Autonomic and psychological responses to an acute psychological stressor and relaxation: The influence of hypnotizability and absorption

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AUTONOMIC AND PSYCHOLOGICAL RESPONSES TO AN ACUTE PSYCHOLOGICAL STRESSOR AND RELAXATION: The Influence of Hypnotizability and Absorption¹

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Abstract: This study examined the influence of hypnotizability and absorption on psychological and autonomic responses to an experimental stressor and a relaxation procedure of 13 high and 13 low hypnotizable subjects. Heart-rate variability was the measure of autonomic reactivity. Absorption was found to be the only significant predictor of autonomic reactivity in both experimental conditions. Expectation and previous relaxation training, but not absorption or hypnotizability, predicted perceived relaxation in the relaxation condition. The results suggest that in a nonhypnotic context the influence of hypnotizability on responses to experimental conditions may be less prominent than the influence of absorption. Absorption may be associated with greater awareness of internal physical and psychological processes, and the results support previous clinical findings of positive correlations between absorption, subjective perception of autonomic arousal, and somatic symptom reporting.

INTRODUCTION

Hypnosis has been found to be useful in the treatment of a number of psychological, physiological, and psychosomatic disorders thought to
be stress-related. These include anxiety, sleep disorders, obesity, addictive behaviors, pain-related disorders, and gastrointestinal disorders (Brown & Fromm, 1987; Cheek & Le Cron, 1968). Researchers have shown effects of hypnotic suggestion on autonomic function for physiological variables such as peripheral skin temperature (De Pascalis, 1999; Maslach, Marshall, & Zimbardo, 1972; Raynaud et al., 1984; Roberts, Schuler, Bacon, Zimmermann, & Patterson, 1975). Also, several experimental studies of the effects of hypnotic suggestion on immediate- and delayed-type hypersensitivity skin reactions suggest that high hypnotizable subjects generally are more responsive, showing greater changes following hypnotic suggestion (Zachariae, 1996). In a study comparing the effects of guided imagery and relaxation procedures on functional immune measures (e.g., natural killer cell activity and lymphocyte responsiveness to mitogens), high hypnotizable subjects were generally found to exhibit greater changes than low hypnotizable subjects, regardless of the intervention procedure (Zachariae et al., 1994). It therefore seems possible that high hypnotizable subjects are more responsive to hypnotic suggestions to alter immune and other physiological variables. Little, however, is known of the influence of hypnotizability on autonomic responses to adverse stimuli, e.g., stress. In the study showing high hypnotizable subjects to be immunologically more responsive to guided imagery or relaxation procedures than low hypnotizable subjects (Zachariae et al., 1994), a small subgroup of participants was subjected to a mental stressor in the form of a mock IQ test. These preliminary results suggest that high hypnotizable subjects may be immunologically more reactive to a mental stressor than low hypnotizable subjects.

Absorption (Tellegen & Atkinson, 1974) generally shows modest correlations with hypnotizability (Council, Kirsch, & Grant, 1996; Glisky & Kihlstrom, 1993; Nadon, Hoyt, Register, & Kihlstrom, 1991). This personality trait is generally thought to reflect an ability to fully engage mental processes in the object of attention, whether it is another person or object (e.g., a picture or music) or a part of the self (e.g., heart rate, Shea, 1985) and has been defined as a “characteristic of the individual that involves an openness to experience emotional and cognitive alterations across a variety of situations” (Roche & McConkey, 1990, p. 92). Because subjects who are high in absorption may be highly engaged in their internal physical and psychological processes, they may be more sensitive to changes in these processes (Gick, McLeod, & Hulihan, 1997). Even slight discomfort may be attended to and amplified (Wickramasekera, 1986, 1998), leading to increased symptom report and rapid anticipatory conditioning to neutral stimuli. Positive correlations have been found between absorption and both somatic and psychological symptoms in student (Vassend, 1989) and clinical populations (Gick et al., 1997). Cancer patients experiencing anticipatory nausea and vomiting to chemo-
therapy have been found to score higher on absorption (Challis & Stam, 1992), and absorption has been found to predict the severity of symptoms in tinnitus patients (Mirz et al., 1999). These findings suggest that both hypnotizability and the correlated trait of absorption may explain part of the variance in physiological reactivity to different types of stressors.

