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Size-judgement as a function of value, time-interval and ego-strength.

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INTRODUCTION

Historical Background

Whereas pioneers in the area of perception centered their attention around physiological-structural determinants, in the last thirty years there has been a shift in the status of perception from the isolated area of classical psychophysics to the areas of social and personality dynamics. There are now many facts linking motivation to attributes and content of perception. This has followed from testing such hypotheses as, "the perceived world pattern mirrors the organization need pattern within" (45, p. 351). Sherif (54) provided some impetus to the movement when he said, "it is not until the properties of perception have been described that the psychology of thinking, feeling and acting follow." Helson (27) and Sherif and Cantril (55) have used the concept of "frame of reference" and Allport (1) has spoken of "attitudes" as underlying dynamics of perception. Bruner and Postman (11) have supported the notion of "perceptual selectivity" in their hypothesis that an individual both perceives and reacts in a manner consistent with his emotional response to stimulation.

The "modern trend" in perception is demonstrated by the studies which have investigated perception as a function of reward (49), attitudinal orientation (47), frustration (13), release from tension (11), conditioned avoidance (38), and level of aspiration (48). Bruner and Postman (15) have probably best described the contemporary view toward perception when

they said that it is essentially an "instrumental activity" and for a full understanding of the perceptual process it is necessary to vary not only the physical stimulus and the sensory state of the organism but also the central conditions such as motives, predispositions and past learning.

The present study is specifically concerned with size-perception. Relevant research in this area is reviewed below in detail. This review is followed by a general evaluation and discussion.

Studies with Children

Meyers (41) in 1913 published one of the earliest studies relating the value of a coin to size-judgment. In Meyers' experiment a group of 117 fifth grade boys and girls were required to select from memory one of a series of graduated compass-drawn circles that corresponded most nearly in size to a penny, nickel, dime, quarter, half-dollar, and silver dollar. His results indicated that (a) less valued coins (penny, nickel, and dime) were underestimated and more valued coins overestimated, (b) subjects (Ss) maintained a correct order of relative size, and (c) there were exaggerated differences between the coins.

Bruner and Goodman (12) investigated size-judgment of coins in a sample of 10 year old children. The experimental group was asked to estimate the size of various coins by adjusting the diameter of a circle of light. The control group estimated the size of discs of equivalent sizes. The results

revealed a significant tendency for (a) coins to be judged larger than non-social valued objects like gray discs, (b) coins of greater value to be relatively more accentuated in size than coins of lesser denomination, (c) coins to be judged larger by poor children than by rich children, and (d) coins to be judged larger when present than when absent. It is to be noted in this study that all coins were overestimated. Bruner and Goodman concluded that the important determinants of behavior which influence size-perception are sensory conditioning, reward and punishment, Gestalt laws, practice, phenomenal constancy, motivation, and social value.

Carter and Schooler (18) working with 48 children, ages 9 to 11, found comparable results to those of Meyers, that is, coins of lesser denomination were underestimated and coins of greater denomination were overestimated when judgments were made from memory. Like the Bruner and Goodman study, size-judgments were made by adjusting the diameter of a circle of light. Carter and Schooler's Ss were also divided into rich and poor groups and both groups made judgments of coins, aluminum slugs, and cardboard discs from memory and with a standard present. It was found that (a) rich and poor children's judgments were essentially the same when a standard was present, and (b) poor children overestimated the size of the coins when judgments were made from memory. Carter and Schooler offered the following explanation for the findings, "These results and those from other work raise the doubt as to

the general importance of value systems as organizing factors in perception of clear, physically present objects. Apparently need and value may play a role when the stimulus object is equivocal or not present as in the case of judgments from memory."

Bruner and Rodrigues (17) conducted an experiment to investigate whether the differences in the Bruner-Goodman and Carter-Schooler studies were due to the differences in the procedures in the two studies, i.e., the apparatus used by Bruner and Goodman had a nine-corded iris diaphram, whereas the Carter and Schooler apparatus had a circular patch of light. The Ss were 120 children between 10 and 11 years of age. Three experimental groups made estimates of either coins, white metal slugs, or cardboard discs by adjusting the diameter of a patch of light. Different Ss within each group used either a 6 or 9-corded iris diaphram or a circular patch of light. The results indicated that (a) the coins and metal slugs were judged significantly larger than the cardboard discs, (b) as the value of the coins increased, overestimation increased significantly more markedly than in the case of slugs and cardboard discs, and (c) the influence of the shape of the adjustable circle of light had a questionable effect as the nine-corded iris only tended to lead to overestimation of coins and underestimation of slugs and discs. The authors concluded from this study that (a) Carter and Schooler were right, in that, a large number of factors influence absolute size-judgment and relative size of an object,

(b) value of an object does not unequivocally affect absolute size but the physical properties of the stimulus must be taken into account, (c) new experimental designs are necessary to resolve the question of perception and judgment because differences between coins, metal slugs, and cardboard discs make it difficult to interpret results, (d) experimentally inducing value would be preferable to assuming value as it would allow for better control of the physical properties of the stimulus, and (e) value is associated with size-perception of coins because of a general social paring of value and size.

Rosenthal (51) reported a study which was done with 60 rich and 60 poor children whose ages ranged from 6 to 10. The Ss made size-judgments of various coins using an apparatus similar to Bruner and Goodman's. In this experiment, the estimates of the coins were made (a) from memory, (b) with coins in hand, and (c) with coins mounted on a piece of glass. In addition, the Ss made estimates of the size of an aluminum slug. The results indicated that (a) the rich 10 year old Ss estimated the coins significantly larger than the poor 10 year old Ss, (b) the poor six year old Ss estimated the coins significantly larger than the rich six year old Ss, (c) the rich children did not change in overestimation from 6 to 10, but the poor Ss showed a gradual drop in their estimates from 6 to 10, (d) coins held in the hand were estimated larger than coins mounted on a piece of glass, (e) an aluminum slug mounted on a piece of glass was estimated larger than coins mounted on a piece of

glass, and (f) estimates of coins from memory were larger by the poor group than by the rich group.

Lambert, Solomon and Watson (33) induced value experimentally by reinforcement-reward conditions. The experimental group of 37 children, ages 3 to 5, cranked a handle, received a chip for their work and then were rewarded with candy for the chip. The control group of 17 Ss, in the same age range, received the candy without the intervening chip after cranking the handle. After ten days both groups reproduced the size of the chip, with the standard present, by the technique used by Bruner and Goodman. The results indicated that (a) the experimental group's estimate of size after ten days was significantly greater than at pretest, and (b) the control group showed no significant change in its estimate when compared to pretest judgments.

Lambert and Lambert (34) reported another experiment in which value was induced experimentally. The group of 22 children, ages 3 to 5, cranked a handle, and received a red token which was inserted in the cranking machine. The Ss cranked the handle again and received a white token for their work which was rewarded with candy. The intervening red token was used to investigate the associated value of a second token further removed from the reward. The Ss received 28 reinforcements over a period of 10 days. At the end of each days trials the Ss received a blue token through the machine indicating no more candy trials. On the 11th day extinction trials were started which

consisted of no candy following the cranking procedures. Size-estimates were obtained (a) before reinforcement, (b) after 6 days of reinforcement (14 reinforcements), (c) after 10 days of reinforcement (28 reinforcements), and (d) after extinction. Size-judgments of the three colored tokens were made on an apparatus similar to the one used by Bruner and Goodman. The results failed to reveal a significant change in the size-estimates of any of the tokens as a correlate of the reinforcement conditions. A follow up experiment was conducted which eliminated the blue token and shortened the procedures to two days. On the first day pretest estimates were made and on the second day there were five reinforced trials followed by size-estimates. This in turn was followed by three non-reinforced trials and size-estimates. The results indicated (a) a significant increase in size estimates of the white token from pretest to after five reinforcements, (b) a significant decrease in size-estimates of the white token from the five reinforcements to extinction, and (c) size-estimates of the red token were not significant but in the expected direction.

Beams (7) conducted an experiment to test the hypothesis that liking or disliking a dessert would affect perception of its size. Through the use of a questionnaire, Beams collected information about the S's attitudes toward desserts and only used those Ss who consistently indicated strong positive and negative preferences. The Ss were 60 boys and girls between the ages of 10 and 12. The apparatus consisted of a "stimulus

box" in which the Ss were shown various desserts and a "projection box" in which the Ss were shown the same desserts. The Ss were required to move the picture of the dessert in the projection box forwards or backwards and thus adjust its apparent size until it matched the size of the standard in the stimulus box. The results indicated that (a) there was a significant difference in size-judgments between the liked and disliked desserts. The apparent size of the liked desserts was made larger, and (b) age, sex, I.Q., and occupational level of the parents made no difference.

Studies with Adults

Ansbacher (3) reported a study which investigated the hypothesis that monetary value of familar objects influences perception of their size. Subjects were shown cards on which were pasted many stamps of one denomination and the Ss were asked to estimate the number of stamps on each card. The results indicated that the larger the denomination of the stamps the less numerous they were reported. It was concluded that stamps of a larger denomination were perceived as larger than stamps of a lesser denomination.

Lysak and Gilchrist (36) conducted a study in which college Ss were required to judge the size of different denominations of paper currency by manipulating the size of a rectangle. Their findings were interpreted as indicating that young normal adults are able to dissociate size from value.

Dukes and Bevans (20) reported a study in which perceptual

accentuation was investigated as a function of both negative and positive values. Ten college students picked rectangular cards, all the same size, which differed in the amount of money stamped on them. The cards ranged from -$3.00 to +$3.00 which the Ss won or lost. The Ss later estimated the size of these cards by selecting one from a series of graduated standards. The results indicated that (a) size-judgment varied systematicly with the amount of value, (b) the typical trend was a negatively accelerated positive curve with deviations from zero, (c) there was a high degree of symmetry between the positive and negative curves, (d) some Ss were "reality-perceivers" who did not allow their wishes or needs to alter their perception of the "external world", (e) "situational generality" still needs research and this study, in agreement with Helson (27), demonstrated that Ss adopted a frame of reference to fit the situation, that is, accentuation was related to felt involvement and range of values, and (f) since the data best fit two intersecting parabolic arcs instead of one, two frames of reference, positive and negative, were indicated. Lack of symmetry in some Ss strengthened this interpretation.

Bruner and Postman (14) conducted an experiment with undergraduate college students to study size-judgment of positive, negative, and neutral symbols drawn on a circular disc. The symbols included a swastika (negative), a dollar sign (positive), and a square with two diagnals (neutral). The Ss reproduced the diameter of the three discs with an apparatus similar

to the one used by Bruner and Goodman. Results were evaluated by the method of average error. The authors found that positive and negative objects were accentuated in size as compared to the neutral object. They concluded that an object which is important looms larger in perception than one that is not, and that direction and magnitude of accentuation may be a function of the particular value involved.

Solley and Lee (52) reported an experiment which tested the question of whether differences in perceived size found in the Bruner and Postman study could be better explained by symbolic value or by the Gestalt principle of closure (32, p. 92). By comparing size-judgments of a dollar, swastika, and neutral symbol, as used by Bruner and Postman, to symbols equated for closure, but differing in form, the following conclusion was reached, "We conclude that the hypothesis concerning closure was not substantiated. - - - - Certainly, the fact that the disk bearing the dollar was significantly overestimated in size by a large majority of our Ss confirms Bruner and Postman's results, and indicates that symbolic value does have an effect on perceived size."

Bragman (10) reported a study in which the Bruner and Postman experiment was modified. The results indicated that tokens that were positively valued were judged larger than those that were negatively valued but that both were judged larger than one containing a neutral design.

Ashley and Harper (4) reported a study in which hypnotized

Ss, having had a rich or poor induced life history, were required to adjust the size of a circle of light until it was the size of several coins. Nine Ss made the estimates from memory and 8 Ss made the estimates with comparison coins present. The results indicated that (a) there were significant differences between the overestimations of the poor and the underestimations of the rich with comparison coins absent and present, (b) judgments in a normal state fell in between and were almost exact judgments, and (c) with comparison coins present the Ss in both the rich and poor state were less variable and the estimates were not as extreme. The authors concluded that the study confirmed the hypothesis that the "psychological organization" of the Ss contributed to the organization of their perception.

Klein (30) reported a study in which size-judgment was related to thirst and scores on the Thurstone color-word interference test. The results indicated that when judgments were made with a comparison disc present (a) high interference Ss, that is, Ss who could not ignore irrelevant task cues, consistently underestimated discs with thirst related symbols, irrespective of need state, (b) low interference Ss consistently overestimated discs with thirst related symbols, irrespective of need state, (c) Ss in response to a neutral stimulus (unrelated to need state), regardless of interference scores, showed no specific response tendency, (d) need failed to indicate any significant general effect, (e) Ss demonstrated

a significant interaction of interference scores and need, in that need increased the directional response tendency of the interference groups, and (f) when making judgments from memory all groups tended to overestimate, however, overestimation was significantly greater for the low interference group, irrespective of need. Therefore a memory task seemed to produce overestimation and there was a consistency in the within group differences, that is, there was the same tendency for the particular "adaptive response." Klein interpreted the results as indicating that (a) a "cognitive control mechanism" was demonstrated, (b) high interference Ss "do not communicate and release affect easily" and that heightened need intensifies this suppressive control, (c) low interference Ss are characterized by "control by flexibility", and (d) cognitive control, or "attitude", like a need is directional and functions to resolve "disequalibria" and to exert a selective influence on the cognitive filed.

Klein, Schlesinger, and Meister (29) used the Bruner and Postman method to examine the influence of four variables upon size-judgment: (a) the intensity of the value, (b) the difficulty of the task itself, (c) the configural properties of the value stimulus, and (d) the gross presence or absence of any value or neutral figure. Using refugee psychiatrists, native born secretaries, various symbolic and neutral discs, and an apparatus similar to the one used by Bruner and Goodman they found (a) the differences in error among the groups could not

be unequivocally attributed to the effect of value, (b) for each group, the error magnitude for value figures and for neutral figures was not significantly different, i.e., intensity of value and type of value had no consistent influence upon error, (c) two variables which grossly influenced error were size of the disc and difficulty of the task, that is, the poorer the lighting conditions during the size-judgements and the larger the disc, the greater the error, (d) the difficulty of the task seemed to have a directional effect upon error; the more optimal conditions favoring underestimation and the less optimal conditions favoring overestimation, and (d) certain Ss in both groups showed tendencies to overestimate or underestimate which seemed to be independent of particular stimulus figures. A critique following their conclusions argued for a reconceptualization of the problem of value and need in perception, which they stated should be rooted in the study of individual variations, perceptual organization and ego-structure rather than solely in terms of socially inferred motivation.

Mintz (43) conducted a study which investigated the effects of experimentally induced negative, neutral and positive value on size-judgment. Measures were also related to individual differences in perceptual control as measured by a modification of Klopfer's Rorschach form-level score. The results of this study indicated that (a) on psychophysical judgments, when a standard comparison disc was present, only

the low perceptual-control group associated value and size on the failure disc, (b) on verbal rankings, value influenced size for the group as a whole, (c) on the psychophysical judgments overestimation was the common response for the neutral disc, and (d) in all analyses there were highly significant individual differences in estimating size which could not be completely accounted for by the measure of perceptual control. It was concluded that size-estimation was influenced by (a) subjective value of the stimulus object, (b) personality characteristics of S, and (c) type of measure used.

