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## An Analysis of the Content of Perceptual Responses to Randomly Derived Stimuli

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*Abstract.* In order to understand the role of the stimulus in form perception, an analysis of perceptual responses and stimulus characteristics must be undertaken. Previous research was focused upon the characteristics of the stimulus. This study presents a first approach to categorization of response.

Objective, randomly-derived stimuli were presented tachistoscopically to Ss, who responded with their associations to the stimuli. The data suggest that the categories are meaningful ways of construing these responses. Some categories seem to be basic, while others require further differentiation. Hypotheses for future research have been obtained from these data.

Koffka (1935) defined perception as the study of why things seem to us as they do. In some areas, this study has gained many sound insights, but this is less true of the area of form perception. In the specific area of form perception which has to do with determining the stimulus characteristics which elicit a specific perceptual response, very little is known. But work is being done which may eventually lead to a psychophysics of shape. To put it more succinctly, we would like to understand what there is about or within a stimulus which is utilized by Ss when they categorize and verbalize their responses to that stimulus.

In order to begin working toward this goal, we need stimuli which can be objectively and quantitatively manipulated and which are not actually encountered in the normal environment of the S. The shapes of Attneave and Arnoult (1956) fit our specifications. They are constructed according to specifiable, objective methods, can be quantitatively varied and are "non-sense" shapes in the sense that meaningful bias does not enter into their construction. In a sense, they can be said to have no objective meaning in themselves, although they do possess potentially meaningful stimulus characteristics, such as angularity, complexity, stimulus information, symmetry or asymmetry, size, area, etc.

Shapes of this type were used by Arnoult (1960) in his attempt to predict perceptual responses from stimulus characteristics. One of the tasks required of his Ss was that they write down all associations aroused by a one-minute exposure of each stimulus. The mean number of associations was taken as the scaled meaningfulness of the stimulus. About 50% of the variance

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associated with judgments of meaningfulness could be accounted for by physical characteristics of the stimulus. His conclusion suggests that, despite the widespread notion that associations are generally dependent upon past experience, this study's ability to account for substantial amounts of the variance in terms of physical characteristics alone suggests that so-called "nonsense" forms can be related physically to characteristics of meaningful objects in the real world of the S.

We have been conducting similar form perception experiments for some time. We have noticed that an uncritical acceptance of all associations does not adequately describe the meaningfulness of the stimulus. This is because many responses are merely restatements of a general category of response, this latter being related to the stimulus characteristics. For example, if the form is a simple circle, a S may respond "hoop", "circle", "ring", "band", and "ball". Thus we have received five responses, but it seems likely that we are not dealing with five different and distinct organizations of the physical characteristics of the stimulus. It seems more likely that the S has initially associated one or a few broad categories of response and then associated secondarily the specific responses given. In the example, the dimension of roundness seems to be a common element in all the *Rs*, but some of the *Rs* have a three-dimensional quality that the others lack. When we begin to use more complex shapes, the possibilities for organization of stimulus characteristics becomes more complex. Therefore, it is important that we begin to quantify response categories as well as stimulus characteristics. This paper represents a first attempt at such categorization.

## METHOD

### *Subjects*

The subjects used in the experiment were 30 volunteer members of an introductory psychology course at Iowa State University. They received extra credit in the course for taking part in the experiment. The subjects were all males ranging in age from 18 to 20 years old. None had ever previously participated in a psychological experiment.

### *Apparatus*

The apparatus used in this experiment has been described in a previous study (Karas, et al., 1961).

### *Stimuli*

Two classes of stimuli were used for purposes of comparison. Nine shapes were derived from large detail areas (D) of the Rorschach ink blots and angularized by a reversal of the process outlined in Method 1 of Attneave and Arnoult (1956). These

shapes had been used previously by Edelman (1960). Ten nonsense shapes were derived directly by the same Method 1, one of which serving as a sample. All nineteen shapes contained  $24 \pm 2$  points and were constructed of black construction paper and mounted on a white cardboard background.

### *Procedure*

Ss were instructed to look at the stimulus for the full 10 second exposure period and verbally report their associations as soon as these occurred to them. More than one association could be reported. A sample shape was exposed in order to clarify the procedure. After *E* was satisfied that *S* fully understood his task, the 18 experimental stimuli were exposed in a pre-determined, randomly-derived order.

### *Categories*

The content of each response was classified into three major bipolar categories as a first approximation to categorization. These categories were: animate vs. inanimate, movement vs. non-movement, and abstract vs. realistic. Each response was categorized independently on each dimension; unclassifiable *Rs* were placed in a miscellaneous category.

Each category was operationally defined as follows:

(a) animate-inanimate: responses with references to living things as opposed to responses which referred to non-living objects (e.g., animal vs. mineral).

