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ABSTRACT

A study examined the structure of the general vocational interests of 2,709 male and female high school pupils in Australia. The study was part of the longitudinal "Youth in Transition," a national probability sample of Australian youth. Participants completed a 24-item questionnaire that reflected J.L. Holland's vocational interest typology. Multidimensional scaling was used to analyze the intercorrelation matrix, and a three-dimensional solution demonstrated only partial support for the circular ordering of interests. The theoretical consistency of the hexagonal arrangement was evaluated using a randomization test and yielded a correspondence index of only 0.24. A quasi-spherical configuration of interests emerged and the underlying dimensions of interests, namely things versus people and data versus ideas were supported. The results have implications for the classification of interests, and possible explanations of these results are discussed. document (Contains 26 references.) (Author/KC)

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THE DIMENSIONS OF GENERAL VOCATIONAL INTERESTS: A STUDY OF AUSTRALIAN HIGH SCHOOL STUDENTS

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RESEARCH REPORT

THE DIMENSIONS OF GENERAL VOCATIONAL INTERESTS: A STUDY OF AUSTRALIAN HIGH SCHOOL STUDENTS

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This study examined the structure of the general vocational interests of 2709 male and female high school pupils in Australia It formed part of the longitudinal *Youth in Transition* study, which is a national probability sample of Australian youth. Participants completed a 24-item questionnaire that reflected the vocational interest typology of Holland. Multidimensional scaling was used to analyse the intercorrelation matrix and a three-dimensional solution demonstrated only partial support for the circular ordering of interests. The theoretical consistency of the hexagonal arrangement was evaluated using a randomisation test and yielded a correspondence index of only 0.24. A quasi-spherical configuration of interests emerged and the underlying dimensions of interests, namely Things vs People and Data vs Ideas were supported. Results have implications for the classification of interests and possible explanations of these results are discussed.

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THE DIMENSIONS OF GENERAL VOCATIONAL INTERESTS: A STUDY OF AUSTRALIAN HIGH SCHOOL STUDENTS

Vocational interest questionnaires that elicit preferences for a number of activities have a long tradition in psychology - dating at least from the development of the *Strong Vocational Interest Blank* in 1923 - and have now become a mainstay of professional services. They embody an idea of which content areas are important to assess and how the categories might or might not be related. Firstly, a hypothesised structure of vocational interests is embodied in the implicit or explicit framework that underlies their use. A notion that has come to prevail in practice is that vocational interests are organised in two-dimensional space usually represented as a circumplex arrangement. Secondly, interests can be considered at different levels of generality and as a starting point, three structural levels have been differentiated, namely general interests, basic interests and occupational interests (see Rounds, 1995).

General interests include broad areas such as science, which may encompass a variety of occupations such as pharmacist, physician, nuclear physicist, industrial chemist, or marine biologist. There is general agreement in the career development literature that Holland's (1973, 1985) circular ordering of general interests (see below for an explanation) represents people's vocational preferences best of all (Borgen, 1986). Basic interests are more specific and cut across a number of related areas, such as the many occupations that make up the field of medicine. For example, the *Strong Interest Inventory* (see Harmon, Hansen, Borgen & Hamer, 1996) has 25 basic interest scales and there are potentially even more if semi-skilled and unskilled activities were to be added to this group. The next level of specificity is at the level of occupation and/or activity interest factors. These describe the multiple work activities or tasks that make up each of the 12-13,000 known occupations.

The purpose of this report is to examine the dimensions underlying high school students' interest preferences at the level of general themes and activities. I examine the implications that this has for two-dimensional views of interests, such as those of Prediger (1982) and Holland (1996). For instance, Prediger has proposed that two bipolar dimensions of work tasks (Things vs People and Data vs Ideas) account for interests and that occupations can be plotted on a world of work map (see Athanasou, 1981; 1990). On the other hand Rounds (1995, p.190) contended that

"...the circular structure of interests is a poor representation of the complexity of the interest space...". Recently, a spherical representation of vocational interests with a prestige component has been proposed (Tracey & Rounds, 1996). This study used the vocational typology of Holland as a starting point for analysing the underlying structure in career interests of young people.

