CROSS-CULTURAL VALIDATION OF HOLLAND'S INTEREST STRUCTURE IN CHINESE POPULATION

by

WEIWEI YANG

(Under the Direction of Garnett S. Stokes)

ABSTRACT

This study evaluated Holland's structure hypotheses – circular order and circumplex – in two populations in China at both subtest (i.e., Activities, Competencies, Occupational Preferences, and Self-ratings on Abilities) and entire test levels of the Self-Directed Search (SDS; Holland, 1994). Confirmatory factor analysis suggested that the circumplex model was generally not supported for Mainland and Hong Kong samples. Randomization test of hypothesized order relations suggested that the circular order model fit different samples at different test levels of the SDS. The randomization test of differences in fit indicated that the circular order model (1) fit slightly better for Hong Kong males than Mainland males at three subtests (i.e., Activities, Competencies, and Self-ratings on Abilities); (2) fit slightly better for Hong Kong females than Mainland females at three subtests (i.e., Activities, Competencies, and Occupational Preferences); and (3) fit females slightly better than males in both Mainland China and Hong Kong.

INDEX WORDS: Holland's vocational interests; hexagon; cross-cultural validation; Chinese; the Self-Directed Search (SDS).

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B. S. S., The University of Hong Kong, Hong Kong, 2002

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2004

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May 2004

ACKNOWLEDGEMENTS

I would like to thank Dr. Garnett Stokes, my major professor, for her guidance, support, and encouragement. Dr. Stokes has been instrumental in the completion of my thesis as well as my development as an I/O psychologist. I would like to thank my committee members, Drs. Karl Kuhnert and Gary Lautenschlager, for their insightful comments and feedback. I would also like to thank Dr. Terence Tracey, for his assistance with using the RANDALL program. Only through each of these contributions was I able to successfully complete this thesis.

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Vocational interests are predictors of the kinds of work activities that people enjoy, and they identify the types of occupations that are likely to arouse motivation and to create feelings of satisfaction (Lowman, 1991). During the past 30 years, the most persistent and notable attempt to organize vocational interests is Holland's model of vocational interests. His theory continues to dominate the measurement of vocational interests today and enjoys widespread use in counseling.

According to Holland's (1973, 1985, 1997) theory of vocational choices, most people can be categorized according to their resemblance to one of the six personality types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). The more closely a person resembles a particular type, the more likely he or she is to exhibit the traits and behaviors associated with that type. Since different types of people have different interests, competencies and dispositions, they tend to surround themselves with people and materials that are congruent with their interests, competencies and dispositions. By doing so, they create an environment that reflects the types they most resemble. Therefore, the environments in which people function can likewise be characterized as being Realistic, Investigative, Artistic, Social, Enterprising and Conventional. People usually search for environments that will let them exercise their skills and abilities, express their attitudes and values, and take on agreeable problems and roles. Thus, Realistic people are attracted to Realistic environments, Social people to Social environments, and so on. According to Holland, people who have higher levels of congruence between their

personality types and their work environments are more likely to have higher levels of job satisfaction and longer tenure at their jobs.

To define the psychological resemblances among interest types, environments and their interactions, Holland's theory further specifies that the six interest types are arranged according to a hexagonal model (Figure 1), in which the relations among types are inversely proportional to the distances among types. That is, the shorter the distance between any two types, the greater their similarity or psychological resemblance. For example, Realistic and Investigative are close to each other, and therefore, they resemble one another. In contrast, Realistic and Social types are far apart, and therefore, they are very different from each other. Realistic and Artistic types have an intermediate degree of resemblance. The hexagonal model not only describes the relationship among the interest types and the environments, it also specifies the degrees of congruence between person and environment. The most congruent situation for a Realistic person would be to be in a Realistic environment, and the most incongruent situation for a Realistic person would be to be in a Social environment. The hexagonal model is important because it is a simple and complete way to link the main ideas of Holland's theory together so that the theory can be applied to practical and theoretical problems (Holland, 1973, 1985, 1997).

There are two versions of Holland's structural hypotheses concerning the hexagon that have been widely discussed in the vocational literature: the circular order hypothesis and the circumplex hypothesis (Rounds, 1995; Rounds & Tracey, 1996; Rounds, Tracey & Hubert, 1992). The circular order hypothesis specifies that the six interest types can be arranged in R-I-A-S-E-C order to form a circular structure, and the distance among the six interest types represents the relative magnitude of the relations. It requires that the correlations between adjacent types be greater than those between all nonadjacent types (e.g., realistic –

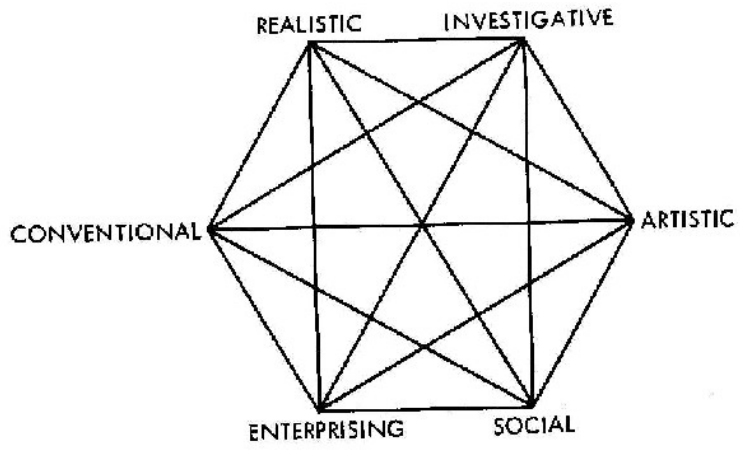

Figure 1

A hexagonal model for defining the psychological resemblances among interest types, environments and their interactions (Holland, 1985, p.29)

investigative > realistic – artistic; investigative – artistic > investigative – enterprising), and the correlations between alternate types be greater than those between opposite types (e.g., realistic – artistic > realistic – social). Therefore, the circular order hypothesis involves 72 order predictions (greater than or less than inequality relations) that can be made within a RIASEC correlation matrix. The circumplex hypothesis is a more constrained version of Holland's structural hypotheses, because it adds an additional prediction on the circular order hypothesis: the interpoint distances are equal for types within adjacent categories, alternate categories, and opposite categories. Specifically, the correlations between each of the adjacent types will be equal (i.e., realistic – investigative = investigative – artistic = artistic – social = social – enterprising = enterprising – conventional = conventional – realistic), the correlations between each of the alternate types will be equal (i.e., realistic – artistic = investigative – social = artistic – enterprising = social – conventional = enterprising – realistic = conventional – investigative), and the correlations between each of the opposite types will be equal (i.e., realistic – social = investigative – enterprising = artistic – conventional). Therefore, in addition to the 72 inequality relations specified by circular order hypothesis, the circumplex hypothesis further accounts for 33 equality predictions that are drawn from Holland's depictions of the six types as forming an equilateral hexagon. Altogether, the circumplex hypothesis specifies 105 possible predictions. In summary, two representations of Holland's RIASEC structure – the circular order hypothesis and the circumplex hypothesis – are usually proposed for model testing in the vocational literature.

Following Holland, Whitney, Cole, and Richards' (1969) first demonstration that a circular arrangement best describes the interrelationships among Vocational Preference Inventory (VPI) RIASEC scales, Holland's hexagonal model has been widely tested in the United States and has received relatively clear and positive support in a wide range of investigations using a variety of samples, data analytic methods, and assessment devices

(Holland, 1985). Cited by Holland (1985), Edwards and Whitney (1972) applied the Cole and Cole (1970) configural analysis and factor analysis to correlational matrices obtained from the Self-Directed Search (SDS) using a sample of 358 and 360 college males and females. The configural analyses approximated a hexagonal model for both male and female students. Tracey and Rounds (1993) did a meta-analysis on 77 U.S. RIASEC matrices, and no differences in fit across gender were found. When the respondents were divided into those between 14 and 18 years of age, those between 18 and 22 and those 22 or older, there was no difference in fit of the circular order model, nor was there any difference in the fit of the circular model across the four interest inventories (Vocational Preference Inventory, Self-Directed Search, American College Testing Program, and Strong Interest Inventory). These results made Rounds and Tracey (1993) conclude that the structural invariance of Holland's model across gender, age, and instrument was supported in U.S. samples.

