Motor Imagery in Hypnosis: Alpha- and Thetapower during Mental Walking Tasks in Hypnosis

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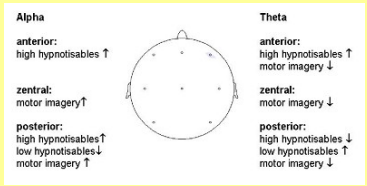
Background

A state-trait-model of imagery could explain why motor imagery (as measured with questionnaires) and hypnosis did not yield any linear relationships in research. Valid EEG markers (alpha- and thetapower) exist for motor imagery and for hypnosis. The objective was to analyse differences between high and low imagers with regard to changes in the EEG and their relation to subjective hypnotic experiences.

Figure 1: Alpha- and thetapower changes in literature



Objectives

(a) Do alpha- and thetapower produced by high an low imagers differ during waking state, during hypnosis and during an active motor imagery task in hypnosis?

(b) Does a direct comparison of the active hypnotic condition (motor imagery) with a passive hypnotic condition (listening to the hypnotic anecdote) show differences between the alpha- and thetaproduction during those phases?

(c) Are differences in EEG-parameters between the two groups reflected in subjective hypnotic experiences?

Methods

Sample: 47 right-handed participants, 32 women and 15 men, average age 25,27 years (SD = 7,35, Range = 32).

Motor Imagery in Hypnosis: A design used by Decety and Jeannerod (1996) was adapted to induce motor imagery in hypnosis. A mental walking task was integrated on a Hypnosis-CD spoken by a qualified hypnotherapist. After a classical hypnotic induction (10 steps down) followed an imaginary journey during which subjects were asked to imagine walking with a friend through a subway labyrinth. All in all 12 times subjects had to walk mentally through tunnels of different lenghts (9m, 6m und 3m) and gates of different widths (1m, 2m und 3 m). As a start signal a deep soft gong was used which was anchored beforehand within the induction. Subjects were requested to lift a finger whenever they reached the end of a tunnel and passed through the gates. Total length of the CD depending on the mental walking times of the subjects was about 45 minutes.

Vividness of Motor Imagery Questionnaire (VMIQ) (Isaac, Marks & Russell, 1986): This scale was created for the assessment of self-reported motor imagery. The questionnaire contains 24 movement imaginations, reaching from simple (walking) to complex actions which require a high degree of coordination (jumping over a wall).

Relaxation Experiences Scale (RES) (Csákó & Mészáros, 2002): The RES is a self-report measurement designed to assess altered states. First, the subjects describe briefly the experiences they had while listening to the hypnosis-CD. Then, they indicate on a 7-point Likert-Scale how they experienced the following: relaxation, visual and motor imagination and hallucination, gustatory and haptic imagery, attentional alterations and depth.

Sampling of EEG: Registration followed the guidelines of the International Federation of Clinical Neurophysiology for minimum standards of EEG measurement. Continuous EEG was acquired with the 16-channel-DC-amplifier „Synamps" (Neuroscan). A monopolar 16-channel 10-20 montage for EEG (Jasper, 1958) was used (Fp1, Fp2, F3, Fz, F4, C3, Cz, C4, P3, P7, P4, P8, O1 und O2) with a common reference (A1 and A2, 10 K-ohm resistance). Ground was applied 3 cm above nasion. Filtering, artifact correction and baseline corrections were conducted automatically with Brainvision Analyzer (© Brainproducts).

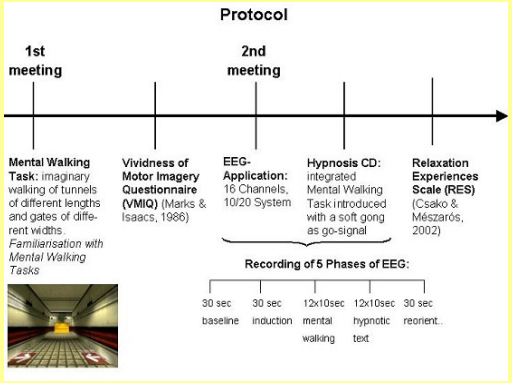


Figure 2: Protocol of experiment

Data analysis: (a) Comparison of high and low imagers according to median split of the VMIQ for the two band widths (alpha, theta): 3 (hypnotic phases: awake, hypnotic text, motor imagery) × 5 (location: fp, f, c, p, o) (Repeated measures ANOVA). (b) Power differences of alpha and theta during a passive hypnotic condition (listening to hypnotic anecdote) and active hypnotic condition (motor imagery task in hypnosis) for the two extreme groups. (Repeated measures ANOVA) (c) Self reported hypnotic experiences (RES) of the two groups and their association with alpha- and thetapower. (MANOVA with VMIQ and RES as factors).

