Neural correlates of induced grapheme-color synesthesia

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Abstract

Synesthesia is a perceptual anomaly where stimulation of one sensory modality elicits sensation of a concurrent stimulus from another modality. A previous study has shown that it is possible to establish such an alteration of perception in non-synesthetes by means of hypnotic suggestion. We tried to extend these results to gain further insight in the underlying neural processes using magnetoencephalography (MEG) to record neural activity. Hypnotic suggestion has been proven to be a particular powerful tool to change even highly automatic processes, at least in a small population of individuals that are highly susceptible.

Participants were administered a formal hypnotic induction and then suggested to perceive specific digits in previously assigned colors. Subsequently, they had to complete a simple digit detection task, where grey digits were shown on a colored background that was either congruent or incongruent to the beforehand learned associations. After the task a second hypnosis session was conducted to cancel the suggestions for synesthetic perception.

MEG of the neural activity was recorded in a baseline session at the beginning, during the two hypnosis sessions and throughout the digit detection task.

The results indicate that there was a significant alteration of perception, however not strong enough to modulate behavior in a measurable way. Nevertheless, the study yielded proof for hypnotically induced trance being an altered state of consciousness with significant changes in neural activity. Furthermore we were able to derive some conclusions on neural correlates of hypnotic suggestion, which are however not as clear as the evidence for the altered state.

Much further research will be needed to explore both of the phenomena more precisely. For not only is hypnotic suggestion of practical importance to the therapist, but it also has broad implications for especially neuroscientific research as well. And given the fascinating nature of synesthesia, it is needless to say that it certainly would be of great interest to continue research in this field, too.

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1. Introduction

1.1 Synesthesia

"I don't remember when the colors began. They've always been with me, like the beat of my own heart or the sound of my own breath. Science teaches that I was likely a fetus when my brain started forming the extra connections or began to have a lack of chemical inhibition that would enhance my world, creating a beautiful watercolor that only I could see. A Technicolor alphabet and numbers and days of the week, as well as colored months and music, would be my experience in life. I would have synesthesia, a blending of the senses, to go with my auburn hair, green eyes, left-handedness, and need for braces."

Maureen Seaberg, "Tasting the Universe", p.19

1.1.1 Synesthetic experiences

In order to perceive the world surrounding us as a unified whole, we have to constantly combine sensations from different sensory modalities. To be able to do so, we either need areas where information is gathered and integrated or cross-talk between modalities processing the different features, or both (Macaluso & Driver, 2005). For people experiencing synesthesia in one or another form an 'inducer' stimulus from one modality automatically and involuntarily elicits the percept of a 'concurrent' from another modality or another facet of the same modality (see Cytowic, 1995; Ramachandran & Hubbard, 2005). For example, in a grapheme-color synesthete (the form dealt with in the current study) seeing a certain grapheme leads to the experience of a distinct color, also called photism. Or when you have colored-hearing synesthesia, aural stimulation will produce color sensations. And for taste-shape synesthetes like M.W., the food they eat will lead to the experience of a shape ("Whenver I taste something with an intense flavor, the feeling sweeps down my arm into my fingertips", see Cytowic, 1993). The most common form known to this day is 'colored days' synesthesia (Simner et al., 2006).

To the synesthete this 'mixture of the senses' is idiosyncratic and highly stable over lifetime (Bargary & Mitchell, 2008). There are indications that the specific pairings are formed through early childhood experiences and that frequency in occurring of what subsequently becomes inducer and concurrent stimulus might contribute to this phenomenon (Rich et al., 2005). However, these findings are based on self-report and therefore to be considered carefully. Simner et al. (2006) conducted perhaps the most reliable study to date (investigating a large number of participants and, most of all, using an objective measure) on synesthesia estimating its prevalence rate around 4% of the population. Regarding the many self-reports available today (see Seaberg, 2011; Cytowic, 1993; or visit one of the many websites, e.g. http://www.synaesthesia.com/), it might well be that this number is still an underestimate. For what most of these reports have in common, is that the narrators did not know there was something different about their sensations because they had been experiencing them since they were born. Most of them describe that they were quite surprised when first reading about their perceptions being a 'special condition' in a newspaper or on the internet or when (often by chance) recognizing other people not seeing shapes and or hearing colors. In addition, they are often deemed being just crazy or drug addicts of some sort.

However by now a great amount of research from many groups all over the world has proven that synesthesia neither is pathological nor simply caused by the use of a substance, albeit that synesthetic experiences can be induced (Cohen-Kadosh et al., 2009).

Considering the formerly suggested sex bias of a 6:1 female to male ratio (Rich et al., 2005), Simner et al. (2006) claim to have disproved it by finding a slight tendency, but no significant asymmetry. However a more recent study of Barnett et al. (2008) underlines the previously estimated 6:1 ratio for their sample. The authors also suggest a predisposition for developing synesthesia to be inherited, since they found 42% of their synesthetes having another case in their family. Furthermore they argue for a single underlying genetic mechanism for the multiple forms of synesthesia, because of the numerous types that occur within families. This hypothesis would also match the results from other laboratories indicating that synesthetes often have various forms (e.g. Ramachandran & Hubbard, 2001a).

1.1.2 Projectors versus Associators

This distinction is primarily concerned with the way the synesthetic experience is expressed. Dixon et al. (2004) suggested that there are two possibilities: One could experience the concurrent within, 'in the mind's eye', or one could experience it on the outside, for example like seeing it on a screen. According to them, the synesthetes experiencing their colors the first way could be called "associators", following the idea of a strong association between the inducer and the concurrent that can be learned. We all have those kind of associations. Imagine a grey scaled traffic light where the top light is blinking. Who does not in some way experience ‘red’ at the same time? The difference is that a synesthete has no choice. Trying hard enough, one could get rid of those associations, even if they were highly over-learned and automatic (as in the case with the traffic light), but the moment the synesthete sees the digit, the color is there. However he sees it ‘in his mind’s eye’, which makes an important difference depending on what test we use to assess the mechanisms behind the phenomenon. For example, if one uses a Stroop (1935) or a Stroop-like task to evaluate the impact of the concurrent sensations on processing of such stimuli (see Mattingley et al., 2001; Dixon et al., 2004): It seems clear that experiencing the synesthetic color internally does not interfere as much with naming the color of the presented digit as does experiencing the color on the outside, maybe even as kind of a ‘transparency’ on the surface of the displayed digit. There we have the other type of synethetes, called the ‘projectors’. To them, whenever they see a digit, it appears in the concurrent color, most of the time like the transparency described before. If you imagine that different perceptual quality on your own, it is not surprising Dixon et al. (2004) could confirm their theoretical assumptions using ‘synesthetic stroop tasks’, where the synesthetes had to name the color of their photisms in one and the color of the displayed digit in another run. Both runs consisted of congruent and incongruent trials, where the color of the digit matched the color of the photism, or not, respectively. The stroop interference (high in the incongruent trials) affected the projectors more, when they had to name the color of the digit. In contrast, the associators showed a stronger stroop effect when they had to name the color of their photisms.

1.1.3 Neural mechanisms

Disinhibited feedback

In their theory of disinhibited feedback Grossenbacher & Lovelace (2001) propose that synesthetic experiences may originate in areas receiving sensory input from different modalities (e.g. ‘color-specific’ and ‘grapheme-specific’ areas within the fusiform gyrus, see Bartels & Zeki, 2000; Cohen et al., 2000), such as the temporo-parietal-occipital junction (Hubbard, 2007), where information is integrated. An aberrant feedback from this area to previous sensory-specific areas may then cause the experience of a concurrent from the same or from another modality. Usually this feedback process is inhibited in the 'normal' working brain. However it can be disinhibited and thus synesthetic experiences can be induced, at least temporarily, by altering perception in taking hallucinatory drugs like lysergic acid diethylamide (LSD, see Hofmann, 1979), through meditation (Walsh, 2005) or via hypnosis (Cohen-Kadosh, 2009).

Another empirical evidence in favor of the disinhibited feedback model is the finding of Muggleton et al. (2007) who were able to restrain synesthetic experience in grapheme-color synesthetes (projectors and associators) using trancranial magnetic stimulation (TMS). Muggleton et al. (2007) stimulated right and left parietal cortex finding that hyperpolarization of parietal regions on the right hemisphere interrupted the synesthesia. They take this as evidence for synesthesia originating in higher, multisensory regions, as the disinhibited feedback model proposes. However, it cannot be excluded that hyper-polarization of neural assemblies on the surface somehow influences earlier stages of processing as well and thus this result does not disprove the following hypothesis.

Cross-activation

Ramachandran & Hubbard (2001a) suggest synesthetic experiences being due to a cross-activation caused by hyperconnectivity between areas processing different features. This cross-activation might be due to defective synaptic pruning (Kennedy et al., 1997) in early childhood in a way that normally discrete operating areas are continuously connected into adulthood. Hubbard (2007) notes the hyperconnectivity is crucial, however being located adjacent to each other may "increase the likelihood" of such connections, however implying that a long-distance cross-wiring might be possible. We believe this is rather unlikely given the 'high economic standards' of the brain (Buzsáki, 2006). Yet in the case of 'cross-wiring' the grapheme-color type might arise from enhanced intercommunication between areas in the fusiform gyrus, a more basic level, where the *form* of the grapheme elicits the color. In contrast, other types could originate from 'higher' processing areas as can be found in the angular gyrus, for example, and therefore more concerned with the *meaning* of a grapheme, similar to the process put forward in the disinhibited feedback model above.

The results of Rouw & Scholte (2007) support the 'cross-wiring' hypothesis in that they found increased structural connectivity in, amongst others, an inferior temporal region close to fusiform gyrus in synesthetes using diffusion tensor imaging (DTI).

Reentrant pathways

The model proposed by Smilek et al. (2001) is in line with Grossenbacher & Lovelace (2001), yet more precise since it is based on empirical data. They suggest that, in the case of digit-color synesthesia, the difference between synesthetes and 'normals' takes place in anterior fusiform and posterior inferior temporal (PIT) areas. Feedback from PIT regions processing the *meaning* of the digit to human V4, the color specific area in fusiform gyrus (McKeefrey & Zeki, 1997), modulates the color processing in V4 leading to the percept of the concurrent. The pin point here is that identification of the digit's *meaning* is necessary to activate the associated color. The first argument for that assumption is that their subject reported experiencing the photism in absence of an external inducer merely by thinking of the adequate digit. More reliable proof comes from an experiment of Dixon et al. (2006) that presented synesthetes with ambiguous graphemes that could either be seen as digits or as letters, depending on the context they were presented in (a number line or a word, respectively). Clear-cut result is that response times significantly slowed down in incongruent trials, e.g. when the context was the word but the color of the target grapheme was from the digit association. Further evidence comes from Ramachandran et al. (2004) who got identical results presenting their synesthetes with an ambiguous 'H/A' form in the two words "THE CAT" (looking like a mixture of "TAE CAT" and "THE CHT"). Although the physical stimulus was identical, the subjects reported to immediately seeing the appropriate color for 'H' and 'A'.

Top-down influence

Regardless to the stage of processing and the time course of synesthetic experiences, a number of studies provide clear evidence they can be modulated by attention. Rich & Mattingley (2003) conducted two speed color naming experiments with Navon-type stimuli (Navon, 1977) composed of color inducing letters and displayed in a congruent or an incongruent color. In the second run, participants were instructed to draw their attention to either the global or the local level. Their results demonstrate that the influence of the inducer is modulated by selective attention.

In another study, Mattingley and colleagues (2006) tried to prove the hypothesis that attentional load can impair the processing of a synesthetic prime. They found a significant attenuation effect caused by attentional load, however a small priming effect could still be observed. Thus the only conclusion that can be drawn is that modulating attention clearly affects the elicitation of concurrent sensations, yet the mechanism remains unclear. Rich & Mattingley (2009) were finally able to prove that selective attention is necessary to elicit a concurrent color, when they found it eliminated by the attentional blink. Last mentioned be the above cited studies on the context dependence of concurrent perceptions (Ramachandran et al., 2004; Dixon et al., 2006), that can also be seen as evidence for the influence of selective attention.

To conclude this brief summary on contemporary synesthesia research with focus on the grapheme-color form, we would like to outline that still few is known for sure about the neural mechanisms of this phenomenon. As mentioned afore, evidence on the grapheme-color type is by far the most, however there are numerous forms which all have to be considered when attempting to generate a unitary model. We believe this is possible, for, even though there are so many different types, the phenomenological basis is the same. There is always some sort of perceptual reality arising without stimulation of the appropriate pathway, yet highly coherent with stimulation of a different modality, a strong and automatic association unique to some individuals. Such fundamental differences in perceiving the world have always been fascinating people, because they are closely linked to questions concerning reality itself.

The existing models all have their advantages and yet are to be fully proven, since to this day none of them can fully account for the existing various results. Thereby we believe it is crucial to apply further methods, especially ones allowing to decrypt the time course of the process leading to the emergence of synesthetic experiences. For we strongly assume the answer to the time course question has the potential to definitely point the direction, since it should render it possible to rule out one of the two: The early, sensory level difference as proposed by the cross-activation model versus the late distinction, indicating the association requires knowledge of the stimulus' *meaning*, as the reentrant and disinhibition models suggest. And in case results revealed both levels to be influenced, perhaps dependent on the form of synesthesia, indicating there are simply different types of combinations, we would know more as well.

Hence, hypothesizing that there are no structural anomalies in synesthetes, in line with the models of Grossenbacher (2001) and Smilek (2001), we tried to replicate the promising study of Cohen-Kadosh et al. (2009), using hypnosis as a tool to induce a grapheme-color synesthesia in individuals that do not normally experience any form

of synesthesia. Yet, for the first time in synesthesia research, we were aiming at illustrating the construction cycle of this fascinating perceptual anomaly.
However, we now want to take a closer look at the 'tool' first.

1.2 Hypnosis

"Hypnosis is a process in which one person [...] offers suggestions to another person [...] for imaginative experiences entailing alterations in perception, memory and action. In the classic case, these experiences are associated with a degree of subjective conviction bordering on delusion, and an experienced involuntariness bordering on compulsion. As such, the phenomena of hypnosis reflect alterations in consciousness that take place in the context of social interaction" (Kihlstrom, 2008).
The above definition is one in numerous attempts to define a phenomenon that goes back at least as far as old Egypt, where in the temples of Aesculapius the high priests used what can be considered as the first known example of a hypnotic induction text to facilitate 'dream healings' (e.g., see Stam & Spanos, 1982). Clearly, it is difficult to find a definition for a phenomenon that has so many facets and such a long and contradictory history, especially in its 'latest' development since the exorcisms of Franz Joseph Gassner (1729-1779). The problems start with naming it after the greek 'God of Sleep' (Hypnos) which seems plainly wrong, especially considering versions like 'active-alert hypnosis' (Bányai & Hilgard, 1976), nowadays an important component of mental training all over the world. This form has absolutely nothing in common with the sleep-like state that led to the label in the first. However, we agree with Kihlstrom (2008), when he doubts the use of arguing about a term that has served well labeling the set of phenomena that researchers are interested in. It is definitely important to interchange opinions and it always leads to a better understanding and to better ways to explain what even nowadays many people cannot classify. The fearful skepticism thus in turn hinders the use of such powerful methods either in therapy or in research. And it is a powerful tool for research, not only since there have come up studies like the one we try to extend here (i.e. Cohen-Kadosh, 2009). Creating "clinically informative, subjectively compelling analogues for established psychological and psychiatric conditions" (Oakley & Halligan, 2011) provides a huge potential for a very specific study of underlying processes and thus ways to make a difference, implying the need for cooperation between science and therapy. Yet, for the sake of methodological precision, it is necessary to be *fully* aware

of what it is about the tools to be applied. And there is the crux: In case of hypnosis, this is just not possible yet. For there are so many things we still can only speculate about, because the bulk of evidence available often is not clear-cut and sometimes even contradictory. However, there are many promising examples as well, be it easily changing highly automatic processes like word processing (Raz et al., 2006), influencing perception of pain (see Jensen, 2008; Vanhaudenhuyse et al., 2008) or trying to illustrate the mechanisms underlying hallucinations (Szechtman et al., 1998), just to name a few. Furthermore, contradictions perhaps are just due to methodological differences that are much more likely to occur when examining a complex phenomenon and thoughtful future research will supposedly be able to account for the differences. And after all, there simply is no other adequate tool for what we were trying to do – artificially establishing the aforementioned condition of grapheme-color synesthesia within an extremely short time frame. Yet, since we were interested in the neural correlates of the oneiric state called trance as well, we chose to include resting state recordings in our procedure to eventually compare 'alert activity' with 'trance activity'. This was relatively easy to realize within the context of the main experimental manipulation and held the promise of helpful additional information. Therefore we will now give a brief overview on neural correlates of hypnosis in terms of facilitating interpretation of the results later on.

1.2.1 Neural correlates

A distinction can be drawn between the effects of a hypnotic induction per se, mostly achieved through comparing 'alert state' activity and 'trance' activity, and the effects caused by specific suggestions to alter perception and experience (Oakley, 2008). Effects of an induction could then be described as the change in 'background activity' or 'normal' consciousness in contrast to the slightly altered state of consciousness being trance. Effects of suggestion would be the distinct patterns of activity due to specific proposals for experience. Most of the times, hypnotic induction and suggestions go together, but there is evidence that, at least for highly susceptible subjects, 'formal' hypnotic induction is not necessary to produce hypnotic responses (Braffman & Kirsch, 1999). Given that one could say *suggestibility* is something that exists independently of being in a state of altered consciousness and causes the behavioral and perceptual changes in the individual. *Inducing trance* is the process that facilitates altering consciousness and thereby enhances the responsiveness to following suggestions, even more when it is named 'hypnosis' (Gandhi & Oakley, 2005). The course of events in the current study addressed both, since the resting state recordings aimed at extracting neural correlates of the altered state of consciousness, whereas the posthypnotic suggestion was thought to specifically change the process of perceiving graphemes and colors.

