Cultural Encountering:
The Applicability of Holland's Typology in Taiwan

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The purpose of the study was to test the applicability of Holland's hexagonal model in Taiwan. Gati's hierarchical model of vocational interest structure derived from the Holland hexagon was also compared. In the first stage of the study, an experimental version of the Chinese Vocational Interest Inventory (CVII) was administered to 572 students in Taiwan. Item selection procedure was conducted through the analysis of item-total correlation, percentage like, and factor analysis. In the second stage, the revised CVII was then tested based on a college sample of 366 males and 465 females. The split half coefficients of the six scales ranged from .66 to .94 for males and .68 to .90 for females. The hit rates were 45.9% for males and 50.5% for females. The multitrait-multimethod matrix also supported the convergent-discriminant validity of the CVII. As far as the generalizability of both Holland's and Gati's models, the results of multidimensional scaling supported Holland's hexagonal model. However, the results of order prediction claimed that Gati's model was better than Holland's model in interpreting the interest structure of Taiwanese college students.

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Vocational interest is one of the important factors that influence an individual's vocational choice. A vocational interest inventory is one of the resources that help students explore their interests and develop career plans. Few vocational interest inventories are available in Taiwan. Some are outdated whereas others have been translated from other languages and are not very satisfactory due to the cultural differences in occupational structure there. Career counselling has become very important for students in Taiwan since the society there is shifting rapidly in its economic, political, and educational development. The need for college and high school students to explore their vocational interests is increasing, especially for high school students who must decide on a college major before entering college at the time they take the college entrance examination. Therefore, the College Entrance Examination Centre also developed an interest inventory for high school students. Almost all high school students take this inventory while they are during 10th to 12th grade. However, a new inventory needs to be developed instead of applying the original one developed by the American College Test (ACT) or the Self-Directed Search (SDS) by Holland because the structure of the college majors at the universities and the world of work might be different in both countries. Also, it would be better for high school students to know exactly what majors are available and related to their interests before they get into the college, because they need to decide the majors before entering university.

Similarly in Hong Kong, Wong and Wong (2006) developed the Wong's Career Interest Assessment Questionnaire (WCIAQ) for secondary school students. It was a newly developed interest inventory based on Holland's hexagon and its validity in Chinese culture was tested. For the interest inventory applied for adults in Taiwan, the author believed that the occupational titles and values adhered to the occupations in Hong Kong might be different from that in Taiwan. Therefore, it is important to create a new version of inventory

indigenous to the cultures in Taiwan. Some of the occupations in the SDS cannot be found in Taiwan, whereas some in Taiwan cannot be found in the United States (U.S.), and some could be found in both countries but apply different title names. These differences are related to the cultures in both countries. The author wanted to exclude the cultural differences derived from the occupational titles before examining the real cultural difference of the hexagon model in both countries. Therefore the new inventory was created. Its force-choice format is also different from the format of the SDS. The author preferred the forced-choice method because Holland also believed that interest is a kind of performance of the individual's personality. In summary, the purpose of this study was to test the applicability of Holland's hexagonal model in Taiwan. In addition, Gati's hierarchical model of vocational interest structure derived from the Holland hexagon was also tested. That is, the applicability of Holland's and Gati's interest structures in Taiwan was compared.

In the past few decades, several models of vocational interest structure have been proposed, for example Roe's (1954) circular model, Holland's (1973, 1985) hexagonal model, the American College Test Program's World of Work Map (Prediger & Hanson, 1976), Gati's (1979) hierarchical model, and Rounds and Tracey's (1996) three group model. Holland's hexagonal model suggests that there are at least six broad personality types in American culture. The interrelationships among the six types are assumed to be inversely proportional to the distances among types. The shorter the distance between two types, the greater the similarity or psychological resemblance between the two types (Holland, 1973). This theoretical and mathematical relationship among types is geometrically represented by a two-dimensional hexagonal configuration with the order of the six types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C).

Gati (1979) raised questions regarding the actual relationships among the six interest types proposed by Holland (1973). He contended that the two dimensional hexagonal model is an over-simplification of the interrelationships of the six types. The model Gati proposed is a hierarchical model with three clusters of interests at the bottom of the model: RI, AS, and EC. In this hierarchical model, the correlation within clusters should be greater than the correlation between the other pairs of types from different clusters. Gati's hierarchical model is considered an alternative to the hexagonal model of vocational interests and was examined in the third stage of the study. It was expected that the comparison of the two models would clarify the structure of interests of students in Taiwan.

Holland's hexagonal model has been incorporated into vocational counselling practice with a variety of populations including high school students, college students, and various ethnic groups (Hood & Johnson, 2007). The model's heuristic value for counselling practice has been illustrated by its popularity as well as by many research studies; however, the construct validity and generalizability of the model has been questioned (Droz, 1990). In addition, Tinsley (1992) suggested that more attention should be paid to the question of the cross-cultural generalizability of Holland's model.

Tracey and Rounds (1995, 1996) asserted that the six RIASEC types themselves are arbitrary and that what matters is the circular structure itself. However, a lot of research has been supportive of the circumplex structure of interests (Darcy & Tracey, 2007; Day & Rounds, 1998; Fouad & Mohler, 2004) and occupations (Tracey & Rounds, 1992) at least in the U.S. (Rounds & Tracey, 1996).

In Europe, Holland's and Gati's models of vocational interest were also tested in different countries. Most of the studies provided evidence

of fit for both models (Einarsdóttir, Rounds, Ægisdóttir, & Gerstein, 2002). In Italy, Tracey, Lent, Brown, Soresi, and Nota (2006) examined adherence to the RIASEC structure in a sample of middle and high school students as it varied over time and with career exploration and parenting style. They found that adherence increased over time for both middle and high school students. In addition, they found that adherence was related to subsequent career exploration and that parental authoritativeness was related to later adherence, especially in middle school students. In Croatia, Holland's (1994) SDS was applied to 1,866 adolescents of different age samples (Šverko & Babarovic, 2006). The instrument has shown a good reliability of all RIASEC scales in all sub-samples. Construct validity was also verified, showing that on the basis of Holland's RIASEC scores, one can predict the educational programme in which the student is enrolled. The results supported the validity of Holland's theory in the Croatian sample.

As far as in Asian region, the structure validity of the vocational interests was also examined. In Japan, 2,492 college students completed the translated Personal Globe Inventory (PGI) (Tracey, 2002) Occupational Title scales. The results supported the RIASEC, octant, and spherical structure of the PGI Occupational Title scales. In addition, there were no structural differences found between men and women (Long, Watanabe, & Tracey, 2006).

In Korea, Tak (2004) examined Holland's vocational interest structure by using the Korean version of the 1994 Strong Interest Inventory (SII). A sample of 829 Korean college students completed the SII and the results showed that there were good fits of Holland's circular order model to the data for both male and female groups. Both male and female Korean students had similar fit indices in their size.

In India, Holland's RIASEC circular model was also tested (Leong,

Austin, Sekaran, & Komarraju, 1998). One hundred and seventy-two natives of India aged from 22 to 63 years completed the Vocational Preference Inventory (VPI). Internal consistency estimates for Holland's dimensions, intercorrelations among participants' vocational interest scales, and the results of a randomization test (Tracey, 1997) all provide evidence for the structure of the VPI with Indians.

To test the applicability of Holland's typology particularly in Chinese culture, the model was tested in the Chinese mainland and Hong Kong. Farh, Leong, and Law (1998) investigated the validity of Holland's (1997) model among 1,813 college freshmen. They measured career interest by using the Unisex edition of the ACT Interest Inventory (UNIACT). Results indicated that the internal structure of the UNIACT was generally consistent with the formulations by Holland. In another study, Long, Adams, and Tracey (2005) applied the Chinese version of the PGI (Tracey, 2002) to 721 college students and 943 high school students. Results of separate factor analyses demonstrated that there were three substantive factors: People/Things, Data/Ideas, and Prestige, similar to the structure of the PGI.

Day and Rounds (1998) indicated that some multicultural theory holds that it is quite possible for subgroups within the U.S. to have such divergent thought patterns from the White majority that mainstream psychological inventories are inappropriate measures. The author supposed that a similar situation might happen in the world of Chinese culture. Tracey and Robbins (2005) investigated the RIASEC interest structure by using a large national sample of 69,987 college bound students in the U.S. The representative ethnic groups included African, Asian, Native, Mexican, Latino (non-Mexican), Anglo, and Multiracial Americans. Results indicated that the structure of interests did not vary as a function of time, gender, or ethnicity. The pattern of interests was fairly stable and similar across all ethnic groups and both genders.

Also in Chinese culture, Yang, Stokes, and Hui (2005) tried to conduct similar cross-cultural comparisons between different Chinese samples. They evaluated Holland's (1973, 1985, 1997) structural hypotheses — circular order and circumplex — in two populations in China at both the sub-test (Activities, Competencies, Occupational Preferences, and Self-ratings on Abilities) and the entire test levels of the SDS (Holland, 1994). Confirmatory factor analyses suggested that the circumplex model was generally not supported for Chinese people. However, order relations suggested that the circular order model fit both the samples of the Chinese mainland and Hong Kong at the Activities and Occupational Preferences sub-tests. Randomization tests of differences in fit indicated that there was generally no cultural or gender differences in terms of model fit.

Leung and Hou (2005) examined the structure of career interest among Chinese high school students in Hong Kong using interest test scores from the SDS. The findings indicated that a hierarchical model of interest with six primary interest factors forming three clusters of interest seems to be most valid for Chinese high school students. However, the social interest loads on both the artistic cluster and the enterprising-conventional cluster although realistic and investigative interest forms one cluster. To further explore the relationship between the cluster relationships among the six types, Wong and Wong (2001) found that the revised two-group model appears to be a more appropriate description of the relationship among the six types than the original six-group model. That is, in Hong Kong, the R and I would be formed to be one group and the other four types would be formed to be another group. They further examined the revised two-group structure in four Chinese societies (Wong & Wong, 2006) and similar results were found. Earlier study conducted by using the SDS and the UNIACT in Hong Kong (Law, Wong, & Leong, 2001) also found that the two-group structure is more appropriate to describe the relationship

among the six types of interest. In the present study, the Gati's three-group model were compared with the Holland's original hexagonal model in Taiwan.

Tang (2001) investigated the occupational interests of 166 Chinese college students who were 18–24 years old using the 1994 version of the SII in Chinese. Her study aimed to accomplish two goals: (a) to provide additional validity data for the Chinese version of the SII, and (b) to examine the structure of vocational interests of Chinese college students. The findings indicated that both female and male Chinese students have similar but not identical order of RIASEC. In addition, the factor analysis found the Basic Interest Scales did not resemble exactly the original classification. It seems that the SII cannot be applied directly in China. A native interest inventory needs to be developed based on the Chinese culture, even in different areas in Chinese world. In the present study, an interest inventory indigenous to Chinese culture in Taiwan was developed in the first stage. The interest structure of the Taiwanese college students was then tested in the second stage.

Tracey and Rounds (1992) conducted a structural meta-analysis on published data matrices and evaluated the fit of both the hierarchical and hexagonal models. They located 104 RIASEC matrices in 58 studies and computed analyses of order predictions (randomization test of hypothesized order relations), spatial structure (confirmatory factor analysis), and discrete structures (individual differences cluster analysis). The overall results indicated that Holland's order and circumplex models were adequate representations of the structure of RIASEC interests and superior to Gati's hierarchical model. In their study, Tracey and Rounds (1992) criticized Gati (1982) for incorrectly crediting his three-group partition structure with nine predictions that should be represented as predictions common to both hierarchical and hexagonal models. In addition, Gati adopted binomial tests for order predictions

(Wakefield & Doughtie, 1973), which Tracey and Rounds (1992) criticized as an inappropriate inference procedure and an incomplete representation of order predictions. Hubert and Arabie (1987) stated that there should be 72 order predictions instead of 54 proposed by Wakefield and Doughtie. The comparisons between adjacent pairs to opposite pairs should also be taken into account.

In the present study, the applicability of Holland's hexagonal model in Taiwan was tested. In the first stage, the Chinese Vocational Interest Inventory (CVII) was developed, and the reliability and validity of the CVII was tested. In the second stage, the cross-cultural generalizability of Holland's hexagonal and Gati's hierarchical models were compared. The applicability of Western interest inventory in Chinese vocational culture was then discussed.

Method

Participants

The participants for the first stage of study were 572 high school and college students. At the second stage of the study, a two-stage cluster sampling procedure was used to select participants. Nine colleges/universities were first selected from 34 universities/colleges in Taipei area. Twelve college majors across the six interest types in Holland's hexagonal model, two in each type, were then selected from the major list classified by Holland (1966). The twelve majors were mechanical engineering, chemical engineering, mathematics, chemistry, drama, sculpture art, social work, child welfare, political science, economics, accounting, and finance. The final sample included 366 male and 465 female students.

Inventory Development

In the first stage of the study, the author created, screened and

selected items for versions of the experimental interest inventory. The initial item pool for the experimental inventory included more than a thousand items. Two criteria were set for the selection of the items. First, each of the items should clearly describe one of the six vocational interest types defined by Holland (1985); and second, the occupations or activities described by the items should exist clearly in Taiwan. Part of the items was created by the author according to the author's understanding about the occupational titles in Taiwan. The Chinese dictionary of occupational titles in Taiwan was also one of the references. For the activities, the author described the activities according to the description on the above-mentioned dictionary but made it shorter and more fluent for college students to read.

The experimental/pilot version included two sections: vocational activities and occupations. Each of the two sections contained six scales: realistic, investigative, artistic, social, enterprising, and conventional scales. The first section (activity scale) included 480 items that described some typical vocational activities, whereas the second section (occupation scale) included 240 occupational titles that could be found in Taiwan. The total number of items was 720.

Since the entire experimental inventory was too long for a student to complete in one hour, the 720 items were divided into 4 equivalent forms. Each form contained 180 items with 120 items in the activity scale and 60 items in the occupation scale. There were 30 items in each of the six interest types defined by Holland for each of the four forms. The format of the experimental inventory used 5-point Likert scale, with 1 indicating "like very much" and 5 "dislike very much." A total of 572 high school and college students completed one of the four forms of the experimental interest inventory. Generally speaking, the students were able to complete an experimental inventory in about 40 minutes.

Criteria for Item Screening

Several steps were carried out to screen and select items that are appropriate for the students in Taiwan. First, the items with percentages indicating liking or disliking "very much" over 90% or below 10% were eliminated. Second, any items that had a higher correlation with any one of the other five scales rather than the scale to which they belonged were eliminated. This criterion for item selection was internal consistency (Gable, 1986), which resulted in the elimination of items that did not relate to the interest category being measured.

The third step to screen the items was factor analysis. Separate principal factor analyses of each of the four forms of experimental inventory were conducted. In the process of factor analysis, the number of factors emerged was forced to be six and the items with high loadings on each of the six expected factors were selected.

Content and Format of the Formal Version of the CVII

An ipsative format for the final version of the CVII was used in order to reduce responses that would reflect a social desirability response set, likely to occur in the Chinese culture. From the process of item selection, 360 items were kept from the experimental version representing 60 for each of the six Holland types. The 360 items were then paired according to the criteria of similar percentages of endorsement on the experimental inventory. Each of the 60 items of a particular type was paired equally with each item of the other five types. There were 120 dyads in the activity scale and 60 in the occupation scale, totalling 180.

Procedure of Data Collection

A two-stage cluster sampling procedure was used to select the participants for the validation portion of the study. Nine out of 34

universities and/or colleges in Taipei area were selected as sampling pool for the study. Twelve college majors, two from each of the six Holland types, were then selected from the major list classified by Holland (1966). The twelve majors selected were: (R) mechanical engineering, chemical engineering; (I) mathematics, chemistry; (A) drama, sculpture art; (S) social work, child welfare; (E) political science, economics; (C) accounting, finance. Usable data were obtained from 831 students (366 males and 465 females) who completed all the questions in the inventory. The students typically finished the inventory in 40 minutes.

Data Analysis

Split-half correlation coefficients were measured to test reliability. Percentage hits were calculated for criterion validity, and multitrait-multimethod (MTMM) matrices were employed for convergent-discriminant validity. In addition, multidimensional scaling (MDS) was conducted to examine Holland's model of vocational interest structure. Davison (1985) compared MDS to factor analysis and suggested that MDS is a more parsimonious solution than factor analysis is. MDS can often represent the structure on fewer dimensions than factor analysis can although both can be used to study the structure of objects. Order prediction was employed to compare Holland's hexagonal and Gati's hierarchical models.

Results

Preliminary Analysis

The means and standard deviations of the six interest scales on the CVII were listed in Table 1. These results were similar to those typically obtained for Holland interests with males obtaining considerably higher scores on Realistic and Investigative interests and females on Artistic and Social interests. Differences were smaller on Enterprising and

Table 1. Means and Standard Deviations of the Six Interest Variables for Males (*N* = 366) and Females (*N* = 465)

		R	I	A	S	E	C
Males	*M*	31.28	30.73	26.33	29.47	35.04	27.14
	SD	11.51	12.00	12.18	11.08	11.92	12.83
Female	*M*	19.01	25.43	35.52	36.56	33.06	30.42
	SD	9.05	10.02	10.65	11.45	10.00	11.22

Conventional interests but with males higher on Enterprising and females on Conventional.

Reliability

The reliability of the CVII was determined by split-half internal consistency. The correlation coefficients of two halves of each of the six scales were calculated and corrected by the Spearman-Brown formula (Anastasi, 1988, p. 121).

The estimated reliability coefficients of the six scales for both males and females are presented in Table 2. The full-scale reliability coefficients ranged from .86 to .94 for males and .84 to .90 for females based on the sample of 366 male and 465 female Taiwanese college students.

Validity

Criterion-related Validity

To obtain evidence of criterion-related validity, the current college major was used as the criterion and the hit rate was calculated. Hit rate was defined as the percent of students whose first letter of their CVII summary code was the same as that of their major. These data (see Table 3) were based on samples of 124 males and 150 females who reported that they were satisfied with their departments and would not

Table 2. Reliability Coefficients of the Six Scales of the CVII

Parts	R	I	A	S	E	C
Males (*N* = 366)						
Activity	.88	.90	.88	.88	.91	.84
Occupation	.66	.86	.86	.75	.82	.70
Full scales	.89	.94	.92	.89	.92	.86
Female (*N* = 465)						
Activity	.82	.80	.83	.88	.84	.87
Occupation	.68	.80	.81	.77	.78	.80
Full scales	.84	.87	.89	.90	.88	.90

change their majors. The percentages of hits were 45.9% for males and 50.5% for females, which is considered an excellent hit rate according to the criteria of Campbell and Hansen (1985).

Cohen's (1960) kappa coefficient was used to remove the chance agreement between predictor and criterion variables. The kappa coefficient for males was .3178 ($p < .001$) and that for females was .3102 ($p < .001$).

Convergent-Discriminant Validity

MTMM analysis was conducted to obtain the convergent-discriminant coefficients. A convergent coefficient shows the extent to which different methods converge on the same interest type. A discriminant coefficient, on the other hand, indicates the extent to which different methods can discriminate among different interest types. Convergent coefficients in this study were determined by the correlations between scores of the same interest types but measured by the two different scales (activities and occupations) in the CVII. Discriminate coefficients, on the other hand, were determined by correlations between scores of different interest types measured by different scales.

Table 3.   Criterion Validity of the CVII Based on the Hit Rate

Major categories	CVII scales					
	R	I	A	S	E	C
Male (*n* = 124)						
R	**4.0** (5)	3.2 (4)	0.8 (1)	1.6 (2)	4.8 (6)	0.8 (1)
I	4.8 (6)	**12.1** (15)	1.6 (2)	3.2 (4)	0 (0)	0.8 (1)
A	3.2 (4)	1.6 (2)	**4.8** (6)	1.6 (2)	2.4 (3)	0 (0)
S	0.8 (1)	1.6 (2)	0.8 (1)	**4.8** (6)	4.8 (6)	0 (0)
E	2.4 (3)	3.2 (4)	0.8 (1)	4.0 (5)	**19.4** (24)	0 (0)
C	1.6 (2)	0.8 (1)	0.8 (1)	0.8 (1)	0.8 (1)	**0.8** (1)
Hit rate = 4.0% + 12.1% + 4.8% + 4.8% + 19.4% + 0.8% = 45.9%						
Female (*n* = 150)						
R	**0** (0)	0 (0)	0 (0)	0 (0)	0.7 (1)	0.7 (1)
I	0 (0)	**1.3** (2)	3.3 (5)	2.7 (4)	0 (0)	1.3 (2)
A	0 (0)	0.7 (1)	**7.3** (11)	2.0 (3)	3.3 (5)	0 (0)
S	0.7 (1)	2.0 (3)	6.0 (9)	**31.3** (47)	2.7 (4)	3.3 (5)
E	0 (0)	1.3 (2)	1.3 (2)	3.3 (5)	**7.3** (11)	2.7 (4)
C	0 (0)	0 (0)	4.0 (6)	5.3 (8)	2.0 (3)	**3.3** (5)
Hit rate = 0% + 1.3% + 7.3% + 31.3% + 7.3% + 3.3% = 50.5%						

Note: Figures in parentheses are number of subjects in the specific categories.

Tables 4 and 5 contained convergent and discriminant coefficient matrices. For males, the convergent coefficient values (in boldface) ranged from .6127 to .8353. For females, they ranged from .5698 to .7825. The discriminant coefficients ranged from –.6611 to .4300 for males and from –.4980 to .4489 for females. In general, the convergent coefficients were greater than the discriminant coefficients. The same interest types measured by the two different scales (i.e., activity and occupation scales) have high correlations; however, different interest types measured by the two different scales have low correlation coefficients. These data supported the validity of the developed CVII.

Table 4. Convergent-Discriminant Coefficients of the CVII (*N* = 366 males)

	Activities						Occupations					
	R	I	A	S	E	C	R	I	A	S	E	C
Activities												
R	(88)											
I	4300	(90)										
A	−2404	−4011	(88)									
S	−4351	−2017	−1026	(88)								
E	−6611	−5639	0281	0393	(91)							
C	−1276	−2873	−3069	−3017	1408	(84)						
Occupations												
R	**7057**	3256	−2719	−1708	−4467	−1771	(66)					
I	4134	**8353**	−3580	−1822	−4504	−2894	2495	(86)				
A	−2198	−3032	**8342**	−0299	0573	−3729	−2761	−2708	(86)			
S	−5699	−3283	−0288	**7512**	2982	−1148	−4022	−3839	−0369	(75)		
E	−2956	−4657	−0390	−2097	**6216**	4076	−3694	−4477	−1377	−0398	(82)	
C	0010	−0560	−2625	−0883	−1231	**6127**	−1121	−1783	−4410	−0614	−0658	(70)

Note: Decimal points omitted. Figures in parentheses are reliability coefficients.

Table 5. Convergent-Discriminant Coefficients of the CVII (*N* = 465 females)

	Activities						Occupations					
	R	I	A	S	E	C	R	I	A	S	E	C
Activities												
R	(82)											
I	3826	(80)										
A	1949	−2631	(83)									
S	3891	−3010	−1365	(88)								
E	4489	−3909	−0718	−0840	(84)							
C	1575	−2576	−3054	−2947	−0521	(87)						
Occupations												
R	**6529**	2445	−1825	−0779	−3029	−2298	(68)					
I	4073	**7748**	−1523	−2162	−2446	−4119	2451	(80)				
A	−1355	−1737	**7825**	−1181	0081	−3281	−2417	−1146	(81)			
S	−4980	−2956	−1225	**7751**	1077	−1539	−3134	−3133	−1601	(77)		
E	−2157	−3190	−1000	−2715	**5698**	3156	−2970	−4045	−1279	−1388	(78)	
C	−1197	−1756	−2809	−0322	−1731	**7024**	−2117	−3424	−4217	−0355	−0933	(80)

Note: Decimal points omitted. Figures in parentheses are reliability coefficients.

The Hexagonal Model Tested by MDS

Classical nonmetric MDS was used in this study to test Holland's hexagonal model. Table 6 shows the Euclidean dissimilarity coefficients of the six interest types with male data below the diagonal and female data above the diagonal. Table 7 shows the ALSCAL solutions for the male and female data obtained from the CVII. These stimulus coordinates identify the locations of the six vocational interest types in two-dimensional space. The two dimensions might be what Holland defined "people-thing" and "data-idea."

Table 6. Euclidean Dissimilarity Coefficient Matrix of Six Vocational Interest Types in the CVII

| Scale	R	I	A	S	E	C
R		265.81	485.99	527.42	459.40	419.37
I	240.48		410.22	445.19	397.10	388.38
A	373.42	392.90		361.20	331.10	404.55
S	370.69	352.40	330.56		354.09	400.04
E	405.32	413.53	365.71	323.73		328.79
C	316.42	338.37	350.42	314.99	313.43	

Note: Coefficients for males ($N = 366$) are shown below the diagonal, and that for females ($N = 465$) are shown above the diagonal.

Table 7. Two-dimensional ALSCAL Solutions for the CVII

Scale	Male ($N = 366$)		Female ($N = 465$)	
	Dimension 1	Dimension 2	Dimension 1	Dimension 2
R	1.4335	0.4287	2.0700	0.1369
I	1.5902	0.2011	1.2116	0.3811
A	−0.6215	−1.6277	−0.9460	0.3802
S	−0.8561	−0.3943	−1.5855	0.1178
E	−1.5158	0.7125	−0.6919	0.2770
C	−0.0304	0.6798	−0.0582	−1.1885

Figure 1 presents the two-dimensional configuration for the male and female data obtained for the CVII. The stress value for males is 0.027 and the RSQ is 0.995, and for females 0.019 and 0.998. According to the criterion proposed by Kruskal (1964), the stress values 0.027 and 0.019 are both excellent, meaning that the configurations presented in Figure 1 fit the data collected in this study. The RSQ values 0.995 and 0.998 indicate that about 99% of the variance of the transformed data could be accounted for by the distances of the MDS solutions.

Figure 1. Two-dimensional Configurations for the CVII
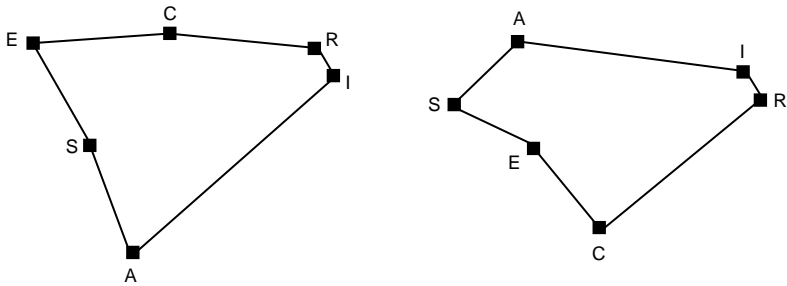
Note: Based on samples of 366 male college students (left; stress = 0.027 and RSQ = 0.995) and 465 female college students (right; stress = 0.019 and RSQ = 0.998)

Order Prediction of Holland's and Gati's Models

The correspondence index proposed by Hubert and Arabie (1987) was calculated to study the fit of Holland's hexagonal and Gati's hierarchical models. The index describes the correspondence between the hypothesized order relations and the observed order relations within a correlation matrix. Tracey and Rounds (1992) suggested that the index could be used to compare the hypothesized order fit between models. This index is of the form: $(A - D)/(A + D + T)$, where A is the number

of order predictions met (agreements), D is the number of violations of the order predictions (disagreements), and T is the number of ties (Hubert & Arabie, 1987, p. 176). The denominator is actually the total number of order predictions.

The correlations between pairs of interest types in the CVII are shown in Table 8, with male data below the diagonal and female data above the diagonal. Many of the negative values are due to the forced-choice format of the CVII.

Table 8.   Correlation Coefficients Between Pairs of Interest Types in the CVII

Scale	R	I	A	S	E	C
R		3930	−2109	−3770	−4165	−2013
I	4287		−2179	−3107	−4036	−3270
A	−2730	−3800		−1462	−0787	−3650
S	−4614	−2695	−0678		−1175	−1951
E	−5881	−5725	0001	0338		−0003
C	−1231	−2543	−3789	−2151	1373	

Note: Decimal points omitted. Correlations for males ($N = 366$) are shown below the diagonal, and correlations for females ($N = 465$) are shown above the diagonal.

According to Holland (1973, 1985), the correlations for the six adjacent pairs (RI, IA, AS, SE, EC, and CR) on the hexagon should be greater than the correlations of the six alternate pairs (RA, AE, ER, IS, SC, and CI) and correlations of the three opposite pairs (RS, IE, and AC). The correlations of the six alternate pairs should be greater than the correlations of the three opposite pairs. Therefore, there are totally 72 order predictions for Holland's model.

For Gati's hierarchical model, there are totally 36 predictions. Gati (1982, 1991) assumed that the six vocational interest types could be

clustered into three groups: R and I, A and S, and E and C. He further suggested that the correlations of the interest types within cluster (i.e., R with I, A with S, and E with C) should be greater than the correlations between the other 12 pairs of types (RA, RS, RE, RC, IA, IS, IE, IC, AE, AC, SE, and SC).

For Holland's model, 61 of the 72 order predictions were met within the male correlation matrix. Violations occurred for the following 11 pairs: IA (–.3800) was less than RA (–.2730); IA (–.3800) was less than IS (–.2695); IA (–.3800) was less than IC (–.2543); IA (–.3800), AS (–.0678), and CR (–.1231) were less than AE (.0001); IA (–.3800) was less than AC (–.3789); IA (–.3800) was less than SC (–.2151); ER (–.5881) was less than RS (–.4614), IE (–.5725), and AC (–.3789). The correspondence index was (61 – 11)/72 = .69.

For the female sample, 62 of the 72 predictions were met. Violations of the predictions occurred for the following 10 pairs: IA (–.2179) was less than RA (–.2109), AE (–.0787), and SC (–.1951); AS (–.1462), SE (–.1175), and CR (–.2013) were less than AE (–.0787); CR (–.2013) was less than SC (–.1951); and ER (–.4165) was less than RS (–.3770), IE (–.4036), and AC (–.3650). The correspondence was (62 – 10)/72 = .72.

In the order prediction of Gati's model, for the male sample there were only two violations, i.e., AS (–.0678) was less than AE (.0001) and SE (.0338). Thirty-four of the 36 predictions were met. The correspondence index was (34 – 2)/36 = .89.

For the female sample, similar violations of the order predictions occurred. The correlation of the pair AS (–.1462) was less than AE (–.0787) and was also less than SE (–.1175). The correspondence index was (34 – 2)/36 = .89. Gati's hierarchical model then, fit the Taiwanese data better than Holland's hexagon.

Discussion

Reliability and Validity of the CVII

There are no absolute guidelines for the judgement of reliability; however, it is generally accepted that standardized tests used to assist in making decisions about individuals should have reliability coefficients of at least .85 (Mehrens & Lehmann, 1987). The CVII reliabilities exceed this guideline. When comparing to similar interest inventories in Asian area, the reliability coefficients of the CVII were pretty high (.84 to .94) compared to the test-retest reliabilities (.72 to .80) of the Wong and Wong's (2001) Interest Inventory made in Hong Kong although these reliabilities are somewhat different. The internal consistency coefficients for the Chinese version of the UNIACT applied in Wong and Wong's (2001) study ranged from .86 to .94, which was good and similar to the reliabilities of the CVII.

From the evidence, the hit rates for males (45.9%) and for females (50.5%) were similar to or better than the hit rate validity obtained in other studies for the SDS (Spokane, 1979: 43.6% for males, 34.4% for females) and SCII (Strong Campbell Interest Inventory) (Eberhardt & Muchinsky, 1984: 40.4% for males, 51.8% for females).

The MTMM matrix was employed to examine the construct validity of the CVII. The monotrait-heteromethod correlations ranged from .6127 to .8353 for males and .5698 to .7825 for females. These values were substantially greater than zero. The heterotrait-heteromethod coefficient values were less than the monotrait-heteromethod correlation coefficients. The heterotrait-monomethod correlations ranged from –.6611 to .4300 for males and –.4980 to .4489 for females. These values were smaller than the heterotrait-monomethod correlation coefficients and satisfactorily meet the four requirements for the MTMM matrix and support the construct validity of the CVII.

This evidence of construct validity of the CVII was better than that for the Chinese SDS translated by Jin (1986). He administered the Chinese SDS to approximately 800 high school boys and girls and obtained a MTMM matrix that yielded values of convergent coefficients generally greater than the discriminant coefficients of the present study.

The Hexagonal Model Tested by MDS

Most of the previous studies used different programs available for MDS. For example, Meir and Ben-Yehuda (1976) used the Guttman-Lingoes Smallest Space Analysis (SSA) and Fouad and Dancer (1992) used SSA, KYST, and ALSCAL. The present study employed the ALSCAL program and yielded stress values of 0.027 for males and 0.019 for females. Kruskal (1964) proposed a guideline to evaluate the stress value: 0.20 = poor, 0.10 = fair, 0.05 = good, 0.025 = excellent, and 0.00 = perfect. If "perfect," there is a perfect monotonic relationship between dissimilarity and the distance. In the present study, female data (excellent) fit Holland's model better than male data (good).

Feldman and Meir (1976) examined the interest structure of Hebrew high school students. The results of their MDS indicated both an IRAESC circular ordering for a female 11th-grade sample and an IRASEC circular ordering for an employed female sample. In another study, Meir and Ben-Yehuda (1976) reported a two-dimensional horseshoe-shaped configuration of RISACE with the RA, SA, and CE scale points clustering together for a combined sample of male and female 9th-grade students. The MDS research by Meir and his colleagues provided little support for Holland's hypothesized interest structure. Compared to the cross-cultural studies conducted in Hebrew culture, the results of the present study suggest that Holland's hexagonal model has greater potential applicability in the Chinese culture. Cultural differences may account for Meir's failure to find the hypothesized interest structure; however, the different ages of the samples used in

those studies may also be a factor. College students' vocational interests may be more clearly defined than those of a high school student.

Fouad and Dancer (1992) compared the interest structure across two cultures, the U.S. and Mexico. The evidence in support of an equilateral hexagonal structure was not found; however, the ordering of RIASEC was found for Mexican and U.S. students and for professional male engineers. Swanson (1992) examined the structure underlying the measured interests of African-American college students. The SII was administered to 189 females and 168 males. A nonmetric MDS was employed and the results indicated the same configuration of the RIASEC scales.

In Australia, Taylor, Kelso, Pretty, and Power (1980) examined the interest structure of high school students by using the VPI (Vocational Preference Inventory) and found an ordering of RISAEC for females and RIASEC for males. This gender difference in interest structure in Australia was not found in the present study. Jin (1986) examined the vocational interest structure of male and female high school students in Taiwan and also found no gender difference.

Jin's (1986) study confirmed Holland's model of vocational interest structure in Taiwan with a sample of high school students. The results of the present study further verified the applicability of Holland's model for college students in Taiwan. In two-dimensional space, Realistic and Investigative types were closer to each other than either of them was to any of the other four types for both male and female samples. The "R" majors (mechanical engineering and chemical engineering) in the present study have strong "I" components. In addition, there are far fewer college males within "R" type interests as compared with the general working population. Thus, the resulting hexagon with close R and I scale points may not occur in a more heterogeneous population. In

Jin's study, the results of factor analysis also indicated that R and I were close to each other. The A, S, E, and C types formed another group in two-dimensional space. Most of the high school students could be classified into two groups, the natural sciences and humanistic-social sciences.

This kind of differentiation is probably partly due to the fact that the students in Taiwan have to decide between the two groups (natural sciences or humanistic-social sciences) before the end of their first year in high school. College students have to decide upon their majors before they enter the college. The differentiation between natural science and humanistic-social sciences is even clearer. Although the results of MDS analysis supported Holland's hexagonal model, the differentiation between the two groups supports Gati's (1979) assertion that "hard science" and "soft science" are two groups at the highest level of his hierarchical model of vocational interests.

Order Predictions of the Holland and Gati Models

The correspondence index proposed by Hubert and Arabie (1987) was used in this study to compare the applicability of both Holland's and Gati's models in Taiwan. According to Gati (1979, 1981, 1991), the six interest types proposed by Holland are arranged in the following three pairs: R and I, A and S, and E and C. The analysis of order prediction in this study supported this classification system. Only 2 of the 36 order predictions violated the hypothesized prediction. Although Jin (1986) pointed out that it was hard to differentiate S type from E type in Taiwan, the two-dimensional configurations in Figure 1 do not indicate shorter distances between S and E. Gati's classification system also corresponds to part of the college entrance examination system conducted several years ago in Taiwan. There were four groups of examinations and the high school students could choose to take only one. The first group was for those students who selected colleges of

engineering or who chose sciences such as chemistry, mathematics, or physics as their major. The second group was for those who intended to enter an arts college or who selected majors such as education, social work, or language. The third group was for those planning to attend such colleges as medicine, pharmacy, or nursing. The last group was for those who planned on law school, or who chose majors such as business management, political science, economics, or accounting. The first and the third groups correspond to Gati's first pair R and I, the second group to Gati's A and S, and the last group E and C. This may be one of the reasons why the order prediction results supported Gati's model.

Gati (1979, 1982, 1991) himself conducted a series of studies and claimed that his hierarchical model is superior to Holland's hexagonal model for interpreting vocational interest structure. The method he used to examine the interrelationships among the six interest types, however, was criticized as not complete by Tracey and Rounds (1992). They re-analysed 104 published matrices based on Holland's six interest types by using a randomization test and correspondence indices between the real order and the hypothesized order predicted by both models. They concluded that Holland's model was superior to Gati's model in representing the RIASEC structure in the U.S. However, for the 26 matrices from non-American cultures (i.e., Australia, Guyana, Taiwan, New Zealand, and Mexico), the correspondence index for Gati's model was greater than that of Holland's. The results of the present study confirmed this finding that Gati's model may be a better model of interest structure for many non-American cultures.

Tien (1996) tested Holland's (1985) hexagonal model, Gati's (1982) hierarchical model, and Rounds and Tracey's (1993) three-class partition model based on a sample of 1,861 high school students (788 males and 1,073 females). The ALSCAL solutions of MDS verified the

order of RIASEC for females. While for males, the ordering of the six interest types on the two-dimensional space was IRASEC rather than RIASEC. With regard to the fit of the three models, the results of randomization test indicated that Gati's hierarchical model was the best to interpret the vocational interest structure of Taiwanese high school students.

The results of the present study verified the generalizability of the hexagonal structure in Taiwan although the hypothesized equilateral hexagonal model needs some modification. Gati's hierarchical model, an alternative RIASEC interest structure model, was indicated in this study to be a better model for Taiwanese college students. Gati's ideas of hard sciences, soft sciences, and three-partition groups can also be used for the students to explore their interests.

Although the findings of order prediction reflected the relative advantage of the hierarchical model, the results of MDS analysis also supported a hexagonal model. The hexagonal model may provide a simple but useful summary for the structure of vocational interests although its underlying assumption — equal distances between adjacent types — is incorrect. An integration of both models would be able to provide with more heuristic values for the application of vocational interest theories.

Implications for Future Research and Practice

The CVII developed in this study was based on Holland's theory of vocational interests. Results of reliability and validity tests indicated that it is a useful inventory for college students in Taiwan. The results of the present study suggest that Holland's hexagonal model has potential applicability for college students in Taiwan. MDS analysis provided support for the hexagonal model of vocational interest. The RIASEC ordering was clearly present for both male and female samples.

Further study could be conducted to explore changing the forced-choice format of the CVII to normative scales. If normative scales are developed for the CVII, however, the factor of response set should be taken into account if it is to be used in counselling in a Chinese culture. One of the strengths of the ipsative format is that it eliminates the problem of subject response set; however, a limitation is that the ipsative format can only provide intra-personal comparisons among the scales. If normative scales are used to modify the inventory, a norming process will be needed, but norms based on broad samples will be able to provide valuable information for the students to compare themselves with others. Substantially broader samples of both occupations and college majors across the six vocational interest types are suggested for future study to increase the clarity of the six interest types on the two-dimensional configuration.

In summary, this study created a new interest inventory appropriate for the Chinese culture in Taiwan. It also has added to the knowledge about the occupational interests of Chinese people. The knowledge about career counselling for high school and university students should be useful for developing career curricula, counselling, and assessment model of occupational interests in Chinese societies.

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文化之交疊：何倫類型論在台灣的適用性

本研究主要目的在探討 Holland（1985）類型論在台灣文化中的適用性，同時也比較 Holland 六角形模式與 Gati 階層模式的適當性。在第一階段研究中，以 572 人為對象，進行中文職業興趣量表的編製，透過單獨題項與總量表之相關、各題項選擇百分比、以及探索性因素分析等方式篩選適當之題目。第二階段則以 831 人為對象，進行量表之信度及效度考驗。結果發現男生六個分量表的折半信度係數，介於 .66 到 .94 之間，女生則介於 .68 至 .90 之間。在效度方面，各類型興趣分數對所屬興趣類型科系的命中百分比，男生為 45.9%，女生為 50.5%。多項特質多重方法的考驗，也支持中文職業興趣量表的聚歛及區辨效度。至於在 Holland 六角形以及 Gati 階層模式的比較方面，多向度量尺分析支持六角形模式，但順序預測分析則發現 Gati 的階層模式更能解釋台灣地區大學生的職業興趣結構。