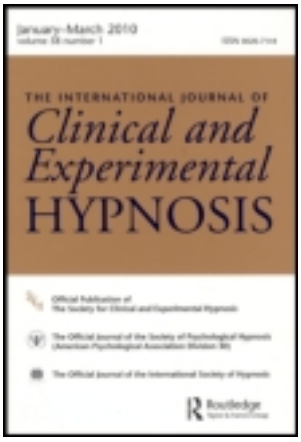
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Relaxation Versus Fractionation as Hypnotic Deepening: Do They Differ in Physiological Changes?

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RELAXATION VERSUS FRACTIONATION AS HYPNOTIC DEEPENING: *Do They Differ in Physiological Changes?*

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Abstract: After rapid hypnotic induction, 12 healthy volunteers underwent hypnotic deepening with relaxation or with fractionation (without relaxation) in a random latin-square protocol. Electroencephalographic occipital alpha activity was measured,

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low-resolution brain electromagnetic tomography was performed, and hemodynamics (stroke volume, heart rate, cardiac output, mean arterial blood pressure, forearm arterial flow and resistance) were monitored in basal conditions and after deepening. After relaxation, both forearm flow (−18%) and blood pressure (−4%) decreased; forearm resistance remained unchanged. After fractionation, a forearm flow decrease comparable to that recorded after relaxation was observed, but blood pressure remained unchanged, leading to an increase of forearm resistance (+51%). Central hemodynamics did not change. Alpha activity increased in the precuneus after fractionation only. In conclusion, both relaxation and fractionation have vasoconstrictor effects, but fractionation is also associated with an increase in peripheral resistance.

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As suggestions of relaxation are administered in the great majority of cases during induction and deepening, the current belief is that hypnosis is relaxing, at least from a subjective point of view. Nevertheless, relaxation is not necessary for reaching hypnosis, and many hypnotists currently prefer to induce and deepen hypnosis with alternative, nonrelaxing techniques (Banyai & Hilgard, 1976; Miller, Barabasz, & Barabasz, 1991).

Very few or even nothing is known about induction and deepening with and without relaxation on a cardiovascular point of view.

Deepening of the hypnotic state is crucial in every hypnotic session. In previous studies by our group where hemodynamics were recorded during hypnosis in an experimental setting (Casiglia et al., 2006, 2007, 2010; Casiglia, Mazza, et al., 1997), it was observed that neutral hypnosis decreased sympathetic discharge, with a significant reduction of peripheral resistance paralleling the subjective feeling of relaxation. Nevertheless, these studies were not specifically aimed at analyzing deepening of hypnosis, which was nothing more than a short, transient epiphenomenon in the road to realization of a mental image.

The pilot study presented herein was conceived to study selectively and specifically the effects of deepening of hypnosis on the cardiovascular system. To this aim, an experimental model was conceived to deepen hypnosis with two different methods, one including and one not including suggestions of relaxation.

Method

Participants

Twelve young, healthy, highly hypnotizable volunteers, whose general characteristics are summarized in Table 1, were studied. They were recruited among the medical and psychological staff of the University of Padova and previously defined as eligible for hypnosis

Table 1
General Characteristics of the 12 Participants at Baseline

	All ($n = 12$)	Group A ($n = 6$)	Group B ($n = 6$)
Men / women ratio	2 / 6	1 / 6	1 / 6
Age (years)	26.2 ± 4.1	26.3 ± 4.0	26.1 ± 3.9
Harvard hypnotizability scale (score)	9 ± 1	9 ± 2	9 ± 1
Systolic blood pressure (mmHg)	124.7 ± 17.6	124.6 ± 16.8	124.8 ± 16.9
Diastolic blood pressure (mmHg)	73.8 ± 6.5	73.6 ± 6.5	73.9 ± 6.6
Mean blood pressure (mmHg)	50.9 ± 12.7	50.8 ± 11.8	51.0 ± 12.1
Heart rate (bpm)	74.0 ± 15.8	74.1 ± 15.6	73.9 ± 16.1
Stroke volume (ml)	65.7 ± 35.1	65.7 ± 35.0	65.7 ± 35.1
Cardiac index ($l \times min^{-1} \times m^{-2}$)	3.0 ± 1.8	2.9 ± 1.5	3.1 ± 1.9
Total peripheral resistance ($mmHg \times min \times l^{-1}$)	21.8 ± 11.9	21.9 ± 12.0	21.7 ± 12.1
Forearm arterial flow ($ml \times min^{-1} \times dl^{-1}$)	5.3 ± 1.4	5.5 ± 1.5	5.4 ± 1.4
Forearm peripheral resistance ($mmHg \times min \times dl \times ml^{-1}$)	23.5 ± 6.1	23.6 ± 6.0	23.1 ± 5.8

Note. The two random groups were not different from each other.

