AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF THE DEGREE OF SHADING CONTRAST IN INK-BLOTS ON VERBAL AND PHYSIOLOGICAL RESPONSES

By

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INTRODUCTION

Recent years have seen a tremendous growth in the popularity of the so-called projective techniques. Among the most prominent of these techniques is the Rorschach method of personality evaluation utilizing ten standardized ink-blots (39).

As the Rorschach method has grown in importance as a clinical tool, the amount of importance attached to the shading responses as specific indicators of types of adjustment or maladjustment has also increased.[1]

Rorschach, in his original experiment, did not mention the shading aspects of the ink-blot material as determinants. In his paper published post-humously by Oberholtzer (40), he named the responses which utilized shading to give three-dimensional effects chiaroscuro responses, and suggested that such responses indicated feelings of insufficiency. The use of shading in this manner was correlated with "cautious and measured affectivity with depressive nuances. This talent frequently, perhaps always, is correlated with feelings of insufficiency, the content of which is feelings of loss of solidarity, of instability, of being 'out of joint with the times'".[2]

Binder, (4, 5), a Swiss colleague of Rorschach treated the shading responses in some detail almost ten years later. Binder supplied

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[1] By the term shading responses, we mean those verbal productions which are determined wholly or in part by the shading nuances which appear in practically all the blots. They are the responses to the stimuli along the black-white axis of the color pyramid, including responses to black, white, and intermediate greys.

[2] c.f. Rorschach and Oberholtzer (40) p. 201

the scoring symbol Ch (chiaroscuro) and combined it with the symbol F (form) to allow for responses in which the sole determinant was the shading, scored Ch, responses where form was subordinant to the shading, scored ChF, and responses where the shading was subordinate to the form scored FCh. He differentiated between responses to the "massive greys" and responses to the smaller shaded areas. In general, Form-chiaroscuro responses indicated control over central mood reactions; Chiaroscuro-form responses indicated domination by central mood reaction; and Chiaroscuro responses without the use of form indicated (1) abnormality in central emotional life, (2) abnormal sensitivity to unpleasant moods, (3) irritation and anxiety, (4) some internal disturbance in the central emotional life.

Beck (2, 3) recognized two types of shading, the light response Y and the vista response, V. As in Binder's system, the amount of form used is indicated by placing the symbol F before or after the Y or V.

The vista response, V, always represents self-appraisal, according to Beck, and, since self-appraisal usually results in self-depreciation, a feeling of inferiority ensues. Beck notes an increase of V in neurotics and the fact that the V responses usually have a morbid, depressed tone. "This unpleasant, morose feeling tone depressing in effect, always overlies the experience expressed in V."[1]

Light responses, Y, indicate a passiveness in the individual: "Y expresses really an absence of activity, which can go all the way

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[1] c.f. Beck (3) p. 34

to passivity. In the healthy it indicates a let-down. In the neurotic it signifies a drastic countermeasure against the individuals own affective energy."[1] Y represents a threat to the individual, and the individual's defense against this threat is passivity.

Beck notes a grey-black shock, indicated by delayed reaction time, decrease in productivity, etc. to the heavily shaded cards. According to Beck grey-black shock is supposed to be an indicator of specific personality faults. "It signalized that anxiety, which, because its roots lie deep in the very early experience of the individual, has become a central character force, diffusing his energies and paralyzing him in almost all of life's crises, even the minor ones."[2] Beck notes that grey-black shock is frequently accompanied by verbalizations of the subject's disturbance - the ink-blot is "gloomy" or "ugly". As contrasted to color shock (delayed reaction time, drop in productivity, etc. to the colored cards), Y shock is more lasting and tends to be disruptive to the response. Whereas color shock may result in avoidance of the color, grey-black shock results in a greater likelihood of grey-black responses. According to Beck the essence of the grey-black shock is fear. "As to the meaning of Y shock, the psychologic trait it projects; it signifies a low threshold sensitivity to events bearing potency of danger."[3]

The highest degree of refinement in the scoring of shading responses is found in Klopfer's system (23, 24). Klopfer recognizes five

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[1] Ubid p. 35

[2] c.f. Beck (3) p. 39

[3] Ibid p. 40

main categories of shading responses. Shading as surface impression (c) determines the way the surface of a seen object looks - rough, furry, rocky, etc. Diffusion responses (K) are responses in which the shading is used as space-filling diffuse material - as smoke, clouds or fog. Vista responses (FK) are responses in which the shading is used to give three-dimensional effects such as landscapes, aerial views, etc. This response always involves the use of form, according to Klopfer, so that the scoring symbol is always preceded by the letter F. Toned-down shading effects (k) are responses in which there is an attempt to use the shading as depth but the form is indefinite, the most common, practically the only, responses which fall into this category are X-rays and topographical maps. Achromatic color responses (C') are responses where the black and grey nuances of the ink-blot or the white color of the spaces is used to give surface color to the seen object. As in Beck's system, these symbols can be preceded or followed by the letter F to indicate the amount of form used in the percept.

Generally, Klopfer's FK, corresponds to Beck's FV, and Klopfer's C' to Beck's Y. The present study utilizes, in broad terms, Klopfer's break-down of responses using shading.

Klopfer interprets the use of shading as surface texture as representing a cautious approach to the outer world. It may represent what we call tact, or an awareness toward the feelings of others. Diffusion responses and toned-down shading responses indicate a haziness of inner life accompanied by feelings of guilt. "Plain diffusion responses (K) and toned down shading effects (k) invariably indicate insecurity and anxiety of the free-floating type".[1] The use of shading

[1] c.f. Klopfer and Kelley (24) p. 241

for the creation of depth impression indicates introspective tendencies developed in an effort to dispel anxiety. In moderate amounts it may indicate the presence of insight. Achromatic color responses in general are interpreted as being indicators of depression, but only if they outweigh the responses to bright color. They are thought to indicate a "burn't child" reaction - a withdrawal from active social participation as a result of early traumatic experiences. Thus while Rorschach, Binder, and Beck consider shading responses, in general to be on the "debit" side of personality adjustment, Klopfer feels that surface texture responses and vista responses, in moderate amounts are on the "credit" side, although all shading responses indicate the presence of, or the residuals of, emotional disturbance of some kind.

Less is known about the significance of the shading responses than any other variable in the Rorschach. This is partly because the significance of shading was considered relatively late in the use of the Rorschach test and partly because it is the one response which Rorschach did not fully describe (2, 3, 24, 36). The evidence, such as we have, is based on clinical observation and quite a large amount of it is purely speculative. There is a paucity of experimental data in all phases of Rorschach development. Rorschach himself, and most of his followers have freely admitted this lack (3, 24, 39).

There have been very few attempts to vary experimentally some aspects of the ink-blot stimuli. Three studies have been reported in which the ink-blot material has been varied by removing its color photographically. In these three studies the chromatic cards were photographed and then reproduced in black and white.

One such study by Wallen (47) investigated some aspects of "color shock" on the Rorschach. His population, consisting of 419 males in naval service, was made up of "unstable" men about to be discharged for psychiatric unsuitability to the service and "stable" men, new recruits just entering training. The normal subjects were shown the ink-blots and asked simply whether they liked or disliked the card. The cards were administered in regular sequence, in reverse order, in regular sequence but with the tenth card in the first position (Card X, I - IX), and with the cards inverted. It was found that cards coming late in the series were better liked than cards appearing early in the series. Cards VIII, IX, and X, popular at the end of the series, were significantly less popular when they appeared at the beginning of the test. When card X appeared initially in the series, a loss in preference for the card appeared. There were no significant differences in preferences when the cards were inverted. When the entire series was rendered achromatic, there was a significant decrease in the popularity of the last three, previously colored, cards for the normal group. This was not true of the red and black cards, II and III.

The unstable men disliked cards II, VI, and IX to a greater extent than did the normal group. When the cards were rendered achromatic, card II increased in popularity. In a supplementary study, 30 normal men and 15 unstable men were shown the original and achromatic versions of the five colored cards simultaneously and asked to tell which of the pair they liked better. The unstable men preferred three of the cards (II, III, and IX) in their achromatic form but the differences are of doubtful significance. When questioned about the reasons for their

dislike for the colored cards, a majority of the unstable group indicated that the colors brought up unpleasant associations. Nine of the men specifically mentioned red as reminding them of blood.

Lazarus (30) also used achromatic renditions of the cards in investigating the influence of color on the Rorschach. Fifty high school seniors were given the group form of the Rorschach, followed six weeks later by the achromatic version of the test. Another equated group of 50 subjects was given the achromatic version, followed later by the colored version. Comparisons of the responses to the color and non-color series showed an increase in responses using form alone in the achromatic version, an expected difference since the opportunity for using color as a determinant was not present in the achromatic cards. The records for both series were scored on 12 indices of "color shock". The responses of 30 subjects who showed "color shock" on the basis of these indices were treated separately. Only one of the indices, "lowest response total" showed a significant increase from the achromatic series to the colored series, for the entire group. In the analysis of the data from the 30 "color shock" subjects, two "color shock" indices showed significant differences between the colored and achromatic series. The index, "lowest response total", decreased in frequency in the achromatic series and the index, "appearance of poor form answers", decreased in the achromatic series. However, the first index, "lowest response total", showed changes mainly on the originally achromatic cards, and changes in the second index, "appearance of poor form answers, appeared mainly in the chromatic cards, apparently as a result of the subjects trying to integrate the form and color in the ink blots. He

concluded that: "... the term color shock may be misnomer, and, with the possible exception of the index poor form quality is not a function of the presence of color in the Rorschach Test".[1]

An earlier experiment by Brosin and Fromm (7) is directly related to the problem of whether color in the stimulus is responsible for the phenomena of "color shock". The Rorschach was administered to twelve subjects with varying degrees of color-weakness. An independent clinical diagnosis of neurosis or psychosis was made.

It was found that the subjects who were diagnosed as neurotic still had "color shock" to the chromatic cards even though some of the subjects were almost completely color blind.

The authors advanced three possible explanations for their findings: (1) sufficient color vision was present in the subjects to cause "color shock", (2) some aspect of the physical stimulus, of which the subject was unaware, registered in the nervous system as color, for the purposes of producing "color shock", (3) the color was perceived as a "psychological grey" which differs from other greys in perceptual quality. In light of more recent studies, particularly that of Lazarus, we can advance a fourth explanation, that some aspect of the achromatic blots other than the color is responsible for what we term "color shock".

Rockwell, et al (38) presented Rorschach cards to 23 subjects. A continuous record of GSR was obtained throughout the response period to the card. The cards were then reduced to black and white and a repeat testing was made. Eight subjects who showed "color shock" in

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[1] c.f. Lazarus (30) p. 510

the original administration showed significant changes in verbal response when presented with the achromatic version of the cards. There was no significant change in GSR. The remaining subjects, who did not show "color shock" in the original administration, did not show significant differences in verbal response but showed differential changes in skin resistance. The author concluded that the "color shock" subjects were not as capable as the "non-color shock" subjects of mobilizing normal defense mechanisms in either test situation. The meaning of these findings is not clear. The "color shock" group, which, by clinical definition is more disturbed, showed differential verbal response when confronted with changed stimuli, whereas the "non-color shock", or presumably more normal group, retained the same verbal response in the face of changed stimulus conditions with, presumably, some attendant anxiety which manifested itself in increased GSR. Apparently the "color shock" group showed behavior which seems more "normal" than the "non-color shock" group in terms of verbal response and GSR.

The four studies just described have been primarily concerned with the influence of the color in the stimulus cards. They are of interest to us because one aspect of the stimulus cards, the color, was varied, either directly or indirectly. A study which attempted to vary systematically a second aspect of the stimulus cards, the shading, might serve to throw some light on the influence of this aspect of the stimulus on the responses of the subject.

It is clear from our discussion of what clinicians believe about the significance of shading responses that (1) some ink blots (i.e. those with more shading) are considered to be more disturbing to some

individuals than others, (2) that some types of shading responses represent a greater degree of disturbance in the individual, and (3) that people who give a greater number of a certain type of shading responses, are more disturbed than people who give a lesser number of this type of response.

Since shading in ink blots and the use of certain forms of shading are thought to be disturbing to the individual, one independent measure of this disturbance might be the physiological indicators of emotional disturbance.

Several studies, in addition to the one just described, have been undertaken utilizing the physiological correlates to Rorschach responses.

Rockwell, et al (37) briefly report an earlier study in which 30 subjects were shown projected images of the cards for 90 seconds. A continous record of changes in palmar skin resistance was made and verbal responses to the cards were recorded in the usual way. Their population consisted of ten controls who showed no "color shock", 10 controls who showed "color shock", and 10 patients in residence at a clinic, who showed "color shock". It was found that "the electrical responses of the three groups of subjects differed significantly. The most striking differences were noted in cards I and VII".[1]

A third study utilizing the somatic correlates of Rorschach responses as indicators of accompanying affect was that of Frost (19). He obtained a continuous record of palmar skin resistance from 20 normal and 20 schizophrenic male subjects during the administration of the

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[1] c.f. Rockwell et al (37) p. 287

Rorschach. He found that the normal group gave more responses per card and that this was accompanied by a higher GSR. The schizophrenic group gave fewer responses per card accompanied by a lower GSR. Responses in which the form predominated were compared with responses in which the form was subordinate, and it was found that the GSR of the normals increased with increase in the predominance of form while in the schizophrenic group the reverse was true. The schizophrenic differed from the normals in that the GSR accompanying their first response to the card was greater than the mean GSR for that card. In the normal group, the GSR accompanying the first response tended to be low, increasing with succeeding responses.

