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in action and construction in Media and Society

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Social Representations
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Tension, Adventure, and Risk (TAR) and the Classification of Occupations: A Multidimensional Analysis

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MARIE CURIE ACTIONS	**European Commission Research** **Directorate General Human Resources and Mobility** **MARIE CURIE CONFERENCES** **& TRAINING COURSES (MSCF-CT-2004-013264)**	European Ph.D	**Social Representations** **in action and construction in Media and Society** **SoReCoMedia & Society**

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Tension, Adventure, and Risk (TAR) and the Classification of Occupations: A Multidimensional Analysis

Abstract

The vast array of occupations can be classified in many ways. The present study employed Roe's (1956) classification, based on psychological differences, which posits eight occupational fields: Business, Organization, General-Cultural, Service, Arts and Entertainment, Outdoor, Science, and Technology. These fields have been found, in more than 25 studies (see Meir, 1975), to display a circular structure. However, an additional group of occupations, entitled Tension, Adventure, and Risk (TAR), does not figure as a separate field in existing occupational classifications, including Roe's. The objective of this investigation was to determine whether TAR constitutes a separate field (Hypothesis 1) or a separate dimension, a differentiation within other fields (Hypothesis 2). Following procedures designed by L. Guttman (1968) and others, namely the SSA and the External Variables module, the findings support the second

hypothesis. Theoretical and practical implications of the results are discussed.

This paper deals with the application of a multidimensional analysis of empirical data to a theoretical issue with practical implications the classification of occupations. The technological revolution of the 20th century has caused numerous occupations to split into separate sub-categories, producing, for example, hundreds of specializations in what was once called "internal medicine," and dozens of specializations in what was once "clinical psychology." Even lower-level occupations have become specialized, with different definitions of "auto mechanic," for instance, according to car model or type of engine. Depending on the agreed variance within categories, the number of occupations has been estimated at anywhere from several hundred and to over 200,000. This situation has led to idiosyncratic training programs, promotion schedules, work conditions, status, salary, etc. for each specialization.

There is a need to classify occupations for several reasons. These include administrative purposes such as population census or manpower management, vocational counseling including organization of occupational information and construction of interest inventories, economic considerations such as cross-cultural comparisons and examination of economic trends, and sociological investigations including examination of

status by sectors of the labor market and gender differences among occupations.

Existing occupational classifications differ according to method and number of categories. Administrative classifications start with broad divisions, followed by sub-divisions, sub-sub divisions, and so on; the main characteristic being that the classification is exhaustive and inclusive (every occupation is included once and only once), regardless of the fact that different occupations within certain categories may not have much in common. Psychologically-based classifications proceed on the principle that, in psychological terms, the occupations within a given category are more similar to each other than they are to the occupations in other categories. This approach was adopted for purposes of the present study.

The most widely-known psychological classifications of occupations are those of Holland (1973, 1985, 1997) and Roe (1956). Holland classified all occupations in six types (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional), with each type divided further by the addition of a second and third label of secondary characteristics: an occupation may be Investigative-Realistic-Enterprising, for example. Roe (1956)

classified all occupations in eight fields (Business, Organization, General-Cultural, Service, Arts and Entertainment, Outdoor, Science, and Technology). Here, each field is further divided into six occupational levels, determined primarily by level of education, responsibility, and skill. Roe's classification was preferred in this study mainly because it contains more categories (eight instead of Holland's six), has been the subject of numerous studies of its structure (see below), and is parsimonious in terms of number of definitions (8 fields x 6 levels = 48 occupation groups).

On the basis of Roe's (1956) classification, the Ramak and Courses interest inventories were developed (Meir, 1975). The items in these inventories are occupational titles or names of courses, respectively, and the respondents are asked to indicate their interest in them on a scale of Y ? N (Yes, Doubtful, No), scored "Y" =2, "?" =1, "N" =0. The sum of the scores for the items in each field is then calculated to produce the respondent's interest profile, consisting of 8 scores.

These interest inventories are typically administered to counselees (for first occupational choice, occupational change, or before retirement), university or high

school students, candidates for a job or a promotion, or respondents "captured" for research purposes. When the intercorrelations of respondents' eight field scores are computed, they produce an 8 x 8 correlation matrix which can be subjected to multidimensional analysis to reveal the structure of the occupational fields.