General Evaluation and further Considerations

The evidence from experimental studies with children indicates that "value" is a significant variable influencing size-judgment, regardless of whether the data came from studies investigating socially valued objects (12,17,18,41,51), preferred foods (7), or objects for which value was experimentally induced (33,34). Two of the studies (18,41) reported significant findings under experimental conditions where the standard was absent and judgments were made from memory. The studies that had the standard present (7,17,33,34) also obtained significant results. Two studies (12,51) demonstrated the phenomenon under both conditions. Thus the studies indicate that the condition of standard "absent" or "present" is not a critical variable for children. Other factors which have been reported as significant in regard to size-judgment are individual differences in economic status (12,18), chronological age (51), whether the stimulus is mounted

or held in the hand (51), and the directness of the relationship between a reward token and the actual reward (34).

McCurdy (37), in a theoretical article, suggested several hypotheses to explain the findings in four different coin-perception studies (12,17,18,41). His evaluation of the findings was as follows: "First there are certain points of agreement between several coin studies, new and old, but the agreement is not such as to encourage the Bruner-Goodman theory that perception itself is distorted by value and need, at least directly. Second, there may be some advantage in applying the concept of schemata to the coin perception problem, and to other perceptual problems as well." McCurdy defined a schema as, ". . . . some kind of cognitive disposition not in itself directly experienced but manifesting itself in imaging, remembering, perceiving and acting." He hypothesized that (a) there is a memory schema for coins which functions to stretch out the total range and to exaggerate the differences between coins, (b) value and need do not significantly disturb the correct order of the sizes, (c) size-accentuation that has been thought of as a "phenomenal magnification", induced by value, might better be interpreted as the result of an "expansive emotional state", and (d) value and need probably influence perception but more likely in an indirect fashion through a schema.

The experimental findings with adults, on the other hand, are not as consistent as those with children. Several studies (3,10,14,20,52) found that the value of the stimulus (negative,

neutral or positive), taken independently, had a significant effect on size-judgment, while other studies (4,29,30,36,43) did not find this to be the case. The results are complicated by differences in studies employing socially inferred values and those employing experimentally induced values. For example, Bragman (10) used social symbols and found that valued objects were judged larger than a neutral object. Klein, Schlesinger and Meister (29), also used socially inferred values, but were unable to obtain any significant difference. Mintz (43) used experimentally induced values and did not find that valued stimuli independently of other variables, significantly influenced size-judgments when a psychophysical procedure was used. Dukes and Bevans (20), on the other hand, reported significant overestimation for experimentally induced values. Bruner and Postman (14) obtained the same results as Dukes and Bevans with symbolic values. This finding was later confirmed by Solley and Lee (52).

Several studies have investigated the effects of both negative and positive values. One study (29) failed to find any significant effects of either negative and positive values while two other studies (14,20) found that both negative and positive values resulted in overestimation. In fact, Dukes and Bevans (20) found that size-overestimation increased very systematically as a negatively accelerated curve both for increasing negative and positive values. Two other studies (10,43) indicated that in addition to negative and positive values being

associated with overestimation, there is a difference in the degree of effect. The findings, however, are opposed in terms of which value elicits the greater size-overestimation.

An explanation for these inconsistencies in the research findings is not possible because of differences in the studies in (a) range, type, size, shape, and value of the standard and variable stimulus materials (stamps, coins, dollar signs, swastikas, induced values), (b) subject characteristics (economic status, involvement, perceptual-control, interference proneness), (c) method of measurement (multiple-choice, psychophysical estimate, verbal ranking), and (d) methodological procedures (stimulus present or absent, stimulus mounted or held in the hand, circular stimulus or iris-diaphram shape, lighting conditions, S or E making the adjustments). Nevertheless these complications also existed in the studies with children and the findings were still consistent in supporting the independent effects of value. An explanation for the relative lack of reliability of results with adults is suggested by three studies (4,30,43) in which value was not independently related to size-judgments but was so in interaction with a personality variable. This was taken to indicate that "individual differences" are more critical in an adult size-judgment study than when Ss are children. This hypothesis will be discussed in more detail under the sub-heading of "Individual differences, including ego-strength."

The influence of positive and negative values. The ex-

perimental evidence supports the hypothesis that negative and positive valued objects are both subject to overestimation (10,14,20,43). However, two studies (10,43) indicated that the degree of overestimation is not the same for negative and positive values, although they disagreed as to which value elicits the greater size-overestimation. A predictive position about this question can be taken by the following theoretical argument. It can be assumed that both negative and positive objects, i.e., unpleasant and pleasant stimuli, elicit autonomic emotional responses. This assumption is supported by McGinnies (38) who has demonstrated that psychogalvanic responses increase as a function of unpleasant experiences. To tie the emotional state to size-judgments it is necessary to further assume that the magnitude of response-produced stimuli arising from the emotions, which are elicited differentially by the external stimuli, are generalized to the magnitude of the associated physical stimulus. In order to make differential predictions for positively and negatively toned stimuli, it is further assumed that, all other things being equal, negative stimuli lead to more intense emotional reactions than do positive stimuli. This assumption is consistent with (a) the view that the organism generally first strives to avoid pain before seeking pleasure, and (b) conflict theory which assumed that concurrent negative stimulation tends to be stronger than concurrent positive stimulation (42).

Individual differences, including ego-strength. The role of individual differences in size-judgment has been illustrated in several studies (4,20,29,30,43) and also has support from "size-constancy" research. Singer (56) found different size-constancy ratios for "thinking introverts and extroverts" under conditions of experimental frustration. Sanders and Pacht (53) found that there were significant differences in the size-constancy index produced by control, neurotic and psychotic groups. These authors concluded that with increasing personality disturbances there is increasing perceptual defensiveness in terms of overcompensation. Klein and Schlesinger (28) in a review of perceptual theory stated: "The deprivation, value and need studies neglect the interaction of value or need stimulus with the ego-structure which must cope with it. It is too simple to say that motivation in the sense of goal seeking under pressure of needs or tensions is the only directive force for perception. It is to the point to stress the ground structure which gives a drive or value a special fate or quality in each person." Luchins (35) also criticizes the strict "value-cognition" approach to perception on the grounds that it conceptualizes S as an "abstract perceiver." Bruner and Postman (15) feel that future research in perception should have as one of its objectives the selection of personality variables so that perceptual theory can be integrated with personality theory.

Experimental findings and theoretical considerations thus indicate that future research in perception, with adults,

should take into account some measure of individual differences. The nature of the personality measure requires some consideration. One obvious choice is a measure that provides an index of the ability to inhibit associative feelings that would interfere with objective judgments. Such a measure could account for the size-value phenomenon being more readily demonstrated with younger age groups than with adults. That is, children are governed relatively more by their feelings than adults. However, if certain adult Ss can be labeled as low in the ability to dissociate feelings from cognitive behavior than it can be predicted that they would respond like children and demonstrate the value-size phenomenon. Such a view would account for the positive findings in one study on adults (43) for a group low in perceptual-control, as measured by a Rorschach form-level assessment of personality. In another study (30), Thurstone's color-word interference test successfully differentiated Ss who underestimated from those who overestimated; however, this index was not able to identify Ss who were "accuracy prone." That is, it indicated direction of accentuation, not the presence or absence of accentuation tendencies.

Erikson (21) in a discussion of ego-strength pointed out, "There are probably as many different meanings of this term as there are people who use it. Most of these different usages, however, seem to refer to a common aspect of behavior, that is, 'the degree to which an individual's behavior is in keeping with

reality of the objective situation'." Since this "in keeping with reality of the objective situation" was the personality dimension with which the present study is concerned, Erikson's term "ego-strength" was adopted. Barron (6) indicated that a "strong sense of reality" is a personality characteristic subsumed under the collective term ego-strength. This was taken to mean that a S who scores high on a scale evaluating reality-testing would be said to have high ego-strength and would be characterized by the ability to respond objectively to environmental stimuli.

Klopfer, Ainsworth, Klopfer and Holt (31, pp. 357,587) report that "form-level" quality in Rorschach responses serves as a measure of reality testing. These authors state, "Various degrees and types of disturbances in thinking due to deficiency in reality testing will be expressed in the way in which the form characteristics of the stimulus material are utilized by the subjects." They feel that form-level scores can differentiate between "concept-dominated" and "fantasy-dominated" responses. Mons (44, p. 70) states, "The F response expresses a critical controlling part of the intellect, pure reason which prefers solid facts to flights of fancy or emotional inspiration . . . . it is always an expression of good reasoning powers and good critical faculties." Halpern (25, p. 64) takes the same position: "On the Rorschach test, good form (F%) has always been considered the primary indicator of the individual's understanding of

the nature of objective reality." These interpretations of form-level are consistent with Rorschach's postulate (50, p. 60-61) which was formulated 25 years ago. Rorschach stated that an F/ response "depends on control of perception process and on critical interpretaion." Beck (8, p. 155) expresses his view of form-level as follows: ". . . . F/ is index to a major aspect of personality, intellectual control . . . . implying, more deeply, stability of character." This position is elaborated in his second volume (9, p. 20) where he states, "In the inaccurate or 'poor' form response, the F- association, the perceptual deviations can be grouped as of personal and of impersonal causation. The former are these in which a personal need distorts the vision. The individual sees not what is there, but what his emotional state dictates." In a synthesis of extensive data, gathered from normals and clinical groups, Beck (9, p. 22) summarizes his empirical data as follows: "Reviewing the F/ and F- findings in these groups, the arresting facts, using the healthy adults as the reference base are: The F/ percentage is low in the young child, in the feeble-minded, in some brain damaged individuals, and in schizophrenia . . . . In the neuroses it is within the healthy range, although usually discrepantly low for the pattern as a whole . . . A high F/ percentage goes with a firm ego. . . . . The F/ potential is thus one of the most important of the Rorschach test factors."

Validation data for form-level was also reported by Mc-

Leod (39) who hypothesized that responses to Rorschach blots should become better matches to the blots with increasing chronological and mental age. The results of his study indicated significant differences between matched groups of 4, 5, and 6 year old children in the direction indicated by his hypothesis. Baker and Harris (5) used experimental stress to test the hypothesis that F/% is an index of control. Working on the assumption that weak control would tend to give way under strain and result in less coordinated behavior, they produced stress by laboratory methods and measured loss of control in speech (word intelligibility and intensity variations). A correlation of .41 was found for F/ and control in speech; although the small number of Ss precluded statistical significance. Williams (59) investigated the predictive value of F/% as an index of control against the external criterion of intellectual efficiency in an experimentally induced stress situation. The F/% correlated .61 with maintenance of intellectual efficiency.

The above material indicates that form-level offers a means of differentiating various levels of reality testing. Since this "tie with reality" was the personality dimension with which the present study is concerned, Eriksen's term "ego-strength" is used to refer to Rorschach form-level measures. The scoring technique is a modification of Klopfer's method (31, pp. 207-239) (See Appendix A). In summary, ego-strength is defined, in the present study as

the ability of a S to respond objectively to environmental stimuli and its operational definition is in terms of a Rorschach form-level score.

In line with, and derived from, the experimental literature which indicates that size-judgment is affected by individual differences (4,20,29,30,43), it is postulated that there is a tendency to generalize from emotional stimuli to external stimuli, but that this tendency is inhibited by individuals of adequate ego-strength.

Time-interval between perception and estimate. Of all the experimental variables that are mentioned above, it should be noted that none of the studies investigated the time-interval between perception of the stimulus object and estimation of its size. Gilchrist and Nesberg (22) state, in this respect, ". . . . a time difference between the presentation of the standard and the variable must be used since, if they are to differ only in the dimension in which the stimulus match is to be made, simultaneous presentation of identical objects would result in both objects being subject to the same distortion effects, if any, and, therefore, such matches as would be made would not differ in their 'error' from those found in the classical psychophysical experiment." Bruner, Postman and Rodiques (16) in a color matching experiment found that a "simultaneous comparison" of a standard and variable "shows no systematic effect at all." Most of the studies have dealt with this time-interval variable on the

crudest level referring to judgments made from memory and judgments made with a standard present. Time-interval has not been systematically investigated, and, at best, has been indefinitely specified. Most of the studies have been conducted with the standard present and all studies on adults that reported significant findings for value were under this condition (3,10,14, 20,52). However, other studies (4,29,30,36,43) did not obtain significant results for value under this time condition. The studies which investigated memory (standard absent) (4,30,43) and did not obtain significant results, indicated that the memory task was associated with larger overestimations, greater variability and more extreme estimates. Thus the literature seems to indicate that accuracy in size-judgment decreases with an increase in the time-interval between the presentation of the stimulus and the response. This suggests the hypothesis that a decrease in the "availability" of the stimulus is associated with a decrease in the degree to which the response can be determined by the objective characteristics of the stimulus (16), and therefore organismic variables, such as ego-strength, and non-objective stimulus associations, such as value, become relatively more important in determining the response. However, as time-interval increases beyond a point, the effects of value associated with the standard disc should also decrease so that emotionally determined responses should finally not occur. In addition, incidental "random" variables should play an increasing part thereby nullifying any effect of value originally associated

with the stimulus.

Induced verus inferred value. A procedure involving induced value was adopted in the present study because social symbols leave much to be desired in terms of experimental control over stimulus characteristics (18). Social symbols differ in appearance, apart from value, so that configurational properties may contaminate the findings. Only a study employing induced value can keep these factors constant. Postman, Bruner and McGinnies (47), in a discussion of the effects of value on the discrimination of size, came to the same conclusion, that is, it is experimentally sounder to induce a value system into the S than to work with inferred values.

Statement of the Problem

The aim of the present study is to investigate size-judgment in adults as a function of (a) type of value (negative or positive) associated with a stimulus object, (b) individual differences in ego-strength as measured by a Rorschach form-level score, (c) time-interval between viewing a stimulus and making a judgment of it and (d) interactions of the preceding three variables. The specific hypotheses to be tested are as follows:

a. Negatively and positively valued discs will be overestimated relative to a neutral disc. This follows from the assumption that the magnitude of the emotional response is generalized to the magnitude of the physical stimulus associated with it.

b. A negatively valued stimulus will influence size-judgments more than a positively valued stimulus. This follows from the assumption that negative stimuli lead to more intense emotional reactions than positive stimuli, all other things being equal.

c. The overestimation of valued objects will occur to a greater extent for Ss low in ego-strength than for Ss high in ego-strength. This follows from the assumption that low ego-strength Ss are less able to inhibit their tendency to generalize from internal emotional stimuli to external stimuli than high ego-strength Ss.

d. As time-interval increases, up to a point, the influence of value and ego-strength upon size-judgment will increase. This follows from the assumption that judgments are less determined by the stimulus and more by the characteristics of the organism as time between stimulus and response is increased.

EXPERIMENTAL METHOD

Subjects

One hundred male undergraduate students from the University of Massachusetts comprised the original sample from which an experimental group of 54 Ss were selected. All Ss were naive with respect to the purpose of the experiment.

Ego-strength groups. The 100 Ss met collectively in four groups of approximately equal numbers to take a Group Rorschach Test which was administered according to the Harrower technique (26) (see Appendix A for summary of administration procedures). Subjects also filled out a questionnaire regarding color-blindness and visual acuity (see Appendix B for questionnaire). Eighteen of the 100 Ss were dropped from the experiment because of color-blindness, visual-acuity problems or failure to follow directions during the administration of the Rorschach Test.

The Rorschach Test was scored by the examiner (E) for ego-strength by a modification of Klopfer's form-level technique (31, pp. 207-239). Responses were quantified according to accuracy and elaborations (see Appendix A for detailed scoring criteria).

Three groups of 18 Ss each were selected in a manner such as to maximize differences between them in ego-strength scores. A "low group" was made up of those Ss whose scores were the lowest, a "middle group" of Ss whose scores fell most tightly within the middle range, and a "high group"

whose scores were the highest in the total distribution of ego-strength scores.

