Bulletin of Educational Psychology, 1986, 19, 219—254
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HOLLAND TYPOLOGY: AN EMPIRICAL STUDY ON ITS FACTORIAL STRUCTURE

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This study was designed to identify the construct validity of the six career types of Holland's hexagonal model, and to test the appropriateness of the model. The subjects for this study were 880 Chinese high school students, balanced by sex and proportional to grade (10th and 12th) in Taipei, Taiwan, the Republic of China. Subjects were acquired by sampling a proportionate number of students from three major types of high schools: namely, senior high school, industrial high school, and commercial high school.

The measure utilized in the assessment of the Holland's six career types was an adaptation and Chinese translation of the Self-Directed Search (SDS), which was developed by using the following procedures: (1) Back-translation technique; (2) Pilot test and revision; and (3) Item analysis of the revised translation. Based on the data of reliability, convergent and discriminant validity, and construct validity, the Chinese SDS is to some extent an equivalent measure of Holland's typology.

In general, the results of factor analyses supported the factorial structure of Holland's hexagonal model. The only exception was that the Social and Enterprising types were combined into one factor for male and female samples. By utilizing the Wakefield and Doughtie's spatial analysis, the psychological resemblances among types confirmed the hexagon model proposed by Holland, yet the hexagon formed was a bell-shaped one. The bellshaped figure, with R and I in the upper portion and A, S, E, C in the lower portion, implies that the perception of Chinese high school students can be classified into two primary categories, the natural sciences and the humanistic-social sciences. However, sex differences were found in these categories. Males were better than females in differentiating the R and I types, while females were better than males' in distinguishing the A-S-E-C types except for the distance between S and E types.

Introduction

Counselors working in high schools and colleges are concerned with assisting students in making the most appropriate and satisfying educational and vocational choices. Over the past few decades, psychological theories of career development have contributed to knowledge useful to counselors with these concerns. Among these theories, Holland's (1973, 19

1. This article is based on the author's doctoral dissertation sumitted to the University of Illinois, Champaign-Urbana.

2. The author wish to thank his committee, Helen S. Farmer (Chairperson), Robert Linn, Alan Peshkin, and Ralph Trimble, for their kind assistance and constructive suggestions during this study. Sincere thanks are extended to John Holland, for his permission to translate the Self-Directed Search.

85) typology of persons and environments, with six types arrayed in a hexagon to model their relationships, has been the most influential approach of the past decade in generating both research and new assessment techniques in career counseling (Eytowski & Borgen, 1983).

Holland assumes that most persons and work environments in Western culture can be categorized as being one of six types (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional; See Figure 1). However, empirical evidence for the factorial structure of Holland's typology and the appropriateness of the hexagonal model (the order of R-I-A-S-E-C) have been shown to have mixed results particularly for persons from different cultures and for females (Edwards & Witney; Feldman & Meir, 1976; Harrington & O'Shea, 1980; Tuck & Kelling, 1980). The types take on a different order in some cultures and some of the types are found to overlap. The typology appears to be more suitable for males than for females in terms of fitting the RIASEC hexagonal model. Less confidence can be placed in the typology for samples selected from cultures other than American. For the present, however, nearly all research testing Holland's typology has been conducted in Western societies. Little is known regarding the theory's applicability in Eastern societies.

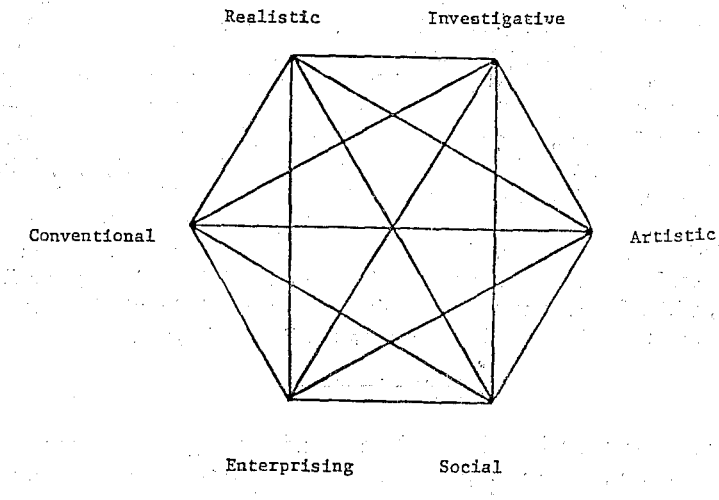

Figure 1. A Holland's hexagonal model. Adapted from "Making Vocational Choice: A Theory of Vocational Personalities and Work Environments" (p. 29) by John Holland, 1985, Englewood Cliffs, New Jersey: Printice-Hall.

In the middle 70s, Chu (1975) reported that response differences on the Strong Vocational Interest Blank (SVIB; Strong, 1966) between American and Chinese students indicated that cultural factors played an important role in influencing vocational interests. In a cross-cultural application of

psychological theory, it is important to view the behavior of interest in the cultural framework in which it occurs (Butcher & Garcia, 1978). Irvine and Carroll (1980) indicated that, the specific cognitive content (i. e., attitudinal obiects, personal constructs, or vocational interests) of people varies markedly within or across cultures. Given the above, the important contribution of the study was to examine whether Holland typology found in the Western culture, can be found in the same form in the Chinese culture. In addition, the study translated Holland's Self-Directed Search (SDS), a major instrument for the practical measurement of his typology, into Chinese. To date, little studies have been done concerning whether Holland's typology can be applied and generalized to Chinese-speaking individuals and societies.

Research Question: 1. Can the six career types of Holland's theory be found as independent types in samples of Chinese high school male and female students? 2. Is the order of the six types in the hexagonal model consistent with RIASEC in samples of Chinese high school male and female students?

Methods

Subjects

Eight hundred and eighty students, balanced by sex and proportional to grade (10th and 12th) were sampled from senior high schools, representing the three major types of high schools in Taipei, Taiwan, the Republic of China: namely, general high school, industrial high school, and commercial high school. Representativeness was ensured by acquiring a proportionate number of students from the selected schools, based on the current educational statistics from the Taipei Municipal Bureau of Education

Table 1

Dispersion of Sample Selected by Sex, Grade and School Type

	Sex		Total
	Boys	Girls	
10th grade			
General High School	94	79	173
Industrial High School	148	14	162
Commercial High School	13	140	153
12th grade			
General High School	84	73	157
Industrial High School	92	9	101
Commercial High Schoo	9	125	134
Total	440	440	880

(Taipei Municipal Bureau of Education, 1984). The dispersion of the subjects is shown in Table 1.

Instrument

The instrument to be used in this study was an adaptation and Chinese translation of Holland's (1979) SDS. The Chinese translation of the SDS was developed by using the back translation technique (Brislin, Lonner, & Thorndike, 1973; Hulin, Drasgow, & Parsons, 1983; Katerberg, Smith, & Hay, 1977; Werner & Campbell, 1970). Because cultural differences could affect the item's suitability for Chinese subjects, several items in the English original were given Chinese alternatives during the translation and pilot test procedures. To maximize the validity of the instrument utilized in the target culture, however, the format, structure and scoring system for the Chinese form remained the same as the original.

The Chinese SDS has 30 subscales partitioned into 4 sections: Activities, Competencies, Occupations, and Self-Estimates. Four separate sections determine a person's resemblance to each of the six career types. The sections and items are arranged as follows:

1. The Activities section contains six scales with eleven items each. The subject rates his/her preferences on a dichotomous scale of like vs. dislike for the activities listed.

2. The Competencies section is composed of six scales of eleven items each. The subject rates his/her ability on a dichotomous scale of yes vs. no for the skill listed

3. The Occupations section includes six scales of fourteen items each. The subject indicates his/her choice of occupations on a dichotomous scales of yes vs. no for the occupations listed.

4. The Self-Estimates section consists of two sets of six ratings of ability or skill. Each rating corresponds to a career type. The subject rates himself/herself on a descending scale from 7 to 1.

The Chinese version of the SDS was developed by the following procedures: (1) Translation of the SDS; (2) Pilot test and revision; and (3) Item analysis of the revised translation.

Reliability of the Chinese SDS

For data from the study sampled, the reliability of the Chinese version of the SDS scales was determined by an internal-consistency and an Guttman split-half estimate, depending on the various formats of the scales. Two reliability coefficients were computed by the SPSS updated program (Hull & Nie, 1979). The Kuder-Richardson formula 20 (KR 20, Kuder & Richardson, 1937) was used for the sections Activities, Competencies, and

Occupations, each scale having eleven or more items and every item is dichotomous. The Guttman split-half was selected for the estimate of the reliability of the Self-Estimates section. The Guttman split-half is coefficient alpha applied to a two-item scale (Hull & Nie, 1979). In the Self-Estimates section, subjects received a different numerical score on each item (from 7 to 1) in two parts which served as a two-item scale for assessing the six career types.