Holland's vocational typology

Holland (1973, 1985, 1996) has proposed that there are six fundamental vocational types or general interests arranged in a hexagonal fashion (see Figure 1). This typology has a major influence on vocational research dominating it worldwide. Holland's vocational typology has also influenced vocational research in Australia (see Ainley, Robinson, Harvey-Beavis, Elsworth & Fleming, 1994; Naylor & Care, 1997; Lokan & Taylor, 1986). It casts interests and preferences within the ambit of personality types and describes the types in order as Realistic, Investigative, Artistic, Social, Enterprising and Conventional. Holland's formulations achieved prominence because of their practical application to careers guidance and counselling. Both people and environments were classified in the same manner allowing users to search a variety of potentially suitable occupations within a coherent and meaningful framework.

Insert Figure 1 about here

Unlike earlier workers in the field of vocational interests, Holland viewed occupational preferences largely as multi-attribute expressions of personality and he went on to specify an overarching relationship between types (or general interests) that added considerably to the utility of his model. He indicated that the personality types were ordered in a two-dimensional circumplex format (see Holland, Whitney, Cole & Richards, 1969). Moreover, he specified a number of related theoretical constructs such as (a) the differentiation of interests (e.g., the difference between the highest and lowest scores and the overall pattern of the profile of the six interests); (b) congruence (e.g., the relationship between interest scores and occupational or educational membership); and (c) consistency or the calculus of the circumplex which specified that some interests were more closely related than others. The closeness of

the relationship was that adjacent interest types were thought to be more consistent than alternate interests, which were thought to be more consistent than opposite interests on the hexagon.

Some indication of the popularity of his theory is that in its latest catalogue, the publisher Psychological Assessment Resources, has announced that over 21 million copies of the *Self-Directed Search* have been sold. More importantly the Holland classification has been incorporated within other major interest inventories such as the *Strong Interest Inventory*, the American College Testing Program's *Uniact Inventory*, the *Career Assessment Inventory* and the *Career Decision Making Inventory* as well as forming a basis for the classification of occupations (Gottfredson & Holland, 1996). This brief description hardly does justice to Holland's contributions to vocational behaviour and the reader is referred to the latest exposition of his theory (Holland, 1996).

For the purposes of the practitioner and the theorist, Holland's model encompassed three key assumptions: (i) a simple circular arrangement of six key interests, (ii) the hexagonal ordering along two dimensions that gave the field of vocational interests some structure and (iii) the calculus or consistency arrangements between the categories which assists in the provision of guidance. These assumptions are examined in this paper using an Australia-wide stratified probability sample. Interest configurations have been affected by the composition of groups studied (see Hanson, Collins, Swanson & Fouad, 1993, p.202) and in previous studies most of the analyses have been generated from non-probability samples (Rounds, 1995, pp.194-198). Moreover, there has been less support for the RIASEC scales in cross-cultural analyses (see Tracey & Rounds, 1996, p.4).

Youth in Transition

This study uses the *Youth in Transition* data, which is an ongoing study of the vocational, educational and social paths of young Australians from high school and beyond. It is a series of longitudinal surveys that form part of the Longitudinal Surveys of Australian Youth conducted by the Australian Council for Educational Research. The surveys are made up of four cohorts of young people born in 1961, 1965, 1970 and 1975. This project evolved from the nationwide literacy and numeracy tests of the Australian Studies in School Performance project. The objective of the surveys was to indicate the main factors that affect personal outcomes and the

surveys encompassed school experiences, socio-economic background, educational attainment, extent of schooling, post-compulsory education and employment. The data fields that were used in this study comprised: demographic data and responses to a 24-item interest questionnaire. A two-stage stratified probability sample involved 25 students randomly selected from a nationwide sample of schools that included government, independent and Catholic school systems. Participants were first contacted in schools and further data collection was by an annual mail survey over a ten-year period. The 1970 cohort is used in this study and was first assessed in 1980 and then followed up at yearly intervals from 1985-1994. Lamb, Polesel and Teese (1995, p.27) went so far as to say "...it represents one of the most substantial long-term studies of outcomes undertaken in Australia". This study took advantage of this valuable data to address the key research question of the number of dimensions required to account for vocational preferences at the highest level of general preferences.

METHOD

Participants. The participants in this study comprised 2,709 pupils (males=1436; female=1273) from the 1970 Youth in Transition study cohort, who were first tested as part of the Australian Studies of School Performance in 1980. When contacted again in 1985 for the first time, some 2,709 out of 3,294 responded completely to every item in the interest questionnaire and were included in this study. The mean age of the sample was 15.5 months (SD=0.3).