Procedure

Before participating in the experiment proper, each of the 54 Ss were given the following information:

> The purpose of this experiment is to measure specific manipulation and intellectual abilities. The experiment will be made up of tests similar to the ones used by the Air Force and Navy to eliminate failures from their pilot, navigator and bombardier training programs. There is reason to believe that these tests also measure practical intelligence. One of the things I am trying to find out in this study is how much of a relationship there is between this practical type of intelligence and a students academic record. Therefore, I am going to compare your test results with your academic record to see if there is any such relationship.
>
> You will be given a series of 12 tests. For each of the tests I have standards of what is considered an inferior, superior, and neutral score. The inferior and superior scores have been found to predict ability but the neutral scores do not seem to have any predictive value at all. Both successful and unsuccessful pilots commonly receive such neutral scores. You will be competing against failure, neutral and success standards used in the Air Force and Navy.
>
> Depending upon how well you do on each of the individual tests you will be given a red, yellow, or green disc. You will get a red disc if you fail a test, a green disc if you do well, and a yellow disc for a neutral performance (colors were counterbalanced according to the color group to which the S was assigned). At the end of the testing session you will have 12 discs, each one indicating how well you did or did not do on each test.
>
> We are going to use the discs to keep score but we are also using them because the Armed Forces found that motivation plays an important role in these tests. They used this procedure when they set the standards so we must do the same if we are going to compare. We are going to use the discs to constantly remind and

encourage you to try your hardest. Some of the men in the experiment will not get the discs and I want to see what happens to their test scores.

Before we can begin testing you must promise not to reveal the content of any of the tests or the nature of the experiment to another person. One hundred students will be participating in the experiment and I don't want any information to leak out. This is particularly important since advance information would lower your test scores by comparison. In addition, I am taking you into my confidence and relying on your integrity as a mature person to realize the importance of keeping the experiment confidential.

Reinforcement procedure. Each S was seen individually for an hour and a half testing session during which time a series of 12 performance tests was administered. By predetermining and controlling all test scores each S randomly received four failure discs, four neutral discs, and four success discs. Performance was purportedly measured by speed and accuracy; any question about time was answered with, "They are all timed problems. Work as fast as you can. I'll call time."

A red, yellow or green disc was used as a reward token following each of the 12 tests so that a failure, neutral or success value was associated with each color. Since the Ss made size-estimations of the three colored discs after the value reinforcement procedure, it was necessary to control for variations in size-judgment as a function of color. The 18 Ss in each ego-strength group were randomly divided into three "color groups" of six Ss each. Group I received a red disc for "failure", a yellow disc for "neutral", and a green disc for "success." Group II received a yellow disc

for failure, a green disc for neutral, and a red disc for success. Group III received a green disc for failure, a red disc for neutral, and a yellow disc for success. (see Figure 1).

Size-judgments. Following the reinforcement procedures all discs were removed and the Ss were required to estimate the size of each of the value discs by a psychophysical procedure. In order to counterbalance for the order in which the discs were judged, two Ss from each color group estimated the failure disc first, then the neutral disc, and finally the success disc; two other Ss estimated the neutral disc first, then the success disc, and finally the failure disc; two other Ss estimated the success disc first, then the failure disc, and finally the neutral disc (see Figure 1).

Size-judgments of the discs were made .5[1], 7, and 49 seconds after having seen the discs. To counterbalance for the order in which the time-intervals were experienced, one S from each value-sequence group made estimates in a decending order (49", 7" and .5") and one made estimates in an ascending order (.5", 7" and 49") (see Figure 1). The procedure, as illustrated for the judgments in the descending time order,

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1. The time interval of .5 seconds represents an approximate estimate of the time required to shift visual fixation from the standard disc to the variable circle of light, or a distance of 52 degrees in the horizontal plane. The transformation to seconds was made merely to provide a descriptive unit consistent with the others.

was as follows: (a) S was shown one of the discs, mounted on a 5 x 5 inch black cardboard on the right half of the apparatus faceboard for 10 seconds. He was told to observe it carefully by turning his head so that he faced it directly and not through the corner of his eyes. He was informed that he would estimate its size at a later time. After 49 seconds, during which time S was occupied with an irrelevent task in order to hold constant the intervening experience (see Appendix C for task and instruction), he made four estimates of the disc by the psychophysical procedure. Judgments alternated between the open and closed position of the circle of light. The circle of light was not fully open or closed, but varied randomly in the degree to which it was larger ("open") or smaller ("closed") than the standard. The Ss were permitted to turn the controlling knob in either direction. The mean value for the four judgments was taken as the score. The same procedure was followed with the other two discs, (b) the same procedure was repeated for the 7 second delay except that no intervening task was possible, and (c) the same procedure was repeated except that the standard disc remained on the faceboard during the size-estimations so that the delay was a function of the time required to shift from the standard disc to the adjustable circle of light. Subjects were permitted to look up and back as frequently as they liked.

During the psychophysical judgments the Ss viewed the standard disc and the adjustable circle of light while seated

in front of the apparatus with their elbows resting on a table and their heads supported in a chin rest. The S's eyes were 17 inches from the standard disc and an adjustable circle of light and on a level with the center of both. All judgments were made with the dominant hand.

After completion of the above procedures, Ss were told that the discs were of slightly different sizes and that, although they might not have consciously noted it, they had probably unconsciously sensed it. They were then requested to give an order of largeness and were urged to guess if necessary. Subjects were also asked to indicate their reactions to the experiment by filling out a questionnaire (see Appendix E for questionnaire). Those who, on the questionnaire, reported no ego-involvement during the reinforcement or size-judgment procedures were to be eliminated from the experiment and additional Ss selected in their place. On a six-point scale no S recorded an ego-involvement rating for the reinforcement and size-judgment procedures of less than 3 and 4, respectively (see Appendix E, question 1 and 3).

Material and Apparatus

In order to measure ego-strength, a Group Rorschach Test following the Harrower technique (26) was used. All ten Rorschach cards were administered, but only cards one to four were evaluated for ego-strength scores by a modification of Klopfer's form-level method (31, pp. 207-239). For

each S, ego-strength scores on cards I and III, and II and IV were summed and correlated. A Pearson product reliability coefficient of .72[1] (n=82) was obtained (see Appendix A for ego-strength response data). Additional cards were not used because the predicted increase in reliability to .87[2], based on 10 cards was not considered to be worth the time and labor.

The 12 reinforcement tests consisted of the following items:

1. Kohs Block Design
2. Object Assembly
3. Whipple's Steadiness Test
4. Koerth Pursuit Test
5. O'Connor's Wiggly-Blocks
6. Paper and Pencil Maze
7. Form Board
8. Minnesota Rate of Manipulation
9. Digit Symbol
10. Picture Arrangement
11. Tweezer Dexterity
12. Code Interpretation

While most of these items are standardized tests, some (6,9,12) were designed by the E. This battery was selected because (a) it was felt that the tests would be interesting and ego-involving for college students, (b) each test could be administered in less then five minutes, and (c) failure and success interpretations of the Ss performance could be easily manipulated in a convincing manner (see Appendix D for a more thorough discussion of each test and the directions for administration).

The apparatus which was used for size-estimates consisted of an American Optical Slide Projector, Model 4961 (AO 500)

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1. Not corrected for attenuation since the obtained r was sufficiently large.
2. Estimated by the Spearman-Brown Prophecy Formula (24, pp. 493).

with a light source of 500 watts. The projector was mounted on a fixed stand and was fitted with a low angle Victor f:2.9 lens which maintained the projected circle of light in constant focus. In front of the low angle lens was a movable plate with a 5/8 inch circular hole. The plate was mounted on a worm gear and rotation of the gear by the control knob outside the apparatus box moved the plate toward or away from a stationary five inch ground glass. Thus the diameter of the projected circle of light varied on the ground glass. Connected to the plate was an indicator pointer which also extended outside the apparatus box. Movement of the plate changed the position of the indicator pointer which was located over a calibrated scale fixed on the side of the apparatus box. The scale was graduated in units of 1/32 of an inch and readings on the scale corresponded to equal changes in the diameter of the circle of light from the standard size of one inch. Movements of the plate to its extreme positions changed the diameter of the circle of light from 3/4 of an inch to 1 1/4 inches, or 1/4 of an inch in both directions from zero (perfect accuracy). The circle of light was focused on the center of the five inch ground glass mounted on the left half of the faceboard. Seventeen inches from the ground glass was a chin-rest (see Appendix C for apparatus).

Three color slides (red, yellow, and green) were inserted in the projector so that the adjustable circle of light was the

same color as the standard. The amount of light transmission through each color slide was modified, by changing the number of layers of cellophane filters, until the "apparent brightness" for each of the colored circles of light was approximately equal. A Mcbeth Illuminometer was used to obtain the apparent brightness measures in foot-candles per square inch.

The telescope of the Mcbeth Illuminometer was set arbitrarily one inch from the colored circles of light. Brightness measures were made at diameter size settings of 3/4", 1", and 1 1/4" for each colored circle of light (minimum, middle, and maximum size settings of the apparatus). Two judges made five brightness judgments of each color at the three size settings. One judge made estimates in an ascending order of size (3/4", 1", 1¼"), and the other made estimates in a descending order (1¼", 1", 3/4"). The final brightness measures for the yellow, red, and green circles of light were within the range of 1.11 and 1.40, .81 and 1.21, and .97 and 1.52 foot-candles per square inch, respectively. The mean brightness measures were 1.23, .90, and 1.22 foot-candles per square inch, respectively. These measures were used only as an approximate balance of the apparent brightness of the circles of light. Differences in brightness were controlled by counterbalancing color in relation to the value associated with it.

The standard discs were machine punched circular metal slugs measuring one inch in diameter. The discs were painted red, yellow or green and corresponded in color to the circles

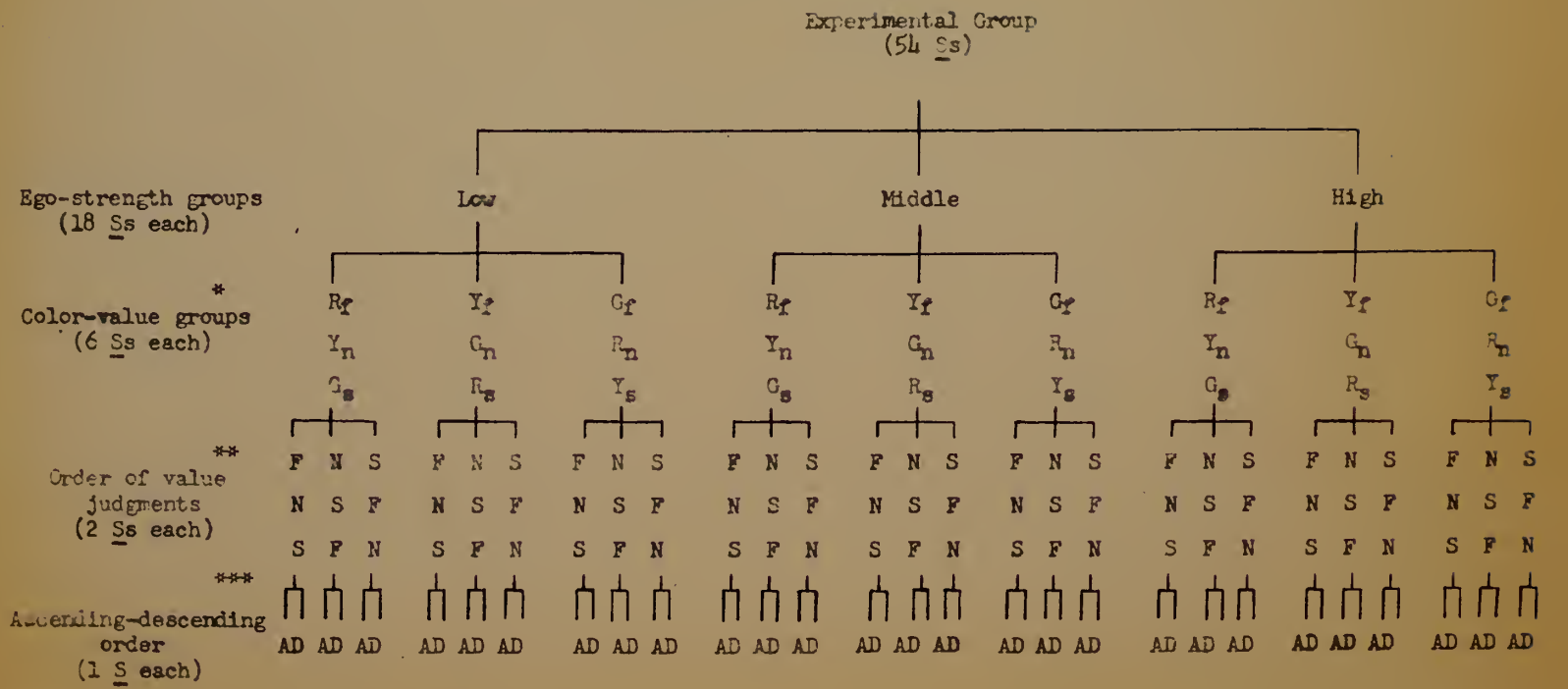
of light.

A disc of each color, centrally mounted on a 5 x 5 inch black cardboard, functioned as the standard during the psychophysical estimates. The standard was mounted in the center of the right half of the apparatus faceboard at the same eye level as the variable circle of light. The distance between the center of the standard discs and the center of the circles of colored light was 21 inches. The horizontal visual angle from the chin rest to the center of the variable circles of light and the center of the standard discs subtended an angle of approximately 52 degrees.

The experimental room, 6 x 14 feet, was illuminated by a 200 watt overhead reflector lamp which was centrally located. A Weston Photronic Foot-Candle Meter (Model 614) indicated that the general room illumination was 3 foot-candles when the reading was taken from the apparatus faceboard.

Figure 1

Methodological Procedure



* $R_fY_nG_s$: Color-value assignment; R_f = Red-failure, Y_n = Yellow-neutral, G_s = Green-success

** F N S : Order in which values were judged; F = Failure, N = Neutral, S = Success

*** A D : A = Ascending time-interval order between being shown a disc and making judgments; .5, 7, 49 seconds
D = Descending time-interval order between being shown a disc and making judgments; 49, 7, .5 seconds

RESULTS

Psychophysical Size-judgments

Errors in Size-estimations as a Function of Value

Table 1 summarizes the means and standard deviations of errors in size-estimation as a function of value. The positive mean size-judgments indicate that overestimation occurred for all conditions. However, it occurred to the greatest degree for the failure value, next for the success value, and least for the neutral value. In Table 2 it can be seen that the F of 55.49 (2 and 196 df) for value is significant at the .001 level of confidence. In Figure 2, the effect of value upon size-judgment is graphically represented along with the effects of time-interval and ego-strength.

Errors in Size-estimations as a Function of Time-interval

Table 1 summarizes the means and standard deviations of errors in size-estimation as a function of time-interval and indicates that the mean size-judgments are all overestimations which decrease as time-interval increases. That is, at .5 seconds the mean size-judgment is the largest overestimation, and at 7 and 49 seconds the mean overestimation becomes increasingly smaller, respectively. Table 2 indicates the F of 103.45 (2 and 196 df) for time-interval is significant at the .001 level of confidence. Mean error in size-judgments as a function of time are graphically represented in Figure 2.

Table 1

Means* and Standard Deviations of Size-estimations for Value, Time-interval, and Ego-strength

Variable	Size-estimations					
	Failure		Success		Neutral	
Value	M	SD	M	SD	M	SD
	4.35	6.15	2.66	6.15	1.45	6.65
	.5		7		49	
Time-interval	M	SD	M	SD	M	SD
	4.18	5.59	3.75	6.86	.54	6.11
	Low		Middle		High	
Ego-strength	M	SD	M	SD	M	SD
	4.91	8.44	3.00	4.95	.55	6.11

* Means are reported in 1/32 of an inch units of deviation in reference to the diameter of the standard.