Neural correlates of the state

The controversial discussion still going on about whether or not trance should be labeled as an 'altered state of consciousness', could be easily resolved by considering the latest findings of neuroimaging experiments within the domain, particularly those with so-called 'hypnotic virtuosos'. Even if passing the individual reports on experience, it is undeniable that there are changes in functionality and activity patterns that clearly distinguish the alert state from the trance state.

A detailed description of the neuropsychological correlates associated with the state per se is to be found in Gruzelier (2006). He gives a summary of his work on hypnotic inductions aiming at deep relaxation as they are commonly used in research and proposes a three stage model:

The first stage would involve mainly left hemispheric anterior frontal processing engaged by "thalamocortical systems and parietofrontal connections" (Gruzelier, 2006). The involved areas are within the 'orienting network' (Posner & Petersen, 1990; Raz & Buhle, 2006) and thus match the fixation (in our case, visually to a small dot and auditory to the experimenter's voice) that usually marks the beginning of an induction.

The second stage, which in the current study was defined by eye closure and continuing proposals to deepen the relaxation and enter into a deep sleep, is often described as the 'letting go' component being crucial to trance. Most subjects experienced this part as some form of 'really steeping into trance'. It is associated with a "lateral shift towards a right hemispheric preference" and includes "frontolimbic inhibitory processes [...] encompassing orbitofrontal and dorsolateral frontal regions and limbic structures such as the amygdalae, hippocampus and cingulate" (Gruzelier, 2006).

The third stage is defined by an increase in posterior cortical activity and an altered functional activity within the brain, with a right hemispheric bias particularly in highly susceptible subjects. In our study, the second trance resting state recording (for a detailed methodological description please see methods) comes closest to Gruzelier's (2006) description of this stage involving "relaxed, passive imagery". Thus the most impressive effects concerning the 'state' should be found in the second trance recording, for in the first, subjects were either given specific suggestions or permissively guided through a positive memory, which, in our opinion, in both cases is a more active experience.

In addition to this three stage model of hypnotic induction, he suggests that in highly susceptible subjects impairment of frontal control mechanisms on one hand leads to a disconnection of these areas from posterior areas. On the other hand the "release from frontal inhibition" might play a role regarding thalamo-cortical connections and "orbitofrontal-hypothalamus-amygdala-brainstem reticular formation" structures that are involved the processing of sensory information and in the 'vigilance aspect' of consciousness (Gruzelier, 2006).

Regarding the 'frontal impairment' as proposed by Gruzelier, Egner et al. (2005) found that in highly susceptible participants ACC activity increased in trance as compared to baseline whereas activity in the lateral frontal cortex, which is more associated with control-aspects, did not. EEG analysis of this effect revealed that gamma band (> 28 Hz) power decreased between frontal midline and lateral sites. Together these results indicate a 'dissociation'/ decoupling within the frontal executive network.

The changes in sensory processing match the focus on internal events and the fading of external events and reduced vigilance, as in the sleep-like appearance is actually what led to the name 'hypnosis' in the first.

Evidence for the three stage model from Gruzelier comes from Rainville et al. (2002). They were investigating the influence of hypnosis on consciousness by means of measuring regional cerebral blood flow (rCBF) with positron emission tomography (PET). In addition, they evaluated personal experience in terms of feelings of relaxation and absorption. Their results show decreases in rCBF in brainstem and thalamic nuclei particularly to be associated with the increasing relaxation. They point out rCBF decrease in these parts have formerly been linked to reduced vigilance. Regarding the feeling of mental absorption they found specific increases in rCBF in upper pons, more dorsal thalamic nuclei and part of the anterior cingulate cortex (ACC). They suggest these results altogether to be a correlate of the 'relaxed, but focused' state, oftentimes illustrated by the fixation and the suggestions to fall into a sleep-like state at the beginning of hypnotic inductions.

Results from a previous study on hypnotic relaxation conducted by Rainville et al. (1999) showed an increase in rCBF not only in ACC but also in right temporal sulcus

and left insula. Significant decreases were found in the parietal cortex, left medial superior frontal gyrus and left posterior medial temporal gyrus. Furthermore, electroencephalographic (EEG) recordings indicated an occipital increase in delta band (1-4 Hz) power that was correlated with increased rCBF in both occipital lobes and left post-central gyrus and a nearly- significant decrease in thalamic rCBF.
Thus they suggest that the decrease in thalamic rCBF they found in their 2002 study might as well be correlated with an increase in (occipital) delta band activity. Oscillations in the delta band are in turn associated with states of reduced vigilance, like deep sleep (see trance inductions in the appendix), wherein thalamocortical neurons sustain them (Buzsáki, 2006).
Further evidence comes from the very recent work of Demertzi et al. (2011) who were studying functional roles in consciousness for the network underlying the default state (Buzsáki, 2006) on the one and an "extrinsic" network on the other hand. The default network is comprised of multiple cores including posterior cingulate and precuneus, ACC and anterior medial prefrontal cortices being active when making self-relevant, affective decisions, and a middle and inferior temporal lobe system and parahippocampal gyri engaged in constructing mental scenes such as in imagery. The extrinsic network includes lateral frontal regions and supramarginal gyri, and is more concerned with external input (Andrews-Hanna et al., 2010; Demertzi et al., 2011). Demertzi et al. (2011) found a hypnosis-specific increase in connectivity in medial frontal and angular gyri whilst in posterior cingulate and bilateral parahippocampal gyri connectivity decreased. Furthermore they found a connectivity decrease in right supramarginal and left superior temporal gyri specifically in the hypnosis condition.

Evidence associated with specific suggestions to alter perception

As outlined before, suggestions per se work independent of a hypnotic induction, yet the responsiveness is enhanced administering them during or subsequent to hypnotic induction. The above described functional decoupling and the resulting dissociation especially between medial frontal conflict monitoring (ACC) and left lateralized orbitofrontal and dorsolateral frontal regions might be the reason why (highly susceptible) subjects evaluate and probe outer reality less and in a way hand over executive functions to the experimenter when they are in trance. So these processes might be the cause for enhancing suggestions through 'hypnosis'. But what actually happens then? Impressive results have been reported using the stroop interference paradigm (Stroop, 1935) to explore influences on attentional processes. For example,

Raz et al. (2005) tested stroop interference on highly susceptible participants with the often described, ‘classic’ results. However, had they, subsequently to a standard hypnotic induction, administered the suggestion that on the screen would appear “meaningless symbols [...] like characters of a foreign language”, the stroop effect was eliminated, or at least substantially decreased (Raz et al., 2007). To examine the underlying neural activity, they compared the highly susceptible with the less susceptible subjects and found a significant decrease in ACC, indicating that the former experienced less conflict. Besides that additional occipital activation led to the assumption that early processing might have been altered as well in the highly susceptible.
Another interesting result from Kosslyn et al. (2000) offers information that highly susceptible people are able to modulate neural processing during color perception. Kosslyn et al. (2000) showed their participants (eight highly susceptible subjects) grey-scaled or colored patterns and suggested to view them either truly or color as grey-scale and vice versa, and examined rCBF with PET. They found that, after hypnotic induction and subsequent suggestion to see a colored pattern, rCBF significantly increased in part of the left fusiform gyrus, independent of what was actually presented. The right hemisphere color processing area within the fusiform showed significant increase in rCBF only with reference to what the subjects were told to perceive and independent of hypnotic induction. Thus, the color processing fusiform area in the right hemisphere seemed to respond to the imagery suggestion, whereas left fusiform area was significantly activated only after hypnotic induction.

Taken together, the excerpt of results presented here, indicate that a) hypnosis is an altered state of consciousness, as reflected by changes in activity in (and connectivity between) areas belonging to the brain’s default, attentional and conflict managing-/ control networks, and b) both early and late mechanisms can be modulated via suggestion, yet the production of the effects is more reliable following a formal hypnotic induction. Thereby it is possible to fundamentally change even highly automatic processes, such as color perception, at least in highly susceptible subjects.
Hence, since the experience of grapheme-color synesthesia seems to be as automatic as ordinary color perception, we have no doubt hypnotic suggestion is the most adequate, if not the only way, to establish such a new way of perceiving in ‘normal’ participants.

Furthermore, believing devoutly in the importance of applying time sensitive methods, we decided to record neural activity by means of magnetoencephalography (MEG), which has a particular high temporal resolution, to examine the construction cycle of this phenomenon known as synesthesia.

2. Methods

2.1 Participants

18 (4 male) subjects (15 right-handed and 3 left-handed) with a mean age of 25.2 years and normal or corrected to normal vision and hearing gave their informed consent to voluntarily participate in the study. Handedness was measured using the short form of the Edinburgh Handedness Inventory (Oldfield, 1971). The study was approved by the ethics committee of the University of Konstanz and participants were remunerated with 30 Euros each.

2.1.1 Selection of the participants

Given that hypnotic susceptibility was expected to be a crucial component of this experiment, we conducted a pre-test where 165 persons voluntarily took part in hypnosis sessions. The pre-test sessions took place in a room at the University of Konstanz in which we created ten cabins separated by wooden screens, so that the room ultimately held place for 10 participants per session. In the center of the room was a small table with the audio equipment.

The sessions started at the same time every day. Subjects were welcomed, asked to take a seat and briefly instructed by the two experimenters. We then administered a tape-recorded version of the German Form of the Harvard Group Scale of Hypnotic Susceptibility, Form A - HGSHS:A - (Bongartz, 1980) in order to measure the degree of their hypnotic susceptibility. Note that only one person had experienced formal hypnosis before. However this subject was subsequently excluded. After this screening subjects scoring higher than the cut-off of 7 points on the HGSHS:A were selected and invited to take part in the present study. They then were randomly assigned to the posthypnotic suggestion (PHS) group or the hypnosis control (HypCon) group. The latter spent a comparable time in trance, however was not given the specific suggestion to experience the grapheme-color synesthesia but rather was given relatively unspecific suggestions guiding them through "pleasant scenes in their

lives". In the end there were 9 participants in each condition, however 4 of them had to be excluded because of bad data quality.
The final 14 proband's scores on the HGSHS:A ranged between 7 and 9 and, in one case, 10 points. According to the German norms for the HGSHS:A (Bongartz, 1985), the test persons can therefore be categorized as "high-medium" (HGSHS:A-score of 7-9) and "highly" hypnotizable (score of 10). We would have preferred to include only highly hypnotizable participants, however this was not possible within the given frame of a diploma thesis.

2.2 Suggesting grapheme-color synesthesia

Digits 1-6 were assigned distinct colors (1-red, 2-yellow, 3-green, 4-turquoise, 5-blue and 6-purple) according to those chosen by Kadosh et al. (2009), only slightly optimized regarding visibility on the screen. These colored digits were presented upon a grey background via Psyscope X (http://psy.ck.sissa.it/) on a MiniMac (Apple Inc.). They were projected inside the magnetically shielded room via a video projector (DLA-G11E, JVC, Friedberg, Germany) and a set of mirrors positioned outside the room. In the posthypnotic suggestion-condition the participants were administered this presentation while being in trance. They had to open their eyes and were given the suggestion that "from now on, whenever you see, think of or imagine this digit, you will experience it in this color". Next the subjects were told to close their eyes again and internally experience the digit in its color again. The presentation was skipped to the next digit and after a short time of letting the experience "sink" and being suggested to "relax even more", the subject was asked to open the eyes again and look at the next digit. This loop continued until all of the digits had been seen once. The control group was guided through their "pleasant memories" by open questions for an equivalent time window. Subsequently followed the first resting state recording in trance, after which the whole suggestion part described above was repeated.

2.3 Digit Detection Task

While performing the digit detection task the participants were fully awake and looked the plastic screen attached to the ceiling of the shielded chamber. Their job was to detect the presence of a digit on the screen and then press one or another key on a touchpad, thus indicating if they saw a digit or not.

The presented stimuli were colored squares that served as backgrounds in the center of which was a single grey digit (in 50% of the trials) or not. The color of the background could be either congruent or incongruent with the induced grapheme-color synesthesia. There were a total of 360 trials containing 60 congruent, 150 incongruent and 150 blank stimuli. Each trial started with a white fixation cross on a grey background presented for 300 ms (milliseconds). Following the offset of the fixation cross the stimulus appeared. The stimulus presentation continued for 5000 ms or until the participant decided whether she saw a digit or not by pressing the adequate key. The next presentation started 1500 ms after the offset of the former (via key press or after the 5000 ms response timeout). Reaction times and accuracy were measured and an MEG recording was conducted for the duration of the task.

2.4 Data acquisition

MEG recordings were conducted using a 148-channel magnetometer (MAGNES 2500 WH, 4D Neuroimaging, San Diego, CA). A subject-specific head frame coordinate reference was defined by means of 5 coils (Left/Right PA, CZ, INION & NASION) that had been applied before recording. These coils served as anatomical landmarks to define the exact position of the subject's head within the sensor subsequently. The head fiducials and the subject's head shape was digitized using a Polhemus 3Space Fasttrack (Polhemus, Colchester, VT, USA) at the beginning of the sessions. The subject's head position relative to the pickup coils and the MEG sensors were estimated before and after each recording to ensure that no large movements occurred during data acquisition. Continuous data sets were recorded with a sampling rate of 678.17 Hz (bandwidth 0.1-200 Hz).

Each MEG session consisted of 4 recordings altogether, 3 of were resting state recordings (each 5 minutes long) and another during the completion of the digit detection task (~20 minutes long). Of the 3 resting state measurements, the first was "alert, eyes closed", and the latter were embedded in the two trance sessions.

During the relaxed but alert resting state session, which will be referred to as "Rest" later on, the experimenter was outside the shielded chamber. Recording the two trance resting state sessions ("Trance_1" and "Trance_2") he was inside guiding the hypnosis.

Participants were video-taped and had the possibility to communicate throughout the experiment.

Anatomical MRI (Magnetic Resonance Imaging) scans were conducted using a 1.5 Tesla MRI system (Intera 1.5T MRI, Philips Medical Systems, Best, Netherlands). We performed a 3-dimensional sagittal scan on each subject in order to generate realistic head models for source analysis.

2.5 Procedure

The experiment consisted of two sessions, one MEG recording and one MRI measurement. The first took place at the MEG laboratory of the University of Konstanz, Konstanz, and the latter at the Kliniken Schmieder, Allensbach, within a span of a few weeks.

The experimental manipulation was carried out in the MEG session. Participants were informed about the experimental procedure once via email and again personally just before beginning the preparations and signed an informed consent. They then were introduced to the facilities and prepared for the recording session. So far the procedure was the same for both the MEG and the MRI measurements.

Before the MEG session, handedness was assessed as described above and participant's neurological and psychiatric history was surveyed using the M.I.N.I. screening questionnaire (Sheehan et al., 1998).

Participant's preparation for the MEG-session included changing into the provided specific metal-free clothes followed by the attachment of the 5 coils serving as fiducials later on. Subjects then were seated in the magnetically shielded chamber and the head shape was digitized. Proximately they were asked to lie down and the sensor was placed above their head. For the rest of the data acquisition the participants continued in this comfortable supine position.

After final instructions the "Rest" session was recorded. Subsequently the experimenter joined the subject in the shielded chamber and conducted the first hypnosis session that included the suggestions to either experience the synesthesia or dwell in "pleasant memories", which were administered twice and framed the "Trance_1" recording.

After having reoriented the participants in time, the experimenter briefly instructed them how to use the touchpad and then left the chamber. The recording was started and participants completed the digit detection task.

Following the digit detection task the experimenter joined the subject in the chamber again for the second hypnosis session, mainly to withdraw the induced grapheme-color synesthesia. Therefore the induction this time included suggestions e.g. "to perceive everything as one did before taking part in this experiment". The "Trance_2" recording was conducted after which participants were reoriented again and left the shielded chamber.

Subjects had the coils removed, changed clothes and then were briefly interviewed by the experimenter. Whereas 3 of the participants had a slight and one a strong amnesia for what happened during the trances, none of them guessed the goal of the study.

The structural MRI recording followed a few weeks later. Two scans were conducted and altogether the MRI session took about 45 minutes per subject.

2.6 Data analysis

After data acquisition, either epochs of 4 s (± 2 s) around stimulus onset were extracted from the raw data or the raw data was cut in 2 s intervals (for the resting state data sets). Visual rejection was performed for all data sets to check for EOG, ECG, or movement artifacts. For the stimulus data trials were grouped into six different response categories ("congruent-yes", "congruent-no", "incongruent-yes", "incongruent-no", "blank-yes" and "blank-no") according to the quality of the stimulus and the answer in terms of whether participants had seen a digit or not.

All epochs were filtered with a 1-Hz high-pass filter (zero-phase, Butterworth) before the analysis of oscillatory activity.

For the analysis of event-related activity, single trials were low-pass filtered with a 30-Hz zero-phase Butterworth filter prior to averaging. A time window of 400 ms before onset of the stimulus was used for baseline adjustment. For the time-frequency analysis, a multi taper fast fourier transformation with frequency-dependent Hanning tapers was computed (time window: $\Delta t = 2/f$; spectral smoothing: $2/\Delta t$). A linear constrained minimum variance (LCMV) beamformer algorithm (Van Veen et al., 1997) was used to identify the sources of the effects found in the time-series analysis.

Since analysis of the behavioral data revealed that subjects did not experience grapheme-color synesthesia, only the "congruent-yes" and "incongruent-yes" conditions were further analyzed to see if there was any difference at all in processing the stimuli. Source analyses were therefore conducted separately on the single trial waveforms of the 2 conditions and the two groups. The difference between projected source activity was then computed in the statistical analysis. The time windows we used for source analyses were based on the effects identified on the sensor level. For the “congruent-yes” condition relevant activation intervals were 150 to 175 ms and 200 to 220 ms and for the “incongruent-yes” category from 148 to 153 ms and 330 to 355 ms after stimulus onset (see Results).

Dynamic imaging of coherent sources (DICS, Gross et al. 2001) was used to identify the sources of the effects found in the time-frequency domain. Source activity was interpolated onto individual anatomical magnetic resonance imaging images and then normalized onto a standard Montreal Neurological Institute (MNI, Coordinates= [x, y, z]) brain using SPM8.

