DOCUMENT RESUME

ED 115 667 TM 004 937

AUTHOR Forsyth, G. Alfred; Huber, R. John

TITLE An Individual Differences Analysis of Double-Aspect Stimulus Perception.

PUB DATE [Nov 74]

NOTE 16p.; Paper presented at the Annual Meeting of the Psychonomic Society (15th, Boston, Massachusetts, November 1974)

EDRS PRICE MF-$0.76 HC-$1.58 Plus Postage

DESCRIPTORS Attention; *Cognitive Processes; Factor Analysis; Homogeneous Grouping; *Individual Differences; Information Processing; Matrices; Models; *Multidimensional Scaling; Perception; *Response Mode; Situational Tests; Stimuli; Visual Perception; *Visual Stimuli

ABSTRACT

Any theory of information processing must address both what is processed and how that processing takes place. Most studies investigating variables which alter physical dimension utilization have ignored the large individual differences in selective attention or cue utilization. A paradigm was developed using an individual focus on information processing. The purposes of this paper were to: (1) review the essential features of this paradigm, and (2) discuss its use as a beginning step in the investigation of double-aspect, human vs. nonhuman stimuli. Ten double-aspect, human vs. nonhuman stimuli were presented to a heterogeneous sample of 520 first, third, fifth, ninth, eleventh graders, college students, and state hospital patients classified as neurotics, schizophrenics, or sociopaths, for identification. An individual-differences multidimensional scaling analysis resulted in a four-dimensional stimulus space used to subgroup like perceiving people. Characterization of the responses to the double-aspect stimuli by each subgroup demonstrated the value of the approach in studing selective information processing. (Author/BJG)

AN INDIVIDUAL DIFFERENCES ANALYSIS OF

DOUBLE-ASPECT STIMULUS PERCEPTION [1]

G. Alfred Forsyth[2] and R. John Huber

University of New Hampshire Merideth College

1 Presented at the Fifteenth Annual Meeting of the Psychonomic Society in Boston, Massachusetts, November, 1974

2 Reprint request address: Department of Psychology
University of New Hampshire
Durham, N.H. 03824

AN INDIVIDUAL DIFFERENCES ANALYSIS OF

DOUBLE-ASPECT STIMULUS PERCEPTION

Abstract

Ten double-aspect, human vs. nonhuman stimuli (e.g., vase - faces) were presented to a heterogeneous sample of 520 individuals for identification. An individual - differences multidimensional scaling analysis resulted in a four-dimensional stimulus space used to subgroup like perceiving Ss. Characterization of the responses to the double-aspect stimuli by each subgroup demonstrated the value of the approach in studying selective information processing.

AN INDIVIDUAL DIFFERENCES ANALYSIS OF

DOUBLE-ASPECT STIMULUS PERCEPTION

Any theory of information processing must address both what is processed and how that processing takes place. A number of information - processing theorists (e.g. J.J. Gibson, 1966; E.J. Gibson, 1969; Garner, 1974) have been redirecting our attention to the definition of the stimulus. The identification of potential distinctive features for specified stimulus domains and an examination of variables affecting the utilization of those features have been central concerns in our program of research on selective perceptual attention. An assumption of the research has been that perception consists of an active search for and selection of distinctive physical dimensions of multidimensional stimuli. It is our job to determine the dimensions to which observers are selectively attending. The stimulus domains used in these psychophysical investigations have included random polygons (Figure 1), schematic faces (Figure 2), and human faces (Figure 3).

Most studies investigating variables which alter physical dimension utilization have ignored the large individual differences in selective attention or cue utilization. When we try to formulate models for how a number of dimensions are combined in making perceptual judgments, the problem of individual differences looms even larger. The outstanding contributions of Tucker and Messick (1963) and Carroll and Wish (1974) offer a major step forward in the inclusion of individual differences concerns in analyses of perceptual and information processing data. We have developed a paradigm in our psychophysical research program at University of New Hampshire using this individual differences focus on information processing (Forsyth, 1973). Its application in the psychophysical study of random polygons, human faces and schematic faces (e.g., Forsyth and Shor, 1974) is resulting in a much clearer understanding of selective attention in information processing with those stimulus domains.

