ABSTRACT

Title of Dissertation: AN INVESTIGATION OF PERSON-ENVIRONMENT CONGRUENCE

Marissa Johnstun McMurray, Doctor of Philosophy, 2012

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This study tested a hypothesis derived from Holland's (1997) theory of personality and environment that congruence between person and environment would influence satisfaction with doctoral training environments and career certainty. Doctoral students' (N =292) vocational interests were measured using questions from the Interest Item Pool, and they provided ratings of their satisfaction with training and certainty about their career choices. Professors (N = 106) described the doctoral training environments of these students using the Position Classification Inventory (PCI). Additional classifications of the training environments were accomplished using the Environmental Assessment Technique (EAT) and the Dictionary of Holland Occupation Codes-Third Edition (DHOC).

Traditional congruence indexes revealed only small correlations of P-E congruence with satisfaction of training environment and no significant correlations of P-E congruence with career certainty. Congruence indexes based on environmental measurement using the PCI were not better predictors of satisfaction or career certainty

than were indexes based on the EAT or DHOC.

In addition to tests using traditional congruence indexes, hierarchical linear models tested for interactions of interests and environmental characteristics in the prediction of satisfaction and career certainty. Results indicate that students with high Realistic or Social vocational interests whose doctoral training programs had high Realistic or Social (respectively) demands were more satisfied with their training environment then similar students who were in incongruent departments. This outcome occurred when either the PCI or the EAT was used as the measure of the environment, but no significant person-environment interactions were found for the prediction of career certainty.

Supplementary analyses examined other potential predictors of student's satisfaction with their training department. The number of years in the doctoral program was negatively correlated with satisfaction, and having fellowships was positively correlated with satisfaction with the doctoral training program. Three student characteristics were significantly correlated with career certainty. The number of years that a student had been in a doctoral department and the number of milestones they had reached in their program were negatively correlated career certainty, while having a fellowship was positively correlated with career certainty.

AN INVESTIGATION OF PERSON-ENVIRONMENT CONGRUENCE

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2012

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Acknowledgments

Thank you to all those who supported me during this time in my life. I would first like to acknowledge Dr. Gary Gottfredson for his help and support in this process. Without him, it would have been a much more arduous task. I would also like to thank the members of my committee, Dr. Denise Gottfredson, Dr. Ellen Fabian, Dr. Matthew Miller, and Dr. William Strein for their support, suggestions, and help during this process.

I would like to thank my husband Stephen for his kind encouragement and help in getting this done. He has supported me in all the ways a husband could during this process including by cleaning and doing laundry while I was hard at work and taking me out to dinner when I was too tired to make it. He has been my sounding board and an ever present technical support person who has taken the frustration out of many tasks. Thank you Stephen. You are my best friend and the love of my life.

I would also like to thank my parents Marion and Marie Johnstun for their support during my academic career. They have faith that I can do what I set my mind to and are always there to lend a hand when needed. Thanks for being my biggest fans and proofreaders! Obrigado to my sister Ann for her editing skills and a big gracias to Jeremiah, April, Josh, Megan, and James for their love and support.

Equal to the support that I received from my own family, is the support and love that I received from my in-laws, the McMurray and Higgins families. A big thank you to Paul for his help with excel and his listening ear. Thanks to Deni for all love and for keeping Steve and I fed and clothed for the past few years. Thanks to Katie and Jim and their kids for their love and support.

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Chapter 1: Holland's Theory of Vocational Choice

Holland's (1959, 1966, 1973, 1985a, 1997) theory of vocational personalities and work environments has been a mainstay in the field of career counseling for over 50 years. The theory assumes that it is useful to characterize persons in terms of their resemblance to six ideal personalities, and to characterize work environments in terms of their resemblance to six environmental models. Congruence between person and environment is said to occur when the demands and rewards of the environment match the competencies and interests of the person. According to the theory, congruence leads to entry and persistence in an environment as well as satisfaction within that environment. This chapter reviews the main ideas in Holland's theory including the person and environment typologies and the congruence postulate. Prior research and meta-analyses will be reviewed to summarize the state of current knowledge about congruence.

The theory of vocational personalities and work environments is based on four tenets:

1. In our culture, most persons can be categorized as one of six personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional.
2. There are six model environments: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional.
3. People search for environments that will let them exercise their skills and abilities, express their attitudes and values, and take on agreeable problems and roles.

4. Behavior is determined by an interaction between personality and environment.

(Holland, 1997, pp. 2-4)

Holland developed his theory over the span of his career and created several career assessment instruments along the way. Prior to Holland's work, career counseling using the person-job matching paradigm was a laborious process, requiring a professional to interpret assessment findings for the individual, utilizing voluminous but poorly organized occupational information. Holland created a theory and assessment tools for counselor- and self-guided career exploration. The ideas in the theory are easy enough for laypersons to guide their own career exploration with minimal counselor assistance, but complex enough to spark over 50 years of research.

Many developments have occurred in the measurement of vocational personality, but work on environmental measures is at a standstill with little progress in the past twenty years. Personality and environment will be discussed next.

Personality

Holland's theory assumes that it is useful to describe individuals in terms of their resemblance to the following personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. Personality types are abstractions or ideals that incorporate vocational interests, competencies, and behaviors of the individual. The six personality types are explained below.

The Realistic (R) personality type involves a preference for "activities that entail the explicit, ordered, or systematic manipulation of objects, tools, machines, and animals" (Holland, 1997, p. 21). Persons who resemble the Realistic type tend to like working

with their hands, solving concrete problems, and working on manual activities.

The Investigative (I) personality type involves "a preference for activities that entail the observational, symbolic, systematic, and creative investigation of physical, biological, and cultural phenomena (in order to understand and control such phenomena)" (Holland, 1997, p. 22). Those who primarily resemble the Investigative type enjoy gaining knowledge in science and mathematics.

The Artistic (A) personality type involves "a preference for ambiguous, free, unsystematized activities that entail the manipulation of physical, verbal, or human materials to create art forms or products" (Holland, 1997, p. 23). Persons who resemble the Artistic type are those who primarily enjoy creating things.

The Social (S) personality type involves "a preference for activities that entail the manipulation of others to inform, train, develop, cure, or enlighten" (Holland, 1997, p. 24). Persons who primarily resemble the Social personality tend to enjoy working in a group or with others rather than doing solitary work.

The Enterprising (E) personality type involves "a preference for activities that entail the manipulation of others to attain organizational goals or economic gain" (Holland, 1997, p. 25). An Enterprising individual would enjoy and value economic and political achievement.

The Conventional (C) personality type involves "a preference for activities that entail the explicit, ordered, systematic manipulation of data (e.g. Keeping records, filing materials, reproducing materials, organizing business machines and data processing equipment to attain organization or economic goals)" (Holland, 1997, p. 27). Those who resemble the Conventional personality types enjoy organizing data and participating in

orderly, consistent environments.

Environments

Holland's theory posits six environmental types that parallel the six model personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The model environments reflect the values encouraged by the environment and the types of activities that are rewarded. Each occupational environment resembles a combination of the six model environments, with some behaviors being more highly rewarded than others.

The Realistic (R) environmental type "is characterized by the dominance of environmental demands that entail the explicit, ordered, or systematic manipulation of objects, tools, machines, and animals, and by a population dominated by Realistic types [persons]" (Holland, 1997, p. 43).

The Investigative (I) environmental type "is characterized by the dominance of environmental demands and opportunities that entail the observation and symbolic, systematic, creative investigation of physical, biological, or cultural phenomena, and by a population dominated by Investigative types" (Holland, 1997, p. 44).

The Artistic (A) environmental type "is characterized by the dominance of environmental demands and opportunities that entail ambiguous, free, unsystematized activities and competencies to create art forms or products, and by the dominance of Artistic types" (Holland, 1997, p. 45).

The Social (S) environmental type "is characterized by the dominance of environmental demands and opportunities that entail the manipulation of others to inform, train, develop, cure, or enlighten, and by a population dominated by Social types"

(Holland, 1997, p.46).

The Enterprising (E) environmental type "is characterized by the dominance of environmental demands and opportunities that entail the manipulation of others to attain organizational or self-interested goals, and by the dominance of Enterprising types" (Holland, 1997, p. 46).

The Conventional (C) environmental type is characterized by "demands and opportunities that entail the explicit, ordered, systematic manipulation of data such as keeping records, filing materials, reproducing materials, organizing written and numerical data according to a prescribed plan, operating business equipment and data processing equipment" (Holland, 1997, p. 47).

Holland's theory assumes that it is useful to describe personality and environment in terms of resemblance to the personality and environmental models. It also assumes that people will seek, be satisfied, and remain in environments congruent with their own values, attitudes, skills and abilities. Many assessment tools have been created to characterize persons in terms of Holland's RIASEC model. Methods of assessing environments in terms of the typology have also been developed but have been the subjects of much less research.

College Departments as Environments

Holland held that college environments mirror other work environments. He wrote, "The choice of, stability in, satisfaction with, and achievement in a field of training or study follow rules identical to those outlined for vocational behavior" (Holland, 1997, p. 71). College Majors can be classified using Holland's RIASEC system. Smart and colleagues have studied college majors and have demonstrated that

college departments represent diverse Holland environmental types. For example, Smart (1985) identified that Mathematics, Economics and Chemical Engineering departments all represent the *Investigative* model, while English, Music and Philosophy represent the *Artistic* model, and Business Administration, Prelaw, and Industrial Engineering represent the *Enterprising* model.

There is some evidence that congruence is higher when specific occupational specialties are used for analysis rather than trying to find congruence using broad occupational categories. Meir and Melamed (2005) conducted a study with 120 engineers and analyzed the congruence-satisfaction relationship using six subspecialties of computer software engineering. They found that occupational specialty congruence correlated approximately .45 with satisfaction. This idea could be extended to specific positions within occupations but precise measurement of the position may still be required for an accurate measure of the occupational environment. Today's college departments often house smaller, more highly specialized programs. An Engineering department may contain Civil Engineering, Computer Engineering, Mechanical Engineering and Nuclear Engineering. While it may be true that the smaller programs within departments may be the most precise environments that one could look at in a college setting, it is sometimes difficult to measure those environments with accuracy due to the small sample sizes within each program.

Assessment Tools

Assessment tools to measure person and environment types have evolved to become more sophisticated over time. A number of important assessments of persons, environments, and person-environment congruence based on the hexagonal calculus

which is part of Holland's (1997) theory are reviewed below.

Measures of person. The Vocational Preference Inventory (VPI, Holland, 1953, 1985b) was the first personality measure to incorporate Holland's theory. First developed in 1953, the VPI has gone through a number of revisions and is in its seventh edition (Spokane, Luchetta, & Richwine, 2002). It is a self-administered, counselor scored and interpreted inventory that contains eleven scales and is easily scored. Administration takes between 15-30 minutes. Clients are asked to indicate whether they like or dislike 160 occupational titles by marking yes or no. The inventory yields a raw score for each of the six Holland personality types and scores on five additional scales: Self-Control, Masculinity/Femininity, Status, Infrequency, and Acquiescence.

The Self-Directed Search (SDS; Holland, 1970; Holland, Frizsche, & Powell, 1994) was created in 1970 and has been revised several times over the years. It is a self-administered, self-scored device that consists of five sections: Daydreams, Activities, Competencies, Occupations, and Self-Estimates of Abilities. The SDS uses the RIASEC scales from the VPI as its Occupations section. This assessment tool is known for its ease of use and understandability, and it is widely used today. Each of the sections includes questions relating to all of the six RIASEC categories. Respondents list and classify occupations they have considered, answer like or dislike for each of the 66 activities; mark yes or no to indicate whether or not they have the 66 Competencies; mark yes or no in reference to their preference for each of the 84 Occupations; and provide self-estimates of their abilities on a scale of 1 through 7 for each of the 12 abilities. The Occupational Daydream portion of the SDS asks the respondent to list the occupations that he or she has considered, listing the most recent one first. In a 1975 article, G. D.

Gottfredson and Holland reported that the classified "occupational daydream" or the first listed occupation by the respondent had the best predictive validity of any portion of the SDS. "The occupational daydream was most efficient, followed by the occupational component for men and by the summary code for women" (G. D. Gottfredson & Holland, 1975, p. 31).

The first edition of the ACT Interest Inventory was introduced in 1971 and was heavily influenced by Holland's work (ACT Technical Manual, 2009). Originally, the ACT Interest Inventory was released with separate versions for men and women. A unisex version or the UNIACT (based on research by Rayman, 1976) was first released in 1977, with revised editions released in 1989 and 2004. The UNIACT was an attempt by the authors to have one set of items in a single inventory that minimized sex differences in scores while retaining construct validity. The current version of the UNIACT (2004) has two levels, with level one intended for students in grades 8-12 and level two focusing on college age students and adults.

The Strong Interest Inventory was first developed in 1927 and was originally named the Strong Vocational Interest Blank. The SVIB (Strong, 1927) was created from a pool of 1000 questions, which were developed by Clarence S. Yoakum through a seminar conducted at the Carnegie Institute of Technology (Donnay, 1997). The inventory was originally published in 1927, had ten scales, and was intended for use with men. A women's version was published in 1933 (Donnay, 1997). The scale has gone through numerous revisions and expansions (Donnay, 1997), and the most noteworthy will be cited here. In 1974, the inventory was revised by Campbell and became the Strong-Campbell Interest Inventory, which included an expanded number of scales and a

single-sex form. The 1974 revision was largely based on a 1972 article by Campbell and Holland, which merged Strong's prior work with Holland's typology, and used Holland codes to classify occupations (Donnay, 1997). This was the first time that Holland's theory had been incorporated into the inventory. The inventory (as subsequently revised) is now known as the Strong Interest Inventory (SII; Donnay, Morris, Schaubhut, & Thompson, 2005).

The Career Assessment Inventory (CAI, Johansson) was introduced in 1975 and was intended for individuals who planned on entering the workforce after high school, community college or trade school completion and is based on Holland's typology. The CAI has been updated several times (1978, 1983, 1986) and now consists of two versions: Career Assessment Inventory-The Vocational version and Career Assessment Inventory-The Enhanced version. CAI-The Vocation version consists of 305 items and 91 occupations that require little or no post-secondary education. CAI-The Enhanced version consists of 370 items and 111 occupations that cover a variety of educational levels.

The O*NET Interest Profiler was introduced by the Department of Labor (1998) and represents one part in a series of career exploration tools, which are called O*NET. The O*NET Interest Profiler can be self-administered and self-scored or administered by a career counselor. This assessment requires an 8th grade reading level and is suggested for use by persons 14 year old or older. The O*Net Interest Profiler can be completed in about 30 minutes and is available online or can be downloaded and taken as a paper-pencil test. One important feature of this assessment is that it is available for free. Another important feature of the O*Net Interest Profiler is that the results of the

assessment are linked with over 800 occupations in O*NET Online, which makes it simple for test-takers to explore career options.

Recently, the Interest Item Pool (IIP) was created by Liao, Armstrong, & Rounds (2007) and is a freely available collection of items. The IIP includes two types of items, RIASEC Marker Items and Basic Interest Markers. The RIASEC markers scales have items corresponding to each of the six model personality types. They consist of two lists, set A and set B, each containing eight occupational tasks corresponding to each of the six Holland types. Between sets A and B, the IIP offers 16 interest items corresponding to the Realistic personality type such as "lay bricks or tile" or "fix a broken faucet," and 16 such items relating to each of the other five codes.

Several other interest inventories based on Holland's typology have been developed over the years and are worth mentioning, but will not be covered in depth here. These include: The Career Key (Jones, 1987-2012), the Armed Services Vocational Aptitude Battery OCCU-Find (ASVAB; US Military, n.d.), and the Campbell Interest and Skill Survey (CISS; Campbell, Hyne, & Nilsen, 1992). There are also a number of Holland based interest inventories in other languages that are not cited here.

Measures of environment. Fewer measures of the environment are available than measures of personality. The following paragraphs provide a brief account of the evolution of environmental measures.

One of the first ways proposed to measure the environment was the Environmental Assessment Technique (EAT; Astin & Holland, 1961). This technique is based on the assumption that, "the dominant features of the environment are dependent on the typical characteristics of its members" (Astin & Holland, 1961, p 308). The

assumption is that by taking the average measurement of the people in an environment, you can estimate the environment's Holland code. It is often said to be based on a census of personality types in an environment. While this is a relatively simple way of classifying environments, it is also somewhat circular in nature when used to calculate congruence. In using the EAT as the environmental measure to calculate congruence, researchers frequently compare a person's interest profile to an averaged profile code of the person and his coworkers. When the environment is classified using the same sample in which a congruence test is made, the observation is not considered independent. This method is still used in research today.

Viernstein (1972) proposed two methods of classifying occupations based on the Dictionary of Occupational Titles (DOT). A DOT code consists of six digits with the first digit representing the broad category (i.e. Clerical or Service); the second represents the type of activity (i.e. Salesmen or Medicine); the third digit gives a more specific job description (i.e. Car salesman or shoe salesman). Digit four indicates a worker's involvement with data, digit five indicates a worker's involvement with people and digit six indicates a worker's involvement with things. The first method or the *Frequency Method* used "the probability of finding a particular DOT code in each of the Holland categories" (p. 112). Baysian statistics were applied to calculate probabilities "for the purpose of placing the DOT code of a particular occupation into one of the six Holland categories" (p.112). The second or *Grouping Method* was used to assign Holland codes to each DOT group (the first three DOT digits) based on the grouping. "For example, any DOT number with the first three digits 001 refers to Architectural occupations in the Dictionary of Occupational Titles, and is thus assigned to the Artistic category of

Holland's classification" (p. 112). Viernstein's method was never widely used in research or practice.

The Dictionary of Holland Occupation Codes-Third Edition (G. D. Gottfredson & Holland, 1996) is a voluminous resource for information on occupations and college majors based on the Holland typology, and will be discussed shortly. Before the publication of the first edition of the DHOC (G. D. Gottfredson, Holland & Ogawa, 1982), people interested in specific Holland codes would refer to published listings of occupational titles along with their assigned Holland codes. These were developed based on data derived by assessing the interests of persons in specific occupations or those pursuing related college majors combined with judgment by individuals who had studied both the typology and the occupations. The Occupations Finder published along with the first edition of the SDS is an example of this kind of published listing of occupational titles. Another example of this type of listing is the Holland Codes for census occupations in G. D. Gottfredson's (1976) dissertation (on which research by G. D. Gottfredson & Daiger (1977) and G. D. Gottfredson (1977) was based). The DHOC was intended to improve on these lists by using the data available from the U.S. Department of Labor occupational analysis research program along with multiple discriminant function analysis to derive an empirically based method to assign occupations to the Holland models they most resembled.

The first edition of the DHOC appeared in 1982 (G. D. Gottfredson, Holland & Ogawa) and has had two subsequent editions (G. D. Gottfredson & Holland, 1989, 1996). The DHOC gives an estimate of environmental Holland codes for occupational titles listed in "seven of the most widely used occupational classifications and information

sources in the United States" (DHOC; G. D. Gottfredson & Holland, 1996, p.1). The DHOC represents an estimate of environmental codes and is not a direct measure of any specific work environment or the work environment of any specific individual. The DHOC is one of the most widely used ways to classify occupational environments in research. Researchers who use this method implicitly assume that the generic code listed for occupational titles apply to the specific positions occupied by the individuals in their studies. There are several sections in the DHOC and a continual problem with research that uses the DHOC to estimate the environmental profile is that researchers almost always fail to identify which section of the DHOC they used to find the occupational code. Some evidence of the validity of the DHOC was provided by a comparison of the DHOC with the Position Classification Inventory (PCI; described shortly). G. D. Gottfredson & Holland compared DHOC and PCI high point codes (first letter RIASEC codes) for 49 occupations as a demonstration of convergent validity. There was an 86% agreement ($\kappa = .83$) between the 49 DHOC and PCI high point codes.

