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A Spatial Model of the Mere Exposure Effect[1]

The mere exposure effect has been central to our understanding of the role of cognition in attitude change. Using a spatial model, an experiment is reported that examines the relationship between exposure, cognition, and affect. Subjects (N = 153) viewed a geometric figure either high or low in complexity within a 64-frame film clip, with each frame appearing for 28 msec. Because of exposure, the simpler stimulus and the term for affect are found to move almost directly toward each other in the multidimensional space, whereas no evidence for any cognitive change for this stimulus is found. No form of processing is found for the more complex stimulus. Results indicate that the spatial model is useful for evaluating the mere exposure effect and that affective change does not seem to require cognitive change.

There are a variety of routes through which communication can change attitudes (see, e.g., Petty, Cacioppo, & Kasmer, 1986). Most obviously, communication can cause change by providing information about the attitudinal object. In this way, a message induces cognitive elaboration (thought) on the merits of the object.

Communication can also cause attitude change when such cognitive elaboration is not necessary. "Mere exposure" studies investigate how exposure to stimuli cause change in attitudes toward these stimuli without apparent cognitive elaboration. Using a great variety of stimuli (e.g., music, abstract art, ads, nonsense syllables, faces, ideographs, smells, and tastes), researchers have found that stimuli increase their attractiveness after repeated exposure (see reviews by Harrison, 1977; Sawyer, 1981).

The mere exposure effect has some very obvious implications for media communication. When producers try to ensure that their message or product gets "a lot of play," they are assuming that exposure does, in fact, lead to an increase in liking (Batra, 1986).

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This effect also has some deeper implications for the study of attitude change. Some believe that exposure leads to increased liking *because* of some thought process (e.g., Harrison, 1977; Lazarus, 1982; Wilmot, 1987). There is a long history behind this idea: Shakespeare said, "There is nothing either good or bad, but thinking makes it so." If this is the case, the impressions, beliefs, and attitudes, which ultimately affect communicative behavior, are the result of some form of "intrapersonal communication" (i.e., messages we generate to ourselves). However, although some contend that attitude change must be mediated by a process of learning or recognition (e.g., Lazarus, 1984), others contend that such cognitive processes are not necessary (e.g., Zajonc, 1984).

This controversy is of special relevance to students of communication, because a communication can change an attitude only if it changes those ideas or feelings that are responsible for the attitude. If an attitude has a basis that is entirely noncognitive, then cognitively based communications will not be effective (Abelson, Kinder, Peters, & Fiske, 1982; T. D. Wilson, Dunn, Bybee, Hyman, & Rotondo, 1984; see also Petty & Cacioppo, 1986, p. 9).

Different views of attitude change are held by mere exposure researchers in the "cognitivist" and "affectivist" camps. Cognitive theorists argue that cognition is a necessary precondition for affect (Lazarus, 1982, 1984) and that cognitive processing, whether conscious or unconscious, precedes and/or mediates the affective response to stimulus exposure (Berlyne, 1970, 1971; Gordon & Holyoak, 1983; Lazarus, 1984; Stang, 1975). Cognitive theorists believe that an individual must be able to identify a stimulus, classify it, and/or recognize it, for a mere exposure effect to occur (see, e.g., Berlyne, 1970, 1971; Harrison, 1968; Smith, 1982; Stang, 1974, 1975).

Representing the affectivist view, Zajonc proposed that "affect and cognition are separate and partially independent systems and that although they ordinarily act conjointly, affect could be generated without prior cognitive process" (Zajonc, 1984, p. 117). Zajonc and his associates posited that exposure to a stimulus can lead to increased affect even in the absence of stimulus recognition (Moreland & Zajonc, 1977; W. R. Wilson, 1979; Zajonc, 1980, 1984). Zajonc (1980) provided evidence consistent with this view from experiments in which stimuli were degraded so that recognition would be at or near chance level (see also Berlyne, 1967; Kunst-Wilson & Zajonc, 1980; Marcel, 1983a; Moreland & Zajonc, 1977; Seamon, Brody, & Kauff, 1983; W. R. Wilson, 1979; see also Obermiller, 1985).[2]

Although both camps have provided evidence in support of their views, the evidence is not without criticism. Cognitivist studies often suffer from failure to control for recognition of stimuli by subjects. Those espousing the affectivist position make the opposite error. Although Zajonc himself (1984, p. 118) has stated that "cognition need not be . . . conscious," his methods fail to account for possible *unconscious* cognitive processes. Instead, his methods typically assume that some measure of recognition suffices as a measure of any cognitive processing. Therefore, he does not assess other possible indicators of cognitive processing.

We propose an alternative methodology—a multidimensional spatial model—that takes into account any cognitive changes (whether accompanied by conscious recognition or not) that a stimulus may acquire as a result of exposure.

Arguments for a Spatial Methodology

Determining a methodology to assess whether cognitive processing has occurred requires that we (a) have a clear sense of what is meant by *cognitive processing*, and (b) have evidence that cognitive processing, if present, is likely to be captured by our method. Zajonc (1968, p. 615) has differentiated among the terms *learning*, *perception*, *sensation*, and *cognition*, indicating that cognition, unlike sensation, "focuses not on energy, but on information." For cognition to take place, "some form of transformation of a present or past sensory input" is required (Zajonc, 1984, p. 118). To find cognitive processing, we must have a model that is able to represent change in the acquired, stored, or retrieved information available to the individual.

There are many models of cognition (see, e.g., Smith & Medin, 1981), each of which has some strengths and some weaknesses. A spatial (dimensional) model will be employed here. This model is able to represent unconscious cognitive processing and is not easily subject to conscious control by the respondent.