The normal subjects had longer reaction times to the cards and tended to spend more time on each card than the schizophrenic subjects.

The author concluded that normal subjects tend to show greater involvement in the test situation, and they were able to exercise better control when form-subordinate stimuli were involved than were the schizophrenic subjects.

Levy (32) utilized the GSR accompanying subjects' Rorschach responses as an indicator of the "affective value" of the cards. Her population of 50 male college students showed significant differences in GSR from subject to subject but no significant differences in GSR from card to card. Position of the card in the series was found to be a significant variable in terms of the GSR which the card produced.

Still a fifth study by Wishner (48), in preparation, on the relationship between physiological tension and Rorschach estimation of anxiety utilizes electroencephalographic and electrocardiographic

measurements in addition to circulatory and respiratory measures.[1]

Brower (8) administered the Rorschach to 38 undergraduates. He then measured diastolic blood pressure, pulse pressure and pulse rate before and after the induction of visuo-motor conflict (mirror drawing). He found significant rank-order correlations between pre-experimental blood pressure and the number of form-color responses given by the subjects. Pre-experimental pulse rate and post-experimental pulse pressure were correlated with the number of pure form responses given the subjects. The number of responses given to the last three colored cards correlated significantly with post-experimental blood pressure and pulse pressure. The author concluded that "higher constrictiveness and repressiveness tend to be correlated with higher pulse rate prior to visuo-motor conflict and higher pulse pressure following visuo-motor conflict".[2] He further concludes that "the higher the residual extraversial reserve in the personality the higher does the post-experimental pulse pressure tend to be and the lower does the post-experimental diastolic blood pressure appear".[3] The implications of these findings are not clear and much further research of this nature needs to be done before they can be understood.

Demonstrations of color shock on the Rorschach utilizing respiratory and circulatory measures have been briefly reported by Luchins (33). Since these measures were used for demonstrative rather experimental purposes, no further information is obtainable.

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[1] c.f. Rabin (35)

[2] c.f. Brower (8) p. 95

[3] Ibid

The seven studies just described have attempted to increase our understanding of what happens to the organism while responding to a standard set of Rorschach ink blots. In these studies no attempt was made to systematically vary any aspect of the stimulus cards.

In addition to the Rorschach studies already described, many studies have utilized respiratory and circulatory measures as indicators of emotional change. Changes in rate and amplitude of breathing under many conditions of stimulation have been widely studied (6, 9, 13, 16, 17, 26, 27, 28, 44, 45). Changes in blood pressure and rate of pulse have also been investigated under differing stimulus conditions (6, 11, 13, 26, 27, 28, 29, 34, 42, 44). These studies agree that under conditions of emotional upset, breathing becomes deeper and more rapid, blood pressure increases and rate of pulse increases. These findings are in agreement with the generally accepted descriptions of physiological changes within the organism during emotional behavior (10).

Increase in rate and amplitude of respiration and increased changes in blood pressure and pulse may, then, provide an independent measure of emotional disturbance in the person while he is responding to ink blots.

In view of the importance given to shading responses in clinical interpretation, the many claims made as to the significance of the shading responses, and the paucity of experimental evidence supporting these claims it was felt that a study investigating the verbal and physiological responses to the shading aspects of the ink blot material should prove fruitful.

STATEMENT OF PROBLEM

The present study was set up to answer the following questions:

1. How does the amount and kind of shading used by the subject vary with the degree of shading contrast in the stimulus ink blot?
2. What is the relationship, if any, between the various physiological responses of the subject and the degree of shading contrast in the ink-blot to which he was responding?
3. Do some ink-blots tend to produce greater amounts of, or different kinds of, shading responses than other ink-blots?
4. Do some ink-blots tend to produce greater physiological responses in the responding subject than other ink-blots?
5. What is the relationship, if any, between the way the shading was used by the subject and the extent of physiological response?
6. Do subjects who use much shading in their responses to ink-blots differ in physiological response from subjects who use little shading in responding to ink-blots?
7. Do subjects who use much shading as surface texture (c) in their responses to ink blots differ in physiological response from subjects who use little shading as surface texture in responding to ink-blots?
8. Do subjects who use much shading as surface color (C') in their responses to ink blots differ in physiological response from subjects who use little shading as surface color in responding to ink blots?
9. Do subjects who use much shading to give depth effects, FK, to their responses to ink blots differ in physiological response from subjects who use little shading to give depth effects to their responses in responding ink blots?

10. Do subjects who use much shading to give diffuse effects, K, to their responses to ink blots differ in physiological response from subjects who use little shading to give diffuse effects to their responses in responding to ink blots?

11. Do subjects who use much shading to give toned-down depth effects, k, to their responses to ink blots differ in physiological response from subjects who use little shading to give toned down depth effects to their responses in responding to ink blots?

METHODOLOGY

Population:

The population for this experiment consisted of three groups of students at Michigan State College equated for age and sex.

All the students volunteered to serve as subjects for the experiment. A majority of the psychology majors used in the experiment were enrolled at the time in the beginning experimental psychology course at Michigan State College. The non-psychology major students came from a wide variety of fields. For the most part, they volunteered for the experiment through hearing of it from students enrolled in experimental psychology.[1]

Previous test experience with the Rorschach or projective techniques disqualified a student as a subject for this experiment.

Table I presents a comparison of the three experimental groups.

Apparatus and Test Materials:

The recording device was a Phipps and Bird continuous feed polygraph which was arranged to record the necessary measurements continuously.

Elapsed time was recorded by connecting an Eberbach interval timer in series with two dry cells and a Phipps and Bird signal magnet which marked off each second on the polygraph chart.

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[1] The greater number of women than men in the experiment was a function of the industry of two women students in experimental psychology in securing subjects from within their sorority groups.

TABLE I

THE NUMBER, SEX AND AGE OF SUBJECTS
IN THE EXPERIMENTAL GROUPS

	Group I	Group II	Group III
N	25	25	25
Males	7	7	7
Females	18	18	18
Mean age	20.44	19.84	20.12
Range of age	18-23	18-23	18-23

A second signal magnet was connected in series with two dry cells and a telegraph key, allowing the experimenter to record directly on the polygraph chart the points at which the card was presented to the subject.

A third signal magnet was in a circuit with an electronic voice key which recorded directly on the polygraph chart any verbal activity on the part of the subject.

A Manning pneumograph (46) was used to obtain a continuous record of respiratory activity in the subject. The pneumograph was connected in a closed pneumatic circuit with a tambour which recorded changes in air pressure directly on the polygraph chart. A length of tubing extending from the polygraph to the point at which the experimenter was stationed permitted the return of the pneumatic system to zero by opening a pinch clamp.

A Tycos sphygmomanometer was connected in a closed pneumatic circuit with an aneroid manometer and a Dunlop reduction capsule. An additional valve consisting of a large C-clamp mounted in a suitable cabinet was placed in the circuit just above the inflating bulb to prevent leakage of air from the circuit. A second closed pneumatic circuit ran from the low pressure side of the reduction capsule to the tambour which recorded changes in air pressure directly on the polygraph chart. As in the pneumograph circuit, a length of tubing with a pinch clamp allowed for the return of the stylus to its zero line by releasing the

air in the low pressure circuit.[1] A diagram of the apparatus appears in Figure 1.

A couch with reclining back was provided for the subject. The stimulus cards were held in a fixed position 60 cm. from the subject's eyes by a suitable stand. A 60 watt lamp 120 cm. from the card provided illumination.

The experiment took place in a sound-proof room 7 feet wide, 13 feet long and 9 feet high. Ten inch thick, heavily insulated walls and ceiling excluded outside noises and kept the room at a relatively constant temperature. The floor which was heavily insulated and independently suspended, excluded vibrations which would interfere with the efficient working of the voice key. A photograph of the equipment used in this experiment appears in Figure 2.

The first seven cards of the Rorschach (39), Behn-Rorschach (49), and Harrower (20) series of ink blots were used as the stimuli in this experiment.

The twenty-one ink blots were photographed on Kodak Commercial film, a film which seemed to give the best rendition of the red coloring on cards II and III in each series. Each of the resulting negatives was then reproduced by contact process on Kodak Azo papers number 0, 2,

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[1] This method devised by Larson (28, 29) does not secure an absolute measure of blood pressure but indicates rises and falls in systolic level. See Chappell (12) for a critique of this procedure. Darrow (14, 15) has devised more elaborate equipment for obtaining absolute readings, but his measurement is also indirect and of doubtful validity. The only way a direct reading of systolic blood pressure could be obtained is by severing a vein and connecting it directly to a manometer. This procedure, of course, is highly impractical.

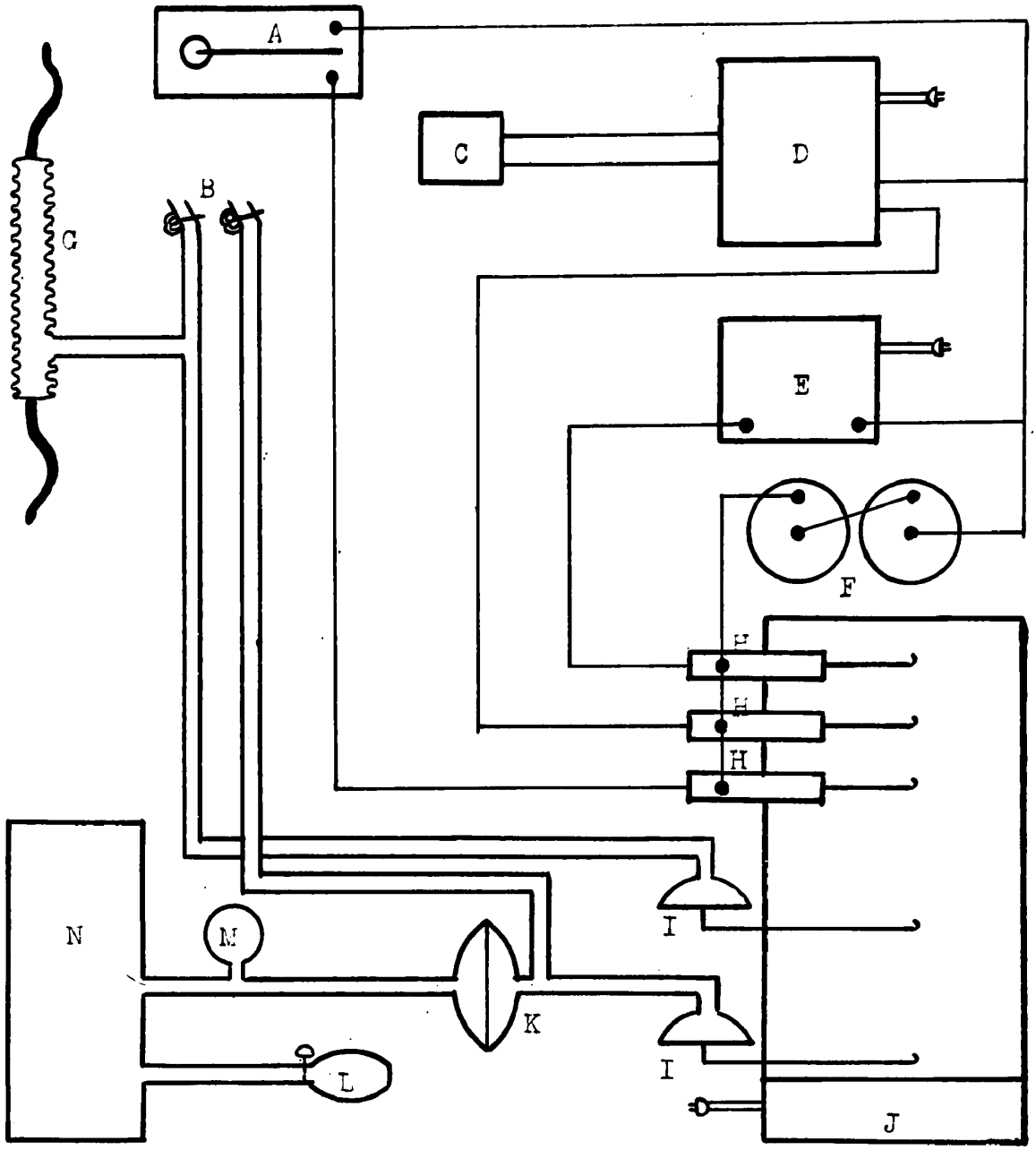

Fig. 1 Diagram of apparatus

A telegraph key
B pinch clamps
C microphone
D voice key amplifier
E interval timer
F dry cells
G pneumograph
H signal magnets
I membrane tambours
J polygraph
K Dunlap reduction capsule
L inflating bulb
M aneroid manometer
N sphygmomanometer

Fig. 2 Photograph of Apparatus

and 4, making a total of 63 ink blots, 21 of light shading contrast, 21 of medium contrast, and 21 of strong shading contrast.

