

## Absorption, Openness to Experience, and Hypnotizability

Martha L. Glisky, Douglas J. Tataryn,  
Betsy A. Tobias, and John F. Kihlstrom  
University of Arizona

Kevin M. McConkey  
Macquarie University, Sydney, Australia

Absorption, a correlate of hypnotizability, is conceptually related to openness to experience. Study 1 found no evidence that gender moderated the correlation between absorption and hypnotizability, or of nonlinear trends. Study 2 showed that openness was factorially complex, and that absorption was related to imaginative involvement, but not to social-political liberalism. Study 3 found small quadratic trends in the relations between these variables and hypnotizability; hypnotizability was related to imaginative involvement, but not liberalism. Study 4 confirmed differential correlations between absorption subscales and hypnotizability but failed to confirm the nonlinear trends. Implications for future studies of the correlates of hypnotizability, and for the nature of the “fifth factor” in personality structure, are discussed.

Over the past decade or so, personality psychologists have devoted increasing attention to personality constructs labeled *absorption* and *openness to experience* (McCrae & Costa, 1985a, 1990; Roche & McConkey, 1990). The roots of these constructs can be found in two somewhat different sources: the search for reliable personality correlates of individual differences in hypnotizability (deGroh, 1989; E. R. Hilgard, 1965; Kihlstrom, 1985) and the search for a concise, coherent structure of personality traits (Goldberg, 1981). Until very recently, however, the two lines of research have proceeded in parallel, largely independent of each other. The purpose of the present research is to begin the process of empirical and theoretical convergence.

The origins of the absorption construct lie partly in the effort, spanning more than 50 years, to uncover correlates of hypnotizability within the wider domain of personality and individual differences (for reviews, see deGroh, 1989; E. R. Hilgard, 1965; J. R. Hilgard, 1979). Subjects vary widely in their responses to standardized hypnotic procedures (E. R. Hilgard, 1965), but these individual differences are difficult to predict in advance. Building on earlier work by Shor (1960; Shor, Orne, & O'Connell, 1962, 1966), J. R. Hilgard (1965; J. R. Hilgard & E. R. Hilgard, 1962), and others, Tellegen and Atkinson (1974) showed that hypnotizable individuals were more open to, and more likely to have, subjective experiences in which their attention was fully engaged by some object or event, resulting in an altered sense of reality. In their original study, Tellegen and Atkinson (1974) introduced the Tellegen Absorption Scale (TAS), which has since been revised and included in Tellegen's (1982) Multidimensional Personality Questionnaire. Numerous studies have confirmed the original finding that openness to absorb-

ing and self-altering experiences (absorption, for short), as measured by the TAS, correlates positively with hypnotizability (e.g., Hoyt et al., 1989; Kihlstrom et al., 1989; for reviews, see deGroh, 1989; Roche & McConkey, 1990).

More recently, Tellegen (1987; see also Roche & McConkey, 1990) has redefined absorption as “a disposition, penchant, or readiness to enter states characterized by marked cognitive restructuring,” experienced as either narrowed or expanded attention, and a “readiness to depart from more everyday life cognitive maps and to restructure . . . one's representation of one's self and its boundaries.” In addition to documenting an association between absorption and hypnotizability, Tellegen and Atkinson (1974) found that absorption did not correlate with the superfactors of extraversion versus introversion and stability versus neuroticism, which are found on nearly all multidimensional personality inventories (see also Tellegen, 1982). This suggested that the absorption measure might be tapping a major but heretofore unappreciated aspect of normal personality.

In fact, two independent lines of investigation have incorporated absorption-like characteristics into a broader dimension of “openness to experience” (Coan, 1972, 1974, 1977; Costa & McCrae, 1976, 1978; McCrae & Costa, 1985a, 1985b, 1987, 1990). The origins of this research lie in the efforts, over the past half-century, to develop an adequate psychometric description of the structure of personality traits (e.g., Allport & Odbert, 1936; Cattell, 1946; for reviews, see John, 1989; Kihlstrom, 1988). As is well known, this work has converged on the “Big Five” structure composed of four temperamental dimensions (extraversion, agreeableness, conscientiousness, and emotional stability) and a fifth cognitive dimension (Digman, 1990; Goldberg, 1981; John, 1990; McCrae, 1989; Wiggins, in press). The precise nature of this fifth factor remains somewhat controversial, however: Norman (1963) characterized it as culturedness, whereas Peabody (1987) preferred intellectance; Coan (1972, 1974) and McCrae and Costa (1985a, 1990) have argued for openness to experience. For Coan, openness reflects emotional sensitivity, aesthetic interests, liberalism, independence, and

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Correspondence concerning this article should be addressed to Martha L. Glisky or John F. Kihlstrom, Department of Psychology, University of Arizona, Tucson, Arizona 85721.

flexibility. The definition by McCrae and Costa deemphasizes intelligence, intellectance, and culture and emphasizes richness of fantasy life, aesthetic sensitivity, awareness of inner feelings, need for variety in actions, intellectual curiosity, and liberal value systems.

This is not the place to settle the dispute over the nature of the fifth factor in personality structure, if for no other reason than that there may be more than five basic dimensions (Botwin & Buss, 1989; Briggs, 1989; Hogan, 1983; John, Angleitner, & Ostendorf, 1988; Peabody, 1987). Nevertheless, McCrae and Costa (1985a, 1990) have shown that openness is conceptually and empirically distinct from both intelligence and culturedness. In any event, absorption and openness to experience would seem to be conceptually related. After all, it would seem difficult to become absorbed in experiences if one had not previously been open to them in the sense of being willing to experience unusual events oneself. Indeed, McCrae and Costa (1985a, 1990) have acknowledged the research of Tellegen and Atkinson (1974) on the relations among absorption, extraversion, and neuroticism as a forerunner of their own work on the three-factor NEO (neuroticism, extraversion, openness) model of personality (e.g., Costa & McCrae, 1976, 1978).