To measure an unconscious perceptual process, Marcel (1983b) suggested using indirect rather than direct measures. We expect the same to be true for unconscious cognitive or affective processes. The spatial model, based on similarity judgments, is an indirect method that can assess changes in affect or cognition that a stimulus has acquired as a result of exposure. Tversky and Gati (1978, p. 79) have noted that "the notion of similarity—that appears under such different names as proximity, resemblance, commonality, representativeness, and psychological distance" is fundamental to the process of judgment, which is a cognitive process. Even if cognitive processing is not conscious, changes in affect or cognition can be viewed as changes in similar-

ity relations, and, using measures of psychological distance, we can evaluate cognitive and affective change. (For examples of the use of a spatial model to assess cognitive change, see Barnett, 1988; Friendly & Glucksberg, 1970; Woelfel, Cody, Gillham, & Holmes, 1980.)

A spatial model is well suited to study the mere exposure effect, because studies that find increased liking without cognition use simple images (Bornstein, Leone, & Galley, 1987; Kunst-Wilson & Zajonc, 1980; Seamon et al., 1983), and there is limited evidence that spatial models may be especially appropriate for representing changes in cognition for such stimuli (cf. Pruzansky, Tversky, & Carroll, 1982; Smith & Medin, 1981, p. 123).

Thus this study employs a methodology that makes it possible to find cognitive change, that has been employed with simple stimuli, and that has been successful when the causal structure of cognitive change has been known. The spatial model is not subject to any obvious control on the part of the subject and does not require conscious recognition. Moreover, it provides a measure of cognitive change consistent with Zajonc's definition of cognition as involving the transformation of sensory input.

Analytic Strategy

The multidimensional scaling (MDS) measurement system called the Galileo technique (Barnett & Woelfel, 1988; Woelfel & Fink, 1980; Woelfel, Holmes, Kincaid, & Barnett, 1980) uses psychological distances to make a "psychological map" of an individual or audience. Because subjects are asked to assess the degree of difference between pairs of terms, they have no obvious means of guessing any hypothesis being tested.

Using measures of similarity, affective change can be assessed by viewing it as change in the distance to a term for affect (here, the term "things I like"; see Barnett, 1988; Neuendorf, Kaplowitz, Fink, & Armstrong, 1987). Because affective measures are sometimes inconsistent with evaluative measures (Harrison, 1977), an evaluative term (i.e., "good") will also be included in the present study.[3]

To create a space (i.e., the "map"), we will need subjects' reported distances between stimuli, descriptive concepts, and affective terms. Based on subjects' reported distances, a space can be created that includes three things: S, the stimulus; A, a term for affect; and D, a term descriptive of the stimulus. Let $d(i, j)$ be the distance from item i to j. If the mere exposure hypothesis is correct, we expect that $d(A, S)$ will be less after exposure to stimulus S, even if recognition is controlled. Using the reported distances, there are three possible basic spatial configurations that the three terms may form: a real triangle, a line, or a non-Euclidean triangle (if the triangle inequality is violated by the data).

For simplicity, we will look at an example in which the terms initially form a line, as shown in Figure 1a. (Conclusions drawn from this linear example are equally applicable to other linear arrangements and to the triangular cases.) If the terms are arrayed *S-D-A*, then if exposure results in *S* moving closer to *A* or *D*, and if the terms remain on a line, then the *S-D* distance and the *S-A* will both decrease (see Figure 1b). In this case, the perception of the stimulus has been altered (it is now seen as more similar to *D*), and the affective tone of *S* has changed as well. In this situation, cognitive change is inextricably bound to affective change.

If affective change occurs without cognitive change, the concepts must form a configuration *different* from both Figures 1a and 1b. For example, if $d(S, D)$ and $d(A, D)$ were unchanged, but $d(S, A)$ became smaller because of exposure, the new distances might create a triangle in the space (see Figure 1c). In other words, some changes in the spatial configuration will indicate purely affective change, some will indicate purely cognitive change, and others will indicate that both forms of change have occurred.

Summary

We see measuring affect and cognition via MDS as having advantages over the methodology of Zajonc and his associates. First, we see some aspects of their measurement of "subjective recognition" as questionable. In particular, we question whether "recognition confidence" and "recognition accuracy" (measures used by Zajonc and his associates) are really good indicators of unconscious cognitive processing. Hence, unlike most studies of mere exposure cited above, we will use *changes in perceptions of similarity* to assess cognition (which may not be conscious), rather than simply using recognition as the indicator of cognitive processing. Second, using MDS provides a parsimonious framework, in that our cognitive and affective measures are treated similarly and, as shown above, can be assessed simultaneously.

A Conceptual Replication of Kunst-Wilson and Zajonc

We will replicate the key aspects of the study by Kunst-Wilson and Zajonc (1980), using a spatial model. This is a much cited and clear example of the