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on the basis of a historical questionnaire, a confidential interview, and a Minnesota Multiphasic Personality Inventory 2 aimed at screening out and excluding any participants with a borderline personality, prone to show unwanted effects during hypnotic dissociation.

Hypnotizability was individually ascertained in each participant by means of the Harvard group scale of hypnotizability (De Pascalis, Russo, & Marucci, 2000). Participants were considered to be highly hypnotizable and eligible for the study if having Harvard Scale score ≥ 9.

Study Design

The study, whose general plan is summarized in Figure 1, was divided into a preliminary setting and an experimental setting.

Preliminary Setting

In the preliminary setting, all participants underwent individual hypnotic induction through verbal suggestions. The voice of an expert hypnotist guided each participant towards focusing his or her attention on a single idea, excluding any other external or internal stimuli.

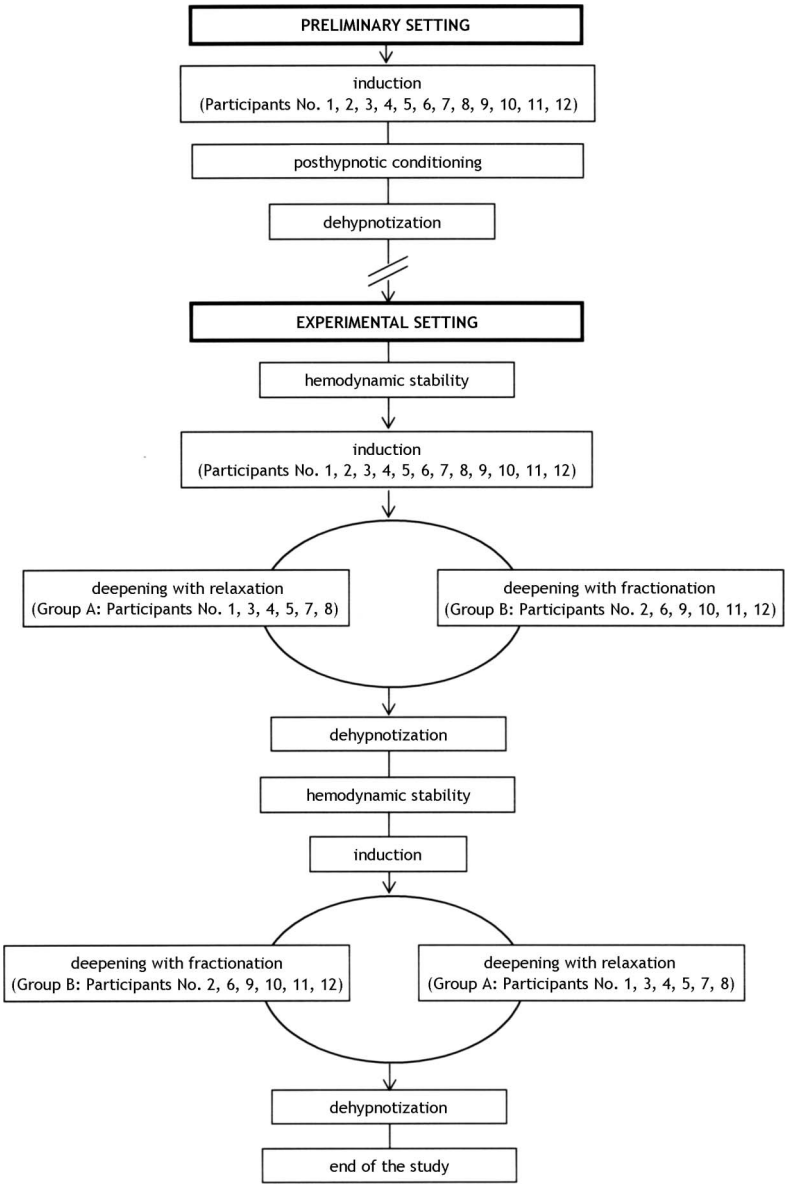


Figure 1. **General plan of the study. A preliminary setting aimed at preparing the participants and at programming posthypnotic conditioning was followed by a latin-square experimental setting where participants were their own controls. Group A and Group B: randomized groups of participants crossing over during the experimental phase.**

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Hypnotic induction consisted of a brief enumeration coupled with suggestions of eyelid heaviness and staring at a point. The verification of hypnosis was based on some signals, such as arm levitation, the easing of facial tension, a dropped lower jaw with a slight opening of the mouth, and slowing down of breathing rate. This phenomenological approach was sufficient to ascertain the presence of deep hypnosis. The analysis of these signals enabled the hypnotist to verify whether the participants were really hypnotized and to maintain or modify this condition by means of continuous appropriate suggestions.