Instrument. The interest inventory used in this study was a 24-item questionnaire of the Holland typology of interests developed especially for administration by mail. It formed one of the twelve sections of the larger survey. Pupils were asked 'How do you feel about each of these activities?' and responded on a four point scale from 'like very much' (1) to 'like somewhat' (2) through to 'dislike somewhat' (3) and 'dislike very much' (4) for items such as: bushwalking, working with machines and tools (R), doing all kinds of experiments (I), acting in plays (A), helping others (S), managing other people (E) and doing office work (C), (see Australian Council for Educational Research, Longitudinal Surveys of Australian Youth, Technical Paper Number 5 for a complete copy of the survey questionnaire; Appendix A provides a copy of the interest questionnaire). Due to restrictions of both space and response time the

questionnaire was limited to four items per scale and designed for moderate levels of internal consistency with alpha coefficients for the six RIASEC scales of 0.802, 0.602, 0.636, 0.545, 0.641, and 0.704 respectively. The questionnaire has been used subsequently in other large-scale studies and validated against subject choice (Ainley, Robinson, Harvey-Beavis, Elsworth & Fleming, 1994).

Analysis. Multidimensional scaling was used to analyse the structure of interests. This approach has a long pedigree in interest analyses (see for example Hansen et al., 1993; Day & Rounds, 1998; Rounds, 1995; Rounds & Zevon, 1983), especially in the area of gender differences. The underlying structure is based on similarity data such as intercorrelations and the proximity of variables is represented graphically. The goodness of fit between the dimensions obtained and the original matrix is reported in terms of stress values, with the lower the stress values the better the fit. Solutions with stress values 0.05 to 0.10 are recommended (see Kruskal & Wish, 1978) with a value of zero representing a perfect fit between the intercorrelations and the multidimensional scaling. Non-metric multi-dimensional scaling was used for analysis of the correlations of the six interest scores and comparisons were made with the expected structure from Prediger's (1982) work-tasks dimensions.

In addition to examining the dimensions underlying the Holland vocational types, a randomisation test (Tracey, 1997) can be used to test the hypothesised ordering of relationship in the RIASEC hexagonal model. This compared the relationship between categories such as RI with RA RS RE RC IA IS IE IC AS AE AC SE SC EC resulting in 72 predicted hexagonal relations. A correspondence index ranging from –1 through 0 to +1 indicates the extent of agreement. Further details of the analysis are contained in the results section.

RESULTS

Circular arrangement of interests. The correlations between all six scales are indicated in Table 1 and ranged from –0.129 (Realistic and Social) to 0.440 (Artistic and Social). Table 2 shows the RIASEC stimulus coordinates from the three-dimension solution with stress values of 0.28, 0.11 and 0.04. Ideally a solution in two-dimensions would have been preferred in order to be consistent with Prediger's arrangement and Holland's model but three dimensions accounted for 73.95% of the

variance and more adequately represented the relations among the scales. The coordinates are plotted in Figure 2. The arrangement of the Holland scales in Figure 2 is circular but does not conform to the RIASEC ordering completely. The multidimensional scaling maps for Dimensions 1 and 3 offers the neatest circular ordering with a six sided polygon, and this is mainly because it appears to represent the underlying Things-People (Dimension 1) and Data-Ideas (Dimension 3).

Insert Tables 1,2 about here

The hexagonal ordering. The weights in Dimension 1 correlated (Spearman rank correlation) 0.853 with Prediger's People-Things notional dimension weights and 0.00 with the notional Data-Ideas dimension weights. Dimension 2 correlated 0.323 with People-Things but 0.00 with Data-Ideas. Dimension 2 represents a weak dimension of gender in which the ordering of the categories approximates the magnitude of the correlations between gender (categorised as 0/1) and the RIASEC scales. Dimension 3, however, more adequately represents the Data-Ideas continuum with which the weights correlated 0.836 and only 0.117 with the Things-People dimension.

The calculus or consistency arrangements. Application of the randomisation test showed that 44 of the 72 predicted hexagonal relations were met and one was tied, resulting in a correspondence index of 0.23 ($p=0.18$, ns). A major problem arose from the location of the Conventional category.