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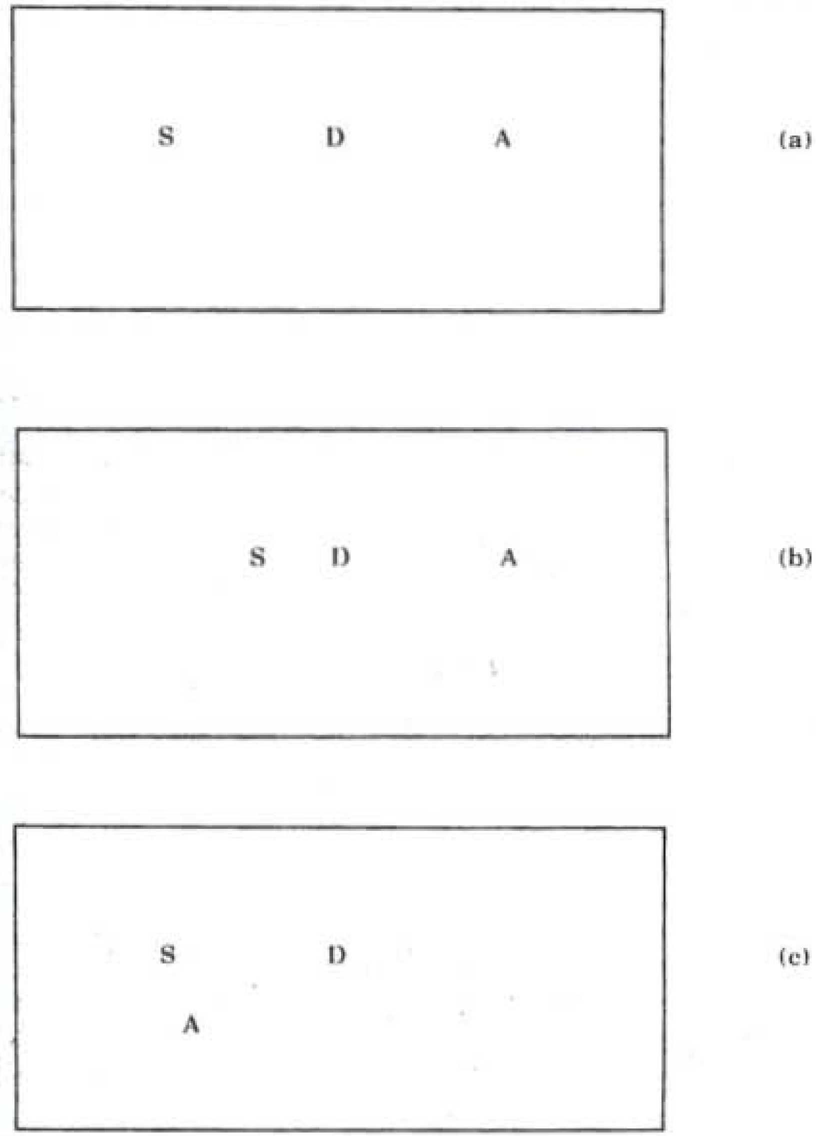


Figure 1. Possible configurations in a multidimensional space: (a) linear arrangement of stimulus (S), descriptive concept (D), and affective term (A); (b) linear rearrangement of stimulus (S), descriptive concept (D), and affective term (A), with exposure resulting in affective and cognitive change; (c) triangular rearrangement of stimulus (S), descriptive concept (D), and affective term (A), with exposure resulting in affective change only.

mere exposure effect when recognition is degraded to near chance level. In that study, irregular octagons were shown without masking for 1 msec each so that recognition performance would be degraded.

The mere exposure effect has been found for a wide variety of stimuli. Because we wish to replicate Kunst-Wilson and Zajonc, relatively simple geometric stimuli will be employed. Further, the mere exposure effect is more likely with simple stimuli. This idea seems to contradict Harrison (1977), who reported that "reducing stimulus complexity lowers the likelihood of an exposure effect . . . " (p. 54); however, he was describing studies in which there had been sufficient exposure to virtually guarantee recognition and in which recognition was not statistically controlled. In recent research where recognition has been at or near chance level, the mere exposure effect has been found with simple stimuli (Bornstein, Leone, & Galley, 1987; Kunst-Wilson & Zajonc, 1980; Seamon et al., 1983; see comment by Zajonc, Pietromonaco, & Bargh, 1982, p. 217). Thus consistent with these more recent studies, and with Kunst-Wilson and Zajonc (1980), a relatively simple stimulus will be employed. However, to assess whether stimulus complexity has an effect when recognition performance is near chance level, we will also employ a somewhat more complex stimulus.

Method

Overview

In the exposure phase of the experiment, subjects viewed one of two films. Each film contained a different critical stimulus and a number of other stimuli. In the rating phase, subjects were shown both the critical stimulus they had seen and the one they had not seen, and they were asked to respond to an MDS questionnaire that included questions about both stimuli.[4]

The Experimental Study

SUBJECTS

The subjects were 153 undergraduate students (43 males, 110 females) enrolled in interpersonal communication classes at the University of Maryland. Subjects took part in the experiment in order to obtain extra credit in their courses.[5]

MATERIALS AND APPARATUS

Twelve different pictures were used as stimuli, the 2 critical stimuli (see Figure 2) and 10 filler slides randomly interposed. The sequence was generated randomly and the critical stimuli did not appear in either the first or the last spot (see Harrison, 1977; Potter, 1976; Potter & Levy, 1969). The order and number of exposures for each noncritical stimulus was also determined randomly. The minimum number of exposures for each noncritical stimulus in the film was three, and the maximum was eight.

Several pretest studies were conducted to discover the amount of exposure that would lead to recognition near chance level. We measured recognition using a 0-100 probability scale, rather than a forced choice (dichotomous response) instrument (see Cheesman & Merikle, in press). Results from these pretest studies indicated that with an exposure duration of 28 msec, exposure frequencies in the range from 3 to 7 would be optimal.