Many studies have been aimed at identifying the structure of occupations using either Holland's (1985) or Roe's (1956) classification. See, for example, Gati, (1991), Holland, (1972), Meir, (1975), Rounds & Tracey (1996), Tracey & Rounds, (1993, 1994). Such studies have employed principal component analysis (Cole & Hansen, 1971), SSA or Smallest Space Analysis (Meir, 1975), or ADDTREE (Gati, 1991).

Meir (1975) found that the eight fields in Roe's (1956) classification constitute a circular structure (sometimes referred to as "circumplex"): Business - Organization - General-Cultural - Service - Arts and Entertainment - Outdoor - Science - Technology - Business... The same arrangement emerged from 24 separate SSA analyses (Meir, 1975), with the only difference being that adjacent fields were sometimes interchanged. This is a particularly convincing result, since the samples in the 24

analyses differed with respect to gender (males, females, both), purpose of administration (counselees, workers, or research volunteers), educational level (from eighth grade to university), interest inventory (Ramak or Courses), size, language, and other features.

Analyses of Holland's (1973, 1985) typology have also revealed a circular arrangement, known as the "RIASEC" or "hexagon" structure (Realistic - Investigative - Artistic - Social - Enterprising - Conventional - Realistic...). Moreover, Meir and Ben-Yehuda (1976) found a circular arrangement using a 14 x 14 matrix that combined Roe's (1956) eight fields and Holland's (1985) six types. Deviations from this structure (or between findings in the initial study and replications) are extremely rare, and may be explained by a randomization test (Tracey & Rounds, 1994).

Given the results of these studies, and many other investigations producing similar findings, one might wonder whether or not all possible occupational fields have been accounted for. If the structure is circular, perhaps there are additional fields which might fit into the between-field spaces. In other words, is it possible that both Holland (1985)

and Roe (1956) overlooked a certain domain of occupations, which, if included in the classification, would appear in the structure as a new cluster?

It is entirely possible that the spaces between the fields in the above classifications are occupied by occupations that share certain characteristics with their "neighbors" in the circular arrangement. A clear circular arrangement, without in-between fields, emerges on the basis of the responses to the interest inventories, from which ambiguous items were excluded following item analysis. Although item analysis helps to eliminate "alien" or ambivalent items, it does not preclude the possibility that an entire cluster was excluded.

It is the hypothesis of the present study that such a group of occupations, which is not of minor importance in psychological terms, was indeed overlooked by both Roe (1956) and Holland (1985). This cluster is characterized by tension, adventure, and risk (henceforth: TAR), and includes occupations such as test pilot, lifeguard, explosives expert, social worker specializing in juvenile delinquency, acrobat, race car driver, boxer, or spy.

In psychological terms, the differences between workers in TAR occupations and those in non-TAR occupations can be illustrated by the difference between a paramedic working in an ambulance and one employed in a blood bank: while the first has to be alert throughout his/her working hours (and beyond), the latter almost never encounters life-and-death situations in which he/she must take immediate action. It could be argued that the fact that TAR items are entirely missing from interest inventories is the sole reason for its absence as a distinct category in the occupational structure.

It goes without saying that people differ in their degree of interest in TAR. This can be expected to have an impact on the work place. Some individuals would find their job very unsatisfying if there is no TAR at any time during their workday, while, for others, the absence of TAR is the highest priority. Thus, it would appear that the presence or absence of TAR should be one of the issues taken into account by vocational counselors when helping counselees to make a suitable occupational choice.

Obviously, the empirical examination of whether or not there is, in fact, a significant group of occupations characterized by TAR requires systematic investigation. This would entail constructing an appropriate list of TAR items, presenting them to a representative sample of counselees or workers, and conducting a longitudinal study to test the relation between participants' level of interest in TAR and the TAR level of their jobs, on one hand, and satisfaction (or some other well-being measure) on the other.

A preliminary answer to this question can be provided, however, by testing the items which are assumed to constitute TAR. If such a distinct group of occupations exists, then the score on TAR items will be differentiated from the other field scores in a multivariate analysis. In other words, the TAR items will show high internal reliability (high intercorrelations). If TAR is a distinct cluster, it will emerge as a separate field located somewhere in the circular arrangement; if it is a separate dimension (meaning it displays a similar level of relation with all other fields), it will appear as a vertical dimension, orthogonal to the two-dimensional horizontal structure of the other eight occupational fields. The latter option would mean that the occupational structure has a

cylindrical, rather than circular, shape.

