O*NET®
Interest Profiler Manual

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[O*NET Interest Profiler Manual]

Executive Summary

The O*NET Interest Profiler (IP) is a vocational interest inventory designed for use in educational planning, career exploration, and career guidance (Lewis & Rivkin, 1999). The Interest Profiler was introduced in 1999 as one of the U.S. Department of Labor's (DOL) O*NET Career Exploration Tools. John Holland's (1997) RIASEC theoretical model (Realistic-Investigative-Artistic-Social-Enterprising-Conventional) is the basis of the Interest Profiler scales. Over the years, millions of people have taken the Interest Profiler. Its current web-based version included in the *My Next Move and Mi Proximo Paso* websites, versions incorporated by private and public application developers, and available paper-and-pencil version continue to make it a widely disseminated and extensively used career exploration tool. Use and integration of the Interest Profiler is offered free-of-charge via the O*NET Career Exploration Tools Content License (https://www.onetcenter.org/license_tools.html).

Since its introduction, the Interest Profiler has undergone several revisions, producing three forms of the Interest Profiler: IP Long-Form, IP Short-Form, and Mini-IP. During these revisions and selection of items and formats, O*NET has published a series of reports that documented the construction and validation of the Interest Profiler. This documentation published on the O*NET website (https://www.onetcenter.org/research.html?c=IP_CIP) has met the spirit of *Standards for Educational and Psychological Testing* (2014), providing information on scoring, reliability and validity of scores, and participants reactions to the experience of completing and receiving score interpretations.

The present Interest Profiler Technical Manual integrates prior scale developmental reports and summarizes over 20 years of research on the Interest Profiler. The manual is written as chapters, authored by students and graduates of Industrial and Organizational PhD programs at the University of Illinois-Urbana-Champaign and the University of Houston. Topics covered include an overview of the Interest Profiler (chapter 1), forms and versions (chapter 2), scoring and reporting (chapter 3), item development (chapter 4), reliability (chapter 5), validity (chapter 6), linkage to occupations (chapter 7), and international applications (chapter 8).

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CHAPTER 1

Interest Assessment and the O*NET Interest Profiler

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At some point in life, every person must decide, "What kind of career do I want?" Children and adolescents begin to learn about their career interests through schooling and extracurricular activities. As young people age, they face important decisions about academic and career planning that impact their later participation in the labor market.

Interest inventories were developed in the early 1900's to help young people make career and educational decisions. Their fundamental purpose is to measure and classify people's vocational interests based on the common interests that underlie different careers. This chapter provides an introduction to interest measurement and the O*NET Interest Profiler, including:

- A broad overview of the O*NET Interest Profiler and its various forms
- Background on the nature and importance of vocational interests
- Holland's interest model and a description of the six RIASEC types
- The various ways in which the Interest Profiler can be used
- Research applications of the Interest Profiler

The O*NET Interest Profiler

The O*NET Interest Profiler (IP) is an interest inventory designed for use in educational planning, career exploration, career guidance, and organizational placement (Lewis & Rivkin, 1999). The Interest Profiler is one of several O*NET Career Exploration Tools publicly available through O*NET websites. The IP assesses career interests according to Holland's (1997) RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) types. Clients are asked to identify their likes and dislikes for different career tasks using a questionnaire. Results are aggregated into *scales* based on Holland's RIASEC types, which together form an *interest profile*. A client's interest profile is then linked to the interest profiles of different careers based on the Standard Occupational Classification [(SOC); Office of Management and Budget, 2000; National Center For O*NET Development, 2010] system (e.g., Kroustalis, Lewis, & Rivkin, 2010).

There are three forms of the O*NET Interest Profiler (IP), including: the IP Long-Form, the IP Short-Form, and the Mini-IP. Each form was developed through rigorous research supporting the psychometric properties of RIASEC scores. These studies have been reported in an ongoing series of research reports, available on the O*NET Reports and Documents website (https://www.onetcenter.org/research.html?c=IP_CIP). Each form is updated to ensure that the items remain current and retain their psychometric properties over time. Because three Interest

Profilers have been developed, each with several versions, O*NET has developed the following labeling conventions (see Chapter 2 for additional details about each form):

1. O*NET Interest Profiler Long Form (IP Long Form; 180 items)
    A. Paper-and-pencil version
    B. Computerized version
2. O*NET Interest Profiler Short Form (IP Short Form; 60 items)
    A. Paper-and-pencil version
    B. Web-based version, English
    C. Web-based version, Spanish
3. O*NET Mini Interest Profiler (Mini-IP; 30 items)
    A. Mobile version

The IP Short Form, Web-based version, is currently delivered through *My Next Move* (https://www.mynextmove.org/). In addition to the English-version delivered through *My Next Move*, a Spanish-language version of the instrument is available through the *Mi Proximo Paso* website (https://www.miproximopaso.org/). Private and public organizations and application developers are also encouraged to incorporate the IP using O*NET Web Services (https://services.onetcenter.org/) or by leveraging the available technical reports. Use and integration of the Interest Profiler is offered free-of-charge via the O*NET Career Exploration Tools Content License (https://www.onetcenter.org/license_tools.html).
Use of the Interest Profiler has increased dramatically after its introduction as a Web-based measure on the *My Next Move* site. The *My Next Move* sites average over one million visits per month (U.S. Department of Labor, 2018). The broad utility of the Interest Profiler plays an important role in developing and maintaining a skilled workforce and contributes to U.S. competitiveness in a global, 21st-century economy.