(b) movement-nonmovement: responses including the present participle of any verb (walking, running) as opposed to responses without such specification (e.g., bear walking vs. funny bear).

(c) abstract-realistic: responses which contained an abstract idea or generalization as opposed to responses which were concrete, tangible and specifiable (e.g., anxiety vs. table).

## RESULTS

Table 1 presents the results for the categorization of animate versus inanimate responses. A third category, called "combination", was established to include those responses which contain both animate and inanimate elements. Differences among categories and between classes of stimuli were marked. The greater number of responses to angularized shapes, as opposed to nonsense shapes, is the same in each of the following analyses, since the only disparities among the row totals are due to a comparatively few unclassifiable responses. No interaction is indicated.

Table 1. Number of Responses per Category and per Stimulus Class

Stimulus Class	Categories			Total
	Animate	Inanimate	Combination	
Nonsense	136	94	23	253
Angularized	167	132	29	328
Total	303	226	52	581

Categorization of the dichotomy movement versus non-movement may be found in Table 2. Once again, the difference between categories is marked. In this case, however, a class-category interaction is evident. This interaction is caused by a greater number of movement responses to the nonsense shapes than to the angularized shapes and a correspondingly large number of nonmovement responses to the angularized shapes than to the nonsense stimuli.

Table 2. Number of Responses per Category 2 and per Stimulus Class

Stimulus Class	Categories		Total
	Movement	Non-Movement	
Nonsense	71	186	257
Angularized	49	282	331
Total	120	468	588

An even more clear-cut difference between categories may be found in Table 3, which presents the results of the categorization of the abstract-realistic dichotomy.

Table 3. Number of Responses per Category 3 and per Stimulus Class

Stimulus Class	Categories		Total
	Abstract	Realistic	
Nonsense	17	240	257
Angularized	24	307	331
Total	41	547	588

The marked differences between categories in each of the attempts at categorization suggests that these are meaningful ways of classifying the data in form perception experiments. Certain of the categories used seem to be capable of further differentiation, whereas others are probably as distinct as they need to be. Both animate and inanimate categories can probably be broken down further. For example, the animate category could be broken up into general categories of living things, such as animal vs. vegetable, or, within the animal category, human vs. non-human; the inanimate category could be broken down to include naturally occurring objects vs. man-made devices, etc. The category of "combination" perhaps should be broken down by assigning its several response elements to appropriate other categories, as is done in Rorschach scoring.

Movement responses can also be differentiated into movement of various types of animate entities and various kinds of inanimate devices or objects. Further differentiation may not be

necessary because of the relatively few responses classified in this category. The category of nonmovement is difficult to break down, although the results suggest that it is capable of much further differentiation. For purposes of this study, nonmovement provided a convenient opposition to movement, but it seems likely that this category is the least independent of all those used. For example, many inanimate responses were also nonmovement. Indeed, the relationships and overlap among even these three attempts at categorization must be considered further. The nonmovement category seems to be the only one which is so highly related to other categories, but further estimations of inter-correlations should be essayed.

The abstract category seems to provide the lone example of final categorization. It is a useful category for ideational concepts but the sparse response total suggests that it is sufficiently broad as to include all such responses and not so broad as to be unwieldy or provide a great deal of overlap. Conversely, the realistic category seems to be so broad as to be unuseable in its present form. Only as an initial or screening categorization might it be useful; that is, if we desire to build a shape which will reliably elicit responses of ideas rather than things, this dichotomy would be used. In general use, however, this category seems to include too much.

Once these next steps at categorization are completed, the correlation of categories and stimulus characteristics may be begun. A small amount of information may be gleaned on this subject from the present study. The data suggest that, for two kinds of categorization, the two stimulus classes did not differ in the proportions of responses assigned to each category and that this occurred despite differences obtained between stimulus classes when considered across all categories. Thus, the dichotomies animate-inanimate and abstract-realistic seem not to be affected by stimulus differences. This is in itself an extremely interesting result if it can be generalized to include stimuli drawn from other stimulus-domains, i.e., constructed by other rules. For example, some form perception experiments at Iowa State have made use of a series of shapes taken directly from the Rorschach ink-blots. Should the same proportion of responses hold for this class also, we may be dealing with an invariant quality of perceptual response. On the other hand, should this generalization not hold, we have the start of a method for discovering shape characteristics which account for these differences.

This generalization (i.e., response unaffected by differences between stimulus classes) does not hold for the movement-non-

movement dichotomy. The apparent interaction suggests that a larger proportion of movement responses occurred in response to the nonsense shapes, while the angularized shapes yielded a greater proportion of non-movement responses. While it will probably be useful to compare these results with other classes of shapes, it is feasible to hypothesize at this point that stimulus characteristics of the two classes of shapes differ and that these differences are demonstrated by differences in response as indicated by this category.

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