The College Majors Finder (Rosen, Holmberg, & Holland, 1989) is intended to be used by students, adults, or researchers to help find college majors that are similar to their vocational personality. The College Majors Finder can be searched in two ways: by looking for majors under each RIASEC combination (e.g. RIA, SEC, ASC) or by looking for majors alphabetically. The Finder lists over 900 majors and categorizes each major as a 2, 4 or 6 indicating what level of education can be attained for each major. A classification of a 2 indicates an associate's degree level, a 4 indicates a bachelor's degree level, and a 6 indicates a postgraduate program such as a master's or doctoral degree may be attained. Carpentry is given a 2, while Psychology is listed as a 2, 4, and

6. Most of the Holland codes in the College Majors Finder were apparently derived from the second edition of the Dictionary of Holland Occupation Codes (G. D. Gottfredson & Holland, 1989) and the Occupations Finder of the Self-Directed Search (Holland, 1985c), but they also seem to involve the judgment or estimates of the listing's authors. Details of the methods used to develop the College Major Finder were not described by the authors. Although the publisher lists Holland among the authors, he was not directly involved in developing this product. Researchers such as Feldman, Smart & Ethington (2004) have used The College Majors Finder to classify environmental codes for college departments.

The Position Classification Inventory was developed by G. D. Gottfredson and Holland in 1991 and represents a direct approach to environmental classification according to the typology. The PCI is an 84-item environmental-inventory, which asks respondents to answer "often," "sometimes," or "seldom/never" to describe the work demands, skills and abilities, work perspectives, personal styles and values, personal characteristics, abilities, skills or talents involved in the positions they are analyzing. The PCI is a direct measure of the environment, but it has seldom been used in research in the past 20 years. A thorough search for research that was conducted using the PCI found that it has been used in fewer than 25 available studies since its publication in 1991. These articles will be reviewed later in this document.

Hexagonal Model

Since the publication of Holland's theory in 1959, it has evolved beyond the simple dual typologies of environment and personality. In subsequent revisions the theory stated that consistency, differentiation, and congruence can affect vocational

behavior. There have been five major revisions to the theory: Holland (1966), Holland (1973), Holland & Gottfredson (1976), Holland (1985) and Holland (1997).

It is easiest to understand consistency, differentiation, and congruence in terms of a hexagon model. Cole, Whitney & Holland (1971) demonstrated that the relations among Holland's personality measures can be roughly represented by a hexagonal arrangement in two-dimensional space (see *Figure 1*), with RIASEC interests that are the most similar being situated near each other in the space. For example, the Realistic type is most closely related to the Conventional and Investigative types, while it is the most different from the Social type, which is across the hexagonal shape.

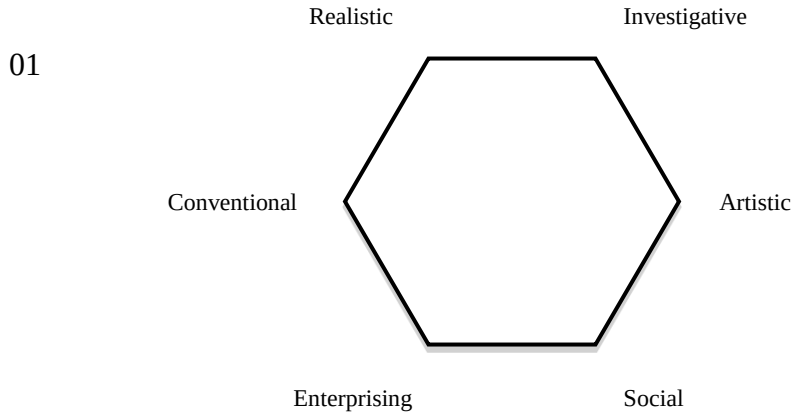


Figure 1. Hexagon Representing Relations Among the Theoretical Types

Congruence. One of the most researched aspects is the notion of congruence or the match between personality and environment, perhaps because Holland (1973) himself wrote, "Congruence of the person-environment is most influential [on satisfaction], differentiation of the person or environment is next, and consistency of person or environment is least influential" (p. 40).

Congruence is an important aspect of Holland's theory because it refers to the

match between an individual's personality pattern and the pattern of his or her environment. Nauta (2010) stated: "congruence—the degree of fit between an individual's personality type and the work environment type—is theorized to be a determinant of several important outcomes, including job satisfaction, stability, and performance" (p. 11). Levels of congruence are described using the hexagonal shape with the highest level of congruence representing an exact match between the person and environment (R person in R environment, A-A, I-I, etc.) , and the lowest level representing an extreme mismatch involving letters opposite each other on the RIASEC hexagon (R person in an S environment, I-E, A-C, etc.).

Consistency and differentiation. Consistency refers to the coherence within a person's or environment's pattern of "interests, competencies, values, traits and perceptions" (Holland, 1973, p. 38). For persons, an interest assessment generally produces a profile of resemblances to the six personality types. A *consistent person* is one whose vocational personality, according to the assessments, resembles related personality types. Similarly, a *consistent environment* is one which, according to an assessment, most resembles related environmental types.

Differentiation refers to "the magnitude of the difference between highest and lowest scores on the six variables used to determine a person's or an environment's degree of resemblance to a personality type or an environmental model" (Holland, 1973, p. 39). A well-differentiated person is one who strongly resembles one or more personality types while not resembling others. A well-differentiated environment is one that strongly rewards and reinforces persons who resemble some of the model types, while not rewarding or reinforcing others.

Although differentiation and consistency are parts of Holland's theory, he stated in 1997 that "differentiation continues to be a weak construct" and that the evidence for consistency was inconsistent. These two constructs are not often used in research today and will not be addressed in the present study.

Congruence Indexes

According to the theory, higher levels of congruence between Personality and Environment should lead to higher levels of satisfaction and stability within the environment, all other things being equal. Traditionally, P-E congruence has been measured by the use of one of several congruence indexes which have been proposed. Each index uses its own formula and assumptions to calculate how similar person and environmental profiles are. Tinsley (2000) reported that there were at least fourteen congruence indices and that they range from the simple to the complex.

Various authors have compared congruence indices, but there is still no definitive best measure (Miller, 1992; Osipow, 1987; Brown & Gore, 1994; Tinsley, 2000; Rounds, et. al, 2000; Bowles, 2008). Three indices: Holland's High Point Code (HPC) Agreement; Holland, 1973), the *C* Index (Brown & Gore, 1994), and Iachan's *M* Index (Iachan, 1984; 1990) will all be discussed in depth.

High point code agreement. Holland's High Point Code agreement (HPC; Holland, 1973) is one of the first indexes created and was often used in early research. HPC agreement was first introduced in Holland's 1973 book, but was not given an official title and thus will be known in this manuscript as the HPC. It is common to describe a person's pattern of resemblances to the six Holland types using a 3-letter code. The first letter in a Holland code represents the type most resembled, the second the type

next most resembled, and so on. HPC agreement is based on the first-letter person code and the first-letter environment code. The degree of match between the first-letter of the environmental pattern and the first letter of the person's pattern are quantified into four distinct levels of congruence (see Appendix A). Level 1 represents the least congruence where the first letters of the environmental and personality codes are opposed on the hexagon. Level 2 represents moderate incongruence where the first letters of the environmental and personality codes are two steps away on the hexagon. Level 3 represents a moderately congruent match where the first letters of the environmental and personality codes are adjacent on the hexagon. Level 4 is most congruent where the first letters of the environmental and personality codes agree. HPC scores range from one to four with one representing the lowest level of congruence and 4 representing the highest. Higher scores indicate higher congruence. While the HPC is easy to calculate, it is also imprecise, leaving out the second and third letters of the environmental and personality codes.

Iachan's *M* index. Iachan's *M* Index (1984, 1990) was proposed as an improvement over the HPC. It makes use of match based on three letter codes rather than the match based on single letters. For this index, congruence scores are calculated by assigning weights to each P-E pair, which is demonstrated in Table 1.

The first letter is given the most weight, and if it matches with the first letter of the other measure, 22 points are assigned. If the first letter matches with the second letter of the other code, 10 points are assigned; if it matches the third letter, 4 points are assigned, and if it doesn't match any of the other letters, then 0 points are assigned. The second letter gets 10 points for matching with the first letter of the other measure, 5 for

the second letter, 2 for the third and 0 for any other letter. The third letter gets 4 points for matching with the first letter of the other measure, 2 for the second and one for the third. The *M* Index has a congruence range from 0-28 with the higher scores indicating higher congruence. Two examples follow in Table 2.

The *C* index. Brown and Gore (1994) compared the characteristics and measurement properties of the following 10 congruence indices: Dichotomous First Letter-Agreement Index (letters same or different; Holland, 1963b), First Letter Hexagonal Distance (HPC; Holland, 1973), Two-Letter Agreement Index (Healy & Mourton, 1983), Z-S Index (Zener & Schnuelle, 1976), Three-Level Congruence Index (Wolfe & Betz, 1981), Compatibility Index (Wiggins & Moody, 1981), Ranked Comparison Congruence Scale (Robbins et al, 1978), *M* Index (Iachan, 1984), Sb Index (Gati, 1985), and the K-P Index (Kwak & Pulvino, 1982). Brown and Gore (1994) reported that the K-P index was the only index that assumed a circumplex RIASEC shape and proposed their own index based on the K-P index.

The *C* Index (Brown & Gore, 1994) was created to simplify the K-P Index and to retain its assumptions and advantages. The *C* Index is calculated by first finding the value of the first letter match of the Environmental and Personality patterns (by convention ranging from 0 to 3 rather than from 1 to 4). A score of three is given to exact matches; a score of two is given to adjacent matches; a score of one is given to matches that are two letters removed; and a score of zero is given for hexagonally opposite letters. The scores are then multiplied by three for the first letter match; two for the second letter match; and one for the third letter match). The three resulting scores are added to equal the congruence score. Scores on this index range from 0-18 with higher

scores indicating higher congruence. Appendix B contains further explanation.

Congruence in vocational psychology and counseling research is traditionally measured by congruence indexes, while industrial-organizational psychologists have recently begun to measure congruence in a polynomial regression model (Edwards & Parry, 1993; Edwards & Shipp, 2008; Ostroff et al., 2008).

Polynomial regression model. In a 2008 article, Edwards and Shipp revisited the notion of using polynomial regression to measure congruence, which was first introduced by Edwards and Parry in 1993. Edwards and Shipp (2008) claimed that while P-E fit models have traditionally been measured as two dimensional structures, they really should be measured three dimensionally, taking into account the type of fit (supplementary, demands-abilities, needs-supplies), the level of the environment (individual, job, group, organization, and vocation), and the content dimensions (global, domain, and facet). These P-E models have been created to fit current theories in industrial-organizational psychology, which hypothesize that persons may desire different levels of interaction with the environment. The theories may involve non-monotonic relations between person and environment characteristics. For example, different persons may desire different degrees of autonomy within an environment; too much autonomy or too little autonomy may lower levels of satisfaction. In contrast, Holland's theory has no corresponding hypothesis about an optimal level of match. That is, Holland never hypothesized that an Investigative environment might have too much *I* for a person with a primarily Investigative personality. The Polynomial Regression Model is appropriate for assessing non-monotonic hypotheses by representing congruence on a three dimensional regression surface.

Research on Congruence

Illustrative primary research on congruence. Many of the early studies of congruence had methodological problems, which were noted by Nafziger, Holland & Gottfredson (1975). One of these problems was that prior studies had looked at the college environment as a whole, all-inclusive unit rather than looking at individual majors as different environments. Previous studies were also conducted with small samples. In order to correct for many of the prior methodological problems, a 1975 study (Nafziger et al.) was conducted with a large sample of 1878 students. The students at a single university were administered the SDS before the start of their freshman year and were administered a measure of satisfaction one to three years later. The study used the SDS as a measure of person type and the students' majors were coded by expert opinion and used as a measure of environment. HPC agreement was used as a measure of congruence. Congruence was shown to have a significant main effect on student satisfaction.

In an early study that explored congruence and satisfaction, Mount & Muchinsky (1978) administered the SDS and the Job Description Index (Smith, Kendall, & Hulin, 1969) to 362 subjects in five of the six Holland typology areas. They excluded Artistic because of a lack of subjects in that area. The SDS was used as a measure of individual personality type, while the Occupation Finder (Holland, 1973) was used to classify occupations. HPC agreement was used to measure congruence. Results indicated higher overall job satisfaction and work satisfaction for those in more congruent jobs.

Helms (1996) reported on an experiment in which high school students were asked to complete six Krumbolz (1971) Job Experience Kits (one for each RIASEC

environmental type). The boys and girls (analyzed separately) were selected from a sample of 2933 high school students for their personality types, as measured by the SDS. Scores from the SDS were used to sort students into twelve groups (six for girls and six for boys) corresponding to their highest Holland personality code. Fifteen students were randomly chosen from each group to be used in the study. Two Holland personality types were excluded for girls because of limited sample numbers for those categories. Each participant was asked to complete all six Krumbolz Job Experience Kits and rate their satisfaction with the experience. Helms analyzed the data in a repeated-measures design. He analyzed the simple effects and the main effects among personality types at each level of the environment for both boys and girls. The individuals viewed the RIASEC environments (the kits) as being different from each other and the interactions between personality type and environment were significant for both sexes. Finding of the P-E congruence between persons of one Holland type (i.e. Realistic) in the corresponding environment (i.e. Realistic) were significant, positive, and in the expected direction for four out of the six RIASEC types for boys and for three out of four RIASEC types for girls.

Smart and colleagues examined Holland's theory with a college student population. Smart, Feldman, & Ethington (2006) found that departments influence the vocational personalities of students. Typically, students who enter into high *R* departments will have higher *R* scores the longer they are in that department. That holds for students who come in with high and low *R* scores, meaning that when both types of students entered into and remained in an *R* environment, their *R* scores increased. The influence of the department did not make the two *R* scores, for the students with high and

low *R* scores to begin with, equivalent. For example, two students (one with a high *R* type and one with a low *R* interest) enter an *R* department at the same time and stay within that department for the same number of years. Both student's *R* levels will increase, but the student who came in with a low *R* score will still have a lower *R* score than the student who came in with the higher *R* score. This held true for the six RIASEC codes.

Meta-analyses of congruence research. Holland's theory of vocational interests has been used to study a broad number of topics with perhaps the biggest one being congruence. Nauta (2010) stated: "Holland's congruence hypotheses have also been well tested. There is strong evidence that congruence predicts individuals' choice of (Betz, 2008; Holland, 1997; Spokane & Cruza-Guet, 2005) and persistence or stability in (Donohue, 2006) college majors and occupations" (p. 15).

Spokane (1985) conducted a meta-analysis of 40 studies involving correlational research on congruence. Of the correlational studies, he reported that 20% (8 studies) found no statistically significant relationship between congruence and the variables studied and 38% (15 studies) had mixed findings. Of the studies reviewed, 42% (17 studies) had mostly positive findings meaning that there was a statistically significant relationship between congruence and the variable measured. Three or more articles found that there was a positive relationship between each of the following: academic performance and persistence, job satisfaction, perceived congruence, personality, and stability of choice. The EAT was used as the environmental measure in four (10%) of the studies, seven (17.5%) had the researchers code the subject's job title, twenty three (57.5%) studies had the researchers code the subject's current or expressed major choice

or expressed career occupation, and the remaining six studies used a variety of measures such as the mean of faculty VPI scores and roommate VPI (roommate as environment). Although Spokane indicated that the researchers of the studies coded job title, major choice, or expressed career occupation it is unclear how they did this. Did they use the DHOC, and if so, which section was used? Did they use expert raters, and if so, how were those raters trained and how was reliability checked. Spokane noted that 26 of the studies had fewer than 50 subjects, and thus should be regarded as underpowered (i.e. unlikely to find a significant association even if one exists in the population), and reported, "Better environmental measures are still needed" (Spokane, 1985, p. 334). The "counting" of significance and non-significance is a poor practice. For more information about significance testing, see Schmidt (1996) and Hunter (1997).

Assouline & Meir (1987) conducted a meta-analysis of 41 individual studies yielding 77 correlations. The studies included examined three relationships: congruence with satisfaction, congruence with stability (meaning intent to persist in an environment), and congruence with achievement. The congruence-satisfaction relationship represented a majority of the correlations (53/77 or 69%). Satisfaction was measured by one question (satisfaction with the job, occupational choice, or environment) in 33 of the correlations, by a satisfaction inventory such as Hoppock's Job Satisfaction Blank in 14 of the correlations, and by specially designed instruments or unreported measures in six of the correlations. The congruence-stability relationship was represented by 17 correlations (22%). Stability was measured by intent to persist in occupation, major or career pursuit. The congruence-achievement relationship was represented by seven correlations (9%) and achievement was measured in all seven instances by grade-point average. Results

indicate a congruence-satisfaction weighted mean correlation of .21, a congruence-stability weighted mean correlation of .15, and a congruence-achievement weighted mean correlation of .06. The technique used to measure the environment may have influenced the sizes of the correlations observed with census techniques (i.e. the EAT) resulting in much higher correlations than were found in the overall sample of studies. Three congruence-stability studies used the EAT technique to measure the environment and these studies had a correlation of .44. Calculating all of the 17 congruence-stability studies together yields a much smaller .15 correlation.

Tranberg, Slane, and Ekeberg (1993) conducted a meta-analysis of 27 studies that reported on the relation between congruence and job or academic satisfaction. Included in this review are 21 articles previously reviewed by Assouline & Meir (1987), with six additional studies published after the 1987 review. Five of the 27 studies had findings that the authors described as "impossible to convert to correlations" (p. 259) and thus 22 studies were included in the meta-analysis. Congruence was measured in 16 of the studies using HPC or a modified version thereof, three studies used a two-letter comparison between personality and environment, and three studies compared scores three letter personality codes and three letter environmental codes. The authors noted how personality was assessed in all 22 studies but fail to report how environment was assessed in any of the studies. The dependent variable for all 22 studies reviewed was either occupational or academic satisfaction, with the finding that there was an overall mean correlation between congruence and satisfaction of .17. Job satisfaction and congruence had a mean correlation of .20, while academic satisfaction had a mean correlation of .095. Out of the 32 correlations gleaned from the literature, the highest

correlations from congruence and satisfaction were found for Social personalities (.33 overall mean correlation), and the lowest scores were found for Realistic personalities (.05 overall mean correlation).

Spokane, Meir, & Catalano (2000) conducted a review of 66 published congruence studies dating from 1985 to 1999 along with 63 studies that had been reviewed earlier by Spokane (1985). Of the published congruence studies, only two used the Positions Classification Inventory as a measure of the environment. Overall, the meta-analysis authors

> …believe that the relationship between congruence and satisfaction in traditional correlational studies is presently around .25, or 5% of variance. As Rounds and Tracey (1990) noted, the variance attributable to congruence is "hardly trivial" and especially so when one considers the multiplicity of external influences upon work and the active shaping siders the multiplicity of external influences upon work and the active shaping that so often occurs in work environments cannot be captured by statistic research designs (Spokane et al., 2000, p. 179).