Figure 3 describes the characteristics of Kodak Azo papers. It is apparent from these graphs that Azo papers number 0, 2, and 4 will yield approximately equal intervals of shading contrast.[1]

At the time the 21 ink blots were photographed, a control figure consisting of a series of greys was also photographed and treated by the same photographic process. This control negative was reproduced on Kodak Azo papers number 0, 2, and 4 also. All the cards and the control greys were photographed, developed and printed at the same time under similar conditions.

The reflectance of the control greys was then determined by use of the MacBeth Illuminometer. The results appear in Table II.

Procedure:

Each of the twenty-one ink blots was designated by a letter as shown in Table III and was then assigned to one of three batches of seven cards. Batch A consisted of cards A,D,G,J,M,P, and S. Batch B consisted of cards B,E,H,K,N,Q, and T. Batch C consisted of cards C,F,I,L,O,R, and U.

The three groups of subjects were shown the stimulus cards in a modified Latin Square design as described in Table IV.

A person in Group I, for example, saw a card which appeared in batch A under strong conditions of shading while a person in Group II saw that card under weak conditions of shading. All subjects saw all

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[1] Reproduced by permission from the Kodak Data Book (25).

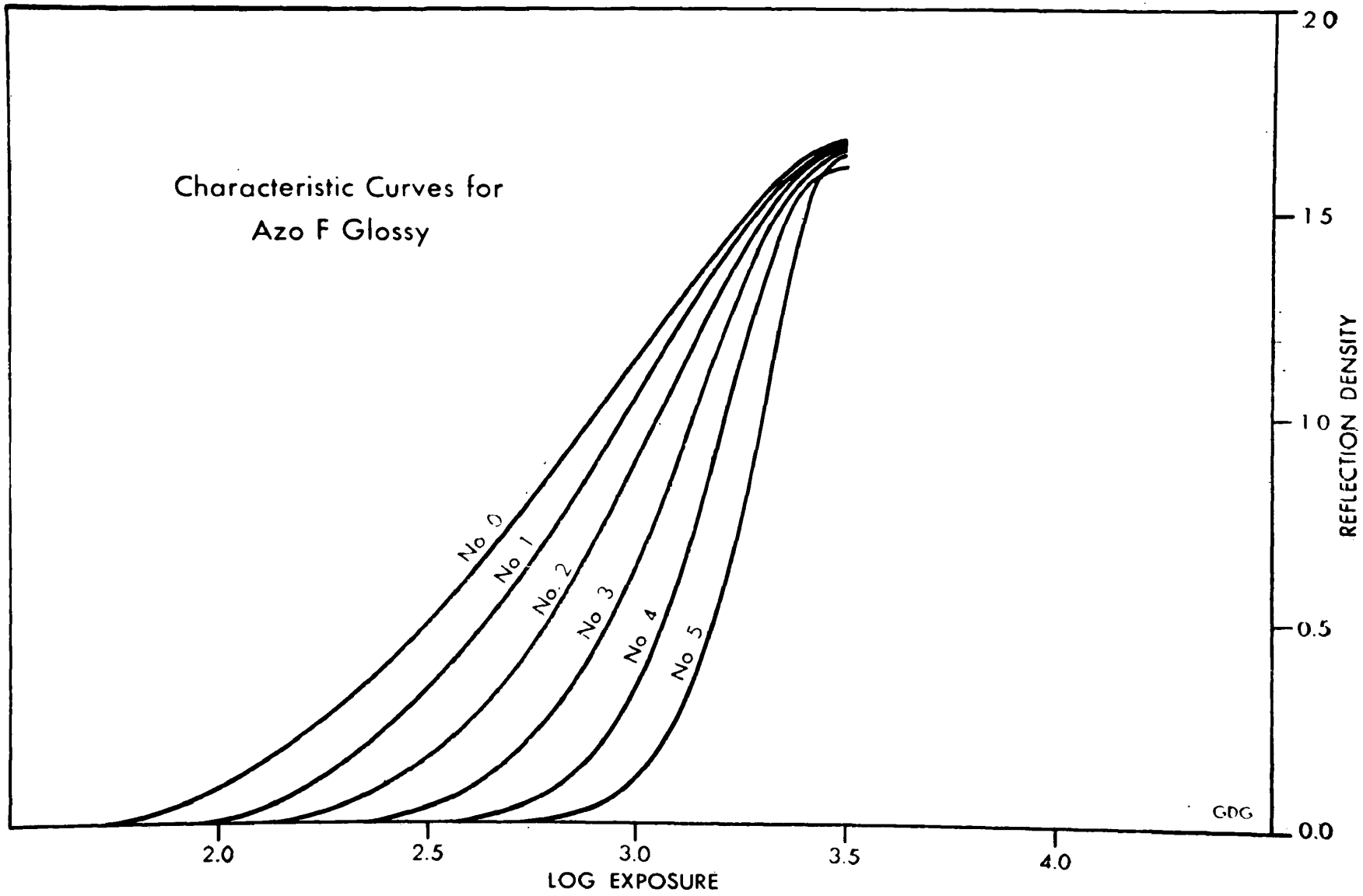
Characteristic Curves for
Azo F Glossy
No 0
No 1
No 2
No 3
No 4
No 5
GDG
2.0
2.5
3.0
3.5
4.0
LOG EXPOSURE
2.0
1.5
1.0
0.5
0.0
REFLECTION DENSITY

Fig. 3

TABLE II

REFLECTANCE OF CONTROL GREYS FOLLOWING PHOTOGRAPHIC REPRODUCTION

Number of grey	Azo paper number 0	Azo paper number 2	Azo paper number 4
1	45.79*	45.57	50.02
2	43.64	44.11	48.73
3	42.79	43.61	47.31
4	40.38	42.28	41.08
5	36.85	35.96	31.66
6	31.19	27.84	21.42
7	25.28	23.76	9.39
8	18.14	11.03	1.58
9	14.50	6.92	1.14
10	11.91	4.01	1.04

*percent of incandescent light reflected

TABLE III

CONDITIONS UNDER WHICH BATCHES OF CARDS WERE SEEN BY GROUPS

	Shading contrast		
	Weak	Medium	Strong
Group I	Batch B	Batch C	Batch A
Group II	Batch A	Batch B	Batch C
Group III	Batch C	Batch A	Batch B

TABLE IV

DESCRIPTION OF STIMULUS CARDS AND THE IDENTIFYING LETTERS ASSIGNED

Card	Description
A	Behn-Rorschach card I
B	Harrower card II
C	Behn-Rorschach card III
D	Behn-Rorschach card IV
E	Behn-Rorschach card V
F	Behn-Rorschach card VII
G	Behn-Rorschach card II
H	Rorschach card I
I	Rorschach card II
J	Rorschach card III
K	Rorschach card IV
L	Rorschach card V
M	Rorschach card VI
N	Rorschach card VII
O	Harrower card I
P	Harrower card VII
Q	Harrower card III
R	Harrower card IV
S	Harrower card V
T	Harrower card VI
U	Behn-Rorschach card VI

of the 21 ink blot forms, seven with weak shading contrast, seven with medium shading contrast, and seven with strong shading contrast. The order of presentation of the stimulus cards was random.

The subjects were scheduled two or more hours apart. The first thirty minutes were spent in obtaining the personal information asked on the form contained in Appendix A and in establishing a relaxed, friendly atmosphere. As none of the apparatus was concealed from the subject, general back action was reduced by explaining the purpose and mechanics of the apparatus to him. The subject was assured that nothing would happen that would harm or startle him.

The polygraph was set to run at a speed of 15 inches per minute and the interval timer set to mark off periods of one second each.

The pneumograph was adjusted at diaphragm level and the sphygomomanometer was attached just above the subject's left knee[1], inflated to a pressure of 90 mm. of mercury.

The input of the voice key amplifier was adjusted to a point where the subject's voice would activate the signal magnet and the pressure in the pneumatic circuits was equalized by opening the pinch clamps.

The subject was given the following directions:

"People see all sorts of things in these ink blot pictures, now tell me what you see, what it might be for you, what it makes you think of."[2]

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[1] Darrow (15) has suggested that where the experiment is prolonged, the use of the leg affords less discomfort to the subject than the upper arm.

[2] Standard Rorschach instructions according to Klopfer. c.f. Klopfer (24) p. 32

The first card was placed in the card holder and the telegraph key was closed. When the subject started his first response, the telegraph key was opened. All responses were recorded verbatim by the experimenter.

When the subject indicated that he was through, the card was removed, the next card placed in the holder, and the procedure repeated. If the subject was not through at the end of 90 seconds, he was allowed to finish the response he was giving after which the card was exchanged.

After seven cards had been seen, the pressure in the sphygomomanometer was released until the subject stated that his leg felt comfortable once again.[1]

This procedure continued until all twenty-one ink blots had been seen.

Treatment of Data:

An interval of twenty seconds was marked off on the polygraph chart for each ink blot starting with the time the subject received the card.[2] The reaction time to the card was determined by counting on the polygraph chart the elapsed seconds between the closing of the telegraph key and the first response as indicated by the voice key.

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[1] This period of time varied in length. During this period, the subject and the experimenter discussed subjects unrelated to the experiment.

[2] It was determined by inspection that most changes in the physiological responses occurred within this interval.

Amplitude of respiration was determined by measuring, in millimeters, the maximum excursion of the pen from its lowest to its highest point during the 20 second interval. The rate of respiration was defined as the number of changes of direction of the stylus during the 20 second interval.

Changes in blood pressure were defined as the change in millimeters from the lowest point which the lower diastolic beat reached to the highest point which the lower diastolic beat reached as measured from the horizontal.[1]

Pulse rate was measured by counting the number of peaks, or systolic beats, occurring within the twenty second interval. (Peaks occurring at the exact beginning or end of the interval were counted as one at the beginning of the interval and not counted at the end of the interval.)

Rate of pulse change was measured by determining the subject's modal pulse rate for each of the twenty-one intervals and then obtaining his deviation for each card from this rate by subtraction.

The verbal productions of the subjects were scored for the number of times shading was used as a determinant on each card, the number of times shading was used to give depth to the response, FK, the number of times the shading was used to give diffuse effects, K, the number of times the shading was used as achromatic color, C', the number of times the shading was used to give toned-down depth effects, k, and

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[1] The time marker line was used as the horizontal rather than the paper edge due to the occasional tendency of the polygraph chart to go through the polygraph at other than a right angle.

the number of times the shading was used as surface texture, c.[1]

In general, scoring criteria according to Klopfer[2] was used to determine into which shading category a response fell. Since there was no inquiry, only the performance proper or "free association" responses could be utilized in evaluating the type of shading used.

1. Depth responses, FK, were scored when the concept was a landscape, scene, valley, mountain, cave, etc. Reflections were not scored FK unless the reflected object itself utilized shading, i.e., "a lake shore with surrounding trees and brush reflected in the water" was scored FK while "a person looking at his reflection in a mirror" was not.
2. Diffuse responses, K, were scored when the object seen was a cloud, fog, haze, or smoke.
3. Surface color, C', was scored when the object seen was described as being black, white or intermediate shades of grey or where the object was described as being striped.
4. Toned-down depth, k, was scored when the object seen was an X-ray or a topographical map.
5. Surface texture responses, c, were responses where the seen object was described as being furry, rough, grainy, hairy, pebbly, etc., or where highlights were specifically mentioned.

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[1] Note that this procedure differs from clinical practice. No attempt was made in this study to determine what constituted a "response" in the clinical sense. The subject was credited with use of shading each time it was utilized. Concept organization was not considered.

[2] c.f. Klopfer (24) p. 119-141. Supra p. 4-6.

6. The number of times shading was used as a determinant on each card was found by adding the five shading categories, above, for each card.

Our responses were scored without regard to form (whether predominant or subordinate) and no distinction was made between main and additional responses.

RESULTS

The following differences were obtained with respect to the degree of shading contrast.

The effect of degree of shading contrast on the number of times shading was used in responding to the ink blots was determined by an analysis of variance technique as described in Table V. The total sums of squares consists of the squares of the total number of times shading was used for each of the 63 cards. The error term consists of the residual variance when the variance due to the three groups, the three conditions of shading contrast, the three batches of cards, and the twenty-one ink blot forms (cards) is subtracted from the total sums of squares. The responses of twenty-one subjects are accounted for in each group.

The analysis of variance indicates that the number of times shading is used does not vary significantly with the degree of shading contrast.

The number of times shading is used as surface texture, c, does not vary significantly with the degree of shading contrast (Table VI) when the results are treated by an analysis of variance similar to that described for the number of times shading was used.

As the degree of shading contrast in the ink blots is increased, there is a significant increase in the number of times shading is used as achromatic color, C'. (Table VII) The total number of C' responses given under weak conditions of shading contrast is 47, under medium conditions of contrast, 60 and under strong conditions it is 70. These differences are significant at the 5% level of confidence.