The aim of this preparatory procedure was to establish a valid interpersonal rapport between the operator and the participant, in order to favor rapid and valid monoideism during the following experimental setting. To reduce the time needed for further inductions, posthypnotic conditioning to reach rapidly hypnosis was predisposed in all participants during this first phase. To this aim, the suggestion was given to reach immediately hypnosis when receiving the command "please, [name], relax" accompanied by a snap. The effectiveness of this conditioning was tested immediately before the end of the session. The participant was then dehypnotized and sent home.

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Experimental Setting

The participants underwent the experimental setting one day after the preliminary setting. They were assigned to Group A (participants number 1, 3, 4, 5, 7, and 8) or Group B (participants number 2, 6, 9, 10, 11, and 12) according to a random-number list. The instrumental devices described below (Figure 2) were applied. After resting in bed until hemodynamic stability was reached, each participant received rapid hypnotic induction in 10 seconds through the previously established posthypnotic command. Hypnosis was then deepened for 3 minutes through suggestions of relaxation (Group A) or using the fractionation technique (Group B).

Deepening with relaxation was reached through ideas of well-being, regular deep breathing, feeling of heaviness, and muscular relaxation, according to a well-known protocol already used with success in our laboratory (Casiglia et al., 2006, 2007, 2010; Casiglia, Mazza, et al., 1997).

Fractionation, a way to deepen hypnosis without relaxation described first by Hammond, Haskins-Bartsch, McGhee, and Grant (1987) and recently by Klein (2010), consisted of opening the eyes without emerging from hypnosis, then closing the eyes, and so on, repeatedly, with suggestion of going deeper and deeper each time the eyes were closed. In brief, after inducing the participant to hypnosis, the operator rapidly counted backward from 10, the participant being prepared to open his or her eyes at 0; then the operator reinduced hypnosis thorough the posthypnotic command, and so on six times

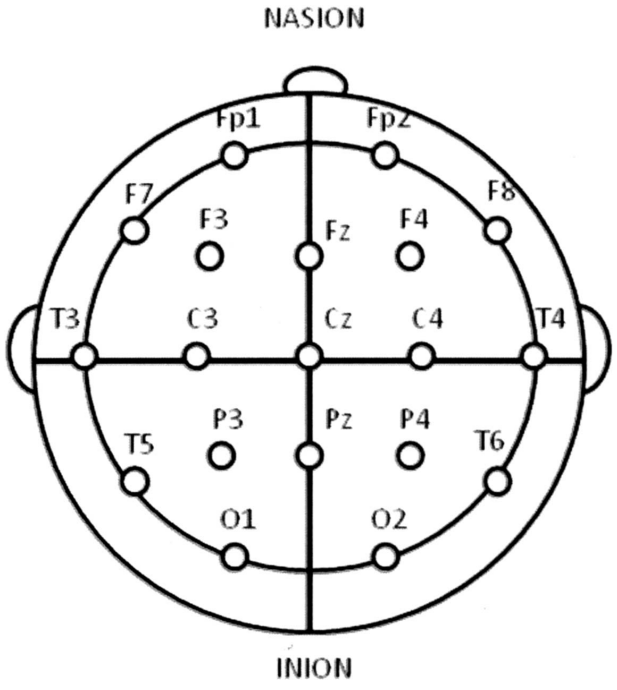


Figure 2. **The 10/20 international-system-prewired-19-electrode cuff.**

in 3 minutes. Count served as a de facto posthypnotic suggestion to induce hypnosis and was reinforced by a predetermined command. In fact, it is difficult to resist the double stimulus (to count and to do the command), and in a short time even participants denying their own ability to be hypnotized become convinced to be hypnotizable through their own responses to suggestions. It is likely that in such conditions the participant remains in hypnosis despite eye opening between one induction and another.

After this phase was concluded, the participant was dehypnotized and rested in bed until reaching hemodynamic stability.

Then, Group A and Group B were inverted as shown in Figure 1.

Cerebral Monitoring

Electroencephalographic Recording. The scalp and earlobes were cleaned with a mildly abrasive gel to remove any fat and dirt from the skin. Then a 10/20 international-system-prewired-19-electrode cuff was applied; the electrogel was injected into each electrode of the cuff plus the earlobes and prepared to keep impedance below 10 KΩ (Figure 2; Jasper, 1958). A linked-ear reference was used. The EEG

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was recorded with patients keeping their eyes closed at baseline, after deepening with relaxation and with fractionation (De Pascalis & Palumbo, 1986; Paskewitz, 1977) using the System Plus software coupled to a 31-channel BQ132S head; each recording session lasted 5 minutes. The signal was digitalized with a 0.05–70 Hz feed through band (sample frequency 256 Hz, 12-bit digital resolution, 244 nVxbit^{-1}). Ocular movement artifacts were monitored with two electrodes placed 1 cm to the left and 1 cm below the left *rima palpebralis*. All artifacts were removed offline from the EEG traces. Spectral analysis with fast-Fourier transformation was obtained from all derivations and the powers of delta, theta, alpha, and beta activity (in μV^{2}xHz^{-1}) were calculated. The EEG data were then processed with low-resolution brain electromagnetic tomography (LORETA) and the map of electrical activity distribution was obtained.

