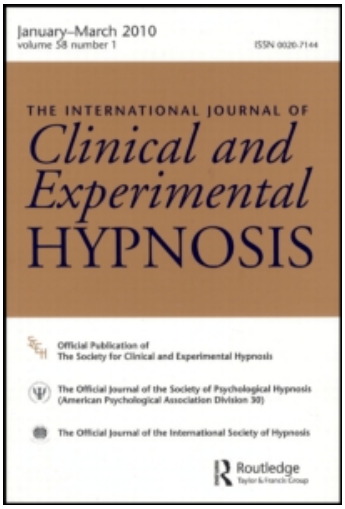

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The Relationship Between Hypnotizability, Internal Imagery, and Efficiency of Neurolinguistic Programming

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THE RELATIONSHIP BETWEEN HYPNOTIZABILITY, INTERNAL IMAGERY, AND EFFICIENCY OF NEUROLINGUISTIC PROGRAMMING[1]

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Abstract: Subjective scoring and autonomic variables (heart rate, skin conduction span) were used to verify the reality of inner experience during recollection of emotionally neutral, positive, and negative past events in 19 high (HH) and 12 low (LH) hypnotizable subjects in hypnotic and nonhypnotic experimental sessions. Also, the influence of hypnotizability on the effectiveness of an imagery-based neurolinguistic programming (NLP) technique was evaluated. Results demonstrated that subjective scores of image vividness and emotional intensity were significantly higher in the HH subjects compared to LH in both sessions. The past-events recollection was followed by increased autonomic activity only in the HH subjects. The NLP procedure was followed by decreased negative emotional intensity in both groups, but autonomic activity decline was observed in the HH subjects and not in the LH.

The search of neurophysiological underpinnings of imagery-generation processes and emotional experience may provide important clues for understanding of the emotional and perceptual integration processes in normal subjects and their disturbances under psychopathological conditions. The neural mechanisms of these phenomena are intensely investigated using contemporary neuroimaging methods. Usually the reexperiencing of past emotional events is applied to fulfill this goal, and it is important to achieve the true

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experience of imagery and emotions under experimental conditions. However, the majority of studies are mostly characterized by insufficient attention to selection of participants and experimental design that failed to control some crucial parameters of inner experience.

Self-imaging is also used for psychological recovering after traumatic negative events. It is commonly acknowledged that negative emotional experience can be a crucial ingredient of vulnerability to both anxiety and mood disorders. Neurolinguistic programming (NLP) comprises a substantial collection of frameworks, tools, and techniques and puts an emphasis on well-being and healthy functioning. Some NLP techniques of destructive emotions overcoming are based on introspective attentiveness and inward monitoring of past emotional events (Grinder & Bandler, 1979). The effectiveness of these procedures might greatly depend on qualities and attributes of the inner images, but such studies have not been performed.

It was shown that intensity of both imagery and affect processing depends on hypnotizability (Crawford, Clarke, & Kitner-Triolo, 1996; Crawford, Wallace, Nomura, & Slater, 1986; Gruzelier, 1998, 2000). Hypnotizability is a stable cognitive personality trait that has high test-retest reliability (Piccione, Hilgard, & Zimbardo, 1989) and correlates with imaginative involvement, vividness of imagery, sustained attentional abilities, and effortless experiencing (Crawford, Brown, & Moon, 1993; Gruzelier, 1998; Kumar, Pekala, & Cummings, 1996; Lichtenberg, Bachner-Melman, Ebstein, & Crawford, 2004). High hypnotizable subjects report more intense affect when viewing violent films (Crowson, Conroy, & Chester, 1991) and when experiencing positive and negative emotions (Crawford, Kapelis, & Harrison, 1995; Crawford et al., 1996).

Hypnotizability is mainly studied in association with hypnosis, when high hypnotizable persons show enhanced imaginary and holistic processing (Crawford, 1990; Crawford et al., 1986). The number of studies of imagery and emotions in a waking state in subjects with different levels of hypnotizability is smaller than in hypnosis.

The present work has two purposes. The first is the investigation of inner imagery and emotion modulation under hypnosis and waking conditions in carefully screened high and low hypnotizable individuals during past events recollection. The second aim is to evaluate how the hypnotizability level moderates the effects of imagery-based psychotherapeutic technique (two-step NLP approach) on regulation of a person's negative emotions. Subjective scoring together with autonomic variables analysis was used to verify the inner experience.

Method

Participants

Thirty-one volunteers, aged 21–55 years, participated in the study. Written informed consent for the investigation was obtained from all subjects.