Reaction times and relative distribution in each subject were computed using the R-software (http://cran.rakanu.com/). All aspects of offline treatment of the MEG signals were accomplished using fieldtrip (Oostenveld et al., 2011; see http://fieldtrip.fcdonders.nl), an open-source signal processing toolbox for Matlab (http://www.mathworks.de/).

2.7 Statistical analysis

Behavioral data was analyzed in terms of differences between the two groups concerning reaction times on one and relative frequency of errors on the other hand. Therefore we computed a Wilcoxon Mann Whitney test on the reaction times and a chi square test comparing the error frequency.

Regarding the resting state data cluster-based (at least 2 sensors per cluster) (in)dependent-samples *t* tests with Monte Carlo randomization were performed on the sensor data (Maris and Oostenveld, 2007). This method allows for the identification of clusters of significant differences in 2D and 3D (time, frequency, and space), effectively controlling for multiple comparisons. Clusters were defined as significant if the probability of observing larger effects from shuffled data was below 0.1 or 1%, comparing “Rest” and “Trance” within, or the difference between the Posthypnotic Suggestion- and the Hypnosis Control group, respectively. The cluster-level test statistic is defined as the sum of the *t* statistics in 2D or 3D space in the respective cluster.

In order to define relevant time and frequency windows for the stimulus data, we performed an independent-samples *t* test with Monte Carlo randomization, corrected for multiple tests according to Holm (1979). The applied level of significance here was $\alpha=0.0001$ for the two relevant conditions.

For the identification of the probable neuronal generators of the observed sensor effects, statistical comparisons at the source level were computed using (in)dependent-samples *t* tests. Results on the source level were thresholded and corrected for multiple comparisons using AlphaSim (http://afni.nimh.nih.gov/afni/). Reaction tendencies were computed as a representation of the individual's behavior. Anatomical structures corresponding to the statistical effects are labeled according to the Talairach atlas [x, y, z] (Talairach, J. & Tournoux, P., 1988).

3. Results

3.1 Behavioral data

Participants were presented with the stimuli described above and had to indicate via button press whether they had seen a digit in the center of the colored square or not. Table 1 & Fig. 1A show the mean error rates for the two groups regarding the three relevant categories. Only the total error rate differed significantly ($\chi^2(72) = 98.21$, $p < 0.02$), denoting that participants did not experience a grapheme-color synesthesia. Table 2 & Fig. 1B illustrate the reaction time medians on which we used a Wilcoxon Mann Whitney U-test. No significant differences were found.

Table 1
Mean error rates for the two groups and the relevant categories.
PHS=Posthypnotic Suggestion Group, HypCon=Hypnosis Control Group

	Congruent → 'No'		Incongruent → 'No'		Blank → 'Yes'		Total	
	PHS	HypCon	PHS	HypCon	PHS	HypCon	PHS	HypCon
ER (%)	1.19	1.90	1.90	2.01	2.00	4.29	1.67	2.76

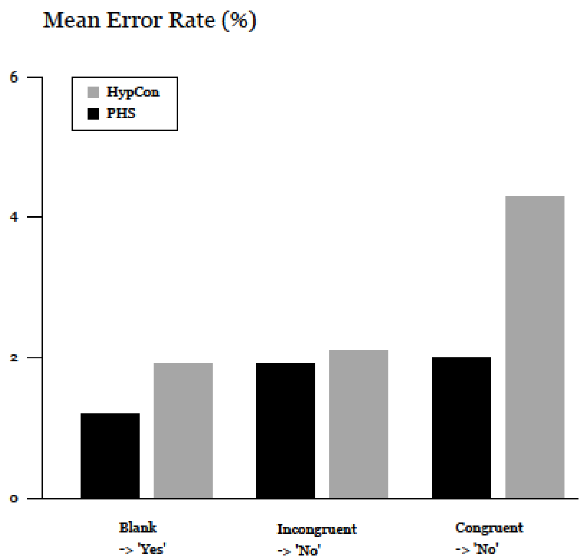

Figure 1A
Mean Error Rates

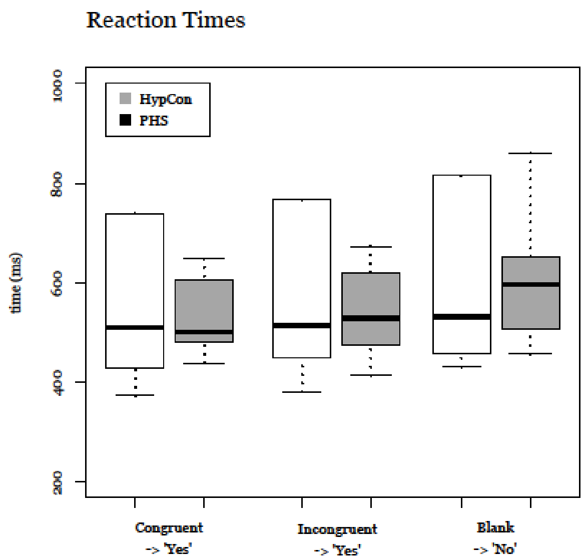

Figure 1B
Reaction Time Medians

Table 2
Reaction time medians for the two groups and the relevant categories.
PHS=Posthypnotic Suggestion Group, HypCon=Hypnosis Control Group

	Congruent → 'Yes'		Incongruent → 'Yes'		Blank → 'No'		Total	
	PHS	HypCon	PHS	HypCon	PHS	HypCon	PHS	HypCon
RT	509.85	501.06	513.88	528.57	531.32	596.35	514.99	548.50

3.2 Oscillatory activity

3.2.1 Resting state

Since we were interested in the ongoing oscillations underlying a hypnotically induced trance state, we started by statistically comparing the neural activity occurring during the "Rest" and "Trance" recordings, applying a $\alpha=0.001$ level of significance as described above. During "Trance_1" subjects exhibited less beta (12-30 Hz) power as compared to the relaxed alert state. The non-parametric permutation analysis revealed two negative clusters that reached significance at parietal and frontal regions ($p<0.001$). Fig. 2 displays a topoplot of these clusters (Fig. 2A) along with the proper source projections (Fig. 2C, D) generated via beamformer source analysis (DICS, Gross et al. 2001). Possible sources are located in the superior parietal lobe and precuneus on one and in the superior and medial frontal cortex on the other hand. Noteworthy, source analysis led to another location in the thalamus (Fig. 2B). However the thalamic source displays greater power in the identified frequency within the beta band (around 29 Hz) and therefore does not match the results on the sensor level, where no positive trends could be found.

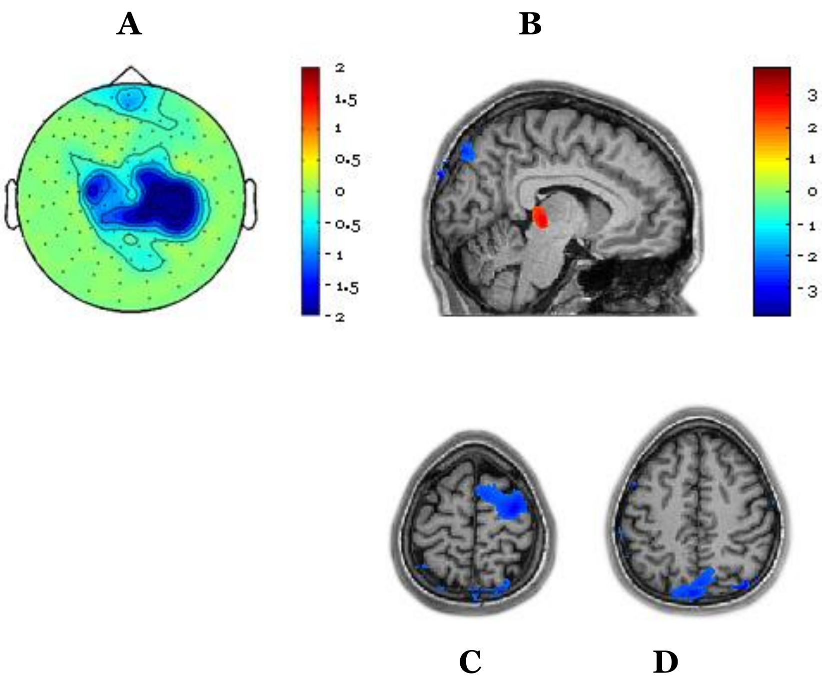

Figure 2
A Topoplot of the negative clusters identified on sensor level.
B Precuneus (MNI coordinates = [18, -71, 55]) and
C a location within superior frontal cortex [23, 3, 64] as possible sources.
D Thalamic source [-8, -31, 0], not confirmed on sensor level.

Color bars show the *t* values of the comparison between the "Rest" and the "Trance_1" recording. Plots are all masked for statistical significance.

Comparing "Trance_2" and "Rest" recordings we found that subjects showed significantly less beta band power ($p<0.001$) at parietal cortex compared to the resting state. As can be seen in Fig. 3, the identified source was again located in the precuneus, this time primarily on the right hemisphere. The relative decrease of beta activity in the precuneus in the trance resting recordings compared to the alert resting state goes with the ideas of precuneus being constantly gathering information and monitoring the world around us (Gusnard & Raichle, 2001). Since characteristic features of being in a state of hypnosis include mental absorption and a diminished tendency to monitor and judge the outside world (Rainville & Price, 2003), this result seems like a natural consequence. In addition it is in line with other studies on hypnosis and its influence on attention processes (e.g. Rainville et al. 1999; Faymonville et al. 2006).

The frontal source identified comparing "Trance_1" and "Rest" could be within the frontal eye field (FEF), which is important for controlling eye movements and visual attention (Schall, 2004). The most obvious reason for decrease in activity in this region is that participants were in a deeper state of relaxation (as compared to the "Rest" recording) and therefore eye movements were diminished as well as attention was more internally, as outlined above a oftentimes reported component of trance.

The relative increase of activity in the thalamus found on the source level veer towards results from the fMRI study of Rainville et al. (2002) who found increases in rCBF in the thalamus significantly correlated with increased feeling of absorption. As mentioned in the introduction, thalamic nuclei and brainstem play an important role regarding the 'vigilance aspect' of consciousness. Yet, and in contrast to Rainville et al. (2002), we found an increase in power in the high beta band. However, since the borders defining the bandwidth of the different frequency bands have been drawn somewhat arbitrarily and overlap (Buzsáki, 2006), what we afore described as 'high beta' oscillation could as well be considered as being 'low gamma'. Thalamocortical gamma band oscillations are associated with a "microarousal" observed during sleep (Buzsáki, 2006).

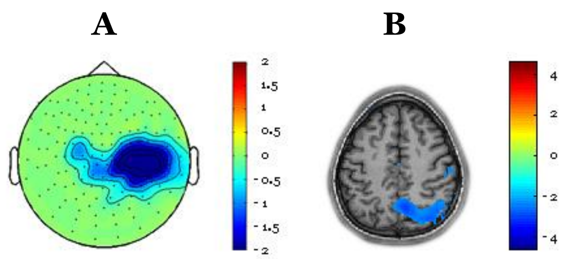

Figure 3
A *t* values (color bars) for the significant beta power decrease in precuneus in "Trance_2" as compared to the "Rest" recording.
B Identified source via DICS statistic.

Both maps masked for statistical significance.

The next step was to compare the posthypnotic suggestion group (PHS) to the hypnosis control group (HypCon) in terms of differences concerning the trance activity patterns. This was particularly interesting because of the possibility to differentiate the changes specifically associated with the suggestion to experience grapheme-color synesthesia apart from those caused by the altered state of consciousness. For this purpose we first removed the state-related variance from the data using the "Rest" datasets. Subsequently we computed a cluster-based independent samples *t* test with Monte Carlo randomization (α=0.01), comparing "Trance_1" and "Trance_2" for the PHS against the HypCon group. Analysis did not reveal any significant clusters for "Trance_1" (at least not when applying the relatively conservative alpha level), however a trend ($p<0.15$) could be noticed pointing out to what should gain high significance in "Trance_2". There the non-parametric permutation analysis bred two significantly different clusters: A positive one comprised of right medial frontal sensors and one negative cluster consisting of left occipital sensors (Fig. 4A, Fig. 5A, $p<0.01$). Subjects of the PHS group exhibited greater beta band power at a frontal site and less theta band (4-8 Hz) power more occipital. Potential generators detected via DICS analysis were in the right medial frontal cortex (MFC) [30, -2, 48] for the positive (Fig. 4B) and in right culmen [23, -38, -25] for the negative cluster (Fig. 5C). Surprisingly, DICS statistic of the theta band decrease revealed another frontal source reaching from superior to medial frontal cortex (Fig. 5B). Again, when interpreting the high beta (around 26.5 Hz) as low gamma band oscillations and their important role in neural synchrony (Buszáki, 2006), one could speculate that the additional source found in the prefrontal region might reflect the frontal 'driving' the occipital oscillations. Sensor data of "Trance_1" also showed a theta band cluster comprised of sensors in this region, however neither in "Trance_1" nor in "Trance_2" did it reach significance (see discussion).

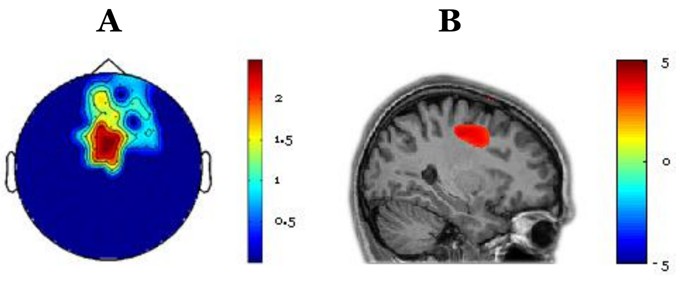

Figure 4
A Topoplot of the positive cluster in the gamma range.
B Origin most likely in right MFC.

Color bars indicate *t* values of the comparison between the PHS and the HypCon group.
Both maps are masked for statistical significance.

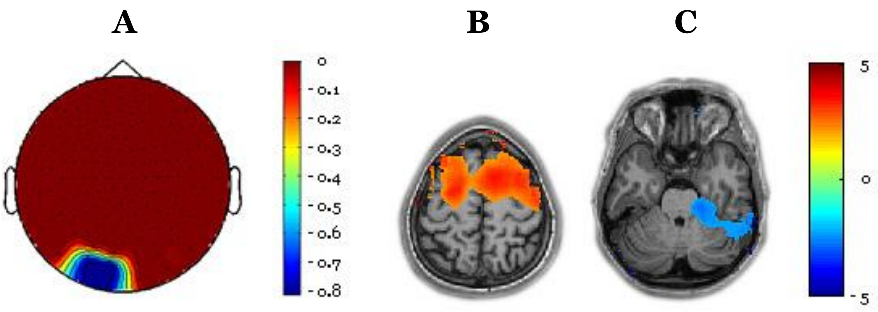

Figure 5
A Topoplot and
B proper source for the theta band cluster in the Culmen.
C Additional source in the theta band identified via DICS located at a superior/ medial frontal site.

Color bars show the *t* values of the comparison between the PHS and the HypCon group.
All illustrations are masked for statistical significance.

3.2.2 Event related fields

Since analysis of the behavioral data made it clear that none of the subjects experienced the synesthesia up to a level where it would affect behavior, the question arose if there nevertheless had been differences in processing the stimuli between the two groups. To address this, we continued by comparing the PHS and the HypCon group in terms of the event related potentials occurring when being presented with the stimuli. We particularly focused on the categories of “congruent-yes” and “incongruent-yes”.

Performing independent-samples *t* tests with Monte Carlo randomization corrected for multiple tests according to Holm (1979), two early activation intervals of interest for each category reached significance: For the “congruent-yes” category the relevant activation intervals were I=150 to 175 ms and II=200 to 220 ms and for the “incongruent-yes” condition we focused on III=148 to 153 ms and IV=330 to 355 ms after stimulus onset. There were more intervals reaching significance, even at this conservative level ($p<0.0001$), however the early effects were most impressive, particularly when computing the source analyses later on. Fig. 5 displays the grand averages for the two categories to illustrate which differences between the two groups found on the sensor level finally led to the time intervals chosen. Statistical analyses on the LCMV beamformer analyses (Van Veen et al., 1997) were always performed at a 0.05 level of significance.

Figures 6A & B illustrate the time intervals chosen based on the time frequency analyses.

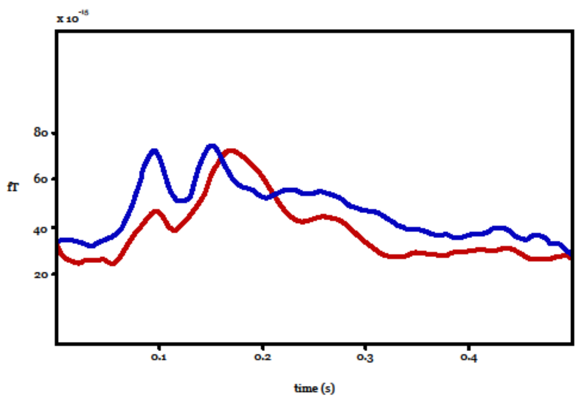

Figure 6A
Grand average for category *congruent*→"*Yes*"

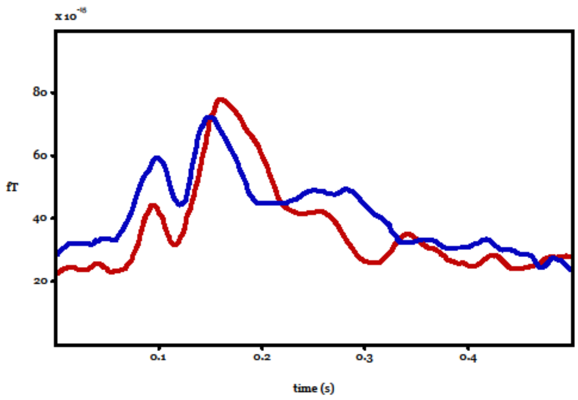

Figure 6B
Grand average for category *incongruent*→"*Yes*"

<u>Congruent → "Yes"</u>

Fig. 7A shows a topoplot of the *t* values for time interval I. Source analysis suggested the following structures as origins of the effects found on the sensor level: The temporal effect on the left hemisphere might be generated by inferior temporal structures or fusiform gyrus ([-32, -35, -19], Fig. 7C, D). The frontal effect is most likely to stem from anterior cingulate cortex (ACC) ([11, 41, 4], Fig. 7B, D) and the occipital difference could originate from right fusiform gyrus ([42, -79, -19], Fig. 7E).
Regarding interval II source analysis revealed two possible generators of the left hemispherical sensor effect as illustrated in Fig. 8 (B, C). Candidates are inferior and medial temporal cortex and part of the supramarginal gyrus (SMG) [-47, -50, 28].
These findings are consistent with previous studies that identified areas in the fusiform gyrus to be selectively responding to colored stimuli (Bartels & Zeki, 2000) or to graphemes (Cohen et al., 2000). These areas lying adjacent within the fusiform gyrus and the early activation further underline the cross-activation theory of Ramachandran & Hubbard (2001) that emphasizes the role of "hyperconnectivity" between adjacent areas. Activity in the supramarginal spot might be due to the oral presentation of the colored digits in the posthypnotic suggestion part of the first trance session. Increased activity in the ACC in the PHS indicates that subjects of the PHS group experienced a greater conflict during the congruent trials. In our opinion, this might be for two reasons: First, it could reflect a greater difficulty in the congruent trials due to the induced associations. This would be in line with Botvinick et al. (2004), who suggest the ACC monitoring conflict "as an index of task difficulty [...] and mental effort". Second, it may be that the suggestions to experience the

synesthesia just did not interfere *enough* to be reflected behaviorally (but see discussion).