The coefficient of reliability is presented separately for each of the 30 scales. Comparative information isprovided for each of the sexes, the gra-

Table 3

Means, Standard Deviation, Rank Order of Preference and KR20 of the Chinese SDS Scales by Sex[e]

	Scale					
	R	I	A	S	E	C
Section A[a]						
M	16.41	20.19	13.20	14.87	11.15	7.03
	5.12	**15.18**	**16.89**	**18.20**	**9.48**	**11.24**
SD	7.83	7.35	7.84	6.90	7.94	6.47
	5.41	**7.78**	**7.94**	**7.15**	**6.90**	**7.83**
Rank[d]	2	1	4	3	5	6
	6	**3**	**2**	**1**	**5**	**4**
N	425	428	428	428	428	429
	430	**431**	**430**	**433**	**430**	**433**
Section B[b]						
M	9.29	9.20	8.00	8.57	7.23	7.97
	6.17	**7.36**	**8.78**	**9.32**	**7.18**	**8.99**
SD	2.82	2.51	2.58	2.44	2.73	2.79
	2.69	**2.39**	**2.40**	**2.21**	**2.57**	**2.58**
Rank	1	2	4	3	6	5
	6	**4**	**3**	**1**	**5**	**2**
N	399	400	398	399	399	399
	402	**402**	**403**	**403**	**402**	**403**
KR20[c]	.89	.87	.89	.86	.90	.87
	.86	**.89**	**.89**	**.87**	**.88**	**.89**
N	396	399	397	398	398	399
	399	**400**	**400**	**403**	**400**	**400**

Note. Abbreviations: R=Realistic; I=Investigative; A=Artistic; S=Social; E=Enterprising; C=Conventional.

[a]The Activities, Competencies and Occupations sections.

[b]The Self-Estimates I and II sections.

[c]Number of items for each scale: 38.

[d]Rank of preference: "1" means the strongest prefence, "2" means the second strogest, and so on.

[e]Data for females are boldfaced.

Table 4

Reliability Coefficients for Scales on the Chinese SDS by Total Sample, Sex, Grade, and School Type

Scale	Total	Sex		Grade		School type		
		M	F	10	12	G	I	C
				KR20 (Alpha)				
Activities								
Realistic	88	83	81	87	89	87	84	81
Investigative	81	78	81	82	80	80	75	83
Artistic	77	73	78	78	77	76	77	78
Social	71	70	68	70	72	71	71	69
Enterprising	82	85	78	82	82	81	83	82
Conventional	82	82	81	84	79	81	81	79
Competencies								
Realistic	83	75	74	83	82	79	76	75
Investigative	71	64	72	69	73	56	68	69
Artistic	75	76	74	77	74	73	78	75
Social	73	73	73	74	72	74	73	73
Enterprising	75	75	75	74	76	75	73	78
Conventional	77	75	78	76	76	72	75	80
Occupations								
Realistic	87	82	81	87	86	86	79	85
Investigative	88	87	89	88	88	85	87	90
Artistic	87	86	86	86	87	86	86	87
Social	87	86	87	85	89	87	85	87
Enterprising	87	88	85	85	88	88	87	86
Conventional	89	87	90	89	90	88	85	89
				Sample Size				
	859-862	427-429	433	473-475	386-387	320-321	257-258	281-283
				Guttman Spilt-half Reliability				
Self-Estimates								
Realistic	75	76	63	77	72	78	77	73
Investigative	65	69	55	61	68	64	68	65
Artistic	53	52	52	51	55	48	59	51
Social	55	51	56	50	59	57	48	55
Enterprising	61	61	61	62	61	57	60	66
Conventional	66	65	66	64	66	68	61	62
				Sample Size				
	801-802	398-400	402-403	436	365	309	234-236	257-258

Note. Decimal points omitted. M=Male; F=Female; G=General High School; I=Industrial High School; C=Commercial High School.

des, and the high schools. The findings of reliability analyses are presented in Table 3 and Table 4.

Conclusions with respect to the reliability of Chinese SDS were drawn as follows: (1) The Chinese SDS summary scales have a reasonably good balance of internal consistency among the six scales; (2) In terms of individual scales, the Chinese SDS has a moderate to high degree of internal consistency; and (3)With few exceptions, the reliability of scales for males and females are similar to each other.

Data Collection

The author conducted the pilot test and the pretest in Taipei from the fifteenth of December, 1984 to the tenth of January, 1985, then, came back to process the internal consistency analysis and to refine a final form of the SDS. The final version of the SDS was sent to the person authorized in Taipei, a doctorate candidate majoring in Educational administration. He conducted the inventory reproduction and the data collection.

The Chinese SDS was administered to the subjects in their classes. There was no time limit. The administration of the Chinese version of SDS took about 50 minutes. In each of the three section (Activities, Competencies, and Occupations), the initial words of the six types (i. e., R, I, A, S, E, and C, respectively) in front of each subscale were retained in English to reduce response set bias. Subjects were required to write their gender, school type, grade, and program enrolled, but not their names. Since there were quite a few incomplete inventories found in the pretest, a sentence was added at the end of the final version of the Chinese SDS to urge the subject to double-check their responses. The administrators were told to emphasize this as well. The return rate was 100% in that the persons administering the inventory collected it when it was completed. However, eighteen invalid inventories (blank or incomplete in personal data or in text) were discarded. Thus, the data prepared for analysis included 429 males and 433 females.

The answer sheet of each subject was coded with a sequence of numers, and each item response was transferred to coding sheets. The combined sum of "like" or "yes" responses on the Activities, Competencies, and Occupations items served as the six type scores for each subject, according to Holland's classification. Two sets of scores were calculated. In the first set, raw scores (the number of items checked or the number circled in the Self-Estimate) were computed for each of the six types on each of the five sections, which produced 30 raw scores for each student. In the second set, the raw scores on each of the 30 variables were transformed into standard scores, using the male and female Chinese students as independent norm groups. A total score on each career type was obtained by

summing up students' standard scores on each of the six types across the five sections.

Analyses

The data were entered directly into the CYBER 175 computer at the University of Illinois by the investigator. The stored data were recalled to be used for the statistical analyses required by this study. The following analyses were conducted separately for sex.

Multitrait-Multimethod Matrix for Detecting Method Variance

Essentially, the SDS is assessing six career types by five methods. The assessment methods of the first three are similar to one another, yet they are different from the last two (Self-Estimates part I and part II). In addition, the Self-Estimates section of the SDS was found to have lower reliability (Holland, 1979; Meir & Ben-Yehuda, 1976). In order to detect whether the Chinese SDS has the same pattern of method variance as those of the original, the Multitrait-Multimethod Matrix (MTMM, Campbell & Fiske, 1959) was employed. From various correlational patterns in the MTMM, it enables one to check method variances in an instrument using two or more traits as assessment methods.

In this study, method variance is suggested if the correlations between scores for different career types are higher when the same method is used to measure the career types than when different methods are used to measure the career types. Based on the results found by the MTMM, the biased methods would not be included in the scale level for factor analyses. The following two sets of analyses were required in accordance with the stated research questions.

Common Factor Analysis for Construct Validity

The method of common factor analysis enables one to deal with the following concerns involving construct validity in relation to the Chinese SDS: (a) the identification of the structure of each section of the entire test, and (b) the appropriateness of the hexagonal model. In the analysis of the factorial structure, an attempt is made to confirm the existence of six factors, corresponding to the six career types. For these, two types of factor analyses were used: 1) the exploratory and 2) the confirmatory (Kim & Mueller, 1978; Long, 1983).

Exploratory factor analysis is mainly used as a mean of exploring the underlying factor structure without prior specification of number of factors and their loadings (Kim & Mueller, 1978). Two studies (Edwards & Whitney, 1972; Tuck & Keeling, 1980) have examined the structure of the SDS.

Their factor analysis for each subtest was based only on six composite scores, each of which was the sum of items corresponding to a given career type. However, according to Rachman et al. (1981), an analysis tested on individual items and not on the six composite career type scores in each subtst could, in addition, expect to obtain a clearer picture of the SDS structure. In other words, one can discover whether the items are really unidimensional within types.