The purpose of the present study was therefore to investigate the hypothesis that both high hypnotizable subjects and subjects scoring high on absorption will show greater psychological and psychophysiological reactions to an experimental stressor. Spectral analysis of heart rate variability (HRV) (Pagani et al., 1986; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996) was chosen as the dependent autonomic variable. In contrast to traditional autonomic measures (e.g., pulse rate, blood pressure, and skin conductance), which are associated with sympathetic nervous system activity, spectral analysis of HRV enables a more detailed noninvasive assessment of autonomic nervous system fluctuations. Increased sympathetic activity decreases HRV, whereas increased parasympathetic activity increases it. (Woo, Stevenson, Moser, Trelease, & Harper, 1992). The seemingly random beat-by-beat changes in the so-called R-R interval contain periodic components, the R-R interval being the time in milliseconds between two electrocardiographic complexes. In humans, two major components are of interest: a low-frequency (LF) and a high-frequency (HF) component, which are thought to be markers of sympathetic and vagal (parasympathetic) activities, respectively (Pagani et al., 1991; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). HF is thought to consist of several components, thereby representing parasympathetic modulation rather than “tone” (Hedman, Hartikainen, Tahvanainen, & Hakumäki, 1995). Measuring LF relative to the changes in the HF component (LF/[LF + HF]) serves as a marker of sympathovagal balance, with greater values representing a shift in sympathovagal balance toward sympathetic predominance.

We would expect then that the subjects, regardless of their hypnotizability or absorption scores, would exhibit greater sympathetic reactivity (LF) as well as greater parasympathetic reactivity (HF) during a mental stressor, compared to a control relaxation condition. Such findings would be concordant with results of previous investigations (Pagani et al., 1991; Zachariae, Jørgensen, Ehmrooth, Svendsen, & Bjerring, 1998). If high hypnotizable subjects and/or subjects scoring high on absorption are generally more reactive to stress, we would expect that high hypnotizable subjects and/or subjects scoring high on absorption would show greater sympathetic reactivity (LF) than low hypnotizable and/or low absorption subjects during exposure to a mental stressor. Due to the homeostatic counter-regulatory mechanisms, we would also
expect that high hypnotizable and/or absorption subjects would exhibit greater parasympathetic reactivity (HF) than low hypnotizable and/or absorption subjects during stress. If high hypnotizable and/or absorption subjects are more prone to respond with autonomic dysregulation when exposed to stress, we would expect greater LF/(LF+HF) values in this group, when compared to the low hypnotizable and/or absorption group. Finally, if high hypnotizable and/or absorption subjects are more responsive to suggestions to relax, greater HF activity would be expected in this group during relaxation, compared to the low hypnotizable and/or absorption group.

**Materials and Methods**

**Subjects**

The subjects were 26 psychology and medical students (12 female, 14 male; mean age, 27.5, range, 20-38) who, 1 to 3 years prior to this study, had been tested for hypnotic susceptibility with the Danish adaptation of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor & Orne, 1962; Zachariae, Molay, & Sommerlund, 1996). Thirteen subjects (8 females, 5 males) were high hypnotic susceptible subjects with a mean score of 10.23 (SD = 0.93), and 13 subjects (7 females, 6 males) were low hypnotic susceptible subjects with a mean score of 2.14 (SD = 1.03). All subjects had completed a brief physical health questionnaire and the Brief Symptom Inventory (Derogatis & Melisaratos, 1983) so as to exclude any subjects with possible physical, psychiatric, or stress-related symptoms. All subjects included in the study could thus be characterized as normal, healthy subjects.