Empirically, secondary analysis of a sample of 48 adults found significant correlations between absorption and openness to experience, especially with the fantasy, aesthetics, and feelings subscales of the openness measure (McCrae & Costa, 1985a). A more recent study by Radtke and Stam (1989) found that absorption was significantly correlated with openness to experience and hypnotizability; however, openness to experience was not significantly correlated with hypnotizability. In this article, we report research conducted independently of these investigators, using considerably larger subject samples, that bears on both the relation of absorption to openness, and the differential relations between absorption and openness on the one hand, and hypnotizability on the other.

### Study 1: Absorption and Hypnotizability

In the process of routine screening of subjects for hypnosis experiments, we have had the opportunity to collect additional data on the relation between absorption and hypnotizability. Although this correlation is well established, there have been some failures to find it, and some controversy about its exact nature (deGroot, 1989; Roche & McConkey, 1990). Accordingly, Study 1 sought to document this correlation in a local sample in order to establish the links between our research and that of other laboratories.

### Method

**Subjects.** Three separate samples totaling 959 undergraduates at the University of Arizona volunteered to participate in experiments on hypnosis and personality. In return for their participation, subjects received credit toward the research requirement of their introductory psychology course.

**Procedure.** The TAS is a 34-item questionnaire derived from Tellegen's (1982) Multidimensional Personality Questionnaire, and is intended to measure the degree to which the subject's "perceptual, motoric, imaginative, and ideational resources" can be committed to forming a "unified representation of the attentional object" (Tellegen

Table 1  
*Correlations Between Absorption and Hypnotizability: Study 1*

Sample	N	TAS		HGSHS:A		r
		M	SD	M	SD	
1	430	20.60	5.91	7.26	2.55	.23
2	370	20.01	5.79	6.58	2.55	.23
3	159	20.11	6.21	6.78	2.38	.17

Note. TAS = Tellegen Absorption Scale; HGSHS:A = Harvard Group Scale of Hypnotic Susceptibility, Form A.

& Atkinson, 1974, p. 274). The items in the scale cover a wide range of tendencies and have been shown by Tellegen (1981, 1982) to comprise nine related content clusters: (a) responsiveness to engaging stimuli, (b) responsiveness to inductive stimuli, (c) imagistic thought, (d) ability to summon vivid and suggestive images, (e) cross-modal experiences (e.g., synesthesia), (f) absorption in thoughts and imaginings, (g) vivid memories of the past, (h) episodes of expanded awareness, and (i) altered states of consciousness. The standard version of the scale is dichotomously scored on the basis of subjects' reports of whether each item is true or false for them.

After completing the TAS, subjects received a tape-recorded administration of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A). This procedure consists of a standardized hypnotic induction accompanied by suggestions for 12 representative hypnotic experiences. Responses to each suggestion are self-scored according to objective behavioral criteria. The subjects were run in groups of approximately 100 to 125 persons, and the experimental sessions lasted approximately 90 min.

### Results

Table 1 shows the average TAS and HGSHS:A scores for each of the three samples, and the correlations obtained between the scales. The scores on the TAS (overall  $M = 20.29$ ) and the HGSHS:A (using the revised criterion for posthypnotic amnesia proposed by Kihlstrom & Register, 1984;  $M = 6.92$ ) were similar to those typically obtained from large samples of college student volunteers. The correlation between TAS and HGSHS:A was significant in all three samples (mean  $r = .22$ , range = .17 to .23; all  $ps < .05$ ). Again, these values were similar to those obtained in similar samples (e.g., Hoyt et al., 1989; Kihlstrom et al., 1989; Nadon, Hoyt, Register, & Kihlstrom, in press).<sup>1</sup> Although these correlations may seem somewhat low, they are nonetheless representative of relations obtained with many different measures of hypnotizability, including those

<sup>1</sup> Recently, Council, Kirsch, and Hafner (1986) reported that the correlation between absorption and hypnotizability was context specific; that is, the correlation between the two measures was significant only when the Tellegen Absorption Scale was administered in a hypnotic context. This finding, in turn, would suggest that the correlation is an artifact of subjects' beliefs about their own hypnotizability. A subsequent study by deGroot, Gwynn, and Spanos (1988), however, found a context effect only for women, whereas two large-scale studies by Nadon, Hoyt, Register, and Kihlstrom (1991) found no evidence of context effects in subjects of either sex. To date, then, the construct validity of absorption has not been impeached by context effects.

that sample a broader range of hypnotic suggestions (e.g., Crawford, 1982; for a review, see deGroh, 1989).

Although most studies of the correlates of hypnotizability have emphasized the linear relations central to the basic personality prediction paradigm (Wiggins, 1973), more complicated patterns of association are theoretically possible. For example, deGroh (1989) has suggested that the relationship between absorption and hypnotizability may be characterized by heteroscedasticity and nonlinearity—in particular, low absorption subjects tend to be unsusceptible to hypnosis, but high absorption subjects divide about evenly between low and high hypnotizability. Although deGroh's (1989) point is well taken, it should be noted that heteroscedasticity and nonlinearity do not describe the same phenomenon in regression (Cohen & Cohen, 1983). Heteroscedasticity refers to unevenness in the variances of residuals around the regression line for different values of the predictor variable. Heteroscedasticity can occur in cases of linear relations, and nonlinear relations can be homoscedastic.

In order to investigate the hypothesis of heteroscedasticity, the three samples were combined to yield an aggregate sample of 959 subjects. Bartlett's test for homogeneity of variance was applied to this data, yielding  $\chi^2(11, N = 959) = 12.56, ns$ . Thus, the absorption-hypnotizability relation found in this data set was not characterized by heteroscedasticity.

