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A STUDY OF THE EFFECT OF HYPNOTIC SUGGESTION ON COLOR PERCEPTION

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CHAPTER I

INTRODUCTION

It is generally accepted that needs, drives, values, set, expectancy, and other such internal factors do affect our reaction to the environment. Traditionally, psychologists have considered the effect as being one upon the response system (Thorndike, 1937; Guthrie, 1935). More recently, however, a general trend in psychology has been to explain the effects of internal factors on behavior in terms of alterations within the perceptual system (Murphy, 1947; Hebb, 1949; Bruner and Krech, 1950; Wapner and Werner, 1952; Allport, 1955). The psychological literature of the last 15 years is replete with experimental demonstrations of such relationships.

Physiological needs, such as hunger, have been shown to affect perception. Sanford (1936), Atkinson (1948), Postman and Crutchfield (1952), Levine, Chein and Murphy (1942) have shown that food deprivation tends to increase the number of food-related objects and words which subjects perceive when ambiguous stimuli are present. Further, it has been shown

that the subject's perceptual threshold for food-related objects (Lazarus, Yousen and Arenberg, 1953; Gilchrist and Nesberg, 1954) and for food-related words (Wispé and Drambarean, 1953) are a function of food deprivation.

The symbolic value of an object is related to the perceived size (Bruner and Goodman, 1947; Bruner and Postman, 1948; Lambert, Soloman and Watson, 1949; Lambert and Lambert, 1953; Ashley, Harper and Runyon, 1951; Bruner and Rodrigues, 1953; Beams, 1954) and to the estimated weight of an object (Dukes and Bevan, 1952).

Personal values also affect perceptual selectivity and sensitization to certain stimuli (McGinnis and Bowles, 1949; Vanderplas and Blake, 1949; McClelland and Liberman, 1949; Lindner, 1953).

The subject's perceptual threshold for material which is inimical, threatening, or tabooed is shown to be different from his perceptual threshold for material of neutral affective significance (Bruner and Postman, 1947; Postman, Bruner, and McGinnies, 1948; Cowan and Beier, 1950, 1954; Newton, 1955; Ericksen, 1951, 1952; Lazarus, Ericksen and Fonda, 1951; Ericksen and Browne, 1956; Postman and Solomon, 1950; Stein, 1953, Osler and Lewisohn, 1954; Neel, 1954; Klineman, 1954; Blum, 1955; and Nelson, 1955).

In all of these experiments, the criterion for judging that internal factors influence perception is the subject's differential response to a standard experimental situation under

different conditions of internal factors. The experimenter may infer that the subject responds differently because he perceives differently; however, it is much more difficult to substantiate this kind of inference than is immediately apparent, for perception is, by definition, private and not directly observable to anyone other than the perceiver. Thus, Pratt (1950) has offered a reasonable argument for the position that perception is a constant and that internal factors alter only response. Prentice (1956), Vernon (1955), and Goldiamond (1958) question whether perceptual manifestations of internal factors have been experimentally demonstrated. In fact, one might characterize recent perceptual research by the controversy, confusion, and disagreement which have accompanied it. Do the subjects in these experiments actually see the experimental stimuli differently or do they merely interpret what they see differently? Increasing recognition of this problem is currently being given in psychological literature. Attempts to summarize and evaluate the findings of perceptual experiments have led to direct expression of the confusion and equivocality ensuing from the ambiguity in perceptual research. Pastore recognized the controversies, inconsistencies, and ambiguities, and asked:

> Is perception itself influenced by needs or is it only the interpretative process accompanying the perceptual response which is influenced by needs? (1949, p. 469)

Prentice asks essentially the same question in a slightly different form:

> It is hard to know whether the presence of the need merely permits the use of a different set of memories or whether the need really modified the perceiving apparatus in some way. This continues to be one of the gaps in perceptual research of the functional kind. (1956, p. 36)

Jenkin systematically reviews and evaluates the experimental studies relating to affective processes in perception, alludes to the ambiguity which obtains, and conceptualizes the problem of perceptual research in the following manner:

> Review of the present field would be incomplete without some reference to a major issue; that is, the definition of perception and specification of the level at which needs states, personality factors, past experiences, and present expectations operate on the experience reported by the subject. The question involves more than semantic convenience. To some it is a central theoretical issue. (1957, p. 121)

George and Handlon recognized the confusion in perceptual research and attempt to clarify some of the semantic problems in the conception and analysis of perceptual experiments. They conclude their analysis by stating:

> Does the observer <u>see</u> events differently as the result of his experience or does he merely believe these events to be different? . . . In natural language the observer cannot wholly divorce what he sees from what he believes. . . The most obvious answer to this psychological delemma is to concentrate on an investigation of the sensory system from a strictly physiological point of view. (1957, p. 22)

Statements and questions such as these bring into bold relief the primary controversial problem which pervades perceptual research; i.e., the problem of differentiating between perception and response, or between levels of perception. Even a cursory acquaintance with perceptual experiments is enough to show that it is very easy to lose sight of the fact that in the

experimental situation the investigator is working with a perceiving, remembering, thinking, feeling, motivated, and responding organism, and that although experimental interest may be focused on one particular aspect to the exclusion of others, the others cannot be entirely ignored. Although these hypothetical processes are presumably integrated in some conjunctive manner, differentiation between them is not always possible in all experimental situations. Bruner clearly recognizes the difficulty of differentiating between hypothesized psychological processes;

> Analytically, let it be noted, one may make a distinction as Gestalt theorists have, between a pure stimulus process and the interaction of that stimulus process with an appropriate memory trace--the latter presumably resulting in a percept that has identity. If indeed there is a pure stimulus process, it is doubtful that it is ever represented in perception bereft of identity characteristics. The phenomena of a completely unplaceable objective or event or "sensation"--even unplaceable with respect to modality--is sufficiently far from experience to be uncanny. . . . If perceptual experience is ever had raw, i.e., free of categorical identity, it is doomed to be a gem serene, locked in the silence of private experience. (1957, p. 124)

Wallach also recognizes this problem:

> Indeed it is questionable that perception is possible without some factors other than sensory entering into it. (1949, p. 10)

In addition to the vagueness resulting from arbitrary experimental fractionation of psychological processes, it is apparent that much of the confusion and controversy in the area results from the differences in terminology and from diverse theoretical orientations. In evaluating the perception

literature, failure to recognize the distinction between "perception" as a construct and perception as a state of awareness adds confusion to some of the more basic problems which are involved in perceptual experiments. Even if one avoids the semantic and terminological pitfalls and considers "perception" as a construct, ambiguity and controversy still exist. The results of any experiment must be interpreted within the framework of a theory, and when diverse theoretical conceptualizations are present, the results of any experiment may be subject to varying interpretations.

Although there are many different theories of perception, it appears that there are only two primary ways in which perception has been conceived. Bevan (1958), in reviewing the evolution of the term "perception", gives special attention to its development as a theoretical concept and brings into focus the differences between the two primary conceptions of perception which prevail. In the early psychophysical conceptions, perception is viewed as a simple mediating process, a constant in the transformation of information received by the organism from a form that exists external to the organism to a form that is utilized in the overt response. Since, according to this conception, perception does not dynamically affect other aspects of behavior, simple sensory qualities and memory images, which are vestiges of them, are related in an uncomplicated fashion to a rather restricted number of physical stimulus dimensions. In the more recent or functional conceptions, perception is a

function not only of present stimulus input and receptor function, but also of motivation and past stimulation. In these formulations a larger number of variables are included, and the nature of the inter-variable relationship is regarded as more complex. The relational character of perception is stressed, the intermodality effects and the role of background described, and the contribution of non-situational (motivational and learning) variables is emphasized. In these more complex and interactive conceptions of perception, the identification and definition of the functions that influence perception become indispensable to the understanding and prediction of both perception and overt response.

Another critical analysis of perceptual theories (Harper, 1952) provides further differences between conceptions of perception which have contributed to controversy in perceptual research. Harper gives his attention to the kind of perceptual mechanism implicit in perceptual theories. He notes that two principal kinds of mechanisms have been postulated to intervene between stimulus and response, and that either or both of these mechanisms are implied in all perceptual theories. The first of these is what Harper calls the <u>undverbindung</u> type of mechanism. This is essentially a cognitive mechanism, in that it allows for response variability through alternation of the cognitive context into which incoming sensory data are assimilated. The second type of mechanism Harper calls the servo-type mechanism. This mechanism allows for response variability by means of a qualitative

change of the incoming sensory data itself rather than just a change of the cognitive context into which the sensory data are assimilated. It is to be noted that Harper's analysis of differences in perception theories parallels that of Bevan's in that the undverbindung mechanism is implicit in the early psychophysical theories while the servo-type mechanism is generally implied by the more recent functional theories.

It appears that, by and large, the early psychophysical theories of perception are conceptualized so as to deal with perceptual phenomena at an atomistic level. The modern functional theories of perception, on the other hand, are conceived in a manner which explains molar units of functioning and which ignores the problem of distinguishing between levels of perception. Even Hebb's (1949) theory of perception, which is perhaps one of the most carefully developed of the modern theories which attempts to explain perceptual phenomena at the atomistic and molar levels, does not specify operational measures which would permit differentiation between sensory and cognitive levels of perception.

Predominantly the controversy in perceptual research relates to the differences between these two types of perceptual theories, and, as Harper (1952) observes, much of the criticism of perceptual research reduces to the question of the existence of the servo-type mechanism.

One may criticize the early psychophysical conceptions of perception as being too narrowly defined and as excluding

from study, phenomena which is pertinent to an investigation of perception. Methodologically, however, such conceptions are quite acceptable. On the other hand, the modern functional theories of perception are so broadly conceived as to include almost all psychological processes, without, however, specifying the relationship between them. Hence, although the arbitrary segmentation of the earlier psychophysical conceptions is avoided, one is now confronted with conceptions of perception which are not sufficiently differentiated or articulated to account adequately for the many subtleties of psychological organization which are known to exist. Further, the functional conceptions of perception tend to be methodologically incomplete, and, hence, it is not possible to make a theoretically-grounded, operationally-specified distinction between the various psychological processes involved in perception.