**Procedure**

The subjects participated in two sessions at the same time of day (1 hour) on two separate mornings, 1 week apart. The subjects were randomly assigned to either a stress task on Day 1 and a relaxation control session on Day 2 or vice versa. The subjects reported to the hospital approximately 1 hour before the experiment and were asked to refrain from smoking and caffeine until after the experimental sessions. On both experiment days, the subjects completed the 14-item Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983) assessing the level of perceived stress during the previous 7 days. On Day 1, the subjects were asked to complete a Danish translation of the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974). Internal and test-retest reliabilities were shown to be acceptable (0.82 and 0.88, respectively) and comparable to those reported for the original U.S. version (Tellegen, 1982).

**Experimental Stressor**

The experimental stressor consisted of playing a computer game. The purpose of the game was to guide a “snake” through a maze, while
“eating” a number of colored circles in the maze. If the snake made contact with the walls of the maze or with its own tail and if the subjects did not touch the arrow keys on the computer keyboard for more than 4 seconds, the subject was given a mild electric stimulus (shock) on the lower part of the dominant leg. Before playing the game, the subjects were given a number of trial shocks so as to find a level that the subject would experience as unpleasant but would find it possible to endure for a period of 20 minutes. The subjects were asked to rate the degree of stress they expected to experience during the game on a 100 mm visual analogue scale (VAS) with the endpoint anchors no stress at all and maximum stress. The game was constructed so as to be so difficult that it would not be possible to avoid getting an electric shock. The subjects were asked to play the game for 20 minutes while being observed by one of the experimenters. The number of electric shocks received was monitored by the computer as a measure of how well the subjects were able to control the game. After completing the game, the subjects were asked to rate the degree of (a) stress experienced while playing the game, (b) their perceived influence on the number of shocks received, and (c) previous experience with similar computer games. These were rated on a VAS consisting of 100 mm lines with endpoints signifying none at all and maximum.

Relaxation

In the control relaxation condition, the subjects were instructed to lie down and listen to a prerecorded, music-assisted, progressive relaxation procedure lasting 20 minutes. Prior to relaxation, the subjects were asked to rate the degree of relaxation they expected to achieve on a VAS scale. After relaxation, the subjects were asked to rate on VAS scales the degree of experienced relaxation, experienced comfort, the ease with which relaxation was achieved, and previous experience with relaxation, yoga, or meditation techniques.

Heart Rate Variability

Autonomic activity was measured during the experimental conditions using the ElectroCard (Bang & Olufsen Technology, Struer, Denmark). The ElectroCard is a portable instrument that measures the heart rate and calculates LF (0.04 to 0.15 Hz), which is proposed to express the activity in the sympathetic nervous system but perhaps also includes vagal stimulation, and HF (0.15 to 0.50 Hz), which is thought to express vagal activity. The power density is calculated for the LF- and HF-components, respectively, and the LF-component relative to the sum of LF and HF, i.e., LF/(LF + HF). LF and HF are measured as ms²/Hz, and sympathovagal balance is measured in normalized units. The results were stored in a logger, and the data were transferred to a computer for subsequent analysis.
RESULTS

Hypnotizability, Absorption, and Gender

High hypnotizable subjects had a mean absorption (TAS) score of 22.2 (SD = 6.1) compared to a mean score of 16.8 (SD = 4.9) of low hypnotizable subjects. This difference was statistically significant, t(24) = 2.53, p < .02, two-tailed. Three of the high hypnotizable subjects scored below the median on the TAS, thus being defined as low absorption subjects, and 3 of the low hypnotizable subjects scored above the median on the TAS, thereby being defined as high absorption subjects. The Spearman rank-order correlation between HGSHS scores and scores on the TAS was .47, p < .02, two-tailed. In subsequent analyses, the results were compared for high and low hypnotizable and high and low absorption subjects. The results for men and women for all psychological and physiological variables were compared with t-tests for independent samples. No differences reached statistical significance, .15 < p < .99, two-tailed, and gender was therefore not included in subsequent analyses.