The correlation between absorption and hypnotizability in this aggregate sample was  $r = .22$ . Following the general procedure used by Spanos, Brett, Menary, and Cross (1987), a 4 × 8 contingency table was constructed relating the two variables, as shown in Table 2. Dividing both variables at their medians showed that 52.8% (247 of 468) of low absorption subjects scored as highly hypnotizable, whereas only 34.8% (171 of 491) of high absorption subjects scored as unsusceptible. This pattern—more low absorption subjects are hypnotizable than high absorption subjects are unsusceptible—is repeated regardless of where the cut points are established. Under the assumption of linearity, one would expect these two proportions to be roughly equivalent. Thus, there does appear to be some departure from nonlinearity, but its direction is opposite to deGroh's (1989) prediction: In our data, high absorption subjects are infrequently unsusceptible to hypnosis.

A general test for nonlinearity is provided by a one-way analy-

sis of covariance (ANCOVA) of TAS scores, with HGSHS:A score serving as both independent variable and covariate. In this application, any linear trend ( $\eta$ ) is fully accounted for by the covariate, and any remaining significant effect of the independent variable (i.e., of HGSHS:A on TAS) represents the nonlinear component of the relation ( $\eta - \eta$ ), whatever shape that relation may take. In this sample, the effect of the covariate was highly significant,  $F(1, 946) = 49.39, p < .001$ , reflecting the correlation between absorption and hypnotizability; however, there was no evidence of a significant nonlinear trend,  $F < 1$ .

DeGroh (1989) has also suggested that the correlation between absorption and hypnotizability may be moderated by gender, such that the association between the two variables is greater for men than for women. Although there does not appear to be any theoretical reason to expect such a gender difference to occur, the aggregate sample was divided into subsamples of men ( $n = 332$ ) and women ( $n = 627$ ). The two absorption-hypnotizability correlations were identical (both  $r_s = .21$ ).

### Study 2: Absorption and Openness to Experience

Study 1 documented a reliable (though small) correlation between absorption and hypnotizability, but none of the samples analyzed included measures of openness to experience, more broadly construed. The purpose of Study 2 was to explore the relations between absorption and openness, with the latter construct being measured in two different ways.

### Method

This study involved two different groups of subjects. Sample A completed three measures of absorption and openness. Sample B was conceived as a cross-validation study, involving only two measures.

**Subjects.** Sample A consisted of 738 undergraduates at the University of Arizona who volunteered to participate in a study of personality. A total of 124 of these subjects were recruited from another experiment involving hypnosis and personality; the remaining 614 subjects were recruited independently of hypnosis. In return for their participation, subjects received credit toward the research requirement of their introductory psychology course.

Sample B consisted of 432 undergraduates at the University of Arizona. A total of 426 subjects completed the HGSHS:A.

**Procedure.** The personality questionnaire administered to the subjects in Sample A included the TAS, the Experience Inventory of Coan (CEI; 1972, 1977), and the Openness to Experience subscale of the NEO Personality Inventory (NEO-OE; Costa & McCrae, 1985). The contents of the TAS have already been described. The CEI consists of 83 items loading on seven factors (Coan, 1972, 1977): (a) aesthetic sensitivity, (b) the occurrence of unusual perceptions and associations, (c) openness to unusual and abstract ideas, (d) constructive use of fantasy and dreams, (e) openness to unconventional views of reality, (f) indulgence in fantasy, and (g) need for orderly thought (or the lack thereof). The NEO-OE consists of 48 items divided into six 8-item subscales (Costa & McCrae, 1985, 1989): (a) Fantasy (richness of fantasy life), (b) Aesthetics (aesthetic sensitivity), (c) Feelings (awareness of inner feelings), (d) Actions (need for variety in actions), (e) Ideas (intellectual curiosity), and (f) Values (liberal value systems).

Whereas the items in the standard versions of the TAS and CEI are dichotomously scored, the NEO-OE items are scored on 5-point Likert scales. In order to provide a consistent response format, the TAS and CEI scales employed in this study used the same 5-point scale as the

Table 2  
*Relation Between Absorption and Hypnotizability: Study 1*

TAS octile	HGSHS:A quartile				Total
	1	2	3	4	
1	27	24	31	16	98
2	24	28	35	20	107
3	24	43	33	37	137
4	21	30	43	32	126
5	21	35	40	28	124
6	18	27	27	53	125
7	19	17	28	39	103
8	8	26	49	56	139
Total	162	230	286	281	959

Note. TAS = Tellegen Absorption Scale; HGSHS:A = Harvard Group Scale of Hypnotic Susceptibility, Form A.

NEO-OE. The three scales were interleaved to form a single questionnaire of 165 items, which the subjects required approximately 30 min to complete. The subjects were run in groups ranging in size from 10 to 80 persons.

In Sample B, the subjects completed the TAS and the NEO-OE scales immediately prior to receiving the HGSHS:A. As before, the two scales were interleaved and presented as 5-point Likert scales. The subjects were run in groups of approximately 110 persons.

## Results

*Sample A.* The average scores for the entire sample of 738 subjects on each questionnaire were as follows: TAS,  $M = 79.63$ ,  $SD = 18.30$ ; CEI,  $M = 191.57$ ,  $SD = 30.72$ ; and NEO-OE,  $M = 120.60$ ,  $SD = 18.10$ . Considering differences in scaling, the average score for the TAS is comparable to that obtained in Study 1, and the mean for the CEI approximates the one reported by Coan (1977). The average NEO-OE score is comparable to norms for college students reported by Costa and McCrae (1989).

The total TAS, CEI, and NEO-OE scores were highly intercorrelated, with  $r$ s ranging from .71 to .85. More interesting were the correlations among the individual subscales. The 22 individual subscale scores were submitted to a principal-components factor analysis. The unrotated solution yielded a strong first factor accounting for 40% of the variance, and five factors had eigenvalues greater than 1 (a five-factor solution was also supported by the Cattell-Nelson-Gorsuch objective scree test; see Gorsuch, 1983). Table 3 shows the loadings of each of the

subscales on each of the five orthogonal factors in the rotated varimax solution. These factors may be characterized as follows, in terms of the factor-based subscales of the three questionnaires:

1. *Unusual Experiences*: unusual perceptions and associations, altered states of consciousness, constructive use of fantasy and dreams, episodes of expanded awareness, imagery ability, openness to unconventional views of reality, cross-modal experiences, and responsiveness to inductive stimuli.
2. *Aesthetic Responsiveness*: aesthetic sensitivity and responsiveness to engaging stimuli.
3. *Fantasy*: openness to fantasy, indulgence in fantasy, absorption in thoughts and imaginings, awareness of inner feelings, imagistic thought, and vivid reexperiencing.
4. *Openness to Ideas*: openness to unusual and abstract ideas and intellectual curiosity.
5. *Liberalism*: deliberate and systematic thought (7, note negative loading in Table 3), need for variety in actions, and liberal value systems.