Experimental attempts to decide which of these types of theories of perception is more adequate have resulted in equivocality. One may attempt to resolve the differences in these two conceptions of perception by critically questioning all assumptions and premises on which each theory rests. This approach leads directly into the realm of metaphysics, and although this may be a vantage point from which to consider perception theories philosophically, such a position is of little help in clarifying problems of research, for scientific research must ultimately be evaluated in terms of the validity

of its methodology. The substantive problems in perceptual research lie in the methodological issues (Harper, 1953; Bevan, 1958; Garner, Hake, and Ericksen, 1954; Goldiamond, 1958).

Harper (1952), in analyzing the factors involved in the "perception versus response" problem, notices that the implicit assumption "response changes because perception changes" is usually untenable, Harper emphasizes that for perceptual experiments, it is extremely important to select dependent variables which permit the experimenter to differentiate between perception and response.

Bevan (1958) notes that the most widespread methodological defect of perceptual theories is the absence of a set of statements that relate propositions about the theoretical model to reduction sentences. The result is that it is not possible to relate data systematically to the characteristics of the perceptual mechanism, nor is it possible to relate various properties of the mechanism to each other. Consequently, as Bevan states:

> . . . it is difficult to make a scientifically meaningful distinction between sensation and perception, perception and conception, or to differentiate operationally between the processes of attention and perception. (1958, p. 52)

The methodological problems resulting from too narrow an understanding of operationism have been analyzed by Garner, Hake, and Ericksen (1956), who note that much confusion in perceptual research has resulted from equating perception with

the discriminatory response by which it is operationally defined. These writers propose a method of "converging operations" by which perception can be operationally distinguished from response. This involves the use of two or more experimental operations, preferably independent, which allow the selection or elimination of alternative hypotheses which would explain an experimental result.

Goldiamond (1958) has also contributed to an understanding of the methodological problems in perceptual research. He finds that certain kinds of perceptual response indicators have characteristics of their own which cannot be attributed to the perception which the response is assumed to indicate. Further, he notes that the experimenter may inadvertently introduce error into his analysis of the experimental results by coupling certain kinds of indicators with certain psychophysical methods.

Clearly, failure to recognize the methodological problems in attributing experimental results to perceptual change has resulted in much confusion in the general area of perceptual research, but nowhere has a lack of consideration for methodology resulted in inconclusive experiments, controversy, and disagreement so much as in the studies relating to subliminal perception, perceptual defense, and perceptual sensitization. The literature in this area has already been systematically reviewed by Jenkin (1957), Adams (1957), and Goldiamond (1958). Briefly, the paradigm for these experiments is as

follows: The subject makes two different and usually simultaneous responses to stimuli from a series presented one at a time. Usually some of the stimuli have a meaning which is different from that of the other stimuli in the set. One response is overt, i.e. verbal, and the other is often physiological, non-verbalizable, and presumably indicative of emotion (such as GSR). The experimenter deals with the differences between the two indicators of perception at related stimulus measures. One response is interpreted as indicating absence of awareness of the stimulus, while the other is interpreted to indicate perception or discrimination of this same stimulus. If the indicators are separated in time a stimulus magnitude is found which relates to reports of no awareness. If at this magnitude or lower the subject later correctly identifies the stimulus, the difference is called "discrepancy." On the other hand, if the perception indicators are contemporaneous and the subject reports no awareness of the stimulus magnitude and also makes a correct identification, this is called the "asynchrony." Characteristically, discrepancy and asynchrony between indicators is interpreted as demonstrating unconscious perceptual processes.

Goldiamond (1958), in a critical methodological analysis of these experiments, focuses on the relationship between the psychophysical methods employed and the kind of data which is collected. His analysis reveals that the discrepancy or asynchrony between indicators may be a function of pairing a

valid indicator with one made less sensitive by admitting invalidating variance, or by using procedures which artificially inflate thresholds and thereby make it appear that processes related to the receipt of information are going on below threshold levels. Goldiamond concludes that:

> . . . most of the substantive contributions in this area (subception, perceptual defense, etc.) cannot be demonstrated to relate to perceptual variables and that the subject in responding to a perceptual situation tends to respond in terms of the consequences of his response and in terms of other nonperceptual variables. (1958, p. 405)

Despite the voluminous literature in perceptual research and the fact that the semantic, theoretical, and methodological problems in differentiating between perception and response or between sensory and cognitive levels of perception have been given thorough consideration, little experimental attention has been given to this problem. Atwater (1953), in a review of perceptual experiments, concludes that only one study yields results which clearly demonstrate that motives may alter perception rather than just response. A subsequent review by the present writer reveals that only a few experiments, in addition to that by Atwater (1953) and Harper (1952), purport to deal with the general problem. These studies may be divided into two groups according to the approach taken on the problem. One approach has been to conceive of perception as a series of temporally organized processes intervening between the stimulus and response. In these experiments, the experimenter attempts to distinguish between levels of perception.

Atwater (1953), in an experimental situation, found that people who read from right to left have a greater sensitivity for stimulation in the left half of the visual field, while people who read from left to right have a greater sensitivity in the right half of the visual field. The dependent variable in his experiment is recognition threshold for an irregularly flashing light, and he interprets the results of his experiment as giving support for the hypothesis that central factors do affect perception rather than just response.

Neisser (1954) was also concerned with differentiating between the perceptual and response manifestations of internal factors. He presented words and their homonyms to his subjects tachistoscopically and found that the set to perceive words as induced by previous visual exposure to them, resulted in the lowering of the subject's threshold for perceiving the printed word rather than facilitating his verbal report.

Wallach (1953) has shown both theoretical and experimental interest in the problem of distinguishing between levels of perception. He is concerned with determining whether central factors alter perception (sensorially) or exert their effect on behavior by altering a memory trace with which the meaning content is connected. Using the kinetic depth effect, Wallach shows that three dimensional figures cast silhouettes which are initially seen as two dimensional, but which are seen as three dimensional after the subject has seen the

silhouette of the figure while it is being rotated. He justifies his conclusion that the report of a change from two to three dimensions is perceptual (sensory) on the basis of his subject's reporting perspective reversal. This is certainly a tenuous argument. Gibson (1957), who performed a similar experiment and obtained comparable results, refers specifically to the differences between his interpretation and that of Wallach, pointing out that Wallach's experiment does not necessarily prove the effect of memory on depth interpretation of an ambiguous static picture. Thus, it appears that the results of the experiment by Wallach do not give sufficient evidence to support the inference that the perceptual changes reported by his subjects were perceptual (sensory) rather than interpretative.

Harper (1952) experimentally demonstrated that red objects, which are usually or always seen as red, are seen under experimental conditions as "redder" than those red objects which have seldom, if ever, before been seen as red. The results of this study give strong support for the hypothesis that past experience with an object may result in a change of perception at a sensory level.

In the experiments by Atwater and by Neisser, the dependent variable is recognition threshold, and although these studies do distinguish operationally between perception and response, they do not yield information with regard to the level at which this perceptual change occurs. As

previously noted, the results of Wallach's experiment are subject to equivocal interpretation, and one may argue, as Gibson has done, that central factors alter depth interpretation rather than depth perception in Wallach's use of the term. Only the experiment by Harper gives support for the hypothesis that internal factors may function to alter perception at a sensory level of perception rather than at an "as if" interpretative level.

A second approach to the problem of experimentally differentiating between perception and response is that of conceiving of perception as sensory awareness. In experiments stemming from this approach, selection of a dependent variable which differentiates between perception and response is of primary importance. Harper (1952) relates an incident in which one of his colleagues, working with a hypnotized subject, presented her with an ordinary yellow pencil, suggesting that the pencil was green. The subject responded subsequently to several tests, including the Ishihari Color Vision Test, as if yellow were for her green. Harper reasons that the hypnotic suggestion resulted in a change of internal organization of the subject so that she actually perceived yellow as green. From the data provided by Harper, it is not possible to conclude that the subject's perception was changed at a sensory level rather than at an "as if" cognitive level of perception. However, this incident as described by Harper suggested hypnosis as a means of manipulating internal factors for experimental study. With a slight modification this technique offers a means of determining whether

or not the subject's perception is altered at a sensory level. It is a well-established fact (Stevens, 1951, p. 853) that people with normal color vision experience a negative after-image following the experience of a bright spot of color and that this after-image is a color experience, complementary to that of the initial color experience. Therefore, if the hypnotically induced expectance to see red, for example, operates at the level of the sense organ, the subject will report an after-image of green, if given an opportunity to do so.

A survey of the literature reveals, however, that this idea for testing the validity of the hypnotically induced color experience is not a new one. Binet and Frére (1888), Dorcus (1937) Erickson and Erickson (1938), and Hibler (1940) all have used this technique in order to determine whether the experience of the hypnotized subject was modified by suggestion at the level of the exteroceptor. The findings of these studies are inconsistent, however, as Binet and Frére and Erickson and Erickson report positive results while Dorcus and Hibler report negative results. It seems logical to assume that the differences in the obtained results are related to differences in experimental procedures; hence, each of these experiments was carefully analyzed in order to discover experimental factors which might have contributed to the difference in the results of these studies.

Binet and Frére (1888) were the first to employ the use of the negative after-image technique as a means of

verifying the sensory manifestations of hypnotically induced perceptual expectancies. Their subject, who was in a somnambulistic trance state, was presented a square of white paper with a centered black spot designed to fix her vision. The suggestion was made that the paper was red. A second sheet of paper, likewise marked with a black spot in the center, was then produced, and as soon as the subject fixated on the spot, she exclaimed that the spot was surrounded by a colored square. The color which she reported was complementary to that which had been made to appear by means of suggestion. Little information is given about the sophistication of the subject, but the authors note that to insure success in such an experiment, care must be taken to define the nature of the suggested color and shade; otherwise, the subject may, for example, see the shade of red for which the after-image is green or the orange-red for which blue is complementary.

Dorcus (1937), prior to the experimental procedure, presented to each of his subjects a color card and demonstrated to them the negative after-image phenomenon. He then induced a deep hypnotic trance and gave several of the standard tests in order to ascertain that all subjects were in a deep trance state. Then the hypnotized subjects were shown a colored card and given the suggestion that it was of another color. In order to make it impossible for his subjects to "fake" an after-image and to neutralize the knowledge which he had given them prior to the experiment, Dorcus required his subjects to

project their after-images on a colored background. Although this is a rather ingenious method of confounding the subject who might give the expected response in order to please the experimenter, it is indeed questionable that any but those who had been trained in reporting color experience could accurately describe the color of the expected after-image as projected on the colored background. The results of this experiment are negative, but the conclusions which Dorcus draws from his experimental data are questionable in view of the fact that the naive subjects could not reasonably be expected to describe accurately the nuances of color which they would be expected to see in the projected after-image.