All participants had been given a modified version of the small group version of the Stanford Hypnotic Susceptibility Scale (SHSS:C; Crawford & Allen, 1982) including six items (hand lowering, moving hands apart, mosquito hallucination, taste hallucination, arm rigidity, and dream). The scores varied from 0 to 5 for each item, and a mean scales score was calculated. Additionally, the experienced hypnotist evaluated the subject's hypnotizability. Nineteen subjects (16 women and 3 men) were selected as high hypnotizable (HH; mean hypnotizability $= 4.2 \pm 0.12$), and 12 subjects (6 women and 6 men) were selected as low hypnotizable (LH; mean hypnotizability $= 1.5 \pm 0.11$). Hypnotizability scores differed significantly between the groups ($p < .001$).

Procedure

Each subject participated in two experimental sessions: (a) under hypnosis and (b) in a waking state. Sessions a and b were carried out separately in 2 days.

Within the hypnotic session (HS), live hypnotic induction was performed by the hypnotist to obtain the true emotional experience. Hypnotic induction, leading to hypnotic relaxation, was followed by the hypnotist's instructions for the recollection of emotionally neutral and the most exciting positive and negative events from past experience. After each set of instructions, there was a 2-minute silence while subjects were told to continue experiencing the event. There were the following eyes-closed conditions in HS: (a) initial baseline period before hypnotic induction (background condition [BG]); (b) deep hypnotic relaxation after the hypnotic induction (R condition); (c) reexperiencing emotionally neutral (Neut condition); (d) positive (Pos condition); and (e) negative (Neg condition) past events.

The same conditions with the same events were included in the waking session (WS), but the hypnotic relaxation condition was replaced by an "inner silence" condition (IS condition) for intensifying the inner attention.

In both sessions, the subjects were given the instruction to recall the past events as active participants that involved the experience of different sensory modalities ("associated" recollection—A mode).

The sequence of positive and negative emotional conditions was counterbalanced across the subjects in both experiments.

Additionally, in the waking session, a two-step approach was utilized to overcome the disturbing negative emotions related to the past event. The first step included reexperiencing an emotionally negative past event in a "dissociated" (D) mode that implied watching the emotional event as a film on the inner screen, not being the participant. The next step included individually selected changes (transformation) of the submodal parameters of the "film" (i.e., color, distance, perspective, sound, etc. [T mode]; Grinder & Bandler, 1979). Changes were chosen in a way to get the maximum decrease of negative emotions intensity.

A short postexperimental interview (Crawford et al., 1996) was given to the participants in order to estimate the vividness of the recollected images and the intensity of the reexperienced emotions (on a scale of 1 to 10).

Recording and Data Analysis

The ECG and skin conduction (SC) were recorded. The period of data accumulation was about 2 minutes for each experimental condition. Mean heart rate (HR) and the span of SC fluctuations were evaluated. Individual SC span for each experimental condition was calculated as an averaged absolute deviation of momentary SC values from their mean for that condition.

Statistical Analysis

Statistical analysis of the obtained results was performed using SPSS 11.0 and STATISTICA 6.0 software.

Analysis of HR and SC span values in different conditions included repeated-measures analysis of variance (ANOVA). The ANOVA comprised the between-subjects factor *Hypnotizability* ($n = 2$: Group H vs. Group L), and the within-subjects factors *Session* ($n = 2$: hypnosis vs. waking), and *Condition* ($n = 4$: Relaxation [or Inner Silence] vs. Neutral vs. Positive vs. Negative event recollection). To assess the efficacy of the procedure of transformation, the comparison of three conditions (associated, dissociated, and transformed recollection of the negative event) was performed for high and low hypnotizable participants. Prior to ANOVA application, all HR and SC span data were transformed by Normal labels method (Terry, 1952).

A Greenhouse-Geisser correction was applied to all analyses of variance. The original F values, degrees of freedom, and ε-corrected p values are reported.

An analysis of contrasts of group means (subjective scoring points, HR, and SC span values) has been performed using nonparametric methods: the Wilcoxon's paired t test for related samples, and the

Mann-Whitney *U* test for independent samples. Means and standard errors are reported.

Results

Subjective Scoring

As a whole, the subjects reported experiencing the appropriately induced positive and negative emotions. Typical ruminations for negative emotions included reexperiencing accident, disease, quarrels with friends or relatives, death of relatives, death of a pet, etc. Some high hypnotizable subjects were tearful. Typical ruminations for happiness included reexperiencing very joyful times with friends or family, winning something, or getting an award.

Results of the subjective scoring of image vividness (ImViv) and emotion intensity (EmInt) are represented in the Table 1.