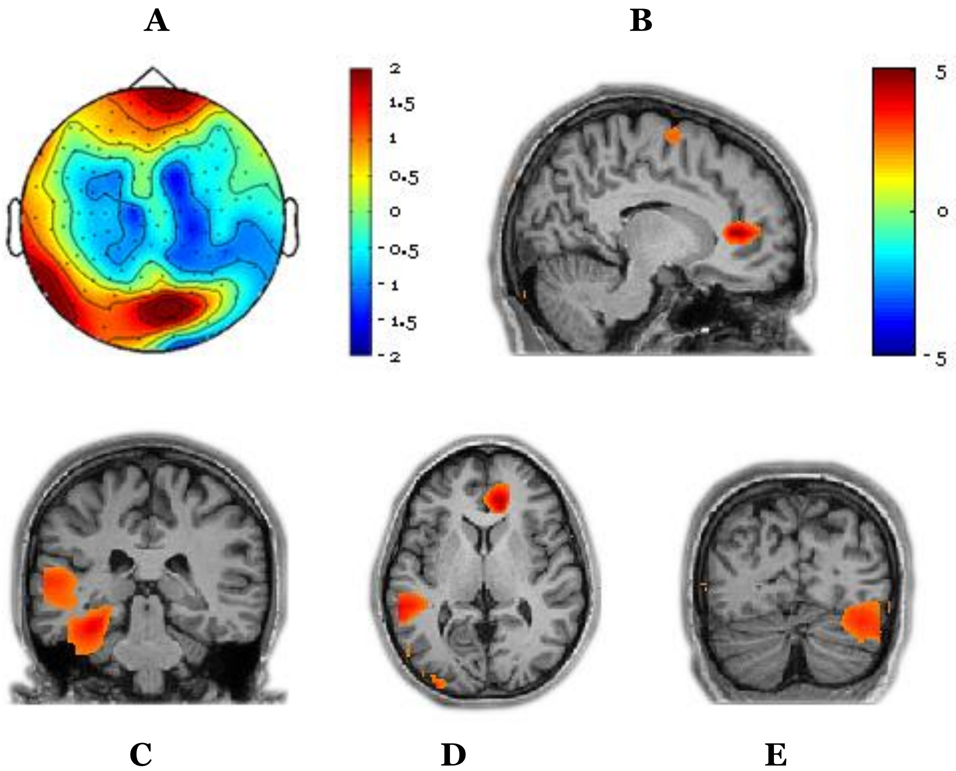

Figure 7
A Topoplot of the effect within interval I (150-175ms after stimulus onset).
B-E Proper sources computed using the LCMV beamformer algorithm.

Color bars indicate *t* values. Results of the LCMV statistics are masked for significance.

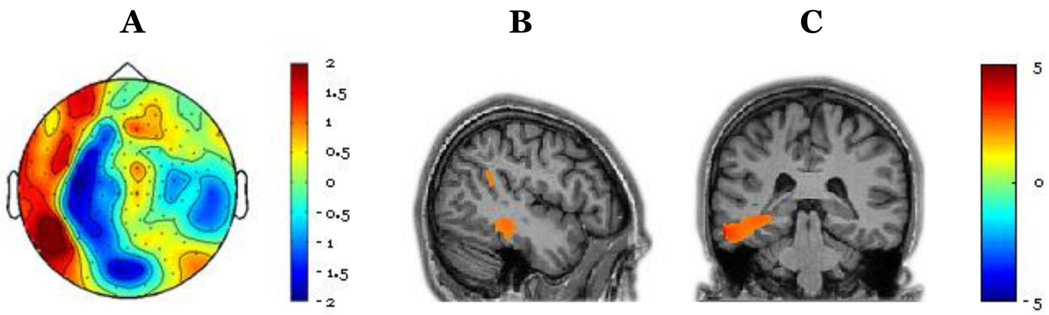

Figure 8
A Effects on sensor level within interval II (200-220ms after stimulus onset).
B, **C** Possible sources identified via LCMV.

Color bars show *t* values displayed and results of the LCMV analyses masked for statistical significance.

Incongruent → "Yes"

For the first time window (III=148-153 ms after stimulus onset), the PHS group as compared to the HypCon group showed more coherent activity mainly in two spots. One within the medial and superior frontal cortex ([6, 65, 7], Fig. 9B) and the other located inferior parietal including the Insula ([-29, -16, 23], Fig. 9C, D, E).

The increase in activity in the left insula is most interesting here, since especially the anterior parts of the insulae are associated with emotion in relation to a social context (Lamm & Singer, 2010) and activation seems to be influenced by *emotional susceptibility* scores (Capara et al., 1985; Iaria et al., 2008).

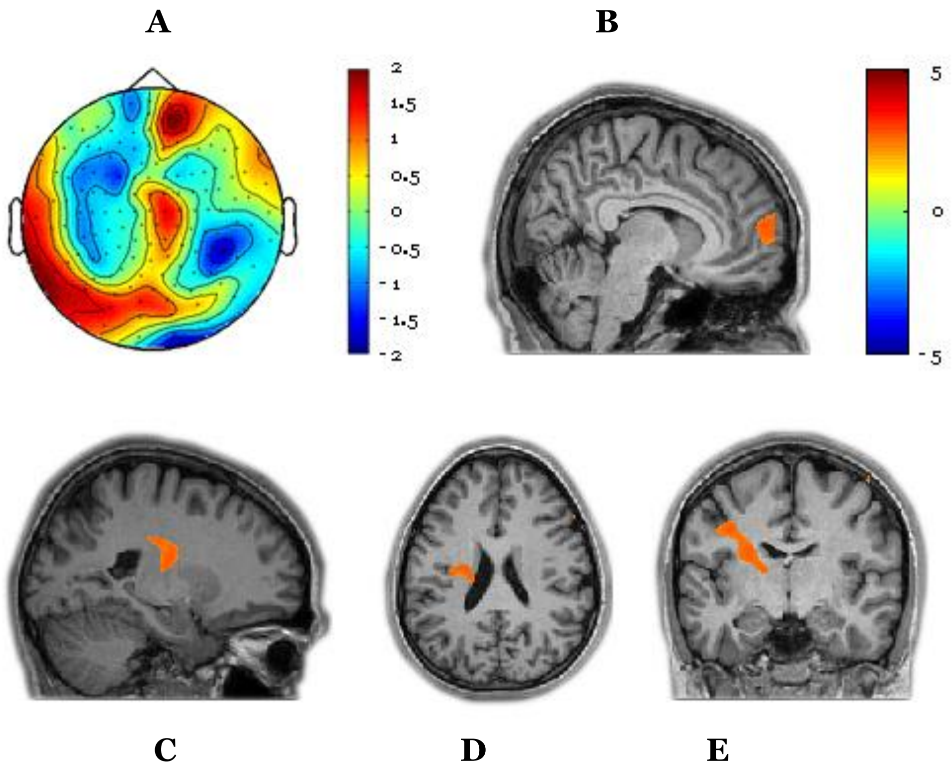

Figure 9
A Topoplot of the early effect (143-153 ms after stimulus onset) as observed on sensor level.
B Frontal effect most likely to be generated by this spot in the superior and medial frontal cortex.
C Inferior parietal region containing Insula as possible source for the left hemispherical effect.

Color bars display the *t* values of the comparison between the PHS and the HypCon group.

In terms of the second activation interval (330 to 355 ms), results showed a frontal and an occipital effect, both right hemispheric. The former might originate in the medial and anterior cingulate cortex (Fig. 10B, D), whereas the latter seems to stem from right culmen (Fig. 10C). Activity in the ACC again could be considered due to the experience of conflict. Activation of the mid cingulate cortex has recently been found, when participants had to detect stimuli in a negative emotional context (Pereira et al., 2010). Taken together, medial and anterior cingulate activity then might reflect that subjects of the experimental group experienced an emotionally negative laden conflict when viewing digits and colored backgrounds that did not match the suggested association (but see discussion). The cerebellar activity at this instant most likely is an early correlate of motor control.

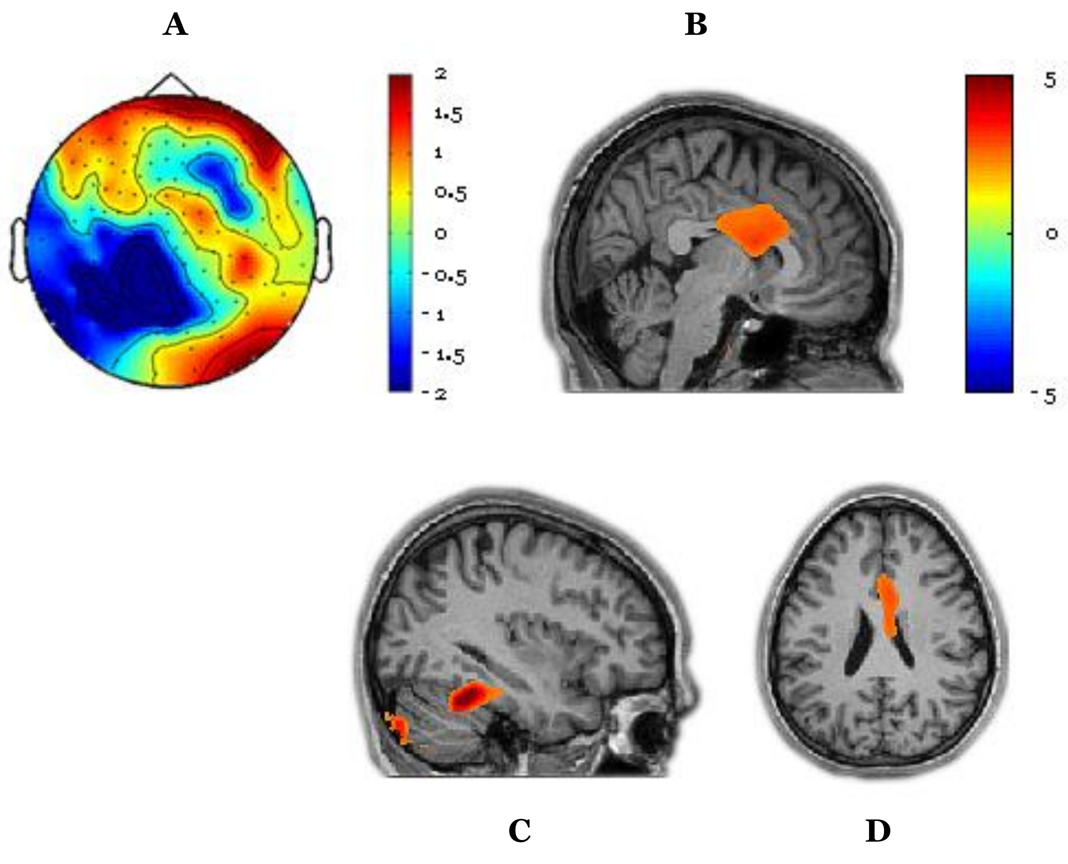

Figure 10
A Topoplot of the effect found between 330 and 355 ms.
B Frontal source possibly located in medial and anterior cingulate [4, 9, 24].
C, **D** Right culmen [35, -49, -26] identified as source for the occipital effect.

Color bars indicate the *t* values of the comparison between groups.

4. Discussion

The only notable difference found on the behavioral level was the mean error rate being higher in the HypCon group, indicating that subjects of the PHS group made significantly less errors in the digit detection task. This is contradictory to the expected tendency, according to which participants of the experimental group should have made more errors (caused by not being able to see the digits in the congruent condition due to the suggested synesthesia). The effects of suggestion on attentional processes are widely studied (e.g., see Kosslyn et al., 2000; Gruzelier, 2006; Oakley & Halligan, 2011), many times using the Stroop (1935) paradigm (e.g., Raz et al., 2005). However, since a significant effect could be observed merely concerning the total error rate, it is not possible to draw further conclusions from this result. The same applies for the reaction times, where statistical analyses yielded far from significant results only. Nevertheless it is quite interesting that the PHS group showed a slight tendency towards a slower reaction exclusively in the congruent condition, whereas in the other conditions they throughout were a snatch quicker to press the button. But in the end it comes down to non significant differences between the groups and thus we refrain from further speculations at this point and start right up with discussing the results from the analyses of oscillatory activity.

4.1 Event related activity

Congruent → "Yes"

Bilateral activity within the fusiform gyri should be associated with the perception of colors and graphemes (e.g., McKeefry & Zeki, 1997; Bartels & Zeki, 2000; Cohen et al., 2000) in the first. Our presentation included both, so this is not an uncommon result. Yet, what clearly is special about this result, is that a) fusiform activity was observed exclusively in the PHS group (to this extent), although the controls were presented with the same stimuli, and b) no other condition (however even in the blank condition the background was colored) showed this difference between the groups. This observation goes well with the preliminary described results of Kosslyn et al. (2000) and definitely deserves further study. However, we cannot be certain this is exclusively a correlate of the induced grapheme-color synesthesia. One way to further evaluate these findings could be including trials where the digits appear on a grey background. If fusiform activity would be seen only in the colored background condition, then one could be certain there was no synesthetic effect. Yet if there was color specific activity in the grey scale condition, it would strongly point towards a synesthetic perception. Subsequently, one would have to evaluate exactly *where* the colors were perceived. Since we were trying to replicate (and extend) the study from Cohen-Kadosh et al. (2009), our design was arranged according to theirs. Thus, we concentrated on the 'projector' type, in terms of Dixon et al. (2004). They emphasize a clear difference in the impact on perception and behavior between 'projectors' and 'associators', as outlined in the introduction. According to this distinction, it might as well have occurred our subjects simply established more of an 'associator' form, independent from the exact phrasing of the posthypnotic suggestion (and that is not unlike, for, after all, participants were only given *suggestions*; see Kihlstrom, 2008). In fact, this could equally explain the lack of behavioral correlates, and would fit the fusiform activity. The slightly slower reaction time median in the PHS group could be interpreted as further hint at this possibility.

Temporal activity, especially in the inferior temporal cortex is associated with visual object identity in a way that its columns describe "a continuous gradient of feature sensitivity", similar to the retinotopic arrangement found in early visual areas (Tootell et al., 2009). In macaque monkeys neural activity in the inferior temporal cortex is known to be modulated by attention (Woloszyn & Sheinberg, 2009; Zhang et al., 2011). These results are in line with the demands of the digit detection task. However, again the question is why there was significantly more activity in the PHS? Perhaps attention was increased through the conflicting suggestions and that is the reason for enhanced coherence observed in the ACC. Or maybe the subjects of the PHS group focused their attention on the congruent digits and the increased activity represents a temporal bias for processing those. This would match the lack of significant differences between groups within the temporal lobe that was observed in the incongruent condition, and fits the associator hypothesis proposed above. Digits and colors had been 'glued' together, however not in the expected way, so they would lead to a projection of the color on the surface of the digit, but in a rather associative manner, somehow resembling learned associations. Yet, note that if it was simply a learned association, then it happened in solely two runs of presentation, reflecting a very effective way of learning.

Another interesting view on the temporal and supramarginal sources would be that the activity in these areas was due to the oral presentation of the colored digits while administering the posthypnotic suggestion. Allusions to this hypothesis come from studies of Paulesu et al. (1995), who reported increased activity in the temporo-parietal-occipital junction in word-color synesthetes, and Steven et al. (2006) reporting increased rCBF in inferior parietal and supramarginal cortex during cases of colored-hearing synesthesia. It is possible our subjects associated the colors not only visually, but also with the sound of the spoken digit, because they were presented this way. This is clearly highly speculative, however noticeable and, in our opinion, also adheres ideas for further research in the field of synesthesia, although it certainly would be demanding to develop precise experimental procedures. Regarding the increased activity in the ACC we found in the early time window in this condition, we already made two assumptions, the latter being that the suggested synesthetic association did not interfere *enough*. If it would have, perhaps additional activity in the dorso-lateral prefrontal cortex (DLPFC) or the posterior parietal cortex (PPC) could have been observed in regard to modulation of the response (Banich, 2009; Buneo & Andersen, 2006).

Another interesting reflection on the source in the ACC arises when considering the integrated model of executive functioning from Banich (2009). The model suggests the primary role of the anterior dorsal part of the ACC is to evaluate responses, based on information from other parts of the network. In that case, it would be more of an evaluating conflict. The observed activity could reflect the subjects struggle to behave according to the suggestions ("... you will perceive this digit in [the specific] color"), although they saw the digit in grey ink. This would veer towards the aforementioned possibility that it is rather unlike a 'projector type' synesthetic experience occurred. However, we still cannot be sure of that, because the experience and its impact on the perception of the digits not only depend on the automatic, immediate appearance of the adequate color, but also on the luminance factor of the projection. Regarding the alternative assumption that subjects simply established more of an associative synesthetic experience, this consideration makes no difference.

