Abstract

A multidimensional scaling approach (the Stone-Coles method) was used to study interpersonal attraction. Judgments were estimates of interpersonal similarity, and attraction rankings made by 16 sorority pledges. Four factor-dimensions emerged from the judgmental data, similarity estimates, which were readily interpretable. Only two dimensions were found to be linearly related to attraction. However, observers loading very high or low on the other two of the dimensions showed a preference for others having similar loadings. Other findings presented were: 1) the individuals who were seen as being more similar to the group were ranked as being more attractive by the group; 2) pairs who the group saw as being most similar to each other ranked each other as more attractive; 3) each judge tended to see, as most attractive, those whom she saw as being most similar to herself.

A Multidimensional Scaling Approach to Interpersonal Similarity and Attraction[1]

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Similarity and its relationship to interpersonal attraction has and continues to be a much researched topic. Most of the studies to date have dealt with the relationship between attitude similarity and attraction, and this relationship has been verified quite uniformly (e.g., Byrne & Clore, 1966; Byrne & Griffitt, 1966; Byrne, Griffitt, Hudgins, & Reeves, 1969; Krauss, 1966). In addition, studies of relationships between other kinds of similarity and attraction have been done, most of which confirm the similarity-attraction hypothesis, e.g., economic similarity (Byrne, Clore, & Worchel, 1966), and personality similarity (Byrne, Griffitt, & Stefaniak, 1967; Griffitt, 1966).

The before-mentioned studies show wide generalization of the similarity-attraction relationship. However, in all the studies mentioned, the experimenter was responsible for determining the aspect of similarity to be considered by subjects. Hence, a subject responding to one, and only one, aspect of the person when rating him on an attraction dimension. This kind of constraint is believed to be removed when using a multidimensional scaling approach (Coles & Stone, 1972; Stone & Coles, 1970; Stone, Coles, & Lindem, 1970). With this judgmental evaluation approach the judgmental task is relatively unstructured, the only requirement being that numbers between zero and 100 are used as estimations of perceived degree of overall similarity for paired presentations of stimuli.

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In a general sense, the Stone-Coles method of multidimensional scaling has already been used widely to study interpersonal similarity. Stone (1972) has reviewed 18 investigations which applied the Stone-Coles scaling technique to persons, in groups, as stimuli. In an earlier investigation (Jackson, Messick, & Solley, 1957) the basic data were judgments of perceived similarity between pairs of members of a collegiate social fraternity. In the Jackson, Messick, and Solley investigation, subjects served as both stimuli and as judges (as was the case in the present investigation). Interestingly, one of the judgment factors which emerged from their analyses was tentatively labeled as a "friendship" dimension. The success of this early investigation and of those reviewed by Stone (1972) certainly suggests that multidimensional scaling as a judgmental evaluation method is well suited for use in the domain of social psychological research.

The present investigation was designed so as to discover whether the multidimensional scaling approach (the Stone-Coles method in particular) might be profitably used in the study of interpersonal attraction. This methodology was employed so as to determine the factor-dimensions of similarity actually used by a collegiate sorority pledge-class when considering the matter of interpersonal attraction. This investigation attempted to answer the following questions: 1) Which perceived similarity factor-dimensions might be related to a measure of interperson attraction? 2) Are those members of a group which are seen (by the group) as most attractive also seen as being most similar to the group in general? 3) If the group sees two members as being very similar, do these two members see each other as being attractive? 4) Is a group member more attracted to those other group members whom the member sees as being most similar to herself?

METHOD

Sixteen members of a sorority pledge class at the University of North Dakota served as the judges (Js) and as the stimuli. The sorority was paid $25.00 for participating. Initially, all Ss completed a biographical questionnaire. They

were asked to judge the perceived overall or generalized similarity of all possible pairs of stimuli, with zero denoting no similarity and 100 denoting identity. Actual instructions given to Ss were adapted from those used by Coles & Stone (1973). Since there were 16 stimuli, and similarity of all possible pairs was rated, each S made 120 similarity judgments. The pairs of stimuli were randomly presented. Finally, each S was asked to rank order the other members of the pledge class in terms of how much she liked the other persons.

