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ABSTRACT

The purpose of the present study was to extend the construct validity of a scale designed to measure attitude toward technology. A revision of the Mechanization Scale (Goldman, Platt & Kaplan, 1972) was administered to 89 undergraduate students with instructions to respond as if each were a member of a specified occupational group. The target occupational groups (Social Worker, Forest Ranger, Banker, and Mechanical Engineer) were chosen because they had been rated to represent extreme high-low combinations of mechanical competence and favorable-unfavorable view of technology. Responses to the questionnaire were analyzed by a 2 X 4 (sex of subject-by-target occupation) multivariate ANOVA. Differences between occupational group centroids were highly significant whereas other contrasts were not. A discriminant function analysis reveals a two dimensional discriminant space in which the configuration of occupational groups reflected the rater-derived configuration. The study was viewed as successfully extending the construct validity of the mechanization scale. (Author)

Abstract

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The purpose of the present study was to extend the construct validity of a scale designed to measure attitude toward technology. A revision of the Mechanization Scale (Goldman, Platt & Kaplan, 1972) was administered to 89 undergraduate students with instructions to respond as if each were a member of a specified occupational group. The target occupational groups (Social Worker, Forest Ranger, Banker, and Mechanical Engineer) were chosen because they had been rated to represent extreme high-low combinations of mechanical competance and favorable-unfavorable view of technology. Responses to the questionnaire were analyzed by a 2 X 4 (sex of subject-by-target occupation) multivariate ANOVA. Differences between occupational group centroids were highly significant whereas other contrasts were not. A Discriminant function analysis reveals a two dimensional discriminant space in which the configuration of occupational groups reflected the rater-derived configuration. The study was viewed as successfully extending the construct validity of the mechanization scale.

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One of the most topical issues today concerns the import of technology. Some people advocate technological change and believe mankind is exalted because of the mechanical things he has created. There are also opponents of technological change. These groups hold technology largely responsible for many of society's ills including loss of privacy, devaluation of human worth, and destruction of the environment. In recent years the public has been exposed to a considerable amount of propaganda concerning technological issues. Politicians, citizens groups, and commercial industries have gone to great lengths to let their views be known.

Because of the importance of the issue of technological change, it is important to measure attitudes toward technology. An earlier paper (Goldman, Platt & Kaplan, 1972) described the first stages in the development of a Mechanization Scale. In that study, a factor-analysis was performed upon a large domain of items reflecting various opinions toward different aspects of technology, resulting in six conceptually focused orthogonal dimensions. The purpose of the present research was to extend the construct validity (Cronbach & Meehl, 1955) of the Mechanization Scale and to examine the stereotypes held by college students of members of various occupations.

To accomplish this aim a shortened revision of the Mechanization Scale was administered to four groups of subjects with the instruction to respond as if each were a member of a (specified) occupational group. These particular occupational groups had been chosen by independent raters to represent extreme

points on two important attitudes toward technology.

It was hypothesized that the Mechanization Scale would represent the differences among stereotypes of occupational groups in a transitive, two-dimensional configuration which would roughly reproduce ratings of these groups.

Method

Subjects. The subjects were 89 students enrolled in an upper division psychology course at the University of California, Riverside.

Questionnaire. A revised and shortened version of the Mechanization Scale (Goldman, Platt & Kaplan, 1972) was presented to all subjects. The scale was believed to consist of five dimensions. The original 80 item scale was reduced to a 40 item version. The shortened Mechanization Scale contained 8 items from each dimension. In the revision of the Mechanization Scale, an item was deleted if it did not show a clear conceptual relationship to other items which loaded highly on the same factor. One of two procedures was used to generate the five subscales of equal length. If the original dimension contains a large number of items, then the eight with the highest loadings were selected for the revised scale.

Dimensions which originally contained less than eight items were expanded through the addition of new items which were conceptually similar. Scale scores were computed by summing the responses to scale item. This procedure produced scales which were correlated but conceptually focused.