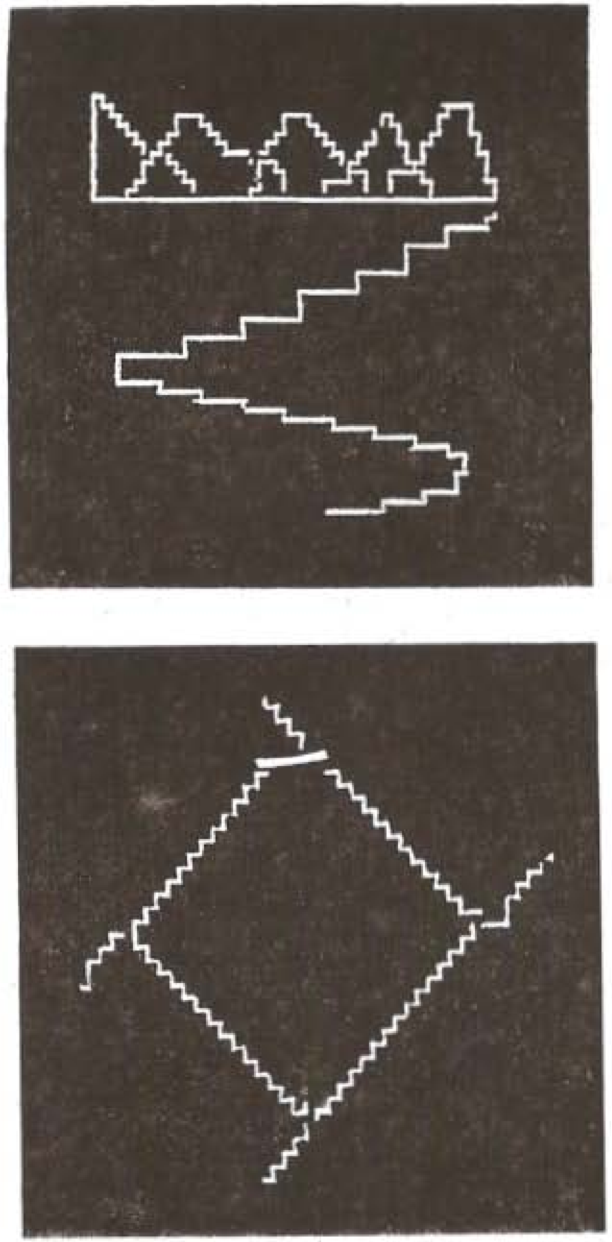
The experiment used two critical films, each film consisting of 64 frames, with each frame exposed for a duration of 28 msec, with no masking (i.e., no blank screens) between images. Thus this part of each film lasted 1.79 sec. In addition, the film clips began with a 1-sec exposure of a noncritical symbol in order to give the subjects an initial fixation point. After this initial image, each frame in the film consisted of 1 of 11 pictures. The two experimental films are identical except that critical stimulus 1 appears seven times in Film 1 and critical stimulus 2 appears six times in Film 2.[6]

In the exposure sequence, the stimuli were shown with a film projector. During the rating sequence that followed, the pictures were shown with a slide projector, with timing controlled by a micro-dissolve unit.

PROCEDURES

Subjects were assigned appointment times and asked to report to a classroom. There were eight different sessions. Each session was randomly assigned to one of the two exposure conditions, with subjects in four of the sessions exposed to stimulus 1, and subjects in the other four sessions exposed to stimulus 2. In addition, each session was randomly assigned to one of two rating conditions, to rate either stimulus 1 or stimulus 2 first. Each session had between 15 and 23 subjects.

During the experiment, subjects were seated in a large lecture hall in every third seat to ensure independence of response. During the exposure



(a)

(b)

Figure 2. The two critical stimuli: (a) stimulus 1, (b) stimulus 2.

phase, the experimenter was blind as to which film would be shown. During the rating phase, the experimenter was aware of the order in which the stimuli were rated, but remained blind as to the stimulus to which the subjects were exposed.

The subjects were first asked to complete a "quasi-sensory communication" (QSC) questionnaire, which asked about things that the subjects might believe to be associated with QSC abilities (see Results section, below, for the items employed).[7] The subjects were then trained in the use of the MDS questionnaire and a recognition scale.

Once the subjects completed the instructions and some practice questions, they viewed a film that was identical to Films 1 and 2 except that *neither* of the critical stimuli appeared. Subjects were told that this first film was being shown to give their eyes a chance to adjust to the dark and to the film speed.

After this film, subjects watched a film containing one of the critical stimuli. In all films, subjects watched stimuli projected from a film projector onto a screen. Subjects closest to the screen sat 3.51 m away from the screen, and subjects farthest away from the screen were 6.40 m away. Each row of seats was 18 cm higher than the row of seats in front of it, and no more than six rows were used. The film projected a 147 cm × 147 cm square onto the screen.

During the rating period, each of the two critical stimuli were shown for 1.5 sec, with enough time between slides to ensure that subjects completed the rating form.[8] During the rating sequence, the slides appeared on the screen as a 99 cm × 99 cm square.

All subjects used an MDS instrument to rate all possible pairs of distances among 13 items. The 13 items consisted of stimuli 1 and 2, "things I like," "good," the five concepts that describe the stimuli (see column A in Table 1), and four additional, affectively similar concepts (see column B in Table 1). As shown below, the concepts in column B will be used to help evaluate the validity of the distance judgments.

In rating the distances, subjects were told to regard the distance between *red* and *white* as 100 units of dissimilarity. If terms were more different than *red* and *white*, subjects were to use numbers proportionately bigger; if the difference was smaller than this standard, they were to use numbers smaller than 100. "No difference" was to be represented by 0.