In the past decades, interest in understanding the utility of interest inventories with ethnic minorities exploded (Fouad, Harmon & Hansen, 1994). As we enter the 21st century, the globalization of the economy inevitably brings in opportunities for use of career assessment tools in cross-cultural settings beyond the U.S. (Tang, 2001). Therefore, there has been vocational literature examining differences in RIASEC interest scores across different cultures by comparing group means on measures across cultures. However, this kind of comparison is meaningful only to the extent that the structure of the scales is invariant across these groups. Without equivalent structures, mean score comparisons across cultures are pointless: the differences or similarities are essentially uninterpretable (Rounds & Tracey, 1996; Tracey & Rounds, 1997). For this reason, cross-cultural evaluation of structural equivalence of the RIASEC model in different cultures is of great importance. Therefore, more research effort has been geared to cross-culture validation of Holland's interest structure among U.S. ethnic minorities as well as in foreign countries.

The vocational literature suggests that the RIASEC structure has been supported with some U.S. ethnic minorities in different contexts, but not necessarily so for some other ethnic groups. Fouad, Harmon, and Hansen (1994) reported that studies on the interest structure of African Americans, American Indians, and Latinos/Hispanics indicated reasonable resemblance to Holland's hexagon model. Rounds and Tracey (1996) examined the circular order model in 20 ethnic minority U.S. samples and found the fit of the U.S. ethnic minority samples was significantly lower than that of the U.S. samples (The U.S. samples may have included ethnic minorities but they were either samples of convenience or representative samples; thus the minority ethnic groups were not selected specifically nor were they large in numbers (Tracey & Rounds, 1997)). Haverkamp, Collins and Hansen (1994) designed a study to investigate the structure of interests in a sample of Asian American university students. They found that for female Asian Americans, Holland's interest order was supported with the exception of a reversal of the Enterprising and Conventional types. The distances between the Conventional and Realistic and between Enterprising and Realistic types were greater than would appear in a regular hexagon. For Asian American men, neither the circular order hypothesis nor the circumplex hypothesis was supported.

In the international setting, the findings about Holland's structural hypotheses are mixed. Leong et al (1998) found support for Holland's theoretical structure and order relationships in a sample of 172 Indian workers using the Vocational Preference Inventory (VPI). Fouad and Dancer (1992) investigated the structure of interests for Mexican and U.S. students and professional engineers. They found that the interest structure of U.S. students and engineers fitted better to the circular order hypothesis than that of the Mexican students and professionals. Farh, Leong and Law (1998) tested the cross-cultural validity of Holland's model in Hong Kong using a sample of 1813 university freshmen. They found support for fit of the Hong Kong data to Holland's circular order model but not the circumplex model.

Rounds and Tracey (1996) meta-analyzed the data from 76 international matrices representing 18 countries, and they concluded that the cross-cultural structural equivalence of Holland's circular order model was not supported.

Research on the vocational interests of Chinese people has theoretical as well as practical value. Theoretically, inconsistent and inconclusive research findings regarding the universality of Holland's interest structure call for more research effort in this area and exploration of the possible reasons. The investigation of the vocational structure of Chinese people would add to research about application of Holland's model in cross-cultural settings. Moreover, China has the largest population in the world, and now its labor force is greatly impacted by the dramatic changes and reconstruction of the economic system. As a result, vocational guidance is highly demanded. A reliable and valid instrument to measure individuals' vocational interests would be helpful in providing effective vocational guidance to Chinese people (Tang, 2001).

There have been altogether two validation studies of Holland's interest structure in Mainland China so far, and the findings are equivocal. The first attempt was made by Yu and Alvi (1996). The study involved 409 secondary school students who were administered the 1985 edition of the Self-Directed Search (SDS) (translated into Chinese), and from the intercorrelations among the six interest scales. The researchers concluded that "the relationships among the six interest types hypothesized by the hexagonal model were fully supported by the results" (Yu and Alvi, 1996, p.245). However, there are some problems with this study. First, the study used inappropriate statistical methods to test the circular order hypothesis. The researchers first calculated the correlations among the six interest types of the sample, visually inspected the resulting correlations, and then compared them with Holland's hypothesized RIASEC circle. It is argued that "methods that rely on visual inspection are woefully inexact" (Rounds and Tracey, 1996, p.312), because visual inspection

"allows one to get an intuitive feel for the pattern of relations in the matrix, but it is inadequate as a means of formal evaluation and subject to wide differences in conclusions across researchers" (Tracey, 2000, p.644). The recommended statistical strategy for the circular order hypothesis is the randomization test of hypothesized order relations (Hubert & Arabie, 1987; Rounds, Tracey & Hubert, 1992; Tracey & Rounds, 1997). Second, the sample in Yu and Alvi's (1996) study consisted of 192 boys and 217 girls from four technical secondary schools in China. The generalization of the results may be questionable.

The other study done in China was Tang's (2001) investigation of the interest structure of Chinese college students. The results based on data of 166 Chinese college students' vocational interests using the Strong Interest Inventory (SII) 1994 version (translated into Chinese) indicated that for Chinese male students, the interest order was RISAEC, with Social and Artistic types reversed, and there was no resemblance to a hexagon at all; for Chinese female students, the interest order was RSAECI, and the configuration was closer to a hexagon shape. In this study, multidimensional scaling (MDS) was used to investigate the hexagon model as a confirmatory technique using a set of spatial coordinates specified in advance (Tracey, 2000). A concern with MDS in analyzing Holland's types is the ratio of types to dimensions in the MDS solution (Armstrong, Hubert & Rounds, 2003). Kruskal and Wish (1978) warned that with less than a 4:1 stimulus to dimensions ratio, measures of model fit are unreliable and uninterpretable. Shepard (1974) recommended that the number of stimuli be more than 10 for a two dimensional solution, and this is a condition that is not met when representing six RIASEC scales in two dimensions. The recommended method for evaluating the circumplex hypothesis is confirmatory factor analysis (CFA; Rounds, Tracey & Hubert, 1992). Moreover, the sample of Tang's (2001) study consisted of college students from 18 to 24 years old, and thus the results may not generalize to the general adult population.

Review of the vocational literature suggests that validation studies of Holland's interest structure in Mainland China are problematic, and the findings are equivocal and inconsistent. Therefore, one purpose of the present study is to further evaluate the universality of Holland's interest structure in Mainland China using better data analysis strategies.

The lack of support for Holland's structural hypotheses in international samples has stimulated a number of studies to explore the possible reasons. One general hypothesis is that the generalizability of Holland's theory to a non-U.S. cultural context depends on the similarity of that culture to the United States (Farh, Leong & Law, 1998). That is, the greater the similarity between a foreign culture and the U.S. culture, the greater the likelihood that Holland's theory will transfer. Rounds and Tracey (1996) tried to link the Hofstede's (1980, 1993, 2001) cultural value dimensions – individualism – collectivism and masculinity – femininity – for comparing vocational interest structures across countries. They found that countries with high collectivistic values had constraints placed on the pattern of vocational preferences, leading to poorer model fit than countries with high individualism. Tang (2001) suggested that examination of the interest structure of the same population in different cultural contexts would greatly enhance the understanding of how culture is related to development of interests. Therefore, the second purpose of the present study is to examine the interest structure of the Chinese population in both Hong Kong and Mainland China.