This procedure was, therefore, conducted with data in terms of two levels: (1) the item level and (2) the scale level. For the item level, three main analyses were carried out: (a) the Activities section based on individual items, (b) the Competencies section related to individual items, and (c) the Occupations section based on individual items. Whereas for the scale level, cross section analysis involving 30 subscales (derived from five separate sections of the Chinese SDS) were conducted. The exploratory factor analysis procedure was conducted by utilizing the FACTOR program in SPSS (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). Pearson product-moment correlations were computed among the items or the scales of each section of the SDS. The resulting matrix was factor analyzed by the principal axes method: principal factoring with iteration (PA2). Squared multiple correlation coefficients were used as approximations to the communalities. The number of factors extracted was determined by a scree test (Cattell, 1966), which directs one to examine the graph of eigenvalues, and stop factoring at the point where the eigenvalues begin to level off forming a straight line with an almost horizontal slope. Since the hexagonal model assumes that the career types are somewhat correlated, the approximation to simple structure should be based upon oblique rotation. All items or scales with loadings above 0.40 on a factor were considered as making up that factor.

Confirmatory factor analysis was conducted for the Chinese SDS in the scale level only. The specification of the confirmatory factor model (Jöreskog & Sörbom, 1984; Long, 1983) was based on the factors extracted and rotated from exploratory analysis. Confirmatory factor analysis allows researcher to be free to fix, constrain, or let vary any parameter in the matrices to be identified. This procedure was intended to test the adequateness of the model specified. The confirmatory analyses models were estimated by using the LISREL program (LISREL USERPROC) in SPSS-X (SPSS, 1984).

Wakefield and Doughtie's Spatial Analysis for the Appropriateness of Hexagonal Model

To test the hexagonal model, the second set of scores were used, that

is, the sum of the standard scores for each type in each section, and the total standard score for each type across sections. All common factors having positive eigenvalues were extracted from the 6×6 matrix of correlations, and the loadings were used to calculate the distances between pairs of types in the factorial space after rotation. Distance between types in space were computed according to the method introduced by Wakefield and Doughtie (1973), which is considered to be a more precise testing procedure than Cole and Cole's (1970) mathematical formulation for obtaining the hexagonal configuration (Holland, 1985).

If the SDS scales measure the hexagonal arrangement of career types, an identical pattern of distances should be found. According to Holland's model, the distances in space between the six adjacent types should be less than the distances between the six alternate types, which, in turn, should be less than the distances between the three opposite types. With each diametrically opposed distance compared with each alternate distance, and each alternate distance compared with each adjacent distance, Holland's hexagonal model involves 54 independent distance comparisons between pairs of constructs.

Using the loadings as coordinates on the axes representing rotated factors, each of the six career types was located as a point in the common-factor space. The distances between each pair of the six career types in the common-factor space were computed by using the formula used by Wakefield and Doughtie.

Applying the approximation to a binominal test for goodness of fit (Siegel, 1956, pp. 36-42), Wakefield, Yom, Doughtie, Chang and Alston (1975) found that it requires 34 of the 54 comparisons in the predicted direction to reject the hypothesis of a random arrangement of the constructs in Holland's model at the .05 level of significance. Thirty-seven of the 54 construct pair comparisons must be as predicted for significance at the .01 level. These criteria were used to test the postulated ordering of the types.

Results

Variance of the Chinese SDS

The purpose of presenting and evaluating the data of MTMM validity are, first, to serve as supplementary comprehension for the construct validity of the Chinese SDS and, then, to detect the potential method variance of the inventory, as depicted in the previous section. The five sections of Chinese SDS were treated as five various methods for MTMM analyses. An overview of the MTMM matrix is provided in Table 5. The matrix is a rectangular display of correlations, which is similar to a correlation matrix. Two main types of MTMM validity can be read in Table 5:

Table 5

Correlation Coefficients for the Individual Scales of Chinese SDS Arranged in A Multitrait-Multimethod Matrix by Sex

	Activfties						Competencies						Occupations						Self-Estimates I						Self-Rstimates II					
	R	I	A	S	E	C	R	I	A	S	E	C	R	I	A	S	E	C	R	I	A	S	E	C	R	I	A	S	E	C
Activities																														
R		44	27	-01	13	04	60	24	09	06	13	03	55	45	18	08	14	-02	60	31	-05	-04	-01	-14	35	13	00	-03	03	-02
I	33		30	18	33	04	41	46	19	13	19	01	35	65	21	14	14	-08	38	56	01	05	07	-15	22	28	06	09	11	-02
A	16	19		32	31	03	25	28	53	32	24	-01	18	29	57	23	14	-17	18	24	38	21	09	14	14	-02	30	20	24	17
S	15	16	39		38	27	06	13	27	48	25	16	11	11	23	40	25	10	03	12	21	28	29	19	01	07	23	41	31	22
E	07	15	30	41		19	20	29	33	47	61	13	18	30	30	35	48	09	18	24	24	30	44	12	03	13	18	27	38	20
C	16	09	29	33	41		08	01	04	19	12	45	06	05	04	20	35	63	01	07	00	13	20	29	01	18	01	09	27	33
Competencies																														
R	49	31	08	15	11	04		43	18	20	19	18	48	41	17	12	18	00	50	32	03	00	01	07	36	12	04	06	09	05
I	25	48	13	11	18	05	46		27	25	23	12	24	63	17	15	09	14	35	44	08	09	05	08	20	25	13	13	15	06
A	08	13	60	30	30	27	24	19		49	45	07	12	20	52	18	19	12	18	29	63	25	21	17	12	02	46	29	29	19
S	12	17	42	49	45	35	26	25	49		61	26	10	10	29	60	35	08	13	15	31	34	39	27	06	09	31	53	44	29
E	13	15	33	37	62	40	22	24	43	65		27	18	21	24	31	40	06	21	27	24	33	52	16	07	11	20	37	46	23
C	15	19	28	19	32	48	26	21	36	41	48		09	05	01	18	32	63	07	02	04	18	21	29	15	18	04	20	30	36
Occupations																														
R	62	25	14	09	11	14	43	22	06	13	16	22		52	29	20	30	06	42	25	02	05	03	04	26	08	02	06	00	01
I	27	53	27	12	21	09	24	39	18	17	20	23	43		35	23	20	05	42	51	00	00	04	16	25	11	04	02	02	03
A	07	06	63	34	29	27	09	09	58	36	35	26	14	31		29	23	12	20	21	35	13	15	14	09	03	32	12	16	07
S	09	04	33	37	48	45	10	10	32	42	47	35	28	27	58		40	28	08	10	14	33	28	18	02	03	07	30	28	18
E	25	01	26	29	48	41	21	09	28	35	44	39	39	23	23	52		44	11	13	11	16	43	18	05	08	13	28	29	23
C	12	00	19	21	34	59	11	03	24	28	33	49	21	14	28	54	58		05	17	08	10	13	23	03	05	06	09	16	28
Self-Estimates I																														
R	46	27	03	01	03	07	54	33	06	10	07	09	33	10	07	09	03	01		53	02	04	10	05	46	24	10	04	17	15
I	05	40	02	05	02	03	24	44	10	14	13	10	05	28	04	10	07	053	48		19	15	12	06	27	38	19	12	15	04
A	13	01	40	19	26	13	04	09	43	34	30	16	14	05	37	24	12	16	01	12		35	19	41	06	01	35	29	21	22
S	13	03	22	18	30	15	00	05	26	34	35	19	06	03	23	38	17	20	01	16	42		37	29	04	22	24	40	37	32
E	07	02	22	23	50	22	13	12	29	38	52	25	11	07	18	27	44	25	12	14	29	42		26	02	08	20	42	44	26
C	11	12	16	12	23	34	01	04	25	19	22	27	09	00	18	19	11	25	05	07	42	25	27		08	04	22	37	38	49
Self-Estimates II																														
R	40	17	05	02	05	03	55	27	09	13	08	14	40	14	02	03	10	06	61	36	03	05	12	01		26	17	09	22	22
I	01	28	05	03	01	05	09	33	04	09	13	08	03	10	09	00	07	03	23	52	08	22	07	04	22		19	14	19	12
A	08	01	39	22	14	10	06	08	52	28	22	18	14	00	37	17	07	10	03	08	36	26	17	23	10	13		36	32	23
S	01	03	15	30	38	24	07	07	31	46	39	22	05	03	14	27	24	22	06	07	30	35	39	33	14	15	30		53	41
E	02	00	21	26	55	32	12	12	25	43	52	35	01	04	22	30	38	24	07	06	26	34	44	35	15	06	24	51		62
C	01	04	19	23	37	33	15	12	27	33	38	38	01	04	19	21	34	25	03	02	25	20	32	48	16	03	23	40	65	

Note. Declmal points omitted. Correlations for boys (N=390) are shown above the diagonal, and correlations for girls (N=395) are shown below the diagonal.

convergent validity and discriminant validity. Convergent validity shows that the extent to which the methods converge on the career type, which can be demonstrated by correlations between scores on the sections of the Chinese SDS measuring the same career type by different methods (e. g., correlations of Realistic type between Activities and Competencies). Discriminant validity shows that the extent to which the methods discriminate between different career types, which can be demonstrated by correltions between scores on the sections of the Chinese SDS measuring diffrent career types (e.g., correlations of RI or RA between Activities and Competencies). In general, the scales measuring different psychological constructs in an inventory have correlation pattern with high values for within-trait correlations (i.e., high convergent validity) and low values for across-trait correlations (i.e., low discriminant validity) are considered as having satisfactory properties.