It should be noted that Factors 4 and 5, representing openness to ideas and liberal value systems, respectively, are entirely products of the CEI and the NEO-OE. With the exception of imagistic thought, none of the TAS subscales shows substantial correlations with these factors.

Because many NEO-OE items were derived from the CEI, there was considerable redundancy between the two scales. Accordingly, in a second analysis the CEI subscales were omitted from the data and the correlation matrix refactored. The resulting principal-components solution yielded two factors accounting for 50% of the total variance (see the first two columns of data in Table 4). When rotated orthogonally, Factor 1 comprised all nine TAS subscales and the fantasy, aesthetic sensitivity, and feelings subscales of the NEO-OE; this factor may be labeled *absorption*. Factor 2 consisted of the remaining NEO-OE subscales and may be labeled *liberalism*.<sup>2</sup>

*Sample B.* The average scores for the entire sample of 432 subjects on each questionnaire were as follows: TAS,  $M = 84.47$ ,  $SD = 18.16$ ; and NEO-OE,  $M = 121.48$ ,  $SD = 18.26$ . These values, derived from a sample of volunteers for hypnosis research, are not substantially different from those yielded by the largely unselected sample in Sample A.

The total TAS and NEO-OE scores were highly intercorrelated,  $r = .68$ . The 15 individual subscale scores were submitted to a principal-components factor analysis. The unrotated solution yielded two factors with eigenvalues greater than 1, accounting for 50% of the variance. The third and fourth columns of data in Table 4 show the loadings of each of the subscales on

Table 3  
Factor Analysis of Absorption and Openness—Five-Factor Solution With Coan Experience Inventory: Study 2, Sample A

Subscale	Factor				
	1	2	3	4	5
Unusual Perceptions (CEI)	<b>75</b>	13	14	20	05
Altered States (TAS)	<b>74</b>	22	17	17	-01
Expanded Awareness (TAS)	<b>69</b>	09	23	09	07
Constructive Fantasy (CEI)	<b>69</b>	23	23	02	05
Vivid Images (TAS)	<b>66</b>	19	23	22	02
Unconventional Views (CEI)	<b>60</b>	21	19	00	32
Cross-Modal (TAS)	<b>55</b>	50	14	11	00
Inductive Stimuli (TAS)	<b>55</b>	43	32	13	-05
Aesthetics (NEO)	31	<b>81</b>	15	15	08
Aesthetic Sensitivity (CEI)	31	<b>76</b>	13	10	26
Engaging Stimuli (TAS)	28	<b>71</b>	26	13	09
Fantasy (NEO)	20	22	<b>77</b>	10	31
Fantasy Indulgence (CEI)	35	28	<b>76</b>	10	25
Absorption (TAS)	29	17	<b>68</b>	11	-10
Feelings (NEO)	10	57	<b>50</b>	16	00
Imagistic Thought (TAS)	29	13	<b>49</b>	33	33
Vivid Memories (TAS)	40	05	<b>47</b>	09	16
Unusual Ideas (CEI)	23	01	20	<b>85</b>	00
Ideas (NEO)	18	28	10	<b>83</b>	00
Orderly Thought (CEI)	-02	25	-03	20	<b>-79</b>
Actions (NEO)	10	32	06	18	<b>67</b>
Values (NEO)	01	28	00	18	<b>54</b>

Note. CEI = Coan Experience Inventory; NEO = NEO Personality Inventory; TAS = Tellegen Absorption Scale. Values in boldface indicate the factor to which each variable has been assigned.

<sup>2</sup> These factor analyses were repeated using common factors rather than principal components, leading to identical varimax solutions. Promax rotations (Tataryn & Wood, 1990) yielded five-factor oblique solutions that closely resembled the five-factor orthogonal solution reported in the text. When all three questionnaires were analyzed, the four factors representing absorption were highly intercorrelated,  $.51 < r < .77$ ; the fifth, representing liberalism, was virtually uncorrelated with the first four,  $-.16 < r < .07$ . When the Coan Experience Inventory subscales were eliminated from the analysis, the intercorrelations among the absorption factors,  $.66 < r < .81$ , were still substantially higher than the correlations involving the liberalism factor,  $.12 < r < .43$ .

**Table 4**  
*Factor Analysis of Absorption and Openness: Two-Factor Solutions Without Coan Experience Inventory*

Scale	Study 2 (Sample A)		Study 2 (Sample B)		Study 3 (combined sample)		HGSHS:A	
	1	2	1	2	1	2	<i>r</i> <sup>a</sup>	<i>r</i> <sup>b</sup>
<b>TAS factor</b>								
Engaging Stimuli	<b>52</b>	57	<b>64</b>	39	<b>58</b>	50	19	18
Inductive Stimuli	<b>72</b>	28	<b>72</b>	15	<b>73</b>	24	16	16
Imagistic Thought	<b>62</b>	14	<b>58</b>	23	<b>60</b>	17	07	09
Vivid Images	<b>69</b>	21	<b>72</b>	08	<b>71</b>	17	12	21
Cross-Modal	<b>60</b>	38	<b>69</b>	28	<b>65</b>	33	10	18
Absorption	<b>69</b>	09	<b>69</b>	00	<b>68</b>	06	07	10
Vivid Memories	<b>70</b>	-09	<b>59</b>	-05	<b>65</b>	-09	13	10
Expanded Awareness	<b>66</b>	11	<b>67</b>	11	<b>67</b>	10	06	20
Altered States	<b>74</b>	15	<b>75</b>	13	<b>75</b>	14	14	15
<b>NEO-PI facet</b>								
Fantasy	<b>55</b>	38	<b>57</b>	30	<b>54</b>	36	10	—
Aesthetics	<b>52</b>	60	<b>61</b>	45	<b>55</b>	54	14	—
Feelings	<b>49</b>	39	<b>42</b>	41	<b>47</b>	39	16	—
Actions	05	<b>72</b>	10	<b>73</b>	07	<b>73</b>	07	—
Ideas	37	<b>46</b>	38	<b>60</b>	38	<b>51</b>	08	—
Values	-07	<b>69</b>	-13	<b>73</b>	-09	<b>70</b>	06	—