Erickson and Erickson (1938), using a technique similar to that of Binet and Frère, obtained positive results from four of the five subjects used in their experiment. The nature of the experimental task was disguised by presenting the subjects with eight white cards, suggesting in advance a color experience for the odd numbered cards and requesting the subjects to identify the color of all cards. Subjects were given free-association tests before and after the experimental procedure in order to determine whether previous knowledge of the negative after-image phenomenon entered into the obtained results. Following the experiment the subjects were questioned concerning a definition of complementary colors and required to hazard guesses as to what colors were complementary. The results of the free-association tests and post-

experimental interrogation yielded no reason to suspect that the subjects had any previous knowledge of negative after-images, although all subjects were intellectually sophisticated college students. Nor was there any evidence of their gaining any knowledge of color complements from the experimental experience.

Hibler (1940) introduced his subjects to four different experimental conditions. First, he asked the subjects to report what they would see after gazing at a brightly colored disk for thirty seconds. Hibler did not, however, actually present color cards to the subjects but only requested that the subject imagine what he might experience if he were exposed to a disk of each of the primary colors and then continued to gaze at a neutral background. The purpose of this was to test the subject's knowledge of the after-image phenomenon. Second, Hibler hypnotized his subjects, presented to them a grey card and suggested a color experience. Then presenting to the subject another grey card, he asked for a report of the color experienced. Hibler then repeated this procedure but awakened the subject before asking for a report of the after-image. Third, repeating this procedure, he used a blue stimulus card but suggested that it was identical in color, hue, and brightness to a red card which he showed the subject. He asked for the after-image on a grey card while the subject was hypnotized, and then again after the subject had been awakened. Fourth, he repeated condition one

under hypnosis and also conducted the usual after-image experiment, using actual color stimuli, offered no hypnotic suggestion, and elicited the after-image report after the subject had been awakened.

Hibler's results were not consistent with those obtained by Binet and Frère or by Erickson and Erickson. Hibler states in a footnote that one factor which may have accounted for this difference is that he spent only three to five minutes inducing a hypnotic trance, whereas Erickson and Erickson spent from 30 to 45 minutes. It must also be noted that Hibler's instructions to his subjects were so ambiguous that he may have inadvertently influenced their responses. For example, in his procedure to elicit the after-image, he informed the subjects that he would present a "grey" card. It is not surprising that many reported the card to be grey. It is also important to note that Hibler did not suggest to his subjects that they would <u>see</u> (the blue card as) red, and it is quite possible that the lack of clarity and the tentativeness of his suggestions in part three of his experiment contributed to his failure to obtain the expected results. Further, three of his four subjects were familiar with the negative after-image phenomenon and, hence, could have given the appropriate responses on the basis of their memory of previous situations. There is one factor which certainly modified and confounded the results obtained by Hibler. His data reveal that all subjects' reports of

negative after-images under hypnotic conditions are consistent with their initial pre-hypnotic commitments. Hence, the technique which he used to determine prior knowledge of the negative after-image phenomenon actually supplied the subjects with a knowledge (whether correct or incorrect) of how to respond during the experiment, and they responded in terms of this knowledge.

From the foregoing it is apparent that there are a variety of factors which may have contributed to the differences in results obtained. In regard to the two studies which report positive results, it is quite possible that the subjects were acquainted with the negative after-image phenomenon prior to their participation in the experiment. The free-association technique employed by Erickson and Erickson is hardly adequate to determine whether the subject knows that experientially green is the opposite of red. An opposite-association technique would seem more appropriate. Also, from their comment on the interrogation of the subjects after the experiment, one cannot discern whether the questioning amounted to more than an intellectual examination to determine the subject's ability to define complementary colors. A more detailed questioning concerning the subject's knowledge of or previous experience of the negative after-image phenomenon would seem more desirable.

As previously noted, it is not known whether the subject used by Binet and Fréré was acquainted with the negative

after-image phenomenon. Further, the measure employed by Dorcus, requiring that the subject identify the color of an after-image as projected on a colored background, makes for such a difficult task that only persons trained in reporting color experiences could be expected to describe accurately the after-image color. If his subjects actually were so sophisticated, then they would almost certainly have knowledge of complementary colors. If they were not, then their description of the after-image color would be of dubious accuracy. The results of the experiment would be confounded whether the subjects were naive or sophisticated. As previously mentioned, the pre-experimental 'imaginary situation,' used by Hibler to determine the subject's knowledge of complementary colors, introduced in the subject an expectancy which conceivably prevents him from reporting any negative after-image experience which is inconsistent with this expectancy. Hence, it is obvious that one must obtain an adequate measure of the subject's knowledge of complementary colors and of the negative after-image phenomenon, but one also must be careful to avoid giving the subject any knowledge or expectancy which would confound the results of his participation in the experiment proper. It is also obvious that the experimenter's instructions must be very specific, positive, and unambiguous so that the subject is clearly instructed to experience only the suggested color. Another important variable is the length of time spent in trance induction. There is reason to believe

that this variable is related to depth of trance, and that possitive results can be obtained only if the subject is in a deep somnambulistic trance.

These four experiments are identical in that the hypnotized subject is given a suggestion to experience color when presented with a pseudo-stimulus card, and then required to report a negative after-image in relation to another card. However, they differ in other respects, which have already been discussed. The following diagram summarizes these differences.

	Sophistication of subjects	Length of time spent in trance induction	Chromaticity of cards
Binet and Frere	?	?	Achromatic only
Dorcus	Naive and Sophisticated	?	Chromatic only
Erickson and Erickson	?	30 minutes	Achromatic only
Hibler	Naive and Sophisticated	5 minutes	Achromatic and Chromatic cards

The diagram above emphasizes the fact that adequate consideration of all three major variables is not given in any one of these four experiments and that the experiments differ among themselves.

An experiment designed to allow for systematic

manipulation of these three major variables would give some basis for determining the extent to which these variables may have contributed to the conflicting results of the four experiments and also would yield information pertinent to the question of whether internal factors can alter perception as sensory awareness. Such an experiment is described in the following pages.

CHAPTER II

STATEMENT OF PROBLEM

The major purpose of this study is to investigate the effect of internal factors (such as set, suggestion) on perception. More specifically, the purpose is to investigate the effect of hypnotic suggestion on perception of color. A further purpose is to try to account for the difference in results obtained by other investigators. Previous studies have differed among themselves not only with respect to their conclusions about the effect of hypnotic suggestion on color perception, but also with respect to the use of three variables: length of time spent in trance induction, degree of sophistication of subjects, and chromaticity of pseudo-stimulus cards. Accordingly, the current study proposes to investigate the influence of these variables on the perception of color.

CHAPTER III

METHODS

Subjects

The 64 subjects used for the experiment were volunteers from the Oklahoma Girls Training School. In this institution there are 137 girls. Table 1 shows their distribution according to age and educational status.

Table 1

Distribution of Population According to Age and Educational Status

Age		Grade placement		Grades retarded	
Years	Number	Grade	Number	Years	Number
12	1	7	21	0	33
13	3	8	25	1	50
14	32	9	41	2	36
15	35	10	35	3	10
16	42	11	11	4	7
17	23	12	4	5	1
18	1				
	137		137		137

Table 1 indicates that almost all girls fall within the 14 to 17 year age range. It is also apparent that over

75% of the group are retarded at least one year in school progress. Although IQ scores are not available for all the girls in the school, the writer has administered individual intelligence tests to a randomly selected set of these girls. Table 2 shows the frequencies of IQ scores falling within 10 point intervals.

Table 2

Distribution of IQ Scores for a Random Sample of the Population

IQ range	Number
110-119	2
100-109	3
90-99	7
80-89	12
70-79	7
60-69	5
50-59	2
40-49	1
	39

Table 2 reveals that this sample is below average in intelligence relative to the general population. This might be expected, however, since all but one or two of the girls in the institution came from lower socio-economic levels.

Since knowledge of the after-image phenomenon might influence the subject's responses in the experimental situation, it is essential that subjects who have no knowledge of this phenomenon be selected. Hibler's findings (1940) indicate that it is not feasible to question the subject about her knowledge

of this phenomenon prior to the experiment, for this procedure gives the subject cues which then function as determinants of her response to the experimental situation. The use of subjects who have little formal education and limited intellectual interests tends to ensure naivete with regard to the negative after-image phenomenon. In order to obtain an empirical basis for inferring that naivete characterizes the sample from which the subjects were drawn, 40 girls who are similar to the experimental sample with respect to age, intelligence, and socio-economic level were given a test of knowledge of after-image phenomenon, orally (See Appendix B). Analysis of the results reveals that only one correct response was given out of a possible 160. This study gives support to the assumption that the subjects have no knowledge of the negative after-image phenomenon.

All subjects must have normal color vision, for only such persons could be expected to give correct after-image reports. Therefore, the Ishihari Color Vision Test was administered to all prospective subjects, and only those who manifest no color vision anomolies were considered for the experiment.

Those who volunteered for the experiment and who had normal color vision were then selected on the basis of somnambulistic trance susceptibility. Techniques described by Estabrooks (1951, pp. 23-49) were used. Those subjects who could achieve a somnambulistic trance according to the criteria

outlined by Estabrooks (1951) were chosen as subjects for the two trance groups (See Appendix E).

Variables

Sophistication of subjects. On the basis of a preliminary study (See Appendix B), it was assumed that none of the subjects selected for the experiment had knowledge of the negative after-image phenomenon. Half of the subjects received no information about the negative after-image phenomenon and are referred to as the Naive Group. The other half of the subjects were given information which would permit them to report the correct negative after-images in response to the experimental situation without having experienced any sensory image. The information is contained in the following:

> I want to tell you a little about the eye and how it works. Because of the way the eye is made, certain colors are opposites. Black and white are opposites, red and green are opposites, and blue and yellow are opposites. Now if we look at a color on a grey background for several seconds and then take the color away, we will see the opposite color. For example, if you look at a small black square in the center of a large sheet of grey paper for several seconds then take the black square away, you will see a white square on the grey paper where the black square has been, although there will actually not be any white paper there. The same thing happens with other colors. If you look at a color on a grey background and then take it away, the opposite color will appear. Now remember black and white are opposites, red and green are opposites, and blue and yellow are opposites.