In the Chinese version of SDS, the convergent validity coefficients (values contained in diagonal) were compared with the discriminant validity coefficients (values contained in broken-line triangles). For both sexes, the values of convergent validity on average were relatively higher than those of the discriminant validity for the same methods. For example, the diagonal values on the career types measured by Activities and Competencies ranged from. 48 to .62, while the values on the methods measuring different career types (the upper left and the lower right broken rectangle) were ranged from .08 to .45 (upper left) and .08 to. 42 (lower right). Convergent validity was demonstrated satisfactorily in the Chinese SDS, in that most of the methods were converged on the career types. Exception was found for females in the correlations between Occupations and Self-Estimates Part II on the Investigative type ($r=.11$). A similar result was yielded for males with a convergent value of .10 in the same type.

In terms of the discriminant validity, the data generally showed that different career types can be discriminated by the methods. However, the unusual correlation coefficients came forth for the types of Social and Enterprising when using the same or the different methods for both sexes, which were relatively higher than those of the other correlation coefficients. For these, it is implied that the types of Social and Enterprising for males and for females might be difficult to discern.

The findings presented in Table 5, however, revealed a few exceptions as to the similarity of correlation patterns. It is suggested that the method variance in the Chinese SDS might existed. As outlined by Campdell and Fiske (1959), the presence of method variance can be reviewed in the MTMM matrix by two ways: (1) detect the difference in level of correlation between the parallel values of the monomethod block and heteromethod blocks,

and (2) check the validity diagonal between methods. According to the ways listed above, first, the correlations between different career types in the same methods and the different methods were compared. In almost all the comparisons, the larger correlations were found for the types which were measured by the same methods. For instance, the coefficients of RI in Activities (.33) was larger the coefficients of RI in the methods of Activities and Competencies (.25), the methods of Activities and Occupations (.27); the coefficients of RI in Competencies (.46) was larger than the coefficients of RI in the methods of Occupations and Competencies (.24), the methods of Self-Estimates Part I and Competencies (.24), in males' data, and so forth. Based on these comparisons, as suggested in the preceding section method variance was therefore implied for both sexes' data.

In order to differentiate the degree of variance among methods, the second method cited by Campbell and Fiske was utilized by examining the validity diagonal between methods. The absolute values of all diagonal correlations in each of the ten matrices were first converted to Fisher's Z scores, then the averaged diagonal correlation coefficients for each method was back-transformed. The average diagonal validity coefficients in hetero-method blocks for each sex is presented in Table 6. Although such an average correlation coefficients has no psychological meaning, it can be informative with respect to the extent of method variance. The results for males and females were very similar to each other. Three of the methods,

Table 6

Average Correlation Coefficients of the Same Career Type (Monotrait) Derived from the Mutitrait-Mutimethod Matrix by Sex

Methods	A	C	O	S1	S2
Activities (A)		0.53	0.56	0.44	0.34
Competencies (C)	0.53		0.45	0.43	0.41
Occupations (O)	0.54	0.46		0.38	0.26
Self-Estimates I (S1)	0.39	0.43	0.35		0.42
Self-Estimates II (S2)	0.38	0.41	0.30	0.47	

Note. Correlalations for boys (N=390)are shown below the diagonal, and correlations for girls (N=395)are shown above the diagonal.

Activities, Competencies, and Occupations, can be seen as sharing method variance, in that each of the pairs indicate an inflated average validity diagonal. A slightly independent method was found in Self-Estimates Part II, with validity diagonals averaging .30 for boys and .26 for girls. However, the Self-Estimates part II shared method variance with Self-Estimates Part I and with Competencies as well. As shown on Table 5 and Table 6, overall, one may suggest that two categories of methods have arisen yet not so distinctively. The first three methods, Activities, Competencies, and Occupations, can be characterized by the affective category; the last two methods, Self-Estimates Part I and Self-Estimates Part II, can be characterized by the cognititve category.

Taken as a whole, from the results presented above, evidence indicated that the convergent and discriminant validity of each method in the Chinese SDS were satisfactory. The data also highlight the facts that the methods embedded in the Chinese SDS were not totally indepedent among one another, although the Self-Estimates Part I and Self-Estimates Part II using scaling methods were different from that of the Activities, Competencies, and Occupations. No evidence was provided that the two parts of Self-Estimates were indpendent from the other three methods. Given these data, none of the five sections would be discarded or be separated for the scale-level factor analyses.

Factorial Structure of the Chinese SDS

Question 1: Can the six career types of Holland's theory be found as independent types in samples of Chinese high school male and female students?

Two parts of the factor analyses were conducted for the factorial structure of the Chinese SDS in responding to this question: the item level and the scale level.

Factor Analyses: The Item Level

In order to obtain a clearer picture of the Chinese SDS, the factor analyses resting on individual items for each of the three sections were first conducted.

The results of factor analyses based on item level by sections of the Chiese SDS were somewhat different for male and female. A final rotated and identified factor structure was obtained for each section as follows.

For males: (a) *Activities:* 1) Enterprising, 2) Realistic, 3) Conventional, 4) Artistic, 5) Investigative, and 6) Social. (b) *Competencies:* 1)Social-Enterprising, 2) Realistic, 3) Investigative, 4) Artistic, 5) Social-Enterprising, and 6) Conventional. (c) *Occupations:* 1) Social, 2) Investigative, 3) Realistic,

4) Artistic, 5) Conventional and 6) Enterprising.

For females: (a) *Activities:* 1) Investigative, 2) Artistic, 3) Conventional, 4) Artistic, 5) Realistic and 6) Social-Enterprising. (b) *Competencies:* 1) Social-Enterprising, 2) Investigative, 3) Conventional, 4) Realistic, 5) Artistic and 6) Social-Enterprising. (c) *Occupations:* 1) Social-Enterprising, 2) Conventional, 3) Investigative, 4) Investigative, 5) Artistic and 6) Realistic.

In short, for males, the Activities and the Occupations sections can satisfactorily differentiate among all the career types prescribed by Holland, only the Competencies section cannot discriminate between the Social and Enterprising types. With regard to female, a fairly consistent result observed among the three sections was that the Social and Enterprising scale items were clumped together as unique factor. Besides, a single career-type factor identified from two complementary factors was found in each section: the Artistic type in the Activities, the Social and Enterprising type in the Competencies, the Investigative type in the Occupations, respectively.

Factor Analyses: The Scale Level

According to the manual (Holland, 1979), the interpretations of SDS were based on the scales in each of the four sections and used together to generate summary codes. Consequently, a factor-analytic study with entire thirty scales simultaneously would be more accurate and more thorough. The factor analyses of Chinese SDS in the scale level were based on 30 scales, that is, six composite scores from Activities, Competencies and Occupations sections, respectively, and twelve single-item scale from the Self-Estimates. Two type of factor analyses were utilized: (1) exploratory and (2) confirmatory. Separate factor analyses were carried out for males and females.

Exploratory factor analyses for males. After rotation, seven factors having eigenvalues greater than 1.0 were identified in males' data. Table 7 presents the loadings of the seven factors, which accounts for 65.2% of the total variance. The seven extracted factors corresponded to the following contents: Social and Enterprising type, Realistic type, Investigative type, Artistic type, and Conventional type.