The purposes of this paper are (1) to review the essential features of the paradigm and (2) to discuss its use as a beginning step in the psychophysical investigation of double-aspect, human vs. non-human stimuli.

The major steps of the individual differences multidimensional scaling paradigm include:

(1) Gathering information - processing scaling data across a variety of stimulus by situation combinations;

(2) Using a components factor analytic procedure to obtain a rotated factor matrix with factor loadings on stimulus situation combinations and factor scores on subjects (this assumes there is some specifiable number of interpretable dimensions underlying the stimulus-situation combinations presented);

(3) Forming homogeneous subgroups of like-perceiving subjects based on their Euclidean distances from each other (Ward, 1963);

(4) Pooling the scaling data for each homogeneous subgroup to differentially characterize the subgroups on the basis of the nature of the information processed under specified treatment conditions (this typically involves a subgroups by stimulus by situation mixed design analysis of variance (Winer, 1971)); and

(5) Searching for individual differences variables which differentiate each information processing subgroup from other subjects not in that subgroup.

While the paradigm is proving very valuable in investigations of attempts to manipulate selective attention to specific dimensions of specified stimulus domains, our hope was that it might also be valuable at the early stages of a psychophysical approach to studying double aspect stimuli. Specifically we examined human vs. non-human responsiveness by 520 subjects to ten double-aspect, human vs. non-human stimuli (Figure 4). The selection of the stimuli and subjects were based on an attempt to investigate predictions stemming from Adler's concept of social interest and perceptual selectivity (Huber and Forsyth, 1972). While that study formed stimulus groupings on an apriori basis, the present re-analysis involved a stimulus grouping using the individual differences multidimensional scaling paradigm.

METHOD

Some of the stimuli shown in Figure 4 are obviously familiar to everyone. Jack Huber has either modified previously described stimuli (e.g.: Vase-Faces by Rubin, 1915; Rabbit - Pirate by Leeper, 1935; Dog - Chef by Wallach and Austin, 1954; or Rat - Man by Bugelski and Alampay, 1961) or created new ones in order to achieve human responses from approximately 50% of a college freshman sample. The 520 subjects in our study consisted of first, third, fifth, seventh, ninth, and eleventh graders, college students, and state hospital patients classified as neurotics, schizophrenics or sociopaths.

Each of the 520 subjects was individually shown each of the ten stimuli for one second per stimulus. Subjects were asked to describe what they saw following each stimulus presentation. Each response was scored as human or non-human. In addition to the 10 double-aspect stimuli, four single-aspect, non-human stimuli were shown.

RESULTS

A principle components factor analysis of the data indicated there were four stimulus factors accounting for 21, 19, 16, and 15 percent of the variability respectively. The stimuli comprising each of the four factors were (see Figure 4):

Factor 1: Ear - Squirrel (7), Nose - Cliff (8) and Mouth - Frog (10)

Factor 2: Face - Cliff (2), Man - Rat (3), and Pirate - Rabbit (5)

Factor 3: Faces - Vase (1) and Chef - Dog (4)