TABLE V

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING

Source of variance	d.f.	s.s.	F	P
Total		2390.840		
Groups	2	34.032	3.06	
Shading	2	24.413	2.19	
Batches	2	103.841	9.32	.01
Cards	18	2016.984	20.12	.01
Error	38	211.570		

TABLE VI

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING AS SURFACE TEXTURE

Source of variance	d.f.	s.s.	F	P
Total		1199.746		
Groups	2	1.365	8.12	
Shading	2	2.317	4.78	
Batches	2	42.317	3.82	.05
Cards	18	943.079	9.45	.01
Error	38	210.668		

TABLE VII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING AS ACHROMATIC COLOR

Source of variance	d.f.	s.s.	F	P
Total		527.714		
Groups	2	9.238	2.83	
Shading	2	6.333	3.89	.05
Batches	2	3.523	1.08	
Cards	18	440.381	15.02	.01
Error	38	61.906		

The number of responses utilizing shading as depth, FK, also varies significantly with the degree of shading contrast (Table VIII). Under weak conditions of shading, the total number of FK responses is 28, under medium conditions, 50 and under strong conditions it is 40. All these differences are significant at the 5% level of confidence.

The remaining shading response categories diffuse effects, K, and toned-down depth effects, k, showed no significant increases or decreases as a result of varying the degree of shading contrast in the stimulus ink blots, (Tables IX and X).

There are no significant differences in any of the physiological response categories as a result of varying the degree of shading contrast (Tables XI, XII, XIII, XIV, XV and XVI) when the physiological response categories are treated by the following analysis of variance technique. Since some of the physiological response categories contained missing data for some cards,[1] subjects with missing data were removed from the group for that physiological response category and the groups made equal by withdrawing subjects from the other groups by use of a table of random numbers. The total sums of squares for the analysis consists of the squares of the totals for each of the 63 cards. The error term consists of the residual variance when the variance due to the three groups, the three conditions of shading contrast, the three batches of cards, and the twenty-one cards is subtracted from the total sums of squares. The analysis of variance of reaction times consists of the reaction times to the cards of 19

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[1]This occurred because of the recording pens running out of ink, running off the chart, etc.

TABLE VIII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING AS DEPTH

Source of variance	d.f.	s.s.	F	P
Total		288.984		
Groups	2	10.889	3.05	
Shading	2	11.555	3.24	.05
Batches	2	.413	8.66	
Cards	18	198.317	6.17	.01
Error	38	67.810		

TABLE IX

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING TO GIVE DIFFUSE EFFECTS

Source of variance	d.f.	s.s.	F	P
Total		134.984		
Groups	2	6.889	3.72	.05
Shading	2	.793	2.33	
Batches	2	.508	3.64	
Cards	18	91.651	5.51	.01
Error	38	35.143		

TABLE X

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PRODUCTION OF RESPONSES USING SHADING TO GIVE TONED-DOWN DEPTH EFFECTS

Source of variance	d.f.	s.s.	F	P
Total		39.556		
Groups	2	3.937	4.07	.05
Shading	2	.127	7.62	
Batches	2	2.112	4.36	.05
Cards	18	12.889	1.48	
Error	38	18.380		

TABLE XI

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON REACTION TIME TO THE CARDS

Source of variance	d.f.	s.s.	F	P
Total		272,321.43		
Groups	2	6,357.23	3.12	
Shading	2	2,114.57	2.07	
Batches	2	30,233.52	14.82	.01
Cards	18	192,746.09	10.49	.01
Error	38	38,756.02		

TABLE XII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE AMPLITUDE OF RESPIRATION OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		130,276.32		
Groups	2	64,584.07	26.89	.01
Shading	2	971.99	2.52	
Batches	2	2,032.12	1.20	
Cards	18	16,170.32	1.36	
Error	38	46,517.82		

TABLE XIII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE RESPIRATORY RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		3,005.715		
Groups	2	360.782	4.46	.01
Shading	2	29.238	2.77	
Batches	2	78.000	1.04	
Cards	18	1,000.381	1.37	
Error	38	1,537.314		

TABLE XIV

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON CHANGE OF BLOOD PRESSURE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		5,761.651		
Groups	2	2,929.746	26.56	.01
Shading	2	51.175	2.16	
Batches	2	10.889	10.13	
Cards	18	674.318	1.47	
Error	38	2,095.523		

TABLE XV

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON THE PULSE RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		9,227.43		
Groups	2	7,086.38	108.12	.01
Shading	2	31.52	2.08	
Batches	2	1.81	36.30	.05
Cards	18	849.43	1.44	
Error	38	1,248.29		

TABLE XVI

AN ANALYSIS OF VARIANCE OF THE EFFECT OF DEGREE OF SHADING CONTRAST ON CHANGE OF PULSE RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		632.316		
Groups	2	11.078	1.98	
Shading	2	24.030	1.10	
Batches	2	3.554	6.16	
Cards	18	377.649	1.92	.05
Error	38	416.005		

subjects for each group. Each group in the analysis of variance of respiratory amplitude and respiratory rate consists of the responses of 16 subjects. The analysis of variance of pulse rate and change of pulse rate includes the pulse rates of 14 subjects in each group. The data from 11 subjects for each group is represented in the analysis of variance of change of blood pressure. Changes in systolic level on the polygraph chart which seemed to be due to unobserved changes in body position were eliminated from the data according to criteria established by Inbau.[1] This left a much smaller number of subjects in each group for this physiological response category.

The following results were obtained with respect to the ink blot forms (cards).

The analyses of variance already completed also indicate whether significant differences exist from card to card, without regard to the degree of shading contrast present in the card. Significant differences from card to card are found for all the shading categories except toned-down depth effects, k, (Tables VI, VII, VIII, IX and X) and for the number of times shading was used (Table V).

Specific differences between cards for these shading response categories are presented in Tables XVII, XVIII, XIX, XX and XXI.

Significant differences in reaction time (Table XI) and change of pulse rate (Table XVI) are found from card to card. Respiratory amplitude, respiratory rate, change of blood pressure, and pulse rate

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[1] Inbau (22) pages 54-61.

do not show any significant increases or decreases from card to card. (Tables XII, XIII, XIV and XV)

Specific differences between cards in reaction times appear in Table XXII. Specific differences between cards in change of pulse rate appear in Table XXIII.

The following differences in physiological response were obtained with respect to the type of shading response given by the subject.

The physiological responses accompanying the verbal responses of subjects to cards in which shading was used in one way (e.g. as surface texture) were compared with the physiological responses of subjects to cards in which shading was used in a different way (e.g. to give depth effects).

An analysis of variance was carried out for each physiological response category. The physiological responses to cards were arranged in columns according to how the shading had been used by the subject in responding to the card. The physiological responses to cards in which the shading was used in more than one way were not used in this analysis. An additional column consisted of the physiological responses to cards in which shading was not used. This column served as a control.

The total sums of squares consisted of the sum of the squares of each item in the table. The error term consisted of the variance due to individuals and was obtained by subtracting the variance due to columns from the total sums of squares. Variance due to the cards was obtained by summing the squares of the totals for each ink blot form.

TABLE XVII

DIFFERENCES BETWEEN TOTALS FOR CARDS IN THE NUMBER OF TIMES SHADING WAS USED AS ACHROMATIC COLOR

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	9																				
C	3	6																			
D	3	6	0																		
E	1	10	4	4																	
F	2	11	5	5	1																
G	4	5	1	1	5	6															
H	4	13	7	7	3	2	8														
I	2	7	1	1	3	4	2	0													
J	3	6	0	0	4	5	1	7	1												
K	4	13	7	7	3	2	8	0	6	7											
L	5	14	8	8	4	3	9	1	7	8	1										
M	1	10	4	4	0	1	5	3	3	4	3	4									
N	2	11	5	5	1	0	6	2	4	5	2	3	1								
O	8	1	5	5	9	10	4	12	6	5	12	13	9	10							
P	8	1	5	5	9	10	4	12	6	5	12	13	9	10	0						
Q	33*	24*	30*	30*	34*	35*	29*	37*	31*	30*	37*	38*	34*	35*	25*	25*					
R	4	5	1	1	5	6	0	8	2	1	8	9	5	6	4	4	29*				
S	3	6	0	0	4	5	1	7	1	0	7	8	4	5	5	5	30*	1			
T	1	8	2	2	2	3	3	5	1	2	5	6	2	3	7	7	32*	3	2		
U	11	2	8	8	12	13	7	15	9	8	15	16	12	13	3	3	22*	7	8	10	

* Significant at the 1 % level of confidence.

TABLE XVIII

DIFFERENCES BETWEEN TOTALS FOR CARDS IN THE NUMBER OF TIMES SHADING WAS USED AS DEPTH

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	3																				
C	5	2																			
D	0	3	5																		
E	4	1	1	4																	
F	17	20†	22†	17	21†																
G	6	3	1	6	2	23*															
H	4	1	1	4	0	21†	2														
I	5	2	0	5	1	22†	1	1													
J	6	3	1	6	2	23*	0	2	1												
K	2	1	3	2	2	19†	4	2	3	4											
L	6	3	1	6	2	23*	0	2	1	0	4										
M	0	3	5	0	4	17	6	4	5	6	2	6									
N	4	7	9	4	8	13	10	8	9	10	6	10	4								
O	5	2	0	5	1	22†	1	1	0	1	3	1	5	9							
P	0	3	5	0	4	17	6	4	5	6	2	6	0	4	5						
Q	6	3	1	6	2	23*	0	2	1	0	4	0	6	10	1	6					
R	4	1	1	4	0	21†	2	0	1	2	2	2	4	8	1	4	2				
S	0	3	5	0	4	17	6	4	5	6	2	6	0	4	5	0	6	4			
T	7	10	12	7	11	10	13	11	12	13	9	13	7	3	12	7	13	11	7		
U	1	2	4	1	3	18†	5	3	4	5	1	5	1	5	4	1	5	3	1	8	

* Significant at the 1% level of confidence.
† Significant at the 5% level of confidence.

TABLE XIX

DIFFERENCES BETWEEN TOTALS FOR CARDS IN THE NUMBER OF TIMES SHADING WAS USED TO GIVE DIFFUSE EFFECTS

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	3																				
C	0	3																			
D	2	1	2																		
E	1	2	1	1																	
F	1	2	1	1	0																
G	1	2	1	1	0	0															
H	1	2	1	1	0	0	0														
I	0	3	0	2	1	1	1	1													
J	2	1	2	0	1	1	1	1	2												
K	4	1	4	2	3	3	3	3	4	2											
L	0	3	0	2	1	1	1	1	0	2	4										
M	1	2	1	1	0	0	0	0	1	1	3	1									
N	14†	11	14†	12	13†	13†	13†	13†	14†	12	10	14†	13†								
O	8	5	8	6	7	7	7	7	8	6	4	8	7	14†							
P	9	6	9	7	8	8	8	8	9	7	5	9	8	5	1						
Q	1	2	1	1	0	0	0	0	1	1	3	1	0	13†	7	8					
R	4	1	4	2	3	3	3	3	4	2	0	4	3	10	4	5	3				
S	5	2	5	3	4	4	4	4	5	3	1	5	4	9	3	4	4	1			
T	0	3	0	2	1	1	1	1	0	2	4	0	1	14†	8	9	1	4	5		
U	7	4	7	5	6	6	6	6	7	5	3	7	6	7	1	2	6	3	2	7	

† Significant at the 5% level of confidence.

TABLE XX

DIFFERENCES BETWEEN TOTALS FOR CARDS IN THE NUMBER OF TIMES SHADING WAS USED AS SURFACE TEXTURE

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	1																				
C	2	1																			
D	17	18	19																		
E	3	4	5	14																	
F	12	13	14	5	9																
G	1	0	1	18	4	13															
H	0	1	2	17	3	12	1														
I	4	3	2	25	7	30	3	4													
J	3	2	1	20	6	15	2	3	1												
K	22	23	24	5	43*	10	23	22	26	25											
L	7	8	9	10	4	5	8	7	11	10	15										
M	45*	46*	47*	28	42*	33†	46*	45*	49*	48*	23	38†									
N	22	23	24	5	43*	10	23	22	26	25	0	15	23								
O	0	1	2	17	3	12	1	0	4	3	22	7	45*	22							
P	10	11	12	7	7	2	11	10	14	13	12	3	35†	12	10						
Q	11	12	13	6	8	1	12	11	15	14	11	4	34†	11	11	1					
R	8	9	10	9	5	4	9	8	12	11	14	1	37†	14	8	2	3				
S	9	10	11	8	6	3	10	9	13	12	13	2	36†	13	9	1	2	1			
T	19	20	21	2	16	7	20	19	23	22	3	12	26	3	19	9	8	11	10		
U	19	20	21	2	16	7	20	19	23	22	3	12	26	3	19	9	8	11	10	0	

* Significant at the 1% level of confidence.
† Significant at the 5% level of confidence.