Isolated activity in the ACC, being part of a wider system of conflict monitoring and cognitive control, further could be considered hinting at the 'frontal decoupling' mechanism of hypnosis, as proposed by Gruzelier (2006; also see Egner et al., 2005).

Incongruent → "Yes"

The most interesting finding in this condition was the activity in structures recently associated with stimulus processing in an emotional context (see Lamm & Singer, 2010; Pereira et al., 2010), as referred to in Results. In case of the insula, activation seems to especially depend on high emotional susceptibility (Iaria et al., 2008). Iaria

et al. (2008), referring to Capara et al. (1985), describe emotional susceptibility as a vulnerability “to both negative and positive emotional events”. People scoring high on emotional susceptibility scales are easily overwhelmed by their emotions and thus easily influenced by emotional content. Lamm & Singer (2010) further speculate that especially the more dorsal parts of the insulae are engaged in adapting behavior in relation to emotional states, and thus are involved in executive mechanisms. As mentioned before, in combination with the activity in the medial and anterior cingulate cortex that could be observed within the second interval, this leads to the assumption that subjects of the PHS group experienced a negative laden conflict viewing the digits on backgrounds that did not ‘match' the associated color. However this is highly speculative and needs further exploration. Yet, if so, it would also point out the induced synesthesia was more of an ‘associator’ type, for ‘real synesthetes’ often describe negative emotions when something is not in the ‘right’ color or shape (e.g., see Cytowic, 1993).
Another important difference between the two categories reviewed here seems to be the lack of color specific activation in the latter, although subjects still saw colored backgrounds. The first interpretation that comes to mind, is that in the *congruent* condition color specific activity in the PHS group was enhanced through the additional synesthetic color experience (perhaps ‘in the mind’s eye’) and therefore significantly increased. Whereas in the *incongruent* condition emphasis was on the (negative laden) conflict and the color specific processes were averaged out in the analyses, because both groups processed color features to the same extent. This is not in contrast to a possible additional color association in the PHS group, as to our knowledge it makes no difference in (color specific) neural activity when perceiving more than one color.

Thus, as a conclusion on the event related activity, by now we can point out that the early and extensive bilateral activity in the fusiform gyri in the *congruent* condition, observed uniquely in the PHS group, could be interpreted as underlining the hyperconnectivity hypothesis (Ramachandran & Hubbard, 2001; Hubbard, 2007; Rouw & Scholte, 2007). Contrary, left hemisphere activity in the temporal lobe and the supramarginal gyrus hints at the disinhibited feedback or reentrant processing models (Grossenbacher & Lovelace, 2001; Smilek et al., 2001, respectively). However, all of this is just speculation, for the design we chose, according to that of Cohen-Kadosh et al. (2009), does not account for differences in terms of the distinction proposed by Dixon et al. (2004). Therefore, the only conclusion we can draw for sure, is that our 'virtual synesthetes' did not produce the 'projector type' *to an extent where it would affect their behavior*. Maybe they just viewed transparent layers on the surface of the digits (as can be found in reports of 'real synesthetes', too), and so it was still easy to detect the numbers. And for the associator type, this design simply cannot account. Yet, there were significant differences in our event related results indicating that the processing was not the same in the two groups. Since subjects differed in no way significantly and were administered the exact same procedure, except for the suggestions to synesthetically perceive the digits in the specific colors, the differences between the groups must be due to these suggestions. This definitely needs further exploration and the application of a more sophisticated design to be able to draw more precise conclusions. Besides, it would surely be interesting to compare cerebral activity of 'real synesthetes' to that of 'virtual synesthetes', needless to say applying time sensitive methods. For, as we preliminary pointed out, the other imaging techniques have reached their limitations in distinguishing the existing neural models.

And it is certainly of great interest to further explore the neural correlates of our 'tool', hypnotic suggestion, because alike within the field of synesthesia, there are numerous questions and inconsistencies that need further research. And being not sure about the neural correlates of trance and especially suggestion is definitely an obstacle when using it to explore another complex phenomenon's neural basis, as indicated in the uncertainty about the individual transfer of the suggestions. Hence, in order to potentially gain further insight into the characteristics of trance experience, we incorporated the resting state recordings into our design in the first.

4.2 Resting state activity

In this paragraph we will concentrate on our results regarding the resting state data first which will lead to implications for future use of hypnotic induction and suggestion in research, focusing on the field of neuroscience.

Regarding our first statistical comparisons between the "Trance" and "Rest" recordings there is not much left to say, for the results fit the existing literature on neural correlates of hypnotic induction and trance states (e.g., Rainville et al., 2002; Faymonville et al., 2006, Demertzi et al., 2011) nicely. The two main spots identified for the activation decrease in the high beta/ low gamma band are most likely a correlate of absorption and withdrawing attention from the outside world combined with increasing relaxation, all common observations during hypnotic induction. Interestingly reflecting the exact phrasing of the induction is the additional thalamic source identified in the statistical analysis of the DICS (Gross et al., 2001) data. Already outlined in the results, this could reflect a low gamma band effect originating in the thalamus, which is associated with "microarousal" observed during sleep (Buzsáki, 2006). Since the induction contained several passages where we suggested participants will soon be falling into a *deep and relaxing sleep*, and given the physiological similarities of relaxative inductions and sleeping, this is not a surprising result and may be a hint at similarities between neural activity during specific sleep stages and trance stadia.

The statistical comparison between the two groups, in terms of cerebral activity induced specifically by the suggestions for grapheme-color synesthesia, yielded significant differences only for "Trance_2". Yet, trends in "Trance_1" were directed the same way. The PHS group showed a frontal increase in high beta/ low gamma band power and an occipital decrease in (high) theta band power, compared to the HypCon group. Statistically non significant was another source in the theta band located in mid frontal gyrus (where the low gamma oscillation was found), reflecting an increase in theta at this location in the PHS group. It might be that there was an overlap of effects on the sensor level, due to which the frontal theta activity was averaged out (maybe in the frontal eye field). Since MEG recording of cerebellum is difficult due to the inhomogeneous orientation of cells, it is likely that the source identified in the culmen is actually located more in the occipital lobe, which matches the sensor data. Both gamma and theta oscillations are important for encoding and consolidation of new information and memory retrieval (Klimesch, 1999; von Stein et al., 2000; Buzsáki, 2006; Jokisch & Jensen, 2007). Gamma band increase has been associated more with sensory, bottom-up processes, and is associated with attention, whereas theta/ alpha oscillations reflect top-down mechanisms (Jensen et al., 2007; von Stein et al., 2000). Specifically alpha has a functionally inhibitory role (Jokisch & Jensen, 2007) and reflects states of internal activity without bottom-up input (von Stein et al., 2000). It has been found that (especially high) theta band oscillations modulate gamma band power (Canolty, 2006) and phase coupled oscillation of theta/ alpha and gamma is important for successful processing of stimuli with behavioral relevance (von Stein et al., 2000). Theta/ gamma phase coupling also facilitates the maintenance of information in the short term memory (Sauseng et al., 2009). In this light, the gamma and theta band increase at the mid frontal area together with the occipital theta power decrease could be explained by memorizing processes in the PHS group regarding the newly 'learned' associations. Since this activity pattern did not reach significance during "Trance_1", yet could be observed on a trend level ($p<0.15$), it seems as if either re-entering trance triggered the memory process again, or it was never offset during the task. It would certainly be interesting to further explore the relation between trance and memory more precisely, although existing results point to an impairment of performance (e.g., Halsband, 2006).

Another interpretation for the results of the comparison between groups comes to mind if we consider the high theta range as low alpha, referring to the aforementioned 'overlap' of borders (Buszáki, 2006). In this case, keeping in mind that alpha oscillations play an important role in functional inhibition (Jokisch & Jensen, 2007), the occipital increase in the HypCon group could be regarded a correlate of the visual occupation by the suggestion to associate digits and colors. Less occipital alpha power thus indicates that participants of the PHS group had a visual 'task', also showing the process triggered by the suggestions was continued.

In line with the results of the event related activity discussed above, a third possibility would be that the conflict subjects of the PHS group experienced, due to the competing associative perceptions, negatively influenced their ability to relax during the second hypnotic induction. Since theta band oscillations are also associated with altered states of consciousness like meditation or sleep (Baijal & Srinivasan, 2010; Buzsáki, 2006, respectively), the less of theta power would point out they were not able to experience relaxation as deep as the HypCon group this time.

Yet, again, further study is needed to clarify and distinguish the parts of hypnotic induction or the state of trance per se, in contrast to the mechanisms of specific suggestions to alter perception.

4.3 Hypnosis and suggestion in research

A lot of research exists in the field of hypnosis. Though often compromised by inhomogeneous designs and a blending of different elements (as unfortunately applies for the current study, too), there are remarkable and promising results, as briefly outlined in the introduction. Further and more precisely elucidating mechanisms of both trance and suggestion, in our opinion, needs to consider those separately in the first. On the one hand, precise markers for trance per se need to be defined to further establish the core elements about this altered state of consciousness. However, it seems very demanding to develop standardized methods that merely extract the correlates of the state, since 'neutral hypnosis' (Kihlstrom, 2008) seems to be difficult to administer. One interesting way might be to widen the vision and incorporate different induction techniques already available for inducing trance states to eventually gain further insights. For, after all, trance has been used for thousands of years and still is in almost every culture, be it in shamanic rituals for different purposes, the preliminary mentioned 'dream healings' in Aesclepian temples or nowadays in hypnotherapy and mental training. Thus, there are numerous methods of inducing trance states that should be considered trying to define the state. Then we could understand better why and how hypnotic induction or trance enhances suggestibility (Ghandi & Oakley, 2005), yet is not needed to produce the compelling effects (Raz et al., 2006) that can be observed. In fact, highly susceptible individuals follow suggestions equally well when those are administered in an 'everyday' state of consciousness, and the best predictor for hypnotic susceptibility seems to be the responsiveness to the same suggestions outside of trance (Braffman & Kirsch, 1999). However, there is the problem of spontaneous occurrence of trance when administered or executing suggestions (Barabasz & Barabasz, 2008). As Oakley & Halligan (2010) point out, it would be informative to examine other forms of 'pure' suggestion as well, e.g. placebo effects. This would of course also yield valuable information on the mechanism underlying the 'additional boost' (Kosslyn et al., 2000) provided by hypnotic induction.

Having defined exact markers would then open a vast field of possibilities for use in research, like the aforementioned of creating analogues for clinical conditions, or the exploration of exceptional perceptions like synesthesia, in a way as we tried to create 'virtual synesthetes' in the current study.

4.4 Hints at a connection between hypnosis and synesthesia

Synesthesia has often been associated with metaphor (Ramachandran & Hubbard, 2003), which however does not lead to further elucidation of the phenomenon, because "it is an example of trying to explain a mystery with an enigma", as the authors pointed out later (Ramachandran et al., 2004). Yet, they seem to have a lot in common. It seems plausible that on a neural level both synesthesia and metaphor need a process of cross-modal *binding* (Treisman & Gelade, 1980). Metaphorical communication is often used in hypnotherapy and trance seems to facilitate metaphorical processing (e.g., Erickson et al., 1976). Thus, one could assume that perceptual binding are altered somehow in both conditions. If it is possible to change binding processes by entering in a different state of consciousness, then there would be no more need for structural differences in synesthetes to explain their exceptional experiences. Yet, it does not rule out that synesthetes might indeed have structural differences, because brain plasticity (e.g., Pascual-Leone, 2005) tells us that neural structures change and evolve all the time, e.g. by learning. Thus, if a predisposition to synesthetic experience (Barnett et al., 2008) exists, experiencing the same way again and again might well be observed as a structural difference some day. Yet, it is more alike that an altered connectivity is the underlying mechanism, if it can be established in such short time frames, as it often is using hypnotic suggestion. Or it might be that highly susceptible subjects share structural differences with synesthetes and that it are those that make it easier to change connectivity patterns, as 'hypnotic virtuosos' seem to be able to do (see Fingelkurts et al., 2007).

Another noticeable relation might be that of the above mentioned emotional susceptibility and hypnotic susceptibility. Since individuals with high emotional susceptibility are easily overwhelmed by emotions, triggered internally or externally (see Capara et al., 1985; Iaria et al., 2008), it seems plausible that there is a connection to highly susceptible subjects, being easily influenced by suggestions in a social context (Kihlstrom, 1999). Studying relations like this could also be informative, for to date, the only well documented attribute of hypnotic susceptible individuals is that they seem to have a talent to easily get mentally absorbed (e.g., Rainville et al., 2002).

As a last, yet important note, measuring hypnotic susceptibility needs to be stressed. In the current study we used the most economic variant administering the German version of the HGSHS:A (Bongartz, 1980). As Bongartz (1985) points out, self-scoring systems for measuring hypnotic susceptibility like the HGSHS:A are prone to distorsion by influence of response sets or individual under- or overestimation. Thus, obligatory an individual, more 'objective' screening has to follow, e.g., using the Stanford Hypnotic Susceptibility Scale: Form C (Weitzenhoffer & Hilgard, 1962) to further evaluate the hypnotic susceptibility. This is of great interest, especially considering the literature on suggestion phenomena. For compelling effects have to date been demonstrated only with highly susceptible subjects (e.g., Raz et al., 2006; Fingelkurts et al., 2007) and oftentimes the same suggestions seem to elicit quite different results for low susceptible individuals (e.g., Egner et al. 2005).

4.5 Concluding remarks

Creating 'virtual synesthetes' did not work out the way we expected, however there are many possible explanations, as we outlined in this discussion. The last point be the first, as we believe insufficient screening (surely due to the given frame of a diploma thesis) has a great share in the tepid results on synesthesia.

Results from resting state recordings to distinguish the alert from the trance state are however clear-cut and in line with previous research on the topic. Extracting a correlate for suggestion is not possible, although there are some interesting findings. But there are many reasons for the differences considering the whole and a major insight is that it is necessary to split things up into smaller pieces in order to gain a more precise picture of the whole. It was not possible to go any further within the given frame, and hence most of all we gained more questions. The most interesting direction for future research, in our opinion, points to analysis of cerebral connectivity patterns, albeit in (virtual) synesthetes and in hypnotic virtuosos, and how they can be influenced by techniques altering consciousness, like hypnotic induction or meditation, that can be learned by everybody.

Thus, we would like to conclude by emphasizing that all of the aspects of this study deserve future research, for they all contain the promise of a more distinct estimation of what really is.

5. References

Andrews-Hanna, J., Reidler, J.S., Sepulcre, J., Poulin, R., Buckner, R.L. (2010). Functional-anatomic fractionation of the brain's default network. *Neuron, 65* (4), 550-562.

Baijal, S., Srinivasan, N. (2010). Theta activity and meditative states: spectral changes during concentrative meditation. *Cognitive Processing, 11*, 31-38.

Banich, M.T. (2009). Executive Function: The search for an integrated account. *Current Directions in Psychological Science, 18* (2), 89-94.

Bányai, É., Hilgard, E. (1976). A comparison of active-alert hypnotic induction with traditional relaxation induction. *Journal of Abnormal Psychology, 85* (2), 218-224.

Barabasz, A.F., Barabasz, M. (2008). Hypnosis and the brain. *In: Nash, M.R., Barnier, A.J. (Eds.). The Oxford Handbook of Hypnosis – Theory, Research and Practice Oxford: Oxford University Press*, 337-363.

Bargary, G., Mitchell, K.J. (2008). Synaesthesia and cortical connectivity *Trends in Neurosciences, 31* (7)*,* 336-342.

Barnett, K.J., Finucane, C., Asher, J.E., Bargary, G., Corvin, A.P., Newell, F.N., Mitchell, K.J. (2008). Familial patterns and the origins of individual differences in synaesthesia. *Cognition, 106*, 871-893.

Baron-Cohen, S. (1996). Is There a Normal Phase of Synaesthesia in Development? *Journal Psyche [online series] 2*(27) available: http://theassc.org/files/assc/2357.pdf

Bartels, A., Zeki, S. (2000). The architecture of the colour centre *European Journal of Neuroscience, 12* (1), 172-193.

Bongartz, W. (1980). *Harvard Hypnosetest für Gruppen, Form A*. [Harvard Group Scale of Hypnotic Susceptibility, Form A.] Konstanz: University of Konstanz.

Bongartz, W. (1985). German Norms For The Harvard Group Scale Of Hypnotic Susceptibility, Form A. *International Journal of Clinical and Experimental Hypnosis, 33* (2), 131-139.

Botvinick, M.M., Cohen, J.D., Carter, C.S. (2004). Conflict monitoring and anterior cingulate cortex: an update. *Trends in Cognitive Sciences, 8* (12), 539-546.

Braffman, W., Kirsch, I. (1999). Imaginative Suggestibility and Hypnotizability: An Empirical Analysis. *Journal of Personality and Social Psychology, 77* (3), 578-587.

Buneo, C.A., Andersen, R.A. (2006). The posterior parietal cortex: Sensorimotor interface for the planning and online control of visually guided movements. *Neuropsychologia, 44*, 2694-2606.

Buzsáki, G. (2006). *Rhythms of the brain*. New York: Oxford University Press.

Canolty, R. T., Edwards, E., Dalal, S. S., Soltani, M., Nagarajan, S. S., Kirsch, H. E., Berger, M. S., Barbaro, N. M. & Knight, R. T. (2006). High Gamma Power Is Phase-Locked to Theta Oscillations in Human Neocortex. *Science, 313* (5793), 1626-1628.

Capara, G.V., Cinanni, V., D'Imperio, G., Passerini, S., Renzi, P., Travaglia, G. (1985). Indicators of impulsive aggression: Present status of research on irritability and emotional susceptibility scales. *Personality and Individual Differences, 6*, 665-674.

Cohen, L., Dehaene, S., Naccache, L., Lehéricy, S., Dehaene-Lambertz, G., Hénaff, M.-A., Michel, F. (2000). The visual word form area: spatial and temporal characterization of an initial stage of reading in normal subjects and posterior split-brain patients. *Brain, 123*, 291-307.