Factor I included almost all the Social and Enterprising scales and most loadings were above .50. No other scale but two marginal loadings for the Conventional scale loaded above .40 on this factor. Since both of these scales were also highly loaded on factor 6 and factor 7, their loadings on this factor did not constitute a menace to factor independence. Factor II had a clear and unique factor loadings for the Realistic scales across sections. Factor IV was dominated by the Artistic scales from each of the

Table 7

Factor Loadings of the 30 Scales in the Chinese SDS by Sex

	Male							Female					
Scale	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI
Activilities													
R	10	**68**	−21	00	**40**	19	18	05	**78**	01	−12	11	35
I	08	32	20	09	**78**	04	09	18	**49**	01	−25	22	**72**
A	35	07	−13	**76**	25	29	02	27	24	00	−02	**74**	26
S	**49**	06	−12	**41**	19	28	07	**47**	−04	32	01	**42**	22
E	**77**	02	−02	32	19	35	19	**69**	15	26	−13	39	35
C	**40**	02	−17	28	14	**67**	27	23	01	**75**	12	01	07
Competencies													
R	18	**72**	09	13	36	13	07	15	**70**	08	−04	16	39
I	19	41	32	15	**56**	07	08	23	37	−03	−05	25	**57**
A	39	14	08	**79**	16	30	20	**45**	14	−03	10	**71**	24
S	**67**	18	11	**53**	20	37	21	**72**	05	27	14	**51**	23
E	**77**	15	12	**44**	20	**46**	22	**80**	17	19	05	36	26
C	38	21	05	32	26	**58**	31	31	09	**55**	27	03	11
Occupations													
R	15	**63**	−22	−01	39	35	28	12	**69**	13	−27	17	25
I	16	27	04	20	**63**	26	17	16	**59**	−01	−36	27	**56**
A	34	03	−13	**72**	16	37	00	28	25	01	−15	**71**	14
S	**56**	02	−07	**40**	12	36	05	**47**	08	30	−13	34	16
E	**56**	23	−18	25	11	37	03	**55**	20	**54**	−11	23	13
C	34	09	−05	25	02	**85**	12	17	−02	**80**	03	−13	−10
Self-Estimates I													
R	04	**75**	33	−03	21	−06	05	16	**70**	−03	09	13	50
I	07	37	**72**	05	35	−11	05	22	40	−11	01	26	**73**
A	34	−05	27	**60**	10	18	26	32	−12	03	20	**59**	08
S	**48**	−04	38	**40**	16	25	12	**47**	−13	24	27	34	23
E	**64**	15	18	30	07	32	19	**67**	−05	29	14	23	15
C	28	−07	07	34	15	30	**53**	30	−19	**40**	**47**	34	−07
Self-Estimates II													
R	06	**76**	27	07	12	03	13	05	**48**	03	33	08	36
I	08	17	**62**	03	19	−06	08	14	14	13	22	−03	**52**
A	23	00	19	**60**	05	09	26	30	−01	02	31	**49**	22
S	**56**	07	20	34	13	23	**40**	**59**	−11	26	37	28	23
E	**69**	10	11	30	03	32	37	**61**	02	37	**50**	35	28
C	**48**	11	03	30	02	33	**70**	38	−02	**47**	**55**	28	14

Note. Decimal points omitted. Loadings above .40 are boldfaced.

sections, but for an exception which was loaded with .53 in the Social scale in Competencies section. Factor III and V were more or less complementary and were defined as Investigative type. The former was Investigative scale in Activities, Competencies and Occupations sections, while the latter was

the same scale in the section of Self-Estimates. The other complementary factors were found in factor VI and VII which were identified as one type named Conventional. Again, the first three sections of the Conventional scale were loaded substantially higher on factor VI and the two parts of Self-Estimates section of the same scales were loaded higher as well on factor VII.

In order to further discern the possible influence of the grade factor, the males' data for the 10th and 12th grades were also analyzed separately. For the 10th grade students, six factors were extracted and classified as four types: Social-Enterprising-Conventional type, Realistic type, Investigative type, and Artistic type. As to the 12th grade studens, the results were identical to the males' as a whole.

In general, for the male sample, the results turned out confirming the Holland's six career types. Yet, a less perfect fit was the finding that the Social and Enterprising scales combined and defined as an unequivocal factor.

Exploratory factor analyses for females. Table 7 also presents the oblique rotations of the six factors extracted for girls, which accounts for 59.9% of the total variance. These factors, with eigenvalues greater than 1.0, were identified as: Social and Enterprising type, Realistic type, Conventional type, Artistic type and Investigative type.

The scales that loaded highly on the first factor were, again, the Social and Enterprising scales. The loadings all ranged from .47 to .80 but for the Artistic scale in the Competencies. The second factor was characterized by the Realistic scale across all sections, with factor loadings ranging from .48 to .78. Less perfect was that three Investigative scales (in Activities, Occupations and Self-Estimates Part I) were likewise loaded high on this factor. Nevertheless, two of them (in Activities and Self-Estimates Part I) had higher loadings on factor VI, which were more Salient for that factor. Factor III was recognized clearly by the Conventional scale from all sections but the Enterprising scale in Occupations. Factor V was Artistic scale with loadings above .49. Exceptions were the two Social scales in Activities and Competencies sections, which loaded .42 and .51, respectively, on the same factor. However, they were loaded higher on the factor in which they were actually identified. The sixth factor was Investigative scale with loadings ranging from .52 to .73. The other scales loaded on this factor were all relatively lower except for the Realistic scale in Self-Estimates Part I. With respect to the Conventional type, as with the males', it was loaded complementary on two facrors; factor 3 and factor 4. Again, the former was dominated by the scales on Artistic, Conventional and Occupations;

while the latter was stood out by the scales on Self-Estimates.

While the female's data were analyzed separately by grade, the results for both the 10th and the 12th grade students were equivalent to those of the females as a whole.

Overall, the factorial structure of the Chinese SDS as an entire test was satisfactorily confirmed with Holland's postulation in Chinese female high school students. The only exception was that the Social and Enterprising scales did not split into two separate factors.

Confirmatory factor analyses. The purpose of utilizing confirmatory factor analyses in this study was to decide whether the rotated structure rested on the exploratory analyses could be adequate or not. In the confirmatory analysis, the correlation matrix of thirty scales for each sex was input separately. The estimation of the specified model was obtained by a Maximum Likelihood Estimates (ML, Jörescog and Sörbom, 1984).

The models to be estimated were specified corresponding to the factorial structure previously derived for boys and giris. In each career-type-defined factor, all the factor loadings which were not supposed to measure the given career type, were to be specified as fixed parameters with values equal to zero. Then, the values of other parameters were specified to be free for the sequential model estimation.

The goodness of the model was assessed by examining the quantities suggested by Jöreskog and Sörbom (1984): (1) Parameterer estimates, (2) Standard errors, (3) Squared multiple correlations, (4) Coefficients of determination, and (5) Correlations of parameter estimates. For males' and females' model, the parameter estimates of lambda and phi (see Table 8 through Table 11) were all positive variances and correlation metrics were almost all positive definite. Few exceptions were found in the parameter estimates of phi metric, where two (for boys) and four (for girls) out of sixteen pair correlations were negative. It should be noted that the two complementary factors representing one career type (Investigative type and Conventional type for boys and Conventional type for girls) were all correlated highly in the phi metrix (0.61, 0.57 and 0.56, respectively), which confirmed that each of the two unobservable factors could be defined as a single career type.

The squared multiple correlations were ranged from .21 to .63 for males and ranged from .24 to .59 for females, showing that the scales served separately as measurement instruments for the latent factors were satisfactory. Furthermore, the total coefficients of determination were remarkably high, .988 for males and .995 for females, indicating that the measurement model in which all the scales jointly serve as measurement instrument for all the latent factors jointly were fairly good.

Table 8

Factor Loadings (Lambda) Based on Confirmatory Factor Analyses in the 30 Scales of the Chinese SDS for Males (N=390)

Scale	Factor						
	SE	R	I1	A	I2	C1	C2
Realistic							
Activities	00	68	00	00	00	00	00
Competencies	00	75	00	00	00	00	00
Occupations	00	75	00	00	00	00	00
Self-Estimates I	00	72	00	00	00	00	00
Self-Estimates II	00	72	00	00	00	00	00
Investigative							
Activities	00	00	00	00	74	00	00
Competencies	00	00	00	00	68	00	00
Occupations	00	00	00	00	63	00	00
Self-Estimates I	00	00	92	00	00	00	00
Self-Estimates II	00	00	56	00	00	00	00
Artistic							
Activities	00	00	00	77	00	00	00
Competencies	00	00	00	81	00	00	00
Occupations	00	00	00	75	00	00	00
Self-Estimates I	00	00	00	54	00	00	00
Self-Estimates II	00	00	00	56	00	00	00
Social							
Activities	51	00	00	00	00	00	00
Competencies	72	00	00	00	00	00	00
Occupations	62	00	00	00	00	00	00
Self-Estimates I	47	00	00	00	00	00	00
Self-Estimates II	57	00	00	00	00	00	00
Enterprising							
Activities	74	00	00	00	00	00	00
Competencies	80	00	00	00	00	00	00
Occpations	60	00	00	00	00	00	00
Self-Estimates I	62	00	00	00	00	00	00
Self-Estimates II	68	00	00	00	00	00	00
Conventional							
Activities	00	00	00	07	77	00	00
Competencies	00	00	00	00	00	68	00
Occupations	00	00	00	00	00	73	00
Self-Estimates I	00	00	00	00	00	00	61
Self-Estimatee II	00	00	00	00	00	00	80

Note. Decimal points omitted.