The present study examines these alternatives using procedures designed by L. Guttman (1968) and others, namely the SSA called Smallest Space Analysis or, later, Similarity Structure Analysis (Bayley, 1974; Bloombaum, 1970; Borg & Lingoes, 1987; Lingoes, 1973; Shye, 1978). This method is particularly appropriate for our purposes, as it is a structural procedure.

SSA is a subset of the broad family of data analysis methods known as multidimensional scaling (MDS), "all of which portray the data' s structure in a spatial fashion easily assimilated by the relatively untrained human eye. The essential ingredient defining all multidimensional scaling methods is the spatial representation of data structure" (Young & Haber, 1987: 3). Multidimensional analysis thus enables the simultaneous treatment of a large amount of data and its geometric representation.

SSA portrays the variables as points in a two-dimensional Euclidean space on the basis of the rank order of the correlations among them: the higher the correlation between a pair

of variables, the closer they will be located to each other. Conversely, the lower the correlation between a pair of variables, the farther apart they will be located on the map. This procedure differs from other classic MDS techniques in the way in which it obtains monotonic transformation. Rather than using a least square transformation, SSA sorts the distances into the order indicated by the data (Cohen & Amar, 1999; Guttman, 1968; Young and Haber, 1987).

When using SPSS, two MDS procedures, whose graphic representations are very similar to the ones drawn by SSA, are available: ALSCAL and PROXCAL. For the purposes of this study, however, the HUDAP computer program (Amar & Toledano, 1994) was used for the SSA analysis of the data because recent developments make it possible to integrate "external" variables into the map while leaving the internal structure unchanged (Cohen & Amar, 1993, 1999, 2002). The specific program adopted for our analysis was WSSA1, with "W" indicating "weighted" and "1" for the symmetric matrix. The SSA method is designed to analyze a matrix of correlations between *n* variables by graphically representing them as points in a two-dimensional Euclidean space called the "smallest space." From this matrix, the SSA program creates a map that can be

interpreted according to the regions of related variables. SSA has been used effectively in previous studies on a variety of subjects. See, for example, Arnow, (1994), Cohen, (1999, 2000a, 2000b, 2001, in press), Cohen, Clifton & Roberts, (2001), Cohen & Rein, (2001), Levy, (1985, 1994), Levy & Guttman, (1975), Schwartz & Bilsky, (1987, 1990).

As in many earlier studies using different methods (Meir, 1973, 1975; Meir & Ben-Yehuda, 1976; Meir & Stauffer, 1980; Tracey & Rounds, 1994), WSSA1 analysis of the eight occupational fields reveals a circular structure. This configuration has emerged in about 30 replications, none of which provide either a theoretical or logical rationale for the arrangement. The present study sought to identify the location of TAR when it is added to the other eight occupational fields in Roe's (1956) classification.

Two alternative hypotheses were formulated:

1. TAR is a separate field of occupations, and will thus appear somewhere in the two-dimensional configuration of the structure of occupations.

2. TAR constitutes a separate dimension (a vertical dimension above the two-dimensional circular arrangement of occupational fields); that is, each of the eight

occupational fields includes occupations with TAR characteristics. Thus, if a two-dimensional analysis is used, TAR will appear as a third dimension in the center of the circular configuration.

To examine these two alternatives, TAR was introduced as a ninth variable, and the WSSA1 program was run in two and three-dimensional analyses.

Method

Participants

The statistical analysis was performed on the responses from a heterogeneous sample of 384 males, aged 21-32 (mean = 25.1; SD = 2.19) who were candidates for financial assistance for academic studies. They were serving in the army as low-rank officers in a variety of functions such as maintenance jobs, teachers, and programmers.

Instruments

The participants responded to the Courses (Meir, 1975) interest inventory (as one of a series of tests and inventories), designed to measure vocational interests, into which 8 TAR items were inserted randomly among the other 64 items. The validity of this inventory (without TAR items) has been confirmed by Meir, Esformes, and Friedland (1994). The eight TAR items were: diving, skydiving, skiing, testing new weapons, desert tours, underwater fishing, judo, and hang gliding.

Procedure

Participants were instructed to circle either "Y", "?", or "N" (yes, doubtful, no; respectively) for each item on the inventory, indicating whether or not they would like to study or work in the activity. The Y ? N responses were scored 2, 1, and 0, respectively, and the sum of the scores on the eight items in each of the nine occupational fields was calculated. The Cronbach alpha reliability of the field scores ranged between .72 and .89 (median = .81), with a TAR reliability of .82. Consequently, each participant was assigned a profile of nine scores, each ranging between 0 and 16, eight for the conservative occupational fields and another for TAR. To overcome any response bias (the tendency to prefer negative or positive responses), all scores were converted to

within-participant percentages (a field score of 10 was converted to 25 for a participant whose total score was 40, and to 20 for a participant whose total score was 50).