TABLE XXI

DIFFERENCES BETWEEN TOTALS FOR CARDS IN THE NUMBER OF TIMES SHADING WAS USED

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	6																				
C	7	13																			
D	22	16	29																		
E	0	6	7	22																	
F	26	20	33†	4	26																
G	3	9	4	25†	3	29															
H	10	16	3	32†	10	36†	7														
I	10	16	3	32†	10	36†	7	0													
J	6	12	1	28	6	32†	3	4†	4												
K	22	16	29	0	22	4†	25	32†	32†	28											
L	8	14†	1	30	8	34†	5	2	2	2	30										
M	43*	37†	50*	21	43*	17	46*	53*	53*	49*	21	51*									
N	37†	31†	44*	15	37†	11	40†	47*	47*	43*	15	45*	6								
O	9	3	16†	13	9	17	12	19†	19†	15†	13	17†	34†	28							
P	25†	19	32†	3	25†	1	28†	35†	35†	31†	3	33†	18	12	16						
Q	35†	29	42*	13	35†	9	38†	45*	45*	41†	13	43*	8	2	26	10					
R	10	4	17	12	10	16	13	20	20	16	12	18	33†	27	1	15	25				
S	2	4	9	20	2	24	5	12†	12†	8†	20	10†	41*	35†	7	23	33†	8			
T	28†	22	35†	6	28†	2	31†	38†	38†	34†	6	36†	15	9	19	3	7	18	26		
U	32†	26	39†	10	32†	6	35†	42*	42*	38†	10	40†	11	9	23	7	3	22	30	4	

* Significant at the 1% level of confidence.
† Significant at the 5% level of confidence.

TABLE XXII

DIFFERENCES BETWEEN TOTALS FOR CARDS IN REACTION TIMES OF SUBJECTS

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
B	100[a]																				
C	113	13																			
D	172	72	59																		
E	76	24	37	96																	
F	255	155	142	83	179																
G	128	228	241	300	204	383															
H	473†	373	360	301	397	218	601*														
I	22	122	135	194	98	277	106	495†													
J	65	35	48	107	11	190	193	408	87												
K	329	229	216	157	253	74	457†	144	351	264											
L	122	22	9	50	46	133	250	351	144	57	207										
M	43	57	70	129	33	212	171	430†	65	22	286	79									
N	102	2	11	70	26	153	230	371	124	37	227	20	59								
O	154	54	41	18	78	101	282	319	176	89	175	32	111	52							
P	62	38	51	110	14	193	190	411	84	3	267	60	19	40	92						
Q	63	163	176	235	139	318	65	536†	41	128	392	185	106	165	217	125					
R	575*	475†	463†	403	497†	320	703*	102	591*	510†	246	453†	532†	473†	421†	513†	638*				
S	197	97	84	25	121	58	325	276	219	132	132	75	154	95	43	135	260	378			
T	98	2	15	74	22	157	226	375	120	33	231	24	55	4	56	36	161	477†	99		
U	328	228	215	156	252	73	456†	145	350	263	1	206	285	226	174	266	391	247	131	230	

[a] Numbers in the table are seconds.
* Significant at the 1% level of confidence.
† Significant at the 5% level of confidence.

TABLE XXIII

DIFFERENCES BETWEEN TOTALS FOR CARDS IN CHANGE OF PULSE RATES OF SUBJECTS

Card	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
B	9																			
C	17	26†																		
D	2	11	15																	
E	4	5	21†	6																
F	0	9	17	2	4															
G	4	13	13	2	8	4														
H	5	14	12	3	9	5	1													
I	10	19	7	8	14	10	6	5												
J	9	18	8	7	13	9	5	4	1											
K	11	20†	6	9	15	11	7	6	1	2										
L	5	4	22†	7	1	5	9	10	15	14	16									
M	8	17	9	6	12	8	4	3	2	1	3	13								
N	9	0	26†	11	5	9	13	14	19	18	20†	4	17							
O	2	7	19	4	2	2	6	7	12	11	13	3	10	2						
P	4	13	13	2	8	4	0	1	6	5	7	9	4	4	6					
Q	6	15	11	4	10	6	2	1	4	3	5	11	2	6	8	2				
R	5	14	12	3	9	5	1	0	5	4	6	10	3	5	7	1	1			
S	12	3	29†	14	8	12	16	17	22†	21†	23	7	20†	12	10	16	18	17		
T	7	16	10	5	11	7	3	2	3	2	4	12	7	7	9	3	1	2	19	
U	6	3	23†	8	2	6	10	11	16	15	17	1	14	6	4	10	12	11	6	13

† Significant at the 5% level of confidence.

An interaction term, cards x individuals, was obtained by subtracting the variance due to cards from the variance due to individuals. This interaction term proved to have little value in the analysis since the F obtained was always significant, the F required for significance being 1.00 due to the large number of degrees of freedom involved. This analysis utilized 1326 responses to cards.

From these analyses of variance it was determined that significant differences exist in reaction time, respiratory amplitude, respiratory rate, and pulse rate with respect to the way in which shading was used by the subject (Tables XXIV, XXV, XXVI and XXVII). No significant differences exist with respect to blood pressure and change of pulse rate[1] (Tables XXVIII and XXIX).

Tables XXX, XXXI and XXXII show the specific differences between the means of the physiological responses for each shading response category. There are no specific differences between any two shading response categories with respect to pulse rate, so these data are not presented in tabular form.

Table XXXIII gives the means of the physiological responses for each shading response category.

Table XXXIV shows these numbers reduced to interval scales of ten according to increase in each physiological response category. Averaging these numbers for each shading response category and ranking them indicates that the greatest increases in physiological response occurred when the shading was used to give diffuse effects, K. Achromatic

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[1]The analysis of variance of change of pulse rate consists of 787 responses instead of the 1326 responses in the analyses of variance of the other physiological response categories.

TABLE XXIV

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE REACTION TIME TO THE CARD

Source of variance	d.f.	s.s.	F	P
Total		296,157.963		
Columns	5	3,584.981	3.23	.01
Individuals	1320	292,572.983		
Cards	20	123,703.771	27.96	.01
Cards X individuals	1300	168,869.212	1.71	

TABLE XXV

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE RESPIRATORY AMPLITUDE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		159,844.794		
Columns	5	1,599.681	2.67	.05
Individuals	1320	158,245.068		
Cards	20	5,305.586	2.21	
Cards X individuals	1300	152,939.482	1.02	

TABLE XXVI

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE RESPIRATORY RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		2,688.061		
Columns	5	33.447	3.33	.01
Individuals	1320	2,654.614		
Cards	20	11.909	5.92	.01
Cards X individuals	1300	2,416.434	1.08	

TABLE XXVII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE PULSE RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		40,922.951		
Columns	5	22.692	6.83	.05
Individuals	1320	40,900.259		
Cards	20	4,905.313	7.92	.01
Cards X individuals	1300	35,994.946	1.12	

TABLE XXVIII

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE BLOOD PRESSURE CHANGES OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		14,777.382		
Columns	5	73.196	1.31	
Individuals	1320	14,704.185		
Cards	20	172.295	1.29	
Cards X individuals	1300	14,531.890	1.00	

TABLE XXIX

AN ANALYSIS OF VARIANCE OF THE EFFECT OF THE TYPE OF SHADING RESPONSE GIVEN BY THE SUBJECT ON THE CHANGE OF PULSE RATE OF THE SUBJECT

Source of variance	d.f.	s.s.	F	P
Total		1,173.822		
Columns	5	10.798	1.45	
Individuals	781	1,163.024		
Cards	20	19.190	1.55	
Cards X individuals	761	1,143.834	1.01	

TABLE XXX

DIFFERENCES BETWEEN MEAN REACTION TIMES ACCOMPANYING DIFFERENT TYPES OF SHADING RESPONSES

Type of response	Diffuse effects	Surface texture	Achromatic color	Depth effects	Toned-down depth effects
Surface texture	3.6340				
Achromatic color	3.3810	.2530			
Depth effects	.0476	3.6816	3.4286		
Toned-down depth effects	.5000	3.1340	2.8810	.5476	
No use of shading	5.5843†	1.9503	2.2033	5.6319*	5.0843

* Significant at the 1% level of confidence.
† Significant at the 5% level of confidence.

TABLE XXXI

DIFFERENCES BETWEEN MEAN AMPLITUDES OF RESPIRATION ACCOMPANYING DIFFERENT TYPES OF SHADING RESPONSES

Type of response	Diffuse effects	Surface texture	Achromatic color	Depth effects	Toned-down depth effects
Surface texture	4.2302†				
Achromatic color	1.5429	2.6873			
Depth effects	3.7048	.5254	2.1619		
Toned-down depth effects	4.3000	.0698	2.7571	.5952	
No use of shading	1.8333	2.3969†	.2904	1.8715	2.4667

† Significant at the 5% level of confidence

TABLE XXXII

DIFFERENCES BETWEEN MEAN RESPIRATORY RATES ACCOMPANYING DIFFERENT TYPES OF SHADING RESPONSES

Type of response	Diffuse effects	Surface texture	Achromatic color	Depth effects	Toned-down depth effects
Surface texture	.2917				
Achromatic color	.2286	.0631			
Depth effects	.8984*	.6067*	.6698*		
Toned-down depth effects	.1643	.1274	.0643	.7341	
No use of shading	.1768	.1149	.0518	.7216*	.0125

* Significant at the 1% level of confidence.

TABLE XXXIII

MEAN PHYSIOLOGICAL RESPONSES ACCOMPANYING DIFFERENT TYPES OF SHADING RESPONSES

	Type of response					
	Diffuse effects	Surface texture	Achromatic color	Depth effects	Toned-down depth effects	No use of shading
Reaction time	18.0000	14.3600	14.6190	18.0476	17.5000	12.4157
Respiratory amplitude	29.8000	25.5698	28.2571	26.0952	25.5000	27.9667
Respiratory rate	6.0857	6.3774	6.3143	6.9841	6.2500	6.2625
Blood pressure	4.9714	4.5660	5.4286	5.2381	5.0625	4.7399
Pulse rate	29.6857	29.6264	29.6952	29.2063	30.1875	29.4691
Change of pulse rate	1.3125	.9673	1.1275	.7838	1.0385	1.1873

TABLE XXXIV

MEAN PHYSIOLOGICAL RESPONSES ACCOMPANYING DIFFERENT TYPES OF SHADING RESPONSES REDUCED TO INTERVAL SCALES OF TEN

	Type of response					
	Diffuse effects	Surface texture	Achromatic color	Depth effects	Toned-down depth effects	No use of shading
Reaction time	9.9155	3.4523	3.9122	10.	9.0277	0
Respiratory amplitude	10.	.1623	6.4119	1.3842	0	5.7365
Respiratory rate	0	3.2469	2.5445	10.	1.8288	1.9679
Blood pressure	4.6997	0	10.	7.7916	5.7559	2.0160
Pulse rate	4.8859	4.2815	4.9827	0	10.	2.6784
Change of pulse rate	10.	3.4708	6.5009	0	4.8175	7.6319
Average position	6.5835	2.4356	5.7254	4.8626	5.2383	3.3384

color, C', toned-down depth effects, k, depth effects, FK, and the control category, no use of shading, follow with responses to surface texture, c, producing the least increases in physiological response.

The following differences between subjects in physiological response were obtained when the subjects were separated into groups on the basis of the number of each type of shading response which they gave. Fisher's t was used as the test of significance in all cases. N represents the number of measurements considered.

The physiological responses of the subjects who stand in the upper quarter of the distribution in the number of times shading was used differ from subjects who stand in the lower quarter of the distribution in the number of times shading was used in the following respects: the subjects who used the most shading have significantly shorter reaction times to the ink blots and significantly greater changes in blood pressure during the twenty second interval following their receiving the ink blot than do the subjects who stand in the lowest quarter in use of shading. There are no significant differences between the groups with respect to respiratory amplitude, respiratory rate, pulse rate or change of pulse rate (Table XXXV).

The subjects who stand in the upper quarter of the distribution in the number of times shading was used as surface texture, c, differ in their physiological responses from the subjects who stand in the lower quarter in the number of times shading was used as surface texture in that the subjects in the upper quarter have significantly shorter reaction times and significantly slower pulse rates than the

TABLE XXXV

COMPARISON OF THE MEAN PHYSIOLOGICAL RESPONSES OF THE UPPER AND LOWER QUARTERS OF THE DISTRIBUTION IN USE OF SHADING

	Upper quarter N=336		Lower quarter N=336			
	Mean	S.D.	Mean	S.D.	t	P
Reaction time	14.720	10.880	17.289	11.545	2.97	.01
Respiratory amplitude	26.408	14.518	26.527	10.420	.12	
Respiratory rate	6.229	1.540	6.434	1.693	1.66	
Blood pressure	5.188	3.087	4.589	2.958	2.56	.05
Pulse rate	30.312	3.472	30.816	5.585	1.40	
Change of pulse rate	1.116	1.245	1.148	1.243	.03	

subjects in the lower quarter. There are no significant differences in respiratory amplitude, respiratory rate, blood pressure, or change of pulse rate between the two groups (Table XXXVI).

Separation of the subjects into quartiles on the basis of the number of their responses utilizing shading as achromatic color, C', to give depth effects, FK, and to give diffuse effects, K, was deemed impractical because of the smaller number of these types of responses given. The physiological responses of those subjects who gave five or more responses using shading as achromatic color were compared with the physiological responses of those subjects who gave one or no responses utilizing the shading as achromatic color.[1]

Those subjects who used the shading as achromatic color, c, five or more times differ in their physiological responses from the subjects who used the shading in this manner only once or not at all, in that the five C' group have significantly shorter reaction times, greater amplitudes of respiration, greater changes in blood pressure, and higher pulse rates than the subjects who used shading as achromatic color only once or not at all. There were no significant differences between the two groups with respect to respiratory rate and change of pulse rate (Table XXXVII).