Tsabari, Tziner, & Meir (2005) conducted a meta-analysis using 26 studies (53 samples) conducted from 1988 to 2003, involving the relationship between congruence and satisfaction. Across all 53 samples, the mean correlation between congruence and satisfaction was .166. This study was said to be a replication of previous meta-analyses and reports having findings closer to Tranberg et al. (1993) than the Assouline & Meir (1987) meta-analysis. When the data were corrected for sampling and measurement errors, a lower correlation of .158 was found. Ordinarily, correcting for measurement

errors and sample restriction would increase rather than decrease correlations. This article contains many methodological problems, which includes selectively choosing articles and leaving out those with correlations that the reviewers deemed to be too high or too low with no report on how many studies were excluded under this criteria.

Holland's theory and associated congruence indexes were the central topics in a series of opinion articles in 2000 (Dawis, 2000; Hesketh, 2000; Prediger, 2000; Rounds et al., 2000; Tinsley, 2000; and Tracy et al., 2000). Tinsley (2000) criticized several aspects of Holland's theory; the most pertinent to this study is his criticism of the unmeasured environment. Tinsley (2000) stated, "A problem with P-E fit theory noted by several of the writers is that operational P-E fit models typically deal only with imaginary global environments (e.g., all elementary school teacher job settings), whereas the actual individual occupies an actual (specific or micro-) environment that may differ from the imaginary global environment in important respects" (p. 417).

Current Conceptual and Methodological Problems

Two major methodological problems are found in most of the research on congruence, in the context of Holland's theory. First, much research relies on the DHOC to classify environments, usually without identifying which part of the DHOC was used to find the environmental code. There are several sections of the DHOC, each of which would be appropriate to use in different types of research, and it would be helpful if researchers identified how they chose the DHOC code that they used. A second and perhaps larger problem is that while much research fails to find large effect sizes for congruence, it also fails to measure directly the environments occupied by persons in the samples. Some important questions arise from research's neglect of the environment

such as the following: “Does the DHOC adequately represent the environment in congruence studies?” “Does the PCI provide a more accurate description of environment than the DHOC?” And “would the use of the PCI provide stronger correlations than the use of the DHOC?”

Chapter 2: The Current Problem

Although much research has been conducted about Holland's theory, especially about congruence, most researchers have failed to measure the environment directly, which may translate into lower or inaccurate congruence scores. L. S. Gottfredson and Richards (1999) described the situation as follows:

> Testing the theory's prediction about [congruence] and other crucial matters rests … on the validity with which both people and environments are assessed. The results of those tests can mislead if either is not measured accurately. Holland's inventories of personality types—the Vocational Preference Inventory (VPI) and Self-Directed Search (SDS)—have been extensively researched and debated for decades. Not so for his measures of environments. (p. 58)

Many calls for a more accurate measure of the environment have come from both critics and proponents of the theory. Fritzsche, Powell, and Hoffman (1999) stated, "More attention should be given to the measurement of the environment code" (p. 61). The *Dictionary of Holland Occupational Codes* (DHOC; G. D. Gottfredson & Holland, 1996) is often used to approximate the classification of the work environments of research subjects or clients, but it does not provide a way to directly assess any specific work environment. It is considered an indirect measure of the environment. Miller, O'Rear, Cowger, and Livingston (2005) stated, "The Position Classification Inventory (PCI; G. D. Gottfredson & Holland, 1991) was developed, in part to address this particular shortcoming of the DHOC" (p. 86) and is considered a direct measure of the environment. The PCI Manual (G.D. Gottfredson & Holland, 1991) describes several

positions in occupations with the same title that show large degrees of within occupation variability when assessed with the PCI. The DHOC makes no distinctions among positions with a single occupational title.

In an article discussing the reasons why congruence research has failed to find larger statistical associations between congruence and outcome measures (i.e. Job satisfaction and performance) Arnold (2004) reviewed fourteen problems that may affect research findings. He concluded that three major things affect congruence research, "(1) that Holland's measures of people and environments partially neglect some important constructs; (2) that environments have not been conceptualized or measured entirely appropriately; and (3) the data that are used in the calculation of congruence indices are insufficiently precise or comprehensive" (Arnold, 2004, p. 95). This article echoes the call for better measures of the environment and the use of more precise data in the calculation of congruence, which are two main focuses of this research.

The PCI has been said to show promise as an environmental classification instrument (Maurer & Tarulli, 1997; Miller, et al., 2005). However, it has been used infrequently in research. Since its publication 20 years ago (1991), it has been used in 21 retrievable studies with 7 of them being doctoral dissertations and 7 being international studies.

Nauta (2010) noted that a PsycINFO search of the years from 1999 to 2009 (10 years) had 2,209 citations of Holland's works. A PsycINFO search of the terms *Holland* and *congruence* from 1991 (when the PCI was published) until 2010 yielded 149 citations. A search of the same terms in broader search of 62 databases (see Appendix C) yielded 272 citations for the same years. While I do not know how many of these hits

explicitly involved original congruence research, it is likely that many were. With so many congruence studies being conducted, but so few choosing to use the PCI, one has to wonder why the measurement of the environment is so often ignored. It seems that the field has missed the mark by choosing to measure the person only and not the environment. Estimating rather than measuring the environment has significantly impacted congruence research in the past and may continue to impair future research unless people realize how important it is.

Studies Involving the PCI

A comprehensive search for studies that used the PCI was conducted on EBSCO using the search term *Position Classification*, search for in all text. All of the articles were reviewed in order to find those that actually used the PCI. A complete list of databases is available in Appendix C. A search of Google Scholar using the same search term was also completed. Each of the 116 references was reviewed to find unique articles that had used the PCI.

Twenty-two articles (including dissertations) were found, in which the PCI was used to measure the occupational environment. Of the 22 manuscripts and publications, seven were doctoral dissertations and 15 were published journal articles. One of the published studies (Perdue, Reardon, & Peterson, 2007) was a review of one of the findings of a doctoral dissertation (Vernick, 2007) and thus there were 21 studies and 22 combined journal articles and dissertations. Thirteen studies were conducted using U. S. based samples, seven studies used non-U.S. based samples and one study used both a U.S. and an international sample. Of the 14 published journal articles nine were published in U.S. Journals: four were published in the *Journal of Vocational Behavior*,

two in the *Journal of Employment Counseling*, one in the *College Student Journal*, one in the *Rehabilitation Counseling Bulletin*, and one in *Personnel Psychology*. The five foreign journal articles were each published in unique journals. Foreign samples were studied in seven articles from Belgium (2), Spain, Indonesia, Germany, Switzerland and Mexico.

The PCI has been translated into four languages other than English, namely, Spanish (Martínez & Fernández, 2003); Dutch (De Fruyt & Mervielde, 1999; De Fruyt, 2002); Indonesian (Televisia & Suyasa, 2008); and German (Joerin, 2003; Proyer, 2007). A reference list of the reviewed studies that included the PCI can be found in Appendix D.

Professional environments. The PCI has been used in a number of studies involving professional environments. A 2007 article (Perdue et. al) based on a 2003 dissertation by Vernick "explored the relationship between person-environment congruence, self-efficacy, and environmental identity and job satisfaction" (Perdue et al., 2007, p. 29). Two locations in the U.S. (an information technology management center in the southeast and a teleconferencing center in the southwest) of a large multinational telecommunications company were used for the study with 198 employees participating. The participants involved had a variety of job titles and managerial levels and included teleconferencing specialists, technical support staff, client consultants, and managers. Instruments used in the study include the VPI, the PCI, the Self-Efficacy Scale (SES; Sherer et al., 2000), the Environmental Identity Scale (EIS; G.D. Gottfredson & Holland, 1996b), and the Job Description Index (JDI; Balzer et al., 1997). P-E congruence between the VPI and PCI was measured by the Iachan's *M* Index and the Mahalonobis

Distance (Cronbach & Gleser, 1953). Neither congruence index had significant correlations with any of the six job satisfaction dimensions.

A study of 90 customer service representatives at a large, national insurance company based in the Western United States was conducted by Fritsche, Powell, and Hoffman in 1999. The K-P Index and the Brown and Gore *C* Index were used to measure P-E Congruence. The SDS, Wonderlic Personnel test (Wonderlic, 1992), PCI, and performance ratings were used in this study. Three hypotheses were investigated that: (a) Congruence scores based on the comparison of the SDS-PCI match would correlate more highly with satisfaction than would a comparison of scores based on the comparison of the SDS-DHOC match. (b) Cognitive ability and congruence would correlate with different aspects of job performance. And (c) congruence scores would significantly relate to job performance while Wonderlic test scores would not. The dependent variables were the performance criteria on three scales Quality, Productivity, and Conduct. Results from hypothesis (a) indicate that using the *C* Index, both the PCI and DHOC environmental codes were significantly correlated with Quality (*r*'s =.23 and .22, respectively), while neither the PCI or DHOC were significantly correlated with Quality using the K-P Index. The conclusion from the first hypothesis was that "no significant differences were found, indicating no superiority of the PCI code in predicting performance" (Fritsche, et al., 1999). Results from hypothesis (b) indicated that congruence significantly related to Quality performance ratings but not with Conduct rating. Wonderlic scores did not correlate with Quality ratings or any of the performance dimensions; thus weak support for the second hypothesis was found. Results for hypothesis (c) indicated that Wonderlic scores did not significantly correlate with

performance ratings, while P-E congruence only significantly correlated with Quality performance (using either the PCI or DHOC), but not to the other two Performance Criteria scales, Productivity and Conduct. Thus, only partial support was found for the third hypothesis. The sample involved persons from a single occupation, and is very limited in its representation of work environments—making it a poor way to test the congruence hypothesis.

Buchanan (1997) sampled 259 American Psychological Association members to identify the unique contributions of within person Differentiation, Consistency and Identity "defined as the possession of a clear and stable picture of one's goals" (p. 4) and how they relate to job satisfaction beyond what P-E congruence can explain. One thousand randomly selected psychologists were sent packets containing the SDS, Job Satisfaction Blank, MVS and PCI and 259 packets were returned and usable. Iachan's *M* Index (1984), Brown and Gore's *C* index (1994), Primary Interest Congruence Scale (PICS; Grotevant, Cooper, & Kramer, 1986) and the Buchanan Congruence Index (BCI; Buchanan, 1997) were used to measure congruence. The PICS is a congruence index that does not rank order the RIASEC scales but instead sums the standardized RIASEC scale scores from the personality and environmental measures. The Buchanan Congruence Index is a complex congruence index that purports to allow for a direct comparison of entire person and environment RIASEC profiles. The Buchanan Congruence Index was only used in one dissertation and the steps to calculating it can be found in the original text. Except for the PICS measure, congruence had very small correlations with satisfaction. Buchanan's sample was composed mainly of social and investigative persons in social and investigative environments, which did not offer a good opportunity

to test her congruence hypothesis.

A 2008 study by Telvisia and Suyasa tested a hypothesis that suitability of interests would be correlated with sales productivity for 90 insurance agents in the same company in Jakarta. At one point the manuscript lists 100 participants, and in another it lists 40 men and 50 women as participants; thus it is unclear if 90 or 100 participants were actually involved. Modified versions of the PCI and VPI were administered to insurance experts and agents, respectively. The specific way in which congruence (suitability of interests) was measured is unclear. Apparently the measure of suitability may have been the correlation of the Enterprising scale with the performance measure, as the six experts who completed the modified PCI apparently indicated that the work predominantly required Enterprising characteristics. They found a significant positive correlation between congruence and employee productivity ($r = .579$, $p < .01$). The productivity measure was the ratio of sales to the sales target for each insurance agent.

Dockins (2004) studied 228 staff nurses from a Tennessee regional referral hospital, using the PCI, SDS, Abridged Job Description Index/Abridged Job In General (AJIG; Balzer et a., 1997), and Nursing Retention Index (Cowin, 2001). Registered nurses and licensed practical nurses were used in the study with levels of training spanning from certification programs to master's degrees. Dockins hypothesized that congruence would predict job satisfaction. Brown and Gore's *C* Index (1994) was used to calculate congruence for each person comparing the individual SDS score to the individual PCI score. The study found the SDS average code for nurses in his sample was SIA, the DHOC code for Nurse-General Duty was SIA, and the PCI overall code was SRC. Dockin's choice of which DHOC code to use may have been a limitation,

because several different Nurse codes are available, including a specific code for Nurse-Licensed Practical (SAC). Bivariate correlations of P-E congruence with Satisfaction and Stability were calculated. The correlation between congruence and satisfaction, as measured by comparing the *C* Index score to the AJIG score, was not statistically significant (*rho* = .095, *p* = .153). The congruence-stability correlation (*rho* = .051, *p* = .444) was not significant, comparing the *C* Index score and the NRI score. Inconsistencies were present in the manuscript with the abstract listing a congruence-stability correlation of .027, while the body of the text reported a correlation of (*rho* = .051, *p* = .444).

Zanakas and Strohmer (2010) used the PCI to measure the work environment of 366 national and international rehabilitation counselors. The research attempted to answer the following three questions (a) What is the model environment (as measured by the PCI) of rehabilitation counselors? (b) Are Rehabilitation Counselor's perceptions of their work environments consistent with their supervisor's rating of the same work environment? And (c) is the model environment for Rehabilitation Counselors congruent with the model Rehabilitation Counselor personality as measured by Leierer, Blackwell, Strohmer, Thompson, and Donnay (2008)? They found that the model (average) rehabilitation counselor environment was SEC and that the view of the Rehabilitation Counselor environment was closely matched to the average view of Rehabilitation Counselor supervisors, SECI. When comparing the average view of the environment by Rehabilitation Counselors and their supervisors to the model (average) Rehabilitation Counselor personality (SAI), a moderate level of congruence was found using Iachan's *M* Index.

A sample of 50 new Catholic Campus Ministers were the subject of a 1998 dissertation by Coddington. The PCI, VPI, Sixteen Personality Factor Questionnaire (16-PF; Cattell, 1989), Spiritual Well-Being Scale (SWBS; Paloutizian & Ellison, 1992), and Job Description Index (JDI; Balzer& Smith, 1990) were used to measure the relation between job satisfaction, tenure, job expectations, congruence, spiritual well-being, and personality traits. The PCI was completed by the subjects twice, once at the beginning of their tenure predicting the job requirements and at six-months reporting the actual job requirements. For each of the campus ministers, three collateral raters were asked to complete the PCI to evaluate each campus minister's occupational environment. These raters included supervisors, coworkers, or students who knew the individual campus minister. Congruence scores were measured by Brown and Gore's *C* Index (1994). Coddington found that there was a high level of congruence between occupational environment (an average of all PCI scores) and individual personality codes (M = 13.84, SD = 3.16). Using the *C* Index, a high level of congruence was found between the initial rating of the PCI and the 6-month rating of the PCI (M = 16.94, SD = 2.09). The PCI, as completed by the subjects, had a high level of congruence as measured by the *C* Index, when compared to the PCI scores from 3 other raters (M = 16.69, SD =2.39). The relationship between congruence and tenure was not significantly different from zero. The relationship between congruence and job satisfaction was also not significantly different from zero.

Stinson (1998) used the PCI and the SDS form CP to measure the similarities between vocational interests and job perceptions (as measured by the PCI) of Chief Information Officers (CIO's, n = 20) and Library Directors (n = 37) in terms of Holland's

theory. Findings indicate that the average 3-letter Holland code of CIO's was IER, while their PCI code was EIS, and that the average 3-letter Holland code of Library Directors was ESI, while their PCI code was ESA. The Iachan's *M* Index (1984) was used to calculate congruence. Stinson reported that while there was a reasonably close match of congruence within the two occupations (CIO's Iachan's *M* Index score = 20; Library Directors Iachan Index score = 27), and across occupational environment (CIO PCI scores compared with Library Directors PCI scores = Iachan's *M* Index score of 24).

Non-professional environments. The PCI has been used to measure congruence in two non-professional environments, with paper container manufacturing plant workers and full-time fly fishermen guides. Twenty paper container manufacturing plant workers completed the PCI and provided demographic information in a 2003 study by Miller and Bass. The study did not identify what jobs the workers held but simply reported that they were workers at a paper container manufacturing plant. Anomalously, the DHOC was used to estimate the *personality* types. Iachan's *M* Index was used to calculate congruence and a relatively high degree of congruence was found for both men (*M*= 24.1) and women (*M* = 21.5).

In a 2006 study, Miller, Skaggs, and Wells studied 20 licensed, full-time fly-fishing guides from around the United States. The personality type for *Guide, Hunting and Fishing, RES,* was estimated from the DHOC (1996), which is an estimation of environmental and not personality codes. The Iachan's *M* Index was used to measure congruence and a moderately high congruence score (*M*=17.15, *SD*= 8.3) was found (Miller et al., 2006). The single overall code from the PCI was found to be RSA for this sample. Job satisfaction was measured by one Likert-scale item. Job satisfaction was

found to be very high, (*M*=8.78, *SD*=1.18), on a 1-10 point scale with 10 being very satisfied. One limitation of both articles about nonprofessional occupations is that while the authors measured the environment, they estimated the occupational personality type from an inappropriate source, the DHOC.

The PCI in university settings. Four studies have examined the PCI in university settings. Two longitudinal studies (De Fruyt & Mervielde, 1999; De Fruyt, 2002) were conducted with a population of graduating seniors from Ghent University in Belgium. Students were initially recruited during their senior year and measures were administered both during their senior year and one year later (post-graduation) to explore employment status, congruence, and job satisfaction.

De Fruyt (2002) studied 401 graduating seniors and measured their occupational personality using the SDS and NEO-PI-R assessments. One year later, the same subjects were recruited to complete the PCI, selected scales from the CASI, and a job stress scale that was created for this research. All measures had been translated into Dutch. Congruence was measured in a unique way and on an inverse scale, where higher numbers indicated less congruence. The author explains how congruence was calculated:

> P and E RIASEC scores were first standardized within each person and within each environment, followed by computing P–E difference scores per type. Standardization within the individual and the environment accounts for the differing scaling levels of the SDS and the PCI, maintaining the RIASEC patterning in both the individual and the environment. Absolute difference scores per type were then aggregated to compute a total congruence index, with large indices indicating poor fit. (p. 80)

As expected De Fruyt found that total incongruence related to Job Satisfaction (r = -.18, p < .01) and Skill Development (r = -.15, p < .01) but not to Work Involvement (r = -.09, p >.01) or Perceived Stress (r = .04, p >.01). In this case congruence was measured by difference scores, so large indices measure poor fit.

In another study using the same sample, De Fruyt and Mervielde (1999) investigated four hypotheses but only one that is relevant to the present review, which was "applicants will be employed in jobs congruent with their RIASEC interest profiles and the pairing of individuals and jobs can be derived from the hexagonal calculus" (p.709). Just as in the above study, 401 subjects were administered the SDS and NEO-PI-R during their senior year at Ghent University and the PCI and other scales after one year. Average correlation coefficients between personality and environmental measures on the diagonal (i.e., person and environment scales with the same name) employing an r to z transformation) were .32, adjacent .11, alternate -.03, and opposite -.09. Results partially supported the hexagonal shape in that average correlations between identical pairs were significantly different from the average correlation of adjacent pairs (p< .01). The average correlation for adjacent pairs was significantly different from the average correlation of alternate pairs (p< .05), but the difference of the averaged correlation for adjacent and opposite pairs was not significantly different from zero.

A study of one female financial aid counselor was conducted to examine the congruence between the DHOC and the PCI using Brown and Gore's *C* Index (Miller, O'Rear, Cowger, & Livingston, 2005). Miller et al. (2005) found that there was moderate congruency between the DHOC code of SEC and the PCI code of CSE. A one-

subject sample is a case study, and thus carries the limitations of a case study, which include the lack of generalizability.