Cohen-Kadosh, R., Henik, A., Catena, A., Walsh, V., Fuentes, L.J. (2009). Induced cross-modal synaesthetic experience without abnormal neuronal connections. *Psychological Science, 20* (2), 258-265.

Culham, J.C., Kanwisher, N.G. (2001). Neuroimaging of cognitive functions in human parietal cortex. *Current Opinion in Neurobiology, 11*, 157-163.

Cytowic, R.E. (1995). Synesthesia: Phenomenology and Neuropsychology - A Review of current knowledge. *Journal Psyche [online series] 2* (10), available: http://theassc.org/files/assc/2357.pdf

Cytowic, R.E. (1993). *The man who tasted shapes*. New York: Warner.

Damasio, A.R. (1996). The somatic marker hypothesis and the possible functions of the prefrontal cortex. *Philos Trans R LOnd B Biol Sci, 351* (1346), 1413-1420.

Demertzi, A., Soddu, A., Faymonville, M.-E., Bahri, M.-A., Gosseries, O., Vanhaudenhuyse, A., Phillips, C., Maquet, P., Noirhomme, Q., Luxen, A., Laureys, S. (2011). Hypnotic modulation of resting state fMRI default mode and extrinsic network connectivity. *Progress in Brain Research, 193*, 309-322.

Dixon, M.J., Smilek, D, Wagar, B.M., Merikle, P.M. (2004). Grapheme-Colour Synaesthesia: When 7 is Yellow and D is Blue. *In: Calvert, G., Spence, C., Stein, B. (Eds.) The handbook of multisensory processes. Cambridge (MA): MIT Press.,* 837-849.

Dixon, M.J., Smilek, D., Merikle, P.M. (2004). Not all synaesthetes are created equal: Projector versus associator synaesthetes. *Cognitive, Affective and Behavioral Neuroscience 4* (3), 335-343.

Dixon, M.J., Smilek, D., Duffy, P.L., Zanna, M.P., Merikle, P.M. (2006). The role of meaning in grapheme-color synaesthesia. *Cortex, 42*, 243-252.

Egner, T., Jamieson, G., Gruzelier, J. (2005). Hypnosis decouples cognitive control from conflict monitoring processes of the frontal lobe. *NeuroImage, 27*, 969-978.

Erickson, M.H., Rossi, E.L., Rossi, S.L. (1976). *Hypnose: Induktion, psychotherapeutische Anwendung, Beispiele*. München: Pfeiffer.

Faymonville, M.-E., Boly, M., Laureys, S. (2006). Functional neuroanatomy of the hypnotic state. *Journal of Physiology – Paris, 99*, 463-469.

Fingelkurts, A.A., Finglekurts, A.A., Kallio, S., Revonsuo, A. (2007). Cortex functional connectivity as a neurophysiological correlate of hypnosis: An EEG case study. *Neuropsychologia, 45* (7), 1452-1462.

Gandhi, B., Oakley, D.A. (2005). Does 'hypnosis' by any other name smell as sweet? The efficacy of 'hypnotic' inductions depends on the label 'hypnosis'. *Consciousness and Cognition, 14*, 304-315.

Gross, J., Kujala, J., Hamalainen, M., Timmermann, L., Schnitzler, A., Salmelin, R. (2001). Dynamic imaging of coherent sources: studying neural interactions in the human brain. *Proc Natl Acad Sci U.S.A., 98* (2), 694-699.

Gruzelier, J.H. (2006). Frontal functions, connectivity and neural efficiency underpinning hypnosis and hypnotic susceptibility. *Contemporary Hypnosis, 23* (1), 15-32

Gusnard, D.A., Raichle, M.E. (2001). Searching for a baseline: functional imaging and the resting human brain. *Nature Reviews | Neuroscience 2*, 685-694.

Halsband, U. (2006). Learning in trance: functional brain imaging studies and neuropsychology. *Journal of Physiology Paris, 99* (4-6), 470-82.

Hubbard, E.M. (2007). Neurophysiology of Synesthesia. *Current Psychiatry Reports 9*, 193-199.

Hofmann, A. (1979). *LSD - mein Sorgenkind*. Stuttgart: Klett-Cotta.

Holm, S. (1979). A Simple Sequentially Rejective Multiple Test Procedure. *Scand J Statist. 6*, 65-70.

Iaria, G., Committeri, G., Pastorelli, C., Pizzamiglio, L., Watkins, K.E., Carota, A. (2008). Neural activity of the anterior insula in emotional processing depends on the individuals emotional susceptibility. *Human Brain Mapping, 29*, 363-373.

Jensen, O., Kaiser, J., Lachaux, J.-P. (2007). Human gamma frequency oscillations associated with attention and memory. *Trends in Neurosciences, 30* (7), 317-324.

Jensen, M.P. (2008). The Neurophysiology of Pain Perception and Hypnotic Analgesia: Implications for Clinical Practice. *American Journal of Clinical Hypnosis, 51* (2), 123-148

Jokisch, D., Jensen, O. (2007). Modulation of gamma and alpha activity during a working memory task engaging the dorsal or ventral stream. *Journal of Neuroscience, 27* (12), 3244-3251.

Kennedy, H., Batardière, A., Dehay, C., Barone, P. (1997). Synaesthesia: implications for developmental neurobiology. *In: Baron-Cohen, S., Harrison, J. (Eds.). Synaesthesia: Classic and contemporary Readings. Oxford: Blackwell*, 243-256.

Kihlstrom, J.F. (2008). The domain of hypnosis, revisited. *In: Nash, M.R., Barnier, A.J. (Eds.). The Oxford Handbook of Hypnosis – Theory, Research and Practice Oxford: Oxford University Press*, 21-52.

Klimesch, W. (1999). EEG alpha and theta oscillations reflect cognitive and memory performance: a review and analysis. *Brain Research Reviews, 29* (2-3), 169-195.

Kosslyn, S.M., Thompson, W.L., Constantini-Ferrando, M.F., Alpert, N.M., Spiegel, D. (2000). Hypnotic visual illusion alters color processing in the brain. *The American Journal of Psychiatry, 157*, 1279-1284.

Lamm, C., Singer, T. (2010). The role of anterior insular cortex in social emotions. *Brain Structure and Function, 214*, 579-591.

Macaluso, E., Driver, J. (2005). Multisensory spatial interactions: a window onto functional integration in the human brain. *Trends in Neurosciences, 28* (5), 264-71.

Mansouri, F.A., Tanaka, K., Buckley, M.J. (2009). Conflict-induced behavioural adjustment: a clue to the executive functions of the prefrontal cortex. *Nature Reviews | Neuroscience, 10*, 141-152.

Maris, E., Oostenveld, R. (2007). Nonparametric statistical testing of EEG and MEG-data. *Journal of Neuroscience Methods, 164* (1), 177-190.

Mattingley, J.B., Rich, A.N., Yelland, G., Bradshaw, J.L. (2001). Unconscious priming eliminates automatic binding of colour and alphanumeric form in synaesthesia. *Nature, 410*, 580-582.

Mattingley, J.B., Payne, J.M. & Rich, A.N. (2006). Attentional Load Attenuates Synaesthetic Priming Effects in Grapheme Colour Synaesthesia. *Cortex, 42* (2), 213-221.

McKeefry, D.J., Zeki, S. (1997). The position and topography of the human color centre as revealed by functional magnetic resonance imaging. *Brain, 120*, 2229-2242.

Muggleton, N., Tsakanikos, E., Walsh, V., Ward, J. (2007). Disruption of synaesthesia following TMS of the right posterior parietal cortex. *Neuropsychologia, 45* (7), 1582-1585.

Navon, D. (1977). Forest before trees: The precedence of global features in visual perception. *Cognitive Psychology, 9* (3), 353-383.

Oakley, D.A. (2008) Hypnosis, trance and suggestion: evidence from neuroimaging. *In: Nash, M.R., Barnier, A.J. (Eds.). The Oxford Handbook of Hypnosis – Theory, Research and Practice Oxford: Oxford University Press*, 365-392.

Oakley, D.A., Halligan, P.W. (2011). Using hypnosis to gain insights into healthy and pathological cognitive functioning. *Consciousness and Cognition, 20* (2), 328-31.

Oldfield, R. (1971). The assessment and analysis of handedness: the Edinburgh inventory. *Neuropsychologia, 9* (1), 97-113.

Oostenveld, R., Fries, P., Maris, E., Schoffelen, J.- M. (2011). FieldTrip: open source software for advanced analysis of MEG, EEG, and invasive electrophysiological data. *Comput Int Neurosci. 2011*, 1-9.

Pascual-Leone, A., Amedi, A., Fregni, F., Merabet, L.B. (2005). The plastic human brain cortex. *Annual Reviews of Neuroscience, 28* (3), 377-401.

Paulesu, E., Harrison, J., Baron-Cohen, S., Watson, J.D.G., Goldstein, L., Heather, J., Frackowiak, R.S.J., Frith, C.D. (1995). The physiology of coloured hearing: A PET activation study of colour-word synaesthesia. *Brain, 118*, 661-676.

Pereira, M.G., Oliveira, L., Erthal, F.S., Joffily, M., Mocaiber, I.F., Volchan, E., Pessoa, L. (2010). Emotion affects action: Midcingulate cortex as a pivotal node of interaction between negative emotion and motor signals. *Cogn Affect Behav Neurosci., 10* (1), 94-106.

Posner, M.I., Petersen, S.E. (1990). The attention system of the human brain. *Annual Review of Neuroscience, 13*, 25-42.

Rainville, P., Hofbauer, R.K., Paus, T., Duncan, G.H., Bushnell, M.C., Price, D.D. (1999). Cerebral mechanisms of hypnotic induction and suggestion. *Journal of Cognitive Neuroscience 11*, 110-125.

Rainville, P., Hofbauer, R.K. , Bushnell, M.C., Duncan, G.H., Price, D.D. (2002). Hypnosis Modulates Activity in Brain Structures Involved in the Regulation of Consciousness. *Journal of Cognitive Neuroscience, 14*, 887-901.

Rainville, P., Price, D.D. (2003). Hypnosis phenomenology and the neurobiology of consciousness. *International Journal of Clinical & Experimental Hypnosis, 51* (2), 105-129.

Ramachandran, V.S., Hubbard, E.M. (2001a). Synaesthesia: A window into perception, thought and language. *Journal of Consciousness Studies, 8* (12), 3-34.

Ramachandran, V.S., Hubbard, E.M. (2003). The phenomenology of synesthesia. *Journal of Consciousness Studies, 10* (8), 49-57.

Ramachandran, V.S., Hubbard, E.M., Butcher, P.A. (2004). Synesthesia, cross-activation and the foundations of Neuroepistemology. *In: Calvert, G., Spence, C., Stein, B. (Eds.). The handbook of multisensory processes. Cambridge (MA): MIT Press.*, 867-883.

Ramachandran, V.S., Hubbard, E.M. (2005). Neurocognitive Mechanisms of Synaesthesia. *Neuron, 48*, 509-520.

Raz, A., Fan, J., Posner, M.I. (2005). Hypnotic suggestion reduces conflict in the human brain. *Proc Natl Acad Sci U.S.A., 102*, 9978-9983.

Raz, A., Buhle, J. (2006). Typologies of attentional networks. *Nature Reviews | Neuroscience, 7*, 367-379.

Raz, A., Moreno-Íñiguez, M., Martin, L. & Zhu, H. (2006). Suggestion overrides the Stroop effect in highly hypnotizable individuals. *Consciousness and Cognition, 16*, 331-338.

Raz, A., Kirsch, I., Pollard, J., Nitkin-Kaner, Y. (2006). Suggestion reduces the stroop effect. *Psychological Science, 17* (2), 91-95.

Rich, A.N. & Mattingley, J.B. (2003). The effects of stimulus competition and voluntary attention on colour-graphemic synaesthesia. *Cognitive Neuroscience and Neuropsychology/ Neuroreport*, *14* (14), 1793-1798.

Rich, A.N., Bradshaw, J.L. & Mattingley, J.B. (2005). A systematic, large-scale study of synaesthesia: implications for the role of early experience in lexical-colour associations. *Cognition, 98*, 53–84.

Rich, A.N., Mattingley, J.B. (2009). Out of sight, out of mind: The attentional blink can eliminate synaesthetic colours. *Cognition, 114*, 320-328.

Rouw, R. & Scholte, S. (2007). Increased structural connectivity in grapheme-color synesthesia. *Nature Neuroscience, 10* (6), 792-797.

Sauseng, P., Klimesch, W., Heise, K.F., Gruber, W.R., Holz, E., Karim, A.A., Glennon, M., Hummel, F.C. (2009). Brain Oscillatory Substrates of Visual Short-Term Memory Capacity. *Current Biology, 19* (21), 1846-1852.

Seaberg, M. (2011). *Tasting the Universe: People Who See Colors in Words and Rainbows in Symphonies*. New Jersey: Career Press.

Schall, J.D. (2004). On the role of frontal eye field in guiding attention and saccades. *Vision Research, 44* (12), 1453-1467.

Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., Dunbar, G.C. (1998). The Mini- International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J Clin Psychiatry, 59 (Suppl 20)*, 22–33 quiz 34-57.

Shor, R.E., Orne, E.C. (1962). *Harvard Group Scale of Hypnotic Susceptibility: Form A*. Palo Alto, California: Consulting Psychologists Press.

Simner, J., Mulvennaô, C., Sagiv, N., Tsakanikos, E., Witherby, S.A.,Fraser, C., Scott, K., War, J (2006). Synaesthesia: The prevalence of atypical cross-modal experiences. *Perception, 35*, 1024 -1033.

Smilek, D., Dixon, M.J., Cudahy, C., Merikle, P.M. (2001). Synaesthetic photisms influence visual perception. *Journal of Cognitive Neurosciences, 13* (7), 930-6.

Stam, H.J., Spanos, N.P. (1982). The Asclepian dream healings and hypnosis: a critique. *International Journal of Clinical and Experimental Hypnosis, 30* (1), 9-22.

Steven, M.S., Hansen, P.C., Blakemore, C. (2006). Activation of color-selective areas of the visual cortex in a blind synesthete. *Cortex, 42* (2), 304-308.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643-662.

Szechtman, H., Woody, E., Bowers, K.S., Nahmias, C. (1998). Where the imaginal appears real: a positron emission tomography study of auditory hallucinations. *Proceedings of the National Academy of Sciences, 95*, 1956-1960.

Talairach, J., Tournoux, P. (1988). *Co-Planar stereotaxtic atlas of the human brain*. Stuttgart, Thieme.

Tootell, R.B.H., Devaney, K.J., Young, J.C., Postelnicu, G., Rajimehr, R., Ungerleider, L.G. (2009). fMRI mapping of a morphed continuum of 3D shapes within inferior temporal cortex. *Proc Natl Acad Sci U.S.A., 105* (9), 3605-3609.

Treisman, A.M., Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology, 12*, 97-136.

Van Veen, B., van Drongelen, W., Yuchtman, M., Suzuki, A. (1997). Localization of brain electrical activity via linearly constrained minimum variance spatial filtering. *IEEE Trans Bio-Med Eng, 44* (9), 867-880.

Van Veen, V., Carter, C.S. (2002). The anterior cingulate as a conflict monitor: fMRI and ERP studies. *Physiology & Behavior,* 77, 477-482.

Vanhaudenhuyse, A., Boveroux, P., Boly, M., Schnakers, C., Bruno, M.A., Kirsch, M., Demertzi, A., Lamy, M., Maquet, P., Laureys, S., Faymonville, M.E. (2008). Hypnosis and pain perception. *Revue Médicale de Liège, 63* (5-6), 424-8.

von Stein, A., Chiang, C., König, P. (2000). Top-down processing mediated by interareal synchronization. *Proc Natl Acad Sci U.S.A., 97* (26), 14784-14753.

Walsh, R. (2005). Can Synaesthesia Be Cultivated?: Indications from Surveys of Meditators. *Journal of Consciousness Studies, 12* (4-5), 5-17.

Ward, J., Simner, J., Auyeung, V. (2005). A comparison of lexical-gustatory and grapheme-color synaesthesia. *Cognitive Neuropsychology, 22* (1), 28-41.

Weitzenhoffer, A.M., Hilgard, E.R. (1959). *Stanford Hypnotic Susceptibility Scale: Form C.* Palo Alto, California: Consulting Psychologists Press.

Woloszyn, L., Sheinberg, D.L. (2009). Neural Dynamics in Inferior Temporal Cortex during a Visual Working Memory Task. *Journal of Neuroscience, 29* (17), 5494-5507.

Zhang, Y., Meyers, E.M., Bichot, N.P., Serre, T., Poggio, T.A., Desimone, R. (2011). Object decoding with attention in inferior temporal cortex. *Proc Natl Acad Sci U.S.A., 108* (21), 8850-8855.