RESULTS

So as to discover whether there were one or more points-of-view held by Js, a rather well-known strategy was employed. A 16 x 16 inter-J correlation matrix, based on the 120 estimates made by each J, was computed and factored (principal components with the limiting eigenvalue set at 1.0). This type of analysis is sometimes known as an "inverse" or "Q-type" analysis. Stone, Coles, and Lindem (1970) refer to such an analysis as Observer Factor Judgment Analysis (OFJA). In the current study, the OFJA resulted in one major judgment factor which accounted for 35 percent of the inter-judge variance. Three other factors were extracted also, which accounted for only a small percentage of variance (9, 7, and 6 percent). Therefore, it was concluded that, for the most part, a common judgmental approach was utilized by the Js.

The 120 similarity estimates were averaged for each pair comparison across all 16 Js. The mean similarity entries in the ij^{th} element were used for the ji^{th} element. This produced a symmetric 16 x 16 mean similarity matrix. The columns of this full mean similarity matrix (with unity values in the diagonal) were intercorrelated to produce a 16 x 16 correlational similarity matrix which was factor analyzed (principal components) and rotated to simple structure using Kaiser's varimax criterion (1958).

Four factors, which accounted for 79 percent of the judgmental variance of the mean similarity estimates, emerged from this analysis. These four rotated factors, along with the communalities for each stimulus, which ranged from 0.51

to 0.95 (mean h^2 = 0.79), are shown in Table 1. Factors I and III were clearly bipolar with high loadings (above ± .5) on both poles. Factors II and IV showed high loadings on one pole, but only low or moderate loadings on the other pole. In other words, Factors II and IV seemed to be only mildly bipolar in character.

Table 1

Rotated (Varimax) Judgment Factor Matrix

	Factor				
Stimulus	I	II	III	IV	h^2
A	.40	.24	.67	-.31	.77
B	.27	.37	-.80	.07	.86
C	.34	-.10	-.87	-.18	.92
D	.67	.18	.06	-.18	.51
E	.79	-.14	-.19	.16	.71
F	.57	-.50	.54	.21	.76
G	.26	.76	.29	.26	.80
H	.49	-.31	.65	.03	.76
I	.19	.75	-.14	-.17	.64
J	.53	.49	.55	.13	.83
K	.28	.79	.07	.12	.72
L	-.16	.85	-.11	.38	.91
M	-.87	-.34	-.05	-.08	.88
N	-.03	.83	-.21	-.03	.74
O	.13	.22	.04	.94	.95
P	-.89	-.26	-.01	-.03	.86
Percent of Total Variance Accounted For	25	26	19	.09	79

Similarity-Attraction Correlations

The estimates of similarity of each stimulus to each of the other stimuli were transformed into correlational similarities (cf. Stone, Coles, and Lindem, 1970). These correlational similarities were averaged to produce correlational similarity means for each stimulus. Such mean correlational similarities indicate the degree to which the stimulus was seen to be similar to all other stimuli in the group. A single stimulus' general similarity to the total group of stimuli is thus represented by a single number. These mean correlational similarities can be statistically compared and tested for difference. The attraction values given each stimulus were also averaged across Js to produce a mean attraction value for each stimulus. The values for both mean correlational similarity and mean attraction are presented in Table 2. A correlation between these two measures indicates the relationship between similarity to the group and attraction as rated by the group. A product-moment correlation (r) between these indices was computed. This coefficient was high, (-.84) and is significant well beyond the .001 level (df=14).