According to Hofstede (1980, 2001), in individualistic societies, higher value is placed on individual decisions. Children are told that telling the truth about how one feels is seen as a characteristic of a sincere and honest person. In contrast, in collectivist cultures, personal opinions do not exist – they are predetermined by the group. A child who repeatedly voices opinions that deviate from what is collectively felt is considered to have a bad character. Therefore, family influence is an important factor for children in collectivistic cultures in terms of their career choice. Leong (1986) suggested that in traditional Chinese culture, an

individual's occupation is not viewed only as an indicator of personal achievement and social status, but also as a family's accomplishment. An individual's career choice is expected to fulfill the family's expectation and to bring honor to the family. Tang (2002) compared parental influences on Caucasian American, Asian American and Chinese college students' career choices and found that both Asian American and Chinese students were more likely to compromise with their parents, whereas Caucasian Americans were more likely to insist on making their own choices; furthermore, the Chinese students yielded to their parents' opinions more often than Asian American and Caucasian American students. This indicates that Asian Americans, as a result of interaction with both Chinese and American cultures, have blended two cultures to some extent. Therefore, it is evident that in collectivistic cultures, an occupation is not a self-expression, as explained by most career development theories in Western culture, but an indication of upward social mobility and a compromise between parents' expectations and individual preferences.

In terms of the cultural context, because of 150 years of British rule, Hong Kong is a city with traditional Chinese values coexisting with modern, Western values. In contrast, Chinese values are predominant in Mainland China. Furthermore, Mainland China is a socialist country, which explicitly employs every measure to promote collectivism, patriotism, and egalitarianism. Hong Kong is a capitalist society, which allows people to develop their concern for self-interests and individualism (Cheung & Kwok, 1999). Hofstede's (1993) study also suggests that compared to Mainland China, Hong Kong scores higher on individualism. Therefore, people in Hong Kong might be relatively freely to develop their vocational preferences and make their vocational choices, whereas family/authority expectations might be more influential to people in Mainland China, and thus they are more likely to look for jobs that can bring fame to families even if they may not find them intrinsically interesting.

In addition to cultural factors, social and educational systems may also influence people's pattern of vocational interests. In terms of vocational choices, in Mainland China, people were assigned to state-owned factories/enterprises after they graduated from schools. They were not only guaranteed permanent employment but also provided with subsidized housing, health care, education for their children, and generous retirement packages. As a result, people were not free to make their vocational choices, there was little job switching from one enterprise to another, and there was for a long time nothing like a free labor market. It was not until the recent introduction of a contract system in the mid 1990's that the government stopped making job assignments to graduates, and people started to more freely choose or switch jobs. In contrast, Hong Kong operates in a market economy under a laissez-fair policy. People in Hong Kong never had any social barriers to making their vocational choices according to their own preferences and the demands of the job market. In terms of curriculum choices, students in Mainland China need to determine their majors before entering colleges and universities, and they are not allowed to switch majors afterwards. In contrast, students in Hong Kong have opportunities to expose themselves to a variety of courses in colleges/universities before they determine their majors. They are also free to switch majors whenever they want.

In conclusion, less collectivistic cultural values as well as fewer barriers to educational and vocational opportunities place less constraints on development of vocational interests for people in Hong Kong, and therefore, Holland's structural hypotheses are expected to fit Hong Kong people better than people from Mainland China.

Hypothesis: Holland's structural hypotheses will fit Hong Kong people better than people from Mainland China.

In summary, the purpose of the present study is two-fold. First, due to the problematic designs and equivocal results in past research, the current study is designed to further validate

Holland's interest structure in Mainland China using better data analysis strategies. The second purpose of the current study is to better understand the relationship between culture and interests by examining the interest structure of the Chinese population in different cultural contexts. The expected result is that Holland's structural hypotheses will fit Hong Kong people better than people from Mainland China.

CHAPTER 2

METHOD

Measure

Self-Directed Search (SDS). The Self-Directed Search (SDS) is now one of the most widely used instruments for the assessment of vocational interests. It is a 228-item instrument designed to be self-administered, self-scored, and self-interpreted. The SDS was designed specifically to estimate an individual's resemblance to each of the six Holland interest types. The SDS has four separate sections: three subtests (i.e., Activities, Competencies, and Occupational Preferences) and Self-rating of abilities. In each section the RIASEC types are represented. The items of the first three subtests (i.e., Activities, Competencies, and Occupational Preferences) are in a dichotomous format, that is "like" vs. "dislike" for the Activities subtest, and "yes" vs. "no" for the Competencies and Occupational Preferences subtests. In the Self-rating section, for every vocational interest type there are two abilities. The participants judge themselves on a rating scale from 1 to 7, with scale anchors High (7), Average (4), and Low (1). Summary scores of RIASEC scales are calculated by aggregating the subscores (6×4=24) in the four SDS sections.

Holland (1985) reported KR-20 internal consistency estimates for SDS summary scales ranging from .86 to .91 and from .87 to .92 for young adult and older adult samples, respectively. There is sufficient evidence of content validity. A number of studies supporting the predictive validity of the SDS have been compiled and are reported in the SDS manual.

The Chinese version of the SDS was used to measure vocational interests. The translation retains the meaning and format of the English version. The Chinese version

together with the English version was tested among Chinese students in four Hong Kong secondary schools, and the results across instruments were comparable (Hau, 1999).

Procedure

Archival data were used in the present study. The data were collected in a collaborative project by Dr. Harry C. Hui, Tess Pak from the University of Hong Kong, and the present author. The research project was promoted by sending invitations to alumni of two universities in Hong Kong and advertising the study through two websites in Mainland China. Most of the subscribers to the latter resided in China, whereas most of the university alumni were in Hong Kong. We described the study as one on personality and vocational interests, and promised prospective participants that they would receive detailed feedback on their own personality and vocational interests. They were also encouraged to forward the invitation email to friends they knew, thus broadening the sampling network.

Participants clicked on a link to a website to respond a number of personality measures. At the end of the session, they provided their demographic information and email address. A total of 2,102 persons completed this first session. Six months later, these individuals were approached again for the completion of the SDS. A total of 811 people responded to the second call for participation and provided complete data for the study. Participants were later sent the feedback on their personalities and vocational interests via email.

For the current study, only the demographic information and SDS results of the participants were used for data analysis.

Participants

Among the 811 participants in the data set, 273 were from Mainland China, 528 were from Hong Kong, and 10 were from other geographical locations. Only the data given by people from Hong Kong and Mainland China (total 801 cases) were used for further analysis.

Among the Hong Kong sample, 203 were males (38.4%) and 325 were females (61.6%). For the Mainland sample, 150 (54.9%) were males and 123 (45.1%) were females. Detailed descriptive statistics concerning the participants' demographic information are shown in Table 1 and Table 2.

Data Analysis

Numerous studies have been conducted to factor analyze the Self-directed Search (e.g., Boyle & Fabris, 1992; Dumenci, 1995; Oosterveld, 1994; Rachman, Amernic & Aranya, 1981; Tuck & Keeling, 1980). It is concluded that it is appropriate to treat the SDS subtests separately. For example, Rachman, Amernic and Aranya (1981) found that among the subtests of the SDS, only the Occupational Preferences subtest could differentiate Holland's six types, especially for Social and Enterprising types, for which other subtests could not discriminate. Similarly, Dumenci (1995) and Oosterveld (1994) investigated the multitrait-multimethod matrix structure of the SDS and concluded that the subtest profiles contained information that might be absent from the summary scores. Rachman, Amernic and Aranya (1981) treated the SDS subtests separately and examined the RIASEC structure at each subtest level. Therefore, in the current study, Holland's circumplex and circular order hypotheses were tested at both the subtest and the entire test levels.

Although there is no evidence showing that Holland's interest structure is influenced by age (for adult groups), educational level, employment status and occupation, there is some evidence of gender influence on the interest structure in the literature; that is, Holland's hexagon structure fits males better than females (Holland, 1997). The result of the chi-square test shows that the gender compositions of the two samples in the current study were significantly different ($\chi^2 = 19.87$, $p < .01$). To control for the gender effect, the following analysis were conducted with males and females separately in the two samples.