In the high hypnotizable subjects (HH group**)** the ImViv scoring during the recollection of all three events was high (mean values were from

Table 1
Intensity of Emotions and Vividness of Images for Neutral, Positive, and Negative Conditions During Hypnosis and Waking: The Contrasts Between the High and Low Hypnotizable Subjects Groups

Condition	Parameter	Groups		Level of Significance M-U
		Group H ($n = 19$) Mean *SE*	Group L ($n = 12$) Mean *SE*	
Hypnosis				
Neutral	Intensity of Emotion	5.75 ± 0.54	2.08 ± 0.72	$p < .001$
	Vividness of Images	8.33 ± 0.51	5.95 ± 0.76	$p < .05$
Positive	Intensity of Emotion	8.27 ± 0.35	5.33 ± 0.752	$p < .01$
	Vividness of Images	8.94 ± 0.39	5.58 ± 0.72	$p < .01$
Negative	Intensity of Emotion	8.50 ± 0.39	5.50 ± 0.81	$p < .01$
	Vividness of Images	8.26 ± 0.51	5.87 ± 0.68	$p < .01$
Waking				
Neutral	Intensity of Emotion	4.00 ± 0.55	1.70 ± 0.41	$p < .01$
	Vividness of Images	7.63 ± 0.61	4.66 ± 0.59	$p < .01$
Positive	Intensity of Emotion	8.11 ± 0.43	5.70 ± 0.94	$p < .05$
	Vividness of Images	8.63 ± 0.43	5.91 ± 0.74	$p < .01$
Negative	Intensity of Emotion	8.63 ± 0.42	4.66 ± 0.87	$p < .01$
	Vividness of Images	8.11 ± 0.47	4.70 ± 0.72	$p < .001$

8.3 to 8.9, Table 1) and did not differ between hypnotic and waking experimental sessions.

The EmInt was also high in the HH group. During the recollection of positive and negative emotional events EmInt mean values were from 8.1 to 8.6 and did not differ between HS and WS (Table 1). During hypnosis as well as during waking, positive and negative event recollections were followed by significantly more intensive emotions than the neutral condition ($p < .001$ relative to both positive and negative emotions in HS and WS). Thus, we concluded that sad and happy emotions were successfully induced in both experimental sessions.

The comparison of EmInt values in HS and WS has revealed only the higher intensity of positive emotion during the recollection of emotionally neutral event under hypnosis ($p < .05$) compared to WS (see also Table 1).

In the LH subjects, ImViv and EmInt were clearly lower compared to the HH ones in both sessions (Table 1). Mean values of the ImViv during the recollection of all three events varied from 5.6 to 6.0 balls under hypnosis and from 4.7 to 5.9 in waking (Table 1). The paired comparisons revealed that image vividness was significantly higher in HS compared to WS during the recollection of neutral (5.95 vs. 4.66, $p < .05$) and negative (5.87 vs. 4.70, $p < .05$) events.

EmInt mean values were from 4.7 to 5.7 points during the recollection of the emotional past events and did not differ between sessions in the LH group (Table 1). As well as in the HH group, EmInt in this group was significantly lower during the neutral event recollection in HS (2.1 ± 0.72, $p < .01$ relative both to positive and negative emotions) and in WS (1.7 ± 0.41, $p < .01$ both for positive and negative emotions (Table 1).

The comparison of the two groups has demonstrated significantly higher ImViv and EmInt subjective scores in the high hypnotizable subjects compared to low ones in both experimental sessions (Table 1).

Heart rate

Hypnotic session. Background mean heart rate (HR) values did not differ significantly between the groups and were 77.4 ± 3.30 min^{-1} in the HH group and 75.9 ± 4.14 min^{-1} in the LH group in HS. There were not any distinct changes under hypnotic relaxation condition in both groups. Further, during recollection of past events the HR dynamics clearly differed in experimental groups, Group x Condition: $F(3, 87) = 8.93$, $p < .001$.

In the HH subjects, HR increased during recollection of all past events and reached its maximum (91.2 ± 3.98 min^{-1}) under negative emotional condition. The comparison of four hypnotic states (four levels) has found the significant effect of condition, $F(3, 54) = 18.68$, $p < .001$) in this group. Paired comparison of mean values revealed significant HR increases during the recollection of neutral ($p < .01$),

positive ($p < .01$), and negative ($p < .001$) past events compared to the hypnotic relaxation condition. At that, HR was significantly ($p < .01$) higher under the negative event recollection condition compared to both positive and neutral ones (Figure 1).

In the LH subjects, HR did not change clearly during HS, and the effect of condition (four levels) was insignificant.