Table 9

Factor Loadings (Lambda) Based on Confirmatory Factor Analyses in the 30 Scales of the Chinese SDS for Females (N=395)

Scale	Factor					
	SE	R	C1	C2	A	I
Realistic						
Activities	00	80	00	00	00	00
Competencies	00	73	00	00	00	00
Occupations	00	66	00	00	00	00
Self-Estimates I	00	74	00	00	00	00
Self-Estimates II	00	49	00	00	00	00
Investigative						
Activities	00	00	00	00	00	80
Competencies	00	00	00	00	00	60
Occupations	00	00	00	00	00	77
Self-Estimates I	00	00	00	00	00	71
Self-Estimates II	00	00	00	00	00	82
Artistic						
Activities	00	00	00	00	71	00
Competencies	00	00	00	00	78	00
Occupations	00	00	00	00	68	00
Self-Estimates I	00	00	00	00	56	00
Self-Estimates II	00	00	00	00	53	00
Social						
Activities	55	00	00	00	00	00
Competencies	75	00	00	00	00	00
Occupations	52	00	00	00	00	00
Self-Estimates I	51	00	00	00	00	00
Self-Estimates II	63	00	00	00	00	00
Enterprising						
Activities	67	00	00	00	00	00
Competencies	72	00	00	00	00	00
Occupations	55	00	00	00	00	00
Self-Estimates I	62	00	00	00	00	00
Self-Estimates II	66	00	00	00	00	00
Conventional						
Activities	00	00	79	00	00	00
Competencies	00	00	59	00	00	00
Occupations	00	00	67	00	00	00
Self-Estimates I	00	00	00	70	00	00
Self-Estimates II	00	00	00	71	00	00

Note. Decimal points omitted.

Table 10

Intercorrelations (Phi) Based on Confirmatory Factor Analyses in the 30 Scales of the Chinese SDS for Males (N=390)

Scales	SE	R	I1	A	I2	C1	C2
Social-Enterprising (SE)							
Realistic (R)	.20						
Investigative I (I1)	.11	.39					
Artistic (A)	.61	.13	.05				
Investigative II (I2)	.26	.57	.61	.27			
Conventional I (C1)	.70	.19	−.06	.46	.20		
Conventional II (C2)	.65	.08	−.01	.43	.03	.57	

Table 11

Intercorrelations (Phi) Based on Confirmatory Factor Analyses in the 30 Scales of the Chinese SDS for Females (N=395)

Scales	SE	R	C1	C2	A	I
Social-Enterprising (SE)						
Realistic (R)	.20					
Conventional I (C1)	.38	.06				
Conventional II (C2)	.60	−.04	.56			
Artistic (A)	.59	.28	−.09	.37		
Investigative (I)	.32	.71	−.07	−.11	.39	

As to the correlations of parameter estimates, both models were found not very high. This means that the models were somewhat identified.

Given the above, the confirmatory factor analyses present further evidence as to the substantiation of factor structures derived from the exploratory factor analyses for males and females.

The Appropriateness of Hexagonal Model

This section presents the results, by utilizing the Wakefield and Douhgtie's spatial analysis, for the following question.

Question 2: Is the order of the six types in the hexagonal model consistent with RIASEC in samples of Chinese high school male and female students?

Pearson product-moment correlation coefficients among the six career types as measured by summated standard scores are presented in Table

12. The correlation patterns of males and females were similar to each other. The intercorrelations among the six composite scores generally confirm the Holland's hexagonal model. In other words, the adjacent scales were more highly correlated with each other than with non-adjacent scales, and opposite scales were least correlated with one another. Nevertheless, two pairs of correlations, the Enterprising and Artistic scales, the Realistic and Conventional scales, were not correlated as highly as would be predicted by the model. The correlations between Investigative and Artistic scales were .16 for boys, and .29 for girls. The correlations between Realistic and Conventional scales were, even lower, .12 for boys, and .05 for girls. Conversely, the highest correlated pairs were Social and Enterprising types for both sexes, which confirmed the factorial structure found previously.

As to the test of the appropriateness of Holland's hexagonal model, 54 comparisons including the distances between the six adjacent, six alternate and three opposite types were calculated. Figure 2 displays the distance relationships among pairs. The two letters of a pair delineate the distance between the two career types. Table 13 presents the computed distance in common factor space between pairs of the six career types by sex. In order to faciliate the comparison of the distances, the ranks of the distance likewise are given in the same table as well.

In terms of the male sample, 44 of the 54 distance comparisons between the constructs in Holland's hexagonal model were consistent with the prescribed order of RIASEC. The z score corresponding to 44 correct obser vations is 4.4908 ($p<.000001$). When the data were analyzed separately by grade, 35 and 42 of the 54 comparisons were consistent with Holland's model for 10th grade boys and 12th grade boys, respectively. The z score for the

Table 12

Intercorrelations of Scales of the Chinese SDS by Sex

Scale	R	I	A	S	E	C
Realistic (R)		57	21	10	21	05
Investigative (I)	42		29	23	29	—03
Artistic (A)	06	16		48	41	12
Social (S)	12	17	56		66	41
Enterprising (E)	18	17	43	70		44
Conventional (C)	12	07	42	55	62	

Note. Decimal points omitted. Boys below diagonal, girls above.

35 and 42 correct observations is 2.0414 ($p<.0414$) and 3.9464 ($p<.00008$), respectively.

Table 13

Distance Between Pairs of Career Types in Common Factor Space by Sex

Pair	Male		Female	
	Distance	Rank	Distance	Rank
Adjacent				
RI	0.361	13	0.264	14
IA	0.903	8	0.775	8
AS	0.368	12	0.639	10
SE	0.242	15	0.236	15
EC	0.287	14	0.612	12
CR	1.082	6	1.277	4
Alternate				
RA	1.004	7	0.800	7
AE	0.583	9	0.627	11
ER	1.144	4	1.209	5
IS	1.129	5	1.289	3
SC	0.369	11	0.597	11
CI	1.150	3	1.347	1
Opposite				
IE	1.180	1	1.180	6
RS	1.169	2	1.326	2
CA	0.542	10	0.691	9

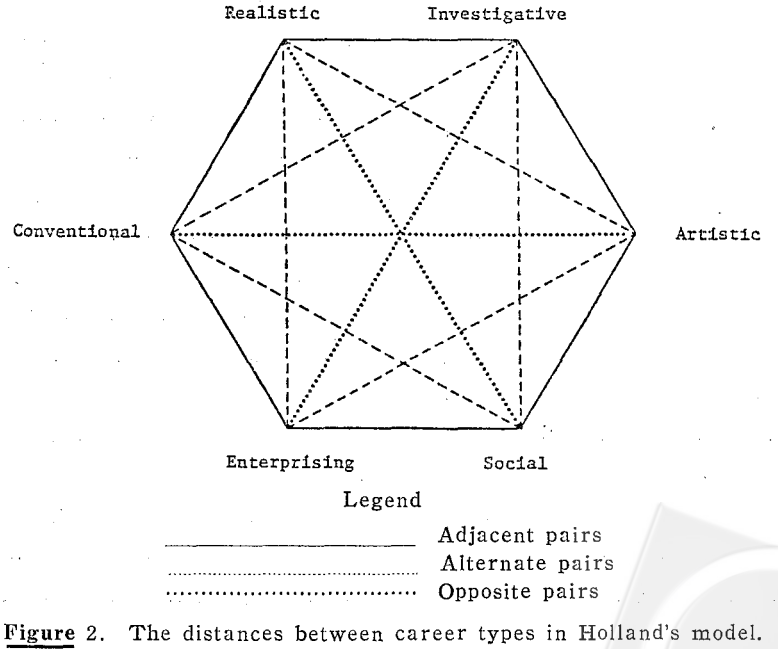

Figure 2. The distances between career types in Holland's model.