What Are Vocational Interests?

Vocational interests are trait-like preferences for activities, environments, or outcomes that motivate goal-oriented behavior (Rounds & Su, 2014). More simply, interests describe what people like to do and where they like to focus their attention and effort. Vocational interests are a unique psychological variable in that they are directly contextualized to work and educational environments. By asking what people like to do, interest assessments capture the degree of fit between a person's interests and the characteristics of different environments. This concept—*person-environment fit*—explains why interests are a powerful predictor of the choices people make throughout their careers and whether they are successful (Su, Stoll, & Rounds, 2018).

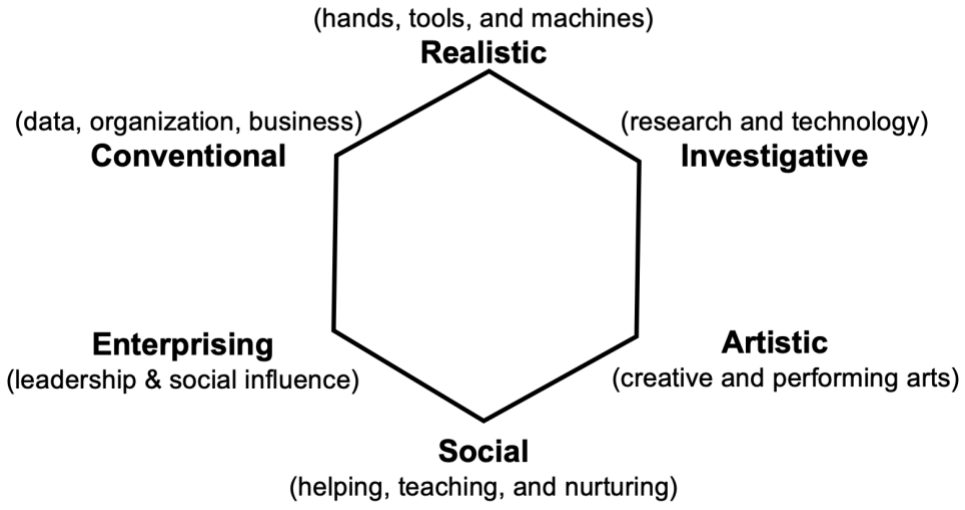
The O*NET Interest Profiler (IP) uses Holland's (1959, 1997) RIASEC model to measure and classify vocational interests. Holland's model is the most widely used theoretical framework for measuring interests. Holland's typology describes people and work environments based on six vocational personalities and environments, together known as RIASEC: realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). These types are organized in a hexagon, also described as a circular structure (Day & Rounds, 1998), outlined in

Figure 1. The interest categories that are next to each other (adjacent) on the hexagon are more closely related than those further away or opposite on the hexagon. For example, Realistic interests that involve working with hands, tools, and machines are closely related to Investigative interests associated with science and technology.

Each RIASEC category contains a variety of work activities, occupations, and basic interests[1]. On the O*NET OnLine website (www.onetonline.org), all occupations have numeric profiles for the six RIASEC interest categories as well as high-point codes. Occupational Interest Profiles (OIPs) were developed by expert raters following standardized coding procedures (Rounds, Armstrong, Liao, Lewis, & Rivkin, 2008; Rounds, Su, Lewis, & Rivkin, 2013). O*NET OnLine emphasizes high-point interest codes in each occupation's Summary Report. High-point codes represent the interest categories that best define an occupation, ranging from one-to-three letters. All occupations have a first-letter code that best characterizes the occupation, followed by (possible) second- and third-letter codes that capture secondary aspects of the job. For example, the three-letter interest profile for Personal Financial Advisors is ECS (Enterprising, Conventional, Social). This means that enterprising interests best describe the occupation, but personal financial advising also involves conventional and social activities.

O*NET OnLine also displays numeric interest profiles for all six RIASEC categories under each occupation's Detailed Report (values range from 0-100). For example, under the Detailed Report for Personal Financial Advisors, numeric values are displayed for all six RIASEC interests ranging from "95" for Enterprising to "0" for Realistic. In addition to the O*NET Online website, OIP data is also available for download in a variety of software formats (https://www.onetcenter.org/dictionary/25.2/excel/interests.html).

Figure 1. Holland's RIASEC Vocational Interest Model.