Planned comparison of the HR mean values between the groups revealed significantly ($p < .01$) higher HR in HH group in the condition associated with recollection of a negative event (Figure 1).

Waking session. The similar results were obtained in the waking session (Figure 1).

Background mean HR values were 74.5 ± 2.53 min^{-1} in the HH group and 73.6 ± 3.10 min^{-1} in the LH group in WS. Slight HR changes were observed under the inner silence (IS) condition in both groups.

In the HH group, HR values were higher during the past events recollection compared to the IS condition (Figure 1). HR maximum was recorded during negative event recollection (85.8 ± 3.30 min^{-1}). The comparison of the four experimental conditions revealed, as well as in HS, a highly significant effect of condition, four levels: $F(3, 54) = 7.89$,

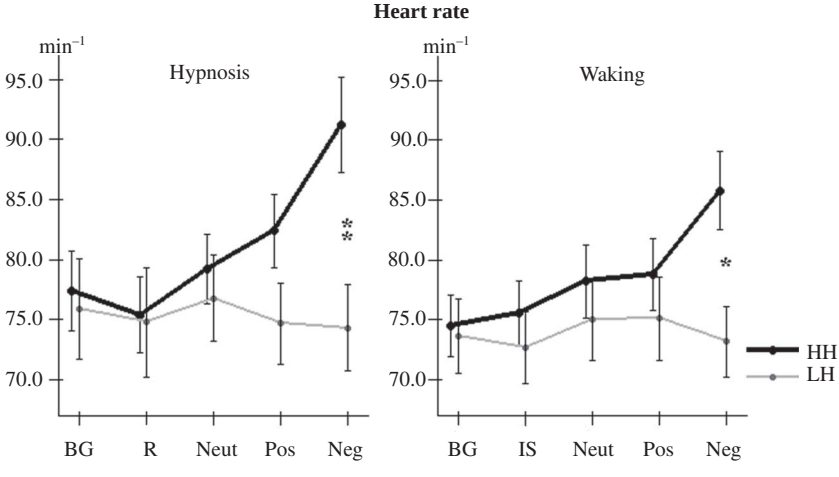

Figure 1. **Heart rate (HR) as index of emotional activation in the high (HH) and low (LH) hypnotizable subjects under hypnosis and in waking.**
Ordinate = Heart Rate; Abscissa = Conditions: BG = background, R = hypnotic relaxation (IS = inner silence condition), Neut = neutral event recollection, Pos = positive event recollection, Neg = negative event recollection.
Asterisks designate the significant between-group differences: * = $p < .05$; ** = $p < .01$.

$p < .001$. HR mean values were significantly higher during recollection of all past events compared to IS (Neut, $p < .05$; Pos and Neg, $p < .01$).

In the LH group, a slight increase of HR during the recollection of the three past events was also observed (Figure 1). Maximal HR was recorded under the Pos condition (75.1 ± 3.47 min^{-1}). The effect of condition was significant, four levels: $F(3, 30) = 3.44$, $p = .05$. A significant HR increase was found only for the Neut condition compared to IS ($p < .05$).

The between-group comparison of HR also revealed significance of a group and condition interaction in WS, $F(3, 84) = 4.08$, $p < .05$. Significant differences in the mean HR values between the experimental groups were revealed under the Neg condition (Figure 1).

There were no significant effects of session for HR values in both groups.

Skin Conductance Span

Hypnotic session. Under hypnosis in the HH group baseline SC span was 80.0 ± 26.1 and decreased to 60.3 ± 18.8 in hypnotic relaxation. During the recollection of past events, the SC span increased significantly in this group and reached its maximum (123.7 ± 32.9) during the recollection of negative events (Figure 2). A significant effect of condition was found, four levels: $F(3, 51) = 4.43$, $p < .05$. Mean SC span was significantly higher under the Neg condition compared to the R ($p < .05$) and Pos conditions ($p < .05$, Figure 2).

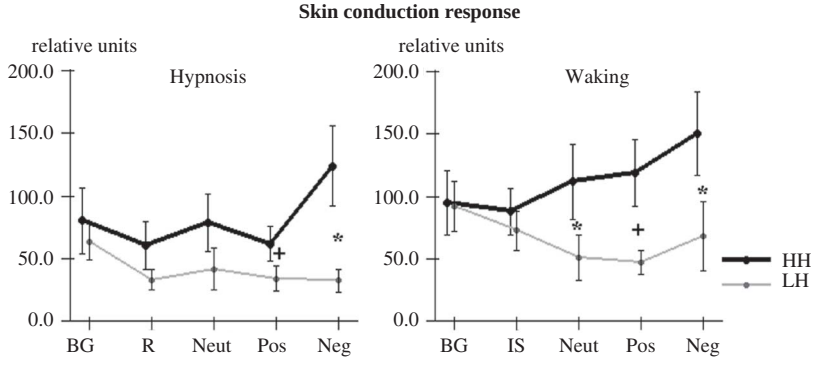

Figure 2. **Skin conduction response (SCR) as an index of emotional activation in the HH and LH subjects under hypnosis and in waking.**
Ordinate = SCR; Abscissa = Conditions. See Figure 1 for the designations.
Asterisks designate the significant between-group differences: + = $p < .1$; ∗ = $p < .05$.