Because there were 13 terms, and distances between all possible pairs were requested, this meant that 78 (= [13 × 12]/2) distances were asked for.

Replicating Kunst-Wilson and Zajonc (1980), subjects were first asked to render affective responses (distance of the stimulus to "things I like" and

Table 1
Descriptive Words and Affectively Similar Nondescriptive Words for Each Stimulus

	(A) Words descriptive of the stimulus	(B) Words affectively similar to descriptive concept
Stimulus 1	steps	patch
	river	star, story
	trees	star
Stimulus 2	patch	steps, week
	diamond	father

"good"), next to provide recognition responses, and finally to complete the rest of the MDS instrument for that stimulus. Next, subjects responded in the same way for the second stimulus. Finally, the paired comparisons that did not ask about stimulus 1 or stimulus 2 were asked. Note that all subjects answered the distance and recognition questions for both critical stimuli even though no subject had in fact seen both critical stimuli in the film presentation. To measure subjective recognition, a 0-100 probability scale was used. The score equaled the subject's assessment of the probability that the stimulus had been shown within the second film.

Subjects reported no difficulties with the questionnaire. Once the subjects completed the rating scales, they were thanked for their time. A debriefing took place in their classes several days following the completion of the experiment.

Results

Preliminary Results

MISSING DATA

The maximum number of missing cases on any variable was one. Most variables had no missing data.

DATA TRANSFORMATION

The magnitude estimation data (the distance responses) were positively skewed with a few outliers. Because the statistical analyses employed assume data to be homoscedastic and normal, data were transformed by reducing the score of the outliers to a maximum value of 10,000 and taking the natural logarithm (after adding 1) of the values. The transformed values were relatively symmetric: The skewness of these transformed measures ranged from −.774 to .908; the overall skewness for the set of measures was −.204.

EQUIVALENCE OF EXPERIMENTAL GROUPS

Recall that subjects were assigned to one of eight sessions and sessions were randomly assigned to experimental conditions. We sought to establish the equivalence of the two experimental exposure groups by using the QSC items that were asked prior to the experimental manipulation. A series of chi-square tests indicated that there were no significant differences between the two exposure groups in regard to the distributions for 10 variables that we thought could affect responses to the stimuli. The only variable for which there was a significant difference was year in college. Hence we conclude that the exposure groups are not substantially different.

RELIABILITY

We examined the reliability of the data by computing the dependability coefficient for the transformed distance estimates (see Cronbach, Gleser, Nanda, & Rajaratnam, 1972; Miller, 1988). For the 78 distance estimates evaluated by the 153 experimental subjects and the 29 subjects used for evaluating the validity of the measures (see note 5), the fixed effects dependability coefficient is .987, and the random effects dependability coefficient is .984. This means that the spaces generated by each person have high geometric similarity.[9] Because these data are highly reliable and homogeneous, we can aggregate the data for analysis.

VALIDITY OF DISTANCE JUDGMENTS

We have two ways of evaluating the validity of the distance judgments as measures of cognition. First, we predict that the distance between a stimulus and a concept that describes it (e.g., stimulus 2 and *diamond*) should be less than the distance between a stimulus and a concept that is affectively similar to the descriptor but does *not* describe it (e.g., stimulus 2 and *father*). This will assure that reported distances between stimuli and their descriptive concepts are not due solely to the affective tone of the concept or concepts. Seven such comparisons (derived from the terms listed in Table 1) are tested.

We performed analyses of covariance with repeated measures, using all subjects. We find that all of the seven comparisons had the difference in the correct direction. For six of these seven, the difference was significant ($p < .0001$). The difference between the mean distance from stimulus 1 to *river*, vs. the mean distance from stimulus 1 to *story* is not statistically significant ($p < .17$). The results of this first set of tests support the validity of the distance judgments.

Our second way of evaluating the validity relies on our findings from a separate, related study (Fink, Monahan, & Kaplowitz, 1988). That study used data in which subjects rated different stimuli, including stimulus 2 from this study. In that data set, in addition to measures of psychological distance and the recognition measures, there was one other cognitive measure. Each subject was asked to *draw* each stimulus after a brief exposure to it. These drawings were rated for accuracy.[10] The stimuli were simple, straight-line, two-dimensional geometric figures; anyone who recalled them accurately would be able to represent them accurately. Thus the accuracy scores are measures of cognition.

For each of three stimuli we conducted a regression in which the accuracy of the drawing was the dependent variable. The predictors in each regression were three psychological distances: the distance between each stimulus and each of two terms that describe it and the distance between these two descriptors. These three distances are considered cognitive measures. For two of the three stimuli, the regression was significant. The one stimulus that did not show a significant effect also had a much smaller variance in the dependent measure, and this could account for the lack of significance.

Hence we see that a very different kind of measure of cognition (representational knowledge, measured by drawing accuracy) is substantially associated with the psychological distances, which are the key measures of cognition in this study. Thus acquisition of knowledge about the stimuli is cognitive change, and this appears reflected in the distance measurements.

In summary, internal evidence from this study and evidence from another study, using a different form of cognitive assessment, support the contention that the distance judgments reliably and validly assess cognitive change.

