The Journal of Mind and Behavior
Autumn 1986, Volume 7, Number 4
Pages 515–540
ISSN 0271–0137

The Differential Organization of the Structures of Consciousness during Hypnosis and a Baseline Condition

Ronald J. Pekala

Coatesville V.A. Medical Center and Jefferson Medical College

and

V. K. Kumar

West Chester University

Patterns of consciousness associated with a baseline condition of eyes closed and an hypnotic induction condition were compared across individuals of differing hypnotic susceptibility. Phenomenological experience on 12 dimensions was quantified by the *Phenomenology of Consciousness Inventory* (PCI) and the relationships among the dimensions were diagramed. Results indicated that high susceptible subjects, vis-a-vis lows, reported experiencing a significantly different pattern of interrelationships among the PCI dimensions during the hypnotic induction condition in comparison to eyes closed. The nature of these pattern differences suggests that hypnosis has differential effects upon the organization of the reported phenomenological structures of consciousness for high and low susceptible subjects.

This paper presents a methodology to determine the changes in the pattern of phenomenological subsystems of consciousness in response to hypnosis. Its purpose is two-fold: (a) to present a methodology that makes possible the study of interrelationships among phenomenological subsystems of consciousness as reported via a self-report phenomenological state instrument and (b) to use the methodology to investigate the organization of the structures of consciousness during hypnosis and a baseline condition for low, medium, and high susceptible subjects. It was hoped that a study of the interrelationships among various phenomenological subsystems of consciousness would allow for an evaluation of the possible differential phenomenological effects of hypnosis vis-a-vis a baseline condition. Furthermore, by examining for the differential pattern of interrelationships across low, medium, and high susceptible subjects, it was also

The authors wish to thank E.R. Hilgard, Ph.D., Steven Pashko, Ph.D., and seven anonymous reviewers for their helpful comments on an earlier version of this paper. Requests for reprints should be sent to Ronald J. Pekala, Ph.D., Psychology Service (116B), Coatesville V.A. Medical Center, Coatesville, Pennsylvania, 19320.

hoped to obtain a broader picture concerning the phenomenological effects of hypnosis as a function of individual differences.

Assessment and Quantification of Phenomenological Experience

Pekala (1982) has developed a retrospective, self-report instrument, called the *Phenomenology of Consciousness Inventory* (PCI), to assess various aspects of subjective experience. Subjects use the inventory to rate the intensities of various aspects of phenomenological experience in reference to an immediately-preceding time period or stimulus condition on seven-point Likert scales. The 53-item questionnaire has been found to reliably and validly assess 12 major dimensions and 14 subdimensions of subjective experience (Kumar and Pekala, 1985, 1986; Pekala, 1985b; Pekala and Kumar, 1985b, 1986a; Pekala, Steinberg, and Kumar, 1986). These dimensions (and associated subdimensions) include: altered experience (time sense, meaning, body image, perception), positive affect (joy, sexual excitement, love), negative affect (anger, sadness, fear), visual imagery (amount, vividness), attention (direction of attention, absorption), rationality, arousal (relaxation), self awareness, memory, volitional control, internal dialogue, and altered state of awareness.

The PCI is best completed immediately afterwards in reference to a short stimulus condition. Given the difficulties with introspection (Ketterer, 1985), time periods of up to several minutes are less problematic than very short (several seconds) or very long (more than ten minutes) time intervals. A stimulus interval of four minutes, rather than 10 to 30 minutes, was chosen so as to decrease the chance of subjects having to *infer* instead of *remember* what occurs in their stream of consciousness. (Ericsson and Simon's [1980] review indicated that verbal reports of phenomenological data are reliable and valid to the extent that such data are remembered rather than inferred.) A four-minute period also allows for any "state" properties of consciousness to be more easily demonstrated than a one to five second interval by tending to eliminate, via memory loss, transient and random events. Such memory loss, however, does not invalidate the obtained data:

> Incompleteness of reports may make some information unavailable, but it does not invalidate the information that is present. In an often cited remark, Duncker (1945) observed that "a protocol is relatively reliable only for what it positively contains, but not for that which it omits" (p. 11). (Ericsson and Simon, 1980, p. 243)

(The reader is referred to Pekala and Wenger [1983] for a more detailed analysis and explanation of the reliability and validity of this method of retrospective assessment for assessing phenomenological experience.)

The dimensions of consciousness assessed by the PCI allow for the intensities of various dimensions or subsystems of consciousness to be quantified. In

addition, the intercorrelation matrices (composed of the 12 major PCI dimensions of consciousness) associated with different and/or similar stimulus conditions can be compared and statistically evaluated to determine if the pattern of relationships among the subsystems of consciousness assessed by the PCI (as quantified by the intercorrelation matrices) are significantly different from one another.

The PCI has been shown to demonstrate adequate reliability and validity. Since the PCI is a relatively recent instrument, that reliability and validity will be briefly reviewed.

Reliability. In two experiments (Pekala, Steinberg, and Kumar, 1986) the PCI was administered in reference to three 4-minute stimulus conditions: eyes open sitting quietly, eyes closed sitting quietly, and hypnosis (a four-minute time period embedded in the induction procedure of the *Harvard Group Scale of Hypnotic Susceptibility* [Shor and Orne, 1962]). Coefficient alphas for the PCI for the major and minor dimensions yielded values between .70 and .90, and averaged .80 across all 12 major dimensions and .79 across all major and minor dimensions combined (Pekala, Steinberg, and Kumar, 1986). Recent research utilizing these same stimulus conditions across a new subject group yielded equivalent reliabilities (Pekala and Kumar, 1986a).

Validity. Validity of the PCI was assessed in terms of its ability to (a) discriminate phenomenological experience across low, medium, and high susceptible subjects in and out of hypnosis (discriminant validity), and (b) generate a predicted *Harvard Group Scale* score (based on regression coefficients using the PCI [sub]dimensions) that would correlate significantly with the actual *Harvard Group Scale* scores (predictive validity). (Since the authors knew of no phenomenological state instrument similar to the PCI at the time this study was undertaken, convergent validity was not assessed.)

Repeated measures MANOVAS were calculated twice using both the PCI major dimensions and the subdimensions as the dependent variables. With Conditions (eyes closed, hypnosis) and Groups (low, medium, high susceptibility) as the independent variables, the analysis yielded significant main effects for Conditions and Groups as well as a significant interaction. As predicted, the hypnotic induction condition was associated with significant changes (in the hypothesized directions) for almost all of the PCI (sub)dimensions (Kumar and Pekala, 1985). The hypnotic condition was associated with significantly less positive affect (joy, sexual excitement, love), negative affect (anger, sadness), imagery (amount, vividness), self awareness, internal dialogue, rationality, volitional control, and memory; and significantly more altered experience (time sense, perception) and altered state of awareness.

Significant differences among low, medium, and high susceptible groups were also found, as predicted. High susceptible subjects, vis-a-vis lows, reported significantly more positive affect (joy), increased inward and absorbed attention,

greater altered experience (body image, time sense, perception, meaning), and an increased alteration in state of awareness. Highs also reported significantly less imagery vividness, self awareness, rationality, volitional control, and memory. Significant differences among lows and mediums and mediums and highs were also found.