The physiological responses of those subjects who used shading to give depth effects, FK, to their responses four or more times were compared with the physiological responses of those subjects who did not use shading to give depth effects.

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[1]Harrower card III (Q) prompted practically all of the subjects to respond to the black and white stripes which appear in the blot. For this reason there were insufficient subjects in the group giving no C' responses to use for comparison.

TABLE XXXVI

COMPARISON OF THE MEAN PHYSIOLOGICAL RESPONSES OF THE UPPER AND LOWER QUARTERS OF THE DISTRIBUTION IN USE OF SHADING AS SURFACE TEXTURE

	Upper quarter N=336		Lower quarter N=336			
	Mean	S.D.	Mean	S.D.	t	P
Reaction time	13.556	8.810	16.610	11.597	3.84	.01
Respiratory amplitude	26.104	9.406	25.967	10.914	.02	
Respiratory rate	6.354	1.430	6.437	1.668	.07	
Blood pressure	4.747	2.813	4.679	2.923	.03	
Pulse rate	29.815	3.980	30.887	4.192	3.39	.01
Change of pulse rate	1.098	1.115	1.064	1.311	.04	

TABLE XXXVII

COMPARISON OF THE MEAN PHYSIOLOGICAL RESPONSES OF SUBJECTS WHO USED SHADING AS ACHROMATIC COLOR FIVE OR MORE TIMES WITH THOSE OF SUBJECTS WHO USED SHADING AS ACHROMATIC COLOR ONCE OR NOT AT ALL

	Five or more achromatic color responses			One or no achromatic color responses				
	N	Mean	S.D.	N	Mean	S.D.	t	P
Reaction time	273	12.388	7.720	441	16.297	11.257	5.46	.01
Respiratory amplitude	252	28.436	10.422	315	25.854	10.253	2.95	.01
Respiratory rate	252	6.456	1.622	315	6.676	1.706	1.56	
Blood pressure	168	6.042	2.797	189	3.963	2.328	7.56	.01
Pulse rate	168	31.655	2.796	336	30.006	4.489	5.04	.01
Change of pulse rate	168	1.185	1.394	336	1.143	1.200	.03	

This comparison indicates that the subjects using shading as depth have significantly shorter reaction times, lower respiratory rates, and greater changes of blood pressure. There are no significant differences in respiratory amplitude, pulse rate or change of pulse rate (Table XXXVIII).

The physiological responses of those subjects who used shading to give diffuse effects, K, to their responses two or more times were compared with the physiological responses of subjects who did not use shading to give diffuse effects.

This comparison indicates that the subjects who used shading to give diffuse effects have shorter reaction times and greater changes in blood pressure than the subjects who give no diffuse responses. There are no significant differences between the two groups of subjects with respect to respiratory amplitude, respiratory rate, pulse rate or change of pulse rate (Table XXXIX).

Too few toned-down depth responses, k, were given by our subjects to make a similar comparison possible.

Figures 4, 5, 6, 7, and 8 compare in graphic form the physiological responses of the different groups. The physiological response, change of pulse rate, is not included as no significant differences were found with respect to this variable.

TABLE XXXVIII

COMPARISON OF THE MEAN PHYSIOLOGICAL RESPONSES OF SUBJECTS WHO USED SHADING TO GIVE DEPTH EFFECTS FOUR OR MORE TIMES WITH THOSE OF SUBJECTS WHO DID NOT USE SHADING TO GIVE DEPTH EFFECTS

	Four or more depth effect responses			No depth effect responses				
	N	Mean	S.D.	N	Mean	S.D.	t	P
Reaction time	273	14.692	10.138	378	16.349	10.829	2.00	.05
Respiratory amplitude	231	25.467	11.219	273	26.758	10.027	1.35	
Respiratory rate	231	6.160	1.567	273	6.608	1.806	2.98	.01
Blood pressure	168	5.863	3.455	231	4.407	2.910	4.43	.01
Pulse rate	231	29.974	3.890	294	30.619	3.605	1.94	
Change of pulse rate	231	1.138	1.295	294	1.112	1.140	.02	

TABLE XXXIX

COMPARISON OF THE MEAN PHYSIOLOGICAL RESPONSES OF SUBJECTS WHO USED SHADING TO GIVE DIFFUSE EFFECTS TWO OR MORE TIMES WITH THOSE OF SUBJECTS WHO DID NOT USE SHADING TO GIVE DIFFUSE EFFECTS

	Two or more diffuse effect responses			No diffuse effect responses				
	N	Mean	S.D.	N	Mean	S.D.	t	P
Reaction time	357	13.532	9.297	504	16.655	10.485	6.07	.01
Respiratory amplitude	273	26.436	10.949	420	26.171	11.027	.03	
Respiratory rate	273	6.271	1.545	420	6.059	2.731	1.29	
Blood pressure	210	5.043	3.013	252	4.381	2.415	2.56	.05
Pulse rate	273	31.249	3.504	357	31.202	4.373	.01	
Change of pulse rate	273	1.167	.599	357	1.097	1.199	.09	