The PCI and archival data. One study used the PCI along with archival data to examine how the PCI related to traditional job analytic measures. Maurer and Tarulli (1997) used two databases of job analysis studies, a 1987 study with information on 506 jobs and a 1991 study with 1336 jobs. Maurer and Tarulli compared the skill inventories of the 1987 and 1991 studies to the PCI code means from 10 trained judges. They hypothesized that RIASEC environmental types would correlate with characteristics of work environments including "work content, skill demands and context factors associated with managerial jobs" (p. 378). "For pairings of all job analysis components with each Holland construct separately (n = 27 pairings within each Holland construct), the correlations between expected and observed coefficients ranged from .20 [Realistic] to .74 for [Enterprising]" (p. 375). All correlations were significantly different than zero (p < .05) with the exception of those for Realistic scores. The Realistic environmental type was not significantly correlated with work context, skill demands or context factors. These findings provide support for the construct validity and framework of the PCI.

The PCI and the army. One study has been completed on using the PCI with a military population. Upperman and Church (1995) used the PCI, VPI, Job Description Index, and Army Crosscodes (three-letter Holland codes assigned to Army Military Occupational Specialties (MOS) using the DHOC and expert judgment) to see if Holland's typology would be useful in classifying and differentiating army specialties. This study used personality scores from 154 enlisted men and compared them with their environments as measured by three different methods: using the EAT method, using the

Army Crosscodes, and using the PCI scores of 61 supervisors who rated all of the environments. They found that Infantry personnel rated themselves as most resembling RIE personality types while their supervisors rated the environmental demands of their job as RCE; the Maintenance personnel rated themselves as resembling RSE personality types while their supervisors rated the environmental demands of their job as RCE; The Artillery personnel rated themselves as resembling RIS personality types while their supervisors rated the environmental demands of their job as REC; and the Supply personnel rated themselves as resembling RIEC personality types while their supervisors rated the environmental demands of their job as RCS. For all MOS's the average personality and environmental profile peaked on Realistic. Correlations among congruence indexes (Iachan's *M* Index, K-P Index, and Brown and Gore's *C* Index) were high. Regardless of how congruence was measured, there were no significant correlations between congruence and job satisfaction. This study involved a narrow range of MOS's, which all peeked on Realistic, and thus it would be difficult to find a correlation between congruence and satisfaction because all of the environments are similar.

Validation Studies of PCI Translations

The PCI has been translated into four languages other than English but only two studies have examined at the validity of the translations.

A 2003 study by Martinez and Fernandez examined the validity of a Spanish translation of the PCI. The PCI was translated by the article authors and two English philology experts (as reported in article) and tested on 525 subjects from the Almeria province of Spain. They found alpha coefficients ranging from .68 to .84 with an average

of .77. They found that 33 of the translated items had less than a .40 correlation with their scale and thus they recommended revising those 33 items and replicating the study with new Spanish populations. The authors do not believe that the current translation is a valid measure of occupational environments for a Spanish population. The 33 items should be re-translated and further replications should be conducted.

Proyer (2007) reviewed a German translation of the PCI named Explojob (Joerin Fux & Stoll; 2006), which is a literal German translation of the PCI's 84 items and with an added 12 questions about occupational context and training. Norming of the test was completed with 311 German speaking-Swiss subjects covering all RIASEC environmental types. Scale alpha's ranged from .83 to .93, but had poor discriminate correlations ranging from .19 to .85. Proyer, as a reviewer of the measure indicates that some correlation coefficients were missing from the administration manual table and that some of the factor analysis details from the test do not match those reflected in tables. Other criticisms from the reviewer indicate that the magnitude of the inter-scale correlations does not match the hexagonal expectation and a multidimensional scaling did not recover the hexagonal arrangement.

Summary of the PCI Research

Most of the research that has been conducted using the PCI has focused on one of two research themes. The first theme centers on testing congruence in single occupation studies such as staff nurses, customer service representatives, fly fisherman guides, paper factory workers or Catholic chaplains. This type of study may be problematic because people who are incongruent with work environments tend to leave incongruent jobs. The second theme focuses on exploring the research possibilities or future uses of the PCI

such as validation studies of translations of the PCI, exploring the overall PCI code for Rehabilitation Counselors, or using archival data to see how the PCI relates to traditional job analytic measures.

The 21 studies that have used the PCI thus far have been explorations into measuring the environment. Several of the studies had small numbers of participants and a few of the studies indicate a lack of understanding of the theory by estimating personality type in odd ways. Several studies focuses on one or two occupations and did not account for job attrition, that is to say that it is likely that those who were incompatible with the job had quit or found new jobs rather than staying in an unsatisfying job. The current study will attempt to resolve several of the weaknesses in the previous studies. This includes having a large, diverse RIASEC sample, and measuring both environment and personality. This study will examine attrition rates as a factor influencing congruence. I will also discuss students self-selected into departments by identifying which students (using their highest RIASEC interest type) chose to join which departments (using the highest aggregated RIASEC type) using all three environmental measures (PCI, EAT, and DHOC).

The PCI has been little studied over the 20 years since its publication in 1991, and more research should be done. Either the PCI provides a more accurate estimation of the environment than the DHOC or it should be set aside for better, more accurate environmental measures, which have yet to be created.

Statement of Research Questions

The present research explores how P-E congruence influences job satisfaction in doctoral training environments. According to the theory, persons enter and persist in

environments that are congruent with their vocational personalities. Other environmental and personal characteristics being equal, persons whose vocational personalities are congruent with the demands and rewards of their work environments will be more satisfied.

Six questions will be examined in this study: (a) Do the departments included in the study make homogeneous enough demands on the doctoral students that they can be considered a common environment? (b) Does satisfaction with the department environment increase as congruence increases? (c) Does P-E congruence correlate significantly with Career Certainty and intention to remain within the doctoral training program? (d) Does a direct measure of the environment (the PCI) have greater predictive ability than using indirect environmental measures (the EAT and the DHOC)? (e) Do departments with higher attrition ultimately have remaining students who are more congruent on average than those with less attrition? (f) Does the PCI show convergent and discriminant validity when compared with the EAT and the DHOC?

These research questions are important because although much has been written about Holland's theory, the majority of work in this area has been done on relatively minor aspects of the theory such as congruence indexes, while ignoring the more substantial questions such as, "How should the environment be measured?" And "Are Holland's P-E interaction predictions supported by the evidence about the actual environments inhabited?" Much of the prior research has used the DHOC to estimate work environments, which may not be a precise enough method to make good congruence calculations.

Spokane, Meir, and Catalano (2000) echoed Smart's (1997) call for more work to

be done to “understand the more complex interactions of people in work and educational environments” (p. 179). The present study aims to answer that call and to bring more understanding to the theory’s applicability in higher education. More importantly, this study explores whether the PCI is good direct measure of the environment and if it has more predictive ability to classify environments than the EAT and the DHOC.

The current study attempts to resolve several of the weaknesses in the previous studies by having a large, diverse RIASEC sample where both the environment and personality are directly measured. A comparison between the PCI and DHOC as direct vs. indirect measures of the environments is made. Attrition rates are examined to determine if they influence congruence within departments.

Chapter 3: Methods

This chapter describes the study sample, method of consent, measures, and data analysis methods. A decision was made to sample doctoral students from a single university so that education level, geographic location, and pay levels would be held relatively constant.

Sample

The University of Maryland, College Park (UMCP) currently has over 10,000 graduate students and over 100 departments that offer graduate degrees. Approximately 40% of graduate students at UMCP are international students.. Information was provided by the Registrar's office indicating the number of students enrolled in doctoral programs during the fall semester of 2011.

Preliminary DHOC coding. Doctoral departments were assigned a preliminary Holland code using the DHOC Part 3: From Occupational Titles to Holland Codes; From the Classification of Instructional Program titles to Holland Codes (CIP to HOC). According to G. D. Gottfredson and Holland (1997), this section of the DHOC (CIP to HOC) should be used for estimating departmental codes. This preliminary coding was used to gather basic information and to determine which departments would be used in this study. A more in depth DHOC coding was completed on the final sample of departments and is discussed on page 56.

The first-letter codes for the departments were as follows: Realistic (5), Investigative (39), Artistic (11), Social (9), Enterprising (8), Conventional (0), Unclassified (12). In order to make the number of departments more consistent in each Holland category more nearly equal, I decided that only the largest Investigative

departments would be included in the study. There were six Investigative departments with over 100 students. These were included in the study. One extra Investigative department, *Clinical Audiology* was included due to a clerical error and thus a total of 7 Investigative departments were included. The other 32 primarily Investigative departments were not included in the study. Doctoral students and faculty were recruited from a total of 52 departments for this study.

A sample of 3201 doctoral students at the University of Maryland, College Park were contacted for recruitment from the selected 52 departments using an email listserv set up specifically for this research by the Registrar's office. The students were recruited via email to complete an interest inventory, a measure of satisfaction with their graduate studies and their department, a measure of career certainty, and to provide demographic data. These measures are described later in this chapter. An email reminder was sent one week after the initial email was sent out to encourage participation in the study. The email list set up by the university was "blind," meaning that the researcher was provided with just one proxy email address in place of 3201 individual email addresses. An email to the proxy address was "reflected" by the university to all of the recipients on the list, without providing the individual emails to the researcher. It was therefore impossible to know which recipients of the original email had already completed the survey at the time of follow-up, and thus the reminder email was sent to all on the list. The student recruitment emails are shown in Appendix E.

A sample of 1186 Assistant, Associate and Full Professors were also contacted for recruitment from the same 52 departments, via a blind email reflector set up by the Registrar's office to complete the Position Classification Inventory (PCI) to describe their

departmental environments and were asked to provide demographic data in order to describe the sample. Professors were recruited via an initial email and a second email reminder, sent one week after the initial email. The reminder email reminder went out to all participants due to the researcher's inability to target only those who had not yet completed the survey. The professor recruitment emails are shown in Appendix F.

Out of the 3201 students that were contacted for the survey, 664 completed the consent form with 641 (20% of 3201) students consenting to complete the survey and 23 students declining participation. A total of 479 students (15% of 3201) completed the survey with usable data including the identification of their department, which was essential for data analysis. The term *usable data* is defined under the "Usable data" subsection of this chapter. A total of 223 professors out of the 1186 contacted completed the consent form with 207 (17% of 1186) consenting to take the survey and 16 declining consent. The number of surveys completed with both sufficient data and identification of their department was 157, representing a response rate of 13%.

It should be noted that due to the types of analyses that were conducted in this study, not all usable student and professor data was utilized in the final analysis.

Final Sample

Because the study was designed to test congruence in two ways, using both traditional congruence indices and multi-level modeling it was determined that the same set of data should be used for all analyses. In order to have sufficient data for the multi-level modeling, only departments with 10 or more student respondents were included in the final data analysis. In order to have environmental profiles that are representative of the doctoral department environments, I decided that departments with six or more raters

would be included in the analysis. G. D. Gottfredson and Holland (1991, p. 41) recommend using an aggregate of 10 or more inventories to measure environments. The basis for this claim is made on page 41 Table 13, which compares the agreement between PCI High-Point Code and First-Letter DHOC codes. The table indicates that with three or more raters, the percentage in first letter agreement is 86% and with 9 or more raters the percentage in agreement is 88%. I chose to compromise between three and ten raters by choosing to analyze departments with six or more usable professor PCI ratings to increase the number of departments that would be included in the analysis.

Matching departments. The data analysis of this study was dependent on being able to identify and match students to their departmental environments. During the creation of the Professor and Student questionnaires, I failed to identify departments in a uniform manner. This mistake influenced the way in which the data was analyzed. The student respondents were asked to choose from a listing of the 52 four-letter Testudo department codes (four letter codes that the university uses for registration purposes). There was also a space provided for "Other" and another option for the students to give their Program Specialty.

Professors were not queried in the same way the students were (identifying their departments using the 52 Testudo department codes), but were instead asked to complete an open-ended question, "What is your department?" The responses were classified according to the 52 Testudo department codes that were originally targeted. During the coding process, it came to light that the University had recently formed three new departments by merging 10 existing departments. While the students had chosen from a list of the original 52 departments, many of the professors named the new departments.

This made it necessary combined these departments. The departments that had been merged by the university were also merged for this data analysis so there were sufficient numbers of student and professor respondents to be included in the final sample.

Combining departments. When data collection was complete, there were 14 departments with 10 or more students with sufficient data for analysis, not counting the 10 departments that had been merged by the university. Of those 14 departments, only six departments had at least six corresponding professor PCI scores. I decided to combine all of the departments that could reasonably be combined by using the following steps. First, if a department had no student and no professor respondents, it was not considered for combination. There were four departments that fell into this category. Second, using the preliminary DHOC coding (see the section labeled 'Data Collection' in the Methods chapter), the departments were considered for combination by RIASEC type. For example, all five of the departments that had previously been coded Realistic using the DHOC were considered together and examined to see which if any of the departments had similar RIASEC ordering and scores. Those departments which were considered similar enough were considered for combination. Third, the twelve departments that were coded as 'Unclassified' were examined to see if they could be analyzed with any of the groups. The grouping was done by the expert judgment of the researcher with help from Gary Gottfredson. An example of the process will be given shortly.

After examining the departments to see if departments in the same major category could be combined, the student and professor respondent numbers were checked to see that if the departments were combined there would be sufficient data to analyze. If there

were not at least 10 student respondents and at least 6 professor respondents with usable data, those departments were considered unusable for this study and were excluded from further analysis. For those departments which, if combined would have sufficient data, the aggregated student data from each department and professor data for each grouping were compared. The term 'aggregated data' means that all of the students' interest scores from each department (with usable data) were totaled and divided by the number of participants to create one mean R score for the students in that department, and so on for the other five interest scales. The aggregated PCI and student data for each department were checked for acceptable standard deviations with very large SDs being undesirable. A check was also done to look for outliers that may be influencing the data. All of the standard deviations were within acceptable limits and no substantive or influential outliers were discovered. The standard deviations for the aggregated PCI data ranged from .03 to .48 and the standard deviations for the aggregated student data ranged from .36 to 1.14.

Following pooling of data, a total of 11 departments and combined departments (combined from 24 separate departments) were included in the study with a total of *N*=292 students and *N*=106 professors. Student demographics for this sample are reported in Table 4. Only two demographic questions were asked of the professors: number of years in the current department and ethnicity. Years in the department ranged from 0.5 to 42 years with a mean of 14.4 years. Professor ethnicity percentages are as follows: White 71% (*n*=75), Black/African-American 2% (n=2), Hispanic 3% (*n*=3), Biracial/ Mixed race 3% (*n*=3), and American Indian 1% (*n*=1). Twenty percent of professors elected not to answer the question about ethnicity (*n*=21).

Consent

Individuals who clicked on the embedded link in the recruitment emails were taken to the survey site, and shown the consent form (see Appendix G for the Professor Consent form and Appendix H for the Student Consent form). Each individual was required to check a box indicating that he or she consented to participate in this project before answering any research question. Data were collected via a secure website provided by Survey Monkey and downloaded to a password protected computer for analysis.

Measures

Faculty members were asked to complete the Position Classification Inventory to describe demands on doctoral students in their departments, to identify their department, and to answer demographic questions. The students were asked to complete 84 questions from the Interest Item Pool's Activity-Based scales (Liao, Armstrong, & Rounds, 2007), an adapted version of Hoppock's Job Satisfaction Blank (HJSB; Hoppock, 1935), and a questionnaire about career certainty and intentions to persist in the training program written specifically for the present research. Student demographic data were also collected as part of the questionnaire. Students were asked to indicate what program milestones they had already completed including: finished thesis, completed Master's Degree, finished coursework, passed comprehensive exams, and dissertation proposal approved. The level of university support was also assessed with one question asking students to check all that apply for supports that they receive from the university: fellowship, research assistantship related to their career interests, teaching assistantship related to their career interests, assistantship not related to their career interests, or no

assistantship or fellowship.

Departmental environment. The Position Classification Inventory is an 84-item device used to measure the resemblance of a work environment to the six environmental models. The inventory includes 14 items for each of the six Holland types. The 84 items are organized under six categories including activities, outlooks, personal style or values, skills/abilities/personal characteristics, abilities/skills/talents and frequency of activities. Respondents are instructed to answer: Seldom/Never, Sometimes, or Often. These responses were coded from one (Seldom/Never) to three (Often) with higher numbers indicating higher departmental demands. Alpha reliability coefficients listed in the PCI manual ranged from .70 to .94 (median .83). The alpha reliability coefficients for this sample were moderately high ranging from .75 to .93 (see Table 5).

Six scales (RIASEC) were calculated for each respondent. Each scale was calculated by summing the 12-14 items answered for that Holland type and dividing by the number of questions answered. Professors who failed to complete at least 12 of the 14 items for each of the six scales had their PCI scores excluded from the study. Individual PCI RIASEC scales had the possibility of ranging from one to three with higher numbers indicating higher departmental demands. The PCI scores of all of the professors within individual departments were reviewed to see if their profile and standard deviations were sufficiently homogeneous. Departments were regarded as sufficiently homogeneous if the first three letters of PCI Holland Codes were similar (i.e. had at least 2 of the same letters), if the RIASEC numeric scores were close, and if the standard deviation of the aggregated scores were under 1.00. Only departments with sufficiently homogeneous scores were included in this study. Aggregated PCI scores

were used to describe each department's demands. The highest three RIASEC scores, ordered by score from highest to lowest, were considered the department's PCI Holland code. The first letter in each Holland code represents the highest RIASEC demands for that department based on the aggregated PCI data; the second represents the next highest RIASEC demands, and so on.

Vocational personality. Eighty-four questions from the brief Activity-Based scales of the Interest Item Pool (IIP; Liao, Armstrong, & Rounds, 2007) were chosen to measure vocational personality. The IIP is a public domain set of item interest statements. Two sets of Activity-Based statements are available (brief sets A and B) with 8 statements for each RIASEC type for each set, totaling 16 statements per type. To parallel the 84 statements in the PCI, 84 questions were chosen from the 96 statements on the combined A and B sets of the Activity-Based scales. As a decision rule to choose 14 statements from sets A and B, all statements were chosen from set B and the first 6 statements from set A were taken for each type, totaling 14 statements for each. Respondents are instructed to answer: Strongly Dislike, Dislike, Neutral, Like, or Strongly Like. These responses were coded from one (Strongly Dislike) to five (Strongly Like) with higher numbers indicating more positive responses. The items can be found in Appendix I. The statements were intermingled by choosing first a statement from R, then I, followed by A, S, E, and C in spiral order.

In a validation study of the Interest Item Pool, Armstrong, Allison, & Rounds (2008) tested the items of the Activity-Based Scales on three college populations totaling 1,661 students from two universities. The two brief sets each had Alpha reliability coefficients ranging from .79 to .94 with a mean of .87. The Armstrong et al. participants

were also given the Strong Interest Inventory, which correlated with the two corresponding brief Activity Based scales with a range of .56 to .72 and a mean of .64. The alpha reliability coefficients for the IIP Scales for the current study were high and ranged from .90 to .94 (see Table 6).

Six scales (RIASEC) were calculated for each student respondent. Each scale was calculated by summing the 12-14 items answered for that Holland type and dividing by the number of questions answered. Students who failed to complete at least 12 of the 14 items for each of the six scales were excluded from the study. Each of the RIASEC scales had the possibility of ranging from one to five with higher numbers indicating higher levels of interest. The highest three RIASEC scores, ordered by score from highest to lowest, were considered the individual's Holland code. The first letter in each Holland code represents the highest RIASEC interest for that individual student; the second represents the next highest RIASEC interest, and so on. Congruence was calculated by comparing each individual student's Holland code with their department's corresponding Holland code for each of the three environmental assessment methods (PCI, EAT, and DHOC). An explanation of ordering when there were RIASEC score ties is given later in the chapter.