Localization of Sources of Cerebral Activity. To localize the presumptive sources of cerebral electrical activity recorded on the scalp, an inverse method based on LORETA was used (Pasqual-Marqui et al., 1999). This method is conceived to obtain a normalized minimal weighted solution aimed at minimizing the Laplace transformation by derivation of a reference-free source. Localization was obtained in relation to three coordinates: *X* for activities recorded from left to right, *Y* for those recorded in the postero-anterior sense, and *Z* for those recorded from depth to surface. Correction for the normalized coordinates of a neuroimaging anatomic atlas (Brett, Johnsrude, & Owen, 2002) were calculated in the frame of a grid ordered in 1,152 points localized inside a half-sphere. When compared to the bipolar leads, the LORETA has the advantage to detect the generators of cerebral electric activity without considering any a priori assumptions about the number and localization of the sources. Calculation of the reorganization of all parameters was performed by a special algorithm by derivation of a common mean reference.

Hemodynamic Monitoring

Arterial Blood Pressure. Arterial blood pressure was measured (in mmHg) by a Finometer PRO model-1 (Finapress Medical Systems, Amsterdam, Netherland), a standalone method providing beat-to-beat blood pressure recordings (Schutte, Huisman, van Rooyen, Malan, & Schutte, 2004). Mean blood pressure was calculated (in mmHg) from the area under the curve of continuous blood pressure recording.

Central Hemodynamics. The amounts of blood ejected from the left ventricle at each systole (stroke volume, in ml) and in 1 minute (cardiac output, in l $\times$ min^{-1}) were measured with an impedance cardiograph featuring enhanced bio-impedance signal morphology

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analysis (PhysioFlow TM-Lab-1, Manatec Biomedical, Ebersviller, France) (Richard et al., 2001).

Cardiac index (in $l \times min^{-1} \times m^{-2}$) was calculated by indexing cardiac output to body surface area calculated with the Du Bois formula (Du Bois & Du Bois, 1916).

Total peripheral resistance was calculated (in mmHg $\times$ min $\times$ $l^{-1} \times m^2$) from mean arterial blood pressure / cardiac index ratio.

Peripheral Hemodynamics. Forearm arterial flow was measured in $ml \times min^{-1} \times dl^{-1}{}_{tissue}$ with an automatic venous-occlusion strain-gauge plethysmographic fluximeter providing complete automation of occlusion/deflation times and pressures (Angiomed, Microlab, Padova, Italy). In brief, this system measures the slope of the curve of the increase of the segmental volume after occlusion by a cuff inflated at overvenous and underdiastolic pressure (50 mmHg) (Casiglia et al., 1996); in such conditions, volume increase is proportional to arterial flow, which can easily be extrapolated by inner software. Automatic calibration was provided before each determination. Forearm peripheral resistance was calculated (in mmHg $\times$ min $\times$ $ml^{-1} \times dl_{tissue}$) as mean arterial blood pressure/forearm flow ratio (Casiglia, 1996).

Procedure Validation

Cerebral monitoring, LORETA, and all the devices for hemodynamic monitoring are validated and have previously been employed with success in the same laboratory in many experimental conditions including hypnosis (Casiglia et al., 1992, 1994, 1996, 1999, 2000, 2006, 2010; Casiglia, Mazza, et al., 1997; Casiglia, Palatini, et al., 1998; Casiglia, Pessina, et al., 1997; Casiglia, Staessen, et al., 1998; Facco et al., 2009).

Statistical Analysis

A priori power analysis indicated that 10 participants included in a latin-square protocol, where participants were their own controls (Figure 1), were sufficient to show effects, if any, avoiding β error. Continuous variables were expressed as mean and standard deviation and compared with analysis of covariance and the Bonferroni's post hoc test. Statistics were adjusted for the covariates age, gender, body weight, and baseline values. Experiment-wise error rate was taken into account when considering significance levels. The trend within each curve, as well as the differences between the curves, were evaluated with the analysis of covariance for repeated measures. The null hypothesis was rejected for $p < .05$.

Ethical Aspects

This research adheres to the principles of the Declaration of Helsinki. All participants gave written informed consent to the procedure. Each

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one was preliminary and personally informed about the aims, methods, and possible risks of the procedure and had the opportunity to ask all questions that he or she considered necessary. The Ethics Committee of the University Hospital of Padova approved the protocol.