Factor 4: Ear - Questionmark (6) and Mouth - Mountain

An H-group Euclidian distance analysis (Ward, 1963) was performed on subject factor scores. While this procedure resulted in several categorizable subgroups, we will limit our discussion in this paper to four pairs of subgroups and their relationship to the stimulus factors and to individual classification in terms of age level or diagnostic category. Specifically, for each stimulus factor, w- will characterize the group selectively making human responses and the group selectively making non-human responses to the stimuli comprising that factor. Table 1 presents a summary of the categories of individuals comprising each group. Chi Square analyses of the data in Table 1 indicated different distributions of human and non-human responders across the subject categories on the first three stimulus factors. Chi Square values (4 d.f.) for stimulus Factors 1, 2, and 3 were 30.97 ($p < .01$), 19.00 ($p < .01$) and 11.69 ($p < .02$) respectively. On Factor 1 stimuli (Ear-Squirrel, Nose-Cliff, and Mouth-Frog) the very young (Grades 1 and 3) and the Institutionalized categories produced most of the "non-human" responders. On Factor 2 stimuli, (Face-Cliff, Man-Rat, and Pirate-Rabbit) the very young again had a disproportionately large number of "Non-human" responders, but a large proportion of the institutionalized subjects made "Human" responses. Factor 3 stimuli (Faces-Vase and Chef-Dog) resulted in the young (grades 1, 3, 5, and 7) producing a disproportionate number of "Non-human" responders. The distribution of "Human" vs "Non-human" responders to these Factor 3 stimuli was almost identical for Institutionalized, college, and Grades 9 and 11 subjects. No evidence obtained for differential selective responding to the Factor 4 stimuli (Ear-Questionmark and Mouth-Mountain) for the five subject categories (Chi Square= 1.676, $p > .20$). There was some suggestion that selective Human vs. Non-human responding to Factor 4 stimuli may be different for different categories of institutionalized subjects. Specifically, the number of Human vs. Non-human responders to Factor 4 stimuli was 1 vs. 2 for neurotics, 1 vs. 4 for schizophrenics, and 5 vs. 0 for sociopaths.

DISCUSSION

The individual differences analysis of this data was helpful in organizing the double-aspect stimuli into groupings created by our subjects. The number of stimuli are not yet sufficient to fully determine whether the selective attention is based on meaning or specific physical properties. It is quite likely that there is some combination of the two. For example, the Factor 2 stimuli (Mountain-Face, Man-Rat, and Pirate-Rabbit) all included a side view of a person's whole face. Factor 3 stimuli also included a side view of a person's face but were represented as silhouettes rather than line drawings. The two "ear" stimuli (6 and 7 in Figure 4) were placed in separate factors. Consisitent with Huber and Forsyth (1972), whole face stimuli (1-5 in Figure 4) and communication organ stimuli (6-10 in Figure 4) were not grouped together. Many more stimuli should be added to these 10 to more fully examine the physical basis or the meaning basis of selective attention. In summary, the paradigm appears to be a useful one in the search for determining the underlying invariants (physical or lingiistic) which are used differentially by different homogeneous groups of like-perceiving subjects. Future investigations must expand the sample of double-aspect stimuli to include other than human vs. non-human type stimuli. The nature of the different subgroups suggests categories of individuals which should be included in future investigations of the stimulus space of double-aspect stimuli.

Table 1. Number of Individuals in Each Homogeneous Subgroup from Five Subject Categories

STIMULUS FACTOR

SUBJECT CATEGORIES	1		2		3		4	
	Human	NH	Human	NH	Human	NH	Human	NH
Grades 1 and 3	1	16	1	12	1	9	5	5
Grades 5 and 7	7	3	6	4	2	6	5	8
Grades 9 and 11	13	2	2	5	8	4	5	6
College	6	3	4	4	7	5	7	4
Institutionalized	1	10	15	3	7	3	7	6

FIGURE CAPTIONS

Figures 1, 2, 3, and 4 are in order on the following four pages. Captions for each are:

Figure 1. Random Polygon Prototype Dimensions Examined with Individual Differences Paradigm

Figure 2. Schematic Face Exemplars Examined with Individual Differences Paradigm

Figure 3. Human Face Stimuli Examined with Individual Differences Paradigm

Figure 4. Double Aspect Stimuli For Present Study

REFERENCES

Bugelski, B. R. and Alampay, D. A. The role of frequency in developing perceptual sets. Canadian Journal of Psychology. 1961, 15, 205-211.

Carroll, J. D. and Wish, M. Applications of individual differences scaling to studies of human perception and judgment. In E. C. Carterette and M. P. Friedman (Eds.), Handbook of Perception, Volume II, New York: Academic Press, 1974.

Forsyth, G. A. Individual differences in information processing: a comparison of paradigms. Paper presented at Canadian Psychological Association meetings, Victoria, British Columbia, June, 1973.

Forsyth, G. A. and Shor, R. E. An individual differences analysis of inter-dimensional additivity in multidimensional scaling. Perception and Psychophysics, 1974, 15, 563-567.