Subjects who receive the above information are referred to as the Sophisticated Group.

Length of time spent in trance induction. This variable consists of three classes; Long, Short, and No-Trance. All girls used in the first two groups were selected hypnotic subjects. They participated in the experiment while in a somnambulistic hypnotic trance. A maximum of five minutes was spent in trance induction for one half of the trance subjects, and they are referred to as the Short-Trance Group. A minimum of 30 minutes was spent in trance induction with the other half of the trance subjects, and they are referred to as the Long-Trance Group. Subjects for the No-Trance Group were selected from those girls who had not been tested for susceptibility to somnambulistic trance.

In order to induce hypnosis, the subject was seated in a comfortable chair and encouraged to relax and to close her eyes. The experimenter then gave the following instructions, which were repeated throughout the attempt to induce hypnosis:

> You are falling sound asleep. Relax all your muscles and imagine that you are going into a deep sleep. Deeper and deeper. You will not wake up until I tell you, then you will wake up quietly; and you will always feel fine as a result of these suggestions. You are falling sound, sound asleep. Deeper and deeper, and deeper. You feel very heavy and tired and relaxed. You are falling deeper and deeper asleep. You will hear only my voice as you sleep.

Pseudo-stimulus card chromaticity. The third variable is the chromaticity of the pseudo-stimulus cards. The four pseudo-stimulus cards presented to half of the subjects were

Achromatic (Color Aid Grey No. 5). For Trance subjects, one of four colors (red, blue, green, yellow) was suggested for each of the achromatic pseudo-stimulus cards. There are 24 permutations of these colors. Since after-images of colors are the complementaries of the colors, it seems undesirable to have any suggested color preceded or followed by the suggestion of its complementary. Of the 24 possible permutations of the four colors, therefore, only eight were used in this study:

1	2	3	4	5	6	7	8
R	R	B	B	G	G	Y	Y
Y	B	R	G	Y	B	G	R
G	G	Y	Y	R	R	B	B
B	Y	G	R	B	Y	R	G

Each subject participating in the Achromatic condition had one of these orders assigned at random to her.

The other half of the subjects were shown chromatic pseudo-stimulus cards which consist of red (Color Aid Red Hue), a blue (Color Aid Blue Hue), a green (Color Aid Green Hue), and a yellow (Color Aid Yellow Hue) card. The same restrictions held for the order of the four chromatic pseudo-stimulus cards, and again there were only eight (the same as above) permissible orders. Each subject in the Chromatic Group had two of eight orders selected for her (one for the chromatic psuedo-stimulus cards, the other for the suggested colors). There are 26 possible pairs of orders. In order to avoid confounding the effect of the chromatic pseudo-stimulus cards with "correct"

after-image it was desireable to impose the following restrictions: the suggested color must be different from either the color of the pseudo-stimulus card or from the complementary color of the pseudo-stimulus card. These restrictions permit the use of only eight of the possible pairs of orders:

Suggested color	Pseudo-stimulus card color	Suggested color	Pseudo-stimulus card color
1		2	
Y	R	B	R
G	Y	G	B
B	G	Y	G
R	B	R	Y
3		4	
R	B	G	B
Y	R	Y	G
G	Y	R	Y
B	G	B	R
5		6	
Y	G	B	G
R	Y	R	B
B	R	Y	R
G	B	G	Y
7		8	
G	Y	R	Y
B	G	B	R
R	B	G	B
Y	R	Y	G

Each subject participating in a chromatic condition had one of these orders assigned at random to her.

Apparatus

In order to facilitate presentation of the pseudo-stimulus cards, after-image cards, and matching colors, an

enclosed box was used. The box was constructed of 1/4" plywood and is 12" deep, 12" long, and 14" wide. The 1 1/2" viewing aperatures, spaced 1" apart, were centered in the front of the box, permitting a binocular view of the interior. In the center of the rear panel is a 1" circular presentation window. A 1 1/2" plywood plate was centered over this presentation window, on the outside of the box and mounted on two parallel wooden strips, 1/8" thick and 1 1/2" long. This arrangement permits the examiner to insert a strip of paper under the plate and expose it through the presentation window to the subject who looks through the viewing aperatures. In the interior of the box the black panel was covered with neutral grey paper (Color Aid Grey No. 5) except for the presentation window. The portion of the cover plate which is visible through the presentation window and the sides of the window itself were painted flat black. The rest of the interior of the box was painted flat white. Two eight-watt Standard Cool White, General Electric flourescent tubes were used to illuminate the interior of the box, being mounted above and below the viewing aperatures.

The top panel of the box lacks 1/8" of joining the rear panel. The resulting slot allows a matching card to be inserted for presentation to the subject. The matching card consists of a 15" x 13" piece of cardboard, covered with neutral grey paper. Four 1" discs of various tints (Color Aid VBV T 2, BG T 3,

RVR T 4, Y T 4) were cemented in a 5" circle on the matching card. These discs were numbered so as to permit the subject to identify any tint by means other than by color naming (i.e. indicating the number rather than the color name).

Procedure

Each of 64 subjects were assigned to one of twelve treatment classes (3 Trance x 2 Chromaticity x 2 Sophistication). Each of the 32 Trance subjects were assigned randomly to one of eight treatment groups (2 Trance x 2 Chromaticity x 2 Sophistication). Four of these groups were Long-Trance; the other four are Short-Trance.

Long-Trance Groups

The procedure for the Long-Trance groups are:

Long-chromatic-sophisticated. Before the subject entered the room, a pair of orders of suggested color and of color of pseudo-stimulus card was selected. After the subject entered the room, she was made comfortable and told that she was participating in some research on color vision. The information about negative after-images (p. 30) was given to her. The experimenter then placed her under deep trance (p. 31) and gave the following instructions:

> When you thoroughly understand the instructions, you will look into the box on the table; and I shall begin to show you a series of eight cards, one at a time. Card number one, as you shall see, will be red for instance, like this (red card shown the subject outside the presentation box for not more than three seconds). Card number three, as you shall see, will be blue, for instance, like this (blue card briefly shown). Card number five, as you shall see will be green, for instance, like this (green card briefly shown). Card number seven as you shall see will be yellow, for instance, like this (yellow card

briefly shown). I shall call out the number of each card as I present it to you, and you will then focus your eyes on the small dot in the center of the card. As you look at cards number one, three, five, and seven I shall describe the color of the card which you see. As you noticed, I did not tell you the colors you will see on cards number two, four, six, and eight. After you look at these cards I will present a card with several colors on it then I will ask you to tell me the number of the color most nearly like that which you have just seen in the central window. Now, make sure you understand the instructions. I will repeat them.

After giving the instructions, the subject was instructed to look into the "test box" (p. 34) and the experimenter presented the series of pseudo-stimulus cards alternately with grey cards. As each pseudo-stimulus card was presented, the experimenter told the subject to "look at" the appropriate suggested color. The experimenter repeated the suggestion several times during the 30-second exposure of the pseudo-stimulus card. Then the grey card (after-image card) was presented for 15 seconds. The subject was then requested to tell the experimenter the number of the colored disc which looked most like the after-image card. If the designated color was the complementary of the suggested color, the response was scored "correct." If it was any of the other three colors, it was scored "incorrect." The matching tints in the test box were considered to be complementary to the suggested colors. That subjects react to these discs as complementaries was shown by results of a preliminary study. (See Appendix D).

At the conclusion of the last test for after-images, the hypnotic suggestions were removed and the subject was

awakened.

After the subject had finished the test, she was asked to cooperate by not discussing the experiment with others. No information about the true nature of the research or about her performance was given her.

Long-chromatic-naive. The procedure was the same as for the Long-Chromatic-Sophisticated Group, but the information about negative after-images was omitted.

Long-achromatic-sophisticated. The procedure was the same as for the Long-Chromatic-Sophisticated Group except that the pseudo-stimulus cards were grey rather than colored and as a consequence, only the order of suggested color was selected for the subject.

Long-achromatic-naive. The procedure was the same as for the Long-Achromatic-Sophisticated Group, but the information about negative after-images was omitted.

Short-trance groups

The procedures for these four groups (Short-Chromatic-Sophisticated, Short-Chromatic-Naive, Short-Achromatic-Sophisticated, Short-Achromatic-Naive) differed from the procedures for the corresponding Long-Trance Groups only with respect to length of trance induction. (p. 31)

No-trance groups

The function of the No-Trance Groups was to serve as a

control for all variables other than the complex variables "hypnotic suggestion." Each of the 32 subjects in the No-Trance Group were paired randomly with a subject in one of the Trance Groups. The No-Trance subject was exposed to the same order of chromatic pseudo-stimulus (if she was matched with a Trance subject in a Chromatic Group) as was the subject with whom she was matched. All responses made by a No-Trance subject were scored as though she had been given the same order of suggested colors as had the Trance subject with whom she was paired. Thus the "correct" responses of a No-Trance subject indicates generalized response tendencies. independent of suggestion.

No-trance-chromatic-sophisticated. Before the subject entered the room, an order of the pseudo-stimulus cards was selected. After the subject entered the room, she was made comfortable and told that she was participating in some research on color vision. The information about negative after-images (p. 30) was given to her. The experimenter then gave the following instructions:

> When you thoroughly understand the instructions, you will look into the box on the table and I shall begin to show you a series of eight cards, one at a time. You will look at each card as I present it to you, and you will then focus your eyes on the small dot in the center of the card. After you look at each of the cards, two, four, six, and eight, I will present a card with several colors on it. Then I will ask you to tell me the number of the color most nearly like that which you have just seen in the central window. Now, to make sure that you understand the instructions, I will repeat them.