Table 1

Distribution of gender, age, education level, work status, occupation and job distribution of Hong Kong sample

Demographical Variables		Frequency	Percent
Gender	Male	203	38.45
	Female	325	61.55
Age	25 or Below	224	42.42
	26-30	183	34.66
	31-35	69	13.07
	36-40	34	6.44
	41-45	14	2.65
	46-50	3	.57
	51 or above	1	.19
Education Level	Below secondary school	2	.38
	Secondary school	61	11.55
	University or institute	341	64.58
	Postgraduate level	124	23.48
Employment Status	Full time in employment	462	87.50
	Part time in employment	24	4.55
	Pending employment	42	7.95
Occupation	Manufacturing	24	4.55
	Electricity and gas	10	1.89
	Construction	33	6.25
	Wholesale, retail, I/E trades, restaurants and hotels	49	9.28
	Transport, storage and communications	41	7.77
	Financing, insurance, real estate and business services	139	26.33
	Community, social and personal services	153	28.98
	Civil service	79	14.96

Table 2

Distribution of gender, age, education level, work status, occupation and job distribution of Mainland sample

Demographical Variables		Frequency	Percent
Gender	Male	150	54.95
	Female	123	45.05
Age	25 or Below	146	53.48
	26-30	92	33.70
	31-35	25	9.16
	36-40	5	1.83
	41-45	2	.73
	46-50	3	1.10
Education Level	Below secondary school	1	.37
	Secondary school	8	2.93
	University or institute	200	73.26
	Postgraduate level	64	23.44
Employment Status	Full time in employment	213	78.02
	Part time in employment	25	9.16
	Pending employment	35	12.82
Occupation	Manufacturing	43	15.75
	Electricity and gas	1	.37
	Construction	13	4.76
	Wholesale, retail, I/E trades, restaurants and hotels	31	11.36
	Transport, storage and communications	38	13.92
	Financing, insurance, real estate and business services	63	23.08
	Community, social and personal services	41	15.02
	Civil service	43	15.75

Pearson correlation was applied to the subtest and summary scores of Realistic, Investigative, Artistic, Social, Enterprising, and Conventional interests obtained from the Chinese version of the SDS (1994). The resulting RIASEC correlation matrices for the samples from Mainland China and Hong Kong were further analyzed using the two recommended statistical methods for circular order and circumplex hypotheses.

The more constrained version of Holland's structural hypotheses – the circumplex hypothesis – was first tested for its fit to the RIASEC correlation matrices. As mentioned previously, Holland's circumplex hypothesis requires that the correlations for the six adjacent pairs (RI, IA, AS, SE, EC, and CR) should be greater than the correlations of the six alternate pairs (RA, AE, ER, IS, SC, and CI) and the three opposite pairs (RS, IE, and AC) and that the correlations for the alternate pairs should be greater than the correlations of the opposite pairs. In addition, correlations among the adjacent types are to be equal, correlations among the alternate types are to be equal, and the same applies to the opposite types. Table 3 is a 15 × 15 matrix that summarizes all the possible correlation order predictions that can be generated from the circumplex hypothesis. According to the circumplex hypothesis, there are (15 × 15 – 15)/2 = 105 distinct order predictions that can be made. Thirty-three of these predictions are for equality, and the remaining 72 are for greater than or less than inequality relations.

Rounds, Tracey, and Hubert (1992) have reviewed various statistical methods for evaluating Holland's structural hypotheses. To test the circumplex hypothesis, which requires the application of parametric methods that can test the value of the equality relations, they recommended confirmatory factor analysis (CFA), which can be used to evaluate whether a pattern of covariation exists within a matrix that supports a given structural model (i.e., the circumplex).

According to Rounds, Tracey, and Hubert (1992), the circumplex structure can be operationalized by using only three parameters to account for the relations within the matrix.

Table 3
Complete specification of order relations implied by Holland's circimplex hypothesis

	RI	RA	RS	RE	RC	IA	IS	IE	IC	AS	AE	AC	SE	SC	EC
RI		>	>	>	=	=	>	>	>	=	>	>	=	>	=
RA	<		>	=	<	<	=	>	=	<	=	>	<	=	<
RS	<	<		<	<	<	<	=	<	<	<	=	<	<	<
RE	<	=	>		<	<	=	>	=	<	=	>	<	=	<
RC	=	>	>	>		=	>	>	>	=	>	>	=	>	=
IA	=	>	>	>	=		>	>	>	=	>	>	=	>	=
IS	<	=	>	=	<	<		>	=	<	=	>	<	=	<
IE	<	<	=	<	<	<	<		<	<	<	=	<	<	<
IC	<	=	>	=	<	<	=	>		<	=	>	<	=	<
AS	=	>	>	>	=	=	>	>	>		>	>	=	>	=
AE	<	=	>	=	<	<	=	>	=	<		>	<	=	<
AC	<	<	=	<	<	<	<	=	<	<	<		<	<	<
SE	=	>	>	>	=	=	>	>	>	=	>	>		>	=
SC	<	=	>	=	<	<	=	>	=	<	=	>	<		<
EC	=	>	>	>	=	=	>	>	>	=	>	>	=	>	

Note. R = realistic, I = investigative, A = artistic, S = social, E = Enterprising C = Conventional. > means the row value is greater than the column value; < Means the row value is less than the column value. Adapted from Tracey and Rounds (1993, p.231)

Table 4 shows the model specification. One parameter (r_1) represents the correlations between adjacent types (RI, IA, AS, SE, EC, and CR), which are assumed to be equal and greater than remaining RIASEC correlations. A second parameter (r_2) represents the correlations between alternate types (RA, AE, ER, IS, SC, and CI), which are assumed to be equal and greater than correlations between opposite types, but less than correlations between adjacent types. The third parameter (r_3) represents the correlations between opposite types (RS, IE, and AC), which are assumed to be equal. The fit of the three-parameter circumplex model to the relations among the RIASEC types can be examined using LISREL 8.54, which can provide maximum likelihood estimates of the parameters and then evaluate the fit of the model estimates to the observed data. Several indices of fit were used to evaluate the fit of the circumplex model. These indices include the overall chi-square statistic, the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). Among these indices, the overall chi-square statistic is the only one that allows for a significance test of the overall fit of the model to the data. However, it is very sensitive to the sample size and model complexity. For CFI and TLI, values above .95 suggest acceptable fit (Bentler & Bonnett, 1980). For RMSEA, values up to .06 represent a reasonable fit (Browne & Cudeck, 1993).

To test the circular order hypothesis, Rounds, Tracey, and Hubert (1992) recommended the randomization test of hypothesized order relations originally proposed by Hubert and Arabie (1987). This test is a confirmatory examination of the fit of any hypothesized pattern of order relations to any similarity or dissimilarity matrix (e.g., a correlation matrix), and this method has been frequently applied to the evaluation of Holland's circular order model, hierarchical cluster models of vocational interests, and interpersonal behavior (Tracey, 1997).

Rounds, Tracey and Hubert (1992) gave a very detailed description of the randomization test of hypothesized order relations. The randomization test first entails a

Table 4

Model specification within a RIASEC correlation matrix for a three-parameter circumplex structure

Type	R	I	A	S	E	C
Realistic (R)	-	r_1	r_2	r_3	r_2	r_1
Investigative (I)	r_1	-	r_1	r_2	r_3	r_2
Artistic (A)	r_2	r_1	-	r_1	r_2	r_3
Social (S)	r_3	r_2	r_1	-	r_1	r_2
Enterprising (E)	r_2	r_3	r_2	r_1	-	r_1
Conventional (C)	r_1	r_2	r_3	r_2	r_1	-