Condition

The results for LF, HF, and LF/(LF+HF) during the conditions of stress and relaxation are shown in Table 1. The results for each of the three dependent variables were analyzed with repeated ANOVAs with condition (stress-relaxation) as the within-subjects factor and high or low hypnotizability and high or low absorption as between-subjects factors. The results are shown in Table 2. The results of the analyses of variance (ANOVA) revealed significant within-subjects effects of experimental condition, with greater LF, HF, and LF/(LF+HF) reactivity found during stress, compared to relaxation. Significant between-subjects effects were found for absorption but not for hypnotizability. To control for perceived stress during the week prior to the experiments, PSS scores for the week prior to relaxation (8.4, SD = 1.7) were compared to PSS scores for the week prior to the stress condition (7.8, SD = 1.6) with t-tests for paired samples, indicating a nonsignificant trend, t(24) = 2.0; p = .053, two-tailed.

Stress

Autonomic reactivity. LF, HF, and LF/(LF+HF) during the stress condition were analyzed separately with two-factor ANCOVAs with hypnotizability and absorption as grouping factors, and expected stress, number of electric stimuli received during the computer game, and previous experience with similar computer games entered as covariates. An effect of absorption was found for LF, F(1, 16) = 5.2; p = .036, and HF F(1, 16) = 5.9; p < .027, but not for LF/(LF+HF). No effects were found for hypnotizability or any of the covariates. To investigate possible effects of
### Table 1

Mean (SD) LF Activity, HF Activity, and Sympathovagal Balance for Subjects With High and Low Hypnotizability and High and Low Absorption During Exposure to an Experimental Stressor and Relaxation

<table>
<thead>
<tr>
<th></th>
<th>LF (ms²/Hz)</th>
<th></th>
<th>HF (ms²/Hz)</th>
<th></th>
<th>LF/(LF+HF) (n.u.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stress</td>
<td>Relaxation</td>
<td>Stress</td>
<td>Relaxation</td>
<td>Stress</td>
</tr>
<tr>
<td>All (N = 26)</td>
<td>71.4 (78.5)</td>
<td>19.3 (9.7)</td>
<td>40.4 (43.3)</td>
<td>16.2 (12.5)</td>
<td>0.69 (0.14)</td>
</tr>
<tr>
<td>HGS HS High (n = 13)</td>
<td>92.5 (100.1)</td>
<td>20.5 (7.3)</td>
<td>41.8 (49.8)</td>
<td>17.8 (12.7)</td>
<td>0.73 (0.15)</td>
</tr>
<tr>
<td>HGS HS Low (n = 13)</td>
<td>50.4 (43.0)</td>
<td>18.1 (11.9)</td>
<td>39.0 (37.7)</td>
<td>14.6 (12.5)</td>
<td>0.65 (0.13)</td>
</tr>
<tr>
<td>TAS High (n = 13)</td>
<td>108.5 (93.8)</td>
<td>22.8 (10.7)</td>
<td>57.3 (49.6)</td>
<td>20.0 (13.6)</td>
<td>0.68 (0.14)</td>
</tr>
<tr>
<td>TAS Low (n = 13)</td>
<td>34.3 (32.3)</td>
<td>15.7 (7.5)</td>
<td>23.5 (10.7)</td>
<td>12.5 (10.3)</td>
<td>0.70 (0.15)</td>
</tr>
</tbody>
</table>
Table 2
Results of Repeated-Measures ANOVAs With Condition (Relaxation, Stress) as Within-Subjects Factor and Hypnotizability (High-Low) and Absorption (High-Low) as Between-Subjects Factors for LF, HF, and LF/(LF+HF)