In the LH group, the mean SC span in baseline was 63.4 ± 14.8 and decreased to 32.9 ± 8.0 in hypnotic relaxation ($p < .05$). SC span did not change significantly during the past events recollection (Figure 2).

The between-group comparison has not found any significant effects of *Group* in HS. However, mean SC span was significantly higher ($p < .05$) under the Neg condition in the HH group (Figure 2).

Waking session. In WS, the baseline SC span was 94.7 ± 25.9 and decreased to 87.8 ± 18.7 under the IS condition in the HH group. During the recollection of all events, the SC span was higher in this group than during inner silence (Figure 2), and it reached its maximum (150.3 ± 33.1) under the Neg condition; condition, four levels: $F(3, 54) = 2.72$, $p = .066$. Comparison of the mean values revealed significant a SC increase during the recollection of positive ($p < .05$) and negative ($p < .01$) events compared to IS.

In the LH group, the baseline SC span was 91.8 ± 19.9 in WS and decreased to 72.3 ± 16.1 under the IS condition. SC span did not distinctly change further (Figure 2).

The comparison of the two groups and four experimental conditions has demonstrated significant effect of group, $F(1, 28) = 6.03$, $p < .05$. The obtained results were related to higher SC span values in the HH group. A planned comparison revealed significantly higher SC span values in the HH group under Neut and Neg conditions ($p < .05$; Figure 2).

Figure 2 demonstrates that SC span values were higher in WS compared to HS in both groups; at that in the HH group, SC span changes were more consistent in the waking state. The analysis of session (two levels) and group (two levels) effects revealed the significant main effect of *Session*, $F(1, 28) = 6.98$, $p < .05$. The interaction of session and group was nonsignificant.

Overcoming Disturbing Emotions

The reasonable decrease of the emotion intensity subjective scores was observed in both experimental groups during the two-step procedure of the submodal parameters transformation of the inner images associated with a emotionally negative event (Figure 3).

High hypnotizable subjects. In the HH group, an EmInt decrease was found in 13 subjects (68.5%) during the dissociated recollection (D mode) of the negative past event. Group mean value of EmInt changed from −8.6 points during the associated recollection (A mode) to −6.97 points during the dissociated recollection ($p < .001$).

During the transformed recollection (T mode) of the negative event, all HH subjects demonstrated a clearly decreased intensity of the negative emotion. At that, in 3 subjects, EmInt became positive (from +3

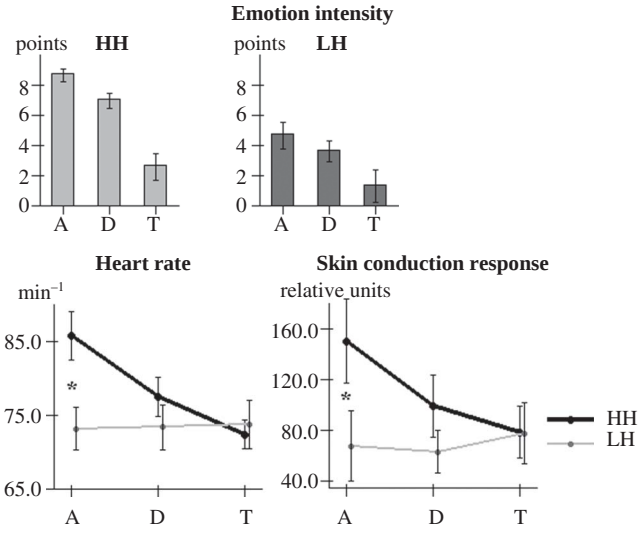

Figure 3. **The changes of negative emotion intensity subjective scores, HR and SCR during associated (A), dissociated (D), and transformed (T) modes of the negative event recollection in the HH and LH subjects (NLP procedure of the negative emotions overcoming).**

Ordinate = Subjective Scores of Emotion Intensity, Points—in HH and LH subjects (two upper plots, correspondingly), Heart Rate, min^{-1} (left lower plot); Skin conduction response, relative units (right lower plot). Abscissa = Modes of Negative Event Recollection.