Environmental assessment technique. The Environmental Assessment Technique (EAT) was used as a way to measure departmental environments. The EAT was calculated by aggregating the interest scores of all of the students within individual departments and the combined departments to create departmental EAT scores. The highest three RIASEC scores, ordered by score, were considered the department's EAT Holland code. The first letter in each Holland code represents the highest RIASEC type

for that department based on the aggregated student data; the second represents the next highest RIASEC type, and so on.

Final DHOC coding. Due to the combination of departments, the DHOC codes had to be checked and revised for the eleven *departments* that were included in the study. Each *department* was reviewed individually to see what program specialties were included within each doctoral program. These program specialties were coded by the author with assistance from Gary Gottfredson. The principal source used for classifying departments was the list of Holland codes for instructional programs (CIP codes) provided in the 3rd edition of the DHOC. In cases of ambiguity involving multiple CIP listings, a formula for determining a single DHOC code was used. This formula involves assigning three points to each first letter (of a three letter Holland code), assigning two points for the second letter and assigning one point for the third letter. The RIASEC letter totals were summed and the letter with the highest number of points was assigned the first spot in the code, the second highest, the second and the third highest the third spot. This was done for each department and combined department. So, if one department included the following four Holland codes for program specialties (RIA, RCA, IAC, RIA) the overall DHOC code would be RIA. These codes were used in the data analysis.

RIASEC score ties. RIASEC ordering was completed in descending order where the first letter represents the scale with the highest score, the second letter represents the second highest, and so on. The highest three scales are used to form the Holland code. When two letters had equal scores, order was assigned following the RIASEC pattern. If *R* and *I* were tied for second place, *R* would be assigned second place and *I* would be assigned third place. If *S* and *C* were tied for first place, *S* was assigned the first place

spot while *C* was assigned a second place. A tie for first place occurred for individual interests thirteen times. No first place ties occurred for either department-level PCI averages or for department level interest average (i.e. EAT scores).

Usable data. The measures used to collect the data including the personality measure and the environmental measure are discussed in the previous chapter, but both measures had 14 questions for each of the RIASEC scales (i.e. 14 R question, 14 I questions, 14 A questions, etc.). The term 'usable data' refers to the respondent (either student or professor) having answered enough questions under each RIASEC scale to be considered for data analysis. The PCI manual suggests that scales with 3 or more missing responses should not be scored due to the lack of data. This rule was used for both the personality and the environmental measures. Respondents with more than 3 missing data points for any of the RIASEC scales were excluded from analysis. The R scale was calculated by summing up all 12-14 of the answered R questions. Those scores were then divided by the number of R questions that were answered to give a mean R score for the individual. These same steps were used to calculate I, A, S, E, and C scores. The steps were also used to calculate individual RIASEC scores for the PCI data. A large portion of the data collected was not included in the study because there were not enough professor respondents or student respondents in the department or that department could not be combined with other departments.

Satisfaction with the training program. Satisfaction with the training program is one of two dependent variables in this study. Satisfaction with the training program is measured by an adaption of the Hoppock's (1935) Job Satisfaction Blank No.5. This is an overall measure of job satisfaction and consists of four questions. The HJSB has been

adapted for this study by changing a few words in each question to reflect the doctoral training environment. For the original questions and the adapted questions for this study, see Appendix J. Responses are indicated on 7-point Likert-type scales (e.g. I love it – I hate it, All of the time – Never). The HJSB yields scores from 4-28, with lower scores indicating lower satisfaction. For the remainder of this manuscript, this variable will be referred to as "Satisfaction with the Training Program" or simply as "Satisfaction." The alpha reliability in this sample as acceptable at .82.

Career certainty. Seven items were written to measure intent to continue in the current doctoral program and career certainty. Career Certainty measures students feeling that they have made the correct choice of career. Career Certainty was measured by a seven-item scale devised for this research and includes the following items: "I am sure that I will finish my doctorate at the University of Maryland, College Park," "I have thoughts about dropping out of my program," "I'm not sure how much longer I can stand being in my department," "I'm certain that I have chosen the right career," "I'm afraid I've made a bad choice of a graduate program," "I need to find out what jobs I can do with a PhD in my area," "Occupations in my current area are unappealing to me," and "I am confident that my department will prepare me for a job I will like." Students were asked to respond on a five-point Likert-type scale from "Not at all true about me" to "Very true about me". Alpha reliability for this scale was acceptable at .79.

The Career Certainty scale was written to measure both career certainty and intent to persist within the current doctoral program. After the data collection was complete, I considered if the seven items on the Career Certainty scale could be split to create two separate scales, one measuring career certainty and one measuring intent to persist.

When the Career Certainty scale was separated, the intent to persist items included the first three questions of the complete scale and had alpha reliability of .61. The career certainty scale consisted of the last four items and had alpha reliability of .74. The two scales were correlated (r = .58, p <.05). I decided to keep the items as one scale called Career Certainty, which had higher alpha reliability.

Congruence

Congruence was measured in both the traditional way using three congruence indices and in a new way using hierarchical linear modeling to see if an alternative statistical procedure was better able to account for satisfaction. Holland's High-Point Code agreement (HPC), Brown and Gore's *C* Index, and Iachan's *M* Index were used to calculate traditional congruence scores. These three indices were chosen for their adherence to Holland's theory, psychometric properties, and because they have often been used in past research. Using multiple indices to calculate congruence is important because currently, there is no clear "best" way to measure congruence. A 2004 dissertation (Horn, 2004) evaluated ten congruence indices to see if results significantly or substantially varied when examining the relationship between congruence and college achievement. Horn reported, "Results from the ten block-entry multiple regression analyses did not provide a definitive answer as to one or more measures of congruence being more effective in investigating the congruence-achievement relationship" (p. v).

Hierarchical Linear Modeling (HLM)

This study examines the match between doctoral students and their training environments. Individual students are nested within departments. Within departments, individual interests differ, but theoretically each department constitutes a single

environment to which all of the doctoral students within it are exposed. A two-level statistical model was created in which individual characteristics were regarded as predictors of satisfaction and career certainty at level 1. Environmental characteristics (level 2) may also influence these outcomes. The congruence hypothesis implies a cross-level interaction of environmental and individual characteristics. This modeling was completed with HLM (Raudenbush & Bryk, 2002).

The level-one model is given by equation 1 where:

Y_{ij} is satisfaction (or career certainty) with the environment for person *i* in department *j*

$\mathcal{R}_{ij}$ is the Realistic score for person *i* in department *j*

$\mathcal{I}_{ij}$ is the Investigative score for person *i* in department *j*

$\mathcal{A}_{ij}$ is the Artistic score for person *i* in department *j*

$\mathcal{S}_{ij}$ is the Social score for person *i* in department *j*

$\mathcal{E}_{ij}$ is the Enterprising score for person *i* in department *j*

$\mathcal{C}_{ij}$ is the Conventional score for person *i* in department *j*

$ß_{0j}$ is the mean satisfaction for department *j*

$ß_{1j}$ through $ß_{6j}$ are the effect coefficients for $\mathcal{R}_j$ through $\mathcal{C}_j$

u_{ij} is an error term for person *i* in department *j*.

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\mathcal{R}_{ij} - \overline{\mathcal{R}}_{\cdot j}) + \beta_{2j}(\mathcal{I}_{ij} - \overline{\mathcal{I}}_{\cdot j}) + \beta_{3j}(\mathcal{A}_{ij} - \overline{\mathcal{A}}_{\cdot j}) + \beta_{4j}(\mathcal{S}_{ij} - \overline{\mathcal{S}}_{\cdot j}) + \beta_{5j}(\mathcal{E}_{ij} - \overline{\mathcal{E}}_{\cdot j}) + \beta_{6j}(\mathcal{C}_{ij} - \overline{\mathcal{C}}_{\cdot j}) + u_{ij} \quad (1)$$

A set of equations involving departmental predictors of the parameters of equation 1 model the effect of environments on the departmental average dependent variable and on each of the within department regressions of the dependent variable on

individual's RIASEC scores.

The level-two model is given by equations 2-8

γ_{00} is the mean of department means

$$\beta_{0j} = \gamma_{00} + \gamma_{01}R_j + \gamma_{02}I_j + \gamma_{03}A_j + \gamma_{04}S_j + \gamma_{05}E_j + \gamma_{06}C_j + u_j \quad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}R_j + \gamma_{12}I_j + \gamma_{13}A_j + \gamma_{14}S_j + \gamma_{15}E_j + \gamma_{16}C_j + u_j \quad (3)$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}R_j + \gamma_{22}I_j + \gamma_{23}A_j + \gamma_{24}S_j + \gamma_{25}E_j + \gamma_{26}C_j + u_j \quad (4)$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}R_j + \gamma_{32}I_j + \gamma_{33}A_j + \gamma_{34}S_j + \gamma_{35}E_j + \gamma_{36}C_j + u_j \quad (5)$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}R_j + \gamma_{42}I_j + \gamma_{43}A_j + \gamma_{44}S_j + \gamma_{45}E_j + \gamma_{46}C_j + u_j \quad (6)$$

$$\beta_{5j} = \gamma_{50} + \gamma_{51}R_j + \gamma_{52}I_j + \gamma_{53}A_j + \gamma_{54}S_j + \gamma_{55}E_j + \gamma_{56}C_j + u_j \quad (7)$$

$$\beta_{6j} = \gamma_{60} + \gamma_{61}R_j + \gamma_{62}I_j + \gamma_{63}A_j + \gamma_{64}S_j + \gamma_{65}E_j + \gamma_{66}C_j + u_j \quad (8)$$

where, R_j = grand mean centered Realistic score for department j

I_j = grand mean centered Investigative score for department j

A_j = grand mean centered Artistic score for department j

S_j = grand mean centered Social score for department j

E_j = grand mean centered Enterprising score for department j

C_j = grand mean centered Conventional score for department j.

γ_{01}through γ_{06} are the effects of departmental resemblance to the RIASEC environments to the department average satisfaction or career certainty. (This is not a focus of my inquiry). In contrast, the hypothesized person-environment interaction effects will be indicated by γ_{11} for Realistic, γ_{22} for Investigative, γ_{33} for Artistic, and so on. For dependent variables satisfaction and career certainty, positive values for these gammas will support the interaction hypothesis.

In all, the congruence hypothesis was tested in 4 ways. First it was tested by

examining the within-department correlations of each dependent variable with (a) Holland's High Point Code (b) Iachan's *M* Index, and (c) Brown-Gore *C* Index. Then it was tested (d) using the hierarchical regression analysis focusing on the interaction of department RIASEC scores with individual RIASEC scores.

Chapter 4: Results

Holland Code Comparison

Department-level three-letter Holland codes were reviewed using the PCI, EAT and DHOC environmental measures for each of the eleven departments included in the study. These codes are shown in Table 7. The environmental assessment data based on the PCI consistently implied higher levels of Investigative demands than did the EAT or the DHOC. This makes sense because a direct measure of the environments would be sensitive to the investigative demands of doctoral programs in a research-intensive university, while the indirect measures would not be. One interesting finding of this comparison is how high the PCI codes are on the RIASEC variables Investigative and Conventional. For all of the departments, Investigative was either the first or second highest Holland code, which is unsurprising in retrospect given the research nature of doctoral programs in a research university. The PCI Conventional scores were unexpectedly high, with C placing among the three highest codes for 8 of 11 departments. High Conventional demands within doctoral departments may reflect faculty concerns with standards including precision in citations, writing, and statistical calculations. Another interesting finding is how often Artistic appears among the 3-letter EAT Holland codes for these departments. The EAT Holland codes represent the aggregated student RIASEC type for each department and is a measure of all of the respondents for that department. Artistic was included in all of the EAT codes.

Student-Level Descriptive Statistics

Student level statistics are presented in Table 8 and include the mean student RIASEC scores, standard deviations, item totals, alpha reliability and lambda hat.

Student interest RIASEC scores have a potential range of one to five, with one indicating no interest and five indicating a high level of interest. RIASEC means of the student sample range from 2.16 to 3.25 with standard deviations ranging from .65 to .86. The highest average student RIASEC interest score was Social, while the lowest was Enterprising. There were 14 items on all RIASEC student interest scales. The alpha reliabilities for the student interest scale ranged from .90 to .94 and the lambdas hat (an estimate of the reliability with which the average department's RIASEC interests are measured by the EAT) range from .64 to .78.

Department-Level Descriptive Statistics

Departmental ratings scores were also explored by examining the mean, standard deviation, number of items, alpha reliability, and lambda-hat for each of the RIASEC scores derived from the PCI (see Table 9). PCI RIASEC scores have a potential range of one to three with one indicating low levels of departmental demands and rewards and three representing high levels of departmental demands and rewards. Department-level means for RIASEC variables ranged from 1.34 to 2.72 with standard deviations ranging from .26 to .45. The highest overall RIASEC score was Investigative, while the lowest was Realistic. Each RIASEC scale consisted of 14 items. The alpha reliabilities of the RIASEC variables ranged from .75 to .93. The estimated lambdas range from .01 to .93, and are surprisingly low for the Enterprising and Conventional scores. These lambdas depend on (a) the proportion of variance in the PCI scores between departments (rho) and (b) the number of persons completing PCIs in the average department. In the case of E and C scores, the rhos are very small (.01 and .26, respectively). Evidently, in the present sample of professors in UMCP departments, most of the variance in PCI E and C scores

reflects individual rather than departmental differences.

Student Self-Selection into Departments

Student self-selection into departments is important because according to Holland's theory, people tend to select work (or academic) environments that match their interests. From prior research, we know that if there is little variability in personality types within an occupation or school environment, it is difficult to predict satisfaction or career certainty using P-E congruence. There was concern whether doctoral students would have enough RIASEC profile variability so that some students would be congruent with their departments while others would not be. Table 10 shows the cross tabulations of student high-point codes as compared to departmental high-point codes when department is classified using the PCI, EAT and DHOC. Most of the student high-point codes were in Social (n = 101), Investigative (n = 95), and Artistic (n = 73). Fewer student high point codes were in Conventional (n = 13), Realistic (n = 8), and Enterprising (n = 2) although all RIASEC variables were represented.

The departmental environments, however, were more limited with the PCI high-point codes representing only two RIASEC categories (Investigative and Artistic), the EAT high-point codes representing three categories (Investigative, Artistic, and Social). The DHOC classifications identified five of the six RIASEC high point codes with Conventional being left out because none of the original doctoral programs had Conventional as the high-point code.

Kappa was calculated as a measure of agreement between student interest high-point codes and environmental high-point codes (see Table 11). All of the kappa calculations were nominally significantly different from zero at the p <.01 level with the

EAT (*kappa* = .34, *SE* = .04) demonstrating higher agreement with student interest codes than the PCI (*kappa* = .09, *SE* = .02) or the DHOC (*kappa* = .15, *SE* = .03). (The term "nominally" is used here because technically the significance test assumes independent observations whereas here students are clustered in departments.)

Traditional Congruence Indexes

Correlations of P-E congruence with Satisfaction and Career Certainty using the three environmental measures (PCI, EAT, and DHOC) as measured by the three traditional congruence indexes are displayed in Table 11. Correlations between the congruence scores (using Iachan's *M* Index, Brown and Gore's *C* Index, or High Point Code agreement) of the PCI with student interest scores were not significantly correlated ($p<.05$) with Satisfaction with the training environment or Career Certainty. Congruence scores based on the Dictionary of Holland Occupation Codes (DHOC) and student interest scores were not significantly correlated ($p<.05$) with either Satisfaction or Career Certainty for any of the three traditional congruence indices. Correlations between congruence scores of the EAT with individual interest profiles were significantly correlated with Satisfaction for both Iachan's *M* Index ($r = .12$, $p<.05$) and the *C* Index ($r = .13$ $p<.05$) but was not significantly correlated with HPC agreement ($r=.11$, $p>.05$). No significant correlations were found between the EAT data and student interest inventories for Career Certainty using the three traditional congruence indices.

The correlations between Satisfaction and Career Certainty and the PCI, EAT and DHOC data were examined separately for each of the 11 departments. The maximum, median and minimum correlations for the 11 departments and Satisfaction with Training Program are shown in Table 13. The minimum correlations were all negative, while the

maximum correlations were all positive with the median correlations centering in the vicinity of zero.

The maximum, median and minimum correlations for the 11 departments and Career Certainty are shown in Table 14. Again, the minimum correlations were all negative, while the maximum correlations were all positive with approximately half of the median correlations being negative and half being positive. This finding indicates that correlations hovered around zero for all P-E congruence indexes and does not support the congruence-satisfaction or congruence-career certainty hypotheses.

Statistical Interactions

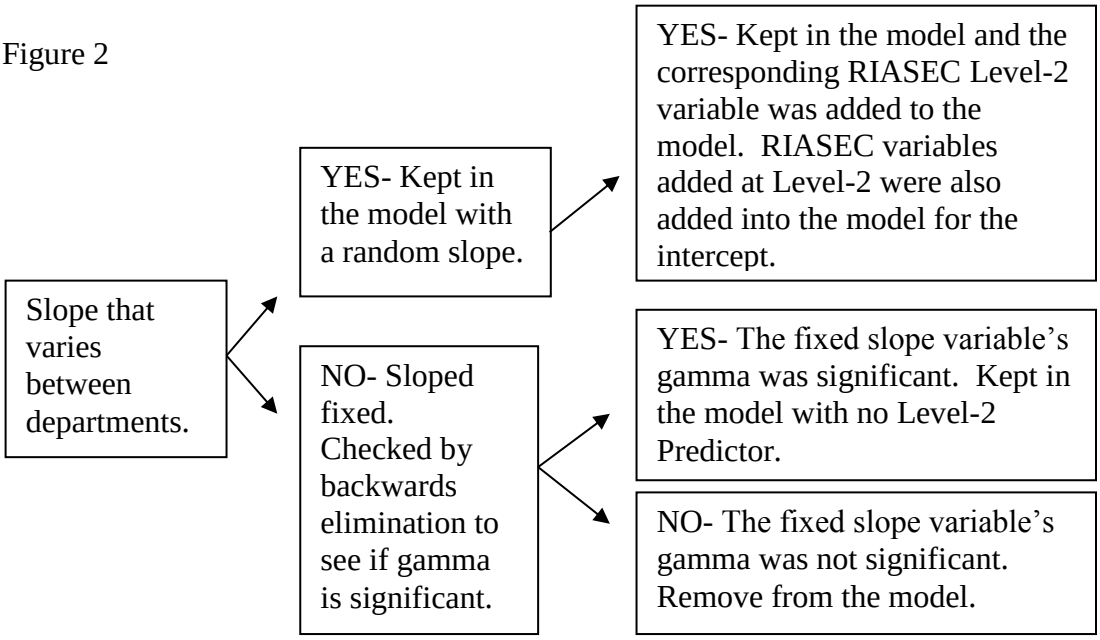
Cross-level interactions were investigated using a multi-level model. The two outcome scales, Satisfaction with the Training Environment and Career Certainty were each used as outcome variables in separate multi-level models and thus four models were created: PCI-Satisfaction (PCI-SAT), PCI-Career Certainty (PCI-CC), EAT-Satisfaction (EAT-Sat), EAT-Career Certainty (EAT-CC). No models were created using the DHOC, because about the classification procedure used generated a 3-letter RIASEC ordering but not six interval level RIASEC scores.