Table 2

Mean Attraction Ranks and Mean Correlational Similarity for Each Stimulus

Stimulus	Mean Attraction	Mean Correlational Similarity
A	9.07	.56
B	5.60	.58
C	9.80	.51
D	9.40	.59
E	8.53	.58
F	8.93	.55
G	4.73	.61
H	11.40	.50
I	8.67	.57
J	5.93	.62
K	6.53	.63
L	5.27	.58
M	11.73	.49
N	5.33	.58
O	5.40	.57
P	11.67	.46

In interpreting correlations between attraction dimensions and the various extracted judgmental factor-dimensions, it must be borne in mind that a higher numerical value on the attraction dimension denotes less attractiveness while a higher similarity score or factor loading is indicative of greater strength on the involved similarity-judgment dimension. Thus, a high negative correlation between the attraction dimension and a specific judgment factor implies a strong positive relationship between rated attraction and that factor. Each stimulus had a loading on each factor extracted from the correlational similarity matrix. For each factor, a product-moment correlation was calculated between the factor loadings (Table 1) and the mean attraction ranks (Table 2). The relationship between Factor I and the mean attraction ranks was shown to be quite low and nonsignificant ($r = +0.26$, $df - 14$, $p > 0.10$). This indicates that Factor I is not highly related to related attraction. A high linear relationship was shown between Factor II and the mean attraction ranks ($r = -0.81$, $df = 14$, $p > .001$). Those who loaded high on this dimension tended to be seen as more attractive. Little relationship was shown between Factor III and the mean attraction dimension ($r = 0.12$, $df = 14$, $p > .10$). Factor IV showed a significant correlation with mean attraction rank ($r = -0.56$, $df = 14$, $p < .05$).

To determine if similarity of loading rather than direction of loading on Factors I and III was related to attraction, the judges-stimuli were divided into two equal groups according to their loadings on Factor I (Table 1). Group I consisted of the eight stimuli with highest positive loadings on Factor I (P, M, L, N, O, I, G, and B), while Group II included the remaining eight stimuli with low-positive or negative loadings on Factor I (E, D, F, J, H, ,A, C, and K). The attraction ranks that each member of Group I gave to every other member of Group II were utilized and a mean attraction value was determined for each J. A t-test was then computed to compare these values with the mean attraction that each member of Group I gave to the members of Group II and those that each member of Group II gave to the members of Group I. In other words, a comparison was made between the 16 mean attraction rankings of those stimuli similar in loading on Factor I

that Group I gave Group I and those that Group II gave Group II and Group II gave Group I if attraction and similarity on this dimension were related. A relationship between similarity on this dimension and attraction was shown (t - 4.57, df = 14, p < .001). The same procedure was used to determine if those girls loading positively (A, H, J, F, G, K, D, and O) and those loading negatively (C, R, N, E, I, L, M, and P) on Factor III showed preference for other girls with loadings similar to their own. A significant difference between the means of rankings of "own group" and rankings of "other group" was also found for this dimension (t = 3.63, df = .14, p < .01). This finding supports the idea of relationship between similarity on this dimension and rated attraction.

The similarity estimates for each pair of stimuli had been averaged to produce mean similarity estimates. These mean similarity estimates were correlationally transformed to produce the correlational similarities for each pair of stimuli. A dyadic attraction score for each pair was determined by averaging the attraction ranks each member of a pair gave the other member. The correlation between the mean correlational similarity for each pair and the dyadic attraction scores was high (r = -.0.70, df = 118). This coefficient is statistically significant well beyond the .001 level. Thus, those girls who the group saw as being most similar to each other consequently saw each other as being most attractive.

The columns of a single J's similarity estimation matrix (16 x 16) were intercorrelated to produce and individual J's correlational similarity matrix. Such a matrix contained correlational similarities between all pairs (based on a single J's estimates), including the correlational similarity of each stimulus to herself. That J's correlational similarities to each of the other stimuli were designated as "correlational similarity-to-self" scores. Each J's "correlational similarity-to-self" scores were then compared to her own produced attraction rankings to determine if a relationship existed between these measurement variables for that J. The degree to which similarity-to-self and attraction were related thus depended only upon the estimates provided by the individual J concerned. For each J such a correlation coefficient between these two measures was computed (Table 3). These correlation coefficients ranged from -.19 to -.94, with all but

Table 3

Correlations Between the Correlational Similarity-To-Self Scores And Attraction Rankings of All Stimuli As Determined for Each *J*