6. Appendix

***Posthypnotic Suggestion Group* Trance_1**

So, alles in Ordnung bei Dir? Geht's Dir gut? Liegst Du noch gut? Keine Druckstellen? Gut.
Dann beginnen wir jetzt mit der Hypnose und Du darfst es Dir dafür so bequem machen, wie es eben geht. Am besten legst Du die Arme entspannt neben den Körper… nicht überkreuzen, denn sonst kann es zu Durchblutungsschwierigkeiten kommen, da Du gleich lange sehr entspannt liegen wirst…
Du weißt vom letzten Mal, zu Beginn einer Hypnose steht meist die Fokussierung der Aufmerksamkeit. Das kann auf allen Kanälen geschehen, durch Musik, durch Bewegung… Klassisch wird das meist visuell induziert, daher habt ihr an der Uni einen Punkt auf Eurer Hand ausgesucht und genau aus diesem Grund habe ich da oben diesen weißen Punkt angeklebt, den Du jetzt bitte beginnst zu fixieren. Schau nur auf diesen Punkt, konzentriere Dich ganz auf diesen Punkt und höre nur auf meine Stimme und das, was ich Dir sage. Vielleicht erinnerst Du Dich auch noch an diese wohlige Entspannung des Körpers … und der eine Teil kann früher entspannen und der andere später … Schau dabei einfach auf diesen Punkt, konzentriere Dich ganz auf diesen Punkt, während ich Dir einige Instruktionen gebe, die Dir helfen werden, Dich zu entspannen und so mehr und mehr in diesen Zustand zu gleiten, den Du ja bereits kennst.
Du wirst einen hypnotischen Zustand nur dann erreichen, wenn Du das tun willst, was ich sage und wenn Du Dich ganz auf diesen Punkt konzentrierst und auf das, was ich Dir sage. Du weißt vom letzten Mal, das Erreichen eines Trance-Zustandes ist im Wesentlichen eine Frage Deiner Bereitschaft, Ideen aufzunehmen und diese Ideen ungestört wirken zu lassen. Du hast Deine Bereitschaft zur Mitarbeit bereits gezeigt, indem Du heute hierhergekommen bist, und ich nehme daher an, dass Du all das erleben möchtest, was Dir möglich ist.
Auch diese Sitzung dient rein wissenschaftlichen Zwecken und Dein persönlicher Bereich wird in keiner Weise berührt.
Du allein entscheidest, ob Du jetzt eine leichte, eine tiefe oder vielleicht sogar eine sehr tiefe Trance erleben möchtest, und ich werde Dir mit meinen Worten lediglich den Weg ein wenig erleichtern. Ich werde Dir fortlaufend Angebote machen, die Du

nutzen kannst, um diesen Zustand selbst-ständig zu vertiefen in Deinem eigenen, für Dich genau richtigen Tempo.
Versuch also Dein Bestes, Dich auf diesen Punkt zu konzentrieren und auf das, was ich Dir sage und ansonsten lass einfach geschehen, was immer Du wahrnimmst. Lass es einfach geschehen.
Du hast vermutlich bereits gemerkt, wie sich Deine Muskeln angenehm entspannen und sich in Deinem ganzen Körper diese wohltuende, schläfrige Schwere ausbreitet. Du hörst dieses vertraute Lüftungsgeräusch im Hintergrund und vielleicht beginnt auch der Punkt, sich ein bisschen verändern, den Du bitte weiter aufmerksam fixierst. Deine Atmung ist auch schon ruhiger geworden und diese schläfrige Schwere breitet sich immer weiter in Deinem Körper aus. All das sind vertraute Zeichen einer beginnenden Trance.
Die fortschreitende Entspannung auf dem Weg in eine hypnotische Trance ähnelt sehr dem Zustand kurz vorm Einschlafen, aber Du wirst gleich nicht im üblichen Sinne schlafen, weil Du weiterhin meine Stimme hören und in der Lage sein wirst, all das zu erleben, was ich Dir sage. Hypnose ist ein wenig wie Schlafwandeln, weil man nicht ganz wach ist, und doch viele Dinge tun kann, die man tut, wenn man wach ist, auch wenn man nicht ganz wach ist ... Schlafen und doch nicht Schlafen ...
Und vielleicht hat sich während ich spreche dieses angenehme Gefühl der Schwere noch weiter ausgebreitet .... wohlige, schläfrige Schwere im ganzen Körper ... Du musst die Augen jetzt auch nicht mehr offen halten. Einfach fallen lassen. So ist es gut. Du kannst jetzt erleben, wie angenehm es sein kann, gleichzeitig konzentriert und entspannt zu sein ... entspannt konzentriert ... und vielleicht hast Du auch schon ähnliche Erfahrungen gemacht ... in der Musik oder im Sport oder wenn Du so vertieft in ein gutes Buch oder einen Film warst, dass Du alles um Dich herum vergessen hast ... Du hörst die Welt und hörst sie nicht ... und Du kannst Dich jetzt daran erinnern, wie angenehm und leicht es sich angefühlt hat...
Und so leicht, wie es sich damals angefühlt hat, können sich nachher, wenn ich Dich darum bitte, Deine Augen einfach öffnen und den Bildschirm betrachten ... und dabei kannst Du noch mehr entspannen. Und mit jedem Mal, bei dem Deine Augen sich öffnen und wieder schließen werden, wirst Du noch tiefer eintauchen ... diese wohltuende, schläfrige Schwere spüren, in der es bald nichts mehr gibt, woran Du denkst ... nur noch entspannen ... loslassen ...

Meine Stimme mag vielleicht schon jetzt ein wenig fremd klingen, so als ob Du sie in einem Traum hörst, aber das ist Dir ganz egal ... Du sinkst einfach immer tiefer und tiefer in Trance ... mehr und mehr ... angenehm müde und schläfrig ...
Richte einfach Deine Gedanken auf das, was ich Dir sage ... Du wirst noch müder und schläfriger ... Bald wirst Du tief schlafen, aber Du wirst keine Schwierigkeiten haben, mich zu hören. Du wirst mich immer gut hören, wie tief schlafend Du Dich auch fühlen magst.
Gleich beginne ich von 1 - 10 zu zählen. Während ich zähle, wirst Du tiefer und tiefer in einen tiefen, angenehmen Schlaf fallen, aber Du wirst in der Lage sein, all die Dinge zu tun, die ich Dir sage ... **1** ... Du wirst noch tiefer schlafen ... **2** ... tief, tiefer, in einen gesunden Schlaf ... **3** ... tiefer und tiefer schlafend. Nicht wird Dich stören. Wann immer etwas von außen an Dich dringt, kann Dir das helfen, noch tiefer einzutauchen ... **4**... **5** ... Du sinkst immer weiter in einen tiefen Schlaf. Nichts berührt Dich. Richte weiter Deine Gedanken auf meine Stimme und auf die Dinge, die ich Dir beschreibe. Du wirst es leicht finden, einfach auf die Dinge zu hören, die ich Dir nenne ... **6** ... **7** ... obwohl tief schlafend, kannst Du mich deutlich hören ... **8** ... tief schlafend, fest schlafend. Du wirst all die Dinge erfahren, die ich Dir beschreiben werde ... **9** ... mehr und mehr ... **10** ... tief schlafend. Du möchtest angenehm schlafen und die Erfahrungen machen, die ich Dir beschreibe.
Du weißt, wenn sich Deine Augen gleich öffnen, wird Dir das helfen, noch tiefer einzutauchen und das erfüllt Dich mit einer großen Erleichterung und Gelassenheit. Tief entspannt lässt Du einfach geschehen, was immer geschieht...

Die Augen öffnen sich jetzt.
Die Farbe, die Du siehst, ist die Farbe der Zahl **1**. Konzentriere Dich ganz auf die Zahl 1 in ihrer Farbe. Wann immer Du in Zukunft die Zahl 1 siehst, denkst oder sie Dir vorstellst, wird sie Dir in dieser Farbe erscheinen. Dann schließ die Augen wieder und betrachte die Zahl 1 in ihrer Farbe noch einmal vor Deinem inneren Auge. Du siehst sie klar und deutlich vor Dir. Nimm Dir die Zeit, dieses Bild zu vertiefen...

Das ist die Farbe der Zahl **2** ...
Das ist die Farbe der Zahl **3** ...
Das ist die Farbe der Zahl **4** ...
Das ist die Farbe der Zahl **5** ...
Das ist die Farbe der Zahl **6** ...

So ist es gut. Immer tiefer ... mehr und mehr ... angenehm müde und schläfrig ...
Ich werde gleich für eine Weile still sein, damit Du Dich ganz und in Ruhe Deinen eigenen Bildern widmen oder auch einfach diese Tiefenentspannung genießen kannst.
Wenn ich dann wieder zu Dir spreche, wirst Du mir wieder zuhören, so wie Du es jetzt noch tust.
Ich bin jetzt still und nichts wird Dich stören ... tiefer und tiefer eintauchend ... jetzt

2. Ruhemessung (5 min.)

So ist es gut. Du hörst jetzt wieder deutlich meine Stimme und fühlst Dich sehr tief entspannt und wohl, da wo Du bist.
Während Du weiter in diesem wohltuenden Zustand bleibst, können Deine Augen sich jetzt noch einmal öffnen.
Die Augen öffnen sich.
Schau Dir die Zahl **1** in ihrer Farbe an. Betrachte sie genau. Wann immer Du in Zukunft die Zahl **1** siehst, denkst oder Dir vorstellst, wird sie Dir in dieser Farbe erscheinen.
Dann schließ die Augen wieder und entspann Dich. Stell Dir auch jetzt die Zahl **1** in ihrer Farbe noch einmal vor. Seh sie vor Deinem inneren Auge. Ganz klar und deutlich.

Das ist die Farbe der Zahl **2** ...
Das ist die Farbe der Zahl **3** ...
Das ist die Farbe der Zahl **4** ...
Das ist die Farbe der Zahl **5** ...
Das ist die Farbe der Zahl **6** ...

Gut.
Bleib entspannt und achte genau auf das, was ich Dir jetzt sage.
Ich werde gleich von 10 an rückwärts zählen. Du wirst dabei langsam aufwachen, aber während der meisten Zeit noch im jetzigen Zustand verbleiben. Wenn ich 3 sage, wirst Du die Augen öffnen, aber Du wirst dann noch nicht ganz wach sein. Erst wenn ich bei 1 ankomme, wirst Du ganz wach sein, im normalen Wachzustand. Du wirst

Dich aber möglicherweise so entspannt haben, dass Du es schwierig finden wirst, Dich an alle Details dessen zu erinnern, was Du erlebt hast. In der Tat wirst Du es so mühsam finden, Dich zu erinnern, dass Du auch keine große Lust verspüren wirst, es überhaupt zu tun. Das ist völlig in Ordnung, denn *Du musst Dich nicht erinnern.*
Dein Unbewusstes wird diesen Zustand und dieses tiefe Wissen gespeichert haben, so dass es Dir zukünftig mit Leichtigkeit gelingen wird, dies abzurufen. Du kannst ganz leicht und schnell in Trance zu gelangen, wann immer Du es willst. Traumhaft sicher wird Dein Unbewusstes Dich leiten, und es ist ganz egal, ob Du weißt, was Du weißt...
Nachdem Du gleich also auf mein Zählen hin wieder wach geworden bist, wirst Du Dich sehr wohl und entspannt fühlen wie nach einem tiefen und gesunden Schlaf. Dein Körper wird sich möglicherweise noch ein wenig steif anfühlen dann, aber das ist völlig normal nach einer solchen Hypnose, und wird sich nach den ersten Bewegungen aufgelöst haben. Ich werde nun von 10 an rückwärts zählen und erst bei 3, nicht früher, wirst Du die Augen öffnen, aber noch nicht ganz wach sein, sondern erst wenn ich 1 sage. Bei 1 bist Du hellwach.
10 -- 9 -- 8 -- 7 -- 6 -- 5 -- 4 -- 3 -- 2 -- 1
Du bist nun vollkommen wach und erfrischt im Hier und Jetzt. Vielleicht willst Du Dich ein wenig bewegen, um den Körper ein bisschen in Schwung zu bringen ...

So, alles in Ordnung bei Dir? Geht's Dir gut? Liegst Du noch gut? Keine Druckstellen? Gut.

Dann beginnen wir jetzt mit der Hypnose und Du darfst es Dir dafür so bequem machen, wie es eben geht. Am besten legst Du die Arme entspannt neben den Körper… nicht überkreuzen, denn sonst kann es zu Durchblutungsschwierigkeiten kommen, da Du gleich lange sehr entspannt liegen wirst…

Du weißt vom letzten Mal, zu Beginn einer Hypnose steht meist die Fokussierung der Aufmerksamkeit. Das kann auf allen Kanälen geschehen, durch Musik, durch Bewegung… Klassisch wird das meist visuell induziert, daher habt ihr an der Uni einen Punkt auf Eurer Hand ausgesucht und genau aus diesem Grund habe ich da oben diesen weißen Punkt angeklebt, den Du jetzt bitte beginnst zu fixieren. Schau nur auf diesen Punkt, konzentriere Dich ganz auf diesen Punkt und höre nur auf meine Stimme und das, was ich Dir sage. Vielleicht erinnerst Du Dich auch noch an diese wohlige Entspannung des Körpers … und der eine Teil kann früher entspannen und der andere später … Schau dabei einfach auf diesen Punkt, konzentriere Dich ganz auf diesen Punkt, während ich Dir einige Instruktionen gebe, die Dir helfen werden, Dich zu entspannen und so mehr und mehr in diesen Zustand zu gleiten, den Du ja bereits kennst.

Du wirst einen hypnotischen Zustand nur dann erreichen, wenn Du das tun willst, was ich sage und wenn Du Dich ganz auf diesen Punkt konzentrierst und auf das, was ich Dir sage. Du weißt vom letzten Mal, das Erreichen eines Trance-Zustandes ist im Wesentlichen eine Frage Deiner Bereitschaft, Ideen aufzunehmen und diese Ideen ungestört wirken zu lassen. Du hast Deine Bereitschaft zur Mitarbeit bereits gezeigt, indem Du heute hierhergekommen bist, und ich nehme daher an, dass Du all das erleben möchtest, was Dir möglich ist.

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Versuch also Dein Bestes, Dich auf diesen Punkt zu konzentrieren und auf das, was ich Dir sage und ansonsten lass einfach geschehen, was immer Du wahrnimmst. Lass es einfach geschehen.

Du hast vermutlich bereits gemerkt, wie sich Deine Muskeln angenehm entspannen und sich in Deinem ganzen Körper diese wohltuende, schläfrige Schwere ausbreitet. Du hörst dieses vertraute Lüftungsgeräusch im Hintergrund und vielleicht beginnt auch der Punkt, sich ein bisschen verändern, den Du bitte weiter aufmerksam fixierst. Deine Atmung ist auch schon ruhiger geworden und diese schläfrige Schwere breitet sich immer weiter in Deinem Körper aus. All das sind vertraute Zeichen einer beginnenden Trance.

Die fortschreitende Entspannung auf dem Weg in eine hypnotische Trance ähnelt sehr dem Zustand kurz vorm Einschlafen, aber Du wirst gleich nicht im üblichen Sinne schlafen, weil Du weiterhin meine Stimme hören und in der Lage sein wirst, all das zu erleben, was ich Dir sage. Hypnose ist ein wenig wie Schlafwandeln, weil man nicht ganz wach ist, und doch viele Dinge tun kann, die man tut, wenn man wach ist, auch wenn man nicht ganz wach ist ... Schlafen und doch nicht Schlafen ...

Und vielleicht hat sich während ich spreche dieses angenehme Gefühl der Schwere noch weiter ausgebreitet .... wohlige, schläfrige Schwere im ganzen Körper ... Du musst die Augen jetzt auch nicht mehr offen halten. Einfach fallen lassen. So ist es gut. Du kannst jetzt erleben, wie angenehm es sein kann, gleichzeitig konzentriert und entspannt zu sein ... entspannt konzentriert ... und vielleicht hast Du auch schon ähnliche Erfahrungen gemacht ... in der Musik oder im Sport oder wenn Du so vertieft in ein gutes Buch oder einen Film warst, dass Du alles um Dich herum vergessen hast ... Du hörst die Welt und hörst sie nicht ... und Du kannst Dich jetzt daran erinnern, wie angenehm und leicht es sich angefühlt hat...

Und so leicht, wie es sich damals angefühlt hat, können sich nachher, wenn ich Dich darum bitte, Deine Augen einfach öffnen und den Bildschirm betrachten ... und dabei kannst Du noch mehr entspannen. Und mit jedem Mal, bei dem Deine Augen sich öffnen und wieder schließen werden, wirst Du noch tiefer eintauchen ... diese wohltuende, schläfrige Schwere spüren, in der es bald nichts mehr gibt, woran Du denkst ... nur noch entspannen ... loslassen ...

Meine Stimme mag vielleicht schon jetzt ein wenig fremd klingen, so als ob Du sie in einem Traum hörst, aber das ist Dir ganz egal ... Du sinkst einfach immer tiefer und tiefer in Trance ... mehr und mehr ... angenehm müde und schläfrig ...

Richte einfach Deine Gedanken auf das, was ich Dir sage ... Du wirst noch müder und schläfriger ... Bald wirst Du tief schlafen, aber Du wirst keine Schwierigkeiten haben, mich zu hören. Du wirst mich immer gut hören, wie tief schlafend Du Dich auch fühlen magst.

Gleich beginne ich von 1 - 10 zu zählen. Während ich zähle, wirst Du tiefer und tiefer in einen tiefen, angenehmen Schlaf fallen, aber Du wirst in der Lage sein, all die Dinge zu tun, die ich Dir sage ... **1** ... Du wirst noch tiefer schlafen ... **2** ... tief, tiefer, in einen gesunden Schlaf ... **3** ... tiefer und tiefer schlafend. Nicht wird Dich stören. Wann immer etwas von außen an Dich dringt, kann Dir das helfen, noch tiefer einzutauchen ... **4**... **5** ... Du sinkst immer weiter in einen tiefen Schlaf. Nichts berührt Dich. Richte weiter Deine Gedanken auf meine Stimme und auf die Dinge, die ich Dir beschreibe. Du wirst es leicht finden, einfach auf die Dinge zu hören, die ich Dir nenne ... **6** ... **7** ... obwohl tief schlafend, kannst Du mich deutlich hören ... **8** ... tief schlafend, fest schlafend. Du wirst all die Dinge erfahren, die ich Dir beschreiben werde ... **9** ... mehr und mehr ... **10** ... tief schlafend. Du möchtest angenehm schlafen und die Erfahrungen machen, die ich Dir beschreibe.

Du weißt, wenn sich Deine Augen gleich öffnen, wird Dir das helfen, noch tiefer einzutauchen und das erfüllt Dich mit einer großen Erleichterung und Gelassenheit. Tief entspannt lässt Du einfach geschehen, was immer geschieht...

Stell Dir vor, Du bist auf einem Weg.