Similar results were also obtained when comparing low, medium, and high absorption subjects (Kumar and Pekala, 1985, Tellegen, 1981), and these results replicated earlier research that used an instrument (the *Dimensions of Consciousness Questionnaire*) that served as a precursor to the PCI (Pekala and Wenger, 1983). Recent research (Kumar and Pekala, 1986) with a different subject group has replicated the aforementioned susceptibility comparisons, supporting the ability of the PCI to discriminate reported phenomenological experience across low, medium, and high susceptible subject groups.

Additional research has recently been completed comparing the phenomenological experience of low, medium, and high intimacy subjects (Kumar, Pekala, and Treadwell, 1986). The results yielded data consistent with the hypothesized predictions and yet were quite different from the phenomenological differences obtained when low, medium, and high susceptibles were compared, suggesting that the PCI has the ability to discriminate phenomenological experience across traits as well as hypnotic susceptibility.

To gather evidence of predictive validity, a multiple regression equation, with the PCI (sub)dimensions as predictor variables, was used to generate predicted susceptibility scores obtained with the *Harvard Group Scale* (Pekala and Kumar, 1985b). The regression equation yielded a multiple of R of .71, $p < .0001$, indicating significantly high predictability of the actual *Harvard Scale* scores from the PCI (sub)dimensions. To cross-validate, subjects were divided into two subject groups, and the regression weights computed on the first group of subjects, were used to predict the *Harvard Scale* scores of the second group of subjects. Cross-validation yielded an multiple of R of .62; the small amount of shrinkage from the first group to the second supports the ability of the PCI in predicting *Harvard Group Scale* scores.

In a second study, Pekala and Kumar (1986a) used the regression equation of the previous study (Pekala and Kumar, 1985b) to predict the actual *Harvard Group Scale* scores for the second study, and vice versa. This cross-validation yielded multiple Rs of .65 and .57, respectively. Again the amount of shrinkage was quite small; typically such validity coefficients usually average between .30 and .60 (Jewell, 1985).

The aforementioned data suggests that the PCI is a reasonably reliable and valid phenomenological state instrument for assessing the intensity variations associated with the stimulus conditions assessed, i.e., eyes closed, eyes open, and hypnosis. Since the PCI correlation matrices are a function of the corresponding PCI intensity scores, this approach should also be a reasonably valid one for

assessing phenomenological pattern structure. Its usefulness will ultimately reside in its ability to assess and predict pattern differences consistent with current theorizing and research (Klinger, 1978).

Mapping a State of Consciousness

Besides quantifying the phenomenological intensity and pattern parameters associated with a given stimulus condition, a methodology has been developed for mapping or diagraming the PCI phenomenological intensity and pattern data via *psygrams* (Pekala, 1985a). A psygram is a graph of the phenomenological state associated with a specific stimulus condition across a group of subjects. It was developed to present two types of information graphically: (a) average phenomenological intensity scores associated with a given phenomenological subsystem, and (b) strength of association (or "coupling") among the various subsystems for a given stimulus condition.

A psygram consists of small circles, each representing a major dimension of consciousness assessed by the PCI, that are positioned on the circumference of a much larger circle. (Since the arrangement of the circles on the circumference is arbitrary, no particular arrangement is necessary, except for placing the altered state dimension at the top, and having all psygrams employ the same arrangement or sequence of circles so that psygrams associated with various stimulus conditions can be visually compared.)

Average PCI intensity scores for each dimension can then be coded in color or with a variety of shading designations within the circles. To code for relationships among dimensions, lines, representing the proportion of variance in common between pairs of major dimensions (as indicated by coefficients of determination), are drawn connecting the two circles. Each line represents approximately 5% of the variance in common. The greater the number of lines, the greater the variance in common, and hence the higher the strength of association (coupling) between two dimensions. (The actual variance percentages are listed next to the lines, while lines representing negative correlations are labeled with a corresponding negative number.) To assure that only nontrivial variance percentages are represented, only those variance percentages are depicted that correspond to correlations significant to alpha not greater than .01.

Table 1 and Figure 1 illustrate the relationship between a psygram and its corresponding correlation matrix. Table 1 depicts the correlation matrix for the 12 major dimensions of consciousness assessed by the PCI during the stimulus condition of eyes open sitting quietly. Figure 1 depicts the pattern of interrelationships among the 12 dimensions for the same stimulus condition in terms of various percentages corresponding to coefficients of determination significant at the .01 level. (Figure 1 also depicts the PCI mean intensity ratings

for each dimension, coded in terms of rotated parallel lines within each circle.)

As the reader can see, there is a strong association between altered state and altered experience, as there is between rationality and memory, memory and vivid (visual) imagery, and vivid imagery and inward, absorbed attention. The exact variance percentages are listed adjacent to their corresponding lines. Many other minor associations are also evident. A psygram thus provides an overall picture of the pattern of relationships in terms of specific connections or couplings between pairs of dimensions for a specific stimulus condition.

Table 1

Intercorrelation Matrix of the 12 Dimensions of Consciousness Assessed by the PCI during Eyes Open*

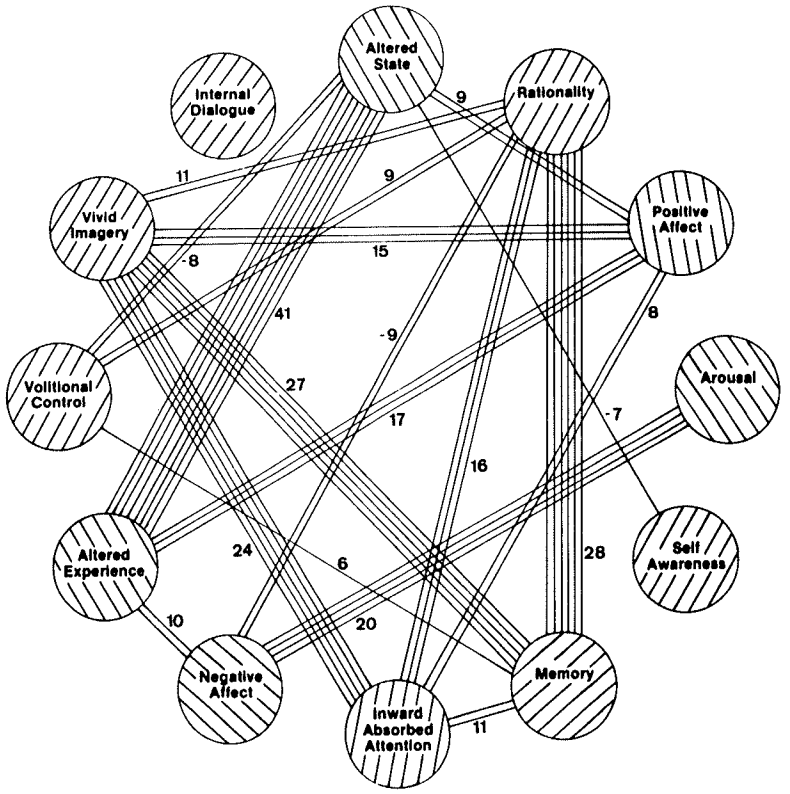
Dimensions	*Self Awareness*	*State of Awareness*	*Internal Dialogue*	*Rationality*	*Volitional Control*	*Memory*	*Arousal*	*Positive Affect*	*Negative Affect*	*Altered Experience*	*Inward Attention*	*Vivid Imagery*
Self Awareness	1.00	−.26[b]	.06	−.08	.15	.09	.07	−.08	.00	−.22[a]	−.03	−.10
State of Awareness		1.00	−.03	.11	−.28[b]	−.07	.14	.30[c]	.12	.64[c]	−.02	.11
Internal Dialogue			1.00	.04	−.02	−.21[a]	−.18	−.01	−.09	−.09	−.07	−.13
Rationality				1.00	.30[c]	.53[c]	−.23[a]	.00	−.30[c]	−.10	.40[c]	.33[c]
Volitional Control					1.00	.25[b]	.17	−.14	−.05	−.10	.22[a]	.21[a]
Memory						1.00	−.18	.07	−.17	−.01	.33[c]	.52[c]
Arousal							1.00	.13	.45[c]	.22[a]	.04	.02
Positive Affect								1.00	.01	.41[c]	.28[b]	.39[c]
Negative Affect									1.00	.32[c]	.02	−.05
Altered Experience										1.00	.08	.10
Inward Attention											1.00	.49[c]
Vivid Imagery												1.00