Insert Figure 2 about here

DISCUSSION

The findings from the multidimensional scaling were consistent with a quasi-circular arrangement of interests for Australian high school students. The first and third dimensions mapped onto the RIASEC categories did match Prediger's theory-based People versus Things and Ideas versus Data connection but the findings did not provide complete support for two-dimensional arrangement of general interests. The interest configuration was not consistent with Holland's structural model of order and for his hypothesised calculus. The Conventional category departed sufficiently from

the RIASEC ordering to lessen the circular ordering of interests. In another context, Rounds also noted that the "...conventional theme was not well represented by the basic interest scales..."(1995, p.223).

The charts in Figure 2 do no justice to a three-dimensional view. When the RIASEC scales are plotted in a three-dimensional arrangement (see Figure 3) the Realistic and Social scales maintain a polarity at the edge of the sphere (almost like an east-west equator of interests). Investigative is closer towards the core of the sphere but Enterprising is located on the edge of the sphere and on the opposite side to Artistic. The results do support a quasi-spherical conception of interests (Tracey & Rounds, 1996) but without the prestige dimension that they advocated. In this case one reason for the absence of prestige may be that the items reflected activities which were of a reasonably neutral status and in which low status activities have been partialled out.

Insert Figure 3 about here

The current results suggest that some theoretical modifications of Holland's model and typology may be necessary to account for the interests of Australian high school pupils. Firstly, the six categories of general interests may need to be supplemented because there are large areas of the three dimensional space which are not represented by general interest themes. This is easiest to visualise in the three-dimensional surface plot. The results of earlier Australian studies (e.g., Athanasou, 1981; 1986; Athanasou, Hall, Fox & Jenkins,1980) using a two dimensional representation may no longer be sufficient to summarise the variance in the vocational interests. Secondly, there is a suggestion in these results that there are underlying gender differences not accounted for in a universal hexagonal ordering. Furthermore, Patton and McMahon (1998) have also argued for the consideration of other socio-cultural factors in career development. Thirdly, the calculation of the construct of consistency by counsellors for the purposes of guidance or interpretation of results may well be in error given that only 45 out of the 72 intercorrelations were in the predicted order.

The advantage of the present study is related largely to the unique sample, its representativeness and its size. Limitations, however, relate to the survey non-response rate and also include the low internal consistency of the 4-item questionnaire

for each of the six categories. Reliance on internal consistency as an explanation is not always helpful, however, as there are instances in which moderate levels of internal consistency are acceptable when there is evidence for validity, or there are practical reasons or the scale is less than 10 items (see Loewenthal, 1996, p.48). Moreover the troublesome Conventional category had the second highest internal consistency reliability of 0.704 after Realistic.

The available evidence indicated some underlying dimensions for the vocational interests of Australian high school pupils that have theoretical potential and meaning. The structure is elusive but the preferences of the sample were not random and many of the expected relationships between categories were supported. The next phase in this program of research is to consider the dimensions at the level of basic and specific interests as well as across different populations and with different instruments. A tentative hypothesis is that many more dimensions are required to account for vocational preferences.

Acknowledgement

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How do you feel about each of these activities?	Holland category
Bushwalking	I
Going shopping	S
Typing	C
Acting in plays	A
Talking with friends	S
Organising things	E
Solving problems and puzzles	I
Working with machines and tools	R
Selling things to people	E
Helping other people	S
Going to live theatre (e.g. plays)	A
Managing other people	E
Doing all kinds of experiments	I
Driving cars	R
Cooking	S
Recording facts and figures	C
Doing handcrafts	A
Getting other people to do things your way/influencing others	E
Repairing things	R
Building things	R
Working with figures	C
Thinking your way through problems	I
Writing stories, poems, plays etc.	A
Doing office work	C