Recognition

Although exposure was not found to correlate significantly with reported recognition (for stimulus 1, $r = .115$, $p < .08$; for stimulus 2, $r = .129$, $p < .06$),

Table 2
Mean (Standard Error) Recognition, by Exposure Condition

	Exposure to	
	Stimulus 1	Stimulus 2
Subjective recognition of stimulus 1	56.96 (2.84)	51.01 (3.04)
Subjective recognition of stimulus 2	62.84 (2.75)	68.67 (2.42)

Note. $N = 153$. Those exposed to a given stimulus were not exposed to the other stimulus.

an analysis of variance treating stimulus shown as a within-subjects variable reveals a significant stimulus-by-exposure interaction ($F[1, 145] = 6.19$, $p < .02$). To avoid any possibility of contamination due to recognition, recognition will be statistically controlled in the analyses that follow.[11] Table 2 reports the mean level of reported recognition-by-exposure condition.

Results Regarding Affect and Cognition

Spatial Results

To test for any exposure effects, we first constructed two multidimensional spaces for each stimulus. The four spaces were the two spaces for stimulus 1 (comparing the maps for subjects in experimental and control exposure conditions), and the two spaces for stimulus 2 for both sets of subjects. We then compared the experimental space for a stimulus with its control space.

We performed an analysis that statistically eliminated effects of recognition. To accomplish such statistical controls, we obtained, from a regression analysis, a corrected value of each distance with the effect of recognition statistically removed.

The spaces for stimulus 1 included stimulus 1 and its five relevant terms as noted in Table 1. The two spaces for stimulus 1 are each centered on its centroid, and then they are rotated to a least squares best fit on each other. The two spaces generated by the GALILEO program both have two real dimensions that account for 95%-97% of the real variance.[12] For stimulus 1, the relatively complex stimulus, only random motions were found, and none of the motions appeared to be large. Because no systematic change occurred, we find no evidence that exposure led to any change in affect or to any other change for this stimulus. Statistical analysis confirmed this result.

Stimulus 2 (the simpler stimulus) and its four relevant terms are included in the multidimensional spaces for stimulus 2. We find that each of the two spaces generated by the GALILEO program has two real dimensions that account for approximately 100% of the real variance. Using the same procedures as for stimulus 1, we find evidence that exposure leads to increased affect, but no evidence of any cognitive change (see Figure 3). It is clear in Figure 3 that, because of exposure, stimulus 2 and "things I like" moved toward each other, approximately along the vector joining them. "Things I like" moved 33 units in the real space, whereas stimulus 2 moved 22 units. In addition to this motion, we see that the word *diamond* moved 30 units, and the word *patch* moved 21 units. Neither concept moves toward either stimulus 2 or toward "things I like"; in fact, they move so as to *maintain their original distances* from the stimulus and the affective terms, thus indicating no cognitive change.

Statistical Analysis: Affective Change

To statistically evaluate our results concerning affective change, an analysis of covariance was performed on the transformed values of the distances from each stimulus to "things I like."[13] In this analysis, there were three between-subjects independent variables: exposure, with two levels (exposed to stimulus 1 vs. exposed to stimulus 2), order of responding (questioned about stimulus 1 first vs. stimulus 2 first), and time of experimental session (early vs. late). To control for recognition, this analysis had two covariates: reported recognition for stimulus 1 was a covariate for subjects exposed to stimulus 1, and reported recognition for stimulus 2 was a covariate for subjects exposed to stimulus 2. Because each subject was asked about liking for both critical stimuli, the stimulus to which one responded was treated as a within-subjects variable, with two levels. The analysis utilized the BMD-P2V program (Jennrich, Sampson, & Frane, 1981). Means for the affective response to each stimulus by exposure condition are found in Table 3, and the analysis of covariance is found in Table 4.

The results support the mere exposure hypothesis for the simpler stimulus: Subjects exposed to stimulus 2 like it more than do subjects not exposed to it (see Table 3). In contrast, subjects exposed to stimulus 1 like it about the same as do subjects not exposed to it. (Note that *lower* means are associated with greater liking.) The stimulus by exposure interaction seen in Table 4 shows that these results are statistically significant ($F[1, 144] = 5.74$, $p = .02$). These results are consistent with those found using the spatial model.