Garner, W. R. The Processing of Information and Structure. New York: John Wiley & Sons, 1974.

Gibson, E. J. Principles of Perceptual Learning and Development. New York: Appleton - Century - Crofts, 1969.

Gibson, J. J. The Senses Considered as Perceptual Systems. Boston: Houghton Mifflin, 1966.

Huber, R. J. and Forsyth, G. A. Selective Attention and Social Interest. Journal of Individual Psychology, 1972, 28, 51-59.

Leeper, R. W. A study of a neglected portion of the field of learning: the development of sensory organization. Journal of Genetic Psychology, 1935, 46, 41-75.

Rubin, E. Synsöplevede Figurer. Copenhagen: Glydenalski, 1915.

Tucker, L. R. and Messick, S. An individual differences model for multidimensional scaling. Psychometrika, 1963, 28, 333-367.

Wallach H. and Austin, P. A. Recognition and the localization of visual traces. American Journal of Psychology, 1954, 67, 338-340.

Ward, J. H. Hierarchical grouping to optimize an objective function. American Statistical Association Journal, 1963, 58, 236-244.

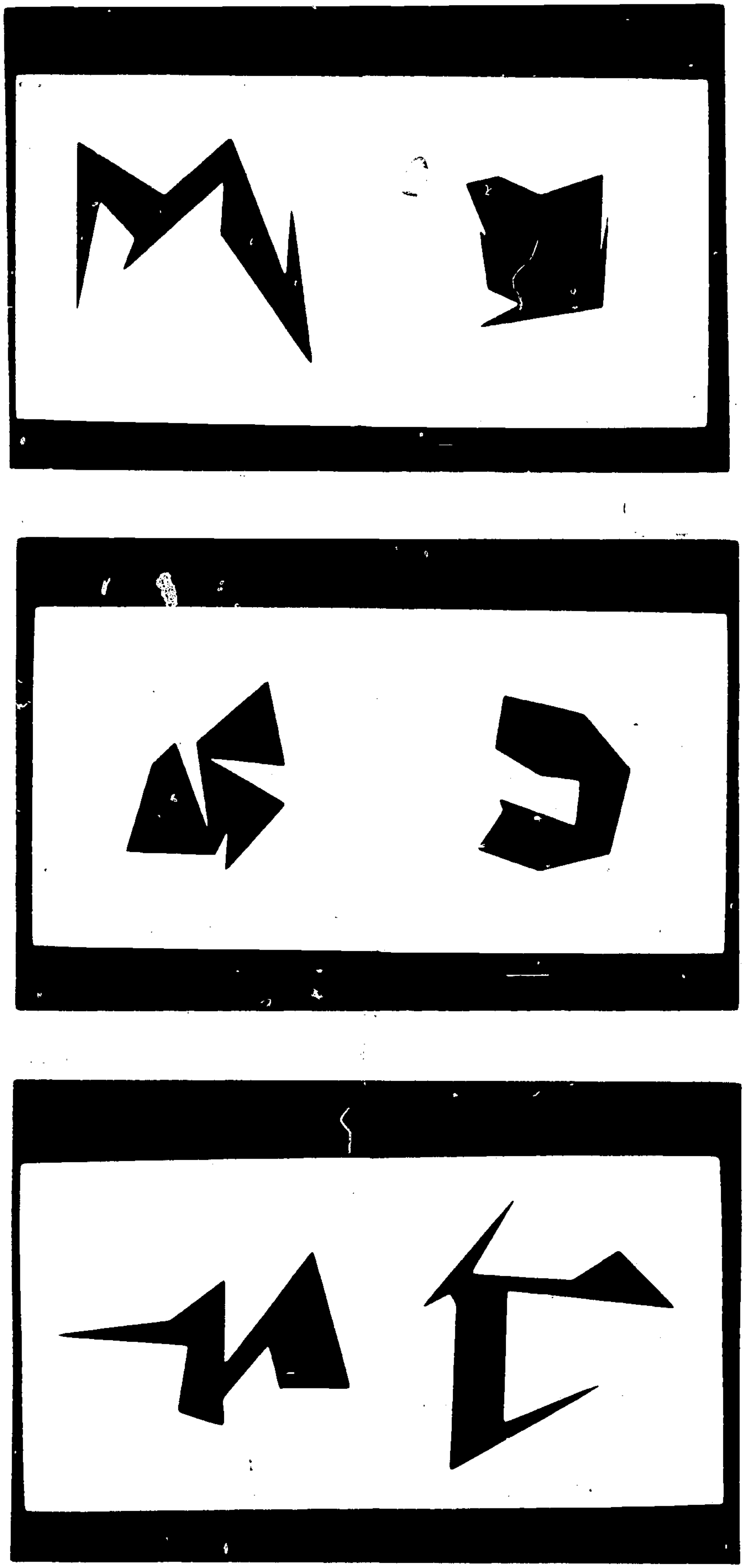
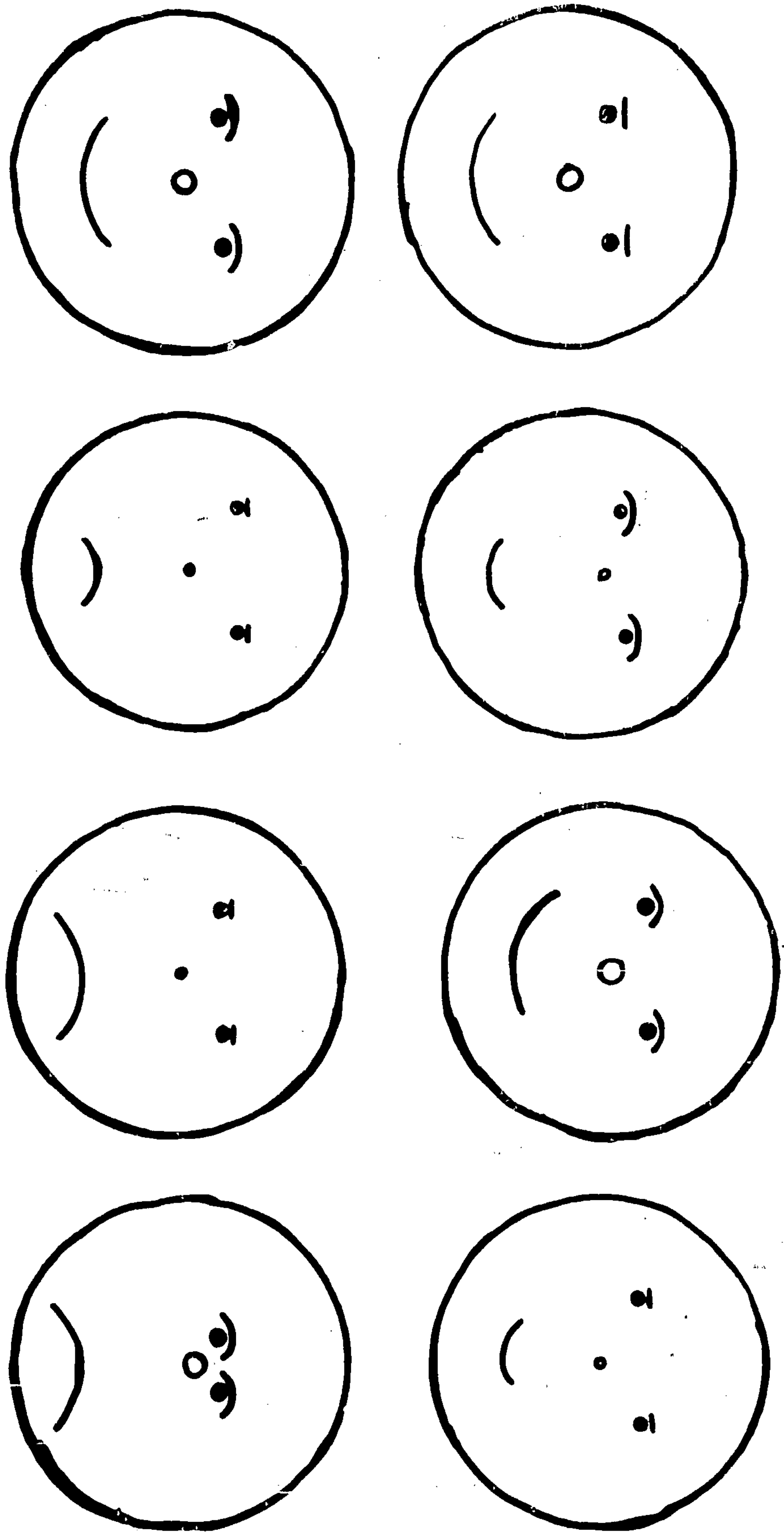