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF (N = 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-Subjects (Condition)</td>
<td>9.40</td>
<td>1.22</td>
<td>.01</td>
</tr>
<tr>
<td>Between-Subjects (Absorption)</td>
<td>5.40</td>
<td>1.22</td>
<td>.03</td>
</tr>
<tr>
<td>Between-Subjects (Hypnotizability)</td>
<td>0.00</td>
<td>1.22</td>
<td>.97</td>
</tr>
<tr>
<td>Absorption × Hypnotizability</td>
<td>0.03</td>
<td>1.22</td>
<td>.87</td>
</tr>
<tr>
<td>HF (N = 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects (Condition)</td>
<td>7.50</td>
<td>1.22</td>
<td>.02</td>
</tr>
<tr>
<td>Between-Subjects (Absorption)</td>
<td>6.90</td>
<td>1.22</td>
<td>.02</td>
</tr>
<tr>
<td>Between-Subjects (Hypnotizability)</td>
<td>1.20</td>
<td>1.22</td>
<td>.28</td>
</tr>
<tr>
<td>Absorption × Hypnotizability</td>
<td>0.60</td>
<td>1.22</td>
<td>.45</td>
</tr>
<tr>
<td>LF/(LF+HF) (N = 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-Subjects (Condition)</td>
<td>5.90</td>
<td>1.22</td>
<td>.02</td>
</tr>
<tr>
<td>Between-Subjects (Absorption)</td>
<td>2.50</td>
<td>1.22</td>
<td>.13</td>
</tr>
<tr>
<td>Between-Subjects (Hypnotizability)</td>
<td>3.00</td>
<td>1.22</td>
<td>.10</td>
</tr>
<tr>
<td>Absorption × Hypnotizability</td>
<td>0.20</td>
<td>1.22</td>
<td>.68</td>
</tr>
</tbody>
</table>

perceived stress during the week prior to the experimental day, correlations between scores on the PSS and LF, HF, and LF/(LF+HF) during the stress condition were calculated. No associations were found between scores on the PSS and LF, \( r = -.08, p = .70 \); HF, \( r = .13, p = .50 \); or LF/(LF+HF), \( r = -.25, p = .24 \). Likewise, no correlations were found between perceived control over the stressor and the autonomic measures. All \( p \) values were two-tailed.

**Perceived Stress**

Perceived stress during the stress condition was analyzed with a two-factor ANCOVA with hypnotizability and absorption as grouping factors and expected stress, number of electric stimuli received during the computer game, and previous experience with similar computer games entered as covariates. No main effect was found, neither were effects of hypnotizability, absorption, or any of the covariates. There was a nonsignificant trend for high absorption subjects to report higher levels of perceived stress during the stressor (64.2, \( SD = 9.9 \)), compared to low absorption subjects (51.4, \( SD = 24.9 \)). To investigate possible effects of perceived stress during the week prior to the experimental day, correlations between scores on PSS and perceived stress during the stress condition were calculated. No association was found between scores on the PSS and perceived stress during the stress condition, \( r = -.13, p = .54 \), two-tailed.
Relaxation

Autonomic reactivity. LF, HF, and LF/(LF+HF) during the relaxation condition were analyzed separately with two-factor ANCOVAs with hypnotizability and absorption as grouping factors, and expected relaxation and previous experience with relaxation techniques entered as covariates. Although there was a nonsignificant trend for high absorption subjects to exhibit higher LF than low absorption subjects, no main effect and no statistically significant effects of either absorption, hypnotizability, or any of the covariates were found. To investigate possible effects of perceived stress during the week prior to the experimental day, correlations between scores on the PSS and LF, HF, and LF/(LF+HF) during the relaxation condition were calculated. No associations were found between scores on the PSS and LF, \( r = .01, p = .96; \) HF, \( r = .10, p = .64; \) or LF/(LF+HF), \( r = -.15, p = .48. \) All \( p \) values are two-tailed.