Note. TAS = Tellegen Absorption Scale; NEO-PI = NEO Personality Inventory. Values in boldface indicate the factor to which each variable has been assigned.

<sup>a</sup> Study 3, correlation with the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A).

<sup>b</sup> Study 4, correlation with HGSHS:A (TAS only).

each of these orthogonal factors in the rotated solution. Again, Factor 1 comprised all nine TAS subscales and the fantasy, aesthetics, and feelings subscales of the NEO-OE, whereas Factor 2 consisted of the remaining NEO-OE subscales.

**Study 3: Absorption, Openness, and Hypnotizability**

Study 2 indicated that openness, far from being a homogeneous dimension of personality, consists of at least two different facets—which we have labeled absorption and liberalism—that are only modestly correlated with each other. This finding raised the question of whether these two facets of openness would show differential correlations with hypnotizability.

*Method*

*Subjects.* As indicated earlier, the samples in Study 2 consisted in part or entirely of subjects for whom hypnotizability scores were also available. Sample A (*N* = 738) includes the subset of 124 subjects who completed the TAS, CEI, and NEO-OE as well as the HGSHS:A; Sample B (*N* = 432) includes the 426 subjects who completed the TAS, NEO-OE, and HGSHS:A. Thus, of the 1,170 subjects in the aggregate sample, a total of 550 subjects contributed hypnotizability data to Study 3.

*Procedure.* In both hypnotizability subsamples, the personality questionnaire was completed immediately prior to the HGSHS:A, and in an explicitly hypnotic context. In addition, this study permitted an analysis of the relations among constituent factors of absorption/openness and of hypnotizability.

The extraction of subscales from the TAS and the NEO-OE was

described in Study 2. For the purpose of Study 3, the TAS and NEO-OE data common to Samples A and B were combined to yield an aggregate data set comprising 1,170 subjects. Factor analysis of the nine TAS and six NEO-OE subscale scores yielded a two-factor solution closely resembling those obtained in Study 2. The unrotated solution yielded two factors with eigenvalues greater than 1, accounting for 50.1% of the variance. The fifth and sixth columns of data in Table 4 show the loadings of each of the subscales on each of these orthogonal factors in the rotated solution. As in the analyses of the individual samples in Study 1, Factor 1 comprised all nine TAS subscales and the fantasy, aesthetics, and feelings subscales of the NEO-OE, whereas Factor 2 consisted of the remaining NEO-OE subscales.

*Results*

The mean HGSHS:A score for the aggregate sample of 550 subjects was 6.65 (*SD* = 2.58). The mean questionnaire scores were 84.00 (*SD* = 18.02) for the TAS, and 121.77 (*SD* = 18.35) for the NEO-OE; these are representative of the sample as a whole.

Table 4 (seventh column of data) shows the correlations between the personality measures and hypnotizability for the aggregate sample (a similar pattern of results was found when the two subsamples were analyzed separately). The correlations between total questionnaire scores and total HGSHS:A scores were *r* = .17 for the TAS, and *r* = .16 for the NEO-OE (for *N* = 540, *r* = .16 is significant at the .001 level, two-tailed).

The total scale scores of the aggregate sample were analyzed for evidence of gender differences. The aggregate sample was divided into subsamples of men (*n* = 211) and women (*n* = 339). For absorption, the correlation with hypnotizability was slightly

higher for women ( $r = .17$ ) than for men ( $r = .14$ ), in line with deGroh's (1989) hypothesis, but the difference did not approach statistical significance ( $z = 0.35$ ). For openness, the direction of the difference actually reversed (women,  $r = .14$ ; men,  $r = .18$ ), but again the difference was not significant ( $z = .46$ ).

Closer examination of the data from the total sample indicated that not all of the absorption and openness subscales showed equivalent correlations with hypnotizability (see Table 4). For the TAS, significant correlations with hypnotizability (i.e.,  $r > .08$ ,  $p < .05$ ) were obtained for the subscales measuring responsiveness to inductive and to engaging stimuli, altered states of consciousness, vivid imagery and memory, and cross-modal experiences. For the NEO-OE, significant correlations were obtained with the subscales measuring awareness of inner feelings, aesthetic sensitivity, and fantasy. Correlations differing by at least .09 are significantly different from each other, all  $t$ 's  $> 1.96$ , all  $p$ 's  $< .05$ . As a rule, the TAS subscales measuring responsiveness to engaging and to inductive stimuli were more strongly associated with hypnotizability than those measuring the occurrence of imagistic thought, absorption in thoughts and memories, and episodes of expanded awareness.

Unfortunately, determining whether each of these correlations differs significantly from any of the others involves a large number of  $t$  tests (36 for TAS subscales and 30 for NEO-OE subscales), increasing the likelihood of a Type I error. Accordingly, scales representing the two facets of openness, absorption (nine TAS subscales and three NEO-OE subscales) and liberalism (three NEO-OE subscales), were created by means of unit weighting. The correlation between hypnotizability and absorption, so defined, was  $r = .19$ ; the corresponding correlation with liberalism was  $r = .10$  (absorption and liberalism correlated  $r = .50$ ). The difference is significant,  $t(537) = 2.17$ ,  $p < .05$ .