Table 2

Analysis of Variance of Size-estimations

Source of Variation	df	SS	MS	F
Between Ss	53	12,812.32		
Ego-strength groups	2	1,550.53	775.27	3.51*
Ss within groups	51	11,261.79	220.82	35.62***
Within Ss	432	7,273.11		
Value	2	688.05	344.03	38.40***
Time	2	1,282.72	641.36	23.95***
Value x Time	4	155.83	38.96	6.28***
Value x Ego-strength	4	30.24	7.56	.84
Ego-strength x Time	4	81.31	20.33	.76
Ego-strength x Value x Time	8	32.36	4.05	.65
Ss x Value	106	949.73	8.96	1.45***
Ss x Time	106	2,838.39	26.78	4.32***
Ss x Value x Time (residual)	196	1,214.48	6.20	
Total	485	20,085.43		

* Significant at the .05 level of confidence

*** Significant at the .001 level of confidence

Note- Ss x Value x Time is the error term for Value x Time, Ego-strength x Value x Time, Ss x Value, and Ss x Time
Ss x Value is the error term for Value, and Value x Ego-strength
Ss x Time is the error term for Time, and Time x Ego-strength

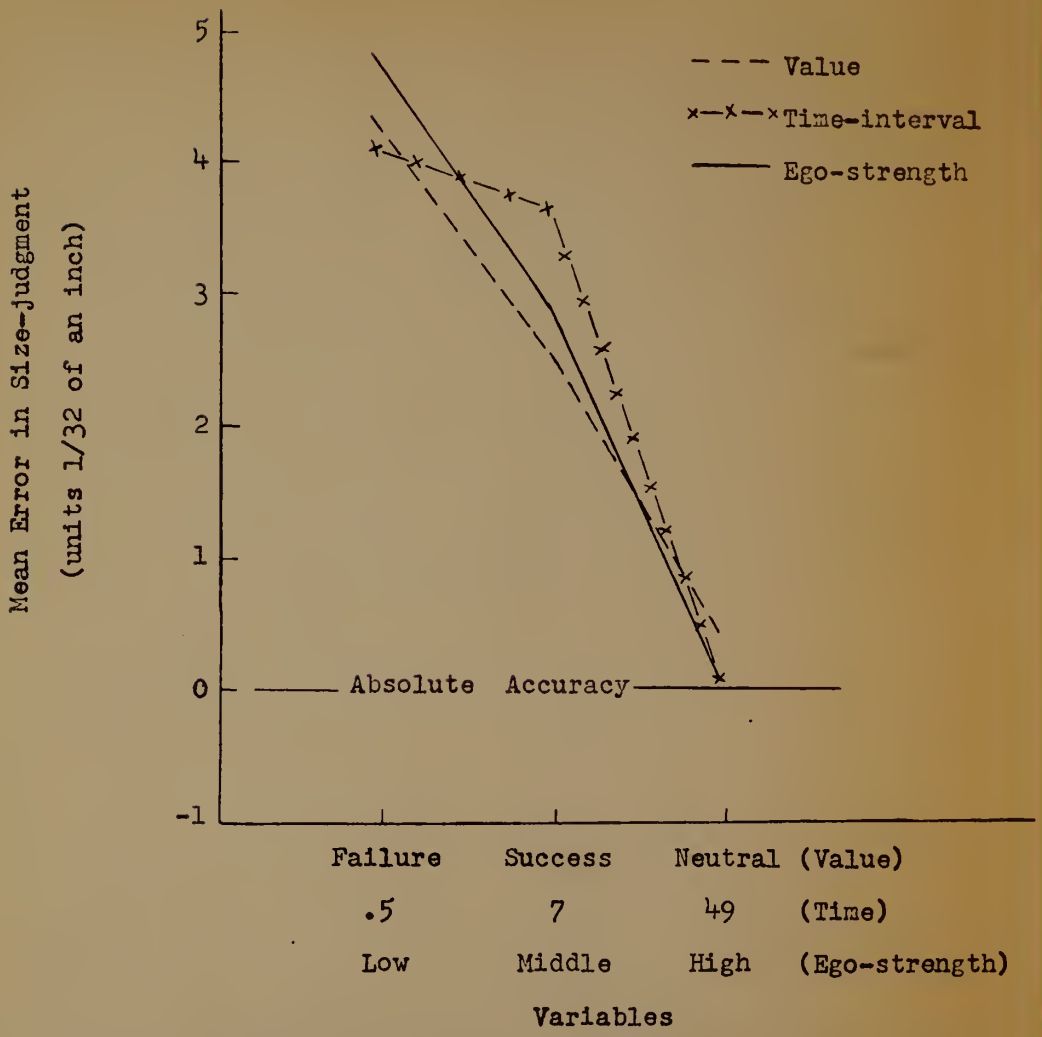


Figure 2. Errors in Size-judgments of the Stimulus Discs as a Function of Value, Time-interval and Ego-strength

Errors in Size-estimations as a Function of Ego-strength

Table 1 summarizes the means and standard deviations of errors in size-estimation as a function of ego-strength. The mean size-judgments for the three ego-strength groups indicate that the low ego-strength group makes the largest size-overestimations and the middle and high groups make increasingly smaller overestimations, respectively. Table 2 summarizes the analysis of variance and indicates that the F of 3.51 (2 and 51 df) for ego-strength is significant at the .05 level of confidence. Errors in size-judgment as a function of ego-strength are graphically represented in Figure 2.

Inspection of Table 1 also indicates large differences in the standard deviations of the ego-strength groups. The low ego-strength group has a variance (71.23) which is slightly less than three times that of the middle ego-strength group (24.50) and twice that of the high ego-strength group (37.33). Bartlett's test of homogeneity of variance (40, pp. 247-248) was applied to these differences and the results indicate that the corrected Chi-square of 78.79 (2 df) is significant at beyound the .01 level of confidence. This finding suggests that the significant F-test in the analysis of variance could be due entirely, or in part, to the significant differences in the variances. This raises the question of how much confidence can be placed in the significant F-test of the means. Two arguments can be presented which support the F-test's validity: (a) systematic changes in the means are not associated with equally

systematic changes in the variances, and (b) Cochran (19, p. 28) in a discussion of heterogeneity of variance, states that, "If ordinary analysis of variance methods are used when the true error variance differs from one observation to another, there will as a rule be a loss of efficiency in the estimates of treatment effects. Similarly, there will be a loss of sensitivity in tests of significance. If the changes in the error variance are large, those losses may be substantial. The validity of the F-test for all treatments is probably the least affected."

Errors in Size-estimations as a Function of the Interaction of Value and Time-interval

Table 3 summarizes the means and standard deviations of errors in size-estimation in relation to the interaction of value and time-interval. The differences in mean size-judgments between the three values increase as the time-interval between stimulus and response increases. It can be seen in Figure 3 that time-interval has the least effect upon the failure value and the greatest effect upon the neutral value. Table 2 summarizes the analysis of variance and indicates that the F of 6.28 (4 and 196 df) for the interaction of value and time-interval is significant at the .001 level of confidence.

Inspection of Table 3 further indicates that at the longest time-interval, namely 49 seconds, the size-judgment of the failure value is an overestimation, the size-judgment of the success value is essentially accurate, and the size-judgment of the neutral value is an underestimation. To test whether the

Table 3

Means* and Standard Deviations of Size-estimations for Value, Time-interval, and Ego-strength Interactions

Interactions		Size-estimations					
		.5		7		49	
Time-interval		M	SD	M	SD	M	SD
x Value	Failure	4.87	5.77	5.13	6.49	3.05	5.92
	Success	4.17	5.03	3.63	7.13	.19	5.23
	Neutral	3.50	5.86	2.48	6.71	-1.63	6.21
		.5		7		49	
Time-interval		M	SD	M	SD	M	SD
x Ego-strength	Low	6.04	7.90	6.57	9.11	2.13	7.29
	Middle	4.59	3.71	3.28	4.98	1.13	5.38
	High	1.91	2.98	1.39	4.47	-1.65	4.76
		Failure		Success		Neutral	
Value x		M	SD	M	SD	M	SD
Ego-strength	Low	6.75	7.80	4.32	8.15	3.67	8.72
	Middle	4.56	4.89	2.98	4.48	1.46	4.98
	High	1.74	3.71	.68	4.48	- .78	4.69

* Means are reported in 1/32 of an inch units of deviation in reference to the diameter of the standard. Negative signs indicate underestimations.

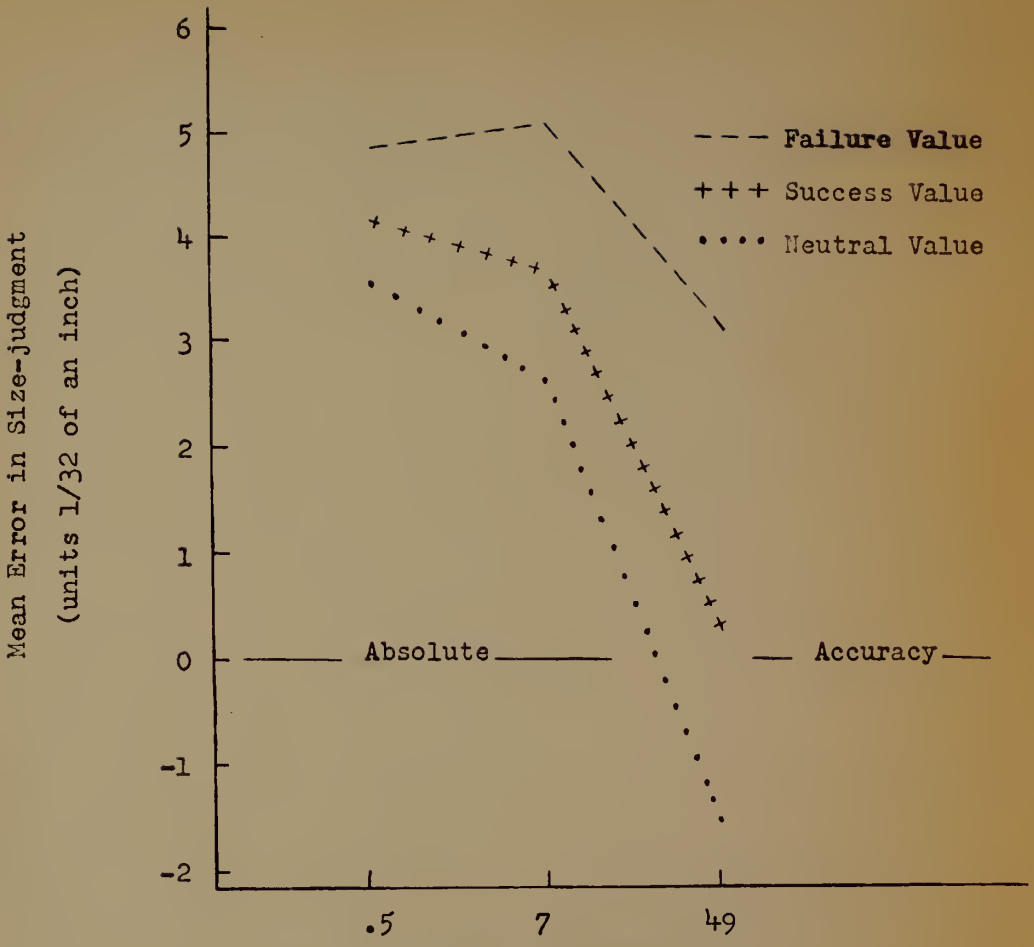


Figure 3. Errors in Size-judgments of the Stimulus Discs as a Function of the Interaction of Value and Time-interval

underestimation of the neutral value was other than a chance variation from accuracy, a t-test of the mean (M = -1.63, SD = 6.21) from a theoretical mean of zero was performed. A t of 1.918 (df = ∞) was obtained which is not significant, but fails to reach significance by only .04 (1.959 needed at the .05 level).

Errors in Size-estimations as a Function of the Interaction of Ego-strength and Time-interval

Table 3 summarizes the means and standard deviations of errors in size-estimation as a function of the interaction of ego-strength and time-interval. It can be seen in Figure 4 that the general trend is for all ego-strength groups to show a decrease in size-estimation with an increase in time-interval. While the decrease is consistent for the middle and high ego-strength groups, the low ego-strength group shows a tendency to increase in mean size-judgment at seven seconds and to drop steeply at 49 seconds. However, as can be seen in Table 2, the analysis of variance indicates that the F of .76 (4 and 196 df) for the interaction of ego-strength and time-interval is not significant.

Inspection of Table 3 also indicates that the standard deviations for the low ego-strength group are larger than those for the other two groups in all three time-interval conditions, which suggests that the high standard deviation of the low ego-strength group, as found in Table 1, is not due to a reaction to a specific time-interval. Bartlett's test of homogeneity of

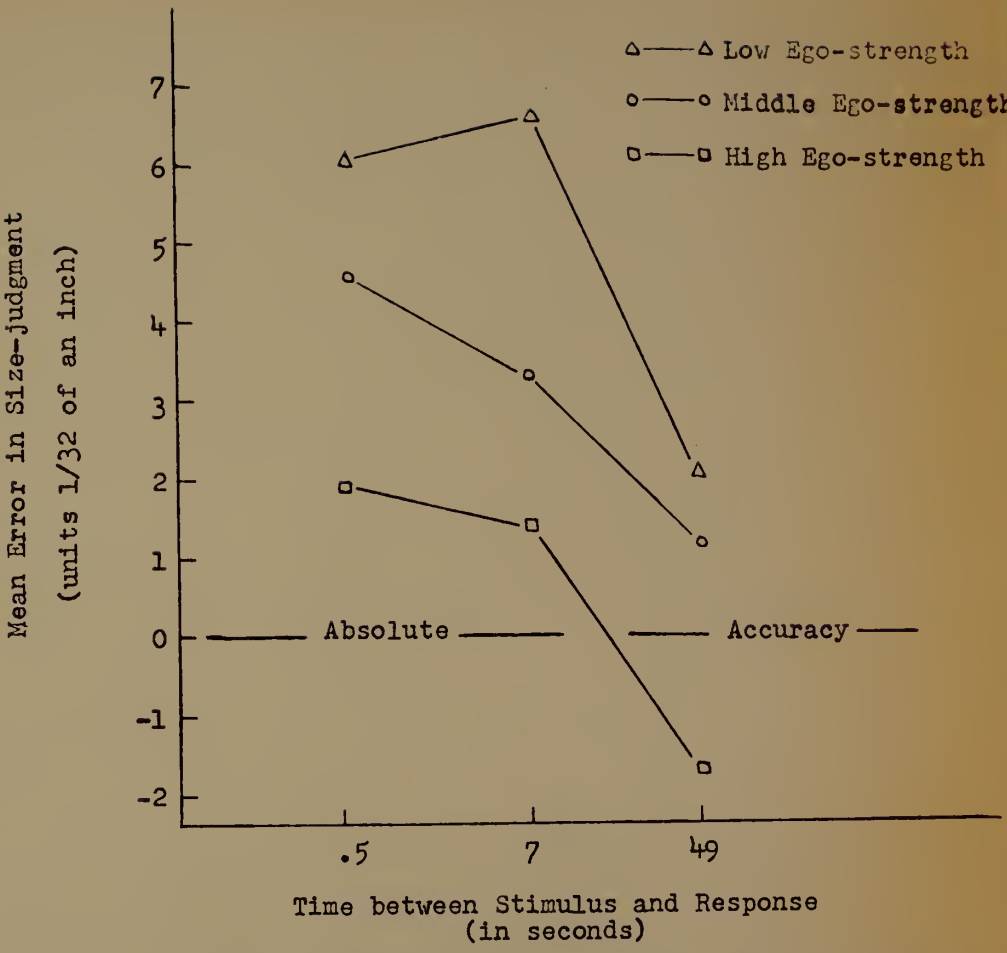


Figure 4. Errors in Size-judgments of the Stimulus Discs as a Function of the Interaction of Ego-strength and Time-interval

variance was applied to the standard deviations of the low ego-strength group. The Chi-square of 2.23 (2 df) was not significant.