Perceived relaxation. Perceived relaxation during the relaxation condition was analyzed with a two-factor analysis of covariance (ANCOVA) with hypnotizability and absorption as grouping factors and expected relaxation and previous experience with relaxation techniques entered as covariates.

A main effect was found, \( F(5, 20) = 5.0, p = .01, \) as were significant effects of expected relaxation, \( F(1, 20) = 10.2, p < .01, \) and previous experience \( F(1, 20) = 10.2, p < .01. \) No significant effects were found for absorption \( F(1, 20) = 1.4, p = .26, \) or hypnotizability \( F(1, 20) = 3.0, p = .10. \) When comparing expected relaxation and previous experience with relaxation techniques for high and low hypnotizable and high and low absorption subjects with \( t \) tests for independent samples, no significant differences were found, \( .12 < p < .42. \) To investigate possible effects of perceived stress during the week prior to the day of the experiment, correlations between scores on PSS and perceived relaxation during the relaxation condition were calculated. No association was found between scores on the PSS and perceived relaxation, \( r = -.22, p = .28. \) A near-significant correlation, \( r = .39, p = .06, \) was found between expected relaxation and perceived relaxation. When calculating the correlation between expected relaxation and previous experience, no correlation, \( r = -.19, p = .34, \) was found. All \( p \) values are two-tailed.

Discussion

Stress

When we compared autonomic reactivity for the two experimental conditions, we found significant differences in the expected direction with greater responses during exposure to the mental stressor compared to the control relaxation condition. The results are in concordance with our previous findings (Zachariae et al., 1998) and indicate that the experimental stressor succeeded in eliciting an autonomic stress response.
Previous research suggests that high daily stress levels may enhance sympathetic, neuroendocrine, and immune reactivity to acute stressors (Pike et al., 1997). We, however, found no correlations between perceived stress in the previous week and either subjective or autonomic reactions to the stressor, and the volunteers in our study did not seem to be overly stressed, as indicated by the moderate scores on the PSS.

Absorption. When we analyzed the effects of hypnotizability and absorption on autonomic reactivity, absorption was found to be the only significant predictor, with high absorption subjects displaying both increased sympathetic and parasympathetic reactivity during exposure to the experimental stressor. This effect of absorption persisted when we controlled for other variables, including the number of shocks received during the stressor, expectation, and previous experience with similar computer games. Although effects of absorption were found for both LF and HF, no effects were found for sympathovagal balance (LF/[LF+HF]). This suggests that although high absorption is associated with greater sympathetic reactivity to the stressor, the increased reactivity is compensated for by an increased counter-regulatory increase in parasympathetic activity (HF).

Contrary to what we had expected, we were unable to find the expected effect of absorption on perceived stress during the stressor, though there was a nonsignificant trend in the expected direction. This marginal result may be due to several factors, one being the relatively low number of subjects in our experiment. A post hoc power analysis indicated a statistical power of 67% (alpha = 5%) and that, given the effect size found (.68; Cohen's $d$, Cohen, 1988), increasing the number of subjects to 36 would yield a statistical power of 81%. Another explanation could be that some subjects may have underreported their actual level of stress. A subgroup of subjects characterized as “emotional repressors” have previously been shown to exhibit greater autonomic reactivity during exposure to experimental stressors than other subjects, in spite of this group of subjects generally reporting low subjective stress during exposure (Weinberger, Schwartz, & Davidson, 1979). This construct of emotional repression is operationalized as low scores on a measure of negative affectivity (e.g., anxiety) in combination with high scores on the trait of defensiveness or social desirability (Weinberger, 1990). Future studies should therefore include a measure of defensiveness (e.g., the Marlowe-Crowne Social Desirability Scale, Marlowe & Crowne, 1977).