Note. $r_1 > r_2 > r_3$. *Adapted from Rounds, Tracey and Hubert (1992)*

complete specification of the order predictions inherent in the RIASEC. As discussed previously, Holland's circular order hypothesis requires that the correlations for the six adjacent pairs (RI, IA, AS, SE, EC, and CR) should be greater than the correlations of the six alternate pairs (RA, AE, ER, IS, SC, and CI) and the three opposite pairs (RS, IE, and AC) and that the correlations for the alternate pairs should be greater than the correlations of the opposite pairs for a total of 72 order predictions. The predictions are then applied to the data matrix to see how many are confirmed. Then the rows and columns of the data matrix are permuted and the hypothesized circular order model is again applied to the altered data matrix. This application is conducted across all permutations of rows and columns. The number of possible permutations is 6!, which equals 720 different ways to arrange the rows and columns of the RIASEC matrix. When applied to all 720 possible permutations of the rows and columns of the correlation matrix, the randomization test then yields an exact significance level (*p* value) to indicate whether the predicted matches are significantly greater than random. Hubert and Arabie (1987) also proposed a descriptive index of the correspondence between the hypothesized order relations and the observed order relations within a correlation matrix. It is defined as (A-D)/(A+D+T), where A is the number of order predictions met, D is the number of violations of the order predictions, and T is the number of ties. Specifically, (A-D)/(A+D+T) is the difference between two conditional probabilities, A/(A+D+T), the probability that the order conjecture is satisfied, and D/(A+D+T), the probability that the order conjecture is not satisfied, and thus yields information on the utility of the predictions. The correspondence index (CI), which is a normalized descriptive statistic indicating the degree to which the ordered predictions are satisfied, can range from +1, indicating perfect fit, to –1, indicating that not one prediction is met. A CI value of 0 indicates as many predictions are met as violated, and a CI value of 0.5 indicates that 75% of the predictions are met while 25% are violated.

In the present study, the randomization test of hypothesized order relations was used to evaluate the fit of the circular order hypothesis in the Chinese population. The randomization test has been operationalized in the Microsoft FORTRAN RANDALL program (Tracey, 1997), which yields the number of predictions met, tied and violated, the correspondence index (CI), and the *p* value. The randomization test was conducted on the RIASEC correlation matrices using RANDALL. A probability level of .05 would indicate that the predicted matches were significantly greater than random.

To further evaluate whether the fit of the circular order model differed between the Mainland and the Hong Kong samples, a variation of the randomization test of hypothesized order relations were conducted using RANDALL (Anderson, Tracey & Rounds, 1997; Glidden-Tracey & Greenwood, 1997). In this analysis, corresponding pairs of Mainland and Hong Kong samples were considered together, and the test computed the number of observed correlations that agree with model predictions in one correlation matrix but not the other, so as to determine the probability (*p*) that the observed differences in predictions met in the two matrices were due to chance. *P* values larger than .05 would indicate no significant difference in the fit of the circular order model to the pair of correlation matrices. The correspondence index (CI) is the number of predictions met in the Mainland matrix but not the Hong Kong matrix, subtracted from the number of predictions met in the Hong Kong matrix but not the Mainland matrix, divided by the total number of predictions met in both data matrices. Positive values of the CI in the comparative analysis would indicate that the model fit the Mainland sample better; negative values would indicate a better fit with the Hong Kong sample.

CHAPTER 3

RESULTS

The RIASEC correlation matrices at both the subtest levels as well as the entire test level obtained from the Chinese version of Self-Directed Search in Mainland and Hong Kong samples are presented in Tables 5 and 6.

The Fit of the Circumplex Model

The results of confirmatory factor analysis regarding the fit of the circumplex model to the samples are presented in Table 7 (please see Appendix for a sample LISREL syntax testing the circumplex model).

The analyses resulted in all χ^2 values (range from 26.42 to 169.66) with 12 degrees of freedom being significant ($p<.01$). In addition, none of the goodness-of-fit indices met the acceptable fit values (i.e., larger than .95 for CFI and TLI; up to .06 for RMSEA), with CIF ranging from .63 to .89, TLI ranging from .54 to .87, and RMSEA ranging from .07 to .21. An exception was found for Mainland females at the Activities subtest level, where the χ^2 value with 12 degrees of freedom was 17.01 ($p>.05$), indicating a good model fit. Furthermore, the three goodness-of-fit indices were near the acceptable ranges (CFI=.94, TLI=.93, and RMSEA=.05). The results suggested that the circumplex model generally did not fit Mainland or Hong Kong people at the subtest and the entire test levels of the Self-Directed Search, with an exception that it fit well for Mainland females at the Activities subtest level.

The Fit of the Circular Order Model

The randomization test was conducted then to determine if the Mainland and Hong Kong data support the less restrictive circular order model. The results are shown in Table 8.

Table 5

RIASEC subtest and summary score correlation matrices for Mainland males (N=150; below the diagonal) and females (N=123; above the diagonal).

	R1	I1	A1	S1	E1	C1	R2	I2	A2	S2	E2	C2	R3	I3	A3	S3	E3	C3	R4	I4	A4	S4	E4	C4	R	I	A	S	E	C
R1		.36	.23	.15	.18	.25																								
I1	.39		.09	.20	.15	.26																								
A1	.15	.00		.23	.39	.03																								
S1	.30	.20	.36		.41	.31																								
E1	.14	-.02	.17	.37		.34																								
C1	.34	.24	.23	.48	.43																									
R2								.31	.34	.25	.30	.03																		
I2							.23		.22	.09	.17	.12																		
A2							.24	.09		.49	.43	.07																		
S2							.29	.21	.44		.72	.19																		
E2							.32	.23	.54	.70		.19																		
C2							.30	.16	.38	.35	.36																			
R3														.61	.13	.33	.16	.30												
I3													.56		.41	.46	.19	.22												
A3													.10	.30		.44	.49	.05												
S3													.19	.40	.41		.49	.31												
E3													.18	.28	.49	.57		.27												
C3													.39	.39	.27	.47	.50													
R4																				.62	.31	.27	.30	.16						
I4																			.41		.22	.21	.16	.11						
A4																			.14	.09		.34	.26	.17						
S4																			.18	.29	.31		.59	.46						
E4																			.24	.14	.33	.50		.44						
C4																			.13	.05	.29	.38	.51							
R																										.59	.24	.25	.27	.21
I																									.47		.24	.24	.15	.27
A																									.11	.03		.47	.51	.10
S																									.26	.20	.45		.66	.36
E																									.23	.14	.42	.66		.38
C																									.31	.28	.35	.58	.57	

Note. R1, I1, A1, S1, E1, and C1are RIASEC scales in Activities subtest; R2, I2, A2, S2, E2, and C2 are RIASEC scales in Competencies subtest; R3, I3, A3, S3, E3, and C3 are RIASEC scales in Occupational Preferences subtest; R4, I4, A4, S4, E4, and C4 are RIASEC scales in Self-Ratings on Abilities section. R, I, A, S, E, and C are RIASEC scales at the entire test level

Table 6

RIASEC subtest and summary score correlation matrices for Hong Kong males (N=203; below the diagonal) and females (N=325; above the diagonal).

	R1	I1	A1	S1	E1	C1	R2	I2	A2	S2	E2	C2	R3	I3	A3	S3	E3	C3	R4	I4	A4	S4	E4	C4	R	I	A	S	E	C
R1		.34	.23	.14	.05	.16																								
I1	.35		-.02	.11	.03	.23																								
A1	.14	.13		.37	.15	-.09																								
S1	.06	.19	.29		.24	.05																								
E1	.09	.12	.02	.36		.26																								
C1	.08	.23	.04	.17	.25																									
R2								.30	.16	.09	.11	.17																		
I2							.20		.02	.09	.12	.16																		
A2							.23	.09		.43	.42	.10																		
S2							.06	.08	.40		.64	.18																		
E2							.20	.22	.40	.67		.26																		
C2							.10	.21	.15	.30	.30																			
R3														.33	.03	.06	.10	.26												
I3													.32		.12	.29	.10	.13												
A3													-.05	.18		.34	.40	.02												
S3													.11	.42	.29		.41	.10												
E3													.15	.15	.25	.46		.32												
C3													.14	.24	-.06	.18	.34													
R4																				.64	.14	.22	.24	.06						
I4																			.62		.10	.28	.19	.03						
A4																			.15	.19		.27	.31	.12						
S4																			.17	.30	.35		.51	.47						
E4																			.17	.19	.25	.59		.38						
C4																			.07	.14	.13	.34	.43							
R																										.51	.09	.11	.12	.25
I																									.40		-.04	.14	.11	.24
A																									.06	.10		.38	.35	.01
S																									.04	.23	.32		.55	.21
E																									.12	.17	.22	.61		.40
C																									-.04	.30	.01	.26	.39	

Note. R1, I1, A1, S1, E1, and C1are RIASEC scales in Activities subtest; R2, I2, A2, S2, E2, and C2 are RIASEC scales in Competencies subtest; R3, I3, A3, S3, E3, and C3 are RIASEC scales in Occupational Preferences subtest; R4, I4, A4, S4, E4, and C4 are RIASEC scales in Self-Ratings on Abilities section. R, I, A, S, E, and C are RIASEC scales at the entire test level.