The present research concerned most specifically two of the five subscales. These two subscales were dubbed Global Mechanism and Mechanical Curiosity.

The Global Mechanism subscale contains items which reveal a positive or negative global attitude toward technology. Included in this are items which indicate the stressful nature of technology (e.g., "Technological

change is occurring so fast people are becoming second to machines."), items which express lack of confidence in technological cures (e.g., "In order to solve the problems of environmental pollution, mankind should stop using machines that pollute, rather than attempt to develop new machines that purportedly will be cleaner."), as well as items which express a low valuation for the products of technology (e.g., "The greatest reason the dollar is worth so little today is that most goods are produced by machine.").

The other subscale of interest was the Mechanical Curiosity factor which contains items that express interest in the mechanism of technology (e.g., "Computers are so foreign to me that I have little understanding of them."), as well as items which express curiosity for machines (e.g., "I have never had any desire to learn how a car engine operates." [scored in the reverse direction]; "I would prefer reading Popular Mechanics to reading Life."). Other items on this scale express a relative preference for technical rather than humanistic events (e.g., "I prefer building models to reading books." ... "If I were in a recording studio, I would probably be more interested in the equipment used in making a record than in listening to the music.").

The other subscales include: 3) Preference for Handmade Goods, reflecting preference for handmade products over those produced by machines; 4) Spiritual Benefits of Technology, composed of items which describe man's aesthetic benefits resulting from technological advance; and 5) Human Vitalism which contains items that allude to a "human element" which cannot be duplicated by machine.

Procedure

The basic task required of the experimental subjects to answer the items on the Mechanization Scale as if each were a member of some stated occupational group. The occupations used for the experiment were chosen because their stereotypes represented different levels of the two factors of interest. There

were two levels of global attitude toward technology (high and low) and two levels of mechanical competence (high and low). The specific occupational groups were chosen as the result of ratings by sixteen graduate students. The target occupations included: 1) mechanical engineer, rated favorable in global attitude and high in competence; 2) banker, representing favorable global attitude but low competence; 3) forest ranger, representing unfavorable global attitude but high competence; and 4) social worker, representing unfavorable global attitude and low competence.

The revised form of the Mechanization Scale was administered to the subjects with the instruction to respond as if they were a member of the occupational group named on the questionnaire. There were an equal number of questionnaires naming each of the target occupational groups. These were randomly mixed and then distributed to the subjects.

It was hypothesized that the stereotypes of the four target occupational groups would be represented by a two dimensional discriminant space with one axis representing global attitude and the other representing mechanical curiosity.

Results

The reliabilities and intercorrelations of all measures are shown in Table 1. Since anonymity was assured, test-retest reliability would not be assessed. Therefore, reliabilities were calculated by the odd-even split half method and corrected for half length by the Spearman-Brown formula. It appears from Table 1 that the five subscales show high intercorrelations. In fact, only subscale 2 shows moderate correlation with the other subscales; a matter which presents itself in the discriminatory analysis.

Comparison of Groups

A multivariate analysis of variance was performed upon the questionnaire

responses, using subscale scores as dependent variables. The design was a 2 X 4 (Sex of Subject X Occupational Group) between subjects design. Although the cell sizes were slightly unequal, a technique was used to unbias the non-orthogonality of the design. This technique has been described elsewhere (Goldman, 1972). There were no significant Sex effects or Sex X Occupation interactions.

The differences between occupational groups, were highly significant. Rao's (1952) approximation to the F ratio (F [15,212] = 15.71) indicated that group centroids differed at beyond the .0001 level. Since the first two roots of W^{-1} A (where W^{-1} = the inverse of the within groups sum of squares and cross-products matrix [SSCP], and A = the among groups SSCP matrix) were each significant at beyond the .0001 level, the differences among the occupational groups could be represented along two orthogonal dimensions (discriminant functions). The first discriminant function (χ^2 [15] = 163.57; $p < .0001$) most heavily weighted Spiritual Benefits and Global. The second discriminant function (χ^2 [8] = 68.76; $p < .0001$) heavily weighted Mechanical Curiosity.