Results

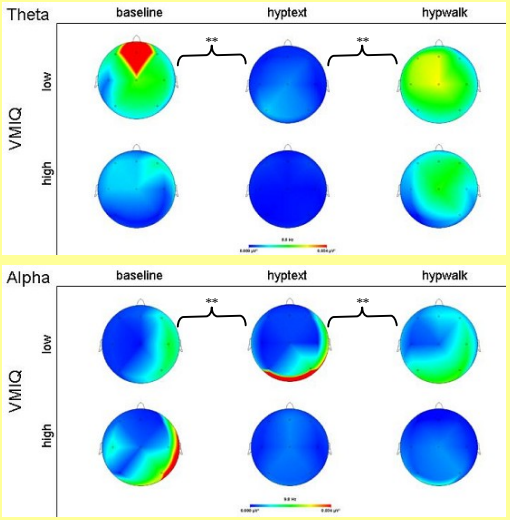


Figure 3: Average Power (alpha and theta). 3 Phases baseline (waiting before hypnosis), hyptext (hypnotic anecdote), and hypwalk (mental walking during hypnosis. Subjects were classified according to their score in the VMIQ into low and high imagers.

Table 1:

Repeated measures ANOVA:
3 (experimental phases) × 5 (localisation) × 2 (trait motor imagery) for alpha and theta power

	Theta		Alpha	
	F	p	F	p
VMIQ	2,33	n.s.	0,50	n.s.
phases	15,23	**p < .001**	4,78	**p < .01**
phases x VMIQ	7,02	**p < .001**	0,93	n.s.
localisation	10,17	**p < .001**	1,13	n.s.
localisation x VMIQ	0,39	n.s.	0,89	n.s.
phases x localisation	8,77	**p < .001**	1,83	**p < .05**
phases x localisation x VMIQ	1,94	**p < .05**	1,39	n.s.

Experimental phase: baseline, hypnotic anecdote (hyptext), and mental walking in hypnosis (hypwalk) × lokalisation (frontopolar, frontal, central, parietal and occipital) × motor imagery (high and low imagery according to VMIQ-scores).

Post-hoc Scheffé Tests (all comparisons p < .001) revealed that occipital alpha, frontal theta and occipital theta are responsible for these significant main and interaction effects.

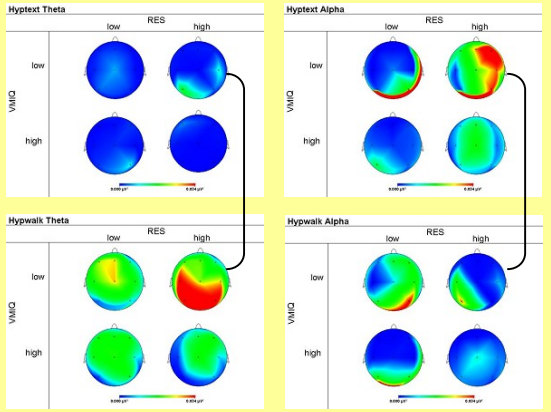


Figure 4: Theta and alpha changes from baseline to motor imagery in hypnosis.Trait imagery (VMIQ) and self-reported intensity of motor imagery in hypnosis (RES)

Discussion

The analysis of EEG-correlates of motor imagery in hypnosis for high and low imagers yielded the following results:
(a) Subjects with low trait imagery according to the VMIQ show a statistically significant higher general alpha- and thetapower than subjects with high trait imagery.
(b) Compared to a passive hypnotic phase both groups produced an increase in occipital alpha during motor imagery. Frontal and central theta also increased during motor imagery in hypnosis – again this increase was independent of trait imagery.
(c) Subjective self-reported hypnotic experiences were associated with a higher alpha-suppression for those who report more hypnotic experiences regardless of their trait imagery.
(d) Subjects who reported vivid imagery in hypnosis although they showed low trait imagery showed a particularly high increase of occipital theta and decrease of frontal alpha in hypnosis.
Results indicate that a dynamic consideration of multiple EEG-Parameters in the sense of the „building blocks" described by Schürmann und Basar (2001) promises more clarification of interactions between different cognitive states. Combined changes of alpha- and thetapower in occipital, central and frontal regions were associated with imagery in hypnosis for both groups. Decety (1996) argued, that the frontal cortex is in involved in the creation and maintenance of dynamic motor images whereas the central cortex is involved based on the isomorphy between imagined and actual movements. This interpretation agrees with the EEG-dynamics found in this study.

Perspective

(a) Occipital alphapower and overall thetapower can be used to test indication of hypnotherapy.
(b) Exact predictions of expected intensity of imaginative experiences – at least for motor imagery – are possible

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