Asterisks designate the significant between-group differences: $* = p < .05$.

to +8), and 1 subject reported about a drop of EmInt to zero. Group mean of EmInt dropped to -2.37 ± 0.85 points during the transformed recollection of a negative past event ($p < .001$ compared to D mode) (Figure 3).

In the HH group, an emotion intensity decrease was also verified by the clear HR and SC span changes during the transformation procedure (Figure 3).

HR decreased consistently from 85.8 ± 3.30 min^{-1} during A recollection of negative event to 77.5 ± 2.69 min^{-1} and 72.4 ± 1.9 min^{-1} during D and T recollection, respectively (A vs. D modes, $p < .001$; D vs. T modes, $p < .01$) (Figure 3). As expected, a significant effect of condition, three levels: $F(2, 34) = 25.50$, $p < .001$, occurred.

The dynamics of SC span changes was similar (Figure 3). SC span dropped from 150.3 ± 33.1 during A recollection to 99.5 ± 24.3 and 78.8 ± 20.1 during D and T recollection, respectively (A vs. D mode, $p < .01$; A vs. T mode, $p < .001$). The high significance of condition, three levels: $F(2, 34) = 15.85$, $p < .001$, was also revealed.

Remarkably, HR and SC span values during the transformed recollection of a negative event did not differ significantly from their origins.

Low hypnotizable subjects. In the LH group, the dissociated recollection of the negative event was followed by an EmInt decrease in 9 subjects (75%). EmInt group mean value declined from -4.67 ± 0.87 points during the A mode of recollection to -3.58 ± 0.69 points during D mode ($p < .001$) and to -1.3 ± 1.1 points ($p < .001$ relative D condition) during the T mode. Nine subjects reported a decrease in the intensity of negative emotion after the procedure of inner images transformation, and the valence of emotion changed to positive in two of them.

No significant HR and SC span changes were found during the NLP procedure in the LH group.

Between-group comparison of EmInt has revealed higher values in the HH group under A and D conditions ($p < .001$). EmInt did not differ between groups during the transformed recollection of the negative event.

The between-group comparison of HR revealed a significant interaction of group and condition, three levels, $F(2, 56) = 14.18$, $p < .001$. The group and condition (three levels) interaction was also significant for SC span, $F(2, 56) = 4.26$, $p < .005$.

Discussion

The obtained results demonstrated that the inner-image characteristics during the recollection of past events depended on hypnotizability score: Image vividness and emotion intensity were significantly higher in the HH subjects compared to the low ones in both sessions. Remarkably, past events recollection was followed by a pronounced increase of autonomic activity only in the high hypnotizable subjects in both experimental sessions. The results of the study clearly showed that during the recollection of the past events the high hypnotizable subjects exhibited the self-report and autonomic activity patterns quite similar to actual situations. The consistent negative emotion intensity decrease during the two-step NLP procedure was followed by a pronounced autonomic activity decrease in the HH subjects but not in the LH ones.

The comparison of hypnotic and waking sessions has shown some differences: (a) In the HH group the intensity of positive emotion under the "neutral" condition was higher in the hypnotic session; (b) in the LH group more vivid images were found during neutral and negative

event recollection in HS; and (c) during waking, SC span values were clearly higher under all conditions in both groups.

It was shown that LH as well as HH subjects undergo distinct functional changes in brain functioning with hypnosis, but the effects of hypnotic induction are often opposite in these groups (Gruzelier, 1998, 2000; Croft, Williams, Haenschel, & Gruzelier, 2002). In the HH subjects, left anterior inhibition, functional deficit of fronto-limbic supervisory attentional system, and enhanced right hemispheric processing were found under hypnotic condition (Gruzelier, 1998). Elevation of mood was noticed as an uncommon feature of hypnotic induction in hypnotizable subjects (Gruzelier, 2000). The latter is in line with the higher intensity of positive emotion under the "neutral" condition in the HH group in hypnosis compared to waking.

Previously, Crawford et al. (1996) found that subjective scores of emotion intensity and image vividness during past event recollection were markedly higher in hypnosis compared to waking in HH subjects. In contrast to these results, we have obtained very high EmInt and ImViv subjective scores in HH subjects in the waking session too. Perhaps, it was related to the instruction of active participation of the subject in the recollected event with the experience of different sensory modalities. However, only in the hypnotic conditions did we have to stop the experiment because of crying by the high hypnotizable participants (four cases); in the waking session, they were only tearful. This phenomenon might possibly be explained by the lack of behavioral control in high hypnotizable subjects under hypnotic condition (Gruzelier, 1998).

