiological correlates of naturally occurring religious experiences with PET and SPECT methodology. These studies suggest that the assumption of temporo-limbic activation in religious experiences is overly simplistic. For instance, results from Azari et al.'s [1] and Newberg's (for a recent review, see [17]) studies on highly religiously devoted participants' repetitive recital of religious texts and meditation, respectively, suggest that attentional and higher cognitive functions, associated with prefrontal cortical activation, are more likely neurophysiological candidates for religious experiences than the emotional processes associated with temporo-limbic activation. It should be noted, though, that the Azari and Newberg findings, which concern more meditative states, may not be generalizable to the mystical experiences of interest in the present study. If those experiences could be studied in controlled settings, they may well involve temporo-limbic activation.

The commercially available weak complex field TMS devices have a different design than the device employed in the present study, but their function builds on the same principles. However, no double-blind studies of these devices have been reported in the scientific literature that may support an effect of their magnetic fields. Note, though, that insofar as prospective purchasers of such equipment are high on suggestibility, placing the helmet on their heads in a sensory deprivation context might have the anticipated effects, whether or not the cord is plugged in.

Regarding methodological considerations, the present study employed a more rigorous research design compared to previous studies in this area. Also, we had a relatively large sample, which consisted of religious as well as non-religious participants, and used measures with well-established reliability and validity. In other words, the possibility to detect effects from the magnetic fields was optimized. Any future replication, or extant findings cited in opposition to the present results, will also need to be based on a randomized, controlled, double-blind procedure to have credibility.

If at all possible, more powerful techniques than the application of weak complex magnetic fields seem necessary to induce religious experiences. Perhaps stronger magnetic fields, approaching the strength of those used in the TMS literature, might produce such effects? However, religious experiences are most likely complex and multifactorial, involving motivational, cognitive, and setting factors [3,30] that cannot be equated with easily defined neurophysiological states. Also, our findings suggest that it is necessary to take the contribution of the individual's personality characteristics into consideration.

Acknowledgments

We are grateful to Stanley Koren and Dr. Persinger for generously providing their magnetic field device, and instructing us in its use. We thank Lars-Erik Larsson for technological assistance. P.G. is supported by a Sasakawa Young Leaders' post-doctoral fellowship, and M.F. by the Swedish Research Council.