Results

Induction and General Trend of the Study

Rapid induction (~10 seconds) was obtained in all subjects thanks to previously established posthypnotic conditioning. After the end of the experimental procedure and dehypnotization, all subjects, independently of technique, referred pleasant hypnosis with subjective feeling of deepness of 78 ± 9% with fractionation and 76 ± 8% with relaxation ($p = .18$ between techniques).

Deepening With Relaxation

Cerebral Activity. Alpha activity (Figure 3) as well as beta, gamma, and delta activity were not different at baseline and after deepening with relaxation. The LORETA simply showed a mild increase of current density in the right hemisphere (Figure 4).

Hemodynamics

During deepening with relaxation, forearm flow decreased by 18% after the first minute; mean arterial blood pressure also decreased contextually and progressively, reaching –4% at the third minute. As a consequence of the combined reduction of arterial flow and pressure, forearm peripheral resistance remained around the baseline values (Figure 5). Central hemodynamics did not change significantly (Figure 6).

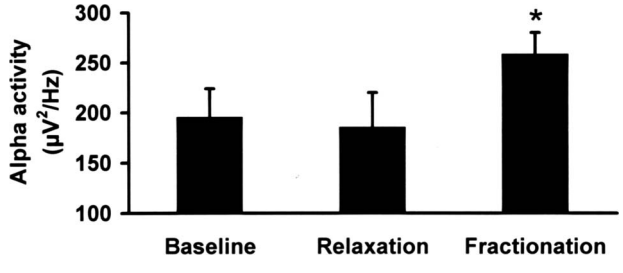


Figure 3. **Cerebral alpha activity recorded from scalp in CzO1 and CzO2 at baseline, during deepening with relaxation and during deepening with fractionation in 12 participants (*$p < .01$ vs. the other phases). Fractionation is associated to greater alpha activity.**

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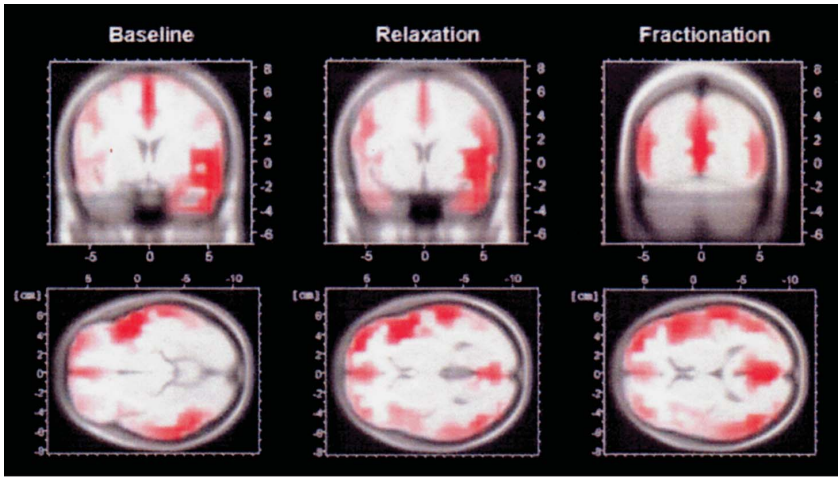


Figure 4. **Cerebral imaging obtained with low-resolution brain electromagnetic tomography (LORETA) at baseline and during hypnotic deepening with relaxation and with fractionation. Posterior and upper views in a male participant aged 28 years. Red intensity indicates density of current. Linear measures are in centimeters.**

Deepening With Fractionation (Without Relaxation)

Cerebral Activity. During deepening with fractionation, alpha activity significantly increased by 33% in comparison to baseline (Figure 3), while beta, gamma, and delta activities were not different in the two conditions. The LORETA showed an increase of current density in the occipital areas and in the precuneus (Figure 4).

Hemodynamics

A forearm flow decrease comparable to that recorded during relaxation was observed; nevertheless, mean blood pressure remained around the baseline values. The combined effect of these two hemodynamic variations was a progressive increase of forearm peripheral resistance that reached +51% at the third minute (Figure 5). Central hemodynamics did not change significantly (Figure 6).