Judge	*r*	*p* (with 13 *df*)
A	-.92	<.001
B	-.83	<.001
C	-.82	<.001
D	-.79	<.001
E	-.80	<.001
F	-.75	<.01
G	-.84	<.001
H	-.80	<.001
I	-.94	<.001
J	-.84	<.001
K	-.74	<.01
L	-.94	<.001
M	-.51	<.10
N	-.79	<.001
O	-.19	>.10
P	-.82	<.001

Js M and O showing correlations significant beyond the .01 level. The correlation for J M showed some relationship between similarity-to-self and attraction (r - - .51, df -- 13, p .10). However, little relationship was found between these two measures for J O (r- -.19, df - 13, p .10).

In order to determine if an overall relationship existed between similarity-to-self and attraction, a single correlation coefficient was computed between all J's correlational similarity-to-self scores and their attraction rankings of all stimuli. It was determined that correlational similarity-to-self was systematically related to attraction (r - -0.73, df - 238, p .001). Those girls whom a J saw as being similar to herself were also generally the girls to whom she was attracted.

DISCUSSION

Interpretation of Similarity Judgment Factors

The factor analytic multidimensional scaling results presented in Table 1 were shown to the 16 judges-stimuli for their interpretation. Identification of the psychological nature of each dimension was to be determined by the pattern of loadings on each factor and their relationship to discernible stimulus characteristics.

Factor I, accounting for 25 percent of the mean similarity variance after rotation, was the most difficult to label. Those who loaded high on this factor (E, D, and F) were wealthy, neat dressers, and conservative in their party-going behavior. They also were all from the same hometown where they had known each other before coming to college. Those who loaded high on the other pole were reported as putting themselves through college, had less money for clothes, and frequently attended parties without dates or switched dates during the evening. Three of these four subjects were from a single, different hometown. Some speculation as to the existence of pre-existing friendship groups and biographical proximity may have been well founded. However, most Js felt that this was not indicative of the identity of the first factor. This factor, after some deliberation, was labeled "dating conservatism-liberalism."

The second factor was labeled "sociability" or "extroversion-introversion" and accounted (after rotation) for 26 percent of the mean similarity variance. Those who loaded high and positive, (L, N, K, G, and I,) were uniformly described as loud, silly, and outgoing extroverts. Because all the girls were outgoing to some extent, the negative pole had only low loadings and these girls (M, H, F, and P) were seen as being somewhat more quiet, reserved, and alone.

Those who seemed to put school work responsibilities first loaded highly on the negative pole of the third factor. B and C were "straight A" students and showed highest loadings on this factor. Although those students with the poorest grades did not define the positive pole, the students who did load the highest in this direction (A, H, J, and F) were seen as less responsible in academic and social duties and were regarded as not very concerned about school work. This factor was frequently interpreted as "non-studiers vs. studiers." However, it is believed that the negative pole might best be named "dependability."

Only one girl (O) loaded very high on the fourth factor, and she was described as being most outspoken and very sure of herself. This factor was determined to represent a "dominance-submission" dimension. Although no one loaded very high on the submission pole, those loading the highest (A, C, and D) were seen as less likely to defy the group and more likely to go along with ideas when they did not agree with them.

Attraction and Its Relationships to Similarity Factor-Dimensions

Factors I and III showed very little linear relationship to rated attraction. A slight, statistically nonsignificant, preference was shown for the wealthier, more conservative daters and the more studious or dependable girls. Although no significant preference was shown for the wealthier, more conservative daters, this in itself would not preclude a reliable relationship between similarity on this dimension and attraction. The very fact that all or most girls did not prefer either the wealthier or the less wealthy girl might point to the existence of a preference for those of similar economic standing or dating habits. If those girls who loaded negatively on this dimension preferred other girls who loaded positively, a cor-

relation between attraction and this dimension might be very low or close to zero. Those who loaded negatively would be liked best by some, while those who loaded positively would be preferred by others. Averaging the attraction rankings would fail to show this preference difference.