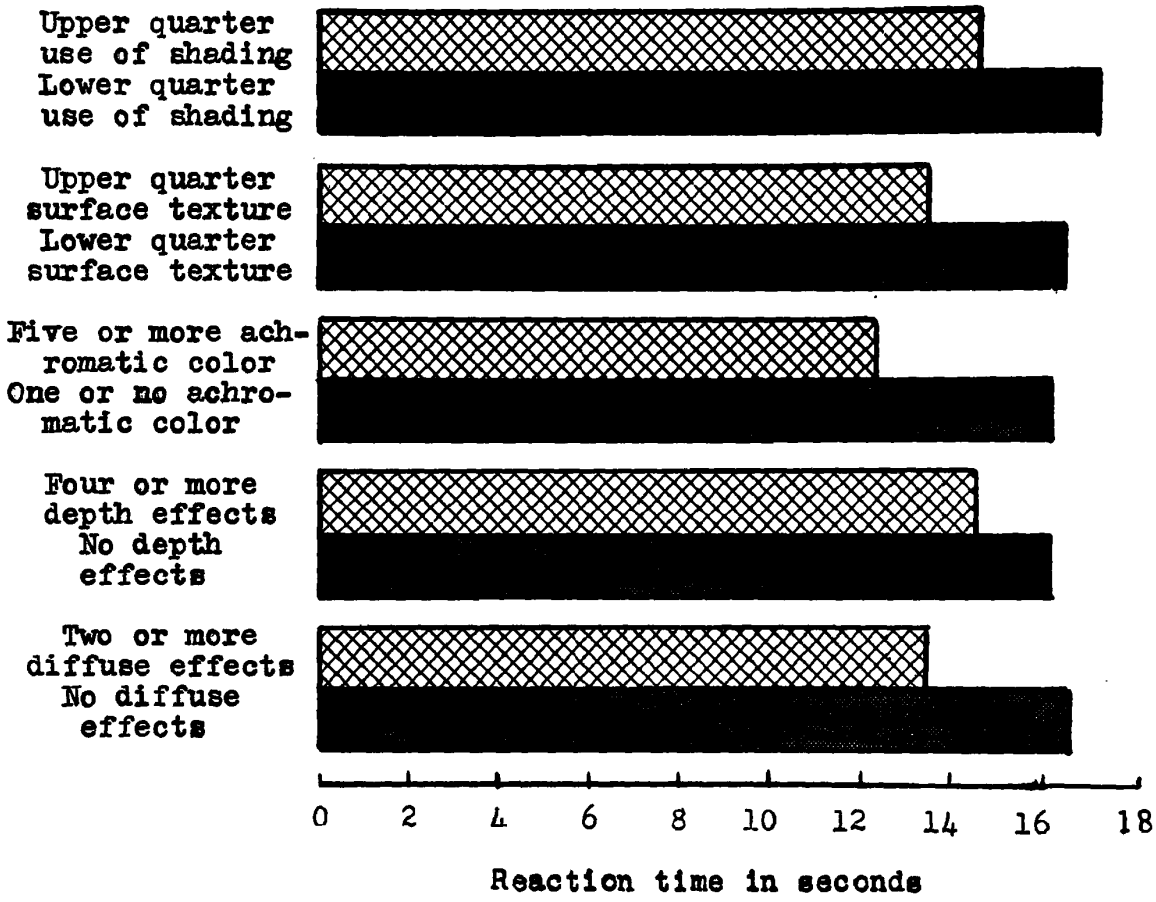

Fig. 4 MEAN REACTION TIMES OF VARIOUS SHADING GROUPS

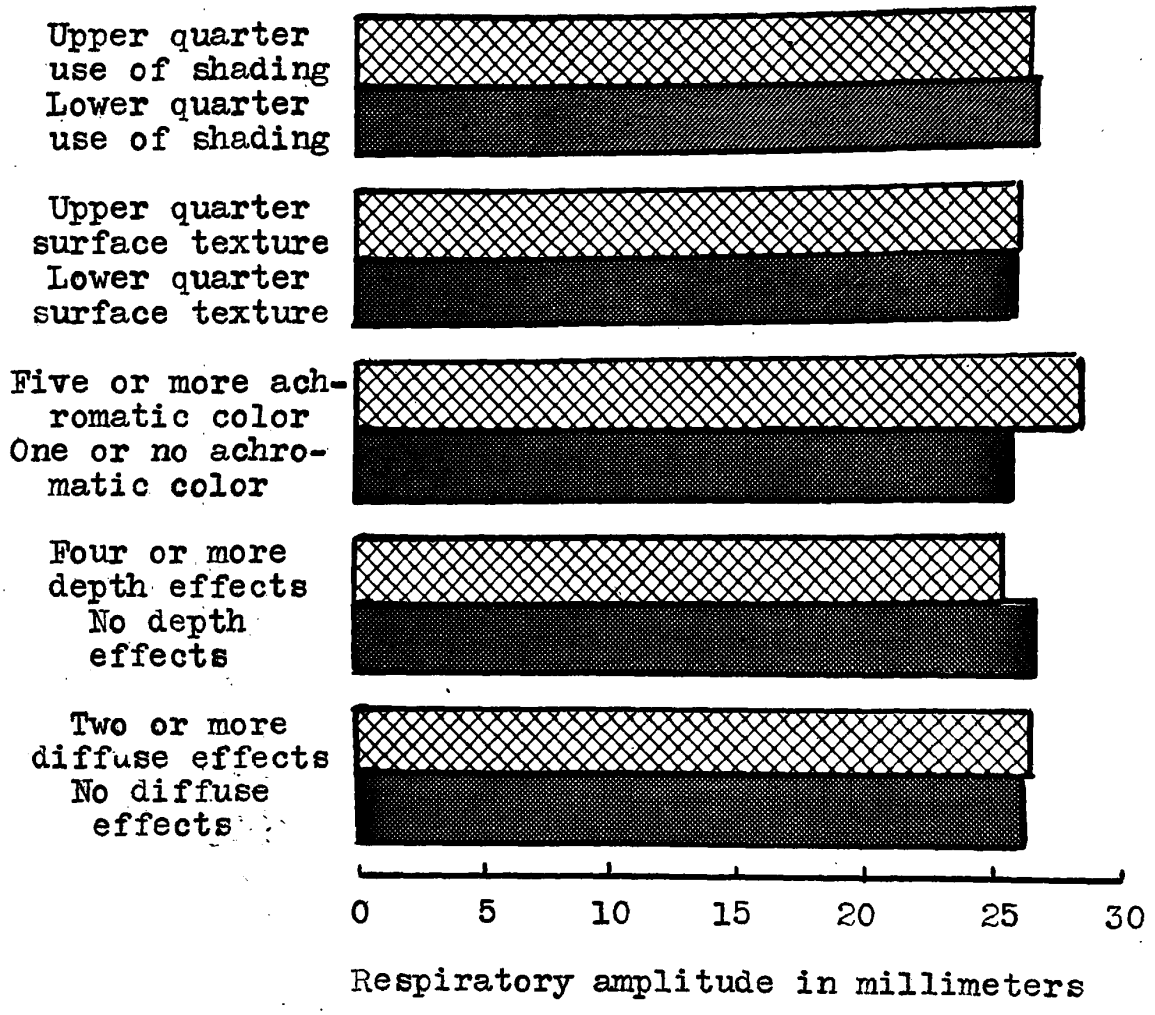

Fig. 5 MEAN RESPIRATORY AMPLITUDES OF VARIOUS SHADING GROUPS

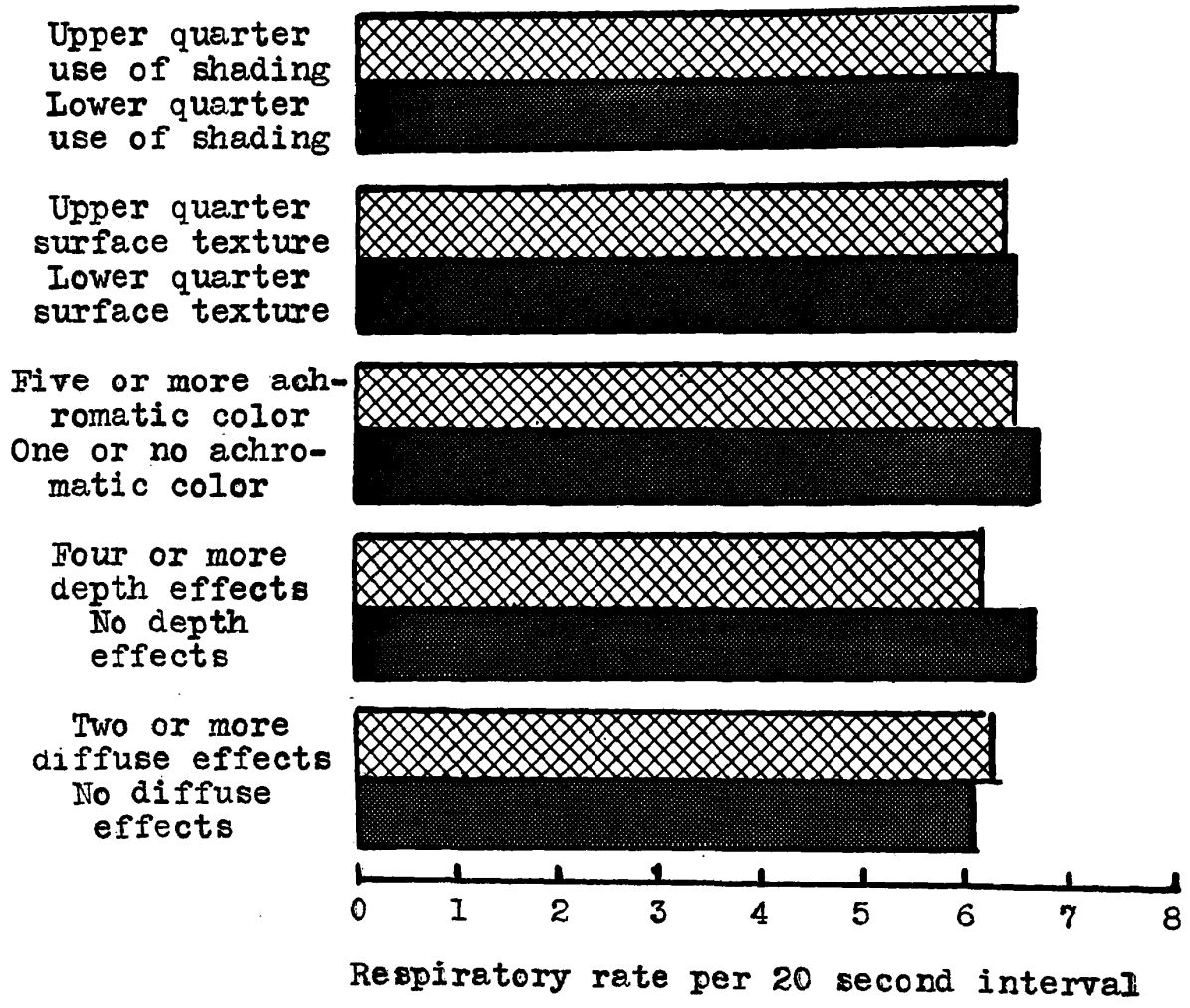

Fig. 6 MEAN RESPIRATORY RATES OF VARIOUS SHADING GROUPS

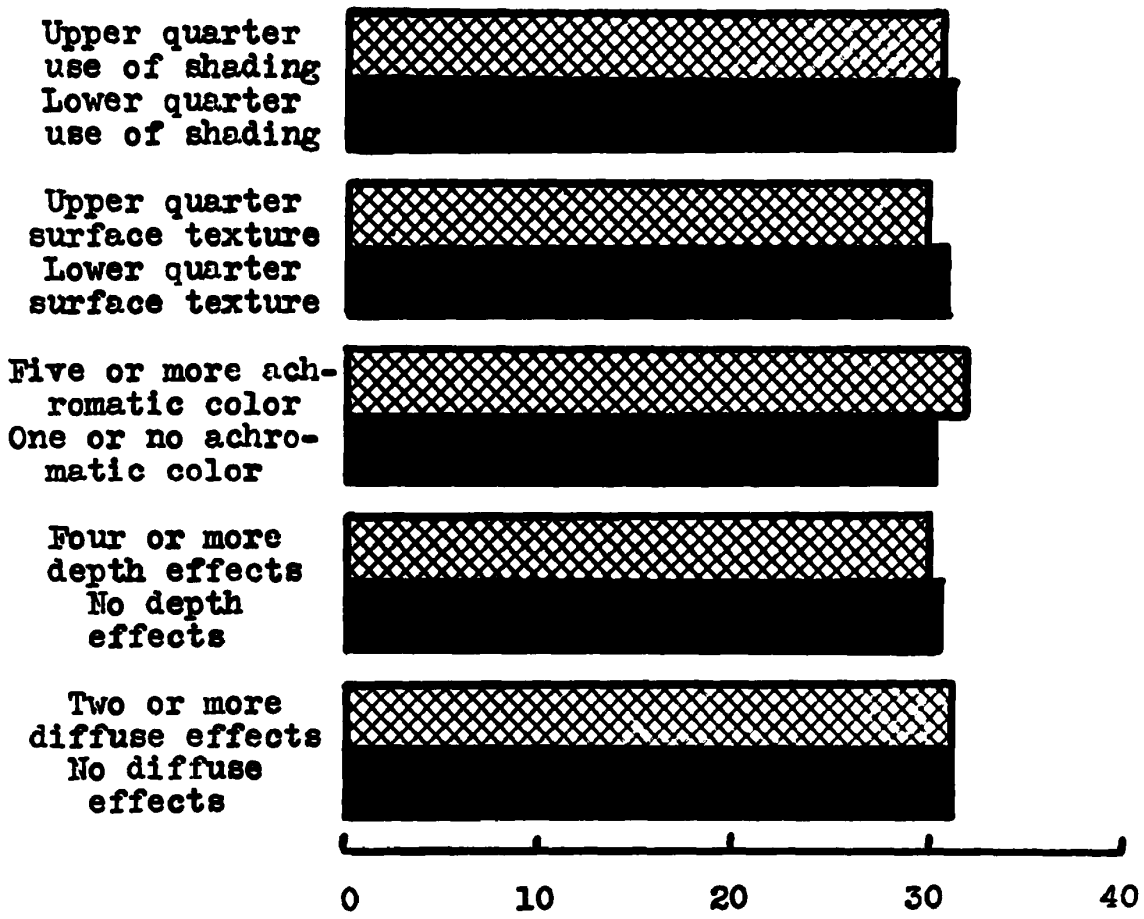

Fig. 7 MEAN PULSE RATES OF VARIOUS SHADING GROUPS

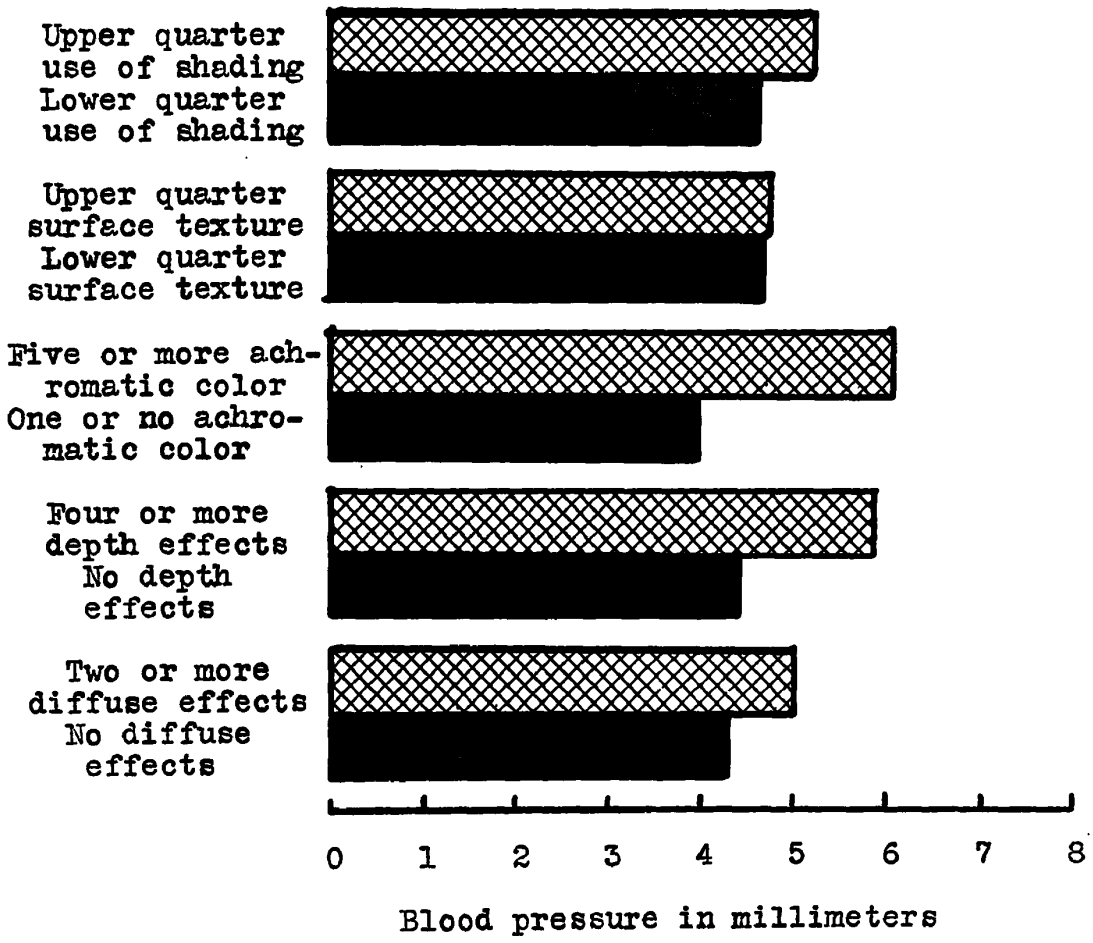

Fig. 8 MEAN CHANGES OF BLOOD PRESSURE OF VARIOUS SHADING GROUPS

DISCUSSION OF RESULTS

The results will be discussed first with reference to the differences which occurred with the respect to the stimuli, secondly with reference to the differences which occurred with respect to the response the subject gave, and, finally, with reference to the differences which were obtained when one group was compared with another on the basis of the number and kind of shading responses which they gave.

One finding of the present study is that increasing the degree of shading contrast results in an increase in the number of responses given which utilize the shading to give surface color to the thing seen, C'. A possible explanation for this increase may be found in an examination of what happens to the ink blot when the degree of shading contrast is increased photographically. When this is done the number and amount of intermediate greys which appear in the ink blot are reduced; the darker greys tend toward the black end of the scale and the lighter greys tend toward white. Thus an ink blot reproduced under strong contrast conditions abounds in black and white whereas the same ink blot reproduced under weak contrast conditions contains hardly any black or white and abounds in intermediate greys. Black and white as surface colors may lend themselves to more objects in nature than do the intermediate greys, resulting in an increase in the number of responses utilizing surface color when more black or white is present.

Another explanation might be that the increased contrast between the black and the white itself serves to attract the attention of the

subject to the achromatic color, resulting in an increased use of the achromatic color in his response.

As a result of varying the degree of shading contrast in the ink blots there are also differences in the number of responses given utilizing the shading as depth. The difference here does not seem to be proportional to the degree of shading contrast in the cards: the ink blot with the weakest shading contrast produces fewest depth responses but the medium shaded cards produce more depth responses than do the cards with the strongest degree of shading contrast. The only significant difference is between the weak shading card and the medium-shaded card.

An examination of the three cards, F, T, and N, which produce the most responses utilizing the shading to give depth to the response, prompts three possible explanations. The process of increasing the contrast tends to lighten the greys which appear at the edges of the blots, causing them to blend with the white surround. The resulting haziness of outline gives an aerial perspective to the blot forms, resulting in more seen depth as the contrast is increased. Secondly, the increased number of depth responses may be attributed to the secondary cue overlay. Some of the ink blots, particularly card F, seem to have layers interposed one on another. With increased contrast between the black and the white, the overlying layers may have become more apparent to the subject. Thirdly, the increased contrast may enhance the depth producing shadow effect of some parts of the blots. This is a provoking finding which deserves further study.

With reference to the card as a stimulus variable, we found significant differences from card to card in the total number of times shading was used by the subject, in the number of times shading was used to give surface texture, diffuse effects, achromatic color or depth to the responses and in reaction time and change of pulse rate.[1] However, there are no significant differences from card to card in the amount of shading used to give toned-down depth effects, k. This is probably due to the fact that too few k responses were given by the subjects to lend significance to the findings.

It therefore seems that greater differences exist with regard to the form of the ink blot itself than exist with regard to the degree of shading contrast in the ink blot.

A generally held clinical belief is that some cards are more disturbing to the responding individual than other cards -- i.e., produce "shading shock". If we accept delayed reaction time as an indicator of "shading shock", as is common clinical practice, we find that some cards do manifest more of this phenomenon than others.