Discussion

After many years passed inducing and deepening volunteers with slow techniques based on relaxation (Casiglia et al., 2006, 2007, 2010;

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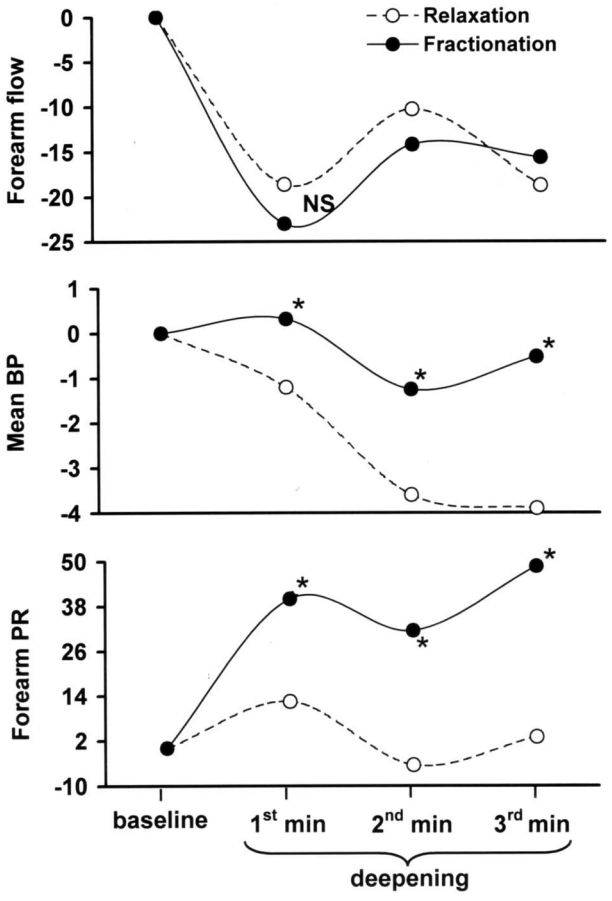


Figure 5. **Percent variation from baseline of forearm arterial flow (FF), mean arterial pressure (MBP), and forearm peripheral resistance (FPR) during hypnotic deepening with relaxation and with fractionation in 12 participants. The trend of FF is similar with the two techniques, while that of FPR is different, due to different pressor response (*$p < .01$ vs. the corresponding time of relaxation. *ns*: no significant difference between curves).**

Casiglia, Mazza, et al., 1997; Facco et al., 2009, 2011; Priftis et al., 2011), we decided to test a rapid technique for deepening hypnosis without relaxation in an experimental context. To this aim, fractionation was compared to relaxation.We demonstrated that the effects of deepening with relaxation and with fractionation are different in that the latter, but not the former, is accompanied by a significant increase of peripheral resistance and is therefore less relaxing than that obtained with relaxation on the basis of the cardiovascular response.

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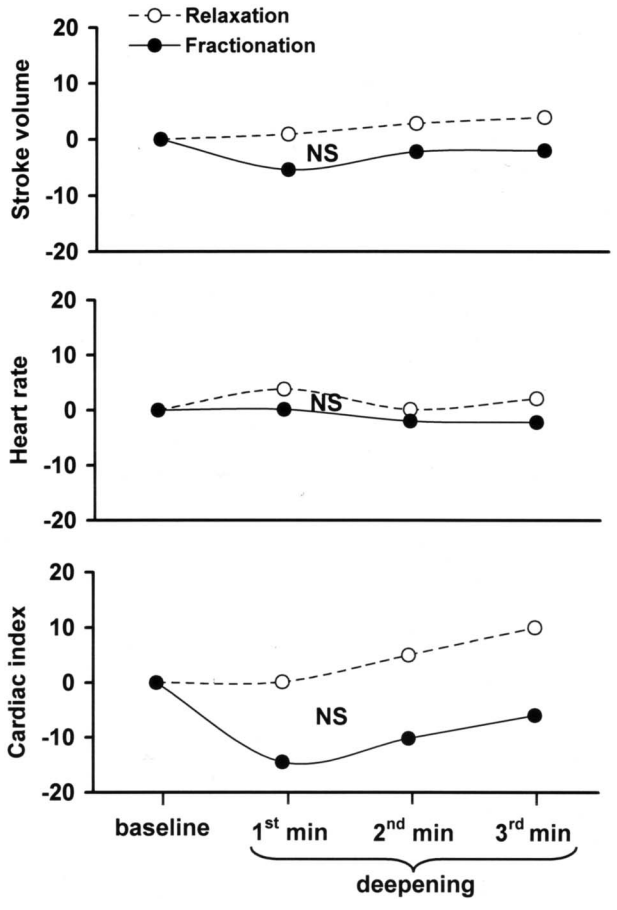


Figure 6. **Percent variation from baseline of stroke volume, heart rate, and cardiac index during deepening with relaxation and with fractionation in 12 participants (*ns*: no significant difference between curves).**

Fractionation (Hammond et al., 1987; Klein, 2010) is one of the most powerful and efficacious nonrelaxing ways to deepen hypnosis, particularly when induction has been obtained through a rapid technique or through posthypnotic conditioning (Klein, 2010). It consists of a rapid sequence of induction → dehypnotization → reinduction in a subject previously induced *via* another technique. The very impressive power of fractionation is explained by the fact that hypnosis is always accompanied in turn by hyperhypnotizability; when a subject comes out of hypnosis, he or she remains for a few moments in an unusual state of modified consciousness with reduction of his or her