*n = 112 [a]$p<.05$ [b]$p<.01$ [c]$p<.001$

The Present Investigation

Investigating the organization of the structures of consciousness during hypnosis. Hypnosis has been hypothesized to differentially affect various phenomenological subsystems of consciousness, (e.g., imagery, memory, volition, or rationality). Although the relationship between hypnosis and individual

FIGURE 1
PCI Psygram: Eyes Open Sitting Quietly*



Intensity Ratings

*n = 112

KEY

Higher intensity ratings denote increased dimension intensity values ranging from none or little (rating equals 0) to much or complete (rating equals 6).

Each line represents approximately 5% of the variance in common. (All variances represent correlations significant at alpha less than .01.)

phenomenological subsystems such as volition (Bowers, 1981; Lynn, Nash, Rhue, Frauman, and Stanley, 1983); absorption (Tellegen and Atkinson, 1974; Yanchar and Johnson, 1981); visual imagery (Spanos and McPeake, 1975); and alterations in state of consciousness (Hilgard, 1969) have been studied, investigations aimed at comparing how these and other phenomenological subsystems relate to each other have not been addressed.

Pekala, Wenger, and Levine (1985), using a precursor to the PCI, the *Dimensions of Consciousness Questionnaire* (DCQ), found not only (sub)dimension intensity differences, but also pattern differences (using the major dimensions of the DCQ in the correrlation matrices) between low and high absorption (Tellegen, 1981) subjects. As absorption is a trait correlated with hypnotic susceptibility (Tellegen and Atkinson, 1974; Yanchar and Johnson, 1981), it is reasonable to expect that the results obtained with absorption would extend to susceptibility, particularly since hypnosis has been shown to result in greater alterations in phenomenological experience for high vis-a-vis low susceptible subjects (Hilgard, 1965, Orne, 1971; Shor, 1979). In addition, if hypnosis results in a reorganization of the subsystems of consciousness (Hilgard, 1977), there might also be significant pattern differences between a hypnotic condition and a baseline condition, such as eyes closed sitting quietly for low, medium, and high susceptible subjects.

To test the previous theorizing, two hypotheses were entertained:

(1) High susceptible subjects will report a significantly different pattern of relationships among phenomenological subsystems (as assessed by the PCI) than low susceptible subjects for the hypnotic induction condition and possibly the baseline condition of eyes closed sitting quietly.

(2) Hypnosis, vis-a-vis the baseline condition, will result in a significantly different pattern of relationships among the phenomenological subsystems of consciousness for high, medium, and possibly low susceptible subjects.

Comparing states of consciousness. The present methodolology also allows for states of consciousness, as defined by Tart (1975), to be statistically assessed and visually compared. According to Tart (1975), a *discrete altered state of consciousness*, in reference to another state of consciousness, can be defined in terms of: (a) a significant pattern difference among various subsystems of consciousness and (b) the degree to which a given state of consciousness, vis-a-vis another state, is perceived as associated with a perceived alteration in subjective experience or the *subjective sense* of *altered state* (SSAS). In contrast, an *identity state of consciousness* is associated with a significant pattern difference from another state of consciousness and yet no significant perceived alteration in state of awareness.

A psygram allows for the state of consciousness associated with a particular stimulus condition to be visually graphed in terms of the pattern structures,

while the state of awareness (altered state) dimension quantifies the perceived alteration in subjective experience. (Except for the state of awareness dimension, the use of the dimension intensity values will not be further addressed since the present paper deals primarily with the pattern effects associated with hypnosis.)

Given the above, high susceptible subjects, during hypnosis, might then be characterized as being in an altered state of consciousness relative to lows if there is a significant pattern difference and a significant SSAS. Similarly, high, medium, and possibly low susceptible subjects during hypnosis might be in an altered state in reference to a baseline state such as eyes closed, if significant pattern and SSAS effects are found between hypnosis and eyes closed for each of these three subject groups.

Since hypotheses 1 and 2 addressed pattern effects, hypotheses 3 and 4 address the SSAS effects:

(3) High susceptibles, compared to lows, will report a greater alteration in the state of awareness dimension of the PCI for hypnosis and possibly the baseline condition.

(4) Hypnosis, vis-a-vis the baseline condition, will result in a significantly greater alteration in the state of awareness dimension for high, medium, and possibly low susceptible subjects.

Method

Subjects

The initial subject pool consisted of 263 undergraduates (88 males and 175 females) enrolled in introductory psychology classes at West Chester University. Subjects were seen in two groups of 131 and 132 individuals. Completed data, however, was available on only 217 subjects (72 males and 145 females). (For one group of subjects, scheduling problems necessitated moving the group after the eyes closed, but before the induction condition, to another room. During this move, approximately 10% left; another 10% were eliminated due to incomplete data.[1]) Subjects received course credit for their participation and they knew beforehand that the study involved hypnosis.

Materials

The *Harvard Group Scale of Hypnotic Susceptibility,* Form A (HGSHS:A) (Shor and Orne, 1962) was used to measure hypnotic susceptibility. It has been

[1]Statistical PCI intensity and pattern analyses performed across the two subject groups revealed no significant intensity and pattern differences between groups. This suggests that the loss of subjects for the one subject group did not significantly affect the results.

shown to have adequate reliability and validity (Hilgard, 1965).

The *Phenomenology of Consciousness Inventory* (PCI) (Pekala, 1982) was used to assess phenomenological experience. There are two forms of the PCI. Both have the same items, but each form has a different sequence of items arranged in a randomized block design. The PCI contains five items similar or identical in content to five other items embedded in the questionnaire to assess for intratest reliability. Subjects responding identically to these item-pairs receive an average difference score of zero, while subjects having marginal reliability would receive an average difference score of greater than two.

Procedure

The 217 participants were seen in groups of 99 and 118 at the same time of day within a one week period. After the general nature of the experiment was explained and consent forms completed, subjects were told to close their eyes, sit quietly, and think about whatever they liked. At the end of four minutes they were asked to open their eyes and complete the PCI, Form 1, in reference to the eyes closed condition.