Results

To assess the validity of the two alternative hypotheses, we considered them separately: first with TAR as a ninth variable (a field of occupations), and then with it as an additional dimension to the eight occupational fields.

Table 1 depicts the intercorrelation matrix of the original eight occupational fields, with TAR as a ninth variable.

Insert Table 1 and Figure 1 about here

Clearly, the well-established and oft-replicated almost perfect circular structure of Roe's eight occupational fields (1956), as presented in Figure 1 (Up), was distorted by the inclusion of TAR as a ninth field (Down). The introduction of TAR affected half of the

structure: General-Cultural and Science are significantly displaced, and, rather than appearing on the perimeter of the new circle, TAR is located inside it. As noted above, the circular structure of the occupational fields has been found in more than 30 independent analyses (Meir, 1975). Figure 1 (down) would therefore appear to call into question the appropriateness of viewing TAR as a ninth field.

As this was an explorative study, we also examined the hypothesis that TAR constitutes a new dimension in the occupational structure. For this purpose, TAR was introduced in the circular structure in such a way that the original configuration was preserved. Here too, the location of TAR was based on its correlations with each of the eight fields of occupations; however, it was introduced as an external variable, leaving the location of the other eight variables unchanged.

External variables, such as sub-populations or content variables, can be plotted in the map (Cohen & Amar 1993, 1999). This is done in such a way that the structure of the original map is not affected. An algorithm was conceived to "fix" the map so that only the relationships between the original variables are considered in the structure into

which the external variables will be introduced. The computer program takes into account the correlation between a single external variable and the matrix of all of the primary variables, placing the external variables on the map one by one. The correlations between the external variables are not considered, and the external variables are not taken into account when placing the primary variables. In other words, only the external variables are dependent on the original variables in their location. The original variables must not depend on the external variables, and neither are the external variables dependent on one another.

The external variable procedure, though relatively new, has been used successfully in a number of data analyses by researchers from the Guttman school (Cohen, 2001, in press; Levy, Levinsohn & Katz, 1993; Lyra, Roazzi & Cohen, 2001).

As explained above, if TAR is a separate dimension, rather than a distinct field, it should appear in the middle of the original structure. As can be seen in Figure 2 (up), TAR is located exactly where it was theoretically expected, indicating that it is indeed a separate dimension.

Insert Figure 2 about here

Despite this apparent confirmation of Hypothesis 2, we wanted to verify whether or not the location of TAR in the center of the original map was accurate. Therefore we run an internal assessment to discover what would happen if we also introduced the eight original variables as external variables. Our hypothesis here was twofold. First, each external variable would be located in proximity to its twin original variable. For example, Service (as an external variable) would be located inside the original circle in front of the original Service variable. We therefore theorized that we would obtain a repetition of the original circular structure with a smaller concentric circle inside. Second, if TAR forms indeed a new dimension, it would again appear in the middle of the original circle, inside the "new" circle. Figure 2 (down) presents the configuration of the 17 variables (the eight original fields, the original fields as external variables, and TAR as an external variable). This analysis clearly produced a map in line with our expectations.

Discussion

We believe that a major contribution of the present study and its results is methodological. It demonstrates the use of multidimensional analyses as a conclusive

means of examining two "logical" alternatives. Two analyses of the same intercorrelation matrix on nine variables led to the clear superiority of one over the other. In this case, the hypothesis that was confirmed is also the one that is more in agreement with earlier findings.

The results of this study have also important implications for vocational psychology. The finding that TAR occupations are a separate dimension in the classification of occupations, rather than a separate occupational field, should be taken into account in various contexts. To illustrate only two domains: (a) Internet occupational information data bases and libraries should offer the option of finding TAR or non-TAR occupations within each of the classic occupational fields; (b) counselors for occupational choice, occupational change, or within-occupation specialization should help their counselees to decide whether to adopt or to avoid jobs that incorporate tension and risk. Since people differ in their personality characteristics, including the level of inclination for a TAR lifestyle, appropriate occupational decisions, which take this feature into consideration, are likely to lead to higher satisfaction (and other well-being outcomes), to the benefit of the individual and society alike.