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critical abilities. In such conditions, it is extremely easy to reinduce hypnosis without passing through the classic relaxation (Klein, 2010). Anyway, this operative explanation says nothing about the real chain of events leading to fractionation deepening and about its hemodynamic consequences. The electroencephalographic changes recorded in this experiment suggest that closed-eyes fractionation is accompanied by a shift of electric activity from frontal areas of the right hemisphere to the occipital areas bilaterally and to the precuneus. These modifications have previously been associated with reduced alertness and temporary distortion in representation of the self (Crawford, Kitner-Triolo, Clarke, & Olesko, 1992; Naish, 2010). It has also been observed that neutral hypnosis (relaxation) reduces while specific suggestions increase precunues activity (Rainville, Carrier, Hofbauer, Bushnell, & Duncan, 1999). Nevertheless, it is impossible to clarify whether or not the variations observed in the present experiment really produced deepening during fractionation or were nothing more than a mere epiphenomenon of fractionation.

Fractionation is generally unknown by psychologists, who do not use it because they do not need it. In fact, in psychotherapy, it is not necessary (or even counterproductive) to reach deep hypnosis, and slower techniques leading to mild detachment from reality are usually preferred (e.g., using inner images of stairs, back enumerations, and so on). On the contrary, when hypnosis is used in a medical context (surgery, dentistry, emergency) or in experimental setting, rapid methods to deepen hypnosis are of paramount importance.

Our results show that both classic deepening (with relaxation) and fractionation (without relaxation) are associated to vasoconstriction with reduction of peripheral flow as an index of increased sympathetic drive and must therefore be considered as stressing.Nevertheless, deepening via fractionation is also associated to an important rise in peripheral resistance, while in that with relaxation resistance remains around the baseline values, perhaps because the sympathetic arteriolar stimulation due to deepening is limited or masked by the concomitant commands of relaxation leading to blood pressure decrease. Deepening with relaxation is therefore less stressing.

Out of our research group, the cardiovascular response to hypnotic deepening has practically never been documented, and very simple responses (heart rate, blood pressure) to whole hypnosis rather than to induction or deepening per se have mostly been recorded (Amigo, Cuesta, Fernandez, & Gongalez, 1993; Clark & Forgione, 1974; Clawson & Swade, 1975; Grabowska, 1971; Hajek, Jakoubek, Kyhos, & Radil, 1992; Harris, Porges, Clemenson Carpenter, & Vincenz, 1993; Muck-Weymann, Joraschky, Hornstein, & Schmid-Schonbein, 1997; Muck-Weymann, Tritt, Hornstein, Mosler, & Joraschky, 1998; Ray et al., 2000; Sletvold, Jensen, & Gotestam, 1990). The specific response of

peripheral resistance to deepening has never been studied before. As we demonstrated in previous experiences (Casiglia et al., 2006, 2007, 2010;Casiglia, Mazza, et al., 1997; Facco et al., 2009), the analysis of peripheral resistance is necessary when studying hypnosis in a cardiovascular perspective. For instance, in the present work, the mere analysis of peripheral flow would fail to show the hemodynamic differences between fractionation and relaxation. In fact, as shown in Figure 5, both of them led to a comparable fall in forearm flow, while their different effects on sympathetic discharge could only be demonstrated by analysis of forearm peripheral resistance. Our inclination towards using resistance – rather than heart rate, blood pressure, or arterial flow – as a marker of the sympathetic drive derives from years of experience in other fields such as arterial hypertension (Casiglia et al., 1996; Casiglia, Palatini, et al., 1998; Casiglia, Staessen, et al., 1998), physical exercise (Casiglia et al., 1994; Casiglia, Pessina, et al., 1997), spinal cord injury (Casiglia et al., 1999), and heart transplantation (Casiglia et al., 2000). A less-aware research group, approaching the cardiovascular consequences of hypnotic deepening without this experience, could have decided to limit the analysis to blood pressure or flow, being misled to the erroneous conclusion that deepening with or without relaxation had the same cardiovascular effect.

The strength of this study is that it is deals for the first time with the crucial problem of the cardiovascular response to hypnotic deepening, underlying the stimulating, stressing effect of every technique, particularly of those performed without suggesting relaxation. Another strength is that the approach and the methods that are typical of human physiology were used to demonstrate the effects of hypnosis. The weakness is the limited number of participants and the fact that they were only chosen among those who were highly hypnotizable. This is a pilot study that needs to be confirmed in a larger number of participants. Finally, it is noteworthy that the two types of deepening had comparable effects on central hemodynamics, probably because stroke volume tends to change slowly being counterbalanced by reflex mechanisms, but the study design was not conceived to demonstrate late hemodynamic variations.