It was shown that in the LH subjects comparatively poor attentional abilities progressively improved through the hypnotic induction (Gruzelier, 1998). So, more vivid inner images in the HS in the low hypnotizable subjects were most likely related to enhanced attentional abilities under hypnosis in this group.

The obtained differences in SC span values between hypnotic and waking sessions are compatible with the Gruzelier (1998) results concerning the reduction in the tonic level of skin conduction and attenuation of arousal reactions in hypnosis. Thus, in both the Gruzelier's study and the present one, there is a suggestion that hypnosis involved functional inhibition of the amygdala that is responsible for excitatory influences on the electrodermal responses. Remarkably, this effect was similar in both groups. However, SC span differences between the two experimental sessions were more distinct in the HH group. HR parameters were not influenced by hypnosis; a fact that is yet unclear.

In the HH subjects, maximal HR and SC values were observed during the recollection of negative events in both sessions. These findings are in agreement with the results of recent electrophysiological

studies that have also demonstrated increased activation during negative compared to positive emotional experiences (Carretié, Mercado, Tapia, & Hinojosa, 2001; Baumgartner, Esslen, & Jäncke, 2006). At the same time, autonomic variables did not differ during neutral and positive event recollections in both sessions. There are two main reasons of the abovementioned lack of differences. The first one is the mild positive affect during the experience of a neutral event especially in hypnosis. Besides, increased autonomic activity was also previously observed during the tasks that involved internal attentional focus (e.g., remembering an event from the subject's past; Cole & Ray, 1985).

The two-step NLP procedure was very successful in the group of high hypnotizable subjects: A sharp decrease of negative emotion intensity was followed by distinct drop of autonomic activity.

According to the subjects' reports, the recollected events often took place many years ago, in some cases more than 20 years before the study. At that, all the participants were healthy subjects, did not have any complaints, and none of the subjects reported a history of psychiatric illness. Noteworthy that in accordance with the results of autonomic activity analysis the traumatic influence of the stored long-term memory negative events was strongly pronounced.

It is obvious that an associated mode of past event recollection, which implies the active participation of the subject in the remembered event, is accompanied by simultaneous activation of neural networks related to information processing of different sensory modalities (visual, audio, kinesthetic, etc.). Parts of the brain concerned to kinesthetic modality are the most tightly connected with the body, including the autonomic nervous system. There is growing evidence that the brain regions involved in encoding an episode are partially reactivated when that episode is later remembered. That is, the process of remembering an episode involves literally returning to the brain state that was present during that episode (Danker & Anderson, 2010). The obtained autonomic variables measures seem to suggest that the HH individuals display increased autonomic activity during the past events recollection not only because of a vivid reexperience of emotional events but also because of activation of autonomic activity traces in long-term memory related to the real event.

The "dissociated" mode of negative event recollection that implied the watching of the emotional event as a film on an inner screen would inevitably lead to the reduction of activity in the kinesthetic networks and autonomic activity decrease. This suggestion has been confirmed by a pronounced decrease of heart rate and skin conduction span values during the "dissociated" recollection of a negative event compared to the "associated" one in the HH subjects.

The procedure of the submodal parameter changes was followed by an even greater decline of emotion intensity subjective scores and

autonomic activity in the HH group. We might suppose that such individually selected transformation of inner images reduced their traumatic content. Furthermore, the dissimilarity between the original and transformed images had resulted in subsequent dissociation between the traumatic image, kinesthetic networks, and autonomic activity. It might be supposed that the NLP procedure used led to the rewriting of the event in long-term memory. This speculation is indirectly supported by the participants' reports that they (60%–70%) did not feel any negative emotions in connection with the negative event after a few months.

Whether psychotherapy techniques of emotion regulation lead to clear changes in patterns of brain activation is a question that has not yet been answered. Clearly short-term changes in brain activation were observed during voluntary emotion regulation (Schaefer et al., 2002). Observed decline of the autonomic activity during the NLP procedure in high hypnotizable subjects proves the possibility of changes in the brain networks. The impact of psychological interventions on brain networks to promote positive affect and the role of plasticity in the functioning of central circuitry of emotion regulation are considered in the literature (Davidson, 2004; Davidson, Jackson, & Kalin, 2000).

Low hypnotizable subjects have demonstrated only moderate decreases of negative emotion intensity subjective scoring without autonomic activity changes in dissociated mode of negative event recollection and during the procedure of the submodal parameter changes. Thus, the possibility of inner-image transformation influencing emotion regulation circuits and health is low in this group. However, LH subjects, in contrast to HH ones, are characterized by enhanced stability against stressful influences that is associated with weak traces in the long-term memory. This peculiarity has been revealed as low intensity of emotions and a lack of autonomic activity changes in the LH subjects during the past event recollections.