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Table 1: Matrix of intercorrelations between the 8 occupational fields and TAR (n = 384)

		1	2	3	4	5	6	7	8	9
Business	1	100	54	14	24	15	22	30	36	19
Organization	2	54	100	13	47	18	19	4	24	14
Culture	3	14	13	100	43	56	44	44	12	24
Service	4	24	47	43	100	42	37	23	12	26
Arts	5	15	18	56	42	100	43	34	25	41
Outdoor	6	22	19	44	37	43	100	59	42	50
Science	7	30	4	44	23	34	59	100	49	31
Technology	8	36	24	12	12	25	42	49	100	40
Tar	9	19	14	24	26	41	50	31	40	100

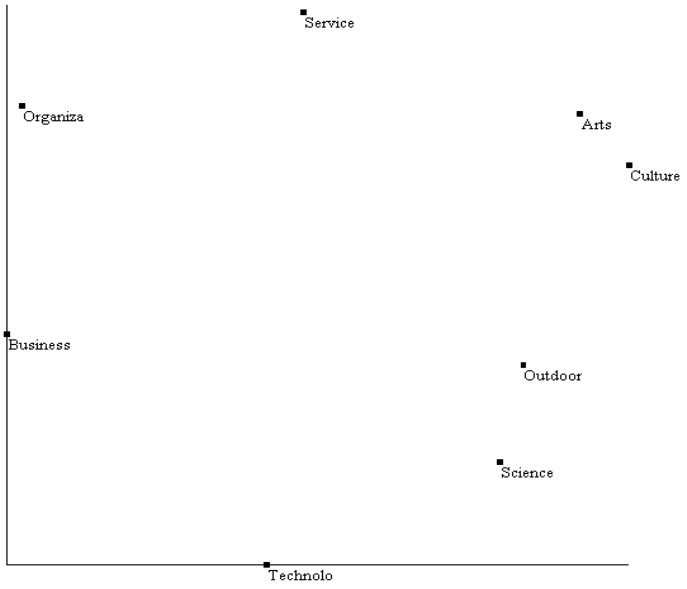
* The original coefficients were multiplied by 100 and rounded into integer numbers

Figure 1:

(Up) Smallest Space Analysis of Roe's 8 original occupational fields

(Down) Smallest Space Analysis of Roe's 8 original occupational fields with TAR as a 9th occupational field

Legend: Business, Organization, General-Cultural, Service, Arts and Entertainment, Outdoor, Science, and Technology, TAR (Tension and Risk)



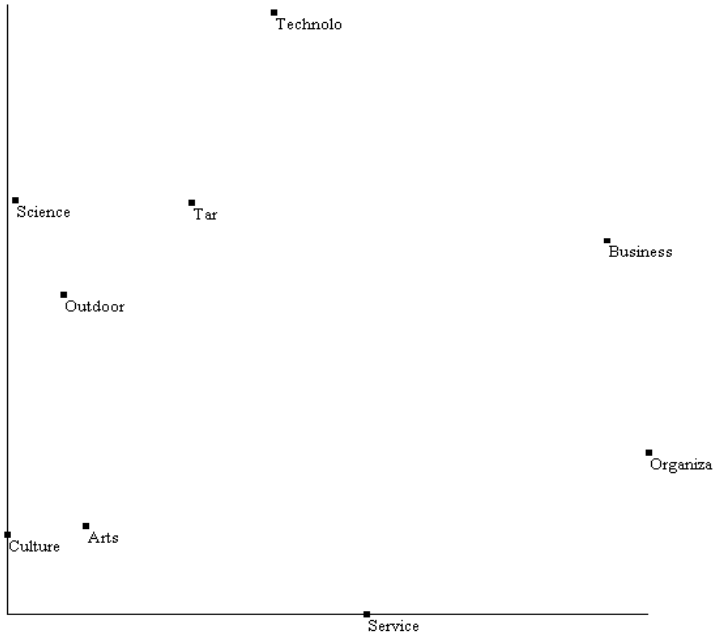


Figure 2:

(Up) Smallest Space Analysis of Roe's 8 original occupational fields (indicated by a square symbol) with TAR as an external variable (indicated by an x symbol)

(Down) Smallest Space Analysis of Roe's 8 original occupational fields (indicated by a square symbol) with TAR and the 8 occupational fields as external variables in the original structure (indicated by an x symbol)