Upon completion of the PCI, subjects experienced the induction procedure of the *Harvard Group Scale*, which was shortened approximately ten minutes to accommodate to the time constraints of the study. (The instructions were shortened by eliminating redundant phraseology prior to the various behavioral suggestions in the latter half of the *Harvard Group Scale*. A short pilot study preceded this experiment to determine the acceptability of shortening the induction. No contraindications were noted.) After the eye catalepsy instructions but before the post-hypnotic suggestion and amnesia, the subjects experienced a four-minute period during which time they were told: "[T]o continue to experience the state you are in right now. For the next several minutes I'm going to stop talking and I want you to experience the state you are in right now."

After the end of the induction procedure and after writing down a list of the hypnotic suggestions subjects remembered (after removal of the amnesia), participants completed the PCI, Form 2, in reference to the aforementioned four-minute period. Subjects then completed the 11 response items of the *Harvard Scale*.

Results

PCI Preliminary Analyses

The participants' responses to the PCI were first assessed for intraindividual reliability. Subjects having a marginal reliability index for a given stimulus

condition (an absolute difference score of greater than two) were eliminated from the analyses. This resulted in 195 subjects for the eyes closed condition, 190 subjects for the induction condition, and 173 subjects for both conditions.

Harvard Group Scale Preliminary Analyses

Three groups were formed by dividing subjects into those scoring in the lowest[2] (0-5, M = 3.25), middle (6-8, M = 7.16), and highest third (9-12, M = 10.27) of the *Harvard Scale*. These means were the same to within one digit to the right of the decimal whether using 195, 190, or 173 subjects.

Pattern Comparisons as a Function of Hypnotic Susceptibility

Dimension intensity scores were computed for each subject for each condition by averaging those items that composed each PCI major dimension. Intercorrelation matrices of the 12 major PCI dimensions were then computed for the eyes closed and the hypnotic induction conditions for low, medium, and high susceptible subject groups. The correlation matrices were subsequently compared with an APL computer program (Pekala and Kumar, 1985a) of Jennrich's (1970) chi-square test, which makes it possible to determine if the correlation matrices, and hence the patterns among the dimensions of consciousness for the various groups, are significantly different from one another.

Comparison of the correlation matrices associated with low ($n = 66$) and high ($n = 59$) susceptibles for the eyes closed condition yielded a chi-square value of 82.82, $p < .10$ (degrees of freedom for all analyses using Jennrich's test were 66; all statistical tests were two-tailed). Whereas correlations for lows ranged from –.43 to .62 with 21 out of 66 correlations significant at $p < .01$, correlations for highs ranged from –.48 to .63 with 15 correlations significant at $p < .01$.

Comparison of the correlation matrices for the eyes closed condition between mediums ($n = 70$) and lows (chi-square = 74.72, $p < .25$), and mediums and highs (chi-square = 66.40, $p < .50$) were not significant. Medium susceptible subjects had correlations ranging from –.65 to .65, of which 20 were significant at $p < .01$.

A significant ($p < .005$) chi-square value of 108.25 was found for the comparison of the correlation matrices associated with lows ($n = 65$) and highs ($n = 57$) for the hypnotic induction condition. Whereas correlations for lows had a range of –.69 to .74, with 29 out of 66 significant at $p < .01$, correlations for highs had a range of –.48 to .63, with only 11 significant at $p < .01$.

---

[2]Although low susceptibles are usually defined as having Harvard Scale scores of zero to four or zero to three, using this criterion would have reduced the number of subjects in this cell to a level that would have made the pattern analyses problematic (Pekala, 1985b).

Although the comparison between the correlation matrices associated with mediums (n = 68) and lows was significant (chi-square = 87.35, $p<.05$), that comparing mediums and highs was not (chi-square = 75.84, $p<.25$). Mediums had 21 correlations significant at $p<.01$, ranging from –.67 to .62.

Pattern Comparisons Between Eyes Closed and the Induction

To assess for pattern differences between eyes closed and the induction as a function of low, medium, or high susceptibility, intercorrelation matrices for the 12 PCI dimensions were constructed for the eyes closed and induction conditions across low (n = 58), medium (n = 63), and high (n = 52) susceptible subjects. (Only those subjects who had a reliability index of two or less during *both* the eyes closed and induction conditions were used so that the pattern comparisons would be conducted across groups composed of the same subjects.) Comparisons for low (chi-square = 117.58, $p<.001$), and medium (chi-square = 93.40, $p<.025$) groups were significant, while that for highs (chi-square = 82.39, $p<.10$) approached significance.[3]

Variance Comparisons

To determine if significant variance differences among low, medium, and high susceptible groups were responsible for the significant chi-square values for the Jennrich tests, the Bartlett-Box F test was utilized to assess for homogeneity of variance for low, medium, and high susceptible subjects during the eyes closed and hypnosis conditions. (Significiantly greater PCI variability among low susceptible subjects, vis-a-vis high susceptibles, could account for higher correlations among the PCI dimensions for the low susceptibles relative to the highs.)

For the eyes closed condition, two of the 12 PCI dimensions had significantly different variances, i.e., negative affect (F = 3.69, $p<.05$) and memory (F = 5.60, $p<.01$). Only for memory, however, were the variances for lows significantly greater than that of highs. For the hypnosis condition, only for the dimension of altered state of awareness were there significantly different variances among groups (F = 5.33, $p<.01$), with lows having significantly greater variability than highs.

[3]Since the Jennrich test was devised for independent groups, its use with correlated groups is a more conservative test of significant differences than would be the case if independent groups were used.

Intensity and Pattern Comparisons Within Stimulus Conditions

However remote, the possibility exists that different groups of subjects experiencing the same stimulus conditions may nevertheless report that the same stimulus conditions are associated with different phenomenological intensity and/or pattern values. To rule out the possibility that such an effect may be related to the differences reported above, intensity and pattern effects were also assessed across the two subject groups (subjects were seen in two groups of 99 and 118). This was done by testing for significant PCI (sub)dimension intensity differences between the two subject groups, and also for significant pattern differences between the two groups.

Concerning the PCI (sub)dimension intensity effects, independent *t*-tests between the two subject groups for all 26 PCI (sub)dimensions revealed no significant differences ($p<.05$) for either the eyes closed or the induction conditions. Comparison of the PCI correlation matrices of the first group of subjects against the second group revealed no significant pattern differences between the two groups for either the eyes closed (chi-square = 73.7, $p<.20$) or the hypnotic induction (chi-square = 80.1, $p<.10$) conditions.

Psygram Analyses

To determine the nature of the differences in the pattern of relationships for the aforementioned groups, psygrams were constructed for each group for each condition. The average intensity scores for each dimension have been omitted from the following psygrams so as not to complicate the graphs. (To save space, psygrams for the medium susceptible subjects were also omitted).