New research is essential to investigate the possibility of transforming brain circuits in adulthood with specific methods designed to regulate negative emotions and to cultivate positive affect.

The present results suggest several conclusions: (a) The level of hypnotizability is a valid trait for the selection of participants for the investigations of imagery generation processes; (b) the instruction of an active subject's participation in the recollected event with the experience of different sensory modalities is an appropriate model to attain a similar-to-actual-situation experience of past events outside of hypnosis; (c) heart rate and skin conduction changes are objective indices of the reality of inner experience; and (d) the ability to achieve the true inner experience is important for the efficacy of imagery-based psychotherapeutic techniques.

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Die Beziehung zwischen Hypnotisierbarkeit, innerem Vorstellungsvermögen und der Effizienz der neurolinguistischen Programmierung

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Abstract: Die Subjektive Bewertung sowie autonome Variablen (Herzfrequenz, Hautleitfähigkeitsniveau Spannweite) von 19 hoch (HH) und 12 schwach (LH) hypnotisierbaren Probanden wurden verwendet, um die Realität der inneren Erfahrung während der Erinnerung an emotional neutrale, positive und negative vergangene Ereignisse in hypnotischen und nichthypnotischen experimentellen Sitzungen zu prüfen. Außerdem wurde der Einfluss der Hypnotisierbarkeit auf die Wirksamkeit der bildbasierten NLP Technik ausgewertet. Die Ergebnisse zeigten, dass die subjektiven Bewertungen der Lebendigkeit der Bilder sowiederemotionalen Intensität in beiden Sitzungen in der HH-Gruppesignifikant höher lagenals in der LH-Gruppe. Auf dieErinnerung an vergangene Ereignisse folgte nur in der HH-Gruppe eine erhöhte autonome Aktivität.Das NLP Verfahren verursachte in beiden Gruppen eineVerringerung negativer emotionaler Intensität, wobei ein Rückgang autonomer Aktivitäten nur in der HH-Gruppe und nicht in der LH-Gruppe beobachtet wurde.

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La relation entre l'hypnotisabilité, l'imagerie intérieure et l'efficacité de la programmation neurolinguistique

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Résumé: Des scores subjectifs et des variables autonomiques (rythme cardiaque, délai de conduction cutanée) ont été utilisés pour vérifier la réalité de l'expérience intérieure durant le rappel d'évènements passés émotionnellement négatifs, positifs ou neutres, chez 19 sujets hautement hypnotisables (HH) et 12 sujets faiblement hypnotisables (FH), dans le cadre de séances expérimentales hypnotiques et non hypnotiques. L'influence de

l'hypnotisabilité sur l'efficacité de la technique de programmation neurolinguistique (PNL) basée sur l'imagerie mentale a également été utilisée. Les résultats ont démontré que les scores subjectifs de clarté de l'imagerie et d'intensité émotionnelle étaient significativement plus élevés chez les sujets HH que chez les sujets FH, et ce dans les deux séances. Le souvenir d'évènements passés n'était suivi d'une augmentation de l'activité autonomique que chez les sujets HH. La procédure de PNL était suivie d'une diminution de l'intensité émotionnelle négative dans les deux groupes, mais une baisse de l'activité autonomique a été observée chez les sujets HH et non chez les sujets FH.

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La relación entre hipnotizabilidad, visualizaciones internas, y eficiencia de la programación neurolingüística

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Resumen: Se utilizaron puntuaciones subjetivas y variables autonómicas (ritmo cardiaco, y periodo de conductividad de piel) para verificar la realidad de la experiencia interna durante la recolección de eventos pasados emocionalmente neutros, positivos, y negativos en 19 sujetos altamente (HH) y poco (LH) hipnotizables en sesiones experimentales hipnóticas y no-hipnóticas. También se evaluó la influencia de la hipnotizabilidad en la eficacia de una técnica de visualización de la programación neurolingüística (PNL). Los resultados demuestran que las puntuaciones subjetivas sobre lo vívido de las visualizaciones y la intensidad emocional fueron significativamente más altas en los sujetos HH comparadas con los LH en ambas sesiones. La recolección de eventos pasados fue seguida de un incremento en actividad autonómica sólo en los sujetos HH. Después del procedimiento de PNL, se registró un decremento en la intensidad emocional negativa en ambos grupos, sin embargo la diminución de actividad autonómica se observo en los sujetos HH y no en los LH.

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