Table 7

Confirmatory factor analysis results of the fit of Holland's circumplex model to Mainland and Hong Kong samples at subtest levels and entire test level of the SDS

Sample	SDS Section	χ^2	df	CFI	TLI	RMSEA
Mainland Males	Activities	39.43 (p=0.00)	12	.80	.75	.12
	Competencies	53.27 (p=0.00)	12	.80	.75	.15
	Occupational Preferences	38.50 (p=0.00)	12	.89	.87	.12
	Self-Ratings on Abilities	42.50 (p=0.00)	12	.80	.74	.14
	Summary Scores	56.90 (p=0.00)	12	.82	.77	.16
Mainland Females	Activities	17.01 (p=0.15)	12	.94	.93	.05
	Competencies	49.31 (p=0.00)	12	.75	.69	.16
	Occupational Preferences	45.61 (p=0.00)	12	.82	.78	.16
	Self-Ratings on Abilities	43.69 (p=0.00)	12	.81	.77	.14
	Summary Scores	39.65 (p=0.00)	12	.86	.83	.13
Hong Kong Males	Activities	26.42 (p=0.0094)	12	.85	.81	.07
	Competencies	71.96 (p=0.00)	12	.72	.65	.15
	Occupational Preferences	48.05 (p=0.00)	12	.78	.73	.12
	Self-Ratings on Abilities	71.55 (p=0.00)	12	.78	.72	.16
	Summary Scores	77.57 (p=0.00)	12	.69	.61	.15
Hong Kong Females	Activities	67.06 (p=0.00)	12	.68	.60	.12
	Competencies	98.71 (p=0.00)	12	.73	.66	.15
	Occupational Preferences	59.48 (p=0.00)	12	.81	.76	.11
	Self-Ratings on Abilities	169.66 (p=0.00)	12	.63	.54	.21
	Summary Scores	103.09 (p=0.00)	12	.75	.69	.14

Table 8

Randomization test of the fit of Holland's circular order model to the Mainland and Hong Kong samples at subtest levels and entire test level of the SDS

Sample	SDS Section	72 hypothesized relations							
		Confirmed		Violated		Tie		CI	*p*
		No.	%	No.	%	No.	%		
Mainland Males	Activities	50	69	22	31	0	0	.39	.03
	Competencies	39	54	32	44	1	1	.10	.30
	Occupational Preferences	56	78	15	21	1	1	.57	.02
	Self-Ratings on Abilities	46	64	24	33	2	3	.31	.17
	Summary Scores	49	68	23	32	0	0	.36	.07
Mainland Females	Activities	55	76	16	22	1	1	.54	.05
	Competencies	47	65	24	33	1	1	.32	.07
	Occupational Preferences	53	74	18	25	1	1	.49	.05
	Self-Ratings on Abilities	52	72	19	26	1	1	.46	.10
	Summary Scores	54	75	16	22	2	3	.53	.05
Hong Kong Males	Activities	59	82	13	18	0	0	.64	.05
	Competencies	45	63	24	33	3	4	.29	.12
	Occupational Preferences	56	78	14	19	2	3	.58	.02
	Self-Ratings on Abilities	53	74	17	24	2	3	.50	.02
	Summary Scores	55	76	17	24	0	0	.53	.03
Hong Kong Females	Activities	59	82	13	18	0	0	.64	.05
	Competencies	57	79	14	19	1	1	.60	.05
	Occupational Preferences	60	83	10	14	2	3	.69	.02
	Self-Ratings on Abilities	47	65	25	35	0	0	.31	.15
	Summary Scores	60	83	12	17	0	0	.67	.02

For Mainland males, the circular order model was supported at Activities and Occupational Preferences subtest levels. For the Activities subtest, 50 out of 72 (69%) hypothesized relations were confirmed, resulting in a CI value of .39 ($p<.05$). For the Occupational Preferences subtest, 56 out of 72 (78%) order relations were confirmed, resulting in a CI value of .57 ($p<.05$).

For Mainland females, the circular order model fit the data at Activities and Occupational Preferences subtest levels as well as the entire test level. For the Activities subtest, 55 (76%) order predictions were met, resulting in a CI of .54 ($p=.05$). For the Occupational Preferences subtest, 53 (74%) hypothesized relations were confirmed with a CI of .49 ($p=.05$). At the entire test level, 54 out of 72 (75%) order relations were confirmed, resulting in a CI of .53 ($p=.05$).

For Hong Kong males, the circular order model was supported at the Activities, Occupational Preferences and Self-ratings on Abilities subtest levels, as well as the entire test level. For the Activities subtest, 59 (82%) order relations were confirmed with a CI of .64 ($p=.05$). For the Occupational Preferences subtest, 56 (78%) order predictions were met, resulting in a CI of .58 ($p<.05$). For the Self-ratings on Abilities subtest, 53 (74%) order relations were met with a CI of .50 ($p<.05$). For the entire test level, 55 (76%) order predictions were confirmed with a CI of .53 ($p<.05$).

For Hong Kong females, the circular order model was supported at the Activities, Competencies, and Occupational Preferences subtests levels as well as at the entire test level. For the Activities subtest, 59 out of 72 (82%) order predictions were met with a CI of .64 ($p=.05$). For the Competencies subtest, 57 out of 72 (79%) order relations were confirmed with a CI of .60 ($p=.05$). For the Occupational Preferences subtest, 60 (83%) order relations were confirmed with a CI of .69 ($p<.05$). At the entire test level, 60 out of 72 (83%) order predictions were confirmed, resulting in a CI of .67 ($p<.05$).

The results suggested that the circular order model fit different samples at different test levels of the SDS. Specifically, the circular order model was supported in all four samples at the Occupational Preferences subtest level. In addition, the circular order model fit both Mainland and Hong Kong female samples at Activities and Occupational Preferences subtests, as well as the entire test level, but not the Self-rating on Abilities section. For both Mainland and Hong Kong males, the circular order model fit the data at Activities and Occupational Preferences subtests, but not the Competencies subtest.

Cultural Differences in the Fit of the Circular Order Model

Randomization test of differences in fit was conducted to determine if there are any cultural differences in the fit of the circular order model to people from Mainland China and Hong Kong. The results are presented in Table 9.

As mentioned previously, in this comparative analysis, positive CIs indicate that the circular order model fits the Mainland sample better, and negative CIs indicate a better fit with the Hong Kong sample. The results showed that the circular order model fit Hong Kong males better than Mainland males at the three subtest levels (i.e., Abilities, Competencies, and Self-ratings on Abilities) as well as the entire test level with CIs ranging from -.11 to -.08. There was no difference of model fit in these two samples at the Occupational Preferences subtest level, as indicated by the CI value of 0. To evaluate the possibility of the more subtle differences in model-data fit, a list of prediction violations for the Mainland and Hong Kong male samples was compiled across different test levels of the SDS. Two consistent differences in predictions violated across culture were observed: for Hong Kong males, the predicted relationships of RA>AC and RE>AC were confirmed across different test levels of the SDS; whereas for Mainland males, these two predicted relationships were violated across different test levels of the SDS.