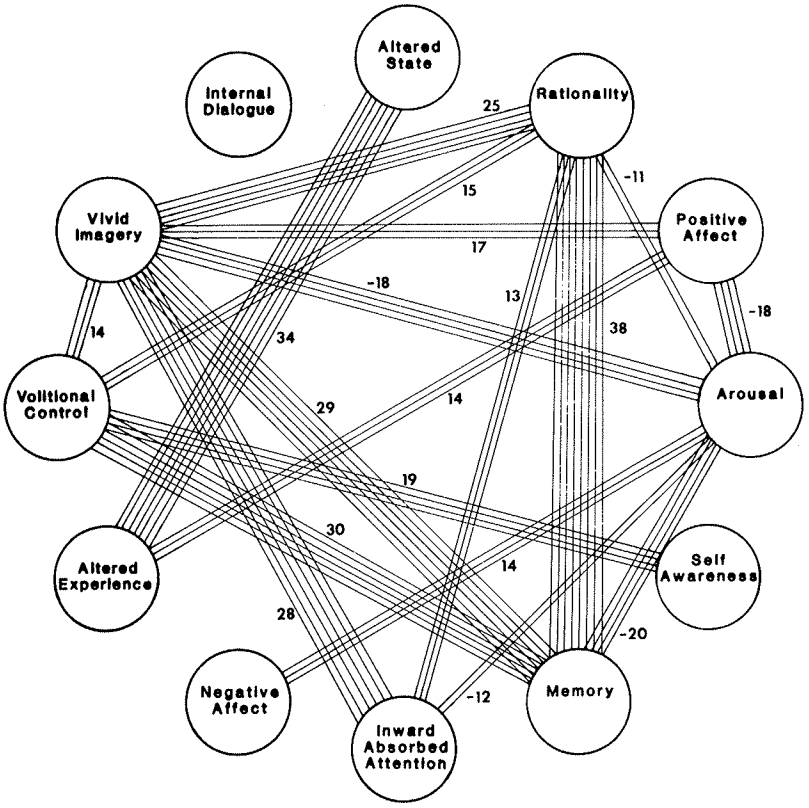
Figure 2 depicts the psygram of low susceptible subjects during eyes closed sitting quietly. Figure 2 is contrasted with Figure 3, a psygram of low susceptibles during the hypnotic induction. (As mentioned, these patterns are significantly different from one another as assessed by statistical comparison of the correlation matrices.) Notice how the associations (variance percentages) among dimensions have become much more intense and frequent for the induction condition compared to the eyes closed condition.

Figure 4 depicts the psygram of high susceptibles during eyes closed, while Figure 5 depicts the psygram of highs during hypnosis. In contrast to the previous psygrams, the hypnotic induction for highs is associated with less frequent and less intense variance percentages than eyes closed (the Jennrich comparison between these correlation matrices approached significance), an effect opposite to that seen with low susceptible subjects.

In addition, although the psygrams of lows (Figure 2) and highs (Figure 4) during eyes closed appear similar, psygrams of lows (Figure 3) and highs (Figure 5) during hypnosis are vastly (and significantly) different.

FIGURE 2

Low Susceptible Individuals: Eyes Closed Sitting Quietly*



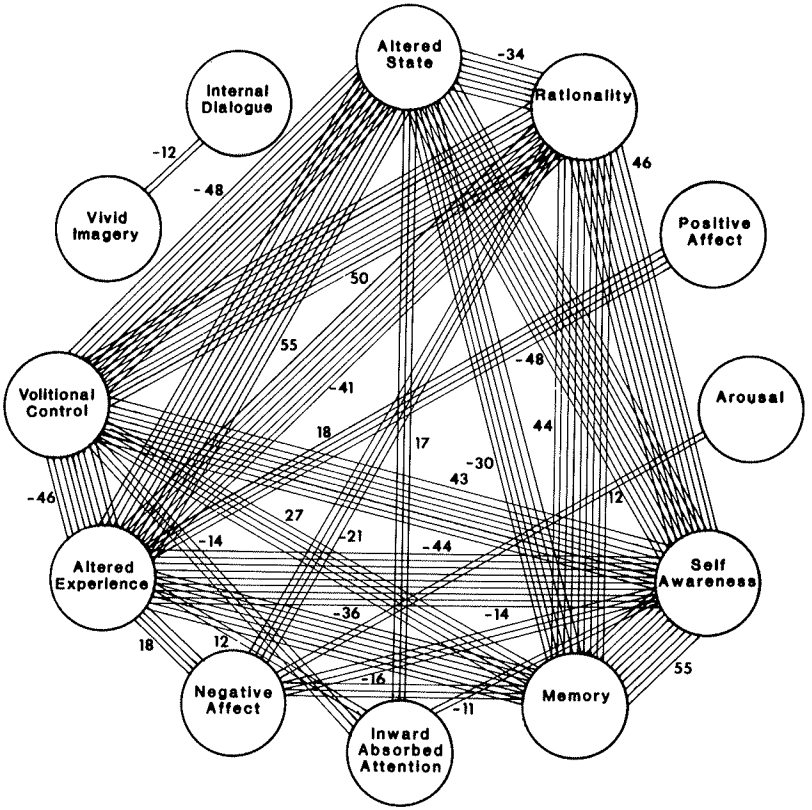
KEY

Each line represents approximately 5% of the variance in common.
(All variances represent correlations significant at alpha less than approximately .01.)

*n=66

FIGURE 3

Low Susceptible Individuals: Hypnotic Induction (HGSHS)*



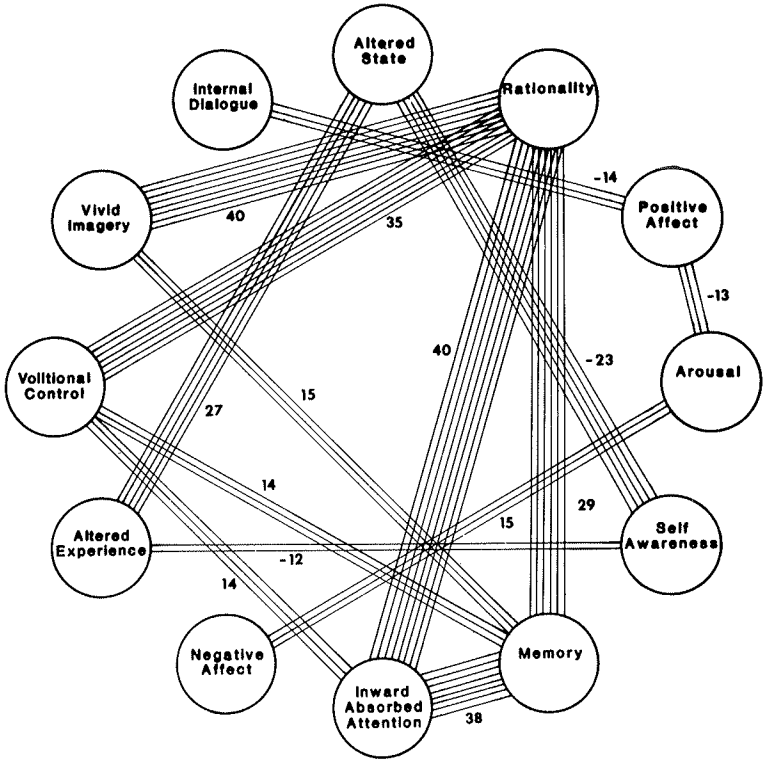
KEY

Each line represents approximately 5% of the variance in common.
(All variances represent correlations significant at alpha less than approximately .01.)