1 Basic interests represent an intermediate level of aggregation between specific occupations and Holland's 1997 general occupational themes (c.f., Armstrong, Smith, Donnay, & Rounds, 2004; Su, Tay, Liao, & Rounds, 2019). Each RIASEC category contains multiple basic interest scales, and each basic interest scale contains multiple occupations that are closely related to each other.

Realistic: Realistic careers involve working with hands, tools, and machines. Realistic activities often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the careers involve practical problems and solutions, and occasionally working outdoors.

Example basic interests: mechanics, engineering, outdoors, construction, agriculture
Example careers: farmworkers, civil engineers, and carpenters

Investigative: Investigative careers involve working with ideas, and scientific and research pursuits. Investigative activities often require an extensive amount of thinking. These careers can involve searching for facts and figuring out problems mentally.

Example basic interests: medical science, life science, physical science, mathematics
Example careers: biologists, veterinarians, and chemists

Artistic: Artistic careers involve self-expression and creativity and are typically associated with the performing, written, and visual arts. Artistic activities often require working with forms, designs and patterns, and the work can be done without following a clear set of rules.

Example basic interests: media, design, performing arts, music, writing, culinary art
Example careers: actors, writers, art directors

Social: Social careers involve helping, nurturing, and teaching other people. These careers often require assisting or providing service to others.

Example basic interests: social science, education, health care service, humanities
Example careers: counselors, teachers, child and family social workers

Enterprising: Enterprising careers involve selling, managing, and social influence typically in a business context. Enterprising activities often require supervising people, leading projects, and making decisions.

Example basic interests: management, marketing, public speaking, sales, politics
Example careers: managers, salespersons, and restaurant bar and waiting staff

Conventional: Conventional careers involve the ordered and systematic manipulation of data with clear standards, typically, in a business setting. Conventional activities typically require following set rules with an attention to detail.

Example basic interests: finance, accounting, information technology, office work
Example careers: accountants, bank tellers, inspectors

A key assumption of Holland's RIASEC model is that interest inventories do not simply measure interests. They provide information about interrelated preferences, traits, self-concepts, values, and abilities. Holland originally described the RIASEC categories as 'personality types' to denote the surplus meaning associated with RIASEC vocational interests. This is consistent with Holland's (1958) initial proposal that "the choice of an occupation is an expressive act which

reflects the person's motivation, knowledge, personality, and ability" (p. 336). Thus, although the O*NET Interest Profiler assesses vocational interests, it also provides information about a range of other variables that develop in relation to interests (e.g., personality traits, abilities, and values).

Why Assess Vocational Interests?

Vocational interests are among the most widely applied psychological variables. Interest assessments are used to inform decision-making in a variety of contexts, such as educational planning, career guidance, and organizational placement. The use of interest assessments as a decision-making aid is supported by decades of research showing that vocational interests are stable over time and predict important academic, career, and life outcomes.

Educational and workforce planning

Students, teachers, counselors, and parents can benefit by using the O*NET Interest Profiler as a tool for educational planning and workforce preparation. After taking the IP, clients' interest profiles are directly connected to the O*NET OnLine website which classifies over 900 occupations in terms of interests (RIASEC coded), education, experience, and training required to perform the occupation (as well as a host of other variables). Clients can use their IP results to learn about the amount of preparation, training, and education required for careers that match their interests. In addition, O*NET OnLine lists detailed information about technology skills, knowledge, and abilities associated with different jobs. This information can be used to select coursework or choose college majors that will prepare students for careers in which they are interested. Teachers, counselors, and school administrators can also use this information to guide curriculum development based on students' interests (Lara & Vess, 2014).

Career exploration

People of all ages are encouraged to use the IP to learn about themselves and the interests that underlie different careers (Chauhan, 2019). The Interest Profiler can serve as a springboard for self-discovery and exploration about the world of work. Young people who have not yet entered the labor market can benefit by taking the IP to explore part-time jobs, summer work, and other experiences that fit their interests. Students can also use their IP results to conduct informational interviews to learn about the nature of work from people already working in different careers. In addition, clients are encouraged to retake the IP over time to examine whether their interests have changed with age and experience. The IP is regularly updated to ensure that it keeps up with the latest technology and trends in occupations and workforce development. The IP also allows individuals to relate their interest assessment results to the requirements of occupations in the local labor market.

Career decision-making

The Interest Profiler can be used to inform a variety of career decisions that people face across the life span. For example, high school students must choose whether to attend college, complete vocational training, or enter the labor market. College students must decide on a field of study and job to pursue after graduation. Adults at all ages face career decisions such as whether to leave an organization or pursue a second career. Because these decisions have a major impact on

people's quality of life, they should be as well-informed as possible. The IP can provide useful direction and guidance for individuals making career decisions. Research shows that interest fit is a strong predictor of several aspects of career success, including job performance, income, and occupational prestige (Neumann, Olitsky, & Robbins, 2009; Nye et al., 2017; Rounds & Su, 2014). Of course, interest fit is one consideration among several others that determine how successful people are in their careers. Clients are encouraged to use