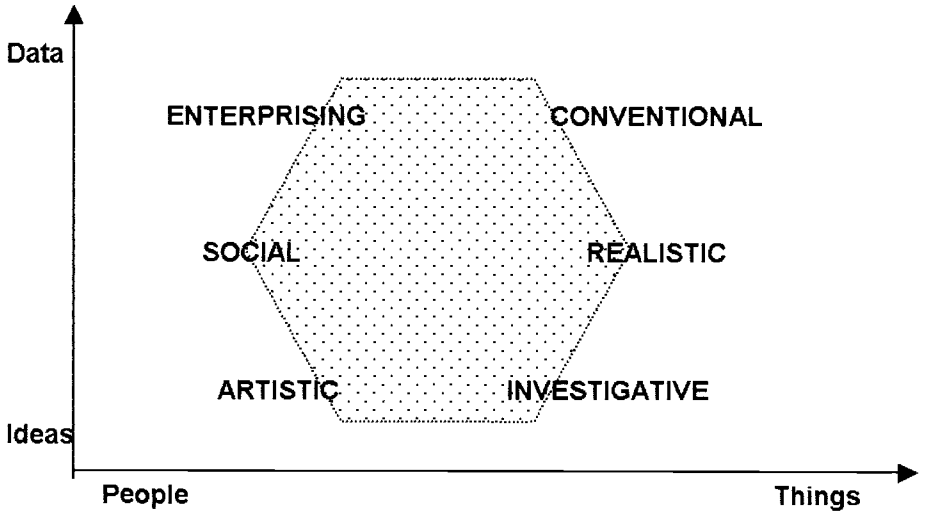

Figure 1 Holland's hexagonal ordering of occupational types and Prediger's work-task dimensions

Table 1. Pearson Correlations (N=2709)

	R	I	A	S	E	C	Mean (SD)
R	-	0.412	-0.075	-0.129	0.161	0.045	7.5 (2.6)
I		-	0.333	0.207	0.292	0.413	7.9 (2.2)
A			-	0.440	0.278	0.295	9.5 (2.8)
S				-	0.269	0.348	6.5 (1.8)
E					-	0.247	8.5 (2.3)
C						-	10.1 (2.7)

Table 2. Three-dimensional non-metric solution

Variables	Dim1	Dim2	Dim3	Data/Ideas[1]	Things/People[1]
R	-0.5050	0.0264	-0.1424	0.00	-0.66
I	-0.1785	-0.2166	-0.0534	-0.57	-0.33
A	0.2890	0.0706	-0.2366	-0.57	+0.33
S	0.4196	0.0253	-0.0314	0.00	+0.66
E	-0.0750	0.3625	0.2083	+0.57	+0.33
C	0.0499	-0.2683	0.2555	+0.57	-0.33
Stress	0..171	0.001	0.000		

[1]Dimension weights follow Prediger (1982) but signs reversed and adjusted for the range of the MDS dimensions.

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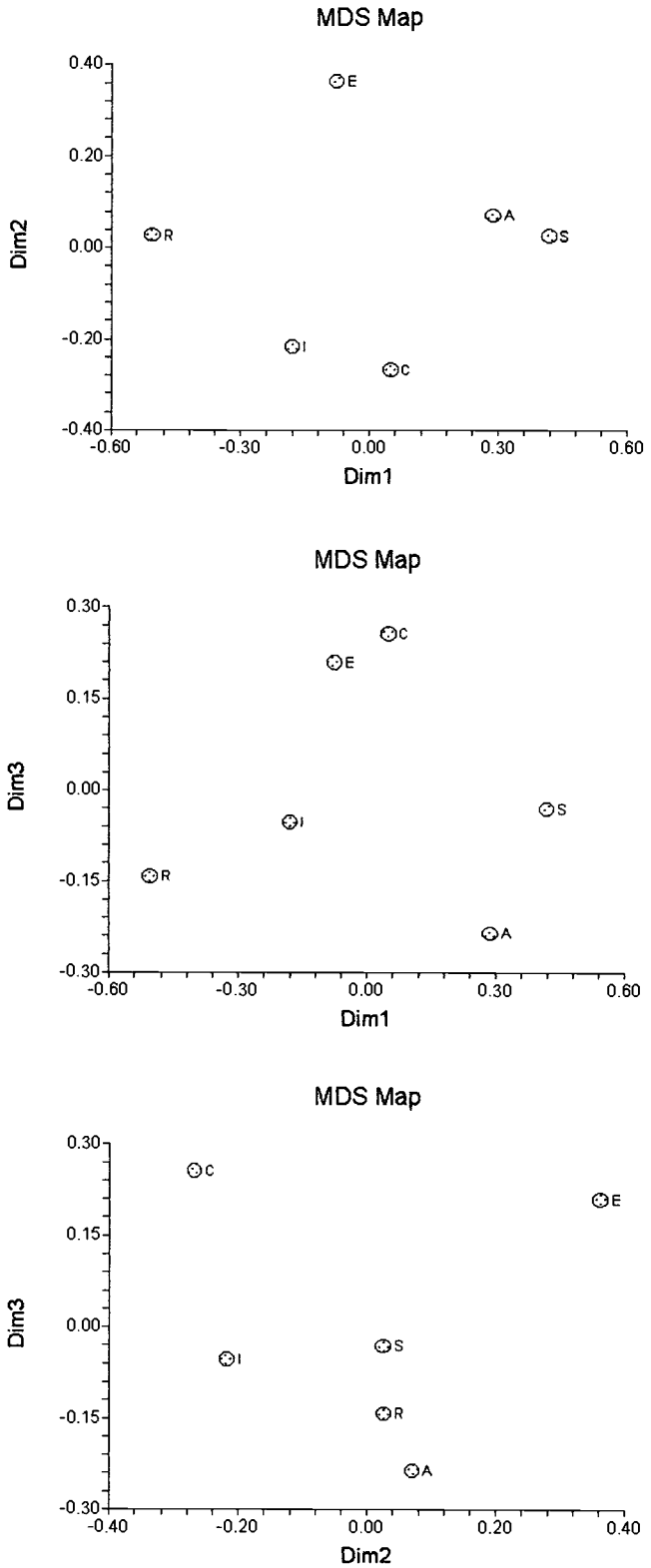