Table 9

Randomization test of differences in fit of Holland's circular order model to pairs of Mainland and Hong Kong data matrices at subtest levels and entire test level of the SDS

Sample	SDS Section	Predictions met by sample						CI	*p*
		Both		Mainland		Hong Kong			
		No.	%	No.	%	No.	%		
Males	Activities	43	60	7	10	15	21	-.11	.90
	Competencies	33	42	5	7	12	17	-.10	.80
	Occupational Preferences	51	71	5	7	5	7	.00	.55
	Self-ratings on Abilities	43	60	2	3	9	13	-.10	.97
	Summary Scores	42	58	7	10	13	18	-.08	.83
Females	Activities	51	71	4	6	7	10	-.04	.62
	Competencies	42	58	5	7	14	19	-.13	.90
	Occupational Preferences	50	69	2	3	9	13	-.10	.93
	Self-ratings on Abilities	45	63	7	10	2	3	.07	.18
	Summary Scores	51	71	3	4	9	13	-.09	.85

For the two female samples, the CIs at three subtest levels (i.e., Abilities, Competencies, and Occupational Preferences) as well as the entire test level were negative (ranging from -.04 to -.13), indicating that at these test levels, the circular order model fit Hong Kong females better than Mainland females. The CIs at the Self-ratings on Abilities was .07, indicating that the circular order model fit Mainland females better than Hong Kong females in terms of Self-ratings on Abilities. Again, a list of prediction violations for Mainland and Hong Kong female samples across different test levels of the SDS was compiled, and no consistent differences in predictions violated across culture were observed.

Since none of the *p* values was less than .05, the observed difference in model fit was not statistically different. Taken together, the results suggested that although the *p* values were not significant, the circular order model fit slightly better for Hong Kong males than Mainland males (except for the Occupational Preference subtest). It also fit slightly better for Hong Kong females than Mainland females (except for the Self-ratings on Abilities subtest).

Gender Differences in the Fit of the Circular Order Model

Randomization test of differences in fit was conducted to determine if there are any gender differences in the fit of the circular order model to people from Mainland China and Hong Kong. The results are presented in Table 10.

The results showed that when comparing Mainland males and females, all the CIs were negative (ranging from -.06 to -.11), except for the Occupational Preferences subtest, indicating that the circular order model fit females better than males in Mainland China except for the Occupational Preferences. Two consistent differences in predictions violated across gender were observed: for Mainland females, the predicted relationships of RA>AC and RE>AC were confirmed across different test levels of the SDS; whereas for Mainland males, these two predicted relationships were violated across different test levels of the SDS.

Table 10

Randomization test of differences in fit of Holland's circular order model to pairs of male and female data matrices at subtest levels and entire test level of the SDS

Sample	SDS Section	Predictions met by sample						CI	*p*
		Both		Male		Female			
		No.	%	No.	%	No.	%		
Mainland	Abilities	42	58	7	10	13	18	-.08	.80
	Competencies	29	40	9	13	17	24	-.11	.90
	Occupational Preferences	47	65	8	11	5	7	.04	.25
	Self-ratings on Abilities	43	60	3	4	7	10	-.06	.78
	Summary Scores	42	58	7	10	12	17	-.07	.78
Hong Kong	Abilities	51	71	7	10	8	11	-.01	.60
	Competencies	42	58	2	3	12	17	-.15	.98
	Occupational Preferences	52	72	3	4	7	10	-.06	.80
	Self-ratings on Abilities	44	61	9	13	2	3	.10	.03
	Summary Scores	51	71	4	6	9	13	-.07	.77

For Hong Kong males and females, all the CIs were negative (ranging from -.01 to -.15), indicating that the circular order model fit females better than males in Hong Kong. An exception was found at the Self-ratings on Abilities section, in which the p value associated with the positive CI (.10) was significant. This indicates that the circular order model fit males better than females in Hong Kong in terms of the Self-ratings on Abilities. No consistent differences in predictions violated across gender were observed in Hong Kong.

Taken together, although the differences were not significant, the circular order model fit females slightly better than males in both Mainland China (with exception for Occupational Preferences) and Hong Kong (with exception for Self-ratings). At the Self-ratings on Abilities level, the circular order model fit males significantly better than females in Hong Kong.

CHAPTER 4

DISCUSSION

The present study was conducted to further evaluate Holland's structure hypotheses in Mainland China using better data analysis strategies. Moreover, to better understand the cross-cultural validity of Holland's model, the present study compared the fit of Holland's structural hypotheses in samples from Hong Kong and Mainland China. Gender differences in terms of model fit were also examined.

In terms of the circumplex model, confirmatory factor analysis of the RIASEC correlation matrices showed that it generally did not fit people in Mainland China and Hong Kong at the SDS subtest as well as entire test levels, except for Mainland females in terms of the Activities (CIF=.94, TLI=.93, and RMSEA=.05). This is consistent with some previous cross-cultural findings that Non-U.S. samples typically do not support the more restrictive version of Holland's structural hypotheses. For example, Farh, Leong and Law (1998) conducted confirmatory factor analysis with 1813 freshmen in Hong Kong based on their scores on the ACT Interest Inventory (UNIACT). The results did not support the circumplex model of vocational interests (CFI=.78, GFI=.88, and RMSEA=.19). In addition, the present author conducted a confirmatory factor analysis on Mainland Chinese college students' RIASEC correlation matrices obtained from the Strong Interest Inventory published by Tang (2001) in the Journal of Career Assessment (p.370). The results did not support the circumplex model for male (TLI=.80, RMSEA=.16) and female (TLI=.85, RMSEA=.14) students. The magnitudes of goodness-of-fit indices in the present study are comparable to the previously published RIASEC data collected from people in Mainland China and Hong Kong.

For the circular order model, the results suggested that it fit different samples at different levels of the SDS. First, the circular order model was supported for all four samples at the Activities and Occupational Preferences subtests. It seems that only these two subtests can clearly discriminate among the six interest types and reflect the circular order structure. This is consistent with Rachman, Amernic and Arnaya's (1981) conclusion that whereas the Activities and Occupational Preferences subtest seems to measure a relatively general attitude toward activities and occupations, the results of other subtests are dependent on the abilities, environments, and other factors the individuals interact with. In other words, the environments (e.g., occupations) the individuals are in can bestow them with certain abilities and competencies, which are what the other subtests (i.e., Competencies, and Self-ratings on Abilities) of SDS measure. Another finding concerning the fit of the circular order model in the current study is that it was not supported in the female samples at the Self-ratings on Abilities level. These results may be due to the possibility that Self-ratings on Abilities involves a cognitive component of SDS rather than an affective component (e.g., Activities and Occupational Preferences subtests; Tuck & Keeling, 1980), and thus the results may be more influenced by gender stereotyping instead of genuine interest. Some of the abilities in the Self-rating section are clearly associated with gender stereotyping, such as mechanical ability, technical ability, mathematical ability, and so on. For example, numerous studies found that women perceived themselves to have lower ability in mathematics- and science-related tasks (e.g., Betz & Hackett, 1983; Matsui, Matsui & Ohnishi, 1990). Rammstedt and Rammsayer (2000) had a sample of German students to rate on their own mental abilities and found that females rated their mathematical, logical and spatial intelligence lower than males. Research also suggests that lack of encouragement and support also prevents women from excelling masculine tasks (Greenhaus, Callanan & Godshalk, 2000). Therefore, when rating themselves on the items in the Self-ratings on Abilities section, females might choose

answers that are consistent with their perceptions and gender norms instead of intrinsic interests.