The pattern of discriminant function coefficients, as well as univariate F ratios for the comparison of occupational groups, are presented in Table 2. The centroids for the occupational groups are presented in Table 3.

Discussion

The major purpose of the present study was to further investigate the construct validity of the Mechanization Scale. The method of Group Differences, as outlined by Cronbach and Meehl (1955), was used. Our "groups" were "created" by instructing subjects to respond as if they were members of one of four occupational groups. These occupational groups had been chosen by raters to represent extreme points on two attitudes toward technology. It was hypothesized that a discriminant function analysis of the Mechanization Scale

would recreate the configuration of the occupational groups in a two dimensional space. It appears that this hypothesis has been supported. The configuration of groups in discriminant space is clearly two-dimensional (as indicated by the statistical significance of two discriminant functions). Furthermore, the dimensions appear to reflect those used for rating occupational groups, namely, a global favorable-unfavorable attitude, and mechanical curiosity-competence. The configuration of groups in the discriminant space accurately and transitively reflects the rater-derived configuration. A reference to Table 3 reveals that Banker is viewed as highly favorable in global attitude toward technology but low in mechanical curiosity; Mechanical Engineer is highly favorable in global attitude and also high in mechanical curiosity; and, Social Worker is unfavorable in global attitude and low in mechanical curiosity. Since this was, essentially, the configuration of groups arrived at by the raters, it appears that the Mechanization Scales has reproduced it. This is one of the requirements for the construct validity of a measurement device which appears to have been satisfied.

A more substantive implication of the present study is the fact that technical competence or curiosity does not necessarily imply a favorable or unfavorable global attitude toward technology. It appears possible for (the stereotype of) a group to demonstrate little mechanical competence and yet maintain a very favorable <u>global</u> attitude toward technology. The converse is also true. This implication is quite intriguing since it is possible people who have enormous effects upon technology (bankers, lawyers) may have little understanding of its mechanisms.

Although the version of the Mechanization Scale contained five subscales, the inclusion of these five scales does not appear to be justified by the present study. There were very high intercorrelations between all scales except <u>Mechanical Curiosity</u>. In the discriminatory analysis, Mechanical Curiosity formed one discriminant function virtually by itself while Global and Spiritual Benefits

formed another. Finally, it is interesting to note that Spiritual Benefits was weighted most heavily on discriminant Function I. The belief in the Spiritual Benefits of technology may actually be a sophisticated way of measuring global attitude. A next step in the construct validation of the Mechanization Scale should include comparisons of actual occupational groups rather than simply stereotypes of these groups.

References

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TABLE 1

RELIABILITIES AND INTERCORRELATIONS

OF MECHANIZATION SUBSCALES

Scale	Reliability	1	2	3	4	5
1. Global Attitude	.86	1.0	.54	.64	-.71	.74
2. Mechanical Curiosity	.86		1.0	.33	-.47	.57
3. Preference for Handmade Goods	.66			1.0	-.64	.66
4. Spiritual Benefits	.86				1.0	-.61
5. Human Vitalism	.82					1.0

TABLE 3

OCCUPATIONAL GROUP CENTROIDS ON THE
TWO LARGEST DISCRIMINANT FUNCTIONS

	Function I	Function II
Social Worker	-3.97	7.23
Banker	-6.35	7.12
Forest Ranger	-2.71	6.11
Mechanical Engineer	-5.37	4.56

TABLE 2

COMPARISON OF OCCUPATIONAL GROUPS: DISCRIMINANT FUNCTION COEFFICIENTS AND UNIVARIATE F RATIOS

Variable	Univariate		Discriminant Function Coefficients	
	F	P	I	II
1. Global	32.17	.0001	.68	-.14
2. Mechanical Curiosity	34.16	.0001	-.45	1.15
3. Pref Handmade	14.46	.0001	.03	.15
4. Spiritual Benefits	44.42	.0001	-.82	.17
5. Human Vitalism	14.05	.0001	-.14	-.13