References

[1] N.P. Azari, J. Nickel, G. Wunderlich, M. Niedeggen, H. Hefter, L. Tellmann, H. Herzog, P. Stoerig, D. Birnbacher, R.J. Seitz, Neural correlates of religious experiences, Eur. J. Neurosci. 13 (2001) 1649–1652.
[2] J.L. Barrett, Exploring the natural foundations of religion, Trends Cogn. Sci. 4 (2000) 29–34.
[3] C.D. Batson, P. Schoenrade, W.L. Ventis, Religion and the Individual: A Social Psychological Perspective, Oxford University Press, NY, 1993.
[4] J. Cohen, Statistical Power Analysis for the Behavioral Sciences, second ed., Erlbaum, NJ, 1988.
[5] J. Cohen, P. Cohen, Applied Multiple Regression/correlation Analysis for the Behavioral Sciences, second ed., Erlbaum, NJ, 1983.
[6] C.M. Cook, M.A. Persinger, Geophysical variables and behavior: XCII. Experimental elicitation of the experience of a sentient being by right hemispheric, weak magnetic fields: Interaction with temporal lobe sensitivity, Percept. Motor Skills 92 (2001) 447–448.
[7] E.G. d'Aquili, A.B. Newberg, Religious and mystical states: a neuropsychological model, Zygon 28 (1993) 177–200.
[8] M. Farias, G. Claridge, M. Lalljee, Personality and cognitive predictors of new age practices and beliefs, submitted for publication.
[9] J. Glickson, T.R. Barrett, Absorption and hallucinatory experience, Appl. Cogn. Psychol. 17 (2003) 833–849.
[10] P. Granqvist, New age orientation and the adult attachment interview: adverse experiences and preoccupied and unresolved states of mind, in preparation.
[11] P. Granqvist, B. Hagekull, Seeking security in the new age: on attachment and emotional compensation, J. Sci. Study Relig. 40 (2001) 529–547.
[12] D.R. Hill, M.A. Persinger, Application of transcerebral, weak (1 microT) complex magnetic fields and mystical experiences: are they generated by field-induced dimethyltryptamine release from the pineal organ? Percept. Motor Skills 97 (2003) 1049–1050.
[13] N.G. Holm, Mysticism and intense experiences, J. Sci. Study Relig. 21 (1982) 268–276.
[14] R.W. Hood Jr., The construction and preliminary validation of a measure of reported mystical experience, J. Sci. Study Relig. 21 (1975) 29–41.
[15] A.M. Kremen, J. Block, Absorption: construct explication by Q-sort assessments of personality, J. Res. Personality 36 (2002) 252–259.
[16] K. Makarec, M.A. Persinger, Electroencephalographic validation of a temporal lobe signs inventory, J. Res. Personality 24 (1990) 323–337.
[17] A.B. Newberg, J. Iversen, The neural basis of the complex mental task of meditation: Neurotransmitters and neurochemical considerations, Med. Hypotheses 61 (2003) 282–291.
[18] M.A. Persinger, Keynote Address, International Symposium, Magnetic Fields: Recent Advances in Diagnosis and Therapy, Lawson Research Institute Conference, London, Ontario, Canada, 1997.
[19] M.A. Persinger, Experimental simulation of the God experience: implications for religious beliefs and the future of the human species, in: R. Joseph (Ed.), Neurotheology, University Press, California, 2002, pp. 267–284.
[20] M.A. Persinger, S.A. Koren, R.P. O'Connor, Geophysical variables and behavior: CIV. Power-frequency magnetic field transients (5 microtesla) and reports of haunt experiences within an electronically dense house, Percept. Motor Skills 92 (2001) 673–674.
[21] M.A. Persinger, K. Makarec, Temporal lobe epileptic signs and correlative behaviors displayed by normal populations, J. Gen. Psychol. 114 (1987) 179–195.
[22] M.A. Persinger, K. Makarec, Complex partial epileptic signs as a continuum from normals to epileptics: normative data and clinical populations, J. Clin. Psychol. 49 (1993) 33–45.
[23] M.A. Persinger, P.M. Richards, Quantitative electroencephalographic validation of left and right temporal lobe signs and indicators in normal people, Percept. Motor Skills 79 (1994) 1571–1578.
[24] M.A. Persinger, S.G. Tiller, S.A. Koren, Experimental simulation of a haunt experience and elicitation of paroxysmal electroencephalographic activity by transcerebral complex magnetic fields: induction of a synthetic "ghost"? Percept. Motor Skills 90 (2000) 659–674.
[25] V.S. Ramachandran, S. Blakeslee, Phantoms in the Brain, William Morrow, NY, 1999.
[26] P.M. Richards, S.A. Koren, M.A. Persinger, Experimental stimulation by burstfiring weak magnetic fields over the right temporal lobe may facilitate apprehension in women, Percept. Motor Skills 75 (1992) 667–670.
[27] J. Ruohonen, Transcranial magnetic stimulation: modelling and new tehcniques, Doctoral Dissertation at Department of Engineering Physics and Mathematics, Helsinki University of Technology, 1998.
[28] J.L. Saver, J. Rabin, The neural substrates of religious experience, J. Neuropsychiatr. Clin. Neurosci. 9 (1997) 498–510.
[29] N.P. Spanos, P. Moretti, Correlates of mystical and diabolical experiences in a sample of female university students, J. Sci. Study Relig. 27 (1988) 105–116.
[30] B. Spilka, R.W. Hood Jr., B. Hunsberger, R. Gorsuch, The Psychology of Religion: An Empirical Approach, third ed., Guilford, NY, 2003.
[31] A. Tellegen, G. Atkinson, Openness to absorbing and self-altering experiences ("absorption"), a trait related to hypnotic susceptibility, J. Abnorm. Psychol. 83 (1974) 268–277.
[32] R. Zachariae, M.M. Jorgensen, P. Bjerring, G. Svendsen, Autonomic and psychological responses to an acute psychological stressor and relaxation: the influence of hypnotizability and absorption, Int. J. Clin. Exp. Hypnosis 48 (2000) 388–403.