Du fühlst Dich sehr wohl dabei, diesen Weg zu gehen. Vielleicht kennst Du ihn auch schon und bist schon einmal da gewesen. Du schreitest diesen Weg entlang, bis Du Dich langsam einer Tür näherst. Es ist eine sehr interessante und schöne Tür und Du schaust Dir die Tür genau an - ihre Farbe, ihre Beschaffenheit ... wie sie sich anfühlt ... und wie hört sich diese Tür an, wenn Du Du sie jetzt öffnest? Die Tür führt Dich in eine Erinnerung, bei der Du Dich so richtig wohl gefühlt hast. Und ich weiß nicht, woran Du Dich erinnerst ... ob das schon lange her ist oder ob es erst vor Kurzem war ... aber das ist auch ganz egal, denn Du weißt es ... und Du fühlst Dich so richtig wohl dort ... angenehm ... Bist Du alleine dort oder ist noch jemand bei Dir? ... Du siehst, was Du damals gesehen hast und riechst wieder den Duft ... Du spürst die Luft auf Deiner Haut ... und du hörst die vertrauten Geräusche ... vielleicht sind es Stimmen ... oder eine Musik ... Du tauchst ganz ein ...

So ist es gut. Immer tiefer ... mehr und mehr ... angenehm müde und schläfrig ...

Ich werde gleich für eine Weile still sein, damit Du Dich ganz und in Ruhe Deinen eigenen Bildern widmen oder auch einfach diese Tiefenentspannung genießen kannst.
Wenn ich dann wieder zu Dir spreche, wirst Du mir wieder zuhören, so wie Du es jetzt noch tust.
Ich bin jetzt still und nichts wird Dich stören ... tiefer und tiefer eintauchend ... jetzt

2. Ruhemessung (5 min.)

So ist es gut. Du hörst jetzt wieder deutlich meine Stimme und fühlst Dich sehr tief entspannt und wohl, da wo Du bist.
Während Du weiter in diesem wohltuenden Zustand bleibst, kannst Du Dich jetzt noch einmal in diese wohltuende Erinnerung begeben ... Du hörst wieder die vertrauten Geräusche und tauchst ein an diesem Ort, den nur Du kennst ... mit diesen angenehmen Gefühlen tauchst Du immer weiter ein in diese Erinnerung und erlebst diese angenehme Geborgenheit ... und es geht Dir so richtig gut ... genau richtig ... während Du immer weiter ziehst durch diese Szene und alles siehst ... und noch viel mehr siehst ... und spürst, was Dir so gut getan hat ... und wie gut es hier riecht ... und Du bleibst noch eine Weile dort und genießt dieses wohlige Gefühl ...

Gut.
Bleib entspannt und achte genau auf das, was ich Dir jetzt sage.
Ich werde gleich von 10 an rückwärts zählen. Du wirst dabei langsam aufwachen, aber während der meisten Zeit noch im jetzigen Zustand verbleiben. Wenn ich 3 sage, wirst Du die Augen öffnen, aber Du wirst dann noch nicht ganz wach sein. Erst wenn ich bei 1 ankomme, wirst Du ganz wach sein, im normalen Wachzustand. Du wirst Dich aber möglicherweise so entspannt haben, dass Du es schwierig finden wirst, Dich an alle Details dessen zu erinnern, was Du erlebt hast. In der Tat wirst Du es so mühsam finden, Dich zu erinnern, dass Du auch keine große Lust verspüren wirst, es überhaupt zu tun. Das ist völlig in Ordnung, denn *Du musst Dich nicht erinnern*.
Dein Unbewusstes wird diesen Zustand und dieses tiefe Wissen gespeichert haben, so dass es Dir zukünftig mit Leichtigkeit gelingen wird, dies abzurufen. Du kannst ganz leicht und schnell in Trance zu gelangen, wann immer Du es willst. Traumhaft sicher wird Dein Unbewusstes Dich leiten, und es ist ganz egal, ob Du weißt, was Du weißt...

Nachdem Du gleich also auf mein Zählen hin wieder wach geworden bist, wirst Du Dich sehr wohl und entspannt fühlen wie nach einem tiefen und gesunden Schlaf. Dein Körper wird sich möglicherweise noch ein wenig steif anfühlen dann, aber das ist völlig normal nach einer solchen Hypnose, und wird sich nach den ersten Bewegungen aufgelöst haben. Ich werde nun von 10 an rückwärts zählen und erst bei 3, nicht früher, wirst Du die Augen öffnen, aber noch nicht ganz wach sein, sondern erst wenn ich 1 sage. Bei 1 bist Du hellwach.

10 -- 9 -- 8 -- 7 -- 6 -- 5 -- 4 -- 3 -- 2 -- 1

Du bist nun vollkommen wach und erfrischt im Hier und Jetzt. Vielleicht willst Du Dich ein wenig bewegen, um den Körper ein bisschen in Schwung zu bringen …

So, nun richte Deinen Blick bitte wieder auf den Punkt da oben.
Siehst Du ihn nach wie vor gut?
Ok.
Du darfst dann beginnen, Dich wieder zu entspannen und es Dir so einzurichten, wie es am Bequemsten für Dich ist.
Schau auf diesen Punkt und höre auf meine Stimme und auf das, was ich Dir sage.
Du kennst diesen Zustand und den Weg dahin jetzt bereits und ich möchte, dass Du Dich einfach daran erinnerst, wie es sich eben angefühlt hat ... wie sich Dein Körper angefühlt hat ... welcher Teil zuerst entspannte ... die vertrauten Geräusche hier drinnen ... wie der Punkt vielleicht schon jetzt langsam beginnt, sich ein bisschen zu verändern ... und Deine Augenlider werden stetig schwerer ... Du hast das ganze Wissen, wie man diesen hypnotischen Zustand erreicht, vorher gespeichert und kannst es jetzt einfach abrufen. Ich werde Dir daher dieses Mal nur ein paar Instruktionen geben, die Dir helfen sollen, Dich in Hypnose zu begeben. Du darfst dabei gerne selbstständig in den hypnotischen Zustand gleiten und in Deinem ganz eigenen, für Dich genau richtigen Tempo immer tiefer und tiefer entspannen ...
Du spürst, wie die Muskeln in Deinem gesamten Körper schon jetzt sehr entspannt und Deine Atmung immer ruhiger wird. Du musst auch die Augen nicht mehr offen halten, sondern kannst gleich ganz eintauchen.
Ich möchte, dass Du Dich einmal auf diesen Moment zwischen Einatmen und Ausatmen konzentrierst ... Dieser kleine Moment der inneren Stille ... Du kannst diesen Punkt der inneren Stille nutzen, um mit dieser grenzenlosen Ruhe mehr und mehr zu entspannen und immer tiefer ... und tiefer ... in diesen schlafähnlichen Zustand zu sinken ...
Du weißt, dass Du diesen angenehmen Zustand jederzeit schnell und ganz leicht erreichen kannst, wenn Du es willst, und das erfüllt Dich mit einer tiefen Zufriedenheit. Ganz gelassen lässt Du einfach geschehen, was auch immer geschieht.
Bald wirst Du wieder tief schlafen, aber Du wirst auch dieses Mal keine Schwierigkeiten haben, mich zu hören. Du wirst mich immer hören, wie tief entspannt Du Dich auch fühlen magst und Du wirst erst dann vollständig erwachen, wenn ich es sage.
Ich werde nun abermals von 1 - 10 zählen. Während ich zähle, wirst Du fortschreitend immer tiefer in diesen schlafähnlichen Zustand eintauchen, aber Du

wirst in der Lage sein, all die Dinge zu tun, die ich Dir sage und Du wirst erst dann ganz aufwachen, wenn ich es sage ...Und **1** ... Du wirst noch tiefer schlafen ... **2** ... tief, tiefer, in einen gesunden Schlaf ... **3** ... mehr und mehr ... **4**... **5** ... Du sinkst hinein in diesen wohligen Zustand. Nichts berührt Dich. Richte weiter Deine Gedanken auf meine Stimme und auf die Dinge, die ich Dir beschreibe ... **6** ... Du wirst es leicht finden, einfach auf die Dinge zu hören, die ich Dir nenne ... **7** ... obwohl tief schlafend, kannst Du mich deutlich hören. Du wirst mich immer deutlich hören, wie tief schlafend Du Dich auch fühlen magst ... **8** ... tief schlafend, fest schlafend. Nichts wird Dich stören. Du wirst all die Dinge erfahren, die ich Dir beschreiben werde ... **9** ... **10** tief schlafend. Du möchtest angenehm schlafen und meine Stimme wird Dich dabei begleiten.

Im Anschluss an die Hypnose, wenn Du wieder völlig ausgeruht und ganz wach im Hier und Jetzt angekommen bist, wirst Du alle Zahlen wieder so sehen, denken oder Dir vorstellen, wie es schon immer war ... wie Du sie als kleines Kind gelernt hast und seither damit umgehst. Du wirst möglicherweise sogar Schwierigkeiten haben, Dich daran zu erinnern, dass es je anders war. Das ist völlig in Ordnung, denn Du musst Dich nicht erinnern. Es kann sogar sein, dass Du gleich nach dem Aufwachen oder erst später, wenn wir diesen Raum verlassen haben, Dich an absolut nichts mehr erinnern kannst, was hier geschehen ist. Auch das wäre ganz normal und Du musst Dich nicht erinnern.

Tief in Dir wirst Du wissen, wie Du diesen Zustand zur Entspannung und Konzentration jederzeit ganz einfach nutzen kannst, wann immer Du es willst, und es ist ganz gleich, ob Du weißt, was Du weißt ... gleich wie in dem Traum der Löwin, in dem sie weit vorausschaut auf die Zeit, von der aus sie zurückschaut ... Und es ist ein ganz merkwürdiges Gefühl ... weit vorauszuschauen auf den Punkt, von dem man aus zurückschaut ... und sie ist so ruhig und so zufrieden an diesem Punkt ... Sie ist am Ziel ... und was sie überrascht und verwundert ... sie weiß später nichts mehr von dem Inhalt von diesem Traum ... sie weiß noch, dass sie ganz detailliert geträumt hat von diesem Punkt weit voraus, von dem aus sie zurückschaut ... angenehm ... Sie sieht sich an diesem Punkt, an den sie wirklich hin will ... und sie ist überrascht nach dem Aufwachen ... dass ihr viel, viel wichtiger ist tief drin ... dass sie genau weiß, dass sie tief drin diesen Traum hat ... es ist ihr viel wichtiger, dass sie weiß, dass sie es weiß ... tief drin ... als dass sie inhaltlich weiß, dass sie was sie weiß ... und das ist überraschend für sie ... normalerweise möchte sie immer genau wissen, was sie weiß ... und jetzt ist es ihr plötzlich viel, viel wichtiger, dass sie es weiß ... und sie ist sich

sicher, sie wird wissen, was zu tun ist ... im richtigen Moment ... wie von alleine ... so wie früher, wenn sie oft irgendwo auf der Jagd war ... zurück in ein Gebiet ging, in dem sie früher gelebt hatte ... und sie war Jahre nicht dort ... und sie könnte niemand mehr beschreiben, wie es dort aussieht ... und doch weiß sie ganz genau, wenn sie dort ist ... sie wird wissen, wo sie abzubiegen hat ... sie wird wissen, wie sie sich zu entscheiden hat ... sie wird intuitiv die richtigen Entscheidungen treffen, obwohl sie es im Moment niemandem beschreiben kann ... und es gibt ihr diese Sicherheit ... diese Lockerheit ... sie weiß tief drin, dass sie es weiß ... und so kannst Du, wenn Du nachher aufwachst und alles so ist, wie es vor Deinem Besuch hier war, ganz gelassen dem entgegen blicken, was kommt ...
Ich werde nun abermals für eine Weile still sein, damit Du noch einmal ganz für Dich und in Ruhe die Entspannung genießen kannst ...
Wenn ich dann wieder zu Dir spreche, wirst Du mir wieder zuhören, wie Du es jetzt noch tust.
Ich bin jetzt still und Du darfst Dich ganz fallen lassen in diesen wohltuenden Zustand ... mehr und mehr ... angenehm tief entspannt ... jetzt ...

3. Ruhemessung (5 min)

Du hörst nun wieder deutlich meine Stimme und fühlst Dich sehr wohl und angenehm tief entspannt.
Bleib entspannt und achte auf das, was ich Dir sage. Ich werde gleich wieder von **10** an rückwärts zählen und Du wirst dabei langsam aufwachen. Bei **3** wirst Du die Augen öffnen, aber Du wirst dann noch nicht ganz wach sein, sondern erst, wenn ich bei **1** ankomme. Bei **1** wirst Du ganz wach sein, im normalen Wachzustand, und alles wird wieder so sein wie heute Morgen. Du weißt, Du musst Dich nicht erinnern, denn es ist viel wichtiger, dass Du weißt, was Du wie Du es weißt.
Du kannst diese tiefe Entspannung und Konzentration jederzeit nutzen, wenn Du das wünschst. Ganz einfach und leicht.
Nachdem Du die Augen geöffnet hast, wirst Du Dich sehr wohl und entspannt fühlen wie nach einem tiefen und gesunden Schlaf. Dein Körper wird auch dieses Mal noch ein bisschen steif sein, aber nach ein paar Bewegungen wieder ganz locker und angenehm. Fertig:
10 -- 9 -- 8 -- 7 -- 6 -- 5 -- 4 -- 3 -- 2 -- 1
Nun fühlst Du Dich vollkommen wach und erfrischt im Hier und Jetzt.

So, nun richte Deinen Blick bitte wieder auf den Punkt da oben.
Siehst Du ihn nach wie vor gut?
Ok.
Du darfst dann beginnen, Dich wieder zu entspannen und es Dir so einzurichten, wie es am Bequemsten für Dich ist.
Schau auf diesen Punkt und höre auf meine Stimme und auf das, was ich Dir sage.
Du kennst diesen Zustand und den Weg dahin jetzt bereits und ich möchte, dass Du Dich einfach daran erinnerst, wie es sich eben angefühlt hat … wie sich Dein Körper angefühlt hat … welcher Teil zuerst entspannte … die vertrauten Geräusche hier drinnen … wie der Punkt vielleicht schon jetzt langsam beginnt, sich ein bisschen zu verändern … und Deine Augenlider werden stetig schwerer … Du hast das ganze Wissen, wie man diesen hypnotischen Zustand erreicht, vorher gespeichert und kannst es jetzt einfach abrufen. Ich werde Dir daher dieses Mal nur ein paar Instruktionen geben, die Dir helfen sollen, Dich in Hypnose zu begeben. Du darfst dabei gerne selbstständig in den hypnotischen Zustand gleiten und in Deinem ganz eigenen, für Dich genau richtigen Tempo immer tiefer und tiefer entspannen …
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Ich möchte, dass Du Dich einmal auf diesen Moment zwischen Einatmen und Ausatmen konzentrierst … Dieser kleine Moment der inneren Stille … Du kannst diesen Punkt der inneren Stille nutzen, um mit dieser grenzenlosen Ruhe mehr und mehr zu entspannen und immer tiefer … und tiefer … in diesen schlafähnlichen Zustand zu sinken …
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Ich werde nun abermals von 1 - 10 zählen. Während ich zähle, wirst Du fortschreitend immer tiefer in diesen schlafähnlichen Zustand eintauchen, aber Du

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Im Anschluss an die Hypnose, wenn Du wieder völlig ausgeruht und ganz wach im Hier und Jetzt angekommen bist, wird alles wieder so sein, wie es heute Morgen war, bevor Du hierher gekommen bist. Du wirst möglicherweise Schwierigkeiten haben, Dich an alles zu erinnern, was Du hier erlebt hast. Das ist völlig in Ordnung, denn Du musst Dich nicht erinnern. Es kann sogar sein, dass Du gleich nach dem Aufwachen oder erst später, wenn wir diesen Raum verlassen haben, Dich an absolut nichts mehr erinnern kannst, was hier geschehen ist. Auch das wäre ganz normal und Du musst Dich nicht erinnern.

Tief in Dir wirst Du wissen, wie Du diesen Zustand zur Entspannung und Konzentration jederzeit ganz einfach nutzen kannst, wann immer Du es willst, und es ist ganz gleich, ob Du weißt, was Du weißt ... gleich wie in dem Traum der Löwin, in dem sie weit vorausschaut auf die Zeit, von der aus sie zurückschaut ... Und es ist ein ganz merkwürdiges Gefühl ... weit vorauszuschauen auf den Punkt, von dem man aus zurückschaut ... und sie ist so ruhig und so zufrieden an diesem Punkt ... Sie ist am Ziel ... und was sie überrascht und verwundert ... sie weiß später nichts mehr von dem Inhalt von diesem Traum ... sie weiß noch, dass sie ganz detailliert geträumt hat von diesem Punkt weit voraus, von dem aus sie zurückschaut ... angenehm ... Sie sieht sich an diesem Punkt, an den sie wirklich hin will ... und sie ist überrascht nach dem Aufwachen ... dass ihr viel, viel wichtiger ist tief drin ... dass sie genau weiß, dass sie tief drin diesen Traum hat ... es ist ihr viel wichtiger, dass sie weiß, dass sie es weiß ... tief drin ... als dass sie inhaltlich weiß, dass sie was sie weiß ... und das ist überraschend für sie ... normalerweise möchte sie immer genau wissen, was sie weiß ... und jetzt ist es ihr plötzlich viel, viel wichtiger, dass sie es weiß ... und sie ist sich sicher, sie wird wissen, was zu tun ist ... im richtigen Moment ... wie von alleine ... so wie früher, wenn sie oft irgendwo auf der Jagd war ... zurück in ein Gebiet ging, in dem sie früher gelebt hatte ... und sie war Jahre nicht dort ... und sie könnte niemand mehr beschreiben, wie es dort aussieht ... und doch weiß sie ganz genau, wenn sie dort ist ... sie wird wissen, wo sie abzubiegen hat ... sie wird wissen, wie sie sich zu entscheiden hat ... sie wird intuitiv die richtigen Entscheidungen treffen, obwohl sie es im Moment niemandem beschreiben kann ... und es gibt ihr diese Sicherheit ... diese Lockerheit ... sie weiß tief drin, dass sie es weiß ... und so kannst Du, wenn Du nachher aufwachst und alles so ist, wie es vor Deinem Besuch hier war, ganz gelassen dem entgegen blicken, was kommt ...

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