In conclusion, both fractionation and short-term relaxation may be appropriate techniques for deepening hypnosis. The final effect is full hypnosis in both cases. Both techniques seem to be stressing, increasing sympathetic tone. Fractionation is faster but significantly increases peripheral resistance.

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Entspannung versus Fraktionierung zur Hypnosevertiefung : Unterscheiden sie sich in bezug auf physiologische Veränderungen ?

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Abstrakt: Nach einer Turboinduktion durchliefen 12 gesunde Freiwillige eine hypnotische Vertiefung mittels Entspannung oder Fraktionierung (ohne Entspannung) nach einem randomisierten Lateinischem Quadratplan. Die occipitale alpha-Aktivität wurde elektroenzephalographisch gemessen, ein niedrig-auflösendes Hirn-MRT wurde angewendet, Vitalparameter (Schlagvolumen, Herzfrequenz, Auswurffraktion, mittlerer arterieller Blutdruck, arterieller Fluß im Unterarm und Widerstand) unter Normalbedingungen und nach Vertiefung aufgezeichnet. Nach Entspannung sanken Unterarmfluß (−18%) und Blutdruck (−4%), der Widerstand im Unterarm blieb unverändert. Nach Fraktionierung wurde ein Rückgang des Flusses im Unterarm ähnlich dem nach Entspannung beobachtet, der Blutdruck blieb jedoch unverändert, was zu einer Zunahme des Unterarm-Widerstandes (+51%) führte. Zentrake Vitalparameter veränderten sich nicht. Die alpha-Aktivität nahm im Precuneus nur nach Fraktionierung zu. Zusammenfassend läßt sich sagen, daß sowohl Entspannung als auch Fraktionierung beide vasokonstriktorische Effekte haben, Fraktionierung jedoch außerdem mit einer Zunahme des peripheren Widerstandes einhergeht.

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La relaxation et le fractionnement en tant que moyens d'approfondissement hypnotique : diffèrent-ils du point de vue des changements physiologiques?

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Résumé: Après une rapide induction hypnotique, 12 volontaires en bonne santé ont participé à un approfondissement hypnotique avec relaxation

ou fractionnement (sans relaxation) à l'aide d'une méthode aléatoire du carré latin. On a mesuré l'activité *électroencéphalographique* alpha occipitale, effectué une tomographie électromagnétique à basse résolution du cerveau, surveillé les signes hémodynamiques (volume d'éjection systolique, rythme cardiaque, débit cardiaque, pression artérielle, et pression et résistance artérielles à l'avant-bras) dans des conditions de base, suivant l'approfondissement hypnotique. Après la relaxation, la pression artérielle à l'avant-bras (−18%) et la pression artérielle générale (−4%) avaient diminué, mais la résistance artérielle à l'avant-bras était demeurée la même. Après le fractionnement, on a observé une baisse de débit à l'avant-bras comparable à celle enregistrée après la relaxation, mais la pression sanguine est demeurée inchangée, entraînant une hausse de la résistance artérielle à l'avant-bras (+51%). Les signes hémodynamiques centraux sont demeurés les mêmes. Le rythme alpha n'avait augmenté dans le précunéus qu'après le fractionnement. En conclusion, la relaxation, comme le fractionnement, produisent des effets vasoconstricteurs, mais le fractionnement entraîne également une augmentation de la résistance artérielle périphérique.

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Relajación versus fraccionamiento como profundización hipnótica: ¿Difieren en cuanto a cambios fisiológicos?

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Resumen: Después de una inducción hipnótica rápida, 12 voluntarios sanos fueron sometidos a una profundización hipnótica con relajación o con fraccionamiento (sin relajación) en un diseño aleatorio en cuadrado latino. Se midió la actividad electroencefalográfica occipital, se realizó una tomografía electromagnética del cerebro en baja resolución, y la hemodinámica (volumen de expulsión, ritmo cardiaco, gasto cardiaco, presión arterial sanguínea media, flujo arterial del antebrazo, y resistencia) se monitoreó en la condición basal y después de la profundización. Después de la relajación, tanto el flujo en el antebrazo (−18%) como la presión sanguínea (−4%) decreció, la resistencia en el antebrazo se mantuvo constante. Después del fraccionamiento, se observó un decremento en el flujo del antebrazo comparable al registrado después de la relajación, pero no hubo cambios en la presión sanguínea, lo que induciendo a una resistencia en el antebrazo (+51%). La hemodinámica central no cambió. La actividad alfa incrementó en el precúneo solo después del fraccionamiento. En conclusión, tanto la relajación como el fraccionamiento tienen un efecto vasoconstrictor, aunque el fraccionamiento también está asociado con un incremento en la resistencia periférica.

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