Hypnotizability. To our surprise, no significant effects were found for hypnotizability. When inspecting the results, high hypnotizable subjects did show a trend toward greater sympathetic activity during exposure to the stressor, and when we compared the mean LF values of high and low hypnotizable subjects, we found a mean difference corresponding to
a moderate effect size (0.54; Cohen's $d$, Cohen, 1988). But this was not statistically significant. Again power was an issue. A post hoc power analysis suggested that increasing the number of subjects from 26 to 66 would yield sufficient statistical power (81%) to detect a moderate effect size (0.25, Cohen's $f$). In contrast, we found a large effect size ($d = 0.95$) for the comparison of LF for high and low absorption subjects. Although we therefore cannot rule out the possible importance of hypnotizability in autonomic reactivity to experimental stress, the results suggest that the influence of hypnotizability may be less pronounced than the influence of absorption.

Absorption and hypnotizability were significantly and positively correlated, but the Spearman rank correlations coefficient of .47 obtained in this study of high and low hypnotizables cannot be safely compared to the Pearson Product-Moment correlations obtained in subjects across the entire spectrum of hypnotizability (as is the case in all other studies of which we are aware). Council et al. (1996) acknowledge that there is probably a small correlation between hypnotizability and absorption, even when measured separately. However, they argue that there is a more substantial effect of context. The subjects in our study all had their hypnotizability assessed one to three years prior to the study. Also, in this study no mention of hypnosis or hypnotizability was made, nor were the subjects aware that they had been selected on the basis of hypnotizability scores. Thus, it seems reasonable to conclude that, at least among our subjects, high hypnotizables were more likely than low hypnotizables to have a greater capacity for absorption, and that this relationship cannot be accounted for by contextual features. Of course, the absorption status of the bulk of hypnotic subjects (i.e., medium hypnotizables) cannot be discerned given our design. It may indeed be the case that absorption and hypnotizability share common ground with a capacity for imaginative involvement (Glisky & Kihlstrom, 1993). Our results, however, also suggest an important difference. The psychophysiological reactivity of high hypnotizable subjects may depend on whether the context is interpreted as hypnotic or not, whereas the trait of absorption may be less dependent on this factor. One possible explanation of the stronger influence of absorption found in our study, compared to that of hypnotizability, may therefore in part be due to the use of a nonhypnotic experimental context.

**Relaxation**

When inspecting the data, high absorption subjects exhibited greater mean LF and HF than low absorption subjects during the condition of relaxation. Analyses of variance, however, showed no effects of either hypnotizability or absorption for any of the autonomic responses to relaxation. We were thus unable to confirm our hypothesis that high hypnotizable and/or high absorption subjects exhibited greater para-
sympathetic reactivity during relaxation than low hypnotizable and/or low absorption subjects. The near-significant trend found between high and low absorption subjects in LF during relaxation suggests that the negative result may be due to the limited number of subjects in our experiment. The results for sympathovagal balance (LF/[LF + HF]), however, showed no such trend between high and low hypnotizable or high and low absorption subjects. The effect size found for hypnotizability was near zero ($d = .07$), and the effect size for absorption was negligible ($d = .20$). The results suggest that although we cannot rule out that high absorption subjects may respond with greater sympathetic reactivity during relaxation, this is clearly compensated by increased parasympathetic activity as indicated by the lack of differences in sympathovagal balance between high and low absorption subjects. It should be noted that our primary goal was to investigate the role of hypnotizability and absorption in autonomic reactivity to a stressor, and the relaxation condition was primarily included as a control condition. For practical reasons, we did not measure HRV in a resting control condition, and we are therefore unable to tell whether relaxation in general produced changes in HRV toward greater parasympathetic predominance. Our previously reported results, however, suggest that this could be the case (Zachariae et al., 1998).