***n=65**

FIGURE 4

High Susceptible Individuals: Eyes Closed Sitting Quietly*



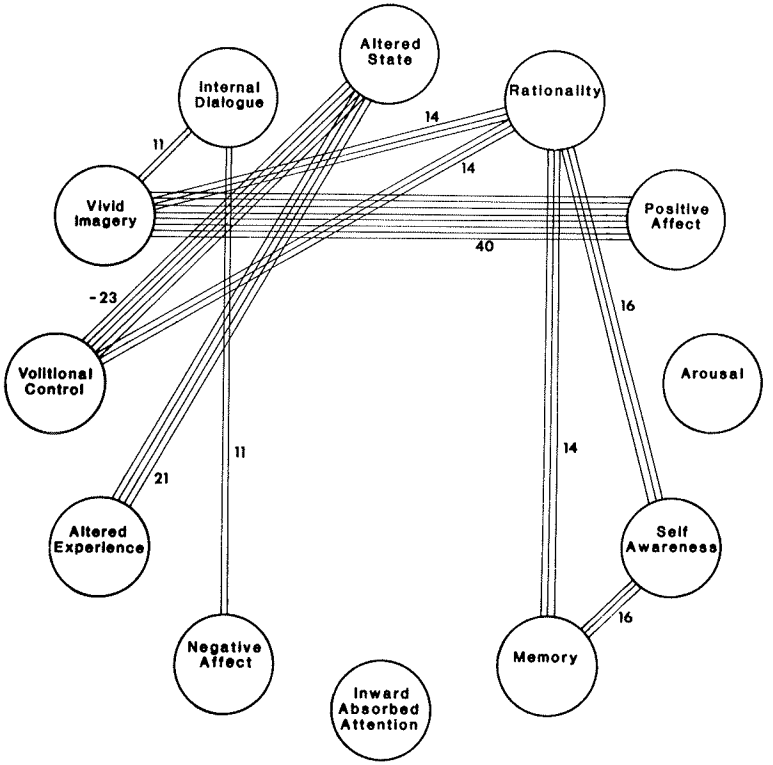
KEY

Each line represents approximately 5% of the variance in common.
(All variances represent correlations significant at alpha less than approximately .01.)

*n=59

FIGURE 5

High Susceptible Individuals: Hypnotic Induction (HGSHS)*



KEY

Each line represents approximately 5% of the variance in common.
(All variances represent correlations significant at alpha less than approximately .01.)

*n=57

Altered State Intensity Comparisons

A one-way analysis of variance (low, medium, and high susceptible subjects) revealed a significant main effect for the altered state of awareness dimension of the PCI for the eyes closed condition ($F = 4.07$, $df = 2/192$, $p < .02$) and the hypnotic induction condition ($F = 37.44$, $df = 2/187$, $p < .0001$). Mediums and highs for both conditions reported a significantly greater alteration in awareness than lows (Student-Newman-Keuls post hoc comparison).

Paired t tests revealed that lows ($t = 3.30$, $df = 57$, $p < .01$), mediums ($t = 8.68$, $df = 62$, $p < .001$), and highs ($t = 10.72$, $df = 51$, $p < .0001$) all reported a greater alteration in state of awareness for the hypnotic induction condition vis-a-vis the eyes closed condition.

Discussion

Pattern and Intensity Comparison Results

Hypotheses one and two were generally supported. High susceptible subjects were found to report a significantly different organizational structure from that of lows for the hypnotic induction condition. (This was not the case for the eyes closed baseline condition however.) Diagraming the pattern results via the psygrams supported this, as the very different psygrams for these two groups for the hypnotic induction condition indicates.

The data also support the conclusion of significantly different patterns of relationship among PCI dimensions between hypnosis and eyes closed sitting quietly for low, medium, and possibly high susceptible subjects. (The fact that the pattern comparison approached significance for highs, suggests that it may have been significant if a test for correlated groups were used instead of a test for independent groups.)

Hypotheses three and four were also supported. Not only did highs and mediums report a significantly greater alteration in state of awareness than lows for the hypnotic induction and baseline condition, but highs, mediums, and lows also reported that the hypnotic induction was associated with a greater alteration in state of awareness than the eyes closed condition.

States of Consciousness as a Function of Susceptibility

According to Tart (1975), an altered state of consciousness can be defined, in reference to other states, by means of a significant pattern difference, and a significant SSAS. High susceptible subjects were found to report a significantly different pattern, relative to lows, during the hypnotic induction condition. Highs also reported experiencing a significantly greater subjective sense of

altered state, vis-a-vis lows, during the induction. Thus, using Tart's definitions, high susceptible subjects can be said to have been in an altered state of consciousness relative to lows during the hypnotic induction. In contrast, this cannot be said to be the case during the eyes closed condition, since the Jennrich comparison only approached significance.

Interestingly, if one adheres to Tart's definitions, then the induction procedure may have caused medium susceptible subjects, relative to lows, to enter an altered state of consciousness. This was because mediums, during the induction, reported their state of consciousness (in terms of the pattern of relationships among PCI dimensions and the subjective sense of altered state) to be significantly different from that of lows, although no such significant pattern differences were evident during eyes closed between these groups.

Discrete Altered States of Consciousness

Comparison of patterns for hypnosis and eyes closed across low, medium, and high susceptible subjects indicated that the induction condition, relative to eyes closed, was perceived as an altered state of consciousness for low and medium susceptible subjects. This was because low and medium groups, when comparing the induction to the baseline condition, were found to report a significantly different structure and a significantly greater alteration in state of awareness.

Highs also reported a significantly greater SSAS relative to baseline, but only a near significant difference in structure. This suggests that the hypnotic induction may have had less of an effect upon subsystem structure for high, than medium and low susceptible subjects. As mentioned, however, the Jennrich comparison, used for independent groups, is a more conservative test of differences when used with correlated groups. Thus, this comparison may also have been significant if a test for correlated correlation matrices were used. (Although Steiger [1980] has developed a computer program for testing for significant differences in correlation matrices between two correlated groups, we have been unable to utilize it for the large matrix sizes needed in the PCI pattern analyses.)

Although all three subject groups reported the induction condition to be associated with a greater alteration in state of awareness (SSAS) from the eyes closed condition, visual depiction of the structures via psygrams indicated that the altered state of consciousness during hypnosis reported by high susceptibles was quite different from that reported by lows.

Tart (1975) has coined the term, *discrete altered state of consciousness*, to denote the fact that a given altered state may be different from another altered state, and yet both may be altered from a reference state of consciousness. Such states are discrete since each are composed of a *unique* pattern or organization

of structures. Thus, the altered state of consciousness associated with hypnosis (vis-a-vis eyes closed) reported by low susceptible subjects was much different from that reported by medium (or high) susceptible subjects.

Differential Pattern Effects as a Function of Susceptibility: Interpretations and Speculations

The psygram data suggests that low susceptible subjects responded to the hypnotic induction in a much different manner than high susceptibles. The plethora of associations for lows during hypnosis suggests that alterations in many of the subsystems of consciousness mapped by the PCI (altered state, rationality, self awareness, memory, altered experience, and volitional control) led to rather consistent alterations in associately-coupled subsystems.