As before, the hypothesis of nonlinearity between hypnotizability and absorption/openness was tested in the combined sample, examining only total scale scores (absorption or openness data were missing for a few subjects). As in Study 1, a  $4 \times 8$  contingency table was constructed relating the two variables, as shown in Table 5. Dividing both absorption and hypnotizability at their medians (top half of Table 5) showed that 46.4% (104 of 224) of low absorption subjects scored as highly hypnotizable, whereas only 37.4% (119 of 318) of high absorption subjects scored as insusceptible. For openness (bottom half of Table 5), the corresponding percentages were 47.3% (122 of 258) and 36.1% (103 of 285). Again, this pattern was repeated regardless of where the cut points were established. Thus, the results from this sample also indicated that the correlations between hypnotizability and both absorption and openness are largely a product of the fact that high absorption subjects are rarely insusceptible to hypnosis.

Figure 1A shows the mean TAS score for each of 12 values of the HGSHS:A, whereas Figure 1B provides the same information for the NEO-OE (as in Study 1, subjects with HGSHS:A scores of 0 or 1 were combined into a single group). Bartlett's test for homogeneity of variances was again nonsignificant: TAS,  $\chi^2(11, N = 542) = 6.21$ ,  $ns$ , and NEO-OE,  $\chi^2(11, N = 543) = 7.82$ ,  $ns$ .

As in Study 1, the ANCOVA using TAS scores showed a significant linear relation,  $F(1, 530) = 16.89$ ,  $p < .001$ . The nonlinear

Table 5  
*Relation Between Absorption, Openness,  
and Hypnotizability: Study 3*

Octile	HGSHS:A quartile				Total
	1	2	3	4	
TAS					
1	11	15	13	7	46
2	17	9	15	11	52
3	13	24	21	16	74
4	15	16	14	7	52
5	19	16	25	15	75
6	17	16	27	25	85
7	11	13	21	20	65
8	16	11	32	34	93
Total	119	120	168	135	542
NEO-OE					
1	12	17	19	8	56
2	21	12	15	10	58
3	18	16	23	15	72
4	14	26	18	14	72
5	12	16	23	21	72
6	15	14	20	23	72
7	13	9	20	19	61
8	14	10	30	26	80
Total	119	120	168	136	543

Note. TAS = Tellegen Absorption Scale; NEO-OE = Openness to Experience subscale of the NEO Personality Inventory; HGSHS:A = Harvard Group Scale of Hypnotic Susceptibility, Form A.

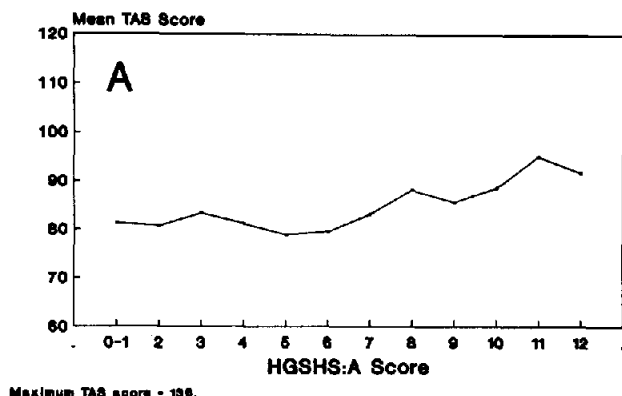
trend was not significant,  $F(10, 530) = 1.19$ ,  $ns$ . In the case of NEO-OE, the ANCOVA again yielded a significant linear relation,  $F(1, 531) = 16.57$ ,  $p < .001$ , but the nonlinear trend approached statistical significance,  $F(10, 531) = 1.79$ ,  $p < .06$ .

Analysis of both TAS and NEO-OE showed nonsignificant trends toward a nonlinear relation with HGSHS:A. Ordinarily, statistical analysis would stop at this point, but because a simple curvilinear relation has been specifically hypothesized by a number of investigators (deGroh, 1989; J. R. Hilgard, 1970), the nonsignificant trends were pursued. As can be seen in Figures 1A and 1B, the trends for both TAS and NEO-OE may be characterized as curvilinear. The hypothesis of a quadratic trend was tested using hierarchical multiple regression in which the linear trend is represented by the raw HGSHS:A score and the quadratic trend is represented by its square (Cohen & Cohen, 1983). By partialling out the linear trend, the remaining variance in TAS or NEO-OE accounted for by HGSHS:A tests for the quadratic trend. The specific test for a quadratic trend proved significant for both TAS,  $F(1, 539) = 4.99$ ,  $p < .05$ , and NEO-OE,  $F(1, 540) = 7.91$ ,  $p < .005$ , bringing the  $R$ 's to .20 and .21, respectively.

#### Study 4

Study 3 yielded some evidence for a nonlinear—specifically, a quadratic—relationship between absorption and openness, on the one hand, and hypnotizability on the other. However, this evidence was by no means strong: As noted, conventional

### Mean TAS Score Subjects Classified by HGSHS:A



### Mean NEO-OE Score Subjects Classified by HGSHS:A

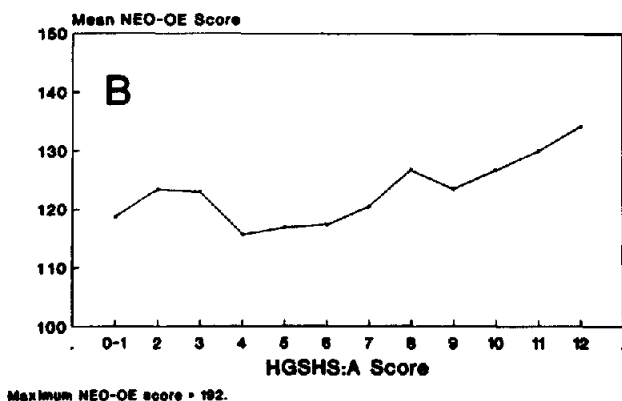


Figure 1. Mean Tellegen Absorption Scale (TAS; Panel A) and NEO Personality Inventory Openness to Experience (NEO-OE; Panel B) scores for subjects classified according to Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A) score (Study 3).