Figure 2. Two-dimensional representations for the RIASEC correlation matrix

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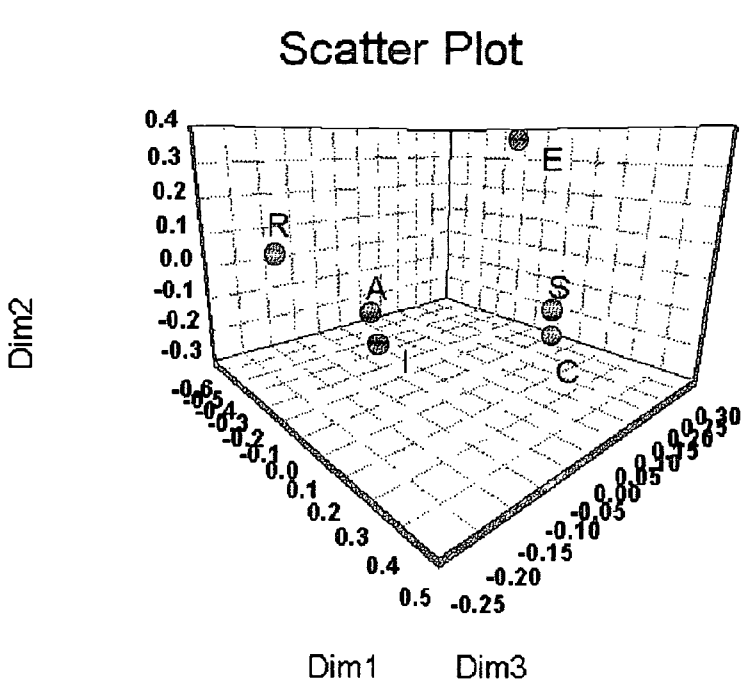

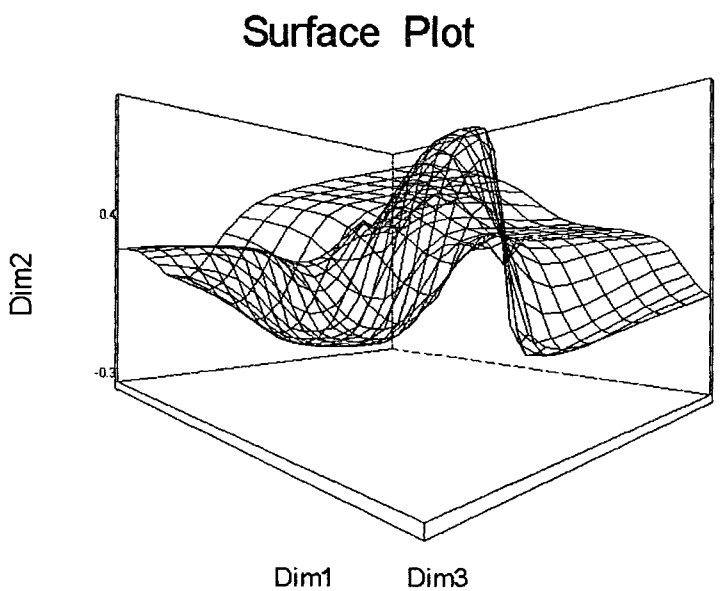

Figure 3. Three-dimensional (scatter plot and surface plot) representations for the RIASEC correlation matrix

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