Figure 1.

Figure 2.



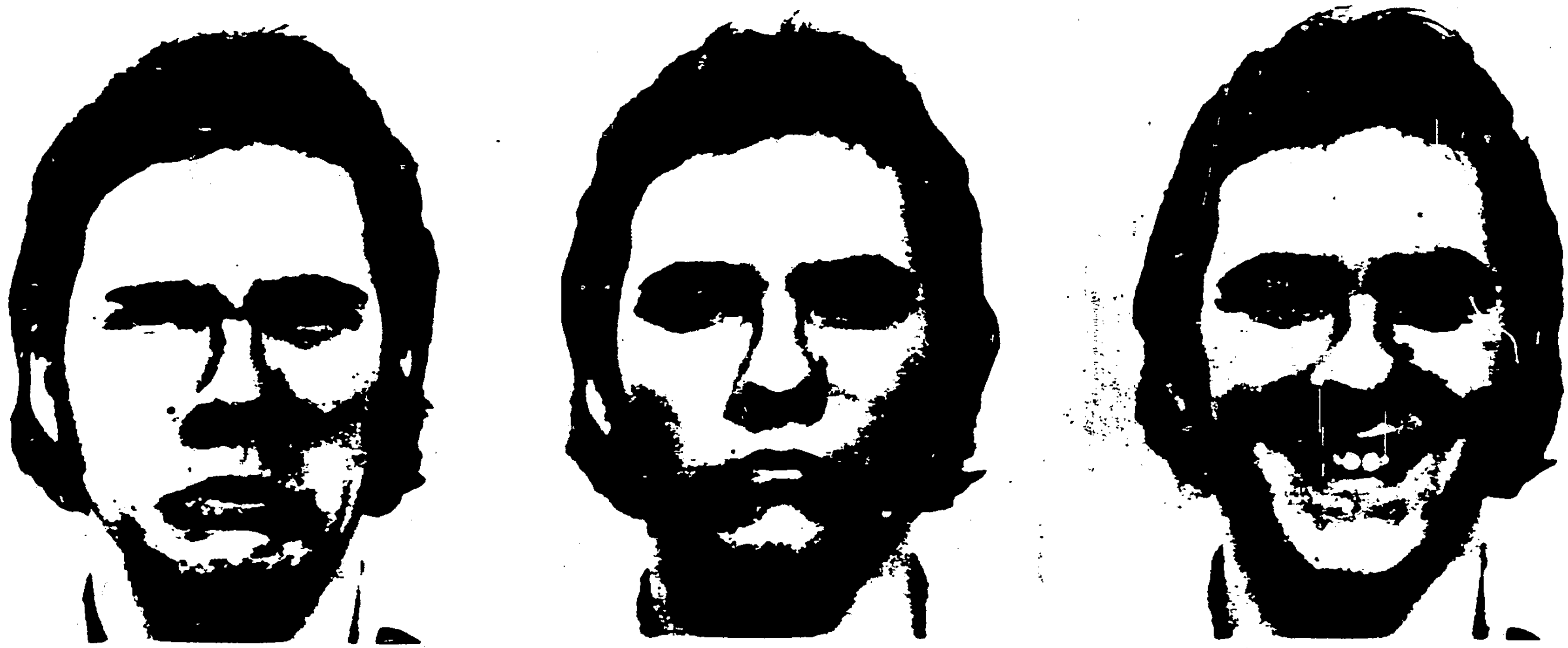