After giving the instructions, the experimenter presented the series of pseudo-stimulus cards alternately with grey cards. Each pseudo-stimulus card was presented without comment other than the instruction to "look at the card." The experimenter repeated the instructions several times during the 30-second exposure period of the pseudo-stimulus card. Then the grey card (after-image card) was presented for 15 seconds. If the designated color was the complementary of the color which was suggested to the subject in the Trance (Long or Short)-Chromatic-Sophisticated Group with whom this No-Trance subject was matched, the response was scored "correct." If it was any of the other three colors, it was scored "incorrect."

After the subject had finished the test, she was asked to cooperate by not discussing the experiment with others. No information about the true nature of the research or about her performance was given to her.

No-trance-chromatic-naive. The procedure was the same as for the No-Trance-Chromatic-Sophisticated Group, but the information about the negative after-images was omitted.

No-trance-achromatic-sophisticated. The procedure was the same as for the No-Trance-Chromatic-Sophisticated Group with the following exceptions: The pseudo-stimulus cards were grey rather than colored; as a consequence, only the order of suggested color was selected for the subject.

No-trance-achromatic-naive. The procedure was the same as for the No-Trance-Achromatic-Sophisticated Group, but the information about negative after-images was omitted.

CHAPTER IV

RESULTS

The distribution of all responses made by all subjects appears in Tables 21, 22, 23, 24, 25, 26, 27, and 28 in Appendix F. Each response was scored as "correct" or "incorrect" according to the criteria presented on pages 38 and 39. The major findings appear below in eight tables, two for each of the suggested colors. These tables for each of the suggested colors consist of the distribution of subjects (one response for each subject) over Response, Length of Trance Induction, Sophistication, and Chromaticity of Pseudostimulus Cards; and the summary of a set of pertinent $\underline{X}^2$ tests obtained by conducting a multiple contingency analysis (Sutcliffe, 1957). The Response effect is tested against the hypothesis that the probability of a correct response is 0.25. All other effects are tested against the hypothesis that (given a correct-response probability of 0.25) all of the variables involved in a given effect are independent of each other. For all tests, the level of significance is 0.05. For degrees of freedom equal to one and two respectively, the critical $\underline{X}^2$ values are 3.84 and 5.99.

Table 3

Distribution of 64 Subjects Over Response (After-Image of Suggested Color), Length of Trance Induction, Sophistication, and Chromaticity of Pseudostimulus Cards

Suggested color: red

Trance induction	Chromaticity	Sophistication			
		Naive		Sophisticated	
		Response		Response	
		Correct	Incorrect	Correct	Incorrect
Long	Chromatic	1	3	0	4
	Achromatic	1	3	0	4
Short	Chromatic	0	4	2	2
	Achromatic	0	4	1	3
No	Chromatic	1	7	1	7
	Achromatic	2	6	2	6

Table 4

Summary of Multiple Contingency Analysis

Suggested color: red

Effect	χ^2	df	Significant at 0.05 level
Response	2.08	1	No
Trance x Response	0.25	2	No
Sophistication x Response	0.09	1	No
Chromaticity x Response	0.09	1	No
Trance x Sophistication x Response	4.25	2	No
Sophistication x Chromaticity x Response	0.06	1	No
Trance x Chromaticity x Response	0.92	2	No
Trance x Sophistication x Chromaticity x Response	0.25	2	No

Table 5

Distribution of 64 Subjects Over Response (After-Image of Suggested Color), Length of Trance Induction, Sophistication, and Chromaticity of Pseudostimulus Cards

Suggested color: blue

Trance induction	Chromaticity	Sophistication			
		Naive		Sophisticated	
		Response		Response	
		Correct	Incorrect	Correct	Incorrect
Long	Chromatic	0	4	1	3
	Achromatic	0	4	1	3
Short	Chromatic	0	4	0	4
	Achromatic	0	4	1	3
No	Chromatic	0	8	0	8
	Achromatic	1	7	2	6

Table 6

Summary of Multiple Contingency Analysis

Suggested color: blue

Effect	X^2	df	Significant at 0.05 level
Response	8.33	1	Yes
Trance x Response	0.16	2	No
Sophistication x Response	1.32	1	No
Chromaticity x Response	1.32	1	No
Trance x Sophistication x Response	0.53	2	No
Sophistication x Chromaticity x Response	0.36	1	No
Trance x Chromaticity x Response	0.53	2	No
Trance x Sophistication x Chromaticity x Response	0.11	2	No

Table 7

Distribution of 64 Subjects Over Response (After-Image of Suggested Color), Length of Trance Induction, Sophistication, and Chromaticity of Pseudostimulus Cards

Suggested color: green

Trance induction	Chromaticity	Sophistication			
		Naive		Sophisticated	
		Response		Response	
		Correct	Incorrect	Correct	Incorrect
Long	Chromatic	0	4	0	4
	Achromatic	1	3	1	3
Short	Chromatic	0	4	1	3
	Achromatic	0	4	1	3
No	Chromatic	0	8	0	8
	Achromatic	0	8	0	8

Table 8

Summary of Multiple Contingency Analysis

Suggested color: green

Effect	X^2	df	Significant at 0.05 level
Response	12.00	1	Yes
Trance x Response	1.33	2	No
Sophistication x Response	0.33	1	No
Chromaticity x Response	0.33	1	No
Trance x Sophistication x Response	1.00	2	No
Sophistication x Chromaticity x Response	0.00	1	No
Trance x Chromaticity x Response	1.02	2	No
Trance x Sophistication x Chromaticity x Response	0.03	2	No

Table 9

Distribution of 64 Subjects Over Response (After-Image of Suggested Color), Length of Trance Induction, Sophistication, and Chromaticity of Pseudostimulus Cards

Suggested color: yellow

Trance induction	Chromaticity	Sophistication			
		Naive		Sophisticated	
		Response		Response	
		Correct	Incorrect	Correct	Incorrect
Long	Chromatic	0	4	0	4
	Achromatic	1	3	0	4
Short	Chromatic	0	4	0	4
	Achromatic	0	4	1	3
No	Chromatic	1	7	0	8
	Achromatic	2	6	2	6

Table 10

Summary of Multiple Contingency Analysis

Suggested color: yellow

Effect	χ^2	df	Significant at 0.05 level
Response	6.75	1	Yes
Trance x Response	0.74	2	No
Sophistication x Response	0.08	1	No
Chromaticity x Response	2.08	1	No
Trance x Sophistication x Response	0.77	2	No
Sophistication x Chromaticity x Response	0.08	1	No
Trance x Chromaticity x Response	0.11	2	No
Trance x Sophistication x Chromaticity x Response	0.71	2	No

Only the response effects for the suggested colors yellow, green, and blue are significant. These results indicate that reliably fewer correct responses were made to these suggested colors than would be expected from the hypothetical probability of 0.25.

Since half of the subjects were shown chromatic pseudo-stimulus cards, it is possible that their responses to the experimental task were determined by the color of the pseudo-stimulus card; i.e., responding to the pseudo-stimulus card color could possibly account for the finding that too few correct responses were made to the suggested colors. In order to test this hypothesis, the responses of the Chromatic subjects were rescored. A response was considered correct if it was the negative after-image of the pseudo-stimulus card which had been presented. The distribution of the subjects over Response, Sophistication, and Trance, and the summary of multiple contingency analyses are shown in Tables 11, 12, 13, 14, 15, 16, 17, and 18.

Table 11

Distribution of 32 Subjects Over Response (After-Image of Pseudostimulus Card Color), Sophistication, and Length of Trance Induction

Color of pseudostimulus card: red

Sophistication	Trance induction	Response	
		Correct	Incorrect
Sophisticated	Long	3	1
	Short	4	0
	No	6	2
Naive	Long	3	1
	Short	2	2
	No	5	3

Table 12

Summary of Multiple Contingency Analysis

Color of pseudostimulus card: red

Effect	χ^2	df	Significant at .05 level
Response	37.50	1	Yes
Sophistication x Response	1.50	1	No
Trance x Response	0.17	2	No
Trance x Sophistication x Response	4.99	2	No

Table 13

Distribution of 32 Subjects Over Response (After-Image of Pseudostimulus Card Color), Sophistication, and Length of Trance Induction

Color of pseudostimulus card: blue

Sophistication	Trance induction	Response	
		Correct	Incorrect
Sophisticated	Long	1	3
	Short	3	1
	No	3	5
Naive	Long	1	3
	Short	1	3
	No	4	4

Table 14

Summary of Multiple Contingency Analysis

Color of pseudostimulus card: blue

Effect	X^2	df	Significant at 0.05 level
Response	6.00	1	Yes
Sophistication x Response	0.67	1	No
Trance x Response	0.67	2	No
Trance x Sophistication x Response	4.67	2	No

Table 15

Distribution of 32 Subjects Over Response (After-Image of Pseudostimulus Card Color), Sophistication, and Length of Trance Induction

Color of pseudostimulus card: green

Sophistication	Trance induction	Response	
		Correct	Incorrect
Sophisticated	Long	1	3
	Short	3	1
	No	3	5
Naive	Long	1	3
	Short	1	3
	No	4	4

Table 16

Summary of Multiple Contingency Analysis

Color of pseudostimulus card: green

Effect	X^2	df	Significant at 0.05 level
Response	4.17	1	Yes
Sophistication x Response	0.17	1	No
Trance x Response	5.67	2	No
Trance x Sophistication x Response	4.67	2	No

Table 17

Distribution of 32 Subjects Over Response (After-Image of Pseudostimulus Card Color), Sophistication, and Length of Trance Induction

Color of pseudostimulus card: yellow

Sophistication	Trance induction	Response	
		Correct	Incorrect
Sophisticated	Long	1	3
	Short	1	3
	No	6	2
Naive	Long	0	4
	Short	1	3
	No	5	3

Table 18

Summary of Multiple Contingency Analysis

Color of pseudostimulus card: yellow

Effect	X^2	df	Significant at 0.05 level
Response	6.00	1	Yes
Sophistication x Response	0.67	1	No
Trance x Response	11.00	2	Yes
Trance x Sophistication x Response	0.33	2	No

The response effects for the red, blue, green, and yellow pseudostimulus cards are significant. These results indicate that reliably more correct responses were made to each of the chromatic pseudostimulus cards than would be expected from the hypothetical probability of 0.25. Of the other effects tested, only the Trance x Response effect for the pseudostimulus color yellow is significant. The data in Table 18 reveal that reliably more correct responses were made to the pseudostimulus card color yellow by the No-Trance subjects than by the Trance subjects. Since the significance of the Trance x Response effect appears for only one of four pseudostimulus cards, there is little basis for arguing that Trance significantly affected responses to the chromatic pseudostimulus cards.