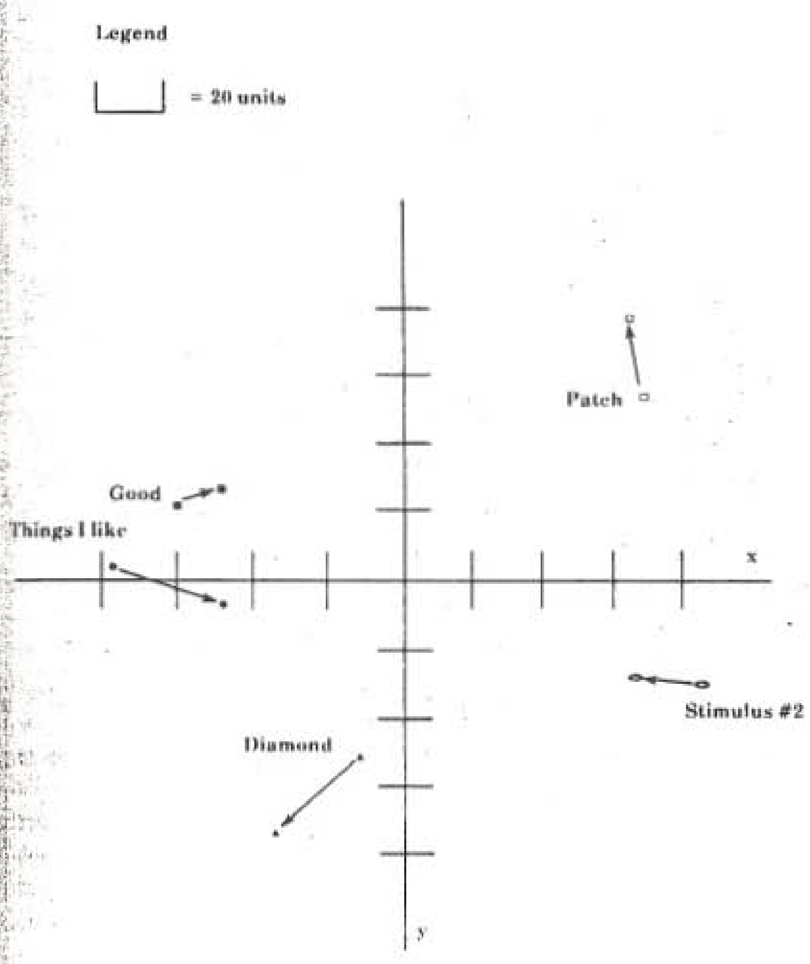


Figure 3. The first two real dimensions for the spaces generated for stimulus 2. (For each item, the line emanates from the location for the group *not* exposed to stimulus 2 to the location for the group exposed to stimulus 2.) Included here are stimulus 2, the concepts descriptive of stimulus 2, the affective term "things I like," and the evaluative term "good."

In addition to these results, there is a significant main effect of time of participation on liking, with subjects in the later sessions reporting less

Table 3

Cell Means (Standard Deviations) for Liking of Stimuli, by Exposure Condition

	Exposure to	
	Stimulus 1	Stimulus 2
Liking for stimulus 1	4.53 (1.62)	4.43 (1.53)
(n)	(38)	(38)
Liking for stimulus 2	5.12 (1.34)	4.52 (1.51)
(n)	(36)	(41)

Note. N = 153. Those exposed to a given stimulus were not exposed to the other stimulus. Scores are logarithmically transformed. Smaller means indicate greater liking.

Table 4

Analysis of Covariance of Affect (Liking) of Critical Stimuli

Source of variance	Sum of squares	Degrees of freedom	Mean square	F	Two-tail probability
Between subjects					
Time (early vs. late)	19.44	1	19.44	5.81	.02
Exposure (stimulus 1 vs. stimulus 2)	11.56	1	11.56	3.45	.07
Order[a]	.77	1	.77	.23	.63
Time × Exposure	.80	1	.81	.24	.63
Time × Order	.04	1	.04	.01	.91
Time × Order × Exposure	4.15	1	4.15	1.24	.27
Covariate	.23	1	.23	.07	.79
Error	481.97	144	3.35		
Within subjects					
Stimulus	9.07	1	9.07	9.35	< .01
Stimulus × Time	1.09	1	1.09	1.13	.29
Stimulus × Exposure	5.57	1	5.57	5.74	.02
Stimulus × Order	25.78	1	25.78	26.57	< .01
Stimulus × Time × Exposure	.26	1	.26	.26	.61
Stimulus × Time × Order	3.68	1	3.68	3.80	.05
Stimulus × Exposure × Order	.08	1	.80	.08	.78
Stimulus × Time × Exposure × Order	3.12	1	3.12	3.22	.08
Covariate	.14	1	.14	.15	.70
Error	139.73	144	.97		

Note. N = 153.

a. *Order* = order in which subjects saw stimuli in testing phase.

liking for either stimulus. There is also a significant difference in liking stimulus 1 as compared to stimulus 2: Stimulus 1, the more complex stimulus, is preferred. Further, there is a significant interaction of stimulus and response order in their effects on liking (see Table 4).

Statistical Analyses: Cognitive Change

To examine whether the affective change found was accompanied by cognitive change for stimulus 2, we did several analyses of covariance utilizing particular cognitive distances. These analyses are similar to those employed above to evaluate affective change. The dependent variables for these analyses were the transformed distances between stimulus 2 and the concepts descriptive of it. None of these analyses found any evidence of any significant cognitive change; this supports the results found using the spatial model.

Although the concepts *diamond* and *patch* appear, in Figure 3, to be moving apart, the change in distance between these two concepts is not statistically significant.

Discussion

In this study, we employed a spatial model to evaluate the mere exposure hypothesis. The results support the mere exposure hypothesis for the simpler stimulus: Exposure led to increased affect for it, even when controlling for any possible effects of a conscious "warm glow" of recognition. What is striking is the clear trajectory found: As a result of exposure, "things I like" and the simple stimulus move directly toward each other. On the other hand, the concepts descriptive of this stimulus move in a such way as to maintain their initial distances from it and "things I like," indicating an absence of cognitive change.

In contrast to the more typical mere exposure methodology that assesses changes in *recognition*, the spatial model enables us to assess cognitive changes that do not involve conscious recognition. In addition, a spatial model offers a simultaneous view of cognition and affect, instead of looking at them separately. In the experiment reported here, spatial data provide a simple and readily interpretable illustration of the changes that occurred.

The stimuli employed here were selected to differ in their complexity and subjects responded to the two stimuli differently: The mere exposure effect is not found for the more complex stimulus. Although exposure led to increased liking of the simple stimulus (stimulus 2), no evidence of any accompanying cognitive change was found. Hence, for the simple stimulus, these results support Zajonc's contention that affective change can occur in the absence of cognition. But why did we find no evidence for any form of processing (affective or cognitive) for the complex stimulus?

Zajonc (1968) differentiated *sensation* from *cognition*. Cognition requires transformation of sensory inputs (information), whereas sensation is concerned with the energy value of inputs. It is possible that the *sensing* of a complex stimulus (or, possibly, *our* complex stimulus) is a more difficult task, and this may account for the differences found between the stimuli. To test this, future research would need to determine the sensory threshold for stimuli that differ in complexity.