Theoretical model specification. The student level model (level-1) included RIASEC interest scores for individual students. Group centering was used at level-1. Initially, all RIASEC variables were entered at level 1 and the slopes were allowed to vary in order to check which slopes varied significantly across departments. The RIASEC variables with slopes that varied significantly among departments at the $p < .06$ were kept in the model with random slopes. Those RIASEC variables that did not have significant varying slopes were then made to have fixed slopes, and their coefficients in

the level-1 model were checked to see if they significantly added to the prediction of the response variable. This was done by checking to see if the corresponding gammas were significantly different from zero. Nonsignificant level-1 covariates were removed.

Level-2 predictors were departmental (environment) means from either the PCI or EAT, with the PCI being a direct measure of the environment and the EAT data representing the census method. The RIASEC departmental means from the PCI (or EAT) were entered at level two only for those variables with significant random slopes for the corresponding individual interest variable. For instance, the null hypothesis of fixed slope across departments for the Investigative interest variable was retained, so I did not test whether Investigative departmental demands predicted the level-1 slope. In contrast, because the slope in the within-department regression of satisfaction on Social interests varied significantly, the level-2 predictor Social demands were tested as a predictor of within-department slope to check for the cross-level interaction. Level-2 predictors were grand mean centered. The decision tree shown in Figure 2 provides a graphical explanation of the theoretical modeling.

Figure 2



PCI-satisfaction model. For the model for PCI-Satisfaction with Training Program, the Realistic, Social, and Conventional variables all had random slopes at level-1 that were significant, with the variable Enterprising being significant with a fixed slope. Both Investigative and Artistic interests were removed from the model. Level-2 (departmental level) predictor variables Realistic and Social had significant cross-level interactions with the respective interest measures: Realistic (γ=.36, *SE*=.13, p<.05) and Social (γ=.66, *SE*=.18, p<.05) (see Table 15). This indicates that when the departmental environment is higher in Realistic demands as measured by the PCI, Realistic interests are more strongly predictive of satisfaction with the training program, and when the departmental environment is higher in Social Demands as measured by the PCI, Social interests are more strongly predictive of satisfaction with the training program. The coefficient reflecting the cross-level interaction for Conventional environments was not significant (γ=*-08*, *SE*= .99, p>.05).

EAT-satisfaction model. For the model for EAT-Satisfaction with Training Program, Realistic, Social, and Conventional variables all had random slopes that were significant at level-1, with the variable Enterprising being significant with a fixed slope. Both Investigative and Artistic interests were removed from the model. Level-2 predictor (departmental level) Social, had a significant (γ = .71, *SE* = .15, p <.05) cross-level interaction with the respective interest variable (see Table 15). When the departmental environment is higher in Social demands as measured by the EAT, Social interests are more strongly predictive of satisfaction with training program. The level-2 predictors Realistic (γ = -.14, *SE* = .05, p >.05) and Conventional (γ = .82, *SE* = .46, p >.05) did not have significant cross-level interactions with the respective R and C interest

variables.

PCI-career certainty model. For the model for PCI-Career Certainty, the Realistic and Conventional variables had random slopes that were significant at level-1 with the variable Social achieving significance with a fixed slope. The variables Investigative, Artistic, and Enterprising interests were removed from the model. The level-2 predictor variables Realistic (γ = .13, *SE* = .12, p >.05) and Conventional (γ = .39, *SE* = .72, p >.05) did not have significant cross-level interactions when the PCI was used to measure the environment (see Table 16). Environmental demands did not significantly interact with person interests in this model.

EAT-career certainty model. For the model EAT-Career Certainty, the Realistic and Conventional variables had random slopes that were significant at level-1 with the variable Social achieving significance with a fixed slope. The variables Investigative, Artistic, and Enterprising were removed from the model. The level-2 predictor variables Realistic (γ = .08, *SE* = .18, p >.05) and Conventional (γ = .38, *SE* = .28, p >.05) did not have significant cross-level interactions when the EAT was used to measure the environment (see Table 16). Environmental demands did not significantly interact with person interests in this model.

So What Does Predict Satisfaction and Career Certainty

Because the tests of the congruence hypothesis with respect to satisfaction and career certainty involving traditional congruence indexes and the novel cross-level interaction approach provided weak and inconsistent support for the hypotheses, I decided to explore the data to see what else predicts Satisfaction and Career Certainty.

Other correlations with the outcome variables. Correlations among the two

dependent variables (Satisfaction and Career Certainty) and nine student demographic variables were reviewed in order to find whether any of the demographic variables were significantly correlated with the dependent variables. The demographic variables that were explored were: Years in the Program, Gender, Age, Milestones, and five levels of University Support: Fellowship, Research Assistantship, Teaching Assistantship, Non-Career Related Assistantship, and No Assistantship or Fellowship. Years in the Program is the student self-report of the number of years in their current doctoral program at the time of the survey. Scores ranged from 1 year to 10+ years and had a median of three and a half years (M=3.48, SD=2.04). Higher scores indicated more years in the program. Gender was coded with 1=male and 2=female with 60% of the respondents self-identifying female, 38% self-identifying male and 2% choosing not to answer. The mean age of the student participants was 32 years old, with a median of 30 years (SD = 8 years). The range in age of student participants was 22 years old to 73 years old. The variable Milestones represents how many milestones, out of five given options, each doctoral student had completed. The milestones that were queried were: finished thesis, completed Master's Degree, finished coursework, passed comprehensive exams, and/or dissertation proposal approved. This variable had a range from 0 to 5, a mean of 2.04, a median of 2.0, and a standard deviation of 1.52. The last five variables are indicators of University Support including: Fellowship, Research Assistantship, Teaching Assistantship, Non-Career Related Assistantship, or No Assistantship or Fellowship. Each of these items was queried separately and some respondents indicated that they had more than one form of university support. These items do not theoretically form a scale, and thus each item was examined separately. For these five items, yes=1 while no= 0.

The correlations of these variables with the two criterion measures are presented in Table 17.

Years in the Program and University Support: Fellowship (Fellowship) were both significantly correlated with both Satisfaction and Career Certainty. Milestones completed was significantly different correlated with Career Certainty but not with Satisfaction. Years in the Program and Milestones completed were negatively correlated with the outcome measures while having a fellowship had positive correlations with the outcome measures. The variables Years in the Program and Milestones completed were highly correlated. The fact that Milestones completed was significant is likely an artifact reflecting this correlation.

Attrition

Departmental attrition may affect the congruence because students who are incongruent are likely to leave the department. A direct measure of departmental attrition rates was not available, but it was possible to obtain statistics for the proportions of cohorts entering from 1999 to 2000 who graduated within 10 years. For departments that were not combined with other departments for this study, the number of doctoral students who entered into a department's program was divided by the number who graduated the same program within 10 years of entering. Those who had not graduated the program within 10 years were assumed to have left the program. For those departments that were combined by the university or for this study, the total number of graduate students who had entered into programs within these departments was divided by the total number of students who had graduated within 10 years. A few programs did not have any gradation data available because they were not in existence under their current program name in the

years 1999 and 2000, and thus were not included in the attrition calculations. The proportions of students who entered the doctoral programs included in this study and who completed their program within 10 years range from .40 to .78 with an overall mean of .57.

The correlations of departmental graduation rates (the percentage of student who had graduated within 10 years) with aggregated departmental data for all nine congruence measures (PCI-Iachan's *M* Index, PCI-*C* Index, PCI-HPC; EAT-Iachan's *M* Index, EAT-*C* Index, EAT-HPC, DHOC-Iachan's *M* Index, DHOC-*C* Index, and DHOC-HPC) and with satisfaction and career certainty were examined. Table 18 displays the results. Graduation rates were not significantly correlated with any of the nine congruence indexes, with correlations ranging from .05 to .37 in this small sample. Satisfaction and percentage graduated were substantially but not significantly correlated (r =.45, p> .05) in this very small sample of departments. Career Certainty and percentage graduated were significantly correlated (r =.61, p <.05) at the departmental level.

Congruence Index Correlations

The correlations between congruence indexes were explored to examine the extent to which they provide convergent estimates of congruence. These correlations are reported for individual student data in Table 19 and for data that had been aggregated at the departmental level in Table 20. At the student level, the alternative congruence indexes *within* each of the three environmental measures (PCI, EAT, and DHOC) were highly correlated with each other (i.e. The PCI-Iachan's *M* scores were highly correlated with the PCI-*C* scores and the PCI-HPC scores, etc.). Of the three environmental measures, the PCI had the highest variability of within-source congruence correlations

(ranging from r =.44 to r =.80). The alternative congruence indexes had higher within environmental-measure correlations when EAT or the DHOC was the source of environmental classification, with correlations ranging from r =.77 to r =.81 (EAT), and from r =.72 to r =.82 (DHOC). The EAT and the DHOC congruence indexes were highly correlated with each other, while neither of them were consistently highly correlated with the PCI congruence indexes.

The correlations in Table 20 for aggregated data were much higher and more stable for all of the environmental measures.

Chapter 5: Discussion

The literature on person-environment congruence has had mixed results in using congruence scores to predict satisfaction. Holland's theory implies that persons will enter and persist in occupations where the demands and tasks are congruent with the personality types the individuals most resemble. Those persons whose occupational interests do not match the environmental demands are expected to be dissatisfied and leave the environment, all other things being equal. The present study used both traditional congruence indexes and multi-level modeling to investigate person-environment congruence and its relation to satisfaction and career certainty. Traditional congruence indexes were not very useful in predicting Satisfaction with the training environment and were not at all useful in predicting Career Certainty. Multi-level modeling was conducted to examine if this approach to conceptualizing congruence as a cross-level person-environment interaction had utility. In the present research, multi-level modeling of cross-level interactions received some support in accounting for Satisfaction, but it was not useful in accounting for Career Certainty.

Correlations between student demographic variables and Satisfaction and Career Certainty were explored to investigate the possibility that they would predict the outcome variables. The number of years in a doctoral department and having a fellowship were significantly correlated with Satisfaction while years in the department, having a fellowship and the number of milestones towards a degree that the student had completed were significantly correlated to Career Certainty. The number of years that a student had spent in their doctoral department was negatively correlated with both Satisfaction and Career Certainty. The number of milestones that a student had attained towards their

doctoral degree was also negatively correlated with Satisfaction and Career Certainty but the correlation only reached significance for the latter. The number of the years that students had spent in their doctoral program was significantly correlated with the number of milestones they had reached. With these variables being highly correlated, it may be that they are both measuring aspects of the same thing, how long the student has been in their doctoral training environment. Spending a long time in a doctoral training program may be due to the failure to make timely progress. It appears that having a fellowship may be related to making timely progress and thus may increase satisfaction with one's training program.

While the previous research has largely ignored or used environmental measures interchangeably, the findings of this study indicate that the DHOC, EAT, and PCI are each unique indicators of environment. The PCI results indicated very high Investigative demands in this university's doctoral departments. The DHOC estimation procedure likely produced estimates of departments in these areas implying a less Investigative nature because most college and university departments are not as intensively research oriented as those in the University of Maryland. The EAT indicates the student personality types within the departments, which may or may not represent the true departmental demands. It is clear that more research should be done to explore the best ways to measure environments.

The following sections discuss the six research questions were posed in this study.

Departmental Homogeneity

An examination of the data implied that none of the eleven individual or

recombined departments were so heterogeneous as to warrant exclusion from the study (either on the basis of the PCI measures or the interests of student inhabitants). The doctoral departments or grouped programs must be sufficiently homogeneous to be considered environments characteristic of specific environmental types; and the sample of departments must be sufficiently heterogeneous with respect to type to provide for test of the congruency hypothesis. For instance, in the present department of Counseling, Higher Education, and Special Education the following specialty areas are represented: school counseling, rehabilitation counseling, counselor education (self-consciously *not* psychological counselor education), counseling psychology, school psychology, special education, international higher education, higher education policy, and college student personnel). In the absence of evidence from the assessment of the department, one might expect that some of these specialties to most resemble the Social environmental type, some Investigative, and perhaps some Enterprising. If the PCI assessment data displayed very high within-department standard deviations (and little distinction among departments), then it would be difficult to consider departments to be sufficiently homogeneous entities to treat as a single environment.

For this study, it was deemed necessary to combine several departments for data analysis either because the departments had been recently combined by the university or because there were too few student or professor respondents for the department to be included on its own. Department combinations were carefully considered for apparent homogeneity with respect to Holland type; and the means, standard deviations, and three letter Holland codes of both the students and the professors were reviewed. Departments were only combined if the combination was judged to be appropriate (i.e. Mechanical

Engineering and Material Science and Engineering), if they had similar three-letter Holland codes for both students and professors, if their means were fairly close and if their standard deviations were acceptable (under .50 for departmentally aggregated PCI data and under 1.15 for departmentally aggregated student interest data). While these program combinations increased the number of departments in the study, they represent a threat to internal validity which is discussed later in the chapter.

Congruence and Satisfaction

An important finding from this analysis is that congruence (as measured by traditional congruence indexes) was a poor predictor of student satisfaction with their department. The relationship between student satisfaction with their doctoral department and congruence was assessed by nine congruence indexes. These nine congruence indexes were created by comparing each student's interest profile to three environmental measures. These nine are based on the PCI, EAT, and DHOC environmental assessment methods and the three traditional congruence indexes: Iachan's *M*, Brown and Gore's *C*, and High-Point Code (HPC) agreement. Correlations of P-E congruence with Satisfaction ranged from $r = -.30$ to $r = .13$. A meta-analysis by Assouline and Meir (1987) reviewed 53 studies on the congruence-satisfaction relationship and found that an overall mean correlation of .21. This study did not achieve any correlations of that magnitude.

When the PCI was used as the environmental measure, congruence was not significantly correlated with satisfaction using any of the three congruence indexes. Similarly, when the DHOC was used as the environmental measure, congruence was not significantly correlated with satisfaction using any of the three congruence indexes. When the EAT was the source of the environmental classification, two of the indexes

significantly predicted satisfaction: Iachan's *M* (r =.12, p<.05), and *C* (r=.13, p<.05), while the HPC agreement did not (r=.11, p>.05). Correlations based on the EAT may be biased upwards if the EAT environmental classification is based on the same sample of individuals as those involved in the congruence study, as is the present case.

The congruence-satisfaction minimum, median and maximum correlations were explored for the eleven individual departments. All of the minimum correlations for the three traditional congruence measures were negative, all of the maximum correlations where positive, and the median correlations hovered around zero. This finding indicates that the congruence-satisfaction match was poorly predicted by all three environmental measures including the PCI, DHOC and EAT.

Using multi-level models to explore the influence of P-E congruence on satisfaction produced somewhat more support for the congruence hypothesis. Models involving RIASEC student predictors at level-1 and RIASEC department variables at level-2 were evaluated for both the PCI and EAT environmental measures. Using the PCI as the environmental measure, small to medium cross-level interactions of the expected kind were found for both Realistic and Social person-environment combinations. For Investigative, Artistic, and Enterprising interests, the null hypotheses that a common regression slope characterized all of the departments was retained, and the cross-level interaction was therefore not explored. Although the regression slope of Satisfaction on Conventional interests did have significant variability across departments, it was not predicted by Conventional environmental demands. Accordingly, the results provide partial support for the congruence hypothesis in the context of these eleven departments.

Congruence and Career Certainty

Contrary to expectations, career certainty and intention to remain within the doctoral training program was not significantly related to congruence as measured by the traditional congruence indexes or by multi-level modeling. None of the correlations between the three traditional congruence indexes and the three environmental measures significantly predicted career certainty. Career certainty was poorly predicted by congruence index scores based on all three of the sources of environmental classification--the PCI, EAT, and DHOC.

It was hypothesized that the Career Certainty scale, which intended to measure both career certainty and intention to remain within the department, would be significantly correlated with P-E congruence. Career certainty and intention to remain in the department is important because doctoral student spend a lot of time and money for their degrees and many doctoral programs spend significant amounts of money by way of stipends and tuition reimbursement to support the students. Studies suggest that attrition from doctoral programs is between 40% and 50% (Smallwood, 2004). In the departments included in the study, a mean of 57% of doctoral students graduated from their program of study within 10 years. Peter Diffley, an associate dean of the Graduate School of Notre Dame and a researcher who studies post-secondary attrition reported at a conference (Smallwood, 2004) that if Notre Dame could reduce attrition by 10%, it would save the university one million dollars a year in stipends alone. Diffely stipulated that the university could save that much money because departments would stop over-enrolling students to compensate for attrition. If P-E congruence was able to predict career certainty and intent to persist in the environment, it could have big implications for

doctoral student selection. Alas, it did not.

Direct Environmental Assessment with the PCI

It was hypothesized that traditional P-E congruence calculated using person-PCI congruence scores would be better at predicting satisfaction and career certainty than using person-DHOC or person-EAT congruence scores. This was not the case. P-E congruence calculated by comparing PCI to the measure of person interest was not significantly correlated with satisfaction or career certainty. No significant correlations were found when using the DHOC as the environmental measure to calculate P-E congruence. Congruence as measured by comparing the EAT data to the measure of person interest was significant for two of the three traditional congruence indexes (Iachan's *M* and *C*) for satisfaction, but was not correlated with career certainty. The EAT data were derived from persons in this sample and correlations based on the EAT may be biased upwards. Median correlations for the 11 individual departments using the PCI, DHOC and EAT as the environmental measure for both satisfaction and career certainty hovered around zero. This finding indicates that all three environmental measures when individually paired with the measure of person interest (PCI-person, DHOC-person, and EAT-person) are equally poor predictors of satisfaction and career certainty when calculating P-E congruence.

Multi-level models were constructed to examine students nested in departmental environments. While the multi-level models were slightly better able to predict satisfaction, the PCI was not superior to the EAT, with both environmental measures achieving similar results.

Departmental Attrition and Congruence

Departments with higher attrition were not statistically significantly more congruent than those with lower attrition as according to the correlations between attrition and the aggregated nine congruence indices (3 indexes and 3 sources of environmental classification). At the same time, the percentage of students who completed their doctoral program within ten years was substantially correlated with Career Certainty ($r = .61$, $p < .05$) and but not with Satisfaction in this small sample of departments ($r = .45$, $p > .05$).

Convergent and Discriminant Validity of the PCI

Table 19 and Table 20, show correlations among congruence indexes based in part on the different environmental measures. Individual student level data demonstrates that that PCI-based congruence indexes were somewhat correlated with EAT- and DHOC-based indexes. These correlations were larger in data aggregated to the department level.

Agreement between person interest and environmental measures was calculated using kappa (see Table 11). Agreement was highest for the EAT, followed by the DHOC and then the PCI. Note that only two environmental types are represented by high-point codes based on the PCI (I and A), whereas more types are represented among EAT- and DHOC-based codes.

Other Findings

Correlations among student-level and aggregated congruence indexes based on different environmental measures was explored. Correlations within environmental measure types were high on both the student-level and the aggregated student-level. Correlations among agreement indexes based on different environmental measures were

much higher for the aggregated than for the student-level indexes.

Limitations

The limitations of the present study include a very small sample of departments, small numbers of individuals within departments, the use of different methods to identify the departments for students and faculty, the combination departments for the study, and the poor representation of a diversity of environmental types among the departments represented in the sample. I was hoping to have much better response rates from students and professors. The response rate for students was 15% and the response rate for professors was 13%. A total of 292 students and 106 professors were used in the 11 department final sample, thus each department had a small number of students and professors for the analysis. The mean number of students in each department was 27 while the mean number of professors was 10. A small sample size has a greater probability that the observations in the study happened by chance and thus it is harder to find significant relationships. The within department sample may have been too small to detect significant correlations between the variables.