Analysis of the subjects' responses to the chromatic pseudostimulus cards supports the idea that fewer correct responses were given to the suggested colors because the Chromatic subjects were responding to the chromatic pseudostimulus cards.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Analysis of the results of this experiment indicate that neither Length of Trance Induction, Sophistication, nor Chromaticity affected after-image responses; nor did any of the interactions affect these responses. Thus, within the limits of this research, no evidence was found to support the contention that hypnotic suggestion alters color perception.

In the current study, length of time spent in trance induction was used as an index of depth of hypnotic trance. The results indicate that if depth of hypnotic trance is related to color perception, then a criterion of depth of trance other than the one used in this study must be employed.

Since the Sophisticated Group did not give a significantly greater number of "correct" responses than did the Naive Group, one may question the efficiency of the instructing procedure for the Sophisticated Group. In a preliminary study (See Appendix A) the instructions for the Sophisticated Group were shown to be relatively intelligible to a group of subjects similar to those used in the experiment. The test for comprehension of the instructions in the preliminary study did not,

however, demand a choice among color samples. Further, the matching colors used in the experiment proper were not those which would be unanimously described as simply red, blue, green, and yellow, and these are the color names which were used in the instructions for the Sophisticated Group. These factors may account for failure to obtain a difference between the Naive and Sophisticated Groups.

The results of this experiment, then, are consistent with those of the experiments by Dorcus (1937) and by Hibler (1940). These results show that hypnotic suggestion does not alter perception at the peripheral level.

The results of another very recent study by Underwood (1960) also are consistent with these results. Underwood, using three optical illusions for experimental tasks, tested the following reasoning: If hypnotic suggestion alters perception, then the perception of a figure superimposed on an hypnotically suggested field should be influenced by that field. Also, the distortion of a perceived figure in an actual field should disappear if an hypnotic suggestion for the absence of the field is given to the subject. From 195 potential subjects Underwood selected 12 subjects who met the generally accepted criteria for deep hypnotic trance. Six of these 12 subjects were assigned to a very deep trance group. Under hypnosis they gave a series of errorless performances to depth-of-hypnosis tests and reported very vivid hallucinations without signs of excessive effort (such as squinting, tear secretion, fatigue,

etc.). Underwood interprets the results of his experiment as showing suggestive evidence of the effect of hypnotic suggestion on perception for subjects in the very deep trance group. His analysis of the results shows, however, that the responses of the very deep trance group do not differ significantly from the responses of the control group.

The positive results obtained by Binet and Fréré (1888) and by Erickson and Erickson (1938) cannot be accounted for by the findings of the present study.

It appears, then, that if hypnotic suggestion alters perception at the peripheral level, it does so only under highly specific and not clearly understood conditions. It is obvious that support for the contention that hypnosis alters perception cannot be found if the experimenter employs only the conventional criteria for depth of trance.

CHAPTER VI

SUMMARY

A long-standing interest in the effects upon perception of central factors such as motivation, set, and suggestion has been pursued with increased vigor in the last decade or so. In trying to investigate these effects, psychologists have been troubled by the problem of making inferences about the subject's experiential state from his reports of that state. One way of solving this problem is to use a task which involves an end-organ-determined response and to try to insure the subject's naivete about what the response should be. Central factors then are manipulated, and the subject's reports are examined to see if they change.

In accordance with such an approach, the presence of color stimuli has been suggested to hypnotized subjects. If these subjects perceive the suggested colors, appropriate after-image responses should be elicited from them. Experiments of this kind were performed by Binet and Frère (1888), Dorcus (1937), Erickson and Erickson (1938), and by Hibler (1940). The results of these experiments were not consistent: Binet and Frère and Erickson and Erickson found that color

perception was induced by the hypnotic suggestion, while Dorcus and Hibler found that it was not.

As a consequence, the present study was designed to test the effect of hypnotic suggestion on color perception and to see whether the disagreement among previous investigators could be explained. Three variables along which previous experiments differed seemed to be likely sources of the discrepancy in results: Depth of trance, degree of sophistication of subjects, and chromaticity of pseudostimulus cards. These variables were incorporated into the design of the present experiment.

Subjects for the experiment were volunteers from the Oklahoma State Training School for Girls. The girls in this institution came from lower socio-economic levels and were slightly below average in intelligence. A preliminary study of a similar sample showed that the subjects had no knowledge of the negative after-image phenomenon; thus naivete was ensured. Only volunteers with normal color vision were used in the experiment.

Through preliminary screening, 32 subjects were selected to serve as trance subjects. These subjects met the following criteria for deep somnambulistic trance: presence of eyelid, arm, and body catalepsy; presence of somnambulism; could converse while in trance; showed automatic movements; had positive visual hallucinations; followed post-hypnotic suggestion; and exhibited post-hypnotic amnesia. Thirty-two of the volunteers who were not seen for hypnotic testing were

used for the No-Trance Group.

The effect of three variables was investigated: Length of time spent in trance induction [No-Trance, Short-Trance Induction (5 minutes), Long-Trance Induction (30-minutes)], Sophistication of subjects with regard to the negative after-image phenomenon (Naive subjects had no information, Sophisticated subjects were given information), and Chromaticity of the pseudostimulus cards (Achromatic cards shown in conjunction with color suggestion, Chromatic cards shown in conjunction with color suggestion).

Each of the 32 trance subjects were assigned randomly to one of eight treatment groups (2 Trance x 2 Chromaticity x 2 Sophistication). Each of the 32 control (No-Trance) subjects was matched randomly with one of the trance subjects, and was placed in the same Sophistication x Chromaticity treatment group as was the subject with whom she had been paired.

Each subject was tested individually. Preliminary to the after-image test subjects in the Sophisticated Group were given a brief description of the negative after-image phenomenon, subjects in the Naive Group were not given this description. A series of eight cards (alternately chromatic and grey) was used for the subjects in the Chromatic Group; a series of eight grey cards was used for the subjects in the Achromatic Group. Thirty minutes were spent inducing hypnosis with subjects in the Long-Trance Induction Group, and five minutes were spent in inducing hypnosis with subjects in the Short-Trance Induction

Group; subjects in the No-Trance Group were not hypnotized.

After a brief orientation period, subjects in the Trance and Sophistication Groups were hypnotized and a series of eight cards was then presented to each subject, one at a time. For the Trance subjects a suggestion to experience color (red, blue, green, yellow) was made when each of the odd-numbered cards was presented. No-Trance subjects were instructed only "to look at" each of the odd-numbered cards. Following the 30-second exposure to each of the odd-numbered cards (psuedostimulus), the subject was shown a grey (after-image) card for 15 seconds. The experimenter then requested that the subject identify the color seen on the after-image card by selecting one of four color-matching discs which were presented.

For Trance subjects, a response was scored "correct" if a subject selected a color sample which was the appropriate negative after-image of the suggested color. For No-Trance subjects, a response was scored according to the criterion of a "correct" response for the Trance subject with whom she had been matched. The data were arranged for each suggested color according to the 12 treatment classes (3 Trance x 2 Chromaticity x 2 Sophistication), and then evaluated by conducting a multiple contingency analysis. The 0.05 level of confidence was selected as a criterion of significance.

No evidence was found to support the contention that hypnotic suggestion alters color perception at the peripheral

level. Neither Length of Trance Induction, Sophistication, nor Chromaticity were effective determinants of the subjects' responses. Hence, the present study failed to account for differences among results of previous experiments.

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Appendix A

A Study of the Pre-Experimental Instructions For the Sophisticated Group

Twenty girls similar to the experimental group with respect to age, socio-economic level, intelligence and institutional residence were given a test to determine if the Pre-Experimental Instructions for the Sophisticated Group were comprehensible. The subjects were assembled in a group, given a pencil and paper, and after writing their name on the paper they were given the following instructions:

> I am going to read you a paragraph in a few minutes, and if you can understand what I read, you will then be able to answer some questions which I will ask you later. Be sure that you understand what I read. If you do not, then let me know and I will repeat it for you.

The Pre-Experimental Instructions for the Sophisticated Group (p. 30) were then read aloud for the group. The subjects were then asked to raise their hand if they did not understand the instructions. No one did so, however. The experimenter then took a large sheet of grey paper, placed a small square of red paper in the center of the grey paper, and displayed it to the group for not more than three seconds. The group was then asked:

> If I place this red paper in the center of this sheet of grey paper and you were to look at it for several seconds and then I remove the red paper, what color would you expect to see where it had been?

This same procedure was followed with green, blue, and yellow, and the subjects were requested to write their responses on paper. These were then scored for accuracy.

Results: Eleven of the twenty girls gave correct responses to all four questions, indicating they fully understood the instructions. Five subjects gave two correct and two incorrect responses, indicating they did not fully comprehend the instructions. One subject gave one correct response and three incorrect responses, indicating she hardly understood the instructions; while three subjects gave all four incorrect responses, indicating they did not comprehend the instructions at all. There were 55 correct responses and 25 incorrect responses or 70% correct responses. The percent of correct responses for each of the four questions asked range from 65 to 75, and hence, is consistent with the ratio of correct responses for the total. The results of this study reveal that the instructions were not perfectly understood by all of the subjects in the group setting. However, it is reasonable to infer that the instructions are sufficiently clear to be readily understood by subjects in an individual setting if repeated.

Appendix B

A Test of Knowledge of Negative After-Image Phenomenon

Forty girls similar to the experimental group with respect to age, intelligence, socio-economic level, and institutional residence were tested individually for knowledge of the negative after-image phenomenon. After being seated near a table, the subject was asked her name, age, and school grade. Then an 8" x 10" sheet of Color Aid Grey No. 5 paper was placed on the table before her and the following questionnaire was read to her:

> If I place this small square of red paper (a small square of red paper is shown the subject for three seconds) in the center of this sheet of grey paper and you were to look at the red paper for about 30 seconds, what would you expect to see after I removed the piece of red paper as you continued to keep your eyes focused on the spot where it had been? (If the answer does not indicate color then the following question is asked.) What color would you see?