An analysis of variance showed that expectation and previous experience with relaxation techniques were significant predictors of perceived relaxation, whereas neither hypnotizability nor absorption predicted this outcome measure. Expectation is thought to be an important component of the behavioral and physiological responses to placebos (Kirsch, 1997), e.g., in placebo treatment of pain (Montgomery & Kirsch, 1996), and previous experience or training in relaxation has been shown to enhance psychophysiological effects of relaxation (Green, Green, & Santoro, 1988; Hall, Minnes, Tosi, & Olness, 1992). Surprisingly, no correlation was found between expectation and experience, suggesting that both previous experience and expectation influenced perceived relaxation independently of each other.

**CONCLUSION**

We had expected both hypnotizability and absorption to be significant predictors of both autonomic and psychological outcome variables. Our hypotheses, however, were only partly confirmed, insofar as absorption emerged as the only significant predictor of autonomic responses across experimental conditions. This result persisted when we controlled for other factors, including expectation and previous experience, suggesting the effect of absorption to be reliable. Although the lack of significant effects of hypnotizability could be related to the limited number of subjects in our study, our results suggest absorption to be of greater importance for autonomic stress reactivity. The results suggest
that although the traits of hypnotizability and absorption may share certain aspects, the influence of hypnotizability may depend on the degree to which the context is similar to that of hypnosis. Absorption, on the other hand, may represent a more general, context independent tendency to engage in internal physical and psychological processes, thereby increasing the sensitivity of high absorption subjects to changes in these processes. Further studies investigating the effect of absorption in a normal, resting control condition are needed, and our results should be regarded as preliminary. The possible mediating role of hypnotic context in the influence of hypnotizability and absorption on stress reactivity also awaits further investigation.

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AUTONOMIC RESPONSES


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**Autonome und psychologische Reaktionen auf einen akuten psychologischen Stressor und Entspannung: der Einfluss von Hypnotisierbarkeit und Absorption**

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Réponses autonomes et psychologiques à un facteur de stress aigu et à une relaxation: influence de l'hypnotisabilité et de l'absorption

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Résumé: Cette étude a examiné l'influence de l'hypnotisabilité et de l'absorption sur des réponses psychologiques et autonomes à un facteur de stress expérimental et à un procédé de relaxation de 13 sujets hautement hypnotisables et 13 faiblement. La variabilité des pulsations cardiaques était la mesure de réactivité autonome. L'absorption s'est avérée le seul prédicteur significatif de la réactivité autonome en les deux conditions expérimentales. Les résultats suggèrent que dans un contexte non hypnotique, l'influence de l'hypnotisabilité sur des réponses aux conditions expérimentales, puisse être moins importante que l'influence de l'absorption. L'absorption peut être associée à une plus grande conscience des processus physiques et psychologiques internes, et les résultats montrent des résultats cliniques avec des corrélations positives entre l'absorption, la perception subjective de l'éveil autonome, et la part somatique du symptôme.

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Respuestas autonómicas y psicológicas a un estrés psicológico agudo y relajación: La influencia de la hipnotizabilidad y la absorción

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Resumen: Este estudio examinó la influencia de la hipnotizabilidad y la absorción en las respuestas psicológicas y autónomas a un estrés experimental y a un procedimiento de relajación en 13 participantes con alta y 13 con baja hipnotizabilidad. Usamos la variabilidad de la tasa cardíaca como medida de reacción autonómica. La absorción fue el único predictor significativo de la reacción autonómica en las condiciones experimentales. Las expectativas y entrenamiento previo en relajación, pero no la absorción o la hipnotizabilidad, predijeron la percepción de relajación en dicha condición. Los resultados sugieren que en un contexto no hipnótico la influencia de la hipnotizabilidad en las respuestas a las condiciones experimentales puede ser menos destacada que la influencia de la absorción. Tal vez la absorción esté asociada a una mayor conciencia de procesos internos físicos y psicológicos; los resultados confirman hallazgos clínicos previos de correlaciones positivas entre la absorción, la percepción subjetiva de excitación autonómica, y la experiencia de síntomas somáticos.

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