The sample of doctoral students that was used in this study contains a larger percentage of women than characterizes the doctoral student population in the university. As Table 4 showed, of students who were included in this study 59% (*n*=174) were female and 39% (*n*=113) were male. The published 2012-2013 demographics of students at the University of Maryland, College Park indicate that out of a total 4342 doctoral students, 56% were male (*n*=2437), while 44% were female (*n*=1905). The gender difference between the respondents and the overall total doctoral students is most likely due to the under-representation of Investigative (science and engineering) departments in

the sample; recall that only a fraction of Investigative departments were sampled because there were so many of them.

The large limitation of this study was the combination of departments. Departments were combined for two reasons: if the university had merge several departments into one new department, or if by combining several like departments, there was sufficient data to include the combined department in the study. It is likely that the departments that had been merged by the university have somewhat similar environmental demands. The departments that were combined for this study had similar student interest RIASEC profiles and similar demands on the PCI, but nevertheless, this is a limitation because it was a manufactured combination of departments. Correlations between congruence and satisfaction and congruence and career certainty were calculated using the six "pure" departments or the departments that each had at least 10 student respondents and six professor respondents. None of these correlations was significantly different from zero, see Table 21. There is not clear evidence that the correlations are higher in departments that have not been combined. The generalizability of results to doctoral departments at other universities is unknown.

The limited range of environmental models included in the study is another limitation. I hoped that by choosing doctoral departments, the range of environmental models would be larger due to the fact that doctoral students often engage in the type of work they are studying. Instead, I found that most of the doctoral departments studied were very highly investigative, due to the focus on research. In the future, it may be helpful to use a sample with more diverse environmental model, i.e. a community college, which might have a more diverse range of environments.

Another study limitation was the use of the email reflector list to gather the sample. Individual emails were not made available for research and there was no way to check that the recruitment emails went to the intended recipients. The unavailability of individual student and faculty member email addresses also made it impossible to target reminders to non-respondents, which is responsible in part for the relatively low response rates for both groups.

Although several covariates were significantly correlated with the outcome variables Satisfaction and Career Certainty, these control variables were not accounted for in the multi-level model calculations. Because these covariates were not controlled for it remains possible that some of the relationships observed may be spurious, at least in part, due to variance shared with these other variables.

M. Miller suggested (personal communication, October, 25, 2012) that perhaps it may be peoples' perceptions of their own environment that are important rather than the objective environment. Holland clearly intended a dual typology and that both persons and environments have measurable characteristics. This is clear from the statement of the theory that delineates these environmental characteristics, the empirical accounts of environments provided in the DHOC. However that may be, when an individual completes the PCI, a great deal of the resulting description may reflect idiosyncratic views. In the current research, I was testing Holland's theory as he described it.

Threats to internal validity. The largest threat to internal validity is a selection threat resulting in range restriction which comes about because individuals self-select into congruent environments. Doctoral students generally choose universities and departments that are well matched to their skills, personalities, and future occupational

desires. This study had smaller amount of variance within departments than would be found if doctoral students could be assigned training programs randomly. Helm's (1996) study was able to find large effects for high school students who were asked to "try out" congruent and incongruent job kits. An experimental study involving the random assignment of graduate students to departments is not feasible, thus a study of the self-selected environments will have to do. Table 10 shows student high point codes cross tabulated with environmental high point codes. Students tended to select congruent environments, but there was a limited range of environments as measured by both the PCI and EAT. Most of the doctoral students (92%) had Investigative, Artistic, or Social high point interest codes, while only 8% had Realistic, Entrepreneurial, or Conventional high point interest codes. Student self-selection into congruent departments limits the ability to test the congruence hypothesis because when persons are in congruent environments, the differences in satisfaction come not from congruence but from outside factors. I would expect to find larger effect estimates if the students were randomly allocated to departments regardless of their interests.

Another threat to internal validity was attrition. While attrition was not directly measured, department degree completion rates were examined. Department degree completion rates were expected to restrict the range of congruence and bias observed correlations between congruence and satisfaction downward, but that did not appear to be the case. Completion rates were used to consider the notion that those who are incongruent with their departmental environment would attrit leaving those students who were more congruent. As shown in Table 18, correlations between the percentage of students who graduated within ten years of entering their doctoral program and

aggregated congruence scores from P-E congruence measures were all positive but not significantly so.

A third threat to internal validity was respondent self-selection into the study. The respondents who chose to complete the measures may have differed from those who did not complete the measures. It is not unreasonable to think that those who are not congruent with their doctoral programs are unwilling to talk about it because of their unhappiness in their department.

Threats to external validity. The choice to conduct this research with doctoral students at a single university restricts generalization. It may be useful to extend this study using a broader sample of training programs and universities. Another threat to external validity is that, while it was attempted to have a variety of departments represented, it did not occur, with most of the departments being highly Investigative as measured by the PCI. A more representative RIASEC sample would have been preferable.

Threats to Construct Validity

Threats to the Construct Validity of this research include the choice of the person interest scale, the combination of departments, and the lack of sufficient numbers of PCI's per department.

The choice to use the IIP scales was made because of cost and ease of availability. The scale created by Liao, Armstrong, and Rounds (2007) is free and available to anyone on the Internet. The IIP has been used in few research articles and has not been correlated, as far as I know, with measures of resemblance to the six personality models developed by Holland. The combination of several departments was completed just for

the study and thus threatens construct validity. The PCI had good alpha reliability but some low lamdas-hat indicating that there may have not been a sufficient number of raters within departments. This presents a problem, because reliable environmental assessments are required to compute valid congruence indexes for the individuals occupying those environments.

Implications for Research and Practice

While the predictive ability of the PCI did not fare much better than the EAT or the DHOC when paired with individual interests using traditional congruence scores or multi-level models, more work remains required to learn if it provides a better measure of the environment than available indirect classification methods. The PCI has a lot of potential as a direct measure of the environment, but the rater sample size and departmental diversity may have been too low in this research. Studies that use higher numbers of PCI raters and a wider variety of environmental types are warranted.

Multi-level models provided some additional information about P-E congruence and future studies could be used to examine the usefulness of this new way to look at congruence. The slopes-as-outcomes models provide a new way to measure P-E congruence as it relates to outcome variables and should be explored in future research.

Table 1

Iachan's M *Index Score Assignment*

	Environment			
Personality	First Letter	Second Letter	Third Letter	Other Letters
First Letter	22	10	4	0
Second Letter	10	5	2	0
Third Letter	4	2	1	0

Table 2

Examples of Iachan's M *Index Congruence Scores*

Person Interest Code	Environmental Code	Score
CES	ESC	4 + 10 + 2 = 16
SIC	SAI	22 + 2 + 0 = 24

Table 3
Final Department Sample Including Department Combinations, Student Respondent Numbers and Teacher Respondent Numbers

	Students	Profs.
Single Departments		
Business and Management	**13**	**11**
Government and Politics	**13**	**6**
School of Music	**10**	**7**
University Combined Departments		
Human Development, Quantitative Methods	0	4
Education: Human Develop	18	2
Education: Measurement, Statistics	4	0
Total	**22**	**6**
Counseling, Higher Education, and Special Ed.	0	9
Education: Counseling and Personnel Services	32	4
Education: Leadership, Higher Ed and Internat. Ed.	24	0
Special Education	12	1
Total	**68**	**14**
Teaching, Learning, Policy, and Leadership	0	7
Education: Curriculum and Instruction	37	2
Total	**37**	**9**
Departments Combined for this Study		
Animal Science	6	7
Behavioral, Ecology, Evolution, and Systematics	5	0
Marine, Estuarine, Environmental Sciences	18	1
Plant Science	4	7
Total	**33**	**15**
Materials Engineering	9	2
Mechanical Engineering	17	6
Total	**26**	**8**
Civil Engineering	16	5
Electrical and Computer Engineering	20	3
Total	**36**	**8**
Comparative Literature	2	0
English Language and Literature	16	7
Total	**18**	**7**
Art History and Archeology	5	7
History	11	8
Total	**16**	**15**

Note. Total department numbers are bolded.

Table 4

Doctoral Student Demographics

Gender	*N*	%
Male	113	39
Female	174	59
Not reported	5	1
Years in Current Program		
1-3	162	55
4-6	106	36
7-9	19	7
10+	5	2
Full-Time or Part-Time		
Full-Time	237	81
Part-Time	54	18
Not reported	1	1
Expected Graduation Date		
2011	19	7
2012	79	27
2013	79	27
2014	56	19
2015	37	13
2016	17	6
2017	4	1
2018	1	<1
Age		
22-32	184	63
33-42	65	22
43-52	17	6
53-62	9	3
63-73	2	<1
Missing	15	5
Ethnicity		
White	187	64
Black/ African-American	18	6
Asian	36	12
Hispanic	11	4
Mixed/ Biracial	5	2
Arab/ Middle Eastern	4	1
International-Other	3	1
Not reported	28	10

Note. Student respondents *N*=292. Decimals omitted.

Table 5

*Alpha Coefficients for 14-item PCI Scales Completed by Professors (*N = *99-105)*

Scale	alpha
Realistic	.93
Investigative	.78
Artistic	.91
Social	.86
Enterprising	.75
Conventional	.78

Table 6

*Alpha Coefficients for 14-item IIP Scales Completed by Doctoral Students (*N=*280-290)*

Scale	alpha
Realistic	.94
Investigative	.93
Artistic	.92
Social	.92
Enterprising	.90
Conventional	.93

Table 7

Aggregated PCI, EAT and DHOC Codes for the 11 Departments Included in the Study

Dept. No.'s	Department Names	PCI	EAT	DHOC
1.	Business and Management	ICS	ASI	ESR
2.	Government and Politics	ICS	AIS	SEI
3.	School of Music	AIS	ASC	ASE
4.	Human Development, Quantitative Methods Education: Human Develop Education: Measurement, Statistics	ISC	SIA	IES
5.	Counseling, Higher Education, and Special Ed. Education: Counseling and Personnel Services Education: Leadership, Higher Ed and Internat. Ed. Special Education	ISC	SAI	SEI
6.	Teaching, Learning, Policy, and Leadership Education: Curriculum and Instruction	ISC	SAI	ESA
7.	Animal Science Behavioral, Ecology, Evolution, and Systematics Marine, Estuarine, Environmental Sciences Plant Science	ICS	ISA	RIE
8.	Materials Engineering Mechanical Engineering	ICS	ISA	RIE
9.	Civil Engineering Electrical and Computer Engineering	ICS	IAS	IRE
10.	Comparative Literature English Language and Literature	AIS	ASI	ASE
11.	Art History and Archeology History	IAS	ASI	ERS

Note. Department numbers were only included to help the reader see departmental groupings. The EAT data represent the aggregated student Holland code for each department.

Table 8

Student RIASEC Interest Score Means, Standard Deviations, Number of Items, alpha Reliability and lambda-hat (N =292 Students)

		Mean	Standard Deviation	Number of Items	alpha Reliability	lambda-hat
R	Interest	2.17	.80	14	.94	.78
I	Interest	3.09	.84	14	.93	.74
A	Interest	3.06	.86	14	.92	.70
S	Interest	3.25	.74	14	.92	.75
E	Interest	2.16	.65	14	.90	.68
C	Interest	2.27	.72	14	.93	.64

Note. Lambdas-hat show the estimated department-level reliability of EAT scores for a department with the average sample size in the present research.

Table 9

*Department RIASEC Position Classification Inventory Score Means, Standard Deviations, Number of Items, alpha Reliability and lambda-hat (*N *=106)*

		Mean	Standard Deviation	Number of Items	alpha Reliability	lambda-hat
R	Demands	1.34	.42	14	.93	.89
I	Demands	2.72	.26	14	.78	.89
A	Demands	1.96	.45	14	.91	.93
S	Demands	2.18	.36	14	.86	.78
E	Demands	1.83	.27	14	.75	.01
C	Demands	2.15	.29	14	.78	.26

Table 10

Crosstabs of Student Self-Selection into Departments as Measured by Student High-Point Codes Compared with High-Point Codes of Environmental Measure (PCI, EAT, DHOC)

	Student High Point Code						
Environmental Measure and High Point Code	R	I	A	S	E	C	Total Students by Environmental Code
PCI							
I	8	93	55	93	2	13	264
A	0	2	18	8	0	0	28
EAT							
I	7	56	14	11	1	6	95
A	1	13	34	20	1	1	70
S	0	26	25	70	0	6	127
DHOC							
R	3	42	4	9	0	1	59
I	4	21	14	11	1	7	58
A	0	2	18	8	0	0	28
S	0	15	14	49	0	3	81
E	1	15	23	24	1	2	66
Total Students by Interest Inventory	8	95	73	101	2	13	292

Note. Student *N* =292, EAT *N*=292, PCI raters per department *N*= 6-15.

Table 11
Kappa and Standard Error for the Crosstabulations of Student High-Point Codes with Environmental Measure High-Point Codes (Doctoral Student N=292).

Environmental Measure	Kappa	Standard Error
PCI	.09	.02
EAT	.34	.04
DHOC	.15	.03

Note. All kappas are significantly different than zero at the .01 level.

Table 12

Correlations of Satisfaction with Department and Career Certainty with Alternative Traditional Congruence Indexes Based on Different Sources of Environmental Information

Environmental Measure and Congruence Index	Satisfaction	Career Certainty
PCI		
Iachan's *M*	-.02	-.04
C Index	-.01	-.04
HPC	-.03	-.07
EAT		
Iachan's *M*	.12	.00
C Index	.13	.02
HPC	.11	-.01
DHOC		
Iachan's *M*	.10	.08
C Index	.10	.08
HPC	.08	.07

Note. N of students =292. Correlations larger in absolute value than 12 are nominally significantly different from zero at the .05 level.

Table 13

Correlations Between Satisfaction with Training Program and Congruence Measured in Different Ways: Minimum, Median, and Maximum Within-Department Correlations

Source of Environmental Information and Congruence Index	Minimum	Median	Maximum
PCI			
Iachan's *M*	-0.45	-0.05	0.26
C Index	-0.32	-0.08	0.40
HPC	-0.39	-0.01	0.38
EAT			
Iachan's *M*	-0.18	0.06	0.30
C Index	-0.15	0.18	0.26
HPC	-0.39	0.14	0.38
DHOC			
Iachan's *M*	-0.35	0.10	0.36
C Index	-0.22	0.11	0.39
HPC	-0.39	0.06	0.38

Table 14

Correlations Between Career Certainty and Congruence Measured in Different Ways: Minimum, Median, and Maximum Within-Department Correlations

Source of Environmental Information and Congruence Index	Minimum	Median	Maximum
PCI			
Iachan's *M*	-0.23	-0.03	0.15
C Index	-0.30	0.02	0.50
HPC	-0.32	-0.02	0.17
EAT			
Iachan's *M*	-0.25	-0.01	0.19
C Index	-0.29	0.04	0.33
HPC	-0.33	0.04	0.17
DHOC			
Iachan's *M*	-0.40	0.06	0.44
C Index	-0.26	0.12	0.36
HPC	-0.23	-0.03	0.15

Table 15

Theory Testing- Coefficients for Departmental Characteristics for Satisfaction: gammas for Level-1 betas

	PCI-SAT		EAT-SAT	
Departmental Characteristic as Predictor of Slope for Student Interest	Coefficient	SE	Coefficient	SE
Department R demands on Student R Interests	.36*	.13	-.14	.20
Department S Demands on Student S Interests	.66*	.18	.71*	.15
Department *C* Demands on Student *C* Interests	-.08	.99	.82	.46

Note. This table shows covariate-adjusted coefficients in the regression of within department slopes for interest on the departmental mean for the respective environmental demand. PCI-SAT= the Position Classification Inventory used as the environmental measure to predict satisfaction. EAT-SAT= the Environmental Assessment Technique used as the environmental measure to predict satisfaction.

*Coefficients significantly different from zero, $p<.05$.

Table 16
Theory Testing- Coefficients for Departmental Characteristics for Career Certainty: gammas for Level-1 betas

	PCI-CC		EAT-CC	
Departmental Characteristic as Predictor of the Slope for Student Interest	Coefficient	SE	Coefficient	SE
Department R Demands on Student R Interests	.13	.12	.08	.18
Department *C* Demands on Student *C* Interests	.39	.72	.38	.28

Note. This table shows covariate-adjusted coefficients in the regression of within department slopes for interest on the departmental mean for the respective environmental demand. PCI-CC= the Position Classification Inventory used as the environmental measure to predict career certainty. EAT-SAT= the Environmental Assessment Technique used as the environmental measure to predict career certainty. None of the coefficients had slopes that significantly differed from zero.

Table 17

Correlations of Satisfaction with Training Program and Career Certainty with Student Characteristics (*N*=292).

	1. Sat	2. Cert	3. Yrs	4. Gend	5. Age	6. Mile	7. Fellow	8. RA	9. TA	10. NCRA	11. None
1. Satisfaction (Sat)	-										
2. Career Certainty (Cert)	.73	-									
3. Years in the Dept. (Yrs)	-.22	-.31	-								
4. Gender (Gend)	.02	-.03	.15	-							
5. Age	.02	.00	.34	.00	-						
6. Milestones (Mile)	-.06	-.13	.60	.00	.18	-					
7. University Support Fellowship (Fellow)	.19	.14	-.08	.05	-.19	-.06	-				
8. University Support Research Assistant. (RA)	-.04	-.11	-.14	.02	-.33	-.10	.09	-			
9. University Support Teaching Assistant. (TA)	-.06	-.04	.03	.05	-.19	.13	.16	.02	-		
10. University Support Non-Career Related Assistant. (NCRA)	-.10	-.08	.09	.08	-.01	.00	-.10	-.17	-.08	-	
11. University Support No Assistantship or Fellowship (None)	.01	.05	.23	-.08	.50	.15	-.33	-.46	-.36	-.18	-

Note: Correlations larger than .13 in absolute value are significantly different from zero.

Table 18

Correlations Between the Percentage of Students who Graduated Within Ten Years of Entering Their Doctoral Program and Aggregated Congruence Scores from Nine P-E Congruence Measures.

Environmental Measure and Congruence Index	Correlation
PCI- Iachan's *M* Index	.24
PCI- *C* Index	.05
PCI- HPC	.37
EAT- Iachan's *M* Index	.24
EAT- *C* Index	.30
EAT- HPC	.24
DHOC- Iachan's *M* Index	.30
DHOC- *C* Index	.35
DHOC- HPC	.20

Note. $N = 11$ departments. None of the correlations were significantly different from zero.

Table 19

Correlations Among Student-Level Congruence Indexes (Iachan's M*, Brown and Gore's* C *Index, and the High Point Code) Based on Different Environmental Measures (*N*=292 Doctoral Students).*

Environmental Measure And Average Congruence Index	PCI			EAT			DHOC		
	Iachan's *M*	*C* Index	HPC	Iachan's *M*	*C* Index	HPC	Iachan's *M*	*C* Index	HPC
PCI Iachan's *M*	-								
PCI C Index	44	-							
PCI HPC	63	80	-						
EAT Iachan's *M*	32	00	08	-					
EAT C Index	17	-15	00	77	-				
EAT HPC	19	-06	04	81	80	-			
DHOC Iachan's *M*	26	-01	00	39	31	43	-		
DHOC *C* Index	09	09	08	34	22	37	72	-	
DHOC HPC	10	-07	-06	40	40	54	82	74	-

Note: Decimals omitted. Correlations larger than absolute value 15 are nominally significantly different from zero. Environmental Measures: PCI= Position Classification Inventory; EAT= Environmental Assessment Technique; DHOC= The Dictionary of Holland Occupation Codes. Congruence Indexes: Iachan's *M*= Iachan's *M* Index; *C* Index= Brown and Gore's *C* Index; HPC=High Point Codes.