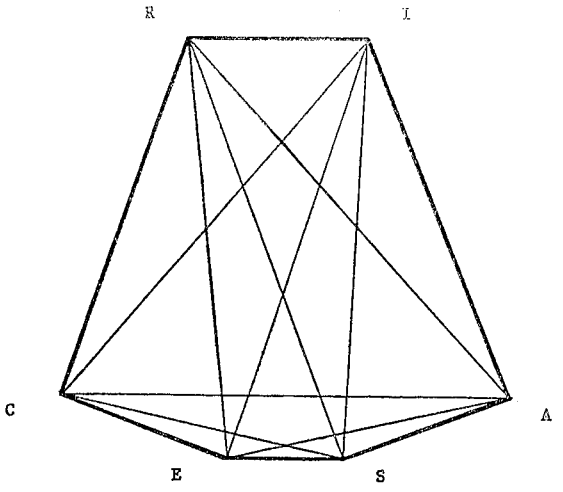

Figure 3. The distances between career types in this study.

With regard to the female sample, 37 of the 54 comparisons were consistent with the order of Holland's model. The z score for the 37 distance pairs occurring in the hypothesized direction is 2.5856 ($p<.00096$). Separating the data by grade, the number of expected comparisons for 10th grade girls (37 pairs) and 12th grade girls (41 pairs) were all significant ($z=2.586$, $p<.0098$; $z=3.6742$, $p<.0002$, respectively). Again, the date support the findings that the number of expected pairs for females also fit the hexagonal model, although the number of pairs are slightly less than that for males.

Comparing the distance patterns of Holland's model and the model obtained in this study, however, one can find two incompatible pairs, which were evident for each sex as a whole, or separated by grade. These were two adjacent types, the distance in space between Realistic and Conventional, and Investigative and Artistic, for which these were two or three times longer than the distance of the other four adjacent career types. Using the method outlined by Wakefield and Doughtie (1973), the distances between career types in space are presented in Figure 4 (for total samples by sex). Should this be the case, a bell-shape hexagonal model instead of a symmetric-equilateral one is suggested, as shown in Figure 3. This unexpected result merits further discussion.

The Wakefield and Doughtie method is based on the assumption that the distances between types can be represented in space. In fact, it may not be possible to represent all six points in two dimensions. Three points can be fixed in two dimensional space but the other three may be a little bit off the plane. Thus the figure is only an approximation of their true relationships.

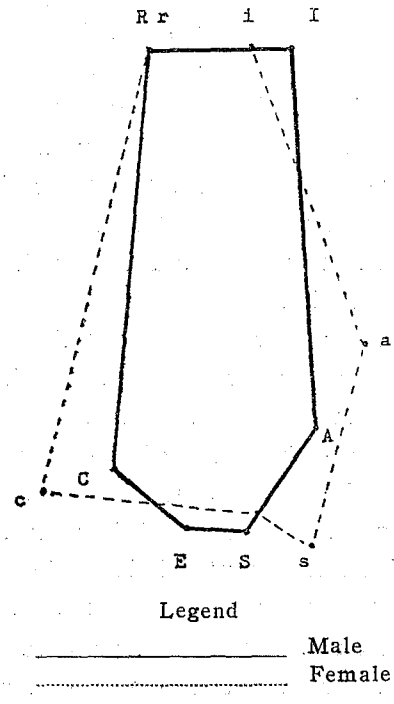

Figure 4. Psychological relationships between types based on common factor space in the Chinese SDS for the Chinese high school students.

Discussion

Factorial Structure of the Holland Model

The initial intent of this study was to validate the factorial structure of Holland's career model in the context of a different culture. This study factor analyzed the items in each section of the Chinese-translated SDS and the total instrument for 880 Chinese high school students. Consistently for males and females, the results for the factor analyses of the entire inventory support the Holland's postulation of six career types. The only exception was that the Social and Enterprising types were combined into one factor. This finding is not unique, but remarkably similar with other studies by other investigators in different cultures (Edwards & Whitney, 1972; Tuck & Keeling, 1980; Rachman et al., 1981). The samples employed in this study were congruent with those held in New Zealand (Tuck & Keeling, 1980), but different from the others, that is, American college students (Edwards & Whitney, 1972) and Canadian professional accountants (Rachman et al., 1981).

The consistent finding that Social and Enterprising form a combined factor is incongruent with Holland's postulation might be attributed to

either the possible limitation of the assessment tool or factors related to the theory. First, the three above mentioned researches as well as the current study were conducted by using the same or/and adapted instrument: the SDS. Reviewing closely the items in the Activities and Competencies sections, one can find that the items representing the Social and Enterprising types have common characteristics, that is, either (or both) dealing with people or reflecting extroverted activities or competencies. This implies the existence of two identical factors underlying the inventory that might influence the assessment results.

Second, it is not surprising to observe that Holland's theoretical structure exhibited in the Chinese culture is not exactly the same as the model constructed originally in the American culture. Recall that one of the assumptions which constitute the heart of the theory is that, each type is the product of a characteristic interaction among a variety of cultural and personal forces including peers, biological heredity, parents, social class, culture, and the physical environment (Holland, 1985). One of the possible cultural forces that might contribute to the research findings is the unique characteristics of Chinese culture. The society, industry, and economics of the Republic of China are impacted by the rapid rate of modernization. These changes are accomplished with some humanistic virtues and characteristics embedded deeply in the Chinese tradition or heritage, such as patience, generosity, perseverance, responsibility, etc. These traditional personality characteristics are apt to be reflected on and characterized by any working environments which are dealing with people. Particularly, these traits can be found compatibly in the Social personality type described by Holland. As to the other people-oriented jobs, the Enterprising is the closest to the Social (Prediger, 1976). We cannot exclude the possibility that the people in a work environment classified as Enterprising includes more Social personality types in the Chinese society than the people in a work environment classified as Enterprising in the Western culture. Furthermore, on the other hand, the personality types defined in the Enterprising type as adventurous, ambitions, domineering, flirtatious etc. (Holland, 1985) have not been highly appraised in the Chinese culture. They were even, to some extent, being devalued or suppressed by those as friendly, tactful, generous, helpful, warm, etc. In this regard, a single career type with two components would be found not surprisingly in the present study in which the students tended to perceive an identical or a similar psychological relationship in the Social and Enterprising career types.

Taking the developmental aspect into account, boys seemed to be somewhat delayed, in comparison with girls, in their approach to career crystalization. A single Social-Enterprising-Conventional type was found

for the 10th grade boys yet not for the same grade girls. According to Ginzberg (see Osipow, 1983, p. 196), clearer conceptions of differing life styles offered by occupations are assumed to have emerged at this age level. Their difficulty in discerning the Conventional type from the Social-Enterprising type might suggest providing different intervention strategies for the 10th grade boys.

Arrangement of the Hexagonal Model

The ordering (R-I-A-S-E-C) of career types in this study was found similar to Holland's postulation as well as many of the earlier studies, yet the hexagon formed a misshapen one with respect to distance between types. With regard to sex differences, however subtle, the study confirmed previous findings that male response to Holland scales conforms to the arrangement of hexagonal model (Cole & Hanson, 1971; Cole, Whitney & Holland, 1971; Edwards & Whitney, 1972; Tuck & Keeling, 1980), while female response to Holland scales conforms to the arrangement of hexagon model, this conformity was somewhat less than that for males (Feldman & Meir, 1976: Utz & Korben, 1976; Tuck & Keeling, 1980). Considering the developmental differences, the study further analyzed the data for each sex separated by grade. The 10th grade students were all found to have less conformity to the Holland model than the 12th grade students.

In terms of the ordering of Holland's model, the data in the present study seemed to demonstrate more cultural differences than sex differences. Studies sampling different populations in Israel (Feldman & Meir, 1976) and New Zealand (Tuck & Keeling, 1980) reported that the model for females resembles IRASEC rather than RIASEC; in Australia (Taylor et al., 1980) it resembles RISAEC, however. Tuck and Keeling suggested that females' perception of the psychological structure of occupational fields is different from that of males. Nevertheless, the present study for females did not confirm the same order as these previous researchers found. Instead findings were congruent with that of Holland's, indicating that for females the perception of occupational fields may arrange in the same psychological order as for males in Taiwan. This evidence is consistent with the research findings conducted in Canada (Rachman et al., 1981) and in the United States (Bobele et al., 1975, 1976; Rounds et al., 1979; Wakefield & Doughtie, 1973) despite the differences in the samples and the research tools employed.