Table 3 also indicates that at the longest time-interval, namely 49 seconds, the mean size-judgment of the high ego-strength group is an underestimation, the mean size-judgment of the middle ego-strength group is relatively accurate, and the mean size-judgment of the low ego-strength group is an overestimation. To test whether the underestimation of the high ego-strength group was other than a chance variation, a t-test of the mean size-judgment (M = 1.65, SD = 4.76) from a theoretical mean of zero was done. A t of 2.54 (df = ∞) was obtained which is significant at the .02 level of confidence. This indicates that the underestimation at 49 seconds is not very likely simply a chance variation from accuracy.

Errors in Size-estimations as a Function of the Interaction of Value and Ego-Strength

Table 3 summarizes the means and standard deviations of errors in size-judgment as a function of the interaction of value and ego-strength. The mean size-judgments fail to indicate any interaction between the two variables, that is, the different values do not have a differential effect on the differences between the ego-strength groups. It can also be seen in Figure 5 that the differences in the mean size-judgments between the ego-strength groups are fairly constant through the three

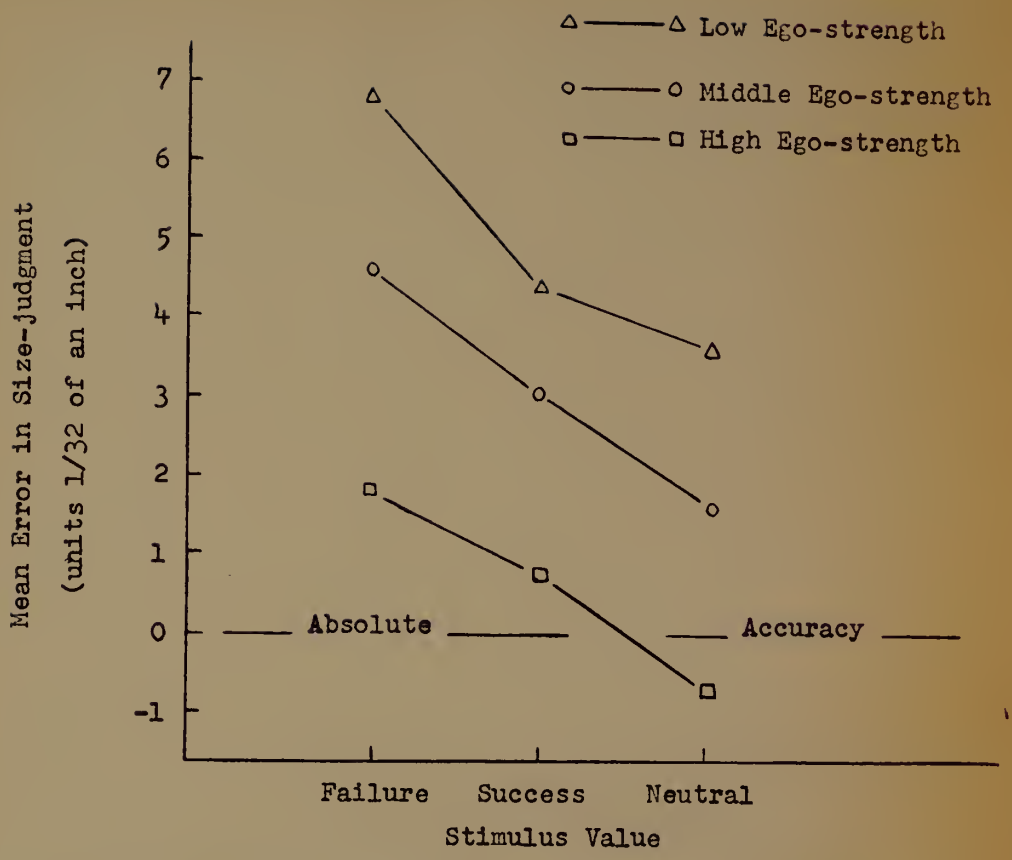


Figure 5. Errors in Size-judgments of the Stimulus Discs as a Function of the Interaction of Value and Ego-strength

value conditions. Table 2 summarizes the analysis of variance and indicates that the F of 1.22 (4 and 196 df) for the interaction is not significant.

Inspection of Table 3 also indicates that the standard deviations of the low ego-strength group are larger than those of the other two groups in all three value conditions (this is consistent with the findings when ego-strength was investigated independently and in interaction with time-interval). Bartlett's test of homogeneity of variance was applied to the standard deviations of the low ego-strength group and a Chi-square of .55 (2 df) was obtained, which is not significant. This finding, in conjunction with the other Chi-square analyses, indicates that the low ego-strength group is generally more heterogeneous in its size-judgments, but that the heterogeneity is not associated with a particular time-interval or value condition.

Errors in Size-estimations as a Function of the Interaction of Value, Time-interval, and Ego-strength

Table 4 summarizes the means and standard deviations of errors in size-estimation as a function of the interaction of value, time-interval, and ego-strength. The mean size-judgments fail to indicate an interaction between the three variables. A graphical representation appears Figure 6. Table 2 summarizes the analysis of variance and indicates that the F of .65 (8 and 196 df) for the interaction is not significant.

Table 4

Means* and Standard Deviations of Size-estimations for Value, Time-interval, and Ego-strength Interaction

Ego-strength Groups	Time : .5 Seconds					
	Value					
	Failure		Success		Neutral	
	M	SD	M	SD	M	SD
Low	6.83	8.29	5.56	6.84	5.72	8.48
Middle	5.22	3.53	4.72	3.90	3.83	3.55
High	2.56	3.08	2.22	2.99	.94	2.68
	Time : 7 Seconds					
	Failure		Success		Neutral	
	M	SD	M	SD	M	SD
Low	8.00	8.01	6.11	10.38	5.61	8.55
Middle	5.06	5.49	2.94	4.16	1.83	4.70
High	2.33	3.99	1.83	4.22	0.00	4.87
	Time : 49 Seconds					
	Failure		Success		Neutral	
	M	SD	M	SD	M	SD
Low	5.44	7.21	1.28	5.50	- .33	7.72
Middle	3.39	5.25	1.28	4.66	-1.28	5.15
High	.33	3.60	-2.00	4.82	-3.28	5.02

* Means are reported in 1/32 of an inch of deviation in reference to the diameter of the standard. Negative signs indicate underestimations.

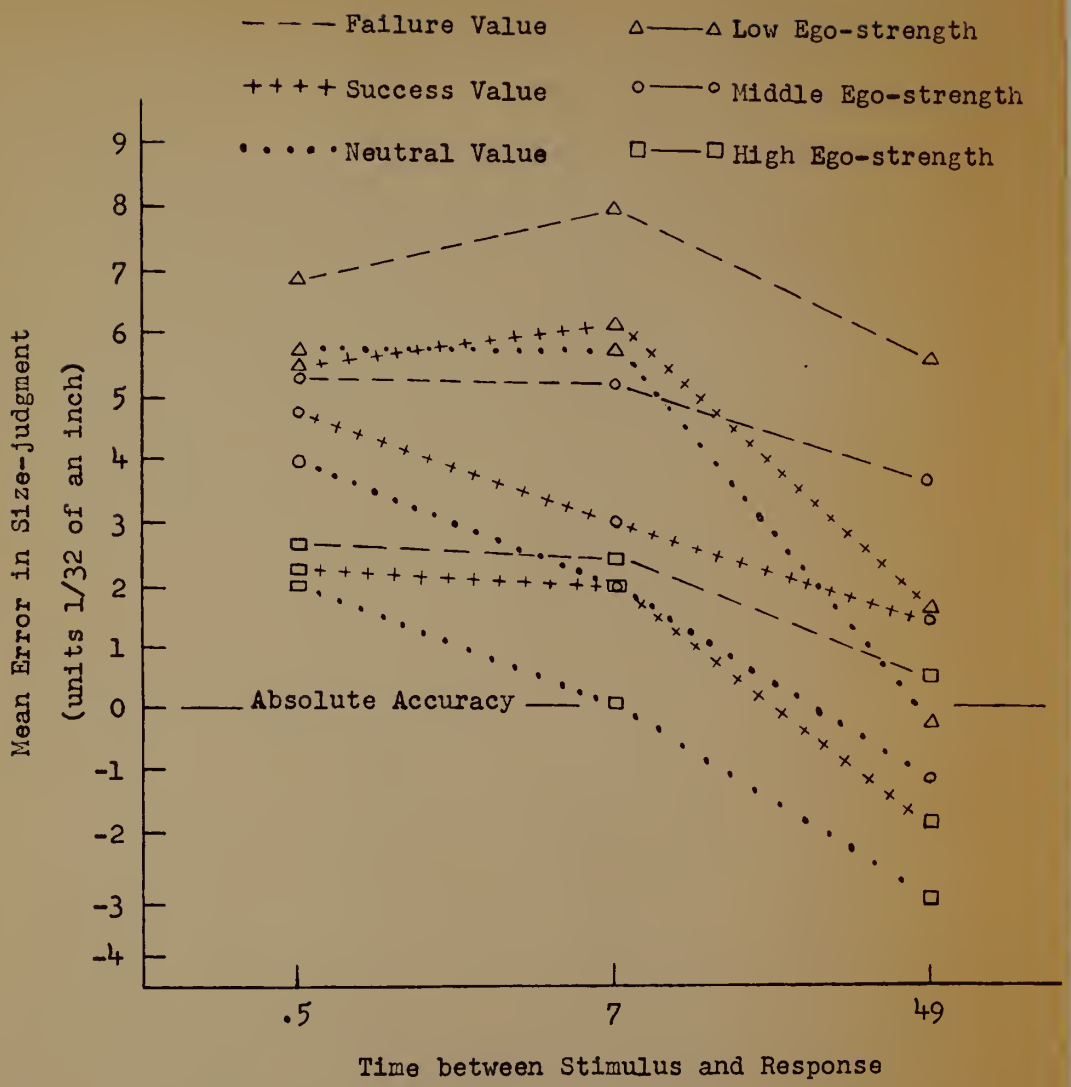


Figure 6. Error in Size-judgments of the Stimulus Discs as a Function of Value, Time-interval, and Ego-strength

Errors in Size-estimations as a Function of Unmeasured Individual Differences

In Table 2, which presents the summary of the analysis of variance, it can be seen that Ss within ego-strength groups are significantly different from each other at the .001 level of confidence (F = 35.62, 51 and 196 df). This indicates that individuals differ reliably in their mean size-estimations when ego-strength is held relatively constant.

Verbal Size-judgments

Table 5 summarizes the frequencies of verbal size-judgments for the three value-discs for each of the ego-strength groups (see Appendix I for verbal rankings of each S). Chi-square analysis was used first to investigate the association of size with value irrespective of ego-strength groups. No significant Chi-squares were found, as can be seen in Table 6. It should be noted, however, that there is a tendency for the failure value to be ranked largest (p = .10-.05). The p for the failure value would have been significant at the .05 level if one more S judged it largest. It thus appears that the lack of significance may simply have been a function of the small number of Ss in the three categories. Accordingly, a two-way division was obtained by pooling the two categories with the smallest frequencies. This resulted in a comparison of the frequency of Ss who rated the failure disc as largest (N = 26) with the frequency of Ss who rated it as smallest or middle (N = 28). The

Table 5

Frequencies of Verbal Size-judgments for Ego-strength Groups

Ego-strength Groups	Discs								
	Failure			Success			Neutral		
	S*	M	L	S	M	L	S	M	L
Low	6	3	9	6	7	5	6	8	4
Middle	7	3	8	5	10	3	6	5	7
High	2	7	9	9	5	4	7	6	5
Total	15	13	26	20	22	12	19	19	16

* S = discs judged smallest; M = discs judged in middle position; L = discs judged largest

Table 6

Chi-square Analysis of Verbal Size-judgments for all Ss

Discs	Judgments	N	X^2	p
	Smallest	15		
Failure	Middle	13	5.45	.10-.05
	Largest	26		
	Smallest	20		
Success	Middle	22	3.11	.30-.20
	Largest	12		
	Smallest	19		
Neutral	Middle	19	.34	.90-.80
	Largest	16		

expected frequencies, assuming a chance distribution, are, respectively, 18 (1/3 of 54) and 36 (2/3 of 54). A Chi-square of 5.33 (df = 1) was obtained which is significant between the .05-.02 level of confidence, i.e., there is a significant tendency for the failure disc to be judged largest in comparison to the combined categories of smallest or middle in size.

The effect of ego-strength upon verbal size-judgment for each of the three value-discs was also investigated. Chi-squares of 5.28, 3.55, and 1.85 (df = 4) for the failure, success, and neutral values, respectively, failed to indicate any significant difference between the ego-strength groups in their judgments of the three values.

Attitude Questionnaire Ratings

Table 7 summarizes the ratings for each item in the attitude questionnaire by the three ego-strength groups (see Appendix E for questionnaire). The ratings to question 1 reveal a range of responses of 3 to 6. Eighty five percent (46 out of 54) of the Ss experienced moderate to very strong ego-involvement in the initial tasks (during the administration of the reinforcement procedures). No S reported a degree of ego-involvement that falls into the lowest intervals of the scale. The variations in ratings between the ego-strength groups indicates a tendency for the ego-strength score to be positively related to a report of maximum ego-involvement as indicated by a questionnaire rating of six (high group 56%, middle group

Table 7

Summary of Ratings for each Item in Attitude Questionnaire

Question	Ego-strength Groups	Ratings 1	2	3	4	5	6	N
1. Test Involvement	Low	0	0	4	5	6	3	18
	Middle	0	0	2	3	6	7	18
	High	0	0	2	6	0	10	18
	Total	0	0	8	14	12	20	54
				Failure		Success		
2a. Emotional Arousal	Low			9		9		18
	Middle			11		7		18
	High			15		3		18
	Total			35		19		54
2b. Strength of Response	Low	3	1	2	5	3	4	18
	Middle	2	0	0	7	5	4	18
	High	0	0	2	4	6	6	18
	Total	5	1	4	16	14	14	54
3. Accuracy Effort	Low	0	0	0	1	5	12	18
	Middle	0	0	0	3	3	12	18
	High	0	0	0	1	6	11	18
	Total	0	0	0	5	14	35	54
4. Score Authenticity	Low	14	3	0	1	0	0	18
	Middle	12	4	0	2	0	0	18
	High	16	2	0	0	0	0	18
	Total	42	9	0	3	0	0	54

39%, and low group 17%).

Responses to question 2a indicate that 67% (35 out of 54) of the Ss report having experienced stronger feelings about the failure disc than the success disc. While the low ego-strength group was equally divided as to which disc aroused stronger feelings, the middle and particularly the high ego-strength groups reported a predominance of "stronger feelings" toward the failure disc, the percentages being 61% and 83%, respectively. The results on question 2b indicate that the differences in feelings between the failure and success discs is rated in the range of moderate to considerable differences 89% of the time (48 out of 54). In this respect, there are no apparent differences between the ego-strength groups.

Question 3 reveals that all Ss rated their effort to be accurate during the size-judgment procedures between 4 and 6. This indicates moderate to high ego-involvement during the last phase of the experimental procedures. There are no apparent differences between the ego-strength groups in this respect.

Responses to Question 4 reveal that 94% (51 out of 54) of the Ss essentially had no insight into the predetermined test scores. The remaining 6% (3 Ss) reported only a "moderate feeling" about the test scores being "fixed."