With the exception of a strong association between positive affect and imagery, there was a lack of associations between subsystems for highs during hypnosis (which cannot be attributable to differences in the distribution of scores for highs vis-a-vis lows due to the lack of significant variance differences). This result suggests that when the experimenter told the subjects to "just continue to experience the state you are in," whereas lows had subsystems that became even more tightly coupled, highs appeared to report a trend ($p < .10$) to "uncouple" subsystems of consciousness (in reference to the previous baseline state). Whether this suggests empirical support for Hilgard's (1977) neodissociation theory of hypnosis for high, vis-a-vis low susceptibles—subsystems of consciousness becoming "dissociated" or segregated from one another for high but not low susceptible subjects—is at this point speculative.

There appear, however, to be interesting parallels between the hypnotic behavior of high susceptibles during hypnosis and the phenomenological pattern effects demonstrated with the psygram data for high susceptibles. A high susceptible during hypnosis is able to completely dissociate pain in, let us say, the hand from the rest of the body, as if the hand were completely separated from it. Somewhat similarly, thoughts or feelings of a traumatic memory can become functionally divorced from the memory, or the whole memory itself separated from other memories, leading to amnestic experiences or even multiple personality (Kluft, 1984) for high susceptibles that is not possible for lows.

The psygram of high susceptibles during hypnosis was constructed from the self-reports of subjects who were told to just sit quietly and continue to experience the state they were in. The instructions allowed for a very open stimulus set to be enacted. The fact that low susceptibles had various phenomenological dimensions of consciousness highly coupled with one another, while highs had little comparative coupling, suggests a significant pattern structure difference for highs, vis-a-vis lows, during hypnosis. Such a

difference appears to be congruent with the hypnotic experiences and behaviors of highs mentioned above. Hypnosis is associated with phenomenological subsystems of consciousness for high susceptibles that become "loosely coupled," which may then be subsequently enabled by the hypnotist (or the subject via self-hypnosis) to be "manipulated" without affecting other phenomenological subsystems due to the loose associations between subsystems. That such hypnotic phenomena are unable to be experienced by low susceptibles is supported by the psygram results for lows during hypnosis. Here, subsystems of consciousness became even more tightly coupled.

Pattern comparisons among the psygrams concerning specific dimensions also uncovered certain patterning effects that may be specific to a given subject group. Whereas low susceptibles have rationality strongly coupled with memory during eyes closed (an r of .62), highs have rationality most strongly coupled with vivid, visual imagery and inward, absorbed attention (rs of .63). (Could this be why "trance logic," [Orne, 1971] is more likely to occur for high than low susceptible subjects?) In addition, whereas memory is statistically independent from attention for lows during eyes closed, memory is strongly coupled with inward, absorbed attention for highs (r = .62). This suggests that highs during eyes closed may be processing information (and possibly storing it) in a much different manner from that of lows.

A controversy in hypnosis research concerns the need for an hypnotic induction in inducing hypnotic effects (Barber and Calverly, 1962). If highs are processing information differently from lows in a supposedly nonhypnotic state like eyes closed sitting quietly, this might be related to evidence which suggests that some hypnotic subjects can produce "hypnotic effects" even without an induction. Further research is needed to address this issue and the related speculations mentioned above.

Limitations of the Present Research

Given the present novelty of this approach, much more research needs to be done with the PCI in retrospective phenomenological assessment, along with its use across other stimulus conditions, subject groups, and altered state induction procedures. The results reported herein must only be regarded as tentative and awaiting replication or refutation. (Pattern data analysis of a second study with a different population [Pekala and Kumar, 1986b] is presented elsewhere.)

Subject group size in the present research was approximately 60 subjects per group. Given that the Jennrich test is a multivariate technique, large sample sizes are needed. Nunnally (1978) suggests that "there should be at least ten times as many subjects as items" and five subjects per item "should be considered the minimum that can be tolerated" (p. 260). If the 12 major PCI dimensions are

used in the pattern analysis, then a minimum permissible number of subjects would be about 60, and probably 120 subjects per group would be needed to assure "stable" results. Hence, the present research needs to be replicated with larger sample sizes.

No attempt was made to control for "demand characteristics" (Orne, 1962) in this study. Significant PCI (sub)dimension intensity differences across low, medium, and high susceptible and absorption subjects (Kumar and Pekala, 1985, 1986), during which subjects were run in mixed groups, suggest that demand characteristics cannot account for these results, and hence probably the pattern comparisons across susceptibility groups reported in this paper. On the other hand, the intensity and pattern comparisons between hypnosis and eyes closed for the three groups may have been influenced by such characteristics, since subjects probably perceived that hypnosis would be associated with more "altered effects" than eyes closed. Sequence effects relating to the "holding back" phenomenon (Sharf and Zamansky, 1963) were also not assessed. Hence, the extent to which subjects possibly underestimated alterations in phenomenological experience during eyes closed, since they knew they were to be hypnotized during the second condition, is unknown. Such effects, however, would be presumed to be equal, since subjects participated in mixed groups, unless response bias was operating. Future research will need to try to address these issues.

The extent to which the reported alterations in subjective experience, and hence pattern structure, were really experienced, or were merely *reported* alterations that were skewed due to response bias, with lows responding in counterdemand fashion and highs responding to maintain the "good subject" role (Jones and Spanos, 1982), is an important question. Although such demands were evident during the hypnotic induction, they appear to have been less salient during the eyes closed condition, which gave no hint as to what phenomenological experiences would be associated with a "good subject" role.

Due to the above, mention was not made of what subjects experienced, but rather what they *reported* they *experienced.* We believe, however, that there is a strong correlation between what subjects experience and what they report they experience, although this does not preclude some subjects from not reporting accurately. The question of response bias is basically a variant of the argument concerning the validity of introspective data (Lieberman, 1979). Thus, as with other self-report data, the validity of this research must be evaluated with repeated replication and validation to determine the extent to which such data make possible the understanding, prediction, and control of human behavior and experience (Klinger, 1978).

As with any new area of research, initial research questions are addressed to determining the nature of the effects related to a given manipulation, and only after specific effects are found and replicated, can researchers then begin to

design more refined studies to determine how much of the variance may be due to the experimental manipulation and how much may be due to nonspecific effects.

Summary and Concluding Remarks

The results of the present experiment tentatively suggest that hypnosis has differential effects upon the reported organization of the phenomenological structures of consciousness across low and high susceptible subjects. The nature of these effects indicate that low susceptibles have subsystems of consciousness that become more tightly "coupled" during hypnosis as opposed to a baseline state, while highs had an opposite, but less dramatic, effect. Speculations concerning how such phenomenological pattern differences may be related to the behavioral effects reported by highs, vis-a-vis lows, during hypnosis were addressed and will need to be more fully assessed in future research.

The data support the feasibility of using the methodology reported herein for mapping and diagraming states and altered states of consciousness associated with hypnosis. Self-report phenomenological state instruments like the PCI and a means to diagram that data via psygrams or similar devices may provide a way to access the "state of consciousness" associated with hypnosis and other altered state induction procedures. By assessing such altered state induction procedures across groups of subjects differing in various traits such as hypnotic susceptibility, one may then determine how individual differences measures may affect reported phenomenological experiences.