A bell-shaped hexagon rather than a symmetrical and equilateral one was found in the study. The distance in space between R and C, I and A, which are postulated adjacent types, was unexpectedly greater than the distance of the other four adjacent career types. The bell-shaped hexagon is manifest for data from male and female samples, as well as for the data separated by grade. The figure, with R and I in the upper portion and A,

S, E, and C in the lower portion, reflects explicitly a culturally related phenomenon in the Chinese cultural context. It implies that for Chinese students the perception of career types can be classified into two primary categories, the natural science and the humanistic-social science, which make sense in Chinese reality yet deviate with what is usually reported in the other cultures. This could probably be attributed to the way educational choices, especially the selection of curriculum programs in the secondary school systems, are made. Students' experience of success in natural science courses (e. g., Mathematics, Physics, Chemistry, Biology, etc.) in junior high is a critical criterion for selecting senior high curriculum, regardless of whether the decision was made by the students themselves or by the suggestions of their parents or class advisors. This early tentative career choice is influenced by their selection of entering either natural-science-emphasized curriculums or humanistic-social-science-emphasized ones in senior high school. Furthermore, owing to the fact that academic performances has been desperately emphasized and even become the absolute criteria for individual achievement and evaluation, they might generalize their affection and cognition in the curriculum world to the external world of work.

As to the sex differences, the psychological resemblance of males in the A-S-E-C types was closer than that found for females. In other words, males differentiate less well than females with respect to these four career types. The finding implies that females may have a clearer perception of distinguishing the characteristics of humanistic-social science careers between the A-S-E-C, except for the distance between S and E types. Conversely, males are better than females in differentiating the R and I types, which are the natural science careers.

Comparing the findings with the work of others, two studies found that only the Conventional and Realistic scales were not correlated so highly as would be predicted by the model (Lowman & Schurman, 1982; Tuck & Keeling, 1980). The former utilized the VPI, while the latter utilized the SDS. Lowman and Schurman (1982) suggested that, this phenomenon might repressent a deficiency in the theory rather than one in the instrument. Granted that the VPI has something unique of its own, it is a part (i. e., the Occupations section) of the SDS and measures something in common with the other sections (Rachman et al., 1981). This study would suggest that, the evidence may not imply a deficiency, nor question the perfectness of Holland's model with respect to its symmetrical and equilateral hexagon, rather, it may reflect the unique characteristic of an emic environment and emphasizing the need for adaptation for the application and interpretation of Holland's hexagonal model in a given cultural context.

Implications

Implications for the Theory

For numerous studies seeking to validate Holland's theory in different countries with different subjects, most of the investigators seemed to be interested in answering the question of whether the tool measuring Holland's career types is adequate, or whether the theory underlying them is in need of further refinement. Using a translated SDS in Chinese form, the present study confirmed that two sections of the Chinese SDS in male data are congruent with Holland's factorial structure. The other sections for males and females were given the same results but with minor exceptions. Furthermore, for the entire test, the ordering and the psychological relationships among career types also confirmed the hexagon model postulated by Holland. These confirmations not only assure the applicability and generalization of Holland's theory in a new cultural context but also suggest that the constructs of theory are sound.

However, there is a need for adaptation of the theory. The contents of Holland's factorial structure are not absolutely stable across countries and across genders. Holland (1979) depicted the possibility that people with different characteristics and backgrounds-age, sex, race, education, intelligence-do, on the average, obtain different scores and codes. He further suggested that these differences are assumed to reflect diverse personal characteristics and life experience. The investigator would generalize these individual differences to societal or cultural differences. A given culture has its unique developmental history and ethnic characteristics. In other words, the inconsistent section of Holland's theory may reflect a culture or society's unique characteristic. Hence, it deserves future verification and confirmation rather than being explained by the "deficiency of theory" (Lowman & Schurman, 1982). Unless various studies are conducted and present consistent evidence in the Chinese society, the generalization and application of Holland's theory must be precautionary.

Implications for Practical Application

The implications of this study for the application of Holland's model for Chinese high school students is mainly to encourage their exploration of a wide range of occupations. The SDS Chinese form can provide high school counselors with a tool based on Holland theory to involve students in an exploratory and continuous career development process. Special consideration of the relevance of the current findings to counseling practice should be highlighted.

First of all, the study was unable to split the Social and Enterprising scales of the SDS into two separate factors for the samples of males and females studies. Meanwhile, both males and females prefer the Social scales to the Enterprising scales in the total response of the first three sections

as well as in the Self-Estimates section. The direction of their preference was unexpected. Gottfredson (1978) has pointed out that enterprising occupations tend to be financially rewarding and constitute a large proportion of all jobs in the United States, which is also applicable to the current societal situation in the Republic of China. The current study cannot suggest, as did Edwards and Whitney (1972), that the use of one type (the Enterprising or the Social type) can be substituted for the other. Rather, the investigator would suggest the counselor provide their clients with the highest code of Social with intensive vocational information relevant to enterprising occupations as well.

Secondly, 10th grade students show less conformity to the factor structure as well as the appropriateness of the hexagonal model. Since the Holland theory explains little about the process of personality development and its role in vocational selection (Osipow, 1983, p. 112), findings from the present study suggests that the use of Holland's theory must be in conjunction with some other career counseling approaches, especially the developmental approach. The identification of clients developmental level and an understanding of their personality development is an important antecedent information to facilitate the application of Holland's theory for career intervention in Taiwan.

Thirdly, in terms of the career preference given on the Chinese SDS, males reflected a stronger preference for the Investigative and Realistic types, the least preferred were the Enterprising and Conventional types. For females, on the other hand, the mean scores indicated their preference for the Social and Artistic types and their rejection of the Realistic type. In general, male and female students are to some extent influenced by sex-role expectations in their career or educational choices. They should be encouraged to choose careers that require their talents and potential. Jointly with results from other career-related assessment devices, the Chinese SDS can provide counselors with valuable information to offset clients' sex-role bias. Given the data, counselors can, as suggested by Farmer (1977), encourage girls and women, boys and men to adopt flexible attitudes toward their sex roles, in opposition to the view that some behaviors and careers are feminine and other are masculine.

Finally, the model found in this study was not in accord with a perfect hexagon, rather a similar misshapen polygon for males and females symbolized in a bell shape. The ordering of career types fit Holland's assumption, which can serve as a basis and a support to develop and establish Chinese-vocational classification system. The present government occupational classification system in the Republic of China is based on the international occupational classification (Ministry of Interior, 1978). The process of

establishing a new classification and testing its usefulness or validity can be developed by following Holland's steps (Holland, 1985). However, for tentative use, it is suggested that we transfer and adapt two versions of Holland's classification: (1) the Occupations Finder of the SDS (Holland, 1978), and (2) the Dictionary of Holland Occupational Codes (Gottfredson, Holland & Ogawa, 1985), incorporated with the current occupational titles in the Chinese DOT. The use of classification, which is an integral part of the Holland theory, would help in the interpretation of a student's profiles and of the psychological distance between one occupation and another. With regard to the psychological distance, the distance between R and C, and I and A in space were much greater than anticipated. To calculate degrees of consistency (Holland, 1985), we should be somewhat cautious to consider them as the middle consistency (the alternate) rather than the high consistency (the adjacent).

The above listed implications for theory application in Chinese society should be ressured by conducting additional empirical researches.

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國立臺灣師範大學教育心理學系
教育心理學報，民75，19期，219－254頁

何倫 (Holland) 類型論之因素結構分析

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摘　　要

本研究之目的，旨在從兩個層面驗證 John Holland 生計類型理論在我國的理論建構：其一在於 測試 Holland 類型論中六個人格類型因素的建構效度，其二在於驗證因素之間排列的適切性。研究對象爲八百八十位臺北市高中（含普通高中、高商、及高工三類學校）的學生，男女各半。測量工具爲 Holland 之「職業自我探索量表」(Self-Directed Search)。中譯本經過回譯法、預試，以及項目分析等手續，在信度、聚斂和區別效度，以及建構效度方面所得到的結果均屬理想。

在因素結構方面，經由因素分析統計結果發現，Holland 理論的因素結構大部份獲得證實，惟在「社會型」與「企業型」方面，無論男女學生的結果均顯示出這兩型屬同一因素。在因素結構排列的適切性方面，經使用 Wakefield & Doughtie 的空間分析發現，六個因素的排列順序與 Holland 的六角形理論並無二致。所不同者，本研究的結果呈鐘形排列，與 Holland 六角對稱的形狀略有出入。本研究之結果反應出若干值得重視的文化差異問題，無論在理論的實際應用方面，或評量工具的修訂方面，均值得進一步探究。