Table 20

Correlations Among Aggregated Student-Level Congruence Indexes (Iachan's M*, Brown and Gore's* C *Index, and the High Point Code) Based on Different Environmental Measures (*N=*11 departments).*

	PCI			EAT			DHOC		
Environmental Measure and Average Congruence Index	Iachan's *M*	*C* Index	HPC	Iachan's *M*	*C* Index	HPC	Iachan's *M*	*C* Index	HPC
PCI Iachan's *M*	-								
PCI C Index	83	-							
PCI HPC	78	86	-						
EAT Iachan's *M*	84	61	50	-					
EAT C Index	71	55	50	91	-				
EAT HPC	79	62	69	85	91	-			
DHOC Iachan's *M*	58	45	42	41	40	46	-		
DHOC *C* Index	68	60	60	55	58	65	95	-	
DHOC HPC	58	43	43	37	41	52	95	90	-

Note: Decimals omitted. Correlations larger than 60 are nominally significantly different from zero at the $p < .05$ level. Environmental Measures: PCI= Position Classification Inventory; EAT= Environmental Assessment Technique; DHOC= The Dictionary of Holland Occupation Codes. Congruence Indexes: Iachan's *M*= Iachan's *M* Index; *C* Index= Brown and Gore's *C* Index; HPC=High Point Codes.

Table 21

Correlations of Satisfaction with Department and Career Certainty with Alternative Traditional Congruence Indexes Based on Different Sources of Environmental Information: Departments that Did Not Have to Be Combined Only (*N* Departments = 6)

Environmental Measure and Congruence Index	Satisfaction	Career Certainty
PCI		
Iachan's *M*	-.10	-.14
C Index	-.03	-.02
HPC	.08	.14
EAT		
Iachan's *M*	.00	-.12
C Index	.13	.00
HPC	-.03	.13
DHOC		
Iachan's *M*	-.03	-.08
C Index	.04	.01
HPC	.00	.01

Note. *N* of students =81

Appendix A

Holland's High Point Code

This index is calculated by comparing first letters of Personality and Environmental Patterns.

Degree 4- Identical first letters (R and R)

Degree 3- Adjacent first letters (R and I)

Degree 2- Two Removed first letters (R and E)

Degree 1- Opposite first letters (R and S)

Table A1
Holland's High Point Code

Degrees of Congruence	Personality Pattern	Environmental Pattern
Degree 4 (Identical)	RIA	RAC
Degree 3 (Adjacent)	RIA	IAC
Degree 2 (Two Removed)	RIA	EAC
Degree 1 (Opposite)	RIA	SAC

Appendix B

The *C* Index

The *C* Index is calculated by first finding the value of the first letter match of the Environmental and Personality patterns. A score of three is given to exact matches; a score of two is given to adjacent matches; a score of one is given to matches that are two letters removed; and a score of zero is given for opposite hexagonal letters. The scores are then multiplied by three for the first letter match; two for the second letter match; and one for the third letter match). The three resulting scores are added up to equal the congruence score.

Formula

((Environmental pattern letter 1 * Distance to Personality pattern letter 1) (3)) +
((Environmental pattern letter 2 * Distance to Personality pattern letter 2) (2)) +
((Environmental pattern letter 3 * Distance to Personality pattern letter 1) (1)) =
Congruence score

Table B1
The C *Index RIASEC Letter Match Values*

Holland Type	R	I	A	S	E	C
R	3	-	-	-	-	-
I	2	3	-	-	-	-
A	1	2	3	-	-	-
S	0	1	2	3	-	-
E	1	0	1	2	3	-
C	2	1	0	1	2	3

Example CRI-CSA match

(C-C Match (3) * 3) + (R-S Match (0) * 2) + (I-A Match (2) * 1)
(3 * 3) + (0 * 2) + (2 * 1) = 11 Congruence score =11

Appendix C

Databases search for "Position Classification Inventory"

1. Abstracts in Social Gerontology
2. Academic Search Premier, Agricola
3. America: History & Life, American Bibliography of Slavic and East European Studies, Art & Architecture Complete
4. Art Index Retrospective: 1929 - 1984 (H.W. Wilson)
5. ATLA Religion Database, British Library Document Supply Centre Inside Serials & Conference Proceedings
6. Business Source Complete, Business Source Premier
7. CAB Abstracts, Catholic Periodical and Literature Index
8. CINAHL
9. Communication & Mass Media Complete
10. Computers & Applied Sciences Complete
11. EconLit, Education Research Complete
12. ERIC
13. European Views of the Americas: 1493 to 1750
14. Family & Society Studies Worldwide, Family Studies Abstracts
15. Film & Television Literature Index with Full Text
16. Funk & Wagnalls New World Encyclopedia, Garden
17. Landscape & Horticulture Index
18. GeoRef
19. GeoRef In Process
20. GreenFILE, Health Source - Consumer Edition
21. Health Source: Nursing/Academic Edition
22. Historical Abstracts, Index Islamicus
23. Index to Jewish Periodicals
24. Inspec Archive - Science Abstracts 1898-1968
25. International Bibliography of Theatre & Dance with Full Text
26. International Political Science Abstracts
27. LGBT Life with Full Text
28. Library, Information Science & Technology Abstracts
29. MAS Ultra - School Edition
30. MasterFILE Premier
31. MEDLINE

32. Mental Measurements Yearbook with Tests in Print
33. Middle Eastern & Central Asian Studies
34. Military & Government Collection
35. MLA Directory of Periodicals
36. MLA International Bibliography
37. Music Index
38. National Criminal Justice Reference Service Abstracts
39. Philosopher's Index
40. Primary Search
41. Professional Development Collection
42. PsycARTICLES, PsycCRITIQUES
43. PsycINFO
44. Race Relations Abstracts
45. Regional Business News
46. RILM Abstracts of Music Literature
47. RIPM - Retrospective Index to Music Periodicals
48. RISM Series A/II: Music Manuscripts after 1600
49. Shock & Vibration Digest, Social Work Abstracts
50. SocINDEX with Full Text
51. SPORTDiscus
52. Teacher Reference Center
53. Urban Studies Abstracts
54. Violence & Abuse Abstracts
55. Women's Studies International
56. The Nation Archive
57. The National Review Archive
58. The New Republic Archive
59. Political Science Complete
60. Public Affairs Index
61. Public Administration Abstract
62. Psychology and Behavioral Sciences Collection

Appendix D

Articles in which the PCI is used:

Buchanan, D. M. (1997). *Unique contributions of differentiation, consistency, and identity in predicting congruence and job satisfaction* (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 9726414)

Coddington, T. M. (1998). *The role of expectations, personality, and spirituality in the tenure of Catholic Campus ministers: A three-year study* (Doctoral dissertation) Retrieved from ProQuest Dissertation and Theses database. (UMI No. 9905443)

De Fruyt, F. (2002). A person-centered approach to P-E fit questions using a multiple-trait model. *Journal of Vocational Behavior,* 60, 73-90.

De Fruyt, F. & Mervielde, I. (1999). RIASEC types and big five traits as predictors of employment status and nature of employment. *Personnel Psychology*, 52, 701-727.

Dockins, J. F. (2004). *Person-Environment congruence, job stability and job satisfaction: An examination of Holland's theory of vocational personality and work environments in the nursing profession* (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 3127324)

Fritzsche, B. A., Powell, A. B., & Hoffman, R. (1999). Person-environment congruence as a predictor of customer service performance. *Journal of Vocational Behavior,* 54, 59-70.

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Appendix E

Student Recruitment Email 1

Dear Doctoral Student,

We would like to interest you in participating in research on graduate student satisfaction within their training environments. We are conducting a study of the relation of students' career interests to the demands and rewards of their training environments, and the implications of interest-environment match for student satisfaction with the training programs. To do this, we need the help of many students from diverse departments. We ask you to fill out a quick 12- to 15-minute online survey about your career interests and satisfaction in your current doctoral program.

The information you provide will be kept confidential and you have the option, at any point in the survey to opt out. If you wish, you may opt to have a personalized interest report sent to you if you are willing to provide your email address after you complete the questionnaire.

Thanks for taking the time to read this email. We hope that you choose to participate in my research. If you have any questions, please feel free to contact one of us at ggottfre.umd.edu or johnstun@umd.edu.

Please click the link below, which will take you to the survey.

https://www.surveymonkey.com/s/B8WFSSQ

Thank you,

Gary D. Gottfredson, Ph.D. Professor
Marissa J. McMurray, Ed.S.
Research Assistant
Department of Counseling and Personnel Services
University of Maryland, College Park

Student Recruitment Email 2

Dear Doctoral Student,

Recently, we sent you a request to participate in a 12- to 15-minute study on career interests and satisfaction in you doctoral training program. Knowing how busy doctoral students are, we thought we would send another brief request for your participation. The survey will ask questions about your career interests as well as your satisfaction with your doctoral training program.

The information you provide will be kept confidential and you have the option, at any point in the survey to opt out. If you wish, you may opt to have a personalized interest report sent to you if you are willing to provide your email address after you complete the questionnaire.

Thanks for taking the time to read this email. We hope that you choose to participate in our research. If you have any questions, please feel free to contact one of us at ggottfre@umd.edu or johnstun.umd.edu .

Please click the link below, which will take you to the survey.

https://www.surveymonkey.com/s/B8WFSSQ

Thank you,

Gary D. Gottfredson, Ph.D.
Professor
Marissa J. McMurray, Ed.S.
Research Assistant
Department of Counseling and Personnel Services
University of Maryland, College Park

Appendix F

Faculty Recruitment Email 1

Dear Faculty Member,

We are conducting research on the congruence between graduate students' interests and the demands and rewards found in their graduate school environments and need your help. Separately, we will be sending an email to doctoral students in your department asking for them to answer questions about their career interests and satisfaction with their training. As part of this research, we need an independent measure of the requirements and rewards of graduate student training environments. We need the help of professors in your department to describe the kinds of tasks graduate students in your department do on a regular basis. The online survey will take less than 10 minutes and your participation would be greatly appreciated.

Please click the link below, which will take you to the survey.
[Link to consent form and questionnaire.]

If you have any questions, please contact one of us at ggottfre@umd.edu or johnstun@umd.edu .

Thank you,

Gary D. Gottfredson, Ph.D.
Professor
Marissa J. McMurray, Ed.S.
Research Assistant
Department of Counseling and Personnel Services
University of Maryland, College Park

Faculty Recruitment Email 2

Dear Faculty Member,

Recently, we sent you a request to complete a ten-minute online survey about the types of tasks graduate students in your department are asked to complete on a regular basis. We hope that you will consider helping us out by participating in this short survey.

Please click the link below, which will take you to the survey.
[Link to consent form and questionnaire.]

Thank you so much for your time.

If you have any questions, please contact one of us at ggottfre@umd.edu or johnstun@umd.edu.

Thank you,

Gary D. Gottfredson, Ph.D.
Professor
Marissa J. McMurray, Ed.S.
Research Assistant
Department of Counseling and Personnel Services
University of Maryland, College Park

Appendix G

Faculty Member Consent Page

1. Consent Form

You are invited to participate in a research study on the interaction between the career interests of graduate students and their departmental environment. The research being conducted by Gary Gottfredson and Marissa McMurray at the University of Maryland. You are being invited to participate because you are a member of the faculty in an academic department at the University of Maryland.

The research focuses on how the demands and rewards of academic environments differ and how these environmental differences interact with the career interests of graduate students. Some combinations may lead to greater student satisfaction and intentions to persist in the kind of work they are being trained to do than others. What you are being asked to do is describe the work demands on and rewards available to graduate students in your department.

This study should take less than 10 minutes of your time. You will be asked to complete an online questionnaire to describe the kinds of tasks graduate students in your department do on a regular basis.

Your decision to participate in this study is completely voluntary and you have the right to terminate your participation at any time. You may choose to opt out of this survey at any point. We will do our best to keep your answers confidential. We will store research data in files that do not contain your name, and we will also strip the data file of email addresses and other personal identifiers.

There are no known risks to individuals participating in this research. Your participation in this research is not intended to benefit you personally. It is hoped that this research will add to the understanding about how the interest-environment interaction affects satisfaction of persons in an academic department.

If you have questions about this project, you may contact Marissa McMurray at johnstun@umd.edu or Dr. Gary Gottfredson at ggottfre@umd.edu .

If you have any questions about your rights as a research participant in the study, please contact the University of Maryland, College Park Institutional Review Board at (301) 405-4212 or at irb@umd.edu.

Please answer the following question:

○ I have read and understand the above consent form by clicking the submit button to enter the survey, I indicate my willingness voluntarily take part in the study.

○ I choose not to participate in this study.

Appendix H

Student Consent Page

1. Consent Form

You are invited to participate in a research study on the interaction between interest and environment. The research being conducted by Gary Gottfredson and Marissa McMurray at the University of Maryland. You are being invited to participate because you are a doctoral student at the University of Maryland.

This study will take approximately 12-15 minutes of your time. You will be asked to complete an online questionnaire about what kinds of occupations you would like to have and those you wouldn't. You will also be asked about your current satisfaction with your work as a graduate student in your academic department.

As an incentive, if you choose to complete the survey and leave your email address, a personalized report on your career interests will be mailed to you.

Your decision to participate or decline participation in this study is voluntary and you have the right to terminate your participation at any time without penalty. You may choose to opt out of this survey at any point. We will do our best to keep your answers confidential. We will store research data in files that do not contain your name, and we will also strip the data file of email addresses and other personal identifiers, unless you choose to have a personalized report created for you. After your report is emailed, your email address will be deleted immediately from our records.

There are no known risks to individuals participating in this research. Your participation in this research is not intended to benefit you personally. It is hoped that this research will add to the understanding about how the interest-environment interaction affects satisfaction of persons in academic department.

If you have questions about this project, you may contact Marissa McMurray at johnstun@umd.edu or Dr. Gary Gottfredson at ggottfre@umd.edu .

If you have any questions about your rights as a research participant in the study, please contact the University of Maryland, College Park Institutional Review Board at (301) 405-4212 or at irb@umd.edu.

Please indicate your consent to participate in the research:

○ I have read and understand the above consent form by clicking the submit button to enter the survey, I indicate my willingness voluntarily take part in the study.

○ I choose not to participate in this study.

Appendix I

Questions from the Student Interest Inventory

2. Interests

This section of the survey contains a list of activities.

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Test the quality of parts before shipment	○	○	○	○	○
Study the structure of the human body	○	○	○	○	○
Conduct a musical choir	○	○	○	○	○
Give career guidance to people	○	○	○	○	○
Sell restaurant franchises to individuals	○	○	○	○	○
Generate the monthly payroll checks for an office	○	○	○	○	○
Lay brick or tile	○	○	○	○	○
Study animal behavior	○	○	○	○	○
Direct a play	○	○	○	○	○
Do volunteer work at a non-profit organization	○	○	○	○	○
Sell merchandise at a department store	○	○	○	○	○
Inventory supplies using a hand-held computer	○	○	○	○	○
Work on an offshore oil-drilling rig	○	○	○	○	○
Do research on plants or animals	○	○	○	○	○

3. Interests

This section of the survey contains another list of activities.

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Design artwork for magazines	○	○	○	○	○
Help people who have problems with drugs or alcohol	○	○	○	○	○
Manage the operations of a hotel	○	○	○	○	○
Use a computer program to generate customer bills	○	○	○	○	○
Assemble electronic parts	○	○	○	○	○
Develop a new medical treatment or procedure	○	○	○	○	○
Write a song	○	○	○	○	○
Teach an individual an exercise routine	○	○	○	○	○
Operate a beauty salon or barber shop	○	○	○	○	○
Maintain employee records	○	○	○	○	○
Operate a grinding machine in a factory	○	○	○	○	○
Conduct biological research	○	○	○	○	○
Write books or plays	○	○	○	○	○
Help people with family-related problems	○	○	○	○	○

4. Interests

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Manage a department within a large company	○	○	○	○	○
Compute and record statistical and other numerical data	○	○	○	○	○
Fix a broken faucet	○	○	○	○	○
Study whales and other types of marine life	○	○	○	○	○
Play a musical instrument	○	○	○	○	○
Supervise the activities of children at a camp	○	○	○	○	○
Manage a clothing store	○	○	○	○	○
Operate a calculator	○	○	○	○	○
Assemble products in a factory	○	○	○	○	○
Work in a biology lab	○	○	○	○	○
Perform stunts for a movie or television show	○	○	○	○	○
Teach children how to read	○	○	○	○	○
Sell houses	○	○	○	○	○
Handle customers' bank transactions	○	○	○	○	○

5. Interests

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Install flooring in houses	○	○	○	○	○
Make a map of the bottom of an ocean	○	○	○	○	○
Design sets for plays	○	○	○	○	○
Help elderly people with their daily activities	○	○	○	○	○
Run a toy store	○	○	○	○	○
Keep shipping and receiving records	○	○	○	○	○
Perform lawn care services	○	○	○	○	○
Study ways to reduce water pollution	○	○	○	○	○
Paint sets for plays	○	○	○	○	○
Work with juveniles on probation	○	○	○	○	○
Sell newspaper advertisements	○	○	○	○	○
Keep inventory records	○	○	○	○	○
Repair household appliances	○	○	○	○	○
Study the movement of planets	○	○	○	○	○

6. Interests

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Act in a movie	○	○	○	○	○
Take care of children at a day-care center	○	○	○	○	○
Sell a soft drink product line to stores and restaurants	○	○	○	○	○
Keep accounts payable/receivable for an office	○	○	○	○	○
Build kitchen cabinets	○	○	○	○	○
Examine blood samples using a microscope	○	○	○	○	○
Sing in a band	○	○	○	○	○
Teach an elementary school class	○	○	○	○	○
Give a presentation about a product you are selling	○	○	○	○	○
Calculate the wages of employees	○	○	○	○	○
Guard money in an armored car	○	○	○	○	○
Study genetics	○	○	○	○	○
Conduct a symphony orchestra	○	○	○	○	○
Work with mentally disabled children	○	○	○	○	○

7. Interests

Please indicate how much you would like to do each activity by marking the box that most closely represents how you feel about it.

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Sell hair-care products to stores and salons	○	○	○	○	○
Develop a spreadsheet using computer software	○	○	○	○	○
Operate a machine on a production line	○	○	○	○	○
Determine the infection rate of a new disease	○	○	○	○	○
Create special effects for movies	○	○	○	○	○
Teach disabled people work and living skills	○	○	○	○	○
Negotiate contracts for professional athletes	○	○	○	○	○
Assist senior level accountants in performing bookkeeping tasks	○	○	○	○	○
Repair and install locks	○	○	○	○	○
Diagnose and treat sick animals	○	○	○	○	○
Compose or arrange music	○	○	○	○	○
Organize field trips for disabled people	○	○	○	○	○
Manage a retail store	○	○	○	○	○
Transfer funds between banks using a computer	○	○	○	○	○

Appendix J

Hoppock Job Satisfaction Blank Adaption

Table K1

Hoppock Job Satisfaction Blank Adaption

Original Questions	Adapted Questions
Which one of the following shows how much of the time you feel satisfied with your job?	Which one of the following shows how much of the time you feel satisfied with your training program?
Choose one of the following statements which best tells how well you like your job.	Choose one of the following statements which best tells how well you like your training experience.
Which one of the following best tells how you feel about changing your job?	Which one of the following tells how you feel about changing your field?
Which one of the following shows how you thing you compare with other people?	Which one of the following shows how you think you compare with other people?

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