This same procedure is repeated substituting the words, blue, green, and yellow for the word, red, in the instructions and substituting corresponding blue, green, and yellow squares for the red square of paper. Responses were recorded.

Scoring of the responses was most lenient. That is, it is assumed that a subject knows the correct after-image of a color if she uses any color description remotely associated to the complementary color. For example, the responses "pink," "lavender," "violet," "purplish," etc. would be scored as correct descriptions of the negative after-image of green.

Results: Of the 160 responses, only one correct response was given. One hundred and twenty-five responses indicate that the subjects would expect a positive after-image. Thirteen responses indicate that the subjects would expect to see a light achromatic after-image. Twenty-one responses indicate that the subject would expect to see nothing except the grey background card. Hence, it is reasonable to assume that this population has no knowledge of the negative after-image phenomenon.

Appendix C

A Study of Negative After-Image Reports

Twenty-six subjects matched with the experimental group for age, socio-economic level, intelligence, and institutional residence were seen individually and requested to describe the after-images induced by a 30-second exposure to each of the four primary colors which are to be used in the experiment. In order to standardize conditions, the subjects viewed the primary colors and the after-images in the presentation box which has been described in the experiment. The order of presentation of the primary colors was random. After the subject was given the Ishihari Color Vision Test, the following instructions were given:

> I am going to show you a color in the window in the back of the box. You will keep your eyes focused on the color. Do not move them. After you have looked at the color for 30 seconds, I will remove it and another color will appear. You are to tell me the name of this color which appears.

After each report of an after-image, the subject is further instructed:

> Now I will show you another color. Keep your eyes focused on the color and when I remove it, tell me the name of the color which appears.

Responses were recorded verbatim. When a subject's description of an after-image was achromatic or inappropriate or was accompanied by some expression of doubt or confusion, then the primary color which induced the after-image was again presented to the subject and the subject was asked to

describe the after-image. When a subject gave conflicting reports on different trials, this procedure was repeated until she could decide on one description. If a subject persisted in giving an achromatic or inappropriate report of an after-image on three different trials, no further attempts were made to elicit description of this after-image.

Of the 26 subjects seen, one was so uncooperative and negativistic that her results were deleted as her negativism was expressed in her responses to the after-image situation. That is, she consistently denied seeing any after-image. Of the remaining 25, 23 correctly identified all of the numerals on the Ishihari Color Vision Test. One girl could not identify the numerals on cards Number 10 and 11, and another girl could not identify the numerals on card Number 10. Since their reports of negative after-images did not reflect color vision anomolies, their results are included. Table 19 shows the frequencies of descriptions of the after-images of the four primary colors used in this study.

In view of the wide varieties of descriptions and the identical terms used to describe different after-images, this study is interpreted as indicating that it is not feasible to use verbal descriptions of the negative after-image for the purpose of the experiment.

Table 19

Frequencies of Negative After-Image Descriptions

Primary stimulus color	Description of after-image	Number
Yellow	blue	10
	purple	8
	bluish purple	1
	light purple	4
	light violet	1
	grey	1
		25
Blue	yellow	16
	pale yellow	2
	light yellow	1
	yellowish	1
	cream color	1
	between pink and white	1
	white	3
		25
Red	green	3
	blue-green	2
	turquoise	3
	blue	7
	dark blue	1
	baby blue	1
	light blue	8
		25
Green	red	2
	reddish	1
	pink	17
	purplish-pink	1
	light pink	1
	light violet	1
	purplish lavender	1
		25

Appendix D

A Study of Negative After-Image Color Matching

Twenty-one girls, matched with the experimental group for age, socio-economic level, intelligence, and institutional residence were seen for the purpose of establishing matching norms for the negative after-images of the four primary colors which are to be used in the experiment. The girls were seen individually and asked to look into the presentation box, which has been described in the experiment. Each of the primary colors was presented to them for 30 seconds and after they acknowledged seeing an after-image, a card bearing 16 color discs was presented to them and they were asked to report the number of the color most nearly like that of the after-image which they had just seen. Three shades or tints of each hue, resembling that of the after-images, were included on the matching card. Also, each of the four primaries was included. Table 20 shows the frequencies of selections of hues, tints, and shades, which the girls reported as most nearly resembling their negative after-images.

Eighteen of the 21 girls selected one of the three tints of Violet-Blue-Violet as most nearly resembling the negative after-image of Yellow. Two selected Blue Hue and one selected Blue-Green Tint 2. Thus, it appears that Violet-Blue-Violet is preponderantly identified as most nearly resembling the negative after-image of Yellow and Tint 2 is selected more frequently than the other tints.

Table 20

Frequencies of Hues, Tints, and Shades Matched With Negative After-Images

Primary color	Shade or tint selected	Number
Yellow	VBV T 2	7
	VBV T 3	6
	VBV T 1	5
	B Hue	2
	BG T 2	1
		21
Red	BG T 3	15
	BG T 2	5
	BG T 1	1
		21
Green	RVR T 4	10
	RV T 4	5
	RVR S 3	5
	VBV T 3	1
		21
Blue	Y T 4	18
	Y T 3	2
	G Hue	1
		21

Note.--Shades and tints are listed according to the identification code used by the Color Aid Company.

All of the 21 girls selected the three Blue-Green Tints as most nearly resembling the negative after-image of Red. Fifteen selected Blue-Green Tint 3, five selected Blue-Green Tint 2, and one selected Blue-Green Tint 1.

Twenty of the 21 girls selected combinations of red and violet as most nearly resembling the negative after-image of Green. Ten selected Red-Violet-Red Tint 4, five selected

Red-Violet-Red Shade 3, five selected Red-Violet Tint 4, and one selected Violet-Blue-Violet Tint 3.

Eighteen girls selected Yellow Tint 4 as most nearly resembling the after-image of Blue. Two girls selected Yellow Tint 3, and one girl selected Green Hue.

It is apparent that the matching procedure is much more reliable than the verbal report procedure as there is much less over-lapping of response or possibility for confusion. Of the 84 responses given, only five deviate from what might be expected, and it is reasonable to assume that this variation would be further reduced by presenting the subjects with fewer response alternatives on the matching task. Hence, only those four most frequently reported tints (VB T 2, BG T 3, RVR T 4, and Y T 4) will be used for the experimental situation.

Appendix E

Selection and Criteria for Trance Subjects

The hypnotic technique outlined by Estabrooks (1951) was used in selecting deep somnambulistic trance subjects. The subject was seated in a comfortable chair and given an opportunity to ask questions about hypnosis. Then the subject was asked to close her eyes while the experimenter suggested relaxation and sleep. Successive tests for depth of trance were made at approximately five-minute intervals. These tests are listed below in the order in which they were made:

a. The experimenter suggested to the subject that her eyes were closed and that she was unable to open them.

b. The experimenter suggested that the subject's arm was so stiff that she could not bend it.

c. The experimenter suggested that the subject had lost control of all muscles in her body and could not stand up.

d. The experimenter suggested that the subject would arise and walk across the room and back.

e. The subject was asked to answer several simple questions, i.e., her name, age, and school grade.

f. The experimenter suggested to the subject that her arms were going around and around and that she could not stop them from rotating.

g. The experimenter suggested that the subject open her eyes and told her she would see a pencil and piece of paper in her lap, and that when she saw the pencil and piece of paper, that she would pick up the pencil and write her name on the paper.

h. Before awakening the subject, the experimenter gave a post-hypnotic suggestion to walk to the back of the room and bring the experimenter a candlestick when the appropriate signal was given. Also, the experimenter suggested to the subject that she would, after being awakened, fall into a deep sleep when a signal was given by the experimenter.

i. The subject was then awakened and requested to "tell me everything you can remember about what happened."

The experimenter continuously suggested "deep sleep" to the subject during the intervals between these tests for depth of trance. If a subject responded positively to the suggestion in each test, then the next test was given. Only those subjects who responded positively to all of these tests, including visual hallucination, post-hypnotic amnesia, and post-hypnotic suggestion, were selected to serve as Trance subjects in the experiment.

Appendix F

Table 21

Responses for Trance Subjects Classified According to Treatment Groups

Suggested color: red

Subject No. (Participation Order)	Length of Trance Induction	Sophistication	Chromaticity	Pseudo-Stimulus Card Color	Response
25	Long	Naive	Achromatic	Grey	Green
29	"	"	"	Grey	Red
30	"	"	"	Grey	Yellow
38	"	"	"	Grey	Red
1	"	"	Chromatic	Yellow	Green
23	"	"	"	Yellow	Red
33	"	"	"	Blue	Red
60	"	"	"	Blue	Red
36	"	Sophisticated	Achromatic	Grey	Yellow
40	"	"	"	Grey	Blue
51	"	"	"	Grey	Yellow
53	"	"	"	Grey	Red
9	"	"	Chromatic	Yellow	Red
11	"	"	"	Yellow	Blue
14	"	"	"	Blue	Blue
55	"	"	"	Yellow	Red
4	Short	Naive	Achromatic	Grey	Yellow
12	"	"	"	Grey	Red
27	"	"	"	Grey	Red
31	"	"	"	Grey	Yellow
7	"	"	Chromatic	Blue	Red
18	"	"	"	Blue	Red
34	"	"	"	Blue	Blue
62	"	"	"	Blue	Blue
6	"	Sophisticated	Achromatic	Grey	Blue
15	"	"	"	Grey	Green
24	"	"	"	Grey	Blue
63	"	"	"	Grey	Blue
3	"	"	Chromatic	Yellow	Green
28	"	"	"	Yellow	Green
32	"	"	"	Blue	Yellow
47	"	"	"	Blue	Yellow