The current study also examined gender differences in the fit of the circular order model, and it was found that although the differences did not reach statistical difference, the circular order model fit females slightly better than males in both Mainland China (except for Occupational Preferences) and Hong Kong (except for Self-ratings on Abilities). This is in contrast to some findings (e.g., Fouad, 2002; Fouad, Harmon & Borgen, 1997; Glidden-Tracey & Greenwood, 1997) that Holland's hexagon fit males better than females. The result is also inconsistent with some findings (e.g., Anderson, Tracey & Rounds, 1997; Tracey & Rounds, 1993) that there is no gender difference in terms of the fit of Holland's hexagon. However, there is at least some evidence that Holland's hexagon fits females better than males. For example, Tracey, Watanabe and Schneider (1997) analyzed Japanese college students' RIASEC data obtained from the Inventory of Occupational Preferences and found that the circular model fit women (CI=.75, $p<.05$) better than men (CI=.47, $p<.05$). Haverkamp, Collins, and Hansen (1994) studied the interest structure of Asian-American college students using the Strong Interest Inventory, and it was found that the circular order model fit the female group (CI=.58, $p<.05$) better than the male group (CI=.39, $p>.05$). The randomization test was performed by the present author to Mainland Chinese college students' RIASEC matrices published by Tang (2001) in the Journal of Career Assessment (p.370), and the results also indicated that although the difference was not significant ($p>.05$), the circular order model fit female students (CI=.46, $p>.05$) slightly better than male students (CI=.33, $p>.05$). It seems that Holland's circular order model typically fits females better than males in Asian cultures, but the opposite is found in Western cultures. Future studies can explore why this is so by examining gender roles/norms, interaction between culture and gender, and their effects on Holland's interest structure.

The results of the current study have several theoretical as well as practical implications. First, compared to the more constrained version of Holland's structural hypothesis – the circumplex model, the circular order model better describes the interrelationships among the interest types in Chinese population, especially when the model is based on people's genuine preferences of activities and occupations. Hence, for Chinese people, the six interest types obtained from the SDS are arranged in R-I-A-S-E-C order forming a misshapen hexagon; and there is no evidence of the equal distances of the hexagon. As discussed at the beginning of this article, the construct of congruence, which is central to Holland's theory, is based on the hexagon shape of the interest structure. Essentially, as long as the interest structure meets two conditions, namely, (1) six interest types are arranged in RIASEC order, and (2) relations among types are inversely proportional to the distances among them, it is good enough to test the congruence construct – no equidistance assumption is required. Hence, the circumplex is just a more precise model allowing a more exact test. In addition to this, there seems no particular advantage of the circumplex model compared to the circular order model (Rounds, McKenna, Hubert & Day, 2000).

Second, the results provide some evidence regarding the universality of Holland's interest structure and the application of Holland's model in the Chinese population. It is clear that the circumplex model is not applicable in the Chinese population in Mainland China and Hong Kong. To the extent that the circular order model fit the samples at different SDS subtest and entire test levels, it provides some support for the applicability of Holland's circular order model in the Chinese population. This is good news for people in Mainland China. Whereas there is little vocational guidance, with the evidence that Holland's circular order model is applicable in the Chinese population, and with the availability of the Chinese version of the SDS, people in China can help themselves to make vocational choices through the use of Holland's model.

Third, the investigation of the interest structure of the Chinese population in different cultural contexts enriched our understanding of the cross-cultural validity of Holland's model. Whereas the United States is a highly individualistic country, Mainland China is a collectivistic country, and Hong Kong, as a result of 150 years' British rules, has blended the two cultures to some extent. The benchmark value of the CIs (.69) obtained from the 73 U.S. samples is relatively high (Tracey & Rounds, 1993), the CIs obtained from Mainland samples in the current study are lower, and Hong Kong samples' CIs are somewhere in between. This supports the general hypothesis that the greater the similarity between a foreign culture and the U.S. culture, the greater the likelihood that Holland's theory will transfer (Farh, Leong & Law, 1998). Therefore, it seems plausible that culture greatly influences people's pattern and development of vocational interests. Evidently, Tang's (2002) study suggests that family influence is very important for Chinese college students' career choices, somewhat important to Asian Americans (who blend Chinese and US cultures to some extent, just like people in Hong Kong), and not related to the career choices of Caucasian Americans. Moreover, there has never been a system assigning people to occupations in the U.S. like what was implemented in Mainland China for more than 40 years. Therefore, American people are more likely to choose occupations they are interested in. In addition to cultural and social differences, financial constraints and scarcity of vocational information might play a part. With the open door policy, there has been a strong materialistic orientation among the young people in Mainland China. With this orientation, many people in Mainland may look for jobs with high pay and good future prospects even if they may not find them interesting. In more wealthy societies (e.g., U.S.), people are more likely to find jobs they like or find interesting. Moreover, the remarkable economic change in Mainland China makes a lot more occupations available than ever before. Because there is little vocational guidance available, people get information about various jobs through different forms of media, which may not necessarily

convey sufficient and accurate features of a particular job. This incomplete information can lead young people to have a false perception about that occupation and then mistakenly think they are interested in it (Tang, 2001). Therefore, in addition to cultural factors and barriers to vocational choices, the materialistic orientation and incomplete vocational information might place some constraints on people's vocational interests in Mainland China.

Fourth, the current study examined Holland's structural hypotheses at both the SDS subtest and entire test levels. The results support previous findings that the SDS subtest profiles and summary profile might tap different information. For example, although the circular order model is not present in Mainland male sample at the entire test level of the SDS, it is confirmed at some subtest levels (e.g., Activities, Occupational Preferences). These results suggest that Dumenci (1995) is correct that the subtest profiles contain information that may be different from the summary profile. Therefore, looking at the summary profile of the SDS only will blur the information provided by the subtests. According to Melamed (1976), cited by Holland (1985), the Occupational Preferences subtest of the SDS had more construct validity than the entire SDS. Hence, vocational counselors should be cautious when interpreting the summary profile. It is better to look at the subtest profiles, especially the Occupational Preferences subtest, along with the summary profile, which contains richer information, such as competencies, self-concepts, etc.

The results of this study should be considered in light of several limitations of the study. First, this study cannot disentangle the effect of culture versus modernization on Chinese people's interest structure. Whereas collectivistic cultural values place constraints on people's expressions of their vocational interests, lack of many kinds of occupations might also influence people's interest structure. Although using the Internet as the sampling method can somewhat lessen this problem in that people from more modernized and developed places in China are oversampled in this study, future studies should use a

better design so as to separate the effect of culture and modernization. Second, most of our participants were under age 35 and about 90% of them had received at least a university level education. This was probably because of the sampling on the Internet, which was biased towards the younger and more educated people. Moreover, people who voluntarily participated in this study were those who were interested in feedback about their interests and personality. These people might have an awareness of their individuality, and therefore, it is possible that the sample would be less collectivistic than most Chinese people in general. To be representative of the general population, future studies should attempt other methods of sampling.

As the world becomes increasingly globalized, it is necessary to investigate the applicability of Western career development theories and assessments in cross-cultural settings. Although this study provides some evidence of the universality of Holland's circular order model in the Chinese population, readers are cautioned that it is pre-mature to generalize the preliminary findings of this study obtained from the SDS to other interest inventories. Different from previous cross-cultural validation studies that are mostly descriptive rather than explanatory, this study shows that deviation from Holland's hypothesized interest structure can be understood by acknowledging cultural and social differences. Future cross-cultural validation of Holland's interest structure can similarly acknowledge the existence of moderating variables, such as perceptions of work, perceptions of career-related barriers, racial identity attitudes, just to name a few, so as to make the theory more useful and to more adequately represent the reality. The search for Holland's structural validity in ethnic minorities and international settings must continue.

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APPENDIX

Sample LISREL syntax of confirmatory factor analysis in testing the circumplex model

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TITLE MAINLAND MALES ON OCCUPATIONAL PREFERENCE
 DA NI=6 NO=150 MA=KM
 KM SY
 1.000
 .560 1.000
 .100  .300 1.000
 .190  .400  .410 1.000
 .180  .280  .490  .570 1.000
 .390  .390  .270  .470  .500 1.000
 MO NX=6 NK=6 LX=ID PH=ST,FI
 VA 1.0 PH 1 1 PH 2 2 PH 3 3 PH 4 4 PH 5 5 PH 6 6
 FR PH 2 1 PH 3 1 PH 4 1
 EQ PH 2 1 PH 3 2 PH 4 3 PH 5 4 PH 6 5 PH 6 1
 EQ PH 3 1 PH 4 2 PH 5 3 PH 6 4 PH 5 1 PH 6 2
 EQ PH 4 1 PH 5 2 PH 6 3
 OU TV RS SS
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