hypothesis-testing strategy probably should have terminated data analysis when the overall ANCOVA of Study 3 showed nonsignificant nonlinear trends, confirming the negative findings of Study 1. However, because nonlinear trends have been so frequently hypothesized in this area of research, we seized on any *F* ratio greater than 1 and used it as an excuse to perform a more detailed analysis for quadratic trends. The successful outcome of this analysis in Study 3 motivated a reexamination of the data in Study 1—again, despite the nonsignificant outcome of the general test for nonlinearity. Partialling out the linear trend, the quadratic trend was nonsignificant,  $F < 1$ . However, this failure to retrospectively confirm the quadratic trend may be mitigated by procedural differences between the two studies. Whereas the same version of the HGSHS:A was administered in both Study 1 and Study 3, the format of the TAS differed markedly: Study 1 used the conventional, dichotomous response format and Study 3 used a modified version with 5-point Likert scales. This shift in format increased the range of possi-

ble TAS scores, and thus permitted the expression of individual differences in absorption that might have been masked by the relatively restricted range of the dichotomous form. Accordingly, we collected another sample of TAS–HGSHS:A data, using 5-point Likert scales, in an attempt to replicate the results of Study 3.

#### Method

For all intents and purposes, this study was an exact replication of Study 3, except that the NEO-OE was not administered. A total of 724 college students completed the TAS immediately before receiving the HGSHS:A.

#### Results

The mean HGSHS:A score for the 724 subjects was 6.81 ( $SD = 2.42$ ), and the mean TAS score was 83.85 ( $SD = 19.67$ ). Thus, the sample analyzed in Study 4 was closely comparable to that of Study 3. The correlation between absorption and hypnotizability was  $r = .22$ ,  $p < .001$  (women,  $n = 482$ ,  $r = .20$ ; men,  $n = 242$ ,  $r = .24$ ).

The correlations between hypnotizability and absorption subscales are shown in the last column of Table 4. Although all of the correlations are statistically significant,  $p < .05$ , correlations differing by at least .08 are significantly different from each other, all  $t_s > 1.96$ , all  $p_s < .05$ . Again, a pattern of differential correlations emerged. As in Study 3, response to engaging stimuli was more strongly associated with hypnotizability than imagistic thought and absorption in thoughts and memories.

As in Studies 1 and 3, a  $4 \times 8$  contingency table was constructed relating the two variables, as shown in Table 6. Dividing both variables at their medians showed that 49.6% (175 of 353) of low absorption subjects scored as highly hypnotizable, whereas only 36.7% (119 of 318) of high absorption subjects scored as insusceptible.

As in Studies 1 and 3, for purposes of the analysis for nonlinearity, subjects with HGSHS:A scores of 0 or 1 were combined into a single group. As in Study 1, the ANCOVA using TAS scores showed a significant linear relation,  $F(1, 712) = 35.69$ ,  $p < .001$ , and a nonsignificant nonlinear trend,  $F(10, 712) < 1$ .

Table 6  
Relation Between Absorption, Openness, and Hypnotizability: Study 4

TAS octile	HGSHS:A quartile				Total
	1	2	3	4	
1	28	25	21	15	89
2	20	27	29	15	91
3	15	22	25	20	82
4	13	25	29	24	91
5	17	25	28	15	85
6	15	20	36	31	102
7	11	21	26	35	93
8	13	14	27	37	91
Total	132	179	221	192	724

Note. TAS = Tellegen Absorption Scale; HGSHS:A = Harvard Group Scale of Hypnotic Susceptibility, Form A.

The specific hypothesis of a quadratic trend was tested using hierarchical multiple regression in which the linear trend is represented by the raw HGSHS:A score and the quadratic trend is represented by its square (Cohen & Cohen, 1983). The specific test for a quadratic trend proved not to be significant,  $F(1, 721) < 1$ . Thus, both Study 1, using a dichotomous format for the TAS, and Study 4, using a Likert-scale format, failed to confirm the nonlinear, quadratic trends observed in Study 3.

### General Discussion

Four separate studies confirmed a significant association between absorption and hypnotizability, confirmed a strong link between absorption and a broader dimension of openness to experience, and found a significant correlation between openness and hypnotizability. More important, the size of these studies, involving more than 2,000 subjects, permitted more detailed analyses of the precise nature of the relationships among these variables than heretofore had been possible.

#### *Absorption, Openness, and Hypnotizability*

Although absorption has proved to be a fairly consistent predictor of hypnotizability, a correlation of .20 obviously leaves a great deal of the variance unexplained (deGroh, 1989), and a number of strategies have been offered as ways of enhancing it.

*Gender as a moderator.* For example, the results of this research offer no support for the hypothesis that the association between absorption (or openness, to which it is related) and hypnotizability is stronger for women than for men. In Study 1, the two correlations were identical. In Study 3, a difference favoring women on absorption was almost precisely reversed on openness. In Study 4, the trend favored men. Even with the large sample sizes used in these studies, none of the differences approached statistical significance. This is not to say, however, that gender might not moderate other correlations with hypnotizability (e.g., Gur & Gur, 1974), or that other variables might not moderate the absorption-hypnotizability association (e.g., Spanos et al., 1987). Nevertheless, it is worth remembering that the search for moderator variables has rarely panned out (Wiggins, 1973): Any claims concerning moderators probably should be accompanied by replication.

*Nonlinear relations.* Replication would also seem to be important with respect to the possibility that the significant correlation between absorption and hypnotizability, representing a linear trend, may obscure a more complex and interesting pattern of association. Study 3 provided some evidence for a quadratic trend in which the level of absorption (or openness) is relatively low for insusceptible subjects, but increases exponentially with hypnotizability. However, this trend was not confirmed by analysis of two other samples (Studies 1 and 4).