Rorschach cards IV and VI are believed to be the cards which, because of their heavy shading, produce the greatest amount of shading shock. Since the Harrower and Rehn-Rorschach ink blots were designed

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[1] In a supplementary analysis of the results for the purpose of ascertaining why change of pulse rate varied from card to card while pulse rate did not, it was discovered that pulse rate tended to be high at the beginning of the experiment, becoming lower as the experiment progressed. Perhaps this tendency obscured any difference in pulse rate, per se, from card to card while change of pulse rate, measured from the subject's own modal pulse rate, was not so obscured due to reduction in the variability of the sample.

to parallel the Rorschach series, we should expect cards IV and VI in these series to exhibit delayed reaction times also. Examination of the total reaction times to card in Table XVIII reveals that Harrower card IV, R, produces the longest reaction times. Rorschach card IV (K) ranks third in the production of delayed reaction time and Behn-Rorschach card IV (D) ranks seventh in delayed reaction time. Behn-Rorschach card VI (U) ranks fourth in delay of response, but the Harrower card VI (T) and the Rorschach card VI (M) rank thirteenth and seventeenth respectively. It therefore seems that longer reaction times accompany card IV in each series but that this is not true of card VI. It is interesting to note that of the Rorschach cards used, card I (H) produces the longest reaction times, ranking second in the entire series of 21 cards.

Only one of our physiological response categories, change of pulse rate, shows significant differences from card to card. Examination of Table XXIII does not indicate that cards IV and VI of each series produce greater changes than other cards.

In general, our findings are in agreement with those of Levy (32) who found no significant changes in PGR from card to card.

Another generally held clinical belief is that the use of shading in responding to ink blots indicates disturbance in the subject. Some particular uses of shading in the response are thought to be indicative of more disturbance than the use of shading in another way.

We have found that significant differences in physiological response do exist from card to card with reference to the type of shading response that was given to the card (e.g. to give depth effects as

contrasted with surface texture), and that the type of shading response which is accompanied by the greatest increases in physiological response is the diffuse response, K. The other responses in order of their tendency to be accompanied by increases in physiological response are (1) the achromatic color response, C'; (2) the toned-down depth response, k; (3) the depth response, FK; (4) the control category (no use of shading); and (5) the surface texture response, c. It will be noted from Table XXXIV that considerable distance exists on the scale between the control category and the depth response. If circulatory and respiratory increases are considered as somatic indicators of emotional behavior, the clinical belief that responses utilizing the shading in the ink blots indicate anxiety in the responding subject, in general is supported.

Klopfer has stated that not all types of shading responses are indicative of disturbance within the individual. The depth response, FK, and the surface texture response, c, in moderate amounts may be indicators of adjustment. Diffuse responses, K, and toned-down depth responses, k, almost always are indicators of anxiety. The achromatic color response C', may indicate depressive tendencies in the individual.[1]

Our findings tend to support Klopfer's beliefs with respect to shading responses. The surface texture response, the "no use of shading" response, and the depth response occupy the last three positions on our scale indicating that these three types of responses are accompanied by the smallest increases in physiological response. The

[1]Supra, page 4-6

toned-down depth response, the achromatic color response, and the diffuse response, which Klopfer believes to be indicative of a greater amount of disturbance in the individual occupy the first three positions on our scale.[1]

One of Frost's (19) findings was that normal subjects show increased GSR with increase in the amount of form used in the response. Of the comparisons between form-predominant and form-subordinate responses which he made, we can make only one. This is due to differences in scoring. In comparing the physiological response accompanying FK responses, with the physiological response accompanying K responses, we find that less increase in physiological response accompanies the FK response. This is the reverse of Frost's findings with respect to GSR.

This suggests that this study, using respiratory and circulatory measures, could be further analyzed with reference to the form in scoring the responses. For example, the Klopfer (24) scoring categories c, cF and Fc are all classified under c, surface texture, in our study. Presumably differences in physiological response may exist in shading categories dependent upon whether the use of form is absent, subordinate or predominant.

This difference in findings may also be due to differences in the point of measurement. Frost took his measurements from the point at which the response itself began. All our measurements were taken

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[1] Beck's Y is roughly equivalent to Klopfer's C', and his FY to Klopfer's FK so our findings with regard to these two shading response categories would be applicable to Beck's scoring system. However, Klopfer's c, k, and K are all classified under FY or YF in Beck's system of scoring making further comparison impossible.

during the first twenty seconds following the time the subject was given the card.

An analysis of this data using the point at which the response was given for measuring physiological change might yield further information about the nature of shading responses. This type of study might follow the physiological changes of the subject through the entire response period to the card, rather than securing only his initial physiological response to the card.

A third belief about shading held widely by clinicians is that people who use much shading in responding to ink blots are more disturbed than people who use little shading, and that the people who use much shading in a particular way are more disturbed than people who use little shading in that way.

The results of this study tend to support these hypotheses. In general, the subjects who use a large amount of shading or a large amount of shading a particular way, tend to have significantly greater circulatory or respiratory responses to all cards than the subjects who use little shading or little shading in a particular way. Exceptions occur in two categories, surface texture and depth effects, with respect to respiratory rate and pulse rate respectively. It is interesting to note that these two reversals take place in differentiating subjects in shading response categories which our previous results have shown to be indicative of less disturbance in the individual.

In all cases, subjects who use much shading or much shading in a particular way have shorter reaction times to the cards than the people who use less shading or less shading of a particular type. Assuming

that longer reaction times to particular cards are valid indicators of disturbance, the following explanation of our results presents itself.

Reaction time, in this part of the study is the average reaction time to all the cards, while in the previous parts of the study we were concerned with the average reaction time to particular cards. There is no reason to believe that people who are more disturbed should have longer reaction times to all ink blots, but only to ink blots which are disturbing to them. Several studies have shown that reaction time to simple stimuli decreases with increase in body tension (1, 17, 39). It may be that the group which is more disturbed reacts more quickly to all the cards because of greater tension, even though blocking causes delayed reaction time on particular cards. In other words, shorter reaction times to all cards rather than longer reaction times are indicators of disturbance in the subject.

Accepting for a moment the thesis that the subjects who use the most shading are the most disturbed, we may venture the following description of the approach of the more disturbed subjects to the cards: the subject reacts to the ink blot with rapid energy mobilization; this results in a shorter reaction time and greater respiratory and circulatory activity. Shading shock to a particular card may still be indicated by delayed reaction time, possibly caused by the fact that the shading presents so many possibilities of response that the subject is unable to make a choice. This point deserves further study.

Again defining the more disturbed subjects in terms of the amount of respiratory and circulatory activity present in responding to the cards, we may say that the presence of achromatic color responses, C',

is the best single shading response indicator of disturbance in responding to ink blots. The decrease in reaction time and increases in respiratory amplitude, blood pressure and pulse rate are far more significant between the group which uses much shading as achromatic color and the group which uses little shading as achromatic color than are the differences between any other two groups.

The question arises as to whether the differences between the groups which use much shading of a particular type and the groups which use little shading in that manner may be reflections of the differences between the subjects who use much shading and the subjects who use little shading. Perhaps the subjects who use much shading in responding to the ink blots also use much shading of each type, so that we are dealing with the same population.

Examination of the critical ratios between groups suggests that this is not the case. For practically all the separate shading response categories, critical ratios between the opposed groups are higher than for the category amount of shading used. The only exception is the comparison of the group which uses shading to give depth to the response four or more times and the group which does not use shading in this manner with respect to reaction time.

The question arises as to how effective our various circulatory, respiratory and reaction time measures are in indicating differences in this study.

Of the various indicators of disturbance which we used, reaction time shows a greater number of significant differences. There are differences significant at the 1% level of confidence in differentiating

between cards, responses, and groups separated on the basis of their verbal responses. Of our other measures, amplitude of respiration shows differences at the .05% level of confidence in differentiating between types of shading responses and one difference, at the 1% level of confidence, found between the groups separated on the basis of the number of C' responses which they gave. Respiratory rate yields differences at the 1% level of confidence between types of shading responses and between groups separated on the basis of the number of FK responses which they gave. Blood pressure yields two differences at the 1% level of confidence and two differences at the .05% level of confidence between groups separated on the basis of the number of particular types of shading responses which they gave whereas pulse rate shows differences at the .05% level of confidence between types of shading responses and shows one difference, significant at the 1% level of confidence, between the group which stands in the upper quarter in the use of c and the group which stands in the lower quarter in use of c. Our final measure, change of pulse rate, shows only one difference, at the 5% level of confidence, between cards and this is the only circulatory or respiratory measure which shows differences from card to card.

Change of pulse rate was obtained by subtracting the subject's pulse rate for a particular card from his modal pulse rate for all cards. The end result was a reduction in the variability of the sample due to partial control over individual differences. Our other physiological measurements had no such control over individual differences which may have overshadowed the small differences which may have existed from one stimulus condition to another.

All in all, then, reaction time seems to have been the best single indicator. This is of interest since it is the only independent measure made during the standard administration of the Rorschach ink blot test by clinicians.

Two suggestions for further research are indicated other than those already mentioned. Our study deals with the shading responses of a normal group. The present type of study might yield differences in the physiological responses accompanying the use of shading by normal groups and by groups of different psychiatric categories.

The types of measurement used in the present study might also yield differences based on responses in categories other than shading for normal and abnormal groups. Perhaps differences may exist based on the scoring categories of pure form, human, animal, inanimate movement, and color response.

SUMMARY

This study was concerned with discovering what differences existed, if any, in the verbal and physiological responses of subjects as a result of varying the amount of shading contrast in ink blots.

We were also concerned with whether differences in the types of shading responses given and in physiological responses concurrent with seeing the ink blot existed from one ink blot to another, whether differences in physiological response existed as a function of the type of shading response given and whether subjects who used much shading or much shading of a particular type differed in their physiological response from the subjects who used little shading or little shading of a particular type.

A set of 21 ink blots was reproduced photographically in such a way that one set of 21 ink blots had strong shading contrast, 21 had medium contrast, and 21 had weak shading contrast.

The cards were then administered in a modified Latin Square design to three groups of 25 subjects each. Each group saw 7 of the 21 cards under strong conditions of shading contrast, 7 under medium conditions of contrast and 7 under weak conditions of contrast.

During the time the subject was responding to the ink blots, a continuous recording was made of his reaction time to the ink blots, respiratory rate, amplitude of respiration, blood pressure, and pulse rate. Verbal responses were recorded verbatim and his shading responses to the ink blots scored according to Klopfer.

Results were as follows:

1. It was found that as the degree of shading contrast was increased from weak to strong, there was an increase in the amount of shading used as achromatic color and an increase in the amount of shading used to give depth effects to the response.
2. There were no significant differences in physiological response as a result of varying the degree of shading contrast.
3. When the twenty-one ink blots were compared, significant differences were found in the amount of shading used, the amount of shading used as surface texture, the amount of shading used as achromatic color, the amount of shading used to give depth effects, and the amount of shading used to give diffuse effects to the response.
4. There were significant differences in reaction time and change of pulse rate from card to card.
5. A comparison of the physiological response to cards in which the shading was used in a particular way with the physiological responses to cards, in which the shading was used in different ways yielded significant differences in reaction time, respiratory amplitude, respiratory rate, and pulse rate. The physiological responses were greatest for cards in which the only shading used was used to give diffuse effects. Achromatic color responses, toned-down depth responses, depth responses, responses in which shading was not used, and surface texture responses followed in order of their tendency to be accompanied by physiological changes.

6. When the subjects who were in the upper quarter of the group in the use of shading were compared with the subjects who were in the lower quarter in the use of shading, it was found that reaction times were shorter and changes in blood pressure greater for the first group.
7. Those subjects who stood in the upper quarter of the group in the use of shading to give surface texture to their responses had significantly shorter reaction times and slower pulse rates than the subjects who stood in the lower quarter of the group in the use of shading as surface texture.
8. The subjects who used shading five or more times as achromatic color had significantly shorter reaction times and significantly greater respiratory amplitudes, changes of blood pressure, and pulse rates.
9. The subjects who used shading four or more times to give depth effects to their responses had shorter reaction times, slower respiratory rates and greater changes of blood pressure than the subjects who used no shading in that manner.
10. When the subjects who used shading to give diffuse effects to their responses two or more times were compared with the subjects who did not use the shading in that manner, shorter reaction times and greater changes in blood pressure were found for the first group.
11. To few responses were given utilizing the shading as toned-down depth effect to compare groups on this basis.

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APPENDIX A

SAMPLE INFORMATION FORM FILLED OUT

FOR ALL SUBJECTS

LAST NAME _____ SUBJECT NUMBER _____

GROUP ____ I ____ II ____ III ____ CARD ORDER _ _ _ _ _ _ _ _ _ _

_ BREAK _____

SOURCE _____

NAME _____ STUDENT NUMBER _____

LOCAL ADDRESS _____

PHONE _____ SCHEDULED DATE _____ TIME _____

DATE _____ TIME BEGAN _____ TIME ENDED _____

SEX _____ MARITAL STATUS _____ AGE _____ CLASS _____

BIRTH DATE _____ BIRTHPLACE _____

DESCENT _____

MAJOR _____ PREVIOUS RORSCHACH EXPERIENCE _____

_____

HEIGHT _____ WEIGHT _____ BUILD GROUP _____

GIRTH AT CHEST _____ AT KNEE _____ BLOOD PRESSURE _____

INITIAL PRESSURE _____ INITIAL PNEUMOGRAPH SETTING _____

REMARKS: