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Generalization of the Strong Interest Inventory in Chinese Culture A Study of Translation, Validation, and Cross-Cultural Comparisons

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Generalization of the Strong Interest Inventory® in Chinese Culture

A Study of Translation, Validation, and Cross-Cultural Comparisons

by

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Abstract

The current 2004 revision of the Strong Interest Inventory has been understudied in China. The present study (a) translated the Strong assessment into Simplified Chinese, (b) investigated the fit of circular and circumplex models of Holland's theory in Chinese population and compared the scores on the construct equivalent scales, and (c) uncovered the generalizability and applicability of the Strong assessment in Chinese culture. The randomization test (RTHOR) and circumplex covariance structure model (CCSM) were applied to a diverse Chinese sample to explore the cross-cultural validity of Holland's models. Empirical support was found for Holland's circular ordering model in the overall sample and subgroups of males and students. Results suggested that the Chinese Strong assessment was psychometrically sound and was promising to be used in China. Theoretical and practical implications were then discussed.

Keywords: Strong Interest Inventory; Generalization; Translation; China

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CHAPTER I: INTRODUCTION

Research on the cross-cultural validity of Holland's theory of vocational personality types has been prevalent in the field of vocational psychology for several decades (Bullock, Andrews, Braud, & Reardon, 2009; Day & Rounds, 1998; Farth, Leong, & Law, 1998; Fouad, 1993; Leong, Austin, Sekaran, & Komarraju, 1998; Leong, Hartung, & Pearce, 2014; Rounds & Tracey, 1996; Subich, 2005). As the majority of popular Holland-based inventories in use are were developed on the population makeup of U.S. society (e.g., Self-Directed Search, Strong Interest Inventory), a frequently asked question for the international use of these inventories is whether Holland's RIASEC model retains the same structure and ordering in non-Western and/or non-English speaking countries. Many have underscored the importance of carefully examining construct equivalence of the model before directly comparing scale scores to culturally different individuals (Long & Tracey, 2006) and interpreting the profiles without any consideration of cultural factors (Fouad, 1993; Westermeyer, 1987).

Language is, if not the only, the fundamental disparity when conducting cross-cultural research (Geisiger & McCormick, 2013). To overcome the language barrier, psychologists and linguists have made joint efforts to translate and adapt the vocational interest assessments into local languages and to examine the generalizability of Holland's theory in countries outside of the U.S. (e.g., Glidden-Tracey & Greenwood, 1997; Goh & Yu, 2001; Hansen & Fouad, 1984). As for China, the increasing attention has also been paid on the transportability of Holland's theory in Chinese society to meet scientific and societal inquiry (Fan & Leong, 2016). Several trending Western-based interest inventories have been translated into Simplified and/or Traditional Chinese and validated by using local Chinese populations (Goh & Yu, 2001; Wang, Xue, Li, & Zhang, 2016; Yang, Lance, & Hui, 2006; Zhang, Wei, Li, & Wang, 2015). These endeavors, however, suggested mixed support for the fit of Holland's models in Chinese culture, which may be further explained by many factors such as incomparable quality of inventory translation, different choices of inventory in use, varied sample constitutions, and so forth. Therefore, vocational psychologists and practitioners have been calling for more investigations into cross-cultural validity (or construct equivalence) of Holland's theory in Chinese context (Fan & Leong, 2016; Hao, Sun, & Yuen, 2015; Yan, 2008).

The Strong Interest Inventory (Donnay, Morris, Schaubhut, & Thompson, 2004) is one of the most popular vocational assessments used in the U.S. and many other countries. Much evidence has been found in the literature that the Strong assessment is reliable and valid to use regardless of race, ethnicity, and/or country of origin (Armstrong, Hubert, & Rounds, 2003; Fouad, Harmon, & Borgen, 1997; Kantamneni & Fouad, 2011, Kantamneni, 2015). A most recent meta-analysis study (Nye, Su, Rounds, & Drasgow, 2017) also concluded that the Strong Interest Inventory outperformed other popular vocational assessments (i.e., Self-Directed Search, Vocational Preference Inventory, and Kuder Preference Recode) when it was used to predict performance criteria such as task performance and organizational citizenship behaviors.

Interestingly enough, a literature search of five major journals in the field (i.e., *Journal of Counseling Psychology, Journal of Vocational Behavior, Journal of Career Assessment, Career Development Quarterly, and Journal of Career Development*) and the most authoritative Chinese journal database (i.e., CNKI) revealed only five articles focusing on the Strong assessment in the Chinese context. All of them used previous revisions of the Strong assessment – three in English (Goh, Lee, & Yu, 2004; Goh & Yu, 2001; Tang, 2001) and two in Chinese (Chen & Shen, 1997; Ge, Yu, & Wang, 1996). As the most ubiquitous vocational interest assessment, the current revision of the Strong assessment (Donnay et al., 2004) has, ironically, never been explored in

China or with respect to Chinese culture, which becomes the important impetus of the current study.

In line with the consideration of cultural validity of career assessments (Leong & Brown, 1995; Marsella & Leong, 1995) and in response to aforementioned research needs, the objective of this study is three-fold: (a) to translate and accommodate the latest Strong Interest Inventory into Simplified Chinese, (b) to investigate the cross-cultural validity of Holland's RIASEC models in Chinese culture, and (c) to evaluate the transportability and generalizability of the Strong assessment in the Chinese population. This study has research and practical implications for the expansion of Holland's theory in a typical non-Western and non-English speaking country. Furthermore, it may also pave the way for future research examinations and benefit practitioners (e.g., career counselors) from expanding the availability of vocational assessment tools in China. To the author's knowledge, this study is the first to result in a Simplified Chinese form of the 1994 Strong assessment.

The structure of the remaining sections is arranged as follows. The literature review section overviews Holland's theory and four specific models, as well as previous research on Holland's RIASEC models in Chinese populations by various interest inventories. Particular emphasis is placed on the translation and field-testing studies of the Strong Interest Inventory (1994 Chinese revision). This is followed by the method section describing the sample composition, instrument, administration, data cleaning and analysis procedure. In contrast to traditional research articles, the translation procedure details are clarified in a subsequent section title "Translation and Adaptation Procedures", which includes an overview of the "forward translation" approach, the translation and review committee composition, and item translation specifications. The results section presents numbers, tables, figures, and narratives that demonstrate the fit of Holland's models and reliability and validity evidence for the Chinese Strong assessment. This study culminates with research and practical implications, as well as limitations and recommendations.

CHAPTER II: LITERATURE REVIEW

Overview of Holland's Theory of Vocational Personalities

Holland's (1973, 1985, 1997) categorization of people's interest (or personality) into six types – Realistic, Investigative, Artistic, Social, Enterprising, and Conventional – is probably the most influential typological framework in vocational psychology (Lowman & Carson, 2013). The overarching assumption is that correlations between two adjacent interest types are greater than those between alternate types and in turn greater than those between opposite types. Two hypotheses derived from Holland's work (1973, 1985, 1997) have resulted in different models examined by subsequent researchers. The calculus hypothesis posits that six interest types are manifested in a circular order and the distance between either two types are "inversely proportional to the theoretical relationships between them" (Holland, 1973, 1985, 1997, p. 5), which was later evolved the circular ordering model (or circular order hypothesis, Rounds, Tracey & Hubert, 1992). While the hexagonal hypothsis derived from Holland (1973, 1985, 1997) specifies that six interest types are shaped into an equilateral hexagon where distances between adjcent types are equal. This unique arrangement of types resembles Guttman's (1954) circumplex model of personality (for a detailed discussion, see Hogan, 1983).

More recent literature (e.g., Darcy & Tracey, 2007) in the field suggests that there are four specific models based on Holland's work, which are determined by two parameters (Figure 1): angular locations (i.e., the polar angles between two types) and communalities (vector length of each type) in the circle (Morgan & Bruin, 2017). Figure 2 provides an explicitly visual presentation of these four models and their differences. The circular ordering model (the least restrictive) and circumplex model (the most restrictive) are derived from Holland's calculus and hexagonal hypothese, which are most popular ones examined by many vocational psychologists

(Rounds et al., 1992; Sodano, 2015). The former focuses on the RIASEC order of types (Tracey, 2000), while the latter examines the equidistance of types on a circumference (Darcy & Tracey, 2007). Falling between them are two quasi-circumplex models constrained by one parameter. In other words, one quasi model probes whether interest types have the same vector in the circle and set the angular locations free, while the other superficially investigate whether polar angles between adjacent interest types equal 60 degrees.

Although Holland's model is proposed based on U.S. populations (Holland, 1973, 1985, 1997), much attention has also been put on testing model's applicability in other countries and cultures. Previous research indicated that the circular ordering model received more support from U.S groups (Kantamneni & Fouad, 2011; Kantamneni, 2014) than from various international samples (Rounds & Tracey, 1996). While contradictory evidence was found for quasi-circumplex and circumplex models across U.S. ethnic groups (Day & Rounds, 1998; Day, Rounds, & Swaney, 1998; Tracey & Robbins, 2005), as well as culturally diverse groups (e.g., Morgan & de Bruin, 2017, in Africa), in that these models are more stringent than the circular ordering model.

Another line of research has examined the potential differences across sex and how such differences influence the ordering of RIASEC model and scores on each interest type. Although previous research provided evidence that males and females shared the same RIASEC order (e.g., Darcy & Tracey, 2007, Tracey & Robbins, 2005; Tracey & Rounds, 1993), other studies did not corroborate these findings (Anderson, Tracey, & Rounds, 1997; Kantamneni & Fouad, 2011; Kantamnenei, 2014; Morris, 2016).

Su, Rounds, and Armstrong's (2009) meta-analysis found that men scored higher on Realistic and Investigative interests, whereas women had higher scores on Artistic, Social, and

Conventional interests. A more recent primary study (Morris, 2016) examining 1,283,110 U.S. residents who completed the Strong assessment revealed that substantial sex differences across age and ethnic groups and such differences were consistent over the period from 2005 to 2014, with the exception that people between 18 and 22 years old showed slightly sex differences in more recent samples.

Research of Holland's Model in China

Examinations of Holland's theory and model in China or Chinese culture are not found to be dominant in vocational literature. Only one meta-analysis published in the last decade (Long & Tracey, 2006) summarized the structure of RIASEC scores in China by evaluating the fit of four particular models: Holland's circular order model[1]; Gati's three-group partition model; Rounds and Tracey's alternative three-group partition model; and Liu and Rounds' modified octant model on 29 correlation matrices collected from 13 empirical studies. It was concluded that Holland's model had the worst fit in the Chinese population among four models and had a lower fit than in the U.S. samples. However, this synthetic finding may be skeptical to be applied to the contemporary Chinese society because sources of correlation matrices were derived from research between 1987 and 2001 and the majority of the samples were student groups at all level (middle school, high school, and college). Therefore, the author searched for and examined more recent literature (esp. 2000 and later) and enumerated the major findings in Table 1.

Generally speaking, studies in Table 1 paint a contradictory picture in terms of the applicability of Holland's model in several native Chinese samples. The Strong Interest Inventory (SII) and Self-Directed Search (SDS) were popular instruments that were used to conduct the cross-cultural validation studies. Almost all research have provided mixed evidence

[1] This is what is called "Circular Ordering Model" in this study.

(Goh & Yu, 2001; Tang, 2001; Yang, Stokes, & Hui, 2005; Tang, 2009) or no support (Goh et al., 2004) for Holland's circular or circumplex model across geographic groups in China through various analytical approaches, such as correlation, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA). Furthermore, sex differences were evident to the structure and/or ordering of six interest types in most of the existing research (Goh & Yu, 2001; Tang, 2001; Yang et al., 2005; Tang, 2009). Researchers of these studies have called for further investigation and replication of interest inventories to diverse, large-scale, and representative Chinese samples (Table 2) before any general conclusions can be drawn. The following section discusses research conducted on the Chinese revision of SII in detail as it is the focus of this study.

The 1994 Chinese Revision of the Strong Interest Inventory

Among all previous revisions of the Strong Interest Inventory, the 1994 revision (Harmon, Hansen, Borgen, & Hammer, 1994) is the only one that was translated into Simplified Chinese. Therefore, a brief overview of the translation procedure (Ge et al., 1996) and subsequent research (Goh et al., 2004; Goh & Yu, 2001; Tang, 2001) is given to this revision.

Ge, Yu, and Wang (1996) made the first attempt to translate the Strong Interest Inventory (1994 revision) into Simplified Chinese as a portion of a cross-cultural research project between China and the U.S. The translation panel was comprised of six (three in China and three in the U.S.) professionals who were proficient in language and culture of both countries as well as basic knowledge of psychological testing and assessments. A rigorous three-step procedure (i.e., direct translation, back translation, and reconciliation) was strictly followed and resulted in 302 items (95.3% of 317) achieving linguistic and inferential equivalence. The remaining 15 items with no linguistic equivalence were replaced by comparable translation items.

This translation revision was subsequently tested and validated by three studies surveying different Chinese samples. Goh and Yu (2001) conducted a field test based on two Chinese samples (N_1 = 124, N_2 = 40) and one American sample (N_3 = 52). The metric equivalence of the translation was found through correlations, t-tests, and profile analyses between two Chinese and one American samples. Results of EFA suggested that three of six factors approximated the interest types of Artistic, Realistic, and Social, while the other three were deviant from the original classifications. Furthermore, they relabeled one factor as "Public" rather than the original "Conventional", in that Basic Interest Scales in this factor is more relevant to public affairs. The same year, Tang (2001) administered the Chinese Strong assessment to 166 college students enrolled in several Chinese universities and explored Holland's model through MDS. Results suggested that males and females had similar but not identical RIASEC orders (RISAEC for males and RSAECI for females). They then conducted an EFA on 25 Basic Interest Scales and found that factors that were extracted did not resemble the original classification. Later, Goh, Lee, and Yu (2004) surveyed 247 Chinese high school students using the Chinese Strong assessment. The CFA findings revealed that the sample did not fit Holland's six-factor model. In addition, their direct examination of intercorrelations among the factors provided weak evidence for the circular ordering of six interest types hypothesized by Holland. Alternatively, the EFA suggested a three-factor solution[2] that mirrored the underlying structure of the Chinese Strong assessment with sufficient amount of variance accounted for (Goh et al., 2004).

Obviously, none of these validation studies provide sufficient evidence that the structure and ordering of Holland's model are applicable to the Chinese population and the Chinese SII can be potentially used in China. Three major limitations concerning translations, samples, and

[2] Factor 1: Artistic/Social; Factor 2: Enterprising/Conventional; Factor 3: Realistic/Investigative

methodologies may contribute to the equivocal findings across the research. The first limitation is that there are 15 items that lack linguistic and inferential equivalence, which are culturally relevant for Chinese people. These items in Chinese culture may not carry the identical conceptual message as they are expected, even replaced by comparable translations. Therefore, discrepancies in item meanings probably decrease applicability of Holland's model in the Chinese population. The second limitation appearing in all three studies concerns the samples that are characterized by small sizes and a lack of diverse. Specifically, the sample sizes are below the recommended minimum subject-to-item ratio of 5:1 (Bryant & Yarnold, 1995; Gorusch, 1983, p.332) or even $N \geq 300$ for factor analysis (Comfrey & Lee, 1992, p.127). As described above, samples were comprised of high school or college students, which make it hard extrapolate the conclusions to non-student groups such as working adults.

The third limitation is about inappropriate analytical approaches and procedures that were applied to validate the underlying structure and ordering of Holland's model. One the one hand, for example, MDS (Tang, 2001) and correlation analysis (Goh et al., 2004) were implemented to test the calculus hypothesis of Holland's model. Specifically, the MDS involves obviously subjective judgment that extracts two dimensions to visualize the circumplex structure[3] without statistics that are crucial to indicate the goodness of fit (Fabinger, Visser, & Browne, 1997). In addition, direct observations of correlation matrices without visual aid (Goh et al., 2004) produced more judgmental errors regarding the calculus hypothesis. On the other hand, inappropriate analytical procedures that compare the scale scores without warranted structure equivalence (e.g., Goh & Yu, 2001) may generate questionable and misleading conclusions from a methodological perspective.

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[3] The circumplex structure considers (a) ordering, (b) angular locations, and (c) communalities among interest types.

To summarize, although the applicability of Chinses SII was not empirically supported by the existing literature, a great deal of effort on translation and validation of the 1994 Strong assessment provides insights into translation, sampling, and methodology for the current study that continue to explore the cross-cultural validity of the most recent Strong assessment.

CHAPTER III: METHOD

Participants

The current sample contained 364 native Chinese participants whose country of origin and residence were People's Republic of China. They were asked to fully complete the Chinese Strong assessment for personal development purpose. Table 3 shows the demographic information of these participants. There were about twice as many females (N = 229) compared to males (N = 135) in the sample. The average age of all participants was 24.09 years (SD = 6.70, median = 23.00), ranging from 15 to 50 years. Two hundred and forty-five participants (67.30%) hold a bachelor's degree or higher. One hundred and ninety-one participants self-identified as full-time students (age M = 20.18, SD = 2.74) and 127 as full-time employees (age M = 29.83, SD = 7.02). Among full-time working adults, 102 were entry-level or non-supervisory employees and 31 were at supervisor level or higher.

Instrument

The Strong Interest Inventory is a highly regarded career assessment tool most commonly used for helping individuals make educational and occupational choices (Donnay et al., 2004). The current revision of the Strong Interest Inventory has 291 items that assess interest in occupations, specific areas of school subjects, activities, people, and personal characteristics on a 5-point Likert-type option anchored by *Strong Like* to *Strongly Dislike*. Responses are standardized into four board categorizations with a mean of 50 and standard deviation of 10 based on a General Representative Sample (GRS, or normative group) consisting of 2,250 respondents (50% male, 50% female, diverse with regard to age and ethnicity) that represent the adult U.S. workforce. The General Occupation Themes (GOTs) are the operationalization of Holland's interest types, with 21 to 31 items for each theme (α = .90 to .95, median = .92). Thirty

Basic Interest Scales (BISs) provides more specific domains that are composed of homogeneous items, with 6 to 12 items for each scale (α = .80 to .92, median = .87). Occupational Scales are the most specific ones that reflect similarities between respondents and people who are employed in and satisfied with particular occupations[4]. Personal Style Scales (PSSs) demonstrate people's living and working styles, with 9 to 41 items for each scale (α = .82 to .87, median = .86). Subsequent research with large samples has provided adequate evidence for the concurrent validity and counseling utility (Gasserm Larson, & Borgen, 2007) and the structure equivalence across races and ethnicities in the U.S. (Kantamneni & Fouad, 2011; Kantamneni, 2014). Another technical brief (Herk & Thompson, 2011) concluded that the Strong assessment has similar and comparable results across translation versions of European English, French, German, Latin American Spanish, and European Spanish.

Administration

Instructions and items of the Chinese Strong assessment were loaded onto a leading online survey platform by the author who had access to a secured account. The snowball sampling technique (Goodman, 1961) was used to collect the email address of potential participants through author's personal network back in China. A total of 966 email invitations were sent to people who showed interest in the assessment and 441 participants (45.7% response rate) completed it. An electronic informed consent was presented before participants moved forward to respond the interest items. Participants were also informed that only those who finished all 291 items in the inventory could get a well-developed standardized feedback report generated by the author via email, albeit response to all items was not required to create reports

[4] Because Cronbach's alphas are not given in the Strong technical manual (Donnay et al., 2004) and OSs are not the focus of this study, α values are not reported here.

(Donnay et al., 2004, p.159). This notice acted as an incentive for participants to go through each question with their whole attention as well as a mechanism that naturally selected out participants who were not willing to complete the inventory. Due to the length of the assessment, participants were allowed multiple accesses to complete all items within one month. Several actions were further taken to protect the copyright of the assessment and secure the data collected from participants.

Data Cleaning

Despite the incentives to complete the inventory, careless responses cannot be avoided given 291 items to respond. Therefore, the data cleaning procedure was applied to 441 participants to identify potentially bad cases characterized by inconsistent item endorsements and irregular response patterns. In particular, the typicality index (Donnay et al., 2004, p.159), designed to catch people who respond in a random fashion, was utilized to help indicate participants who endorsed items in an unusual manner by summarizing the combination of responses of 24 item pairs. The typicality index ranges from 0 (no consistent responses) to 24 (all pairs responded to consistently), and a score lower than 17 indicated possibly inconsistent responses. One respondent had a typicality index lower than 17 and was excluded. Irregular response patterns can also be recognized via looking at the response percentages of five response options (e.g., *indifferent*). Although normal ranges of possible response percentages for GRS was provided in the Strong technical manual (Donnay et al., 2014, pp.153-158), these criteria cannot be directly applied to culturally different individuals because they may have different response styles in answering items (Van de Vijver, 2000, Van de Vijver, 2015). Therefore, an exploratory cutoff score of 70% was applied to the sample in this study. That is, if one participant endorsed the same option across over 203 items (70% of 291), he or she was considered to complete the assessment without paying enough attention. Seventy-six participants violated the 70% cutoff and were excluded, leaving a total of 364 respondents.

Analyses

The correct analysis procedure in cross-cultural studies is specifically important because between-group mean comparisons based on non-equivalent scales and measures are skeptical and problematic and are more inclined to result in misleading and meaningless interpretations and conclusions (Long & Tracey, 2006; Rounds & Tracey, 1996; Fouad, 2002). This implication is usually neglected by cross-cultural researchers. In the light of this, the current study adhered to a restrictive analysis procedure that (a) reliability (Cronbach's alpha) was first calculated to examine the internal consistency of responses on GOT, BIS, and PSS scales, followed by (b) randomization test of hypothesized order relations as well as circumplex covariance structure modeling that evaluated four specific RIASEC models and visually present them in circles, and finally, (c) scale scores of GOT, BIS, and PSS were compared against the U.S. normative scores. Note that only when metric equivalence is achieved can the scores be compared across groups. The following part briefly introduces the randomization test and circumplex covariance structure modeling.

The randomization test of hypothesized order relations (RTHOR; Hubert & Arabie, 1987) has emerged to become a better method (Rounds et al., 1992) and is frequently used to evaluate the hypothesized orders of vocational interests through the RANDALL program (Tracey, 1997). The underlying mechanism of the method is to compare the order predictions in a correlation matrix with the hypothesized orders assumed in Holland's theory that correlations between adjacent interest types are greater than those between alternates types and in turn greater than those between opposite types (Holland, 1997, p. 29). A correspondence index and *p*-value are generated to indicate the degree to which the hypothesized orders are met and to test the null hypothesis that the ordering is random, respectively (Rounds et al., 1992). The range of a correspondence index is set between –1.00 to +1.00, where –1.00 indicates completely violation and +1.00 means perfect model fit. One advantage of using correspondence index is that it allows direct comparisons across studies and matrices (Rounds et al., 1992). Previous research based on the Strong assessment suggests that U.S. samples and ethnic U.S. groups usually have a correspondence index value larger than .70 (Kantamneni & Fouad, 2011; Kantamneni, 2014), while international samples have lower correspondence index values (Rounds & Tracey, 1996). This is also true in Long and Tracey's (2006) meta-analysis that the mean correspondence index value for Holland's theory is .54 (SD = .22) across various Chinese samples from mainland China, Hong Kong SAR, and Taiwan. As a rule of thumb, a p-value < .05 indicates the hypothesis that random relabeling of six interest types in correlation matrices can be rejected for the samples (Kantamneni & Fouad, 2011; Morgan & de Bruin, 2017). Therefore, the criteria of correspondence index > .70 and $p < .05$ will be used to evaluate model fits in our sample. However, the author would expect that the correspondence index value falls between .60 and .70. The correlation matrices used for calculating correspondence index and p values for different groups can be found in Table 5 to Table 9.

The circumplex covariance structure modeling (CCSM; Browne, 1992, for technical specifications) is a promising confirmatory factor analysis strategy that "assesses the extent to which the underlying structure of the correlation matrix is circumplex" (Fabringer, Visser, & Brown, 1997, for non-technical narrative). The CCSM is conducted through the CircE package (Grassi, Luccio, & di Blas, 2010) in RStudio (RStudio Team, 2016). This approach is characterized by the calculation of parameter estimates (see the section of Overview of Holland's theory of vocational personalities) on each interest types and visualization of these estimates on the circumference of a circle. Fit indexes (such as chi-square, RMSEA, and CFI) are also provided to help researchers judge and evaluate the goodness of fit of the models. In the current study, model fits were examined through several indexes including chi-square (χ^2), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker-Lewis Index (TLI). Since χ^2, RMSEA, and SRMR are sensitive to sample size and/or degree of freedom (χ^2 is inclined to be significant for larger sample; RMSEA and SRMR are biased for smaller *df*), CFI and TLI are incorporated as a means of complementation. Two sets of combination rules, therefore, were used in this study to indicate good model fits: (a) CFI $\geq$.95 and SRMR $\leq$ .08, and (b) TLI $\geq$ .95 and SRMR $\leq$ .08 (Hu & Bentler, 1998; Hu & Bentler, 1999). Note that criteria aforementioned are not absolute indicators of good or bad model fit and determinations of adequate fit should consider the synthetic performance of all fit indices.

CHAPTER IV: TRANSLATION AND ADAPTATION PROCEDURES

The translation/back-translation technique is frequently seen in cross-cultural studies where testing and assessments need to be adapted to a target language. However, the back-translation procedure is not without limitations such as no evaluations on the target language items (Harkness, 2003) and fewer emphases on commutations, naturalness, and comprehensibility (Van de Vijver & Leung, 1997, p.39). Therefore, the forward translation technique used in Long, Adams, and Tracey study (2005, for the Personal Globe Inventory) was applied in the current work to translate and adapt the Strong into Simplified Chinese. This method often contains two phases: (a) a group of bilingual individuals translates the assessment into the target language individually, and (b) a team of reviewers judge the equivalence of the source and target language versions and come up with a final version. As suggested by Harkness (2003), the forward translation design is preferred if only one translation design is used. Moreover, this method is also in line with the recommendation of the publisher of the Strong assessment as well as best practices in the International Test Commission Guidelines (ITC, 2016).

The Translation and Review Committee

The committee approach (Geisinger & McCormick, 2013) that multiple bilingual individuals translate the assessment from the original language to the target language is a preferable way to generate more desirable translations. In addition, translators' competencies, in a large extent, can affect the quality of the translation (Goh & Yu, 2001). A qualified translator should understand all meaning of the items in the original language and culture and decide the most appropriate meaning in the target language and context (Kim, 2009). The translation and review committee in this study consisted of four bilingual native Chinese people, two in China and two in the U.S. All committee members were familiar with both cultures, fluent in American English and Simplified Chinese, and holding a bachelor's degree or higher in psychology or related subjects. Two translators were appointed to translate the instructions and items into Simplified Chinese. Specifically, one translator received a master's degree in I/O Psychology from an accredited Midwest university in the U.S. and is now working in China, whereas the other is a current Ph.D. student in Management with psychology background at a Southeastern university in the U.S. On the other side, two reviewers, including the author, were responsible to review and reconcile the translations and generate the Chinese inventory used in this study. The reviewer was appointed by the publisher of the Strong assessment who is the distributor of the publisher's other assessment products in China.

First Phase: Direct Translation

Two bilingual translators were asked to provide the translation of the Strong assessment, respectively. In this stage, instructions and items were literally and directly translated into Simplified Chines without any adaptation to achieve inferential equivalence between the original language and the target language. Results of the comparison between two individual translation work suggested that 105 items (36.1% of 291) reached a complete match. These items were preliminarily considered without cultural adaptation.

Second Phase: Review and Reconciliation

For the remaining 186 items that were not identical, linguistic disagreements were settled by two reviewers through (a) choosing a better translation from two versions, and (b) writing the new translation based on the existing work, resulting in the match-rate increase by 39.5% (115 items) and 23.0% (47 items), as well as four items lacking linguistic equivalence. Specifically, these four items are "bank teller," "cashier in a bank," "English composition," and "prefer working alone rather than on committees." The author adopted three comparable translations from Goh and Yu (2001) and made modifications for the last item. As a result, four items were adapted to "bank teller/cashier," "senior clerk in a bank," "Chinese composition," and "prefer working alone rather than in teams," respectively. Closer inspections suggested that "director of religious education" and "religious leader (e.g., minister, monk, nun, priest, rabbi)" were unusual occupations in Chinese culture, which might be culturally specific to the U.S. population. In brief, 287 items achieved linguistic equivalence after modifications and four items were adjusted specifically for Chinese culture.

CHAPTER V: RESULTS

Descriptive Statistics and Reliability

Six interest types represented by GOTs had satisfied Cronbach's alpha reliability, with a median alpha of .91 (Table 4). Almost all types except the Conventional had an alpha above .90, ranging from .89 to .93. Means and standard deviations of GOTs for the sample and four subgroups are also shown in Table 4. Based on GOT scores, inter-correlations between interest types are yielded in Table 5 to 9 (see Table 5 for all respondents, Table 6 for males, Table 7 for females, Table 8 for students, and Table 9 for employees) and used for RTHOR and CCSM. Means, standard deviations, and reliability estimates of 30 BISs are presented in Table 10. Cronbach's alphas suggested acceptable to good reliability across BISs, ranging from .76 for Office Management to .91 for Mathematics with a median of .85. The reliability for five PSSs were also acceptable to good, ranging from .76 for Team Orientation to .90 for Learning Environment with a median of .85 (Table 11).

Randomization Test

Results of RTHOR are presented in Table 12. The correspondence index values for the sample and four subgroups were all significant with p-values $\leq .05$. The overall sample had a correspondence index value of .78 (> .70), indicating the circular structure had a satisfactory fit to the Chinese sample in this study. As for four subgroups, however, correspondence index values were lower than the U.S. benchmark of .70 but were all greater than .60. Specifically, male participants (.64) had slightly higher correspondence index value than females (.61), and the value for the student group (.69) was much closer to the benchmark than the employee group (.61). In fact, correspondence index values in the current study were much better than these of

Chinese samples in Long and Tracey (2006, mean correspondence index = .54, *SD* = .22) and international samples in Rounds and Tracey (1996, mean correspondence index = .48, *SD* = .18).

Circumplex Covariance Structure Modeling

Model fit statistics from the CCSM are shown in Table 13. Compared against the criteria (CFI ≥.95, TLI ≥ .95, and SRMR ≤ .08), Holland's circular ordering model (χ^2 = 14.020, *df* = 3, CFI = .988, TLI = .942, SRMR = .020) showed better fit to the overall sample than quasi-circumplex models (for equal communality assumption, χ^2 = 62.820, *df* = 8, CFI = .942, TLI = .891, SRMR = .060; for equal angular location assumption, χ^2 = 59.430, *df* = 8, CFI = .945, TLI = .898, SRMR = .051) and circumplex model (χ^2 = 110.840, *df* = 13, CFI = .896, TLI = .880, SRMR = .073). The results of model fit were also replicated by all four subgroups (Table 13). This is not surprising because the circular ordering model is the loosest one without any parameters constrained, while the circumplex model is the most restrictive and is constrained by RIASEC ordering and equal angular locations and communalities.

Therefore, a closer investigation was given to the circular ordering model across the sample and four subgroups. As mentioned before (in the analysis section), one hallmark of the circumplex covariance structure modeling is that it converts the correlation matrices into comparable estimates of polar angles and communalities so that each interest types can be geographically presented along the circumference of a circle. Table 14 presents the point estimates and 95% confidence intervals for angular locations and communalities for six interest types across the sample and subgroups, and the point estimates are further visualized in Figure 3 to Figure 7. Note that when examining these figures, the ordering of six interest types around the circle can either be clockwise or counter-clockwise.

Obviously, the overall sample has an identical circular order of RIASEC that was hypothesized by Holland (1973, 1985, 1997), although Realistic/Investigative and Social/Artistic were much closer than any interest types (11˚ and 35˚, respectively, Figure 3). As for subgroups, males and students fit the RIASEC order, while females and working adults were deviant from it. More specifically, a closer angular locations can be found between Artistic and Social (5˚) in the male group (Figure 4), and Realistic and Investigative (17˚) got much closer among students (Figure 6). Both female and employee groups yielded the ordering of RASECI with Investigative violate the assumed order between Realistic and Artistic. Furthermore, smaller polar angles were found between Investigative and Realistic for these two groups (11˚ for the female group, 5˚ for the employee group).

Comparisons between Two Cultures

Since the results of RTHOR and CCSM suggested that the overall Chinese sample, rather than four subgroups, had a good fit of the RIASEC ordering theme, scores of GOT, BIS, and PSS for the Chinese sample were then compared against the GRS (or normative group) with a standardized mean of 50 and standard deviation of 10. An overall finding for scores across these scales indicated that Chinese participants had a greater central tendency than the U.S. normative group, in that the standard deviations of all scale scores in Table 3, 10 and, 11 were much lower than 10. An investigation of GOT scores suggested that the Chinese sample had comparable interests in Realistic, Investigative, and Enterprising, but higher interests in Artistic, Social, and especially Conventional than the U.S. normative group. Comparisons of BIS scores also revealed some interesting findings that the Chinese sample had lower mean scores on Athletics, Mathematics, and Entrepreneurship, but relatively higher scores on Military, Sales, and Office Management. These findings are further discussed in the following section.

CHAPTER VI: DISCUSSION

In this study, the 2004 Strong Interest Inventory was translated into Simplified Chinese through several judgmental procedures including comparison, merging, and reconciliation. Around 99% of items reached linguistic and inferential equivalence, and the remaining 1% was replaced by comparable items that had similar theoretical meanings in Chinese culture. Several items regarding religions were also found to lack cultural specificity in China. However, no appropriate replacements were found to remedy this problem. Another few items related to agricultural occupations might have had pejorative connotations. In brief, great efforts were made to translate the instructions and items without altering originally underlying meanings and ensure that non-English speakers in China can comprehend and respond to the items without difficulties. This translation work is essential and meaningful to fill the void in the research and practice of career assessment.

Reliability and validity of the Chinese Strong assessment were examined through multiple statistical analyses including Cronbach's alpha, RTHOR, and CCSM. Especially, the latter two approaches were not heavily used by previous research on the applicability of Holland's model in China, which is a methodological advance that warrants the current study. Results of RTHOR provided strong evidence that the overall sample fit the circular ordering model well with a significant correspondence index value of .78. However, less support was found for the RIASEC ordering of the four subgroup partitions (males, females, students, and full-time employees) with correspondence index values ranging from .60 to .70. In addition, our sample provided more favorable evidence than previous empirical and meta-analytic studies that surveyed Chinese samples, which usually resulted in lower correspondence index values ($\leq .60$). The CCSM results indicated that the overall sample (as well as the four subgroups) performed better for the unconstrained loose circular model and worst for the restrictive circumplex model judging from the model fit statistics. A further inspection of parameter estimates and geographic presentations revealed that the overall sample and two subgroups (males and students) followed the RIASEC ordering with some pairs of interest types tending to become closer regarding angular locations. Cross-cultural comparisons on GOT, BIS, and PSS between U.S. normative group and the current Chinese samples suggested comparable standardized scores with few violated scales. To illustrate, the Chinese sample was inclined to have higher GOT scores on Artistic, Social, and Conventional, and lower BIS scores on Athletics, Mathematics, and Entrepreneurship.

Theoretical Implications

This study contributes to the body of vocational interest literature by translating an authoritative U.S.-based interest inventory into Simplified Chinese and providing more up-to-date insights into the RIASEC structure in Chinese culture by examining four specific Holland's models in a Chinese sample. Strong evidence was found for the circular ordering model in the sample through two statistical approaches, RTHOR and CCSM. The inclusion of diverse groups (students and working adults) with a large age range (15 to 50) remedied the drawback of sample compositions in previous studies.

Moreover, existing empirical and meta-analytic research painting a controversial picture of Holland's theory in Chinese culture was challenged by the promising findings in the current study that suggested strong support for the RIASEC ordering model in a diverse Chinese sample. Although the sample was not adequately representative to generalize the conclusions to the whole Chinese population, this study presented a more scientific inventory and several advanced and effective statistical methods for researchers to replicate in the future.

Practical Implications

The practical implication of this study is that the Strong Interest Inventory can be a good candidate used in the Chinese population for most of the ages. A comprehensive vocational assessment has been developed and put into service by the Ministry of Education of the People's Republic of China for more than ten years (Ma, 2003), aiming at providing high school students with scientific and valid vocational information regarding their interests as well as aptitude. However, the set of assessments is not applicable for college students, working adults, and people seeking job opportunities. On the other hand, although Personal Globe Inventory (PGI) and Self-Directed Search (SDS) have received more attention than the Strong Interest Inventory (Donnay et al., 2004) in mainland China, the transportability and generalizability of the Chinese forms of these inventories were still questionable and, to the author's knowledge, PGI and SDS have not been widely used and commercialized in the Chinese market. Therefore, the promising findings in this study may potentially increase the assessment tools for career counselors in China in the future.

Limitations and Future Research

The present study is not without limitations and should be addressed by further research. First, several items off occupations and activities in China are not as usual as them in the U.S. such as "spiritual leader." The translation and review procedure have failed to come up with appropriate substitutions with equivalent underlying meanings, which undoubtedly decrease the cross-cultural validity of the Strong assessment given the notion of culture-free and bias-free assessments (Geisinger & McCormick, 2013). Future research should recruit linguists into the committee to attend to this limitation.

Second, as noticed in the data-cleaning section, the response pattern and item endorsement in the Chinese sample is different from the U.S. normative group, which makes it difficult to identify bad cases as well as comparing the Chinese respondents with the appropriate culturally specific norm. An investigation of response percentages tells that the Chinese sample in more inclined to have middle category endorsements (i.e., indifferent) than extreme ones (e.g., strongly like) due to the unique Chinese culture that values modesty and humility. The addition research is encouraged to put some emphasis on the effect of cultural factors on interest item responses.

Third, as repeatedly mentioned by previous studies in 1994 SII, additional studies using the Chinese translation of the current Strong assessment are expected to replicate the favorable findings in this study. Since the snowball sampling used in this study is a non-probability sampling technique where existing respondents are asked to recruit future participants from their acquaintances, “community bias” may generate from the potentially homogeneous samples recruited through this approach albeit it is useful to access to hard-to-reach populations (Heckathorn, 2011). Therefore, future research is encouraged to use probability sampling methods such as stratified random sampling and systematic random sampling to collect representative samples resembling the population composition of China and use them for cross-cultural validation and norm development.

CHAPTER VII: CONCLUSION

In this study, the author (together with the committee) translated the 2004 Strong Interest Inventory into Simplified Chinese and tested four forms of Holland's model on a diverse Chinese sample. This study extends existing vocational literature by adding the knowledge of the cross-cultural validity of the latest Strong assessment in Chinese culture. In conclusion, the findings suggests that the Chinese sample and two subgroups (males and students) have the identical RIASEC ordering hypothesized by Holland and the Strong Interest Inventory is reliable and valid and can be a promising vocational assessment tool used in China.

References

Anderson, M. Z., Tracey, T. G., & Rounds, J. (1997). Examining the invariance of Holland's vocational interest model across gender. *Journal of Vocational Behavior*, *50*(3), 349-364. http://dx.doi.org/10.1006/jvbe.1996.1550

Armstrong, P. I., Hubert, L., & Rounds, J. (2003). Circular unidimensional scaling: A new look at group differences in interest structure. *Journal of Counseling Psychology*, *50*(3), 297-308. http://dx.doi.org/10.1037/0022-0167.50.3.297

Browne, M. W. (1992). Circumplex models for correlation matrices. *Psychometrika*, *57*(4), 469-497. http://dx.doi.org/10.1007/BF02294416

Bryant, F. B., & Yarnold, P. R. (1995). Principal-components analysis and exploratory and confirmatory factor analysis. In L. G. Grimm, P. R. Yarnold, L. G. Grimm, P. R. Yarnold (Eds.) , *Reading and understanding multivariate statistics* (pp. 99-136). Washington, DC, US: American Psychological Association.

Bullock, E. E., Andrews, L., Braud, J., & Reardon, R. C. (2009). Holland’s theory in an international context: Applicability of RIASEC structure and assessments. *Career Planning and Adult Development Journal*, *25*(4), 29-58.

Comfrey, A. L., & Lee,H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Darcy, M. A., & Tracey, T. G. (2007). Circumplex structure of Holland's RIASEC Interests across gender and time. *Journal of Counseling Psychology*, *54*(1), 17-31. http://dx.doi.org/10.1037/0022-0167.54.1.17

Day, S. X., & Rounds, J. (1998). Universality of vocational interest structure among racial and ethnic minorities. *American Psychologist*, *53*(7), 728-736. http://dx.doi.org/10.1037/0003-066X.53.7.728

Day, S. X., Rounds, J., & Swaney, K. (1998). The structure of vocational interests for diverse racial-ethnic groups. *Psychological Science, 9*(1), 40-44. http://dx.doi.org/10.1111/1467-9280.00007

Donnay, D. A. C., Morris, M. L., Schaubhut, N. A., & Thompson, R. C. (2004). *Strong Interest Inventory manual: Research, development, and strategies for interpretation*. Palo Alto, CA: Consulting Psychologists Press Incorporated.

Fabrigar, L. R., Visser, P. S., & Browne, M. W. (1997). Conceptual and methodological issues in testing the circumplex structure of data in personality and social psychology. *Personality and Social Psychology Review, 1*(3), 184-203. http://dx.doi.org/10.1207/s15327957pspr0103_1

Fan, W., & Leong, F. L. (2016). Introduction to the special issue: Career development and intervention in Chinese contexts. *Career Development Quarterly*, *64*(3), 192-202. http://dx.doi.org/10.1002/cdq.12054

Farth, J. L., Leong, F. T., & Law, K. S. (1998). Cross-cultural validity of Holland's model in Hong Kong. *Journal of vocational behavior*, *52*(3), 425-440. https://doi.org/10.1006/jvbe.1997.1631

Fouad, N. A. (1993). Cross-cultural vocational assessment. *The Career Development Quarterly*, *42*(1), 4-13. https://doi.org/10.1002/j.2161-0045.1993.tb00240.x

Fouad, N. A. (2002). Cross-cultural differences in vocational interests: Between-group differences on the Strong Interest Inventory. *Journal of Counseling Psychology*, *49*(3), 283-289. http://dx.doi.org/10.1037/0022-0167.49.3.282

Fouad, N. A., Harmon, L. W., & Borgen, F. H. (1997). Structure of interests in employed male and female members of US racial-ethnic minority and nonminority groups. *Journal of Counseling Psychology*, *44*(4), 339-345. http://dx.doi.org/10.1037/0022-0167.44.4.339

Gasser, C. E., Larson, L. M., & Borgen, F. H. (2007). Concurrent validity of the 2005 Strong Interest Inventory: An examination of gender and major field of study. *Journal of Career Assessment*, *15*(1), 23-43. http://dx.doi.org/10.1177/1069072706294516

Ge, S., Yu, J., & Wang, S. (1996). The Chinese translation of the Strong Interest Inventory (SII). *Journal of Nanjing Normal University (Social Science Edition)*, (3), 46-49. (in Chinese) [葛树人，余嘉元，万书玉. 斯特朗职业兴趣调查表（SII）的中文翻译. 南京师范大学学报（社会科学版）, 1996, (3): 46-49.] Retrieved from: http://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFD9697&filename=NJSS603.009&v=MTI0MDdkWmVkcEZpN2hWdz09S3lmWWZiVzRIYy9NcjRZcUY1NE9mZ2c1emhBVTRqaDRPWDZUckgwM2ViT1RSYjY=

Geisinger, K. F., & McCormick, C. (2013). Testing and assessment in cross-cultural psychology. In J. R. Graham, J. A. Naglieri, I. B. Weiner, J. R. Graham, J. A. Naglieri, I. B. Weiner (Eds.) , *Handbook of psychology: Assessment psychology* (pp. 114-139). Hoboken, NJ, US: John Wiley & Sons Inc.

Glidden-Tracey, C., & Greenwood, A. K. (1997). A validation study of the Spanish Self-Directed Search using back-translation procedures. *Journal of Career Assessment*, *5*(1), 105-113. http://dx.doi.org/10.1177/106907279700500107

Goh, D. S. (2001). Translation and validation of the Chinese form of the Strong Interest Inventory. *Applied Psychology: An International Review*, *50*(2), 252-268. http://dx.doi.org/10.1111/1464-0597.00057

Goh, D. S., Lee, J. A., & Yu, J. (2004). Factor structure of the Strong Interest Inventory with a Chinese high school sample. *Journal of Psychology*, *138*(2), 171-183. http://dx.doi.org/10.3200/JRLP.138.2.171-184

Goodman, L. A. (1961). Snowball sampling. *Annals of Mathematical Statistics*, *32*, 148-170. http://dx.doi.org/doi:10.1214/aoms/1177705148

Gorusch, R. L. (1983). *Factor Analysis (2nd ed.)*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Grassi, M., Luccio, R., & di Blas, L. (2010). CircE: An R implementation of Browne's circular stochastic process model. *Behavior Research Methods, 42*(1), 55-73. http://dx.doi.org/10.3758/BRM.42.1.55

Guttman, L. R. (1954). A new approach to factor analysis: The radex. In P. F. Lazarsfeld (Ed.), *Mathematical thinking in the social sciences* (pp. 258-348). New York: Columbia University Press.

Hansen, J. C., & Fouad, N. A. (1984). Translation and validation of the Spanish form of the Strong-Campbell Interest Inventory. *Measurement & Evaluation in Guidance*, *16*(4), 192-197.

Hao, D., Sun, V. J., & Yuen, M. (2015). Towards a model of career guidance and counseling for university students in China. *International Journal for the Advancement of Counselling*, *37*(2), 155-167. http://dx.doi.org/10.1007/s10447-015-9234-7

Harkness, J. A. (2003). Questionnaire translation. In J. A. Harkness, F. J. R. van de Vijver, and P.Ph. Mohler (Eds.), *Cross-cultural survey methods* (pp. 35-56). Hoboken, NJ: Wiley.

Harmon, L. W., Hansen, J-I., Borgen, F. H., & Hammer, A. L. (1994). *Strong Interest Inventory: Applications and technical guide.* Palo Alto, CA: Consulting Psychologist Press.

Heckathorn, D. D. (2011). Snowball versus respondent-driven sampling. *Sociological Methodology, 41*(1), 355-366. http://dx.doi.org/10.1111/j.1467-9531.2011.01244.x

Herk, N. A., & Thompson, R. C. (2011). *International Technical Brief for the Strong Interest Inventory Assessment*. Mountain View, CA: CPP, Inc.

Hogan, R. (1983). A socioanalytic theory of personality. In M. M. Page (Ed.), *Nebraska symposium on motivation 1982. Personality: Current theory and research* (pp. 55-89). Lincoln, NE: University of Nebraska Press.

Holland, J. L. (1973). *Making vocational choices: A theory of vocational personalities & work environments*. Englewood Cliffs, NJ: Printice Hall.

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities & work environments (2nd ed.)*. Englewood Cliffs, NJ: Printice Hall.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities & work environments (3rd ed.)*. Lutz, FL: Psychological Assessment Resources.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparamaterized model misspecification. *Psychological Methods, 3,* 424-453. http://dx.doi.org/10.1037/1082-989X.3.4.424

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55. http://dx.doi.org/10.1080/10705519909540118

Hubert, L., & Arabie, P. (1987). Evaluating order hypotheses within proximity matrices. *Psychological Bulletin*, *102*(1), 172-178. http://dx.doi.org/10.1037/0033-2909.102.1.172

International Test Commission. (2016). *The ITC Guidelines for Translating and Adapting Tests (Second edition).* [www.InTestCom.org]

Kantamneni, N. (2014). Vocational interest structures for Asian Americans, Middle-Eastern Americans and Native Americans on the 2005 Strong Interest Inventory. *Journal of Vocational Behavior*, *84*(2), 133-141. http://dx.doi.org/10.1016/j.jvb.2013.11.003

Kantamneni, N., & Fouad, N. (2011). Structure of vocational interests for diverse groups on the 2005 strong interest inventory. *Journal of Vocational Behavior*, *78*(2), 193-201. http://dx.doi.org/10.1016/j.jvb.2010.06.003

Kim, M. (2009). Meaning-Oriented Assessment of Translations: SFL and Its Application to Formative Assessment. In C. V. Angelelli, H. E. Jacobson (Eds.), *Testing and assessment in translation and interpreting studies: A call for dialogue between research and practice* (pp. 123-157). Amsterdam, Netherlands: Benjamins. http://dx.doi.org/10.1075/ata.xiv.08kim

Leong, F. L., & Brown, M. T. (1995). Theoretical issues in cross-cultural career development: Cultural validity and cultural specificity. In W. B. Walsh, S. H. Osipow, W. B. Walsh, S. H. Osipow (Eds.), *Handbook of vocational psychology: Theory, research, and practice* (pp. 143-180). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

Leong, F. L., Hartung, P. J., & Pearce, M. (2014). Work and career development: Theory and research. In F. L. Leong, L. Comas-Díaz, G. C. Nagayama Hall, V. C. McLoyd, J. E. Trimble, F. L. Leong, ... J. E. Trimble (Eds.), *APA handbook of multicultural psychology, Vol. 1: Theory and research* (pp. 451-469). Washington, DC, US: American Psychological Association. http://dx.doi.org/10.1037/14189-024

Leong, F., Austin, J., Sekaran, U., & Komarraju, M. (1998). An evaluation of the cross-cultural validity of Holland's theory: Career choices by workers in India. *Journal of Vocational Behavior*, *52*(3), 441-455. http://dx.doi.org/10.1006/jvbe.1997.1637

Long, L., & Tracey, T. J. (2006). Structure of RIASEC scores in China: A structural meta-analysis. *Journal of Vocational Behavior*, *68*(1), 39-51. http://dx.doi.org/10.1016/j.jvb.2005.01.002

Long, L., Adams, R. S., & Tracey, T. J. G. (2005). Generalizability of interest structure to China: Application of the Personal Globe Inventory. *Journal of Vocational Behavior*, *66*, 66-80. http://dx.doi.org/10.1016/j.jvb.2003.12.004

Lowman, R. L., & Carson, A. D. (2013). Conceptualization and assessment of interests. In J. R. Graham, J. A. Naglieri, I. B. Weiner, J. R. Graham, J. A. Naglieri, I. B. Weiner (Eds.) , *Handbook of Psychology: Assessment Psychology* (pp. 534-557). Hoboken, NJ, US: John Wiley & Sons Inc.

Ma, S. (2003). Development report for Guidance Assessment of Further Education and Employment. *Psychological Exploration*, *23*(3), 60-62.

Marsella, A. J., & Leong, F. L. (1995). Cross-cultural issues in personality and career assessment. *Journal of Career Assessment*, *3*(2), 202-218. http://dx.doi.org/10.1177/106907279500300207

Morgan, B., & de Bruin, G. P. (2017). Structural validity of Holland's circumplex model of vocational personality types in Africa. *Journal of Career Assessment*, *25*(1), 1-17. http://dx.doi.org/10.1177/1069072717692747

Morris, M. L. (2016). Vocational Interests in the United States: Sex, Age, Ethnicity, and Year Effects. *Journal of Counseling Psychology*, *63*(5), 604-615. http://dx.doi.org/10.1037/cou0000164

Nye, C. D., Su, R., Rounds, J., & Drasgow, F. (2017). Interest congruence and performance: Revisiting recent meta-analytic findings. *Journal of Vocational Behavior*, *98*, 138-151. http://dx.doi.org/10.1016/j.jvb.2016.11.002

Rounds, J., & Tracey, T. J. (1996). Cross-cultural structural equivalence of RIASEC models and measures. *Journal of Counseling Psychology*, (3), 310-329. http://dx.doi.org/10.1037/0022-0167.43.3.310

Rounds, J., Tracey, T. J., & Hubert, L. (1992). Methods for evaluating vocational interest structural hypotheses. *Journal of Vocational Behavior, 40*(2), 239-259. http://dx.doi.org/10.1016/0001-8791(92)90073-9

RStudio Team (2016). RStudio: Integrated Development for R (Version 1.0.136) [Software]. Available from: http://www.rstudio.com/.

Sodano, S. M. (2015). Meaning, measurement, and assessment of vocational interests for career intervention. In P. J. Hartung, M. L. Savickas, W. B. Walsh, P. J. Hartung, M. L. Savickas, W. B. Walsh (Eds.) , *APA handbook of career intervention, Volume 1: Foundations* (pp. 281-301). Washington, DC, US: American Psychological Association. http://dx.doi.org/10.1037/14438-016

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: a meta-analysis of sex differences in interests. *Psychological Bulletin*, *135*(6), 859-884. http://dx.doi.org/10.1037/a0017364

Subich, L. M. (2005). Career Assessment with Culturally Diverse Individuals. In W. B. Walsh, M. L. Savickas, W. B. Walsh, M. L. Savickas (Eds.), *Handbook of vocational psychology: Theory, research, and practice, 3rd ed* (pp. 397-421). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Tang, M. (2001). Investigation of the structure of vocational interests of Chinese college students. *Journal of Career Assessment*, *9*(4), 365-380. http://dx.doi.org/10.1177/106907270100900404

Tang, M. (2009). Examining the application of Holland's theory to vocational interests and choices of Chinese college students. *Journal of Career Assessment*, *17*(1), 86-98. http://dx.doi.org/10.1177/1069072708325743

Tracey, T. G. (2000). Analysis of circumplex models. In H. A. Tinsley, S. D. Brown, H. A. Tinsley, S. D. Brown (Eds.) , *Handbook of applied multivariate statistics and mathematical modeling* (pp. 641-664). San Diego, CA, US: Academic Press. http://dx.doi.org/10.1016/B978-012691360-6/50023-9

Tracey, T. J. (1997). RANDALL: A Microsoft FORTRAN program for a randomization test of hypothesized order relations. *Educational and Psychological Measurement*, *57*(1), 164-168. http://dx.doi.org/10.1177/0013164497057001012

Tracey, T. J., & Robbins, S. B. (2005). Stability of interests across ethnicity and gender: A longitudinal examination of grades 8 through 12. *Journal of Vocational Behavior*, *67*(3), 335-364. http://dx.doi.org/10.1016/j.jvb.2004.11.003

Tracey, T. J., & Rounds, J. (1993). Evaluating Holland's and Gati's vocational-interest models: a structural meta-analysis. *Psychological Bulletin*, *113*(2), 229-246. http://dx.doi.org/10.1037/0033-2909.113.2.229

Van de Vijver, F. d., & Kwok, L. (2000). Methodological issues in psychological research on culture. *Journal of Cross-Cultural Psychology*, *31*(1), 33-51. http://dx.doi.org/10.1177/0022022100031001004

Van de Vijver, F. J. R., & Leung, K. (1997). *Methods and data analysis for cross-cultural research.* Thousand Oaks, CA: Sage.

Van de Vijver, F. R. (2015). Methodological aspects of cross-cultural research. In M. J. Gelfand, C. Chiu, Y. Hong, M. J. Gelfand, C. Chiu, Y. Hong (Eds.) , *Handbook of advances in culture and psychology, Vol. 5* (pp. 101-160). New York, NY, US: Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780190218966.003.0003

Wang, L., & Shen, W. (1997). A comprehensive introduction to The Strong-Campbell Interest Inventory (SCII). *Journal of Developments in Psychology*, *5*(2), 28-33. (in Chinese) [王垒，沈伟. 斯特朗-坎贝尔兴趣量表（SCII）的综合介绍. 心理学动态, 1997, 5(2): 28-33.] Retrieved from: http://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFD9697&filename=XLXD702.005&v=MDIxNTZVQT09UFNIVGFyUzRITS9NcjRvcUY1NE9mZ2c1emhBVTRqaDRPWDZUckgwM2ViT1RSYjZkWmVkcEZTM20=

Wang, Y., Xue, X., Li, Y., & Zhang, X. (2016). Empirical validity of the Personal Globe Inventory-Short Chinese form. *Chinese Human Resource Development*, (11), 66-71. (in Chinese) [王宇中，薛雪，李亚欧，张晓宇. 个人球形职业兴趣量表简版中国版（PGI-SC）的实证效度：基于 20 个职业领域的调查资料. 中国人力资源开发, (11), 66-71.] Retrieved from: http://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFDLAST2016&

filename=ZRZK201611011&v=MzE2MDdmWStSdEZ5L25VYnZBUHovUlpiRzRIOWZOcm85RVpZUjhlWDFMdXhZUzdEaDFUM3FUcldNMUZyQ1VSTDI=

Westermeyer, J. (1987). Cultural factors in clinical assessment. *Journal of Consulting and Clinical Psychology*, *55*(4), 471-477. http://dx.doi.org/10.1037/0022-006X.55.4.471

Yan, L. (2008). Localization of career counseling in china: Achievements and challenges. *Career Planning and Adult Development Journal*, *24*(4), 39-43.

Yang, W., Lance, C. E., & Hui, H. C. (2006). Psychometric properties of the Chinese Self-Directed Search (1994 edition). *Journal of Vocational Behavior*, *68*(3), 560-576. http://dx.doi.org/10.1016/j.jvb.2005.12.003

Yang, W., Stokes, G. S., & Hui, C. H. (2005). Cross-cultural validation of Holland's interest structure in Chinese population. *Journal of Vocational Behavior*, *67*(3), 79-396. http://dx.doi.org/10.1016/j.jvb.2004.08.003

Zhang, Y., Wei, Q., Li, H., Wang, Y. & Tracey, J. G. T. (2015). Reliability and validity of the Personal Globe Inventory-short in China. *Chinese Journal of Applied Psychology, 21*(1), 39-48. (in Chinese) [张宇，魏青，李红，王宇中，Terence J. G. Tracey. 个人球形职业兴趣量表简版（PGI-S）中文版的信效度检验. 应用心理学, 2015, 21(1), 39-48.] Retrieved from: http://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFDLAST2015&filename=YXNX201501005&v=MDg5NzExVDNxVHJXTTFGckNVUkwyZlkrUnRGeS9uVWI3QlBEWEZkckc0SDlUTXJvOUZZWVI4ZVgxTHV4WVM3RGg=

Appendix A: Tables

Table 1

Summary of Research on Testing Holland's Model in China

Reference	Instrument (Language)	Sample	Analyses	Gender Difference	Major Findings
Goh & Yu (2001)	SII-1994 (Chinese)	124 Chinese college students in Southeast China and 40 bilingual Chinese college student in the U.S.	• Correlation • T-test • Profile analysis • EFA	Yes	• Six-factor model was yielded • Basic Interest Scales did not resemble to the original classification • "Conventional" was changed to "Public"
Tang (2001)	SII-1994 (Chinese)	166 Chinese college students in Northeastern China, mean age = 21.59, age range = 18 to 24	• MDS • EFA • Discriminant Analysis	Yes	• Support for model fit • No support for calculus hypothesis • Basic Interest Scales did not resemble to the original classification
Goh, Lee, & Yu (2004)	SII-1994 (Chinese)	247 Chinese high school students in Nanjing, age range = 15 to 18	• CFA • Correlation • EFA	N/A	• No support for model fit • No support for calculus hypothesis • A three-factor model was better
Yang, Stokes, & Hui (2005)	SDS-1994 (Chinese)	528 Chinese from Hong Kong SAR and 325 Chinese from mainland China, age range = 18 to 50	• CFA • Randomization Test	Yes	• No support for circumplex model across geographic and gender subgroups • Mixed support for circular model across geographic and gender subgroups
Yang, Lance, & Hui (2006)	SDS-1994 (Chines)	528 Chinese from Hong Kong SAR and 150 Chinese from mainland China, age range = 18 to 50	• CFA • MTMM	No	• Full support across people from Hong Kong SAR and mainland China as well as different gender
Tang (2009)	SDS-1994 (Chinese)	165 Chinese college students in Northeastern China, mean age = 21.6	• MDS • Congruence Scores	Yes	• Mixed support • Identical ordering but different distances of RIASEC for males • Different ordering but identical distances of RIASEC for females

Note. MDS = multidimensional scaling; EFA = exploratory factor analysis; CFA = confirmatory factor analysis

Table 2

Suggestions from Studies on Testing Holland's Model in China

Reference	Suggestions	Category
Goh & Yu (2001)	• Future research with larger samples is needed to cross-validate these findings as well as to clarify some unresolved issues (such as incomparable items)	Sample
Tang (2001)	• Future studies might explore further the issues of universality of vocational structure by incorporating more samples from various cultures	Sample
	• Using a multifaceted approach, longitudinal method, and cross-validation studies will also advance the research about vocational interests	Method
Goh, Lee, & Yu (2004)	• One suggestion is to administer the SII-Chinese to a large standardization sample and use those data to determine its internal structure	Sample
Yang, Stokes, & Hui (2005)	• To be representative of the general population, future studies should attempt other sampling methods	Sample
	• Future cross-cultural validation of Holland's interest structure can similarly acknowledge the existence of moderating variables so as to make the theory more useful and to more adequately represent the reality	Moderators
Yang, Lance, & Hui (2006)	• Further research should examine the Chinese SDS more closely and culturally inappropriate items should be adapted to the local context	Items
Tang (2009)	• To further examine the application of Holland's theory in cross-cultural settings, a larger sample with national representation and cross-sectional validation studies are necessary	Sample
	• Further studies should also explore what factors other than demographics would influence congruence between individuals' interests and career choices	Moderators

Table 3

Demographic Information of Participants

	Number	Percent (%)
Gender		
Male	135	37.1
Female	229	62.9
Education Level		
Some high school	48	13.2
High-school diploma	30	8.2
Trade/Technical Training	2	0.5
Some college (no degree)	19	5.2
Associate/Community college degree	33	9.1
Bachelor’s degree	177	48.6
Master’s degree	50	13.7
Professional degree	1	0.3
Doctorate	4	1.1
Present Status		
Working full-time	127	34.9
Working part-time	6	1.6
Not working for income	2	0.5
Retired	1	0.3
Enrolled as a full-time student	191	52.5
Seeking for a job	29	8.0
None of the above	8	2.2
Total	364	100.0

Table 4

GOT Reliability Statistics

Type	Cronbach's α	Overall M (SD)	Males M (SD)	Females M (SD)	Students M (SD)	Employees M (SD)
R	.906	51.52 (7.85)	54.50 (7.62)	49.76 (7.47)	50.18 (8.09)	53.15 (7.14)
I	.923	50.07 (8.34)	52.05 (8.43)	48.91 (8.08)	49.01 (8.86)	51.44 (7.43)
A	.929	53.93 (7.31)	52.16 (6.86)	54.98 (7.39)	52.57 (7.09)	55.32 (7.19)
S	.909	53.36 (7.64)	52.74 (7.23)	53.73 (7.87)	52.09 (7.94)	54.74 (7.24)
E	.909	51.70 (8.27)	51.63 (7.82)	51.75 (8.54)	50.62 (8.40)	52.75 (7.67)
C	.889	57.04 (8.05)	57.98 (7.99)	56.49 (8.06)	56.94 (8.03)	56.86 (8.31)

Note. *N* (overall) = 364; *N* (male) = 135; *N* (female) =229; *N* (student) = 191; *N* (employees) = 127; R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional.

Table 5

Correlation Matrix for the Overall Sample (N = 364)

	R	I	A	S	E	C
Realistic (R)	1.000					
Investigative (I)	0.728	1.000				
Artistic (A)	0.393	0.408	1.000			
Social (S)	0.466	0.485	0.555	1.000		
Enterprising (E)	0.368	0.263	0.338	0.610	1.000	
Conventional (C)	0.492	0.474	0.321	0.531	0.603	1.000

Table 6

Correlation Matrix for the Male Group (N = 135)

	R	I	A	S	E	C
Realistic (R)	1.000					
Investigative (I)	0.630	1.000				
Artistic (A)	0.298	0.278	1.000			
Social (S)	0.465	0.493	0.596	1.000		
Enterprising (E)	0.376	0.225	0.403	0.569	1.000	
Conventional (C)	0.466	0.372	0.223	0.525	0.591	1.000

Table 7

Correlation Matrix for the Female Group (N = 229)

	R	I	A	S	E	C
Realistic (R)	1.000					
Investigative (I)	0.772	1.000				
Artistic (A)	0.577	0.561	1.000			
Social (S)	0.531	0.515	0.533	1.000		
Enterprising (E)	0.394	0.294	0.313	0.631	1.000	
Conventional (C)	0.502	0.525	0.412	0.549	0.615	1.000

Table 8

Correlation Matrix for the Student Group (N = 191)

	R	I	A	S	E	C
Realistic (R)	1.000					
Investigative (I)	0.707	1.000				
Artistic (A)	0.258	0.298	1.000			
Social (S)	0.413	0.467	0.490	1.000		
Enterprising (E)	0.337	0.212	0.248	0.600	1.000	
Conventional (C)	0.456	0.455	0.217	0.512	0.595	1.000

Table 9

Correlation Matrix for the Employee Group (N = 127)

	R	I	A	S	E	C
Realistic (R)	1.000					
Investigative (I)	0.737	1.000				
Artistic (A)	0.507	0.531	1.000			
Social (S)	0.471	0.461	0.561	1.000		
Enterprising (E)	0.393	0.365	0.368	0.620	1.000	
Conventional (C)	0.573	0.597	0.489	0.697	0.670	1.000

Table 10

BIS Reliability Statistics

Basic Interest Scale	Cronbach's α	Overall M (SD)	Males M (SD)	Females M (SD)
Realistic				
Mechanics & Construction	.861	51.22 (7.80)	54.01 (7.90)	49.57 (7.27)
Computer Hardware & Electronics	.905	51.17 (7.95)	54.76 (7.71)	49.05 (7.32)
Military	.863	55.62 (8.79)	58.37 (8.79)	53.99 (8.40)
Protective Services	.783	52.38 (7.76)	53.37 (7.36)	51.80 (7.94)
Nature & Agriculture	.863	50.67 (7.11)	50.51 (6.76)	50.76 (7.32)
Athletics	.870	49.87 (7.31)	51.88 (7.21)	48.68 (7.11)
Investigative				
Science	.853	50.70 (8.20)	52.63 (8.54)	49.56 (7.78)
Research	.857	51.04 (9.12)	53.11 (8.92)	49.81 (9.03)
Medical Science	.826	51.42 (8.02)	51.60 (7.81)	51.32 (8.15)
Mathematics	.908	49.73 (8.11)	52.04 (8.21)	48.37 (7.76)
Artistic				
Visual Arts & Design	.863	54.02 (7.71)	52.49 (7.47)	54.93 (7.71)
Performing Arts	.855	52.49 (7.89)	50.17 (7.14)	53.86 (8.00)
Writing & Mass Communication	.862	51.25 (7.44)	50.01 (7.22)	51.97 (7.49)
Culinary Arts	.832	52.12 (7.60)	50.63 (7.30)	52.99 (7.65)
Social				
Counselling & Helping	.779	52.90 (7.05)	52.51 (6.79)	53.12 (7.21)
Teaching & Education	.849	53.30 (7.72)	52.43 (7.82)	53.82 (7.64)
Humans Resources & Training	.827	52.35 (8.10)	51.75 (7.57)	52.70 (8.39)
Social Sciences	.785	51.55 (7.82)	52.30 (7.42)	51.10 (8.03)
Religion & Spirituality	.856	50.79 (7.13)	51.17 (7.48)	50.57 (6.93)
Healthcare Services	.844	51.60 (7.94)	51.14 (7.81)	51.87 (8.03)
Enterprising				
Marketing & Advertising	.827	50.48 (7.98)	50.12 (8.08)	50.69 (7.93)
Sales	.877	57.11 (8.64)	57.54 (8.04)	56.87 (8.97)

Management	.803	53.61 (8.29)	53.83 (8.07)	53.49 (8.43)
Entrepreneurship	.792	47.04 (8.22)	47.66 (8.38)	46.68 (8.12)
Politics & Public Speaking	.839	51.70 (7.01)	52.65 (6.83)	51.14 (7.07)
Law	.871	51.46 (7.20)	51.20 (6.87)	51.61 (7.40)
Conventional				
Office Management	.755	56.78 (7.33)	55.90 (7.43)	57.30 (7.23)
Taxes & Accounting	.822	53.02 (7.70)	54.27 (7.95)	52.29 (7.47)
Programming & Information Systems	.849	50.00 (7.78)	52.38 (7.60)	48.59 (7.56)
Finance & Investing	.834	52.58 (8.07)	53.92 (7.84)	51.79 (8.12)

Note. *N* (overall) = 364, *N* (male) = 135, *N* (female) =229.

Table 11

PSS Reliability Statistics

Personal Style Scale	Cronbach's α	Overall M (SD)	Males M (SD)	Females M (SD)
Work Style	.866	51.55 (6.34)	49.17 (6.47)	52.95 (5.84)
Learning Environment	.901	49.34 (6.39)	48.91 (6.80)	49.59 (6.13)
Leadership Style	.852	50.00 (8.20)	50.59 (8.12)	49.65 (8.25)
Risk Taking	.772	49.77 (7.83)	51.76 (7.32)	48.60 (7.90)
Team Orientation	.761	50.29 (8.86)	50.56 (8.84)	50.13 (8.88)

Note. *N* (overall) = 364, *N* (male) = 135, *N* (female) =229.

Table 12

Results of Randomization Test of Hypothesized Ordering Relations

				Predictions		
Group	*N*	CI	*p*	Met	Tied	Not Met
Overall	364	.78	.017*	64	0	8
Male	135	.64	.017*	59	0	13
Female	229	.61	.033*	58	0	14
Students	191	.69	.017*	61	0	11
Employees	127	.61	.017*	58	0	14

Note. CI = correspondence index.
* $p < .05$.

Table 13

Model Fit Statistics for Circumplex Covariance Structure Modeling

Group	Testing Model	χ^2	*df*	RMSEA [90% CI]	SRMR	CFI	TLI
Overall	Circular Ordering	14.020	3	.101 [.052, .156]	0.020	0.988	0.942
	Quasi Equal Comm.	62.820	8	.137 [.107, .170]	0.060	0.942	0.891
	Quasi Equal Ang.	59.430	8	.133 [.103, .166]	0.051	0.945	0.898
	Circumplex	110.840	13	.144 [.120, .169]	0.073	0.896	0.880
Males	Circular Ordering *	9.340	3	.126 [.039, .221]	0.029	0.979	0.934
	Quasi Equal Comm.	28.730	8	.155 [.059, .307]	0.072	0.931	0.871
	Quasi Equal Ang.	29.800	8	.143 [.090, .199]	0.061	0.928	0.865
	Circumplex	50.050	13	.146 [.104, .190]	0.088	0.877	0.858
Females	Circular Ordering *	14.350	3	.107 [.051, .169]	0.023	0.984	0.944
	Quasi Equal Comm.	49.180	8	.150 [.112, .192]	0.055	0.940	0.888
	Quasi Equal Ang.	61.910	8	.237 [.144, .363]	0.067	0.922	0.853
	Circumplex	86.790	13	.158 [.127, .190]	0.078	0.893	0.876
Students	Circular Ordering *	10.180	3	.090 [.020, .161]	0.025	0.984	0.947
	Quasi Equal Comm.	48.950	8	.215 [.119, .353]	0.071	0.907	0.826
	Quasi Equal Ang.	34.750	8	.133 [.089, .179]	0.053	0.939	0.886
	Circumplex	81.940	13	.167 [.134, .203]	0.096	0.844	0.820
Employees	Circular Ordering	2.650	3	.000 [.001, .143]	0.016	1.000	1.005
	Quasi Equal Comm.	16.040	8	.089 [.017, .153]	0.049	0.979	0.961
	Quasi Equal Ang.	29.250	8	.145 [.091, .203]	0.054	0.945	0.897
	Circumplex	42.410	13	.134 [.090, .180]	0.075	0.924	0.924

Note. Quasi Equal Comm. = Quasi-Circumplex Model (Equal Communities Assumed); Quasi Equal Ang. = Quasi-Circumplex (Equal Angular Location Assumed); Circumplex = Circumplex (or Circulant) Model; χ^2 = chi-square; *df.* = degree of freedom; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis NNFI.
* One parameter is on a boundary.

Table 14

Point Estimates and Confidence Intervals for Polar Angles and Communality

Group	Estimate		R	I	A	S	E	C
Overall	Polar Angle	PE	0	349	260	225	159	108
		CI	[0, 0]	[336, 2]	[236, 284]	[207,224]	[130, 188]	[89, 127]
	Communality	PE	.84	.87	.62	.94	.76	.87
		CI	[.89, .89]	[.81, .91]	[.54, .69]	[.83, .98]	[.70, .82]	[.76, .94]
Males	Polar Angle	PE	0	31	137	143	229	258
		CI	[0, 0]	[5, 57]	[92, 181]	[115, 172]	[191, 267]	[226, 289]
	Communality	PE	.84	.77	.60	1.00	.75	.81
		CI	[.69, .93]	[.65, .87]	[.47, .72]	N/A	[.64, .85]	[.67, .90]
Females	Polar Angle	PE	0	11	333	261	213	137
		CI	[0, 0]	[356, 26]	[308, 357]	[225, 297]	[114, 283]	[111, 163]
	Communality	PE	.87	.89	.68	.90	.76	1.00
		CI	[.81, .91]	[.83, .93]	[.60, .76]	[.77, .96]	[.68, .83]	N/A
Students	Polar Angle	PE	0	17	117	144	215	262
		CI	[0, 0]	[0, 34]	[79, 155]	[120, 168]	[179, 251]	[238, 287]
	Communality	PE	.79	.90	.51	1.00	.76	.87
		CI	[.69, .87]	[.79, .96]	[.39, .63]	N/A	[.66, .84]	[.71, .95]
Employees	Polar Angle	PE	0	355	83	152	196	236
		CI	[0, 0]	[328, 22]	[38, 127]	[100, 205]	[128, 264]	[198, 273]
	Communality	PE	.84	.87	.73	.87	.73	.96
		CI	[.75, .91]	[.78, .93]	[.60, .83]	[.75, .94]	[.63, .82]	[.61, 1.00]

Note. PE = point estimate; CI = 95% confidence interval.

Appendix B: Figures

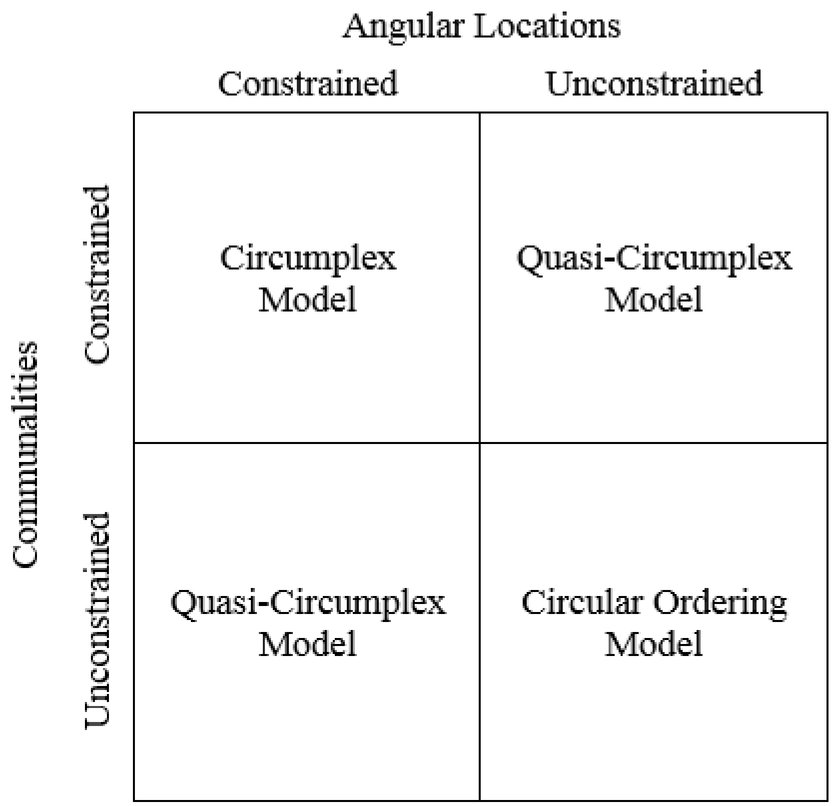

Figure 1. Categorization of four specific Holland's models

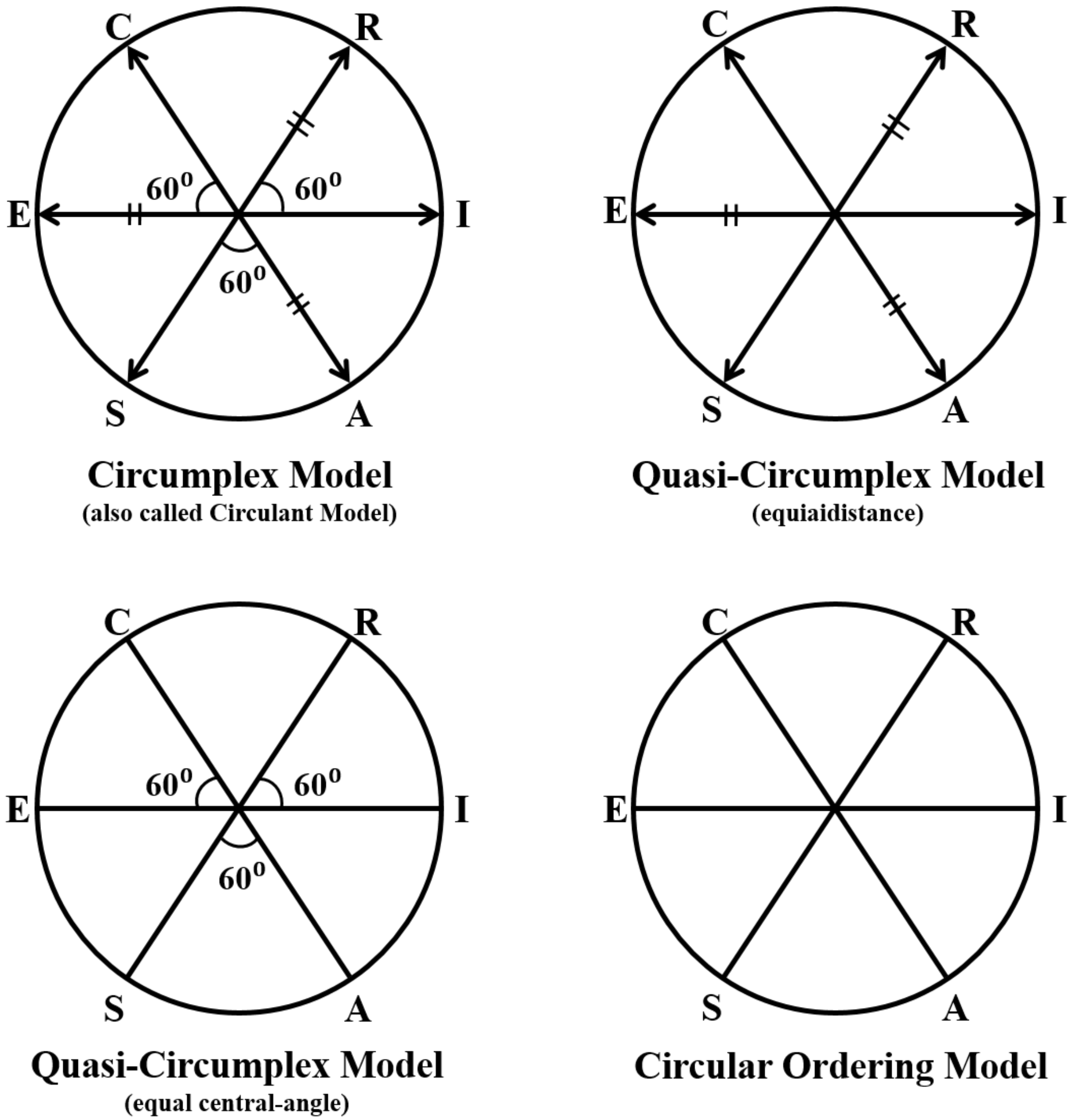

Figure 2. Visual presentation of four specific Holland’s models

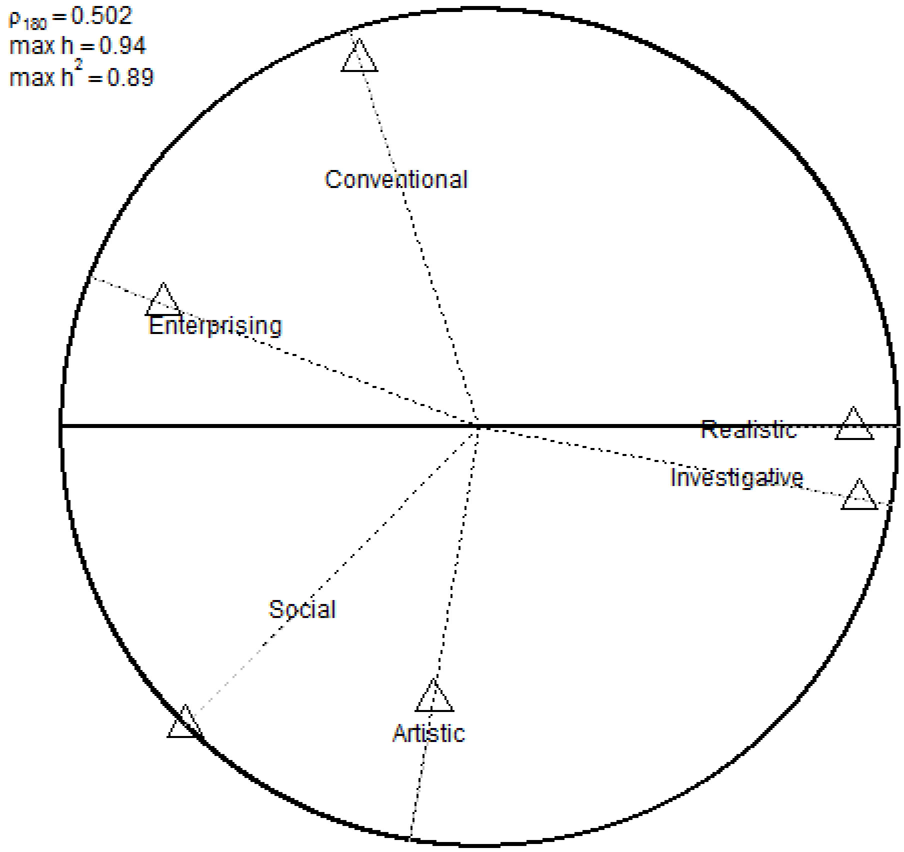

Figure 3. Unconstrained (circular ordering) model for the overall sample (*N* = 364)

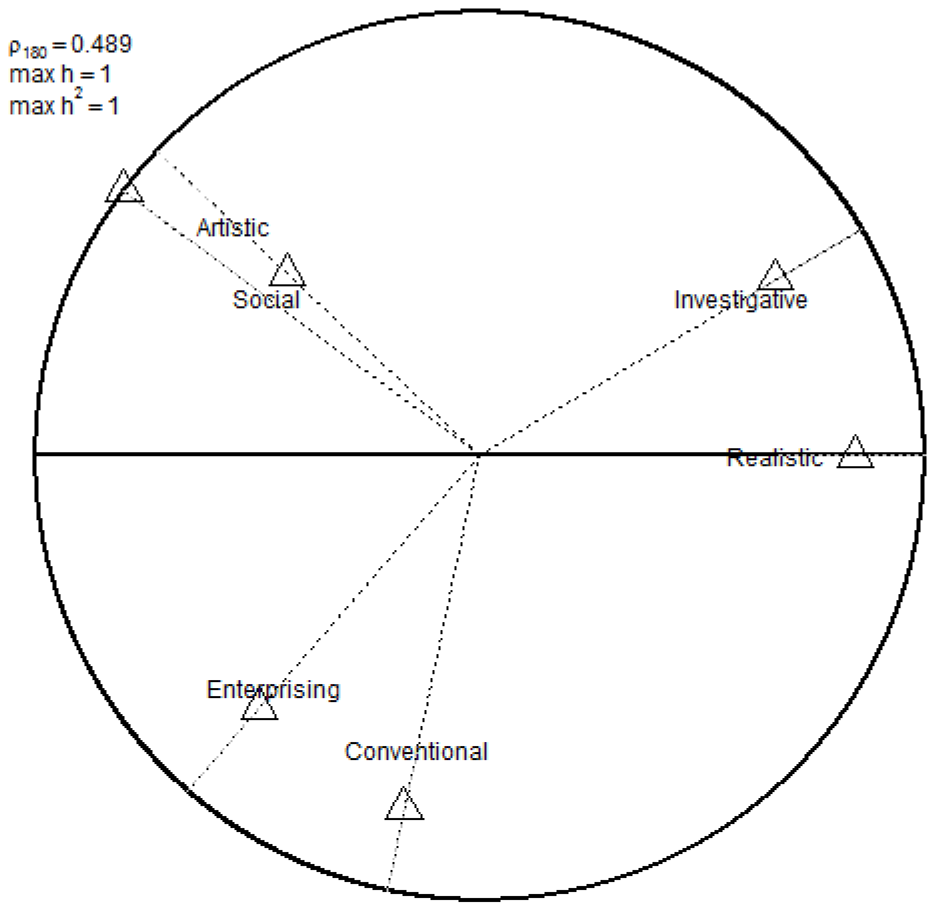

Figure 4. Unconstrained (circular ordering) model for the male group (N = 135)

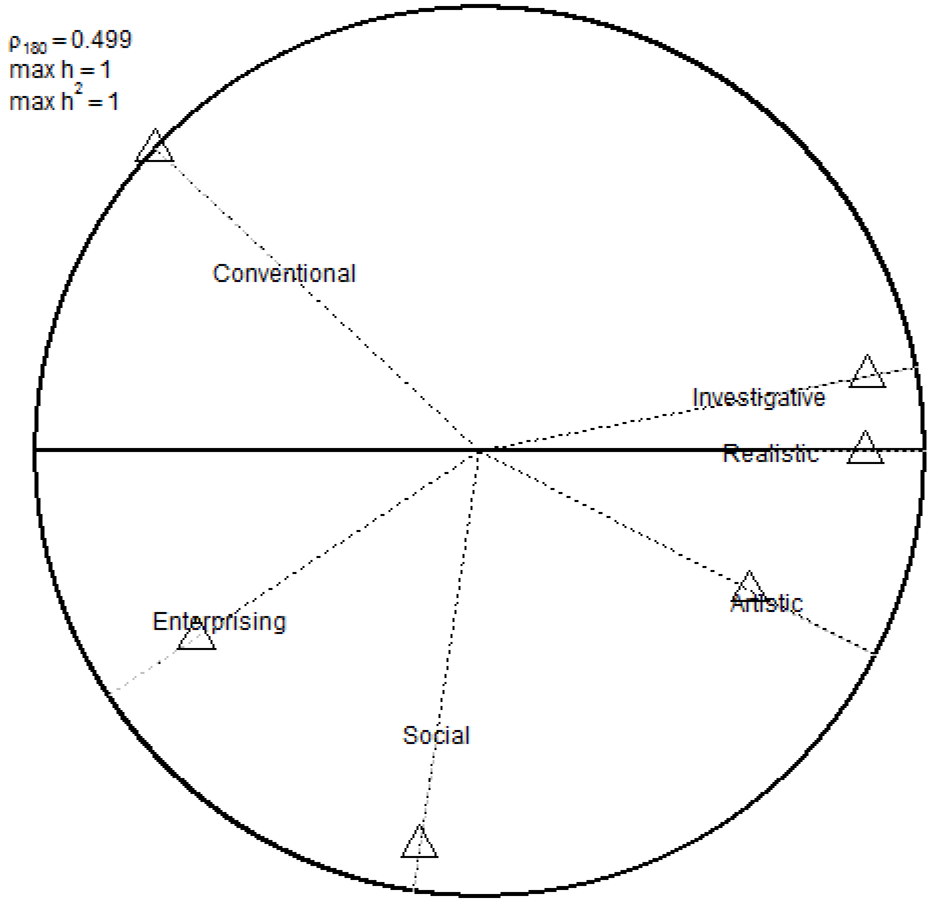

Figure 5. Unconstrained (circular ordering) model for the female group (N = 229)

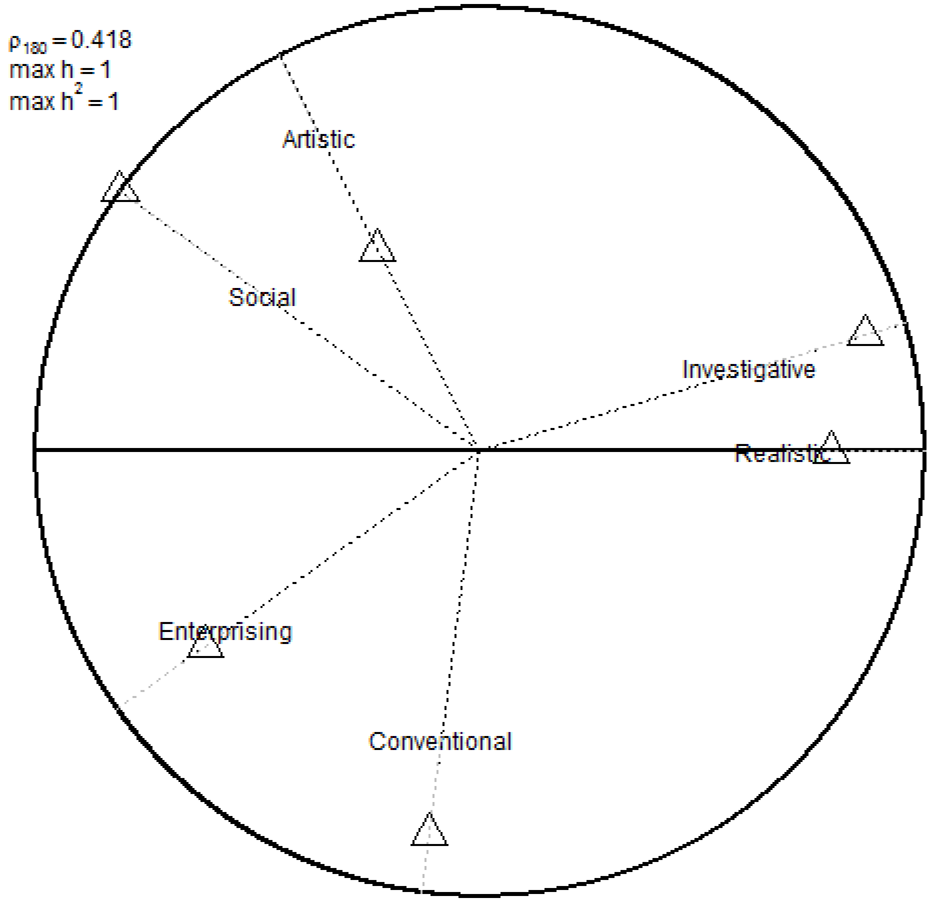

Figure 6. Unconstrained (circular ordering) model for the student group (*N* = 191)

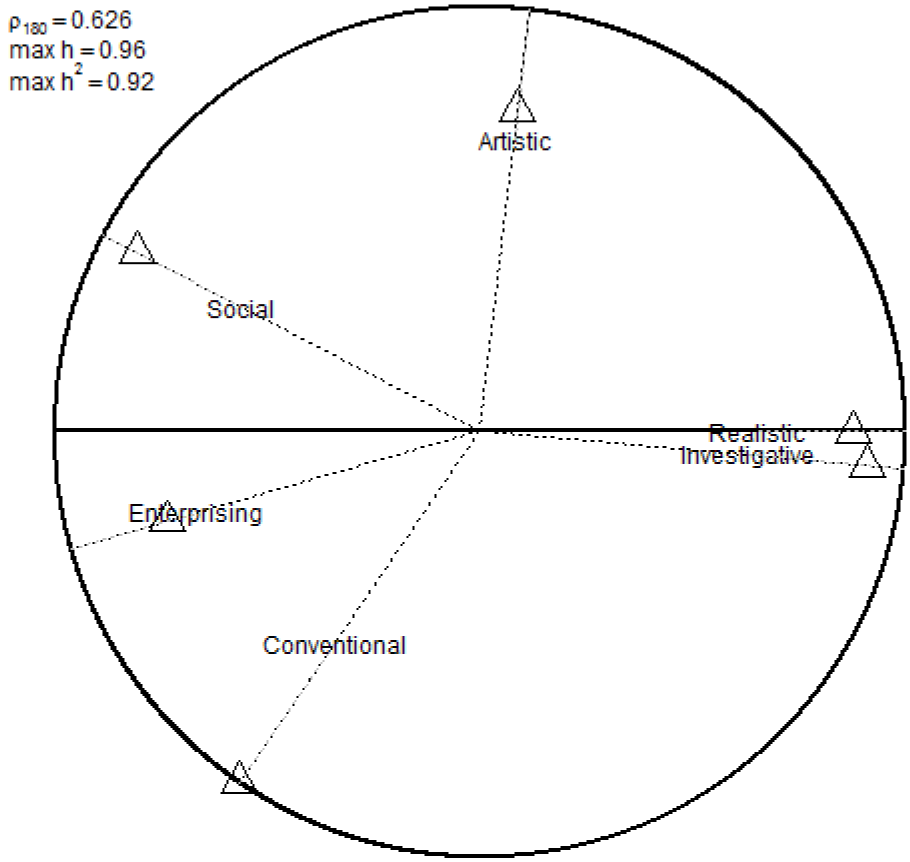

Figure 7. Unconstrained (circular ordering) model for the employee group (N = 127)

Appendix C: IRB Review

ST. CLOUD STATE UNIVERSITY
EDUCATION FOR LIFE.

Institutional Review Board (IRB)

720 4th Avenue South AS 210, St. Cloud, MN 56301-4498

Name: Yang Yang

Address

, USA

Email: yyang4@stcloudstate.edu

IRB PROTOCOL DETERMINATION:
Exempt Review

Project Title: Generalization of Strong Interest Inventory in Chinese Context: A Translation and Validation Study

Advisor Daren S. Protolipoc

The Institutional Review Board has reviewed your protocol to conduct research involving human subjects. Your project has been: **APPROVED**

Please note the following important information concerning IRB projects:

- The principal investigator assumes the responsibilities for the protection of participants in this project. Any adverse events must be reported to the IRB as soon as possible (ex. research related injuries, harmful outcomes, significant withdrawal of subject population, etc.).

- For expedited or full board review, the principal investigator must submit a Continuing Review/Final Report form in advance of the expiration date indicated on this letter to report conclusion of the research or request an extension.

-Exempt review only requires the submission of a Continuing Review/Final Report form in advance of the expiration date indicated in this letter if an extension of time is needed.

- Approved consent forms display the official IRB stamp which documents approval and expiration dates. If a renewal is requested and approved, new consent forms will be officially stamped and reflect the new approval and expiration dates.

- The principal investigator must seek approval for any changes to the study (ex. research design, consent process, survey/interview instruments, funding source, etc.). The IRB reserves the right to review the research at any time.

If we can be of further assistance, feel free to contact the IRB at 320-308-3290 or email ri@stcloudstate.edu and please reference the SCSU IRB number when corresponding.

IRB Institutional Official:

Dr. Latha Ramakrishnan
Interim Associate Provost for Research
Dean of Graduate Studies

OFFICE USE ONLY

SCSU IRB# 1689 - 2105	**Type:** Exempt Review	**Today's Date:** 2/13/2017
1st Year Approval Date: 2/12/2017	**2nd Year Approval Date:**	**3rd Year Approval Date:**
1st Year Expiration Date:	**2nd Year Expiration Date:**	**3rd Year Expiration Date:**