Such a preference difference was shown by the results of the t-test between means of rankings of "own group" as opposed to "other group." The results indicated that those girls loading high and positive on Factor I preferred other girls loading positive, while those who loaded low or negative preferred girls who also loaded low or negative. Byrne, Clore, and Worchel (1966) found a relationship between economic similarity and attraction, and Factor I could have some bearing on this type of similarity. The lack of preference shown for girls at either pole of Factor III would lead to much the same speculations. The relationship between similarity on Factor III and attraction was also supported by the t-test between means of "own group" rankings and "other group" rankings. Thus, those girls who were more studious or more dependable preferred others who were more dependable, while those at the opposite pole of Factor III preferred others loading at that end, those less studious and less dependable.

The "sociability" or "extroversion" dimension (Factor II) showed a high relationship to rated attraction. Those seen as more sociable or extroverted were ranked as being significantly more attractive than the more introverted or less sociable subjects. This is in agreement with a finding by Hogan and Mankin (1970). They found that men showed a significant preference for men who ranked high in sociability as defined by the California Psychological Inventory.

The fourth factor, "dominance-submission" was found to be more significantly rated to attractiveness. The more dominant girls were preferred to those who were more submissive. Although this relationship was not as strong as that between attraction and sociability, it supports other previously reported findings. Palmer and Byrne (1970) found an overall preference across Ss for the dominant over the submissive stranger; as did the previously mentioned Hogan and Mankin study (1970) for acquaintances.

In the current study, all Ss, regardless of their own loadings on the dominance and sociability factors, showed a prefer-

ence for the more dominant and the more sociable peer, while Ss preferred peers who had loadings similar to one's own on the dependability and dating conservatism dimensions. Thus dominance and sociability were personality styles preferred across Ss while attraction depended upon similarity to S in dependability and dating conservatism, with no general preference across Ss.

Overall Similarity and Attraction

The aforementioned correlations were between attraction and each of the four factors and thus were not intended to show a relationship between nondimensionalized or mean similarity and mean attraction. Such a relationship was shown, however, by the correlation between the mean correlational similarities for each stimulus and the mean attraction values for each stimulus. Those who were seen by the group as being the most highly similar to all members of the group were also seen as being more attractive by the group as evidenced by their average attraction values. Also, those pairs who the group saw as being more similar rated each other higher in attractiveness. A dyadic attraction rank was calculated by averaging the attraction ranks each member of a pair gave the other member. This was then correlated with the mean correlational similarity of each pair. Those who were seen by the group as being more similar (as expressed by the mean correlational similarities) ranked each other as being more attractive than others who the group saw as being less similar. The group's perception of the similarity of two persons was thus related to the attraction values these individuals gave each other. A more direct method of similarity-attraction measurement would be to correlate an individual's preference ranking of the stimuli with a measure of her own perceived similarity to those stimuli. The following provides a discussion of the results of such correlations.

Correlations Between Each J's Similarity to Self Estimates and Attraction Ranks

All Js except two (M and O) showed high correlations between their similarity-to-self scores and their attraction rankings of the stimuli. Thus, those girls who a J saw as being more similar to herself were also the girls to whom she

was most attracted. Judges M and O, however, did not seem to follow this trend. Descriptions of these two girls suggested possible reasons for such a discrepancy. Although not to the same degree as the others, J M showed quite a tendency to respond in the expected direction. She was described by other subjects as quiet and reserved. She was seen as the least extroverted by the group as shown by their loading on Factor II. She was reluctant when interpreting the factors as she felt she did not know most of the girls very well. Perhaps this lack of rapport or intimacy was associated with the lower correlations between her attraction rankings and similarity-to-self scores. The other and most atypical J (O) showed a very low, but positive, relationship between attraction and similarity-to-self. The judge was described by others as unconventional, most sure of herself, and very outspoken. She defined the dominance pole of Factor IV almost individually and was singled out as "someone to get to know." Seriousness, understanding, likeability (fourth in group mean attraction ratings) were other descriptions given her. Perhaps her unconventionality and uniqueness affected her estimates of similarity-to-self and attraction rankings. Whatever the explanation, all people cannot be said to operate under the similarity-attraction hypothesis. However, a correlation of all J's similarity-to-self scores and produced attraction rankings showed that there does exist a considerable, on the average, relationship between generalized similarity and attraction.