Table 22

Responses for Trance Subjects Classified According to Treatment Groups

Suggested color: blue

Subject No. (participation order)	Length of trance induction	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
25	Long	Naive	Achromatic	Grey	Green
29	"	"	"	Grey	Green
30	"	"	"	Grey	Blue
38	"	"	"	Grey	Green
1	"	"	Chromatic	Red	Green
23	"	"	"	Red	Green
33	"	"	"	Green	Green
60	"	"	"	Green	Green
36	"	Sophisticated	Achromatic	Grey	Yellow
40	"	"	"	Grey	Green
51	"	"	"	Grey	Green
53	"	"	"	Grey	Blue
9	"	"	Chromatic	Red	Green
11	"	"	"	Red	Yellow
14	"	"	"	Green	Green
55	"	"	"	Red	Green
4	Short	Naive	Achromatic	Grey	Green
12	"	"	"	Grey	Green
27	"	"	"	Grey	Blue
31	"	"	"	Grey	Blue
7	"	"	Chromatic	Green	Green
18	"	"	"	Green	Red
34	"	"	"	Green	Green
62	"	"	"	Green	Blue
6	"	Sophisticated	Achromatic	Grey	Red
15	"	"	"	Grey	Yellow
24	"	"	"	Grey	Red
63	"	"	"	Grey	Green
3	"	"	Chromatic	Red	Green
28	"	"	"	Red	Green
32	"	"	"	Green	Red
47	"	"	"	Green	Red

Table 23

Responses for Trance Subjects Classified According to Treatment Groups

Suggested color: green

Subject No. (participation order)	Length of trance induction	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
25	Long	Naive	Achromatic	Grey	Green
29	"	"	"	Grey	Green
30	"	"	"	Grey	Red
38	"	"	"	Grey	Yellow
1	"	"	Chromatic	Blue	Yellow
23	"	"	"	Blue	Green
33	"	"	"	Yellow	Yellow
60	"	"	"	Yellow	Green
36	"	Sophisticated	Achromatic	Grey	Red
40	"	"	"	Grey	Green
51	"	"	"	Grey	Yellow
53	"	"	"	Grey	Yellow
9	"	"	Chromatic	Blue	Green
11	"	"	"	Blue	Yellow
14	"	"	"	Yellow	Yellow
55	"	"	"	Blue	Yellow
4	Short	Naive	Achromatic	Grey	Blue
12	"	"	"	Grey	Blue
27	"	"	"	Grey	Green
31	"	"	"	Grey	Green
7	"	"	Chromatic	Yellow	Yellow
18	"	"	"	Yellow	Blue
34	"	"	"	Yellow	Green
62	"	"	"	Yellow	Green
6	"	Sophisticated	Achromatic	Grey	Green
15	"	"	"	Grey	Red
24	"	"	"	Grey	Yellow
63	"	"	"	Grey	Yellow
3	"	"	Chromatic	Blue	Red
28	"	"	"	Blue	Yellow
32	"	"	"	Yellow	Blue
47	"	"	"	Yellow	Yellow

Table 24

Responses for Trance Subjects Classified According to Treatment Groups

Suggested color: yellow

Subject No. (participation order)	Length of trance induction	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
25	Long	Naive	Achromatic	Grey	Green
29	"	"	"	Grey	Blue
30	"	"	"	Grey	Green
38	"	"	"	Grey	Green
1	"	"	Chromatic	Green	Red
23	"	"	"	Green	Yellow
33	"	"	"	Red	Yellow
60	"	"	"	Red	Green
36	"	Sophisticated	Achromatic	Grey	Green
40	"	"	"	Grey	Yellow
51	"	"	"	Grey	Red
53	"	"	"	Grey	Green
9	"	"	Chromatic	Green	Yellow
11	"	"	"	Green	Red
14	"	"	"	Red	Green
55	"	"	"	Green	Yellow
4	Short	Naive	Achromatic	Grey	Red
12	"	"	"	Grey	
27	"	"	"	Grey	Yellow
31	"	"	"	Grey	Green
7	"	"	Chromatic	Red	Green
18	"	"	"	Red	Green
34	"	"	"	Red	Red
62	"	"	"	Red	Red
6	"	Sophisticated	Achromatic	Grey	Yellow
15	"	"	"	Grey	Blue
24	"	"	"	Grey	Green
63	"	"	"	Grey	Red
3	"	"	Chromatic	Green	Red
28	"	"	"	Green	Yellow
32	"	"	"	Red	Green
47	"	"	"	Red	Green

Table 25

Responses for No-Trance Subjects Classified According to Treatment Groups

Suggested color: red

Subject No. (participation order)	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
10	Naive	Achromatic	Grey	Orange
49	"	"	Grey	Yellow
5	"	"	Grey	Orange
13	"	"	Grey	Yellow
56	"	Chromatic	Yellow	Blue
45	"	"	Yellow	Blue
54	"	"	Blue	Yellow
26	"	"	Blue	Green
21	Sophisticated	Achromatic	Grey	Yellow
19	"	"	Grey	Blue
22	"	"	Grey	Orange
50	"	"	Grey	Yellow
41	"	Chromatic	Yellow	Blue
16	"	"	Yellow	Blue
8	"	"	Blue	Green
42	"	"	Yellow	Blue
64	Naive	Achromatic	Grey	Green
2	"	"	Grey	Orange
20	"	"	Grey	Green
43	"	"	Grey	Yellow
48	"	Chromatic	Blue	Blue
37	"	"	Blue	Yellow
35	"	"	Blue	Yellow
61	"	"	Blue	Yellow
59	Sophisticated	Achromatic	Grey	Green
46	"	"	Grey	Red
39	"	"	Grey	Green
44	"	"	Grey	Blue
58	"	Chromatic	Yellow	Blue
17	"	"	Yellow	Blue
57	"	"	Blue	Blue
52	"	"	Blue	Blue

Note.--No-Trance subjects are listed in sequence with the Trance subjects (Tables 20, 21, 22, 23) with whom they are matched; i.e., No-Trance subject 10 was matched with Trance subject 25, No-Trance subject 49 was matched with Trance subject 29, etc.

Table 26

Responses for No-Trance Subjects Classified According to Treatment Groups

Suggested color: blue

Subject No. (participation order)	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
10	Naive	Achromatic	Grey	Orange
49	"	"	Grey	Yellow
5	"	"	Grey	Orange
13	"	"	Grey	Green
56	"	Chromatic	Red	Blue
45	"	"	Red	Red
54	"	"	Green	Green
26	"	"	Green	Red
21	Sophisticated	Achromatic	Grey	Green
19	"	"	Grey	Blue
22	"	"	Grey	Orange
50	"	"	Grey	Yellow
41	"	Chromatic	Red	Green
16	"	"	Red	Green
8	"	"	Green	Green
42	"	"	Red	Green
64	Naive	Achromatic	Grey	Red
2	"	"	Grey	Blue
20	"	"	Grey	Green
43	"	"	Grey	Green
48	"	Chromatic	Green	Red
37	"	"	Green	Green
35	"	"	Green	Red
61	"	"	Green	Red
59	Sophisticated	Achromatic	Grey	Orange
46	"	"	Grey	Blue
39	"	"	Grey	Yellow
44	"	"	Grey	Blue
58	"	Chromatic	Red	Green
17	"	"	Red	Red
57	"	"	Green	Red
52	"	"	Green	Blue

Note.--No-Trance subjects are listed in sequence with the Trance subjects (Tables 20, 21, 22, 23) with whom they are matched; i.e., No-Trance subject 10 was matched with Trance subject 25, No-Trance subject 49 was matched with Trance subject 29, etc.

Table 27

Responses for No-Trance Subjects Classified According to Treatment Groups

Suggested color: green

Subject No. (participation order)	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
10	Naive	Achromatic	Grey	Orange
49	"	"	Grey	Yellow
5	"	"	Grey	Orange
13	"	"	Grey	Green
56	"	Chromatic	Blue	Green
45	"	"	Blue	Yellow
54	"	"	Yellow	Green
26	"	"	Yellow	Green
21	Sophisticated	Achromatic	Grey	Orange
19	"	"	Grey	Blue
22	"	"	Grey	Orange
50	"	"	Grey	Yellow
41	"	Chromatic	Blue	Green
16	"	"	Blue	Yellow
8	"	"	Yellow	Green
42	"	"	Blue	Yellow
64	Naive	Achromatic	Grey	Blue
2	"	"	Grey	Green
20	"	"	Grey	Green
43	"	"	Grey	Yellow
48	"	Chromatic	Yellow	Green
37	"	"	Yellow	Blue
35	"	"	Yellow	Blue
61	"	"	Yellow	Blue
59	Sophisticated	Achromatic	Grey	Orange
46	"	"	Grey	Yellow
39	"	"	Grey	Blue
44	"	"	Grey	Green
58	"	Chromatic	Blue	Yellow
17	"	"	Blue	Green
57	"	"	Yellow	Blue
52	"	"	Yellow	Green

Note.--No-Trance subjects are listed in sequence with the Trance subjects (Tables 20, 21, 22, 23) with whom they are matched; i.e., No-Trance subject 10 was matched with Trance subject 25, No-Trance subject 49 was matched with Trance subject 29, etc.

Table 28

Responses for No-Trance Subjects Classified According to Treatment Groups

Suggested color: yellow

Subject No. (participation order)	Sophistication	Chromaticity	Pseudo-stimulus card color	Response
10	Naive	Achromatic	Grey	Orange
49	"	"	Grey	Yellow
5	"	"	Grey	Orange
13	"	"	Grey	Blue
56	"	Chromatic	Green	Blue
45	"	"	Green	Green
54	"	"	Red	Green
26	"	"	Red	Green
21	Sophisticated	Achromatic	Grey	Orange
19	"	"	Grey	Blue
22	"	"	Grey	Orange
50	"	"	Grey	Yellow
41	"	Chromatic	Green	Green
16	"	"	Green	Red
8	"	"	Red	Green
42	"	"	Green	Yellow
64	Naive	Achromatic	Grey	Yellow
2	"	"	Grey	Blue
20	"	"	Grey	Green
43	"	"	Grey	Yellow
48	"	Chromatic	Red	Green
37	"	"	Red	Red
35	"	"	Red	Green
61	"	"	Red	Green
59	Sophisticated	Achromatic	Grey	Orange
46	"	"	Grey	Green
39	"	"	Grey	Yellow
44	"	"	Grey	Blue
58	"	Chromatic	Green	Red
17	"	"	Green	Orange
57	"	"	Red	Red
52	"	"	Red	Green

Note.--No-Trance subjects are listed in sequence with the Trance subjects (Tables 20, 21, 22, 23) with whom they are matched; i.e., No-Trance subject 10 was matched with Trance subject 25, No-Trance subject 49 was matched with Trance subject 29, etc.