Figure 3

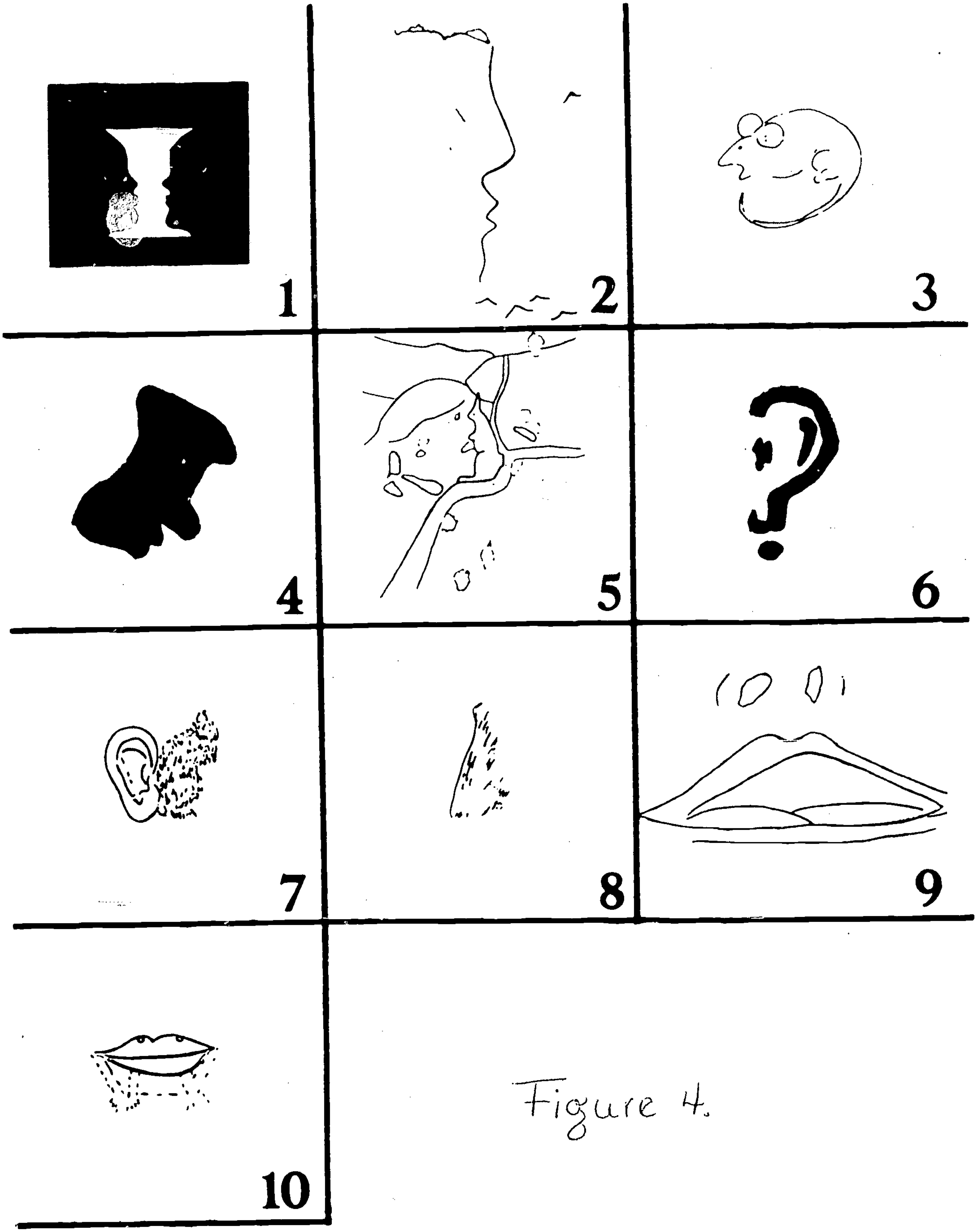


Figure 4.