It should be noted however, that the present research makes no attempt to "prove" that states of consciousness exist. Rather, it stipulates that—given Tart's definitions—a means to statistically assess and diagram the pattern structures of states of consciousness is available to test hypotheses associated with hypnotic theories and/or other theories concerning states and altered states of consciousness.

References

Barber, T.X., and Calverly, D.S. (1962). "Hypnotic behavior" as a function of task motivation. *Journal of Psychology, 54,* 363–389.

Bowers, K.S. (1981). Do the Stanford Scales tap the "classic suggesion effect?" *International Journal of Clinical and Experimental Hypnosis, 29,* 42–53.

Duncker, K. (1945). On problem solving. *Psychological Monographs, 58* (5, Whole number 270).

Ericsson, K.A., and Simon, H.A. (1980). Verbal reports as data. *Psychological Review, 87,* 215–251.

Hilgard, E.R. (1965). *The experience of hypnosis.* New York: Harcourt, Brace, Jovanovich.

Hilgard, E.R. (1969). Altered states of consciousness. *Journal of Nervous and Mental Disease, 149,* 68–79.

Hilgard, E.R. (1977). *Divided consciousness: Multiple controls in human thought and action.* New York: John Wiley and Sons.

Jennrich, R.J. (1970). An asymptotic χ^2 test for the equality of two correlation matrices. *Journal of the American Statistical Association, 65,* 904–912.

Jewell, L.N. (1985). *Contemporary industrial/organizational psychology.* New York: West Publishing.

Jones, B., and Spanos, N.P. (1982). Suggestions for altered auditory sensitivity, the negative subject effect, and hypnotic susceptibility: A signal detection analysis. *Journal of Personality and Social Psychology, 43,* 637–647.

Ketterer, M.W. (1985). Awareness I: The natural ecology of subjective experience and the mind-brain problem revisited. *The Journal of Mind and Behavior, 6,* 469–514.

Klinger, E. (1978). Modes of normal conscious flow. In K.S. Pope, and J.L. Singer (Eds.), *The stream of consciousness: Scientific investigations into the flow of human experience* (pp. 226–258). New York: Plenum.

Kluft, R.P. (1984). An introduction to multiple personality disorder. *American Journal of Clinical Hypnosis, 14,* 19–24.

Kumar, V.K., and Pekala, R.J. (1985). *Absorption, hypnotizability, and individual differences in phenomenological experience.* Manuscript submitted for publication.

Kumar, V.K., and Pekala, R.J. (1986). *Phenomenological experience as a function of hypnotic susceptibility: A replication.* Manuscript in preparation.

Kumar, V.K., Pekala, R.J., and Treadwell, T.W. (1986). *Phenomenological experience as a function of intimacy and gender.* Manuscript in preparation.

Lieberman, D.A. (1979). Behaviorism and the mind: A (limited) call for a return to introspection. *American Psychologist, 34,* 319–333.

Lynn, S.J., Nash, M.R., Rhue, J.W., Frauman, D., and Stanley, S. (1983). Hypnosis and the experience of nonvolition. *International Journal of Clinical and Experimental Hypnosis, 31,* 293–308.

Nunnally, J.C. (1978). *Psychometric theory* (3rd ed.). New York: McGraw-Hall.

Orne, M.T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics. *American Psychologist, 58,* 277–299.

Orne, M.T. (1971). The simulation of hypnosis: Why, how and what it means. *International Journal of Clinical and Experimental Hypnosis, 19,* 183–210.

Pekala, R.J. (1982). *The Phenomenology of Consciousness Inventory (PCI).* Thorndale, Pennsylvania: Psychophenomenological Concepts.

Pekala, R.J. (1985a). A psychophenomenological approach to mapping and diagraming states of consciousness. *Journal of Religion and Psychical Research, 8,* 199–214.

Pekala, R.J. (1985b). *Mapping the structures and patterns of consciousness: User's manual for the Phenomenology of Consciousness Inventory.* Thorndale, Pennsylvania: Psychophenomenological Concepts.

Pekala, R.J., and Kumar, V.K. (1985a). A short program for assessing the equality of two independent correlation matrices. *Educational and Psychological Measurement, 45,* 175–177.

Pekala, R.J., and Kumar, V.K. (1985b). Predicting hypnotic susceptibility by a self-report phenomenological state instrument. *American Journal of Clinical Hypnosis, 27,* 114–121.

Pekala, R.J., and Kumar, V.K. (1986a). *Predicting hypnotic susceptibility via a self-report instrument: A replication.* Manuscript in preparation.

Pekala, R.J., and Kumar, V.K. (1986b). *Patterns of consciousness during hypnosis and a baseline state: A partial replication.* Manuscript in preparation.

Pekala, R.J., Steinberg, J., and Kumar, V.K. (1986). *The Phenomenology of Consciousness Inventory: A self-report questionnaire for mapping phenomenological experience.* Manuscript submitted for publication.

Pekala, R.J., and Wenger, C.F. (1983). Retrospective phenomenological assessment: Mapping consciousness in reference to specific stimulus conditions. *The Journal of Mind and Behavior, 4,* 247–274.

Pekala, R.J., Wenger, C.F., and Levine, R.L. (1985). Individual differences in phenomenological experience: States of consciousness as a function of absorption. *Journal of Personality and Social Psychology, 48,* 125–132.

Sharf, B., and Zamansky, H.S. (1963). Reduction in word-recognition threshhold under hypnosis. *Perceptual and Motor Skills, 17,* 499–510.

Shor, R.E. (1979). A phenomenological method for the measurement of variables important to an understanding of the nature of hypnosis. In E. Fromm, and R.E. Shor (Eds.), *Hypnosis: Developments in research and new perspectives* (pp. 105–135). New York: Aldine-Atherton.

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

Spanos, N.P., and McPeake, J.D. (1975). Involvement in everyday imaginative activities, attitudes toward hypnosis, and hypnotic susceptibility. *Journal of Personality and Social Psychology, 31,* 594–598.

Steiger, J.H. (1980). Tests for comparing elements for a correlation matrix. *Psychological Bulletin, 87,* 245–251.

Tart, C.T. (1975). *States of consciousness.* New York: Dutton.

Tellegen, A. (1981). Practicing the two disciplines for relaxation and enlightenment: Comment on "Role of the biofeedback signal in electromyograph biofeedback: The relevance of attention" by Qualls and Sheehan. *Journal of Experimental Psychology: General, 110,* 217–226.

Tellegen, A., and Atkinson, G. (1974). Openness to absorbing and self-altering experiences ("Absorption"), A trait related to hypnotic susceptibility. *Journal of Abnormal Psychology, 83,* 268–277.

Valle, R.S., and King, M. (1978). An introduction to existential-phenomenological thought in psychology. In R.S. Valle, and M. King (Eds.), *Existential-phenomenological alternatives for psychology* (pp. 6–17). New York: Oxford University Press.

Yanchar, R.J., and Johnson, H.J. (1981). Absorption and attitude towards hypnosis: A moderator analysis. *International Journal of Clinical and Experimental Hypnosis, 29,* 375–382.