IMPLICATIONS

The present investigation shows support (1) for a definite relationship between generalized similarity and attraction, and (2) for a general preference across Ss for persons who "score" high on specific judgmental dimensions extracted from inter-person similarity information. Therefore, while similarity does appear to be an important determinant of interpersonal attraction, the present investigation points to the possibility that variables in addition to similarity are important, that the situation is much more complex. The Byrne similarity-attraction hypothesis would seem, then, to be an

oversimplification. Finally, the results of this study indicate that the multidimensional scaling approach (e.g., the Stone-Coles method, in particular) is well suited to the study of interpersonal attraction.

It is important to note that the interperson judgment factors which emerged from estimates were made by young, female college students. As such, their opportunities for observing one another and the situations they encountered as a group are not easily generalized to a general population of adults. A more general population might perhaps evaluate similarity along other dimensions as they seemingly would have different experiences and priorities upon which to base their estimates. However, these obtained factor-dimensions do appear to provide a guideline for further study in the similarity-attraction area.

REFERENCES

Byrne, D., & Clore, G.L., Jr. Predicting interpersonal attraction toward strangers presented in three different stimulus modes. Psychonomic Science, 1966, 4, 239-240.

Byrne, D., Clore, G.L., Jr., & Worchel, P. The effect of economic similarity-dissimilarity on interpersonal attraction. Journal of Personality and Social Psychology, 1966, 4, 220-224.

Byrne, D., & Griffitt, W. A developmental investigation of the law of attraction. Journal of Personality and Social Psychology, 1966, 4, 669-702.

Byrne, D., Griffitt, W., & Reeves, K. Attitude similarity-dissimilarity and attraction: Generality beyond the college sophomore. Journal of Social Psychology, 1969, 79, 155-161.

Byrne, D., Griffitte, W., & Stefaniak, D. Attraction and similarity of personality characteristics. Journal of Personality and Social Psychology, 1967, 5, 82-90.

Coles, G.J., & Stone, L.A. A new methodological revision of Ekman's "content" model of multidimensional similarity

analysis. Multivariate Behavioral Research, 1972, 7, 85-107.

Coles, G.J., & Stone, L.A. Instructor's multidimensional perception of their students. Perceptual and Motor Skills, 1973, 36, 13-14.

Griffitt, W.B. Interpersonal attraction as a function of self-concept and personality similarity-dissimilarity. Journal of Personality and Social Psychology, 1964, 4, 581-584.

Hogan, R., & Mankin, D. Determinants of interpersonal attraction: A clarification. Psychological Reports, 1970, 26, 235-238.

Jackson, D.N., Messick, S.J., & Solley, C.M. A multidimensional scaling approach to the perception of personality. The Journal of Psychology, 1957, 44, 311-318.

Kaiser, H. F. The varimax criterion for analytic rotation in factor analysis. Psychometrika, 1958, 23, 187-200.

Krauss, R. M. Structural and attitudinal factors in interpersonal bargaining. Journal of Experimental Social Psychology, 1966, 2, 42-55.

Palmer, J., & Byrne, D. Attraction toward dominant and submissive strangers: Similarity verses complimentarity. Journal of Experimental Research in Personality, 1970, 4, 108-115.

Stone, L.A., & Coles, G.J. Correlational similarity: the basis for a new revised method of similarity analysis. Studia Psychologica (Bratislava), 1970, 12, 258-264.

Stone, L.A., Coles, G.J., & Lindem, A.C. Multidimensional evaluation structure analysis. Grand Forks, North Dakota: Judgmetrics, 1970.

Stone, L.A. Multidimensional scaling of persons in groups: progress report. Perceptual and Motor Skills, 1972, 35, 35-42.