DISCUSSION

The present study was undertaken to determine whether the value of a stimulus being judged, the time-interval between the presentation of the stimulus and the response, and individual differences in ego-strength are independently and in combination related to size-judgment in adult Ss. It was found that when a psychophysical measure was used all three variables were independently related to size-judgment and that time-interval interacted significantly with value and ego-strength. However, an interaction effect between value and ego-strength was not found. Verbal estimates of size indicated that the failure disc was significantly more often judged largest than smallest or middle in size. The success disc tended to be judged next largest in size. The above findings indicate that size-estimation is influenced by (a) the value of the object being judged, (b) the time-interval between the stimulus and the response, (c) the ego-strength of the S making the judgment, (d) the interaction of time-interval with value, and (e) the interaction of time-interval with ego-strength.

The discussion which follows will be concerned with the separate effects of these variables and their interactions.

Variables Influencing Judgment of Magnitude

Value of the stimulus. The results indicate that the value of a stimulus significantly influences judgment of its size. That is, a failure disc is judged larger than a success disc

and both are judged larger than a neutral disc. This substantiates the first two hypotheses: (a) "Negatively and positively valued discs will be overestimated relative to a neutral disc. This follows from the assumption that the magnitude of the emotional response is generalized to the magnitude of the physical stimulus associated with it.", and (b) "A negatively valued stimulus will influence size-judgments more than a positively valued stimulus. This follows from the assumption that negative stimuli lead to more intense emotional reactions than positive stimuli, all other things being equal." Some support for the assumption that a negative stimulus leads to more intense emotional reactions than a positive stimulus was obtained by Ss reporting that this was the case on a post-test questionnaire.

The fact that the mean size-judgments of all three discs were overestimations suggests, as one possibility, that the experimental procedure, in general, was an emotionally arousing experience which functioned to increase the mean size-judgment of the neutral disc. A second possibility is that phenomenological overestimation may have occurred because of the physical properties of the discs, the apparatus, the lighting conditions, etc. This alternate explanation is supported if the mean of the pooled size-judgments of all three discs (4.18), at the shortest time-interval (.5 seconds), is taken as the best estimate of the apparent size of the stimulus.

According to McCurdy (37) size-accentuation is a function

of an "expansive emotional state." That is, he considers that "value" of an object induces general emotional reactions which are responsible for size-accentuation. Tajfel (57) has also presented a theoretical analysis of the relationship between "value" and "judgment of magnitude" but his position is not supported by the present study. His interpretation is limited by the assumption that ". . . . accentuation of differences will tend consistently towards an overestimation of valued objects only when there exists a valued series in which there is some discernible relationship between magnitude and value" (such as in coin studies). Since no such "valued series in which there is some discernible relationship between magnitude and value" exists in the present study, this explanation for size-accentuation is untenable. The findings support several studies with adults (3,4,10,14,20,52) which have found overestimation to be a function of value. More important, however, is the finding that a negative value leads to more overestimation than a positive value. One other study (43) has demonstrated this previously.

Time-interval between stimulus and response. The findings indicate that the time-interval between the presentation of a stimulus and the making of a response influences size-judgment. The original hypothesis was stated as follows: "As time-interval increases, up to a point, the influence of value and ego-strength upon size-judgment will increase." Beyond a certain time-interval the influence of value and ego-strength upon size-judgments

could be expected to decrease and accordingly the mean constant error should approach zero, although there would be an increase in random errors. The prediction was that there would be an inverted V-shaped curve, the left slope representing an increase in constant size-error as a function of increasing time-interval, and the right slope representing a decrease in constant size-error as a function of further increasing time-interval. The assumption underlying this prediction was that a progressive decrease in the "availability" of a stimulus (up to a point), from a theoretical zero time-interval, is inversely related to the degree to which the response is "stimulus-bound." This means that at a zero time-interval ". . . . such matches as would be made would not differ in their 'error' from those found in the classical psychophysical experiment" (22).

This prediction has some empirical support from a study by Bruner, Postman, and Rodrigues on the judgment of color (16). In this study, "simultaneous comparisons" ("simultaneous" being operationally specified as 10 cm's between the standard and comparison stimuli at a distance of 150 cm's from the S, or a visual angle of 4 degrees 36 minutes) of the standard and variable failed to elicit any significant difference between the stimuli. However, at 80 degrees visual angle, a significant difference did occur. These authors also interpreted their negative results, under the simultaneous time condition, in terms of the response being stimulus-bound.

It was found that size-overestimation was greatest at a relatively short time-interval, but became progressively smaller with longer time-intervals. The hypothesized increase in constant error, as a function of time, up to a point, was not demonstrated. It may be that even the minimum time-interval, i.e., the time required to shift 52 degrees, was too long. However, if the standard and variable discs were placed sufficiently close, permitting absolutely simultaneous comparison, it is inconceivable that high accuracy would not be attained. The predicted curve of constant error as a function of time, would have been produced.

The finding that size-overestimation decreases with time can be explained by two factors: (a) as the stimulus becomes more remote in time it loses its associated value and consequently no longer evokes an emotional response, which was postulated to be one basis for size-overestimation, and (b) as the stimulus becomes more remote in time its physical properties increase in "vagueness" and size-overestimations are increasingly influenced by chance variations so that the mean increasingly approaches accuracy as constant effects, other than actual size of the stimulus, dissipate.

The time-interval dimension in this study is related to the present-absent dimension reported in the literature. However, the literature has not been specific in regard to the time-intervals involved in "present" and "absent." The finding that overestimation decreases as a function of increasing time-

interval, in general, supports those studies which have reported overestimation under stimulus "present" conditions. However, the possibility still remains that some studies which reported negative results under conditions with the standard present, may have been self-defeating because of simultaneous comparison (22).

Ego-strength. The results indicate that ego-strength is significantly related to accuracy of size-judgment. This finding was not predicted in the original hypotheses. The prediction was that ego-strength would influence size-judgment in interaction with value. The results, however, are consistent with the theoretical position taken in several studies (15, 20, 28, 29, 35). The present E, in a previous study (43), and Klein (30), however, did not find that their "perceptual control" and "inference" measures, respectively, both of which should be related to ego-strength, independently indicated any significant relationship to size-judgment. This may be explained by the differences in the personality measures. A more refined ego-strength measure was used in the present study than in a previous similar study (43). Moreover, the Rorschach form-level measure, as used in the present study, in comparison to Klein's "color-word inference" measure, may be more closely related to accuracy in size-judgment as it is a "perceptual" measure like the size-judgment task itself.

The finding that ego-strength, independently from value, is related to size-judgment supports Luchin's criticism (35)

of the strict "value-cognition" approach to perception, and Klein and Schlesinger's view (28) that perceptual theory must cope with the ego-structure of the S. In the past, most studies overlooked the contribution of non-motivational personality characteristics as one of the variables influencing size-judgment.

That the low ego-strength group is more heterogeneous than the other two groups is in itself interesting. This was also found in a previous study (43). It suggests that people obtain low ego-strength scores for different reasons. Possibly a motivational factor is the main determinant for some Ss and a cognitive-ability factor for others.

Interaction of value and time-interval. The results indicate that the interaction of the value of a stimulus with the time-interval between the presentation of the stimulus and the response is significantly related to accuracy in size-judgment. It was found that at all time-intervals a failure value elicited the greatest size-overestimation while a success and neutral value elicited increasingly less overestimation, respectively. However, differences in size-judgments were smallest at the shortest time-interval and became increasingly larger as the time-interval increased. This indicates that time-interval is critical not only in determining the extent to which size-judgments will differ independently of value, but also the degree to which size-judgments differ as a function of value. Stated otherwise, the influence of a failure value on size-

judgment was least affected by an increase in time-interval while a success and neutral value were increasingly more affected, respectively. This phenomenon might be explained in terms of emotional arousal resulting in a fixation effect.

The results further indicated that at the longest time-interval, namely 49 seconds, the mean size-judgment of the failure value was an overestimation, the mean size-judgment of the success value was essentially accurate, and the mean size-judgment of the neutral value was an underestimation. The failure and the success values do not present a problem as they can be interpreted as approaching and reaching mean accuracy, as hypothesized. The underestimation of the neutral value, however, does raise several problems, namely (a) is it simply a chance variation from accuracy, and, as such, consistent with the above interpretation, (b) is underestimation actually occurring, possibly suggesting an overcompensatory mechanism, and (c) could the same underestimation be expected of the failure and success values if the time-intervals were extended beyond the limits of this study? The results suggest that underestimation may have occurred but the findings are equivocal and more research is needed with extended time-intervals. Assuming that underestimation does occur, an overcompensatory mechanism is conceived of as an attempt by the Ss to "undo" their overestimation tendency as the situation becomes increasingly uncertain by going in the opposite direction, namely, underestimation. Another possible explanation is that

the Ss tend to make judgments in terms of some incidental aspect of the current stimulus complex, such as the mid-point of the range of adjustments, when there is a long time-interval between the standard stimulus and the response, that is, when available cues for accuracy are minimal. This was tested and found not to hold for the mid-point corresponded to a completely accurate judgment but it is conceivable that it would for some other variable.

Interaction of ego-strength and time-interval. The results indicated that the interaction of ego-strength and time-interval was not significantly related to size-judgments. At all time-intervals the low ego-strength group demonstrated the greatest size-overestimation and the high ego-strength group the least size-overestimation. While there was a divergence and convergence in size-judgments of the low ego-strength group through time, in comparison to the intermediate and high ego-strength groups, these groups manifested a constant decrease in size-judgments in a relatively parallel fashion through time. The particular time-interval did not seem to matter in this respect.

At the longest time-interval, namely 49 seconds, the size-judgments of the low ego-strength group was an overestimation, the size-judgment of the middle ego-strength group was relatively accurate, and the size-judgment of

the high ego-strength group was an underestimation. This is a replication of the problem encountered with the value and time-interval interaction and the same type of questions are applicable here. However, the results from the present analysis more strongly support an overcompensatory mechanism. This finding might be generalized to support the notion for an overcompensatory mechanism in the value and time-interval interaction data as underestimation also occurred at the 49 second interval in the pooled group's estimations of the failure disc.

It can be argued that in order to investigate time-interval effects, per se, the position of the standard in relation to the variable, would have to be held constant for all time-intervals. A zero time-interval could be obtained only by placing the standard sufficiently close to the variable disc so that both could be fixated simultaneously.

The overcompensatory hypothesis could be further investigated by systematically extending time-intervals beyond the limits of the present study to observe the occurrence or non-occurrence of the same phenomenon with a middle and low ego-strength group (also with a success and failure value). If, in addition, the underestimation of the neutral disc and of the high ego-strength group continued to increase as a function of time this would further support the

notion of an overcompensatory hypothesis, although alternate explanations would be possible. One such explanation is that there is an adaptation effect as a function of time. That is, judgments approach some general dimension based on some incidental variables of the stimulus complex. There seems to be a theoretical advantage to the overcompensatory hypothesis in that it explains both the results on ego-strength and time-interval with one principal.

Interaction of value and ego-strength. The hypothesis tested was that, "The overestimation of valued objects will occur to a greater extent for Ss low in ego-strength than for Ss high in ego-strength. This follows from the assumption that low ego-strength Ss are less able to inhibit their tendency to generalize from internal emotional stimuli to external stimuli than high ego-strength Ss." The results indicated that the interaction of value and ego-strength was not significantly related to size-judgments. A low ego-strength group consistently demonstrated the largest size-judgment for all values and an intermediate and high ego-strength group demonstrated increasingly smaller judgments, respectively. The particular value did not seem to matter in this respect.

Interaction of value, time-interval, and ego-strength. The results indicated that the interaction of these three variables was not significant. Possibly this is a result of limitations in the sensitivity of the ego-strength measure employed or of other personality variables influencing the manner in which

time-interval and value interact to influence size-judgment. In regard to the first consideration, the differences between the ego-strength groups themselves were only significant at the .05 level. That this measure, at least in its present form, accounts for only a minor portion of the inter-subject variability was attested to by the highly significant differences between Ss within ego-strength groups. Room for a more precise or different personality measure which is related to accuracy in size-judgments is also suggested by the significant interactions of Ss with value and time-interval. Of course, another possibility is that the interaction of the analysis of the three variables does not exert a unique effect upon size-judgment.

Type of response measure. Analysis of the psychophysical size-judgments indicated that the value of the stimulus influenced size-judgment. The Chi-square analysis of the verbal frequencies of ranking for the three values also indicated a significant relationship between value and size. As with the psychophysical judgments, the failure value was judged largest. Thus it is indicated that with a psychophysical and verbal measure the failure stimulus elicits a "largest" response. The success value tended (non-significantly) to be ranked as intermediate in size, which is also consistent with the results from the psychophysical measure.

One explanation for the results on the verbal-ranking of the success stimulus not being significant is that the time

between the reinforcement-association procedure and the verbal response was excessive. Since the analysis of variance findings indicated that time-interval is a critical variable, if verbal rankings were made immediately following the reinforcement procedure, significance may have been obtained for all three values. Another possible explanation is that the gross verbal responses were less reliable than the psychophysical measure.

SUMMARY

The present study was undertaken to investigate the effects of an experimentally induced negative, positive, and neutral value on size-judgment. Errors in judgment were also related to (a) time-interval between viewing the standard stimulus and making the size-judgment, and (b) ego-strength as measured by the Rorschach Test. Size-judgments based on a standard psychophysical procedure as well as on verbal ranking of the valued objects were investigated.

One hundred male undergraduate students met collectively to take a Group Rorschach Test. Contingent upon accuracy and elaboration of responses Ss were evaluated for ego-strength. A "low group" was made up of 18 Ss whose scores were the lowest in the total distribution of ego-strength scores. A "middle group" and "high group" were made up of those 18 Ss whose ego-strength scores fell within the middle and at the high end of the range of scores, respectively.

Each S was seen individually for a two hour testing session during which 12 performance tests were administered. By predetermining and controlling scores, each S randomly received four tests on which he obtained a failure, neutral, and success score. In order to relate failure, neutral and success values to particular discs, colored discs were used as test-reward tokens. Each colored disc corresponded to a different level of test performance; "failure", "success", or "neutral."

To counterbalance for color effects the 18 Ss in each ego-strength group were randomly divided into three "color-groups" of six Ss each. The three colors (red, yellow, green) were assigned equally to each of the values.

Following the above reinforcement procedures the Ss were required to estimate the size of each of the value discs by the method of average error. In order to control for the order in which the discs were judged, each color-group of six Ss was divided into three "value-sequence" groups of two Ss each in such a way that the order of value judgments was counter-balanced.

Size-judgments of the discs were made following a 49, 7, and .5 second delay after having last seen the discs. To counterbalance for the order in which the time-intervals were experienced, one S from each value-sequence group made estimates in a descending order (49", 7", and .5") and one made estimates in an ascending order (.5", 7", and 49"). The Ss made four estimates of each standard disc under conditions which alternated between the open and closed position of the circle of light on the apparatus.

After completion of the above procedures, Ss were required to verbally rank the size of the three discs from memory. Subjects were also asked to evaluate their reactions to the experiment by filling out a questionnaire.

The psychophysical data were evaluated by analysis of variance to determine the effects of value of the stimulus,

time-interval between the stimulus and the response, ego-strength of the S, and the interaction of these variables upon size-judgments. Verbal ranking was evaluated by Chi-square for differences in size as a function of value and of ego-strength.