Although a more exact description of the relation between hypnotizability and absorption/openness eluded us, some departure from strict linearity is clearly indicated by the median splits. Across three studies, these consistently showed that the quadrant representing relatively low absorption (or openness) and relatively high hypnotizability contains a surplus of subjects. That is, whereas high-absorption subjects tend to be hypnotizable, low-absorption subjects are about equally divided between hypnotizable and insusceptible. Similarly, examination of the scatterplots reveals a fan-shaped relation between the two classes of variables (deGroh, 1989; Spanos et al., 1987). One possible explanation for the "fan effect" is that there are several

ways in which high hypnotizability scores may be achieved. One group of subjects, perhaps high in absorption, may actually experience the perceptual/cognitive alterations that are suggested to them, and behave accordingly; another group, lacking a capacity for absorption, might comply behaviorally in the absence of any compelling subjective experiences. These two groups would be indistinguishable on conventional measurements of hypnotizability, which rely on overt behavioral response and ignore subjective experience (Sheehan & McConkey, 1982).

*Differential correlations.* An extremely interesting finding in this research was the pattern of differential correlations observed between hypnotizability and absorption subscales. For example, responsiveness to engaging or inductive stimuli, as measured by the TAS, was consistently more strongly associated with hypnotizability than the occurrence of imagistic thought or episodes of expanded awareness, or absorption in thoughts and memories. Moreover, the subscales loading highly on the absorption facet of openness correlated more highly with hypnotizability than did subscales loading on liberalism. Although none of the subscale correlations exceeded  $r = .20$ , and thus failed the practical test of enhancing the prediction of hypnotizability, the pattern of differential correlates within the domains of absorption and openness is of theoretical interest and should be pursued. In this context, it is worth remembering that a large number of factor analyses of the hypnotizability scales converge on a three-factor solution representing the differences among ideomotor, challenge, and cognitive suggestions (e.g., E. R. Hilgard, 1965; McConkey, Sheehan, & Law, 1980; for reviews, see Balthazard & Woody, 1985, 1989). Thus, it would also be interesting to examine the entire pattern of correlations between facets of absorption and openness on the one hand, and of hypnotizability on the other (e.g., Farthing, Venturino, & Brown, 1983).

*Half empty or half full?* Thus, three strategies for enhancing the correlation between absorption and hypnotizability—moderator variables, nonlinear trends, and analysis of relations among subscales—failed us here. It may be that we will have to resign ourselves to  $r = .20$ . Although in some respects this may be disappointing, it is worth remembering that there are limits to which behavior in any specific situation, such as response to a hypnotic induction, can be predicted from knowledge of general personality attributes such as absorption or openness. In fact, Mischel (1968) proposed  $r = .30$  as an approximate upper limit on such correlations—a ceiling that has rarely been breached over the subsequent years.

Viewed in this context, a correlation of .20, repeatedly confirmed, does not seem so bad. In addition, Rosenthal (1990) recently issued a reminder that even such apparently low correlations may be reasons for celebrating. For example, studies of public health (e.g., the effects of aspirin on heart attacks or of AZT on AIDS) rarely if ever break the .30 ceiling. Yet the results of such studies are deemed to be of considerable practical significance. Viewed in this context, a replicable correlation of .20, yielding a binomial effect size display showing a difference of 60% versus 40% in the rate of high hypnotizability, begins to look even better.

#### *Aspects of Openness*

Turning to more general issues, the present study showed, as expected, a significant correlation between absorption and



measures of a broader dimension of openness to experience. However, despite the high correlations obtained, factor analysis indicated that the two dimensions are somewhat different. Scores on Tellegen's absorption scale were most closely associated with subscales of the Coan and McCrae-Costa openness measures that related to aesthetic sensitivity, unusual perceptions and associations, fantasy and dreams, unconventional views of reality, and awareness of inner feelings. By contrast, openness subscales measuring intellectual curiosity, openness to unusual ideas, need for orderly thought, variety in actions, and liberal values were highly related to each other, but relatively uncorrelated with absorption. Similarly, absorption—and the openness subscales related to it—was positively correlated with hypnotizability; however, hypnotizability was not correlated with the remaining aspects of openness.

These findings suggest that the present measures of openness to experience may have inadvertently conflated two dimensions of personality that should be kept separate. One, measured by Tellegen's absorption scale and some subscales of the openness measures, involves fantasy, dreams, imagery, and other aspects of attention and consciousness. The other, measured by the remaining openness subscales, involves intellectual curiosity on the one hand, and social/political liberalism on the other. Of course, curiosity and liberalism may also be somewhat separable dimensions, but they seem to be more closely related to each other than either is to absorption.

Of course, a common theme of "openness" does underlie all three domains—absorption, curiosity, and liberalism—which is probably why the three sets of items hang together when factor analyzed with others that have nothing to do with any of them. Thus, *openness* may be a good summary label for a broad dimension of individual differences, as it is on the NEO Personality Inventory (Costa & McCrae, 1985, 1989). However, more focused analyses of the correlates, determinants, and consequences of openness may find it more appropriate to maintain a distinction among its various aspects.

Some justification for this position is supplied by a detailed examination of the correlations among absorption, openness, and hypnotizability. Of the six openness subscales of the NEO-PI, those that were highly correlated with absorption also correlated with hypnotizability, whereas those representing curiosity and liberalism did not. External criteria other than hypnotizability might yield quite different patterns of correlation. Thus, electing to take nonrequired science courses might be correlated with curiosity, but not absorption or liberalism, and voting for political candidates of the Democratic party might be correlated with liberalism, but not absorption or curiosity. Moreover, each aspect of openness might be the product of different determinants. Thus, although both absorption and traditionalism appear to have significant genetic components (Tellegen et al., 1988; Waller, Kojetin, Bouchard, Lykken, & Tellegen, 1990), as does hypnotizability (Morgan, 1973), their precise genetic underpinnings may be quite different; furthermore, the environmental contributions to these individual differences may be different as well.

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