Could our failure to find any evidence of cognitive processing be due to the inadequacy of the spatial model, rather than to the absence of cognitive processing? In any study, failure to find a particular effect could be due to the research methods employed, including the measurement instruments used. But the spatial model has been successful in detecting cognitive change in other contexts (e.g., Neuendorf et al., 1987; Woelfel, Barnett, Pruzek, & Zimmelman, 1989; Woelfel et al., 1980), and with stimuli similar in complexity to those employed here. In addition, the model does find evidence of affective change. Clear trajectories are found, with dimensional structures that are simple and reliable. Thus there is no plausible support for the idea that the results are somehow an artifact of the spatial methodology.

Our results have important implications for communication. If incoming sensations can be affectively processed without the intervention of cognition, then, for some topics, cognitively structured persuasion campaigns may be doomed to failure (Zajonc, 1980, p. 157). Furthermore, the general methodology used in assessing attitude change typically relies upon questions that require cognitive operations by the respondent. However, feeling-based attitudes assessed by cognitive methods do not seem to be predictive of behavior, because the feeling, not the thought, is what links the attitude to action (see Petty, Rennier, & Cacioppo, 1987). Thus communication scientists need to differentiate messages and stimuli in the degree to which they have affective versus cognitive effects. Asking for a "rational" accounting for an opinion that is affectively based does not disclose reasons that could be used to change it.

Notes

1. This article is a revised version of a paper presented at the convention of the International Communication Association, Chicago, May 1986. Requests for reprints should be addressed to Edward L. Fink, Department of Speech Communication, 1146 Tawes Fine Arts Building, University of Maryland, College Park, MD 20742-1221. We wish to thank T. J. Aylward, G. A. Barnett, T. J. Carr, J. Goldberg, J. Hillman, M. M. Miller, G. Weiss, J. Cappadona, and K. Thomas for comments and assistance in carrying out this research. This research was assisted by an Undergraduate Research Grant awarded by the University of Maryland to Jennifer L. Monahan, funds provided by the Center for Research in Public Communication at the University of Maryland, and support from the University of Maryland Computer Center.

2. Although the goal of many of the studies supporting the "affect without cognition" argument is to degrade recognition to chance level, this goal is typically not achieved. Rather, although the correlation between exposure and recognition is quite small, it is usually greater than zero (see, e.g., Wilson, 1975, as cited in Zajonc, 1980; W. R. Wilson, 1979).

3. As Osgood, Suci, and Tannenbaum (1957) have noted, words have an evaluative or affective aspect. In our model, change in the affective or evaluative aspect of a concept appears as the change in the concept's distance to "things I like" and "good." Any nonaffective change appears as the independent change in the concept's relation to descriptive words. In other words, the component of change in a concept's location that is not along the vector joining it to an affective term must be due to other than affective change.

4. A pilot study was needed to select experimental stimuli and to provide concepts associated with them. Our stimuli are computer-drawn pictures. Subjects were 50 undergraduate students enrolled in interpersonal communication courses at the University of Maryland. Subjects were asked to list thoughts that came to mind while looking at the stimuli. These lists were used to discover what terms the subjects used to define each picture. Next, the subjects used magnitude-estimation scales to rate the pictures for complexity and other attributes. Cognitive change is most easy to ascertain if there is agreement among subjects for the labels to be used to describe each experimental stimulus. Given this consideration, the criteria used to select the stimuli were as follows: First, the average number of responses generated per person for each stimulus should be low. Second, one or two concepts should account for a large percentage of the responses generated. Third, the percentage of people not providing a response for each stimulus should be small. The stimuli in Figure 2 meet these criteria.

5. In addition to these 153 subjects in the two experimental exposure conditions, 29 subjects were exposed to films that were the same as the experimental films except that neither critical stimulus appeared. The results obtained from these subjects will be used to help assess the validity and reliability of the distance judgments.

6. We had intended to use six exposures for each stimulus. However, because of an editing error the film for stimulus 1 has seven presentations of stimulus 1. This was the film used in the pilot study sequence and the experimental sequence. The results from the pilot study indicate that seven exposures of the complex stimulus and six exposures of the simple stimulus maintained recognition at or near chance level.

7. The term "quasi-sensory communication" is taken from McBain, Fox, Kimura, Nakanishi, and Tirado (1970).

8. Due to problems with the micro-dissolve timing unit, one group was exposed to the critical stimulus slide during the rating period for 3 to 4 sec instead of 1.5 sec. This group's results were compared to those of a group that followed the same procedures. We found that the mean recognition and affect responses of these two groups did not differ significantly, and we decided not to eliminate any respondents due to this timing error.

9. Evidence for the reliability of the affective judgments is also shown by the high correlation between the liking of a concept and the "goodness" of that concept: The transformed distance between stimulus 1 and "things I like" correlates .90 with the transformed distance between stimulus 1 and "good"; the analogous correlation for stimulus 2 is .86.

10. The ratings were done by two independent coders, and the ratings were summed to produce an accuracy score. For the three stimuli, the Spearman-Brown prophecy formula estimated reliabilities ranging from .739 to .855.

11. We are relying on statistical controls to eliminate any effects due to recognition. Evidence from previous studies indicates that statistical controls yield the same results that experimental controls do (see, e.g., Zajonc, 1980).

12. In addition to the two real dimensions, each of the two spaces also contains an imaginary dimension (see Woelfel & Fink, 1980).

13. Because in this study liking and goodness are so highly correlated (see note 9), if we had used "good" as the indicator for affect the results would have been extremely similar.

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