The major results from the psychophysical judgments may be summarized as follows:

1. There were significant differences in size-judgment associated with the value of the discs (.001 level). The failure disc was judged largest, the success disc next largest, and the neutral disc smallest.
2. Size-overestimation, which was general, became progressively less with increasing time-intervals (.001 level).
3. Size-overestimation was inversely associated with ego-strength score (.05 level).
4. There was a significant interaction (.001 level) between the effects of value and time on size-judgment. The amount of decrease for each of the values through time was smallest for the failure value, intermediate for the success value, and largest for the neutral value.
5. There were highly significant (.001 level) individual differences, apart from ego-strength, in estimating size.

The findings for the verbal ranking data indicated a sig-

nificant relationship between value and size. The failure value was judged the largest (.05 level). This finding is consistent with the psychophysical data.

It can be concluded that size-estimates of adults are influenced by (a) the subjective value of the stimulus object, (b) the time-interval between viewing the standard and making the judgment, (c) the ego-strength of the S, and (d) the interaction of time-interval with value.

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Appendix A. Rorschach Ego-strength Data

Summary of Administration Procedures for Group Rorschach Test

Free Association

Subjects were told the following:

1. Some of you may have taken this test before; this will have no effect on your answers.
2. What you will be seeing are inkblots (explained).
3. Your job will be to write in the booklets what you see, what the blots resemble or might be to you.
4. You will see each inkblot for three minutes during which time you will write down what you see.
5. You should number each answer to each slide as you write them.
6. There is a separate page in the booklet for each inkblot, so every time I flash a new inkblot on the screen you turn to the next page.
7. Before going to the next page draw a line under your last response.

(each of the 10 slides were flashed for three minutes)

Inquiry

Subjects were told the following:

1. At this time it is necessary for me to find out exactly where you saw each of the answers you wrote in the booklet.
2. In the booklet you will find a miniature for each of the blots I have shown you. For example: (Card I flashed on screen) some of you might have written (point) butterfly for this area, or dog's head for this area, or legs for this area, or boxing gloves for this area. I want you to draw a circle around that part of the blot within which you saw each of the answers you have written drown and then attach the number of the answer that goes with it (demonstrate).

So far you have told me what you have seen and where you have seen it. It is also important that you tell me all about the card that made you think of the answer you gave. For example: (Card VIII flashed on screen) some of you might have written (point) two bears or animals because they are climbing or stepping for this area; or some kind of flower for this area because of the color; or two cushions because of the satin or silky feel or blueness for this area. Starting in the space "ALTERNATE INSTRUCTIONS FOR INQUIRY" write your elaborations. First write the number of the answer and then elaborate it.

3. Summarize your impressions by putting the answer number in any one, two, three or four sections of the "INSTRUCTIONS FOR INQUIRY." Try to be as accurate as possible.
4. Do the same for your second, third and so on.
5. Any questions?

Rorschach Scoring Criteria for Ego-strength

Basal Score

Inappropriate form	-1.0
Vague or no form (cloud, explosion)	±1.0
Definite but simple form (flower)	±1.5
Non-human form (dog's paw, animal)	±2.0
Human form (face, person)	±2.5*

Additional Points

Movement	± .5
Appropriate use of color	± .5
Two or more things in one percept	± .5
People related	± .5
Appropriate elaboration (two or more details)	± .5
Inappropriate elaboration of details	- .5
Inappropriate use of color	- .5
Inappropriate combinations	- .5

Explanation of Scoring Procedure

Each response was credited with a basal score according to the criteria stated above. Responses then received or lost additional points according to the appropriateness of elaborated determinants. The final score for each response was the sum of the basal score and the additional points. The final score for each card was the sum total of each response on the card.

---

* Human forms were assigned a higher basal score than animal forms because they are correlated with chronological and mental age. In addition, human-form generally involves noting more features, i.e., humans are distinguished in more detail than are animals.

Scores on Individual Rorschach Cards

	Rorschach Cards			
Ss	I	II	III	IV
1	5.5	3.0	3.5	5.5
2	6.5	7.5	4.0	4.0
3	5.0	5.5	6.5	4.0
4	4.5	11.5	12.0	3.0
5	6.0	3.5	3.5	2.0
6	2.0	2.0	3.0	2.5
7	8.5	5.0	8.5	11.5
8	1.5	3.0	3.0	3.5
9	4.0	1.0	4.0	2.0
10	3.0	4.0	4.0	-1.0
11	4.5	7.5	7.0	3.5
12	8.0	6.0	12.0	10.5
13	5.5	6.5	7.5	6.5
14	2.5	3.0	3.0	3.5
15	11.5	12.0	9.5	11.0
16	4.0	5.5	6.0	7.5
17	3.5	5.0	6.5	4.5
18	9.0	6.0	7.5	7.5
19	16.5	8.5	10.5	13.0
20	4.0	6.5	7.0	4.5
21	1.0	4.0	3.5	1.0
22	5.5	6.0	8.5	6.5
23	2.0	4.5	8.0	4.5
24	2.0	2.0	3.5	2.0
25	2.5	5.0	8.5	1.0
26	5.0	3.5	1.5	2.5
27	6.5	3.0	6.0	4.0
28	7.0	5.0	2.5	7.0
29	6.0	3.5	5.5	5.0
30	2.5	4.5	5.0	2.5
31	2.0	2.5	3.5	3.0
32	9.0	3.0	8.0	3.5
33	8.0	5.0	9.0	6.5
34	6.5	5.5	5.0	.5
35	4.0	5.0	3.0	6.0
36	6.0	9.0	7.0	4.5
37	8.5	9.5	5.5	6.5
38	3.0	4.0	6.5	3.0
39	5.0	2.5	1.0	2.0
40	6.0	7.5	7.5	7.0
41	10.0	6.5	8.0	5.0

Scores on Individual Rorschach Cards

Ss	Rorschach Cards			
	I	II	III	IV
42	3.5	5.0	3.5	1.5
43	3.0	.5	5.5	4.0
44	5.5	5.5	3.5	3.0
45	5.5	4.5	8.0	6.0
46	5.5	1.0	3.0	5.5
47	6.5	10.5	5.5	1.5
48	5.5	2.5	2.5	2.5
49	7.5	2.5	6.5	3.5
50	9.0	5.5	11.0	10.0
51	4.0	1.5	2.0	4.5
52	7.0	4.5	11.0	4.5
53	7.0	6.5	8.0	3.5
54	7.0	9.5	11.0	9.5
55	2.0	7.5	3.5	2.0
56	5.0	8.5	6.5	6.5
57	2.5	3.0	3.5	4.5
58	11.0	10.5	3.5	6.0
59	4.5	8.0	7.0	4.5
60	4.5	5.5	6.0	7.0
61	7.0	5.5	2.5	4.5
62	6.5	5.5	6.0	5.5
63	8.5	4.0	3.5	6.0
64	5.0	5.5	5.5	5.0
65	3.0	5.5	3.5	.5
66	11.5	6.0	7.0	2.5
67	5.0	8.5	3.5	6.0
68	11.5	7.0	8.0	6.5
69	10.0	6.0	8.5	5.5
70	6.5	2.5	5.0	4.0
71	1.5	6.0	3.0	2.0
72	3.0	.5	5.5	5.0
73	4.5	4.0	3.5	1.5
74	4.0	1.5	2.5	4.0
75	5.0	8.0	6.0	5.0
76	5.5	5.5	2.5	5.5
77	4.5	4.5	4.0	3.0
78	2.0	2.5	5.0	3.5
79	6.5	7.0	7.0	5.0
80	7.0	8.5	6.0	5.0
81	6.0	4.5	6.5	5.5
82	5.0	3.5	7.0	5.0

Total Scores on Rorschach Cards and

Ego-strength Groups

High Ego-strength Group			Middle Ego-strength Group			Low Ego-strength Group		
S	Score*	Number**	S	Score	Number	S	Score	Number
1	35.5	50	1	19.5	17	1	9.5	24
2	27.0	52	2	23.0	16	2	13.0	43
3	48.5	19	3	19.0	23	3	12.5	26
4	26.5	22	4	19.5	27	4	11.0	31
5	31.0	4	5	21.5	28	5	11.0	9
6	33.0	68	6	23.0	60	6	9.5	21
7	33.5	7	7	22.5	81	7	10.0	10
8	27.0	66	8	20.5	82	8	9.5	6
9	26.5	56	9	21.0	3	9	10.5	39
10	30.0	18	10	22.0	20	10	13.0	48
11	37.0	54	11	22.5	11	11	12.0	14
12	30.0	37	12	18.0	70	12	13.0	38
13	28.5	33	13	19.5	61	13	12.5	65
14	30.0	69	14	19.0	76	14	12.0	51
15	36.5	12	15	21.0	64	15	12.0	74
16	31.0	58	16	22.0	2	16	12.5	71
17	29.5	41	17	23.0	67	17	13.5	73
18	44.0	15	18	20.0	49	18	13.5	57

* Total score on Rorschach cards I-IV

** Subject's number from table "Scores on Individual Rorschach Cards"

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Range and Median Scores of
Ego-strength Groups

Ego-strength Groups	Range of Scores	Median Scores
Low	9.5-13.5	12.0
Middle	18.0-23.0	21.0
High	26.5-48.5	30.5

Appendix B.

Color Blindness and Visual Acuity Questionnaire

Name _____ Age _____

Campus Address _____

Psych. 26 Section _____ Instructor _____

1. Are you color blind? _____ If so, for what colors?

_____

2. Do you wear glasses? _____ If you do wear glasses what is your corrected vision? _____

3. Are you wearing your glasses during this experiment? ____

Note: If you wear glasses be sure to wear them during any part of this experiment.

Appendix C. Irrelevant Task and Instructions

Below you will find a list of scrambled words followed by a space where you are to rearrange the letters into a meaningful word. Some of them are very hard, do not expect to finish them all. How well you do is unimportant as I only want to find out how hard the words are and how many are usually done in a certain amount of time.

maj _____	rotsh _____	gid _____
obtl _____	opord _____	lumeran _____
tasew _____	cafatin _____	termat _____
npsa _____	marw _____	nisg _____
nfyun _____	sparg _____	perap _____
nigr _____	ptek _____	foro _____
ehtrom _____	chith _____	htbor _____
baglera _____	tca _____	dle _____
totoh _____	ceduni _____	dirb _____
necef _____	mand _____	cairh _____
oruf _____	girsp _____	noknw _____
lrotl _____	orgw _____	flet _____
umr _____	rogup _____	tacch _____
nocyar _____	terem _____	kaet _____
anel _____	ledh _____	lorl _____
borth _____	otlurim _____	rou _____
taml _____	wcor _____	slafe _____

Appendix D. Performance Tests

Content of Performance Tests

Tests 1, 2, and 10

Subtests of the Wechsler-Bellevue Intelligence Scale, Form I (58, pp. 178-185). Test I used "Demonstration I" for the practice trial and "Design 7" for the test. Both came from the "Block Design" subtest. Test 2 used the "Manikin" for the practice trial and the "Profile" and "Hand" for the test. All three came from the "object Assembly" subtest. Test 10 used "Hold Up" for the practice trial and the "Fish" and "Taxi" for the test. All three came from the "Picture Arrangement" subtest.

Tests 3 and 5

See Greene (23, pp. 280,283) for further information about these tests.

Tests 4, 8, and 11

See Mursell (46, pp. 227-228) for further information about these tests. The stimulus material for Test 11 follows.

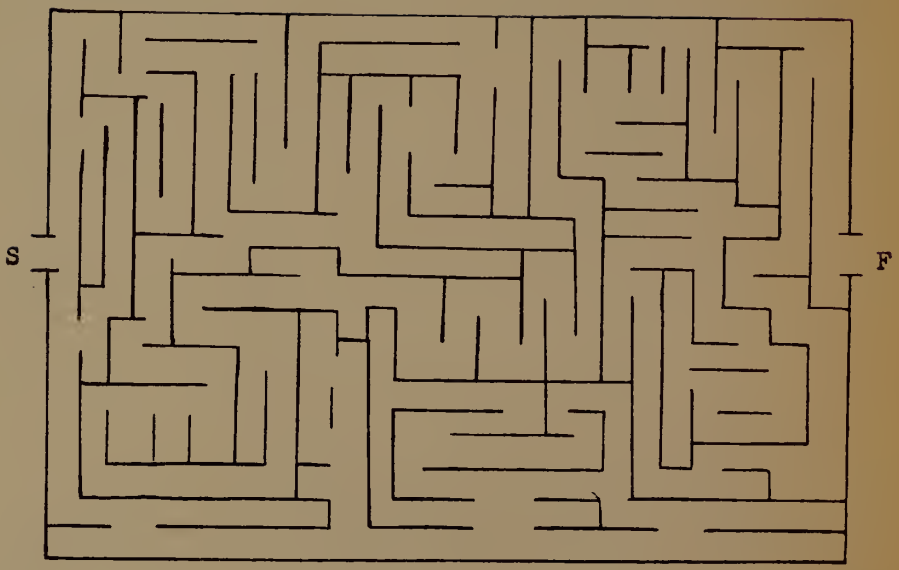
Test 7

"Casuist Form Board" and "Two Figure Form Board" subtests from the Pintner-Paterson Performance Scale. See Anastasi (2, p. 241) for further information about these tests.

Tests 6, 9, and 12

The stimulus material for these tests are original. A model of each follows.

Test 6

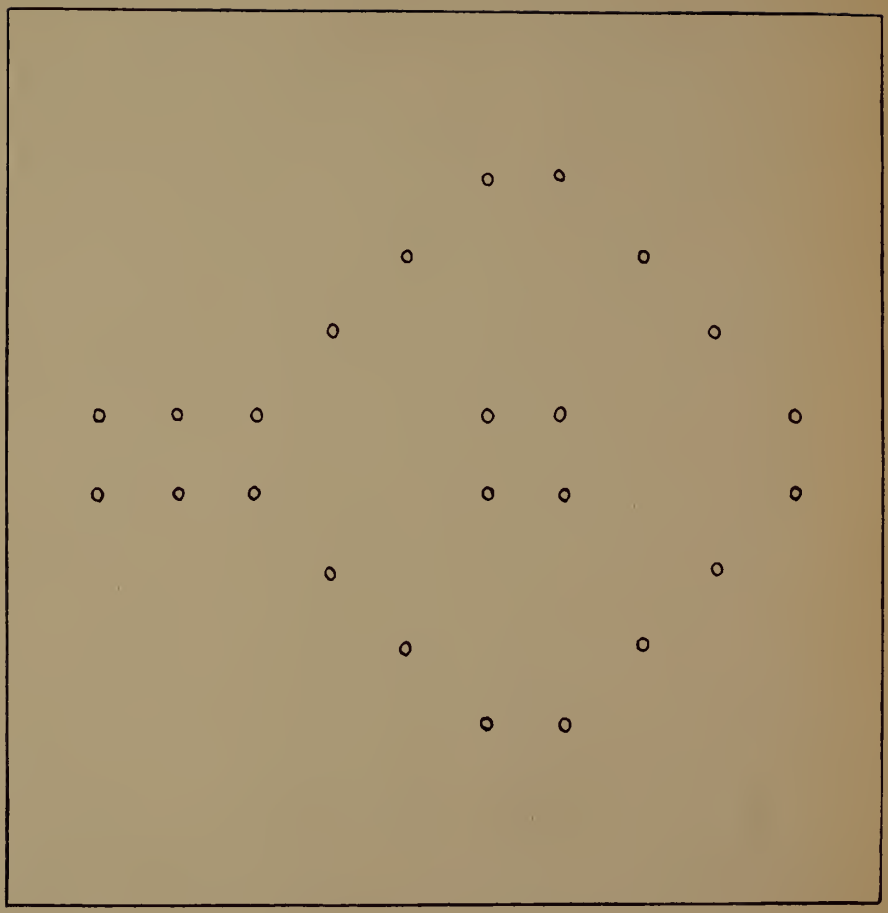


Test 9

1	2	3	4	5	6	7	8	9
								

7	5	4	3	9	2	8	1	3	6	5	2	4	7	8	6	9
2	1	8	4	9	6	4	7	8	4	3	2	9	1	4	7	6
3	9	4	2	6	5	1	3	4	6	9	2	8	4	7	6	3
9	5	2	7	8	1	6	4	9	3	1	8	4	6	2	5	7

Test 11



Test 12

W E L C O M E T O V E R M O N T

y g n e q o g v q x g t o q p v

W E L C O M E T O V E R M O N T

u x c f j m a d m p k n c f r u m p t w c f p s k n m p l o r u

Instructions for Administration of Performance Tests

Test 1 Kohs Block Design

Here are some blocks which are all colored in the same way; red, white, red and white, etc. If we want to make this design (pointing) we would lay the blocks out this way (demonstrate). Using these 16 blocks I want you to make this design (pointing). Work as fast as you can and say finished when you have it completely finished.

Test 2 Object Assembly

In this test you will be expected to piece together the parts that make up the object. Here is a boy (manikin), practice on it. Turn around while I lay out two different objects. The pieces for the two objects will be mixed together. I can not tell you what they are. When I say go, turn around, figure out which pieces go together and assemble the two objects.

Test 3 Whipple's Steadiness Test

In this test you are to hold the pointer as steady as possible in the hole. Every time you touch the side this counter (pointing) will record it. Try this larger hole (pointing) for a 45 second practice trial. When I say go, place the pointer in this hole (pointing) and hold it as steady as possible.

Test 4 Koerth Pursuit Test

During this test you will be required to make contact with the rotating disc with this pointer. Try it first at this slow speed to get the idea, I will let you practice for 45 seconds. When I say go, try to make as many contacts as you can in one minute. This counter (pointing) will keep a record.

Test 5 O'Connor's Wiggly-Blocks

I want you to watch carefully as I take these blocks apart. When I have them separated I will ask you to put them together.This first trial will only be for practice. Assemble them as fast as you can. This time I want you to turn around while I take them apart and when I say go, turn around and put the blocks together as fast as you can.

Test 6 Paper and Pencil Maze

In this test you are to draw a continuous line through the maze from the point marked "S", for start, to the point marked "F", for finish. Work as fast as you can. Do not lift your pencil or cross a line.

Test 7 Form Board

Here are two form boards from which I have removed the pieces. Your job is to determine how the pieces fit and to place them as quickly as possible. There will not be any practice trial. When I say go, work as fast as you can.

Test 8 Minnesota Rate of Manipulation

In this test you will be required to turn each cube over as fast as you can, working across the rows. You can use both hands if you wish. Watch as I demonstrate. You try the first row for practice. When I say go, work as fast as you can, make sure each cube is completely in the hole.

Test 9 Digit Symbol

Here is a series of nine numbers and each one has its own symbol under it. Here are some numbers, in mixed order, with room under each number to put the symbol that goes with it. For example, watch me do these three numbers (demonstrate). When I say go, you finish the rest of them. Work as fast as you can. Do not skip any, go from one line to the next.

Test 10 Picture Arrangement

In this test you are to arrange pictures into their proper sequence so they tell a good story. Two different series will be mixed together so that you will have to separate the cards as well as put them in a proper sequence. Practice on these first. Turn around while it is being laid out. When I say go, turn around and arrange the two series.

Test 11 Tweezer Dexterity

In this test you are to pick up the pins with the tweezer and place them in the board as indicated by the design I will show you. There will not be a practice trial. Do not touch the pins with your fingers. When I say go, work as fast as you can.

Test 12 Code Interpretation

Here is a message that is written in code. This is what we want to say, "Welcome to Vermont" (pointing) and here it is written in code (pointing and read the code). Each letter here in the code stands for a letter up here in the message (indicate each letter in the code and the corresponding letter in the message). You figure out how it goes, what the code system is, and then write "window" in code here (pointing). That was just a practice trial. When I say go, figure out the relationship of this second code and again write the word "window" in code but this time according to the second code.

Appendix E. Attitude Questionnaire

Attitude Questionnaire

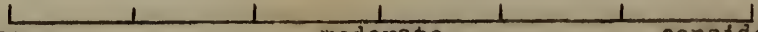
Your ideas and feelings about the tests you took and size judgments you made may well have influenced the results. Consequently it is important toknow what the study meant to you and how you felt about what was going on. Answer each of the following questions by placing a check mark above the appropriate space on each scale. Remember to indicate what your feelings were at the time, not what they are now. Accuracy is very important, so please try to remember as well as you can.

1. How important was it for you to do well on the series of tests you took in the first part of the experiment?

did not matter at all — fairly concerned — very important

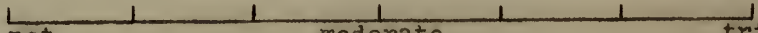
2a. Which disc (failure or success) did you react to with stronger feelings? _____ Rate how much stronger this feeling was.

b.



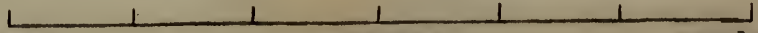
no difference — moderate difference — considerable difference

3. How hard were you trying to be accurate on your size judgments?



was not trying — moderate effort — tried hard

4. In the past it has been found that some students in this type of experiment believe the test scores are fixed because they fail more tests than they expected. Since this attitude has an influence on test performance, it is important to know what your thoughts were in this respect.



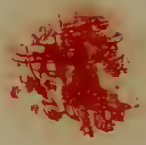
no such idea — moderate feeling — completely convinced

Individual Scores on Attitude Questionnaire

High Ego-strength Group						Middle Ego-strength Group						Low Ego-strength Group					
	Question						Question						Question				
S	1	2a	2b	3	4	S	1	2a	2b	3	4	S	1	2a	2b	3	4
1	6	F	4	5	2	1	5	F	4	4	2	1	6	F	6	6	1
2	4	F	5	6	1	2	4	F	4	6	1	2	4	S	5	5	1
3	3	F	3	6	1	3	6	S	1	6	1	3	5	F	6	5	2
4	3	S	6	6	1	4	6	S	6	6	1	4	6	S	4	6	4
5	4	F	5	4	1	5	5	F	6	6	1	5	5	S	6	4	1
6	6	F	6	6	1	6	4	F	4	6	2	6	4	S	1	6	1
7	4	F	5	5	1	7	3	F	1	5	1	7	6	F	4	6	1
8	6	F	4	5	1	8	6	S	4	4	2	8	3	S	3	6	1
9	6	F	6	6	1	9	6	S	6	6	4	9	5	F	5	6	1
10	6	S	3	5	1	10	5	F	5	4	2	10	3	S	1	5	2
11	6	S	4	6	1	11	4	S	5	6	1	11	4	F	2	6	1
12	6	F	4	5	1	12	6	F	4	6	1	12	4	S	4	5	1
13	6	F	5	6	2	13	6	F	5	6	4	13	5	S	4	6	2
14	4	F	5	6	1	14	3	F	6	6	1	14	5	F	4	6	1
15	6	F	6	5	1	15	6	F	4	6	1	15	5	F	5	6	1
16	4	F	5	6	1	16	5	S	5	5	1	16	4	F	1	5	1
17	4	F	6	6	1	17	5	S	5	5	1	17	3	F	3	6	1
18	6	F	6	6	1	18	5	F	4	6	1	18	3	S	6	6	1

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Appendix F. Standard Discs

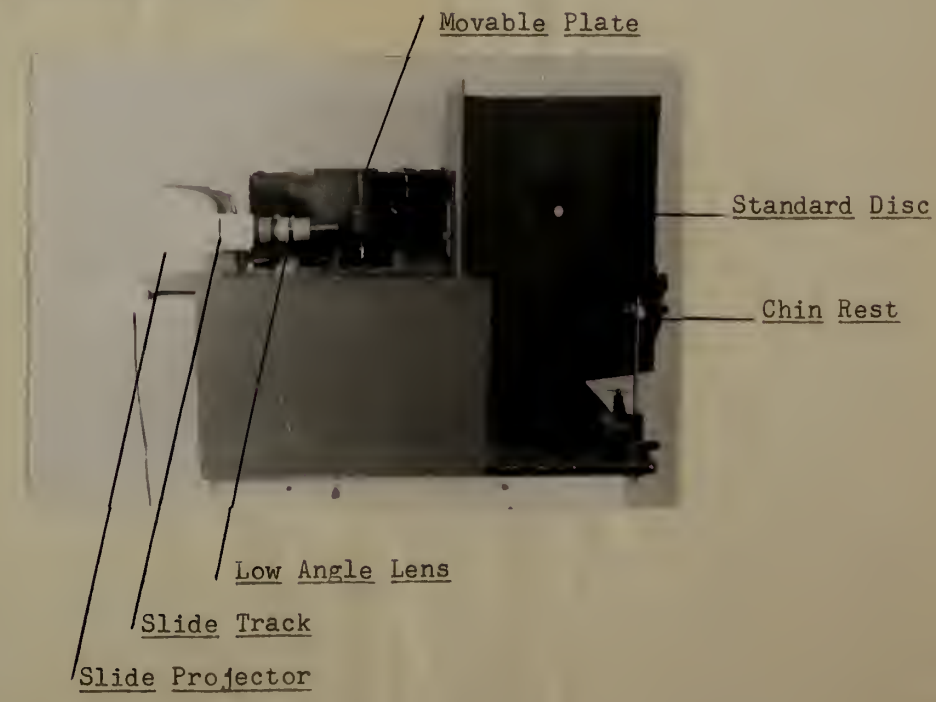


Red

Yellow

Green

Appendix G. Apparatus



Appendix H. Psychophysical Response Data

Mean Constant Errors of Size-estimations for

High Ego-strength Group*

Ss	Time-interval (seconds)								
	.5			7			49		
	Failure	Neutral	Success	Failure	Neutral	Success	Failure	Neutral	Success
1	20	20	20	21	20	21	22	20	20
2	21	19	18	18	16	17	16	12	12
3	21	20	18	20	19	18	20	20	20
4	27	21	22	18	13	15	16	10	12
5	22	20	27	23	22	23	24	22	22
6	23	21	25	35	37	26	29	30	28
7	25	23	26	25	22	27	23	19	22
8	19	14	20	20	14	19	14	10	7
9	27	25	25	27	21	25	23	18	22
10	20	20	20	21	20	21	19	19	18
11	21	20	22	21	18	21	22	13	17
12	21	22	24	22	22	33	24	15	20
13	21	20	20	21	20	22	19	19	19
14	20	20	21	20	19	19	20	20	20
15	21	22	22	22	21	23	19	12	13
16	30	26	26	22	19	21	18	12	16
17	20	19	18	19	16	17	16	12	14
18	27	25	26	27	21	25	22	18	22

* Errors are reported in number of 1/32 of an inch diameter error plus the constant 20 to eliminate negative numbers. Figures below and above 20 correspond to underestimation and overestimation, respectively.

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Mean Constant Errors of Size-estimations for

Middle Ego-strength Group*

Ss	Time-interval (seconds)								
	.5			7			49		
	Failure	Neutral	Success	Failure	Neutral	Success	Failure	Neutral	Success
1	25	34	31	32	29	31	31	33	33
2	27	25	25	24	25	20	28	23	28
3	31	27	27	32	30	30	29	26	22
4	27	24	23	20	17	15	11	19	17
5	18	21	20	18	16	16	21	16	19
6	24	22	24	23	18	22	22	15	18
7	26	26	25	28	27	25	26	25	29
8	29	20	21	26	29	25	24	19	20
9	25	20	20	41	26	27	30	16	27
10	19	20	19	21	19	21	15	12	19
11	29	22	29	30	25	25	22	18	17
12	24	22	24	24	17	22	23	16	19
13	22	24	23	21	18	24	23	19	20
14	28	27	29	24	17	26	32	19	19
15	25	26	31	21	18	19	21	18	20
16	26	22	26	21	20	21	22	16	19
17	20	20	19	22	21	24	19	15	15
18	29	27	29	23	21	20	22	11	22

* Errors are reported in number of 1/32 of an inch diameter error plus the constant 20 to eliminate negative numbers. Figures below and above 20 correspond to underestimation and overestimation, respectively.

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Mean Constant Errors of Size-estimations for

Low Ego-strength Group*

Ss	Time-interval (seconds)								
	.5			7			49		
	Failure	Neutral	Success	Failure	Neutral	Success	Failure	Neutral	Success
1	25	26	29	28	24	21	19	20	20
2	42	44	38	37	42	45	33	27	25
3	44	37	39	39	37	45	34	27	27
4	24	19	19	28	30	24	23	17	20
5	33	32	25	45	33	36	38	26	15
6	20	20	19	16	16	14	13	11	18
7	44	44	39	37	42	45	33	27	25
8	25	24	22	26	20	19	30	18	23
9	25	19	22	17	15	16	16	7	14
10	20	20	19	21	21	18	19	21	17
11	23	22	21	19	20	20	20	18	18
12	23	18	24	20	18	19	20	2	12
13	24	21	22	25	23	24	34	26	31
14	14	15	17	17	13	10	17	11	14
15	23	22	22	30	28	28	25	15	25
16	27	33	30	32	32	29	28	25	30
17	27	26	29	33	25	28	30	30	23
18	20	21	24	31	22	29	26	26	26

* Errors are reported in number of 1/32 of an inch diameter error plus the constant 20 to eliminate negative numbers. Figures below and above 20 correspond to underestimation and overestimation, respectively.

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Appendix I. Verbal Size Ranking of Value Discs

High Ego-strength Group				Middle Ego-strength Group				Low Ego-strength Group			
	Value				Value				Value		
S	F*	S	N	S	F	S	N	S	F	S	N
1	L**	M	S	1	L	S	M	1	M	S	L
2	L	S	M	2	S	M	L	2	L	S	M
3	S	L	M	3	L	M	S	3	L	S	M
4	M	L	S	4	S	M	L	4	S	L	M
5	L	M	S	5	S	M	L	5	L	M	S
6	M	L	S	6	L	S	M	6	L	S	M
7	L	M	S	7	S	L	M	7	L	M	S
8	M	S	L	8	L	M	S	8	M	S	L
9	L	S	M	9	L	M	S	9	L	M	S
10	M	S	L	10	M	S	L	10	L	S	M
11	M	S	L	11	M	L	S	11	S	L	M
12	M	L	S	12	L	S	M	12	S	L	M
13	M	S	L	13	L	S	M	13	L	M	S
14	L	M	S	14	S	M	L	14	S	L	M
15	L	S	M	15	S	M	L	15	L	M	S
16	S	M	L	16	M	L	S	16	S	M	L
17	L	S	M	17	L	M	S	17	S	L	M
18	L	S	M	18	S	M	L	18	M	S	L

* F = failure value; S = success value; N = neutral value
** L = largest; M = middle; S = smallest

Note- Subject numbers on all tables involving divisions according to ego-strength correspond to the same Ss

Appendix J. Individual Data Sheet

Subject _____ Number ____ Psych. 26 Section ____

Color-value group: Failure _____
Neutral _____
Success _____

Test	Score	Test	Score	Test	Score
1.		5.		9.	
2.		6.		10.	
3.		7.		11.	
4.		8.		12.	

Size-estimations:

		Value-order	
	___ ___ ___	___ ___ ___	___ ___ ___
	___ ___ ___	___ ___ ___	___ ___ ___
	___ ___ ___	___ ___ ___	___ ___ ___
Time-interval (___)	___ ___ ___	(___) ___ ___ ___	(___) ___ ___ ___
Mean	___ ___ ___	Mean ___ ___ ___	Mean ___ ___ ___

Verbal Judgments:

Latgest _____ Middle _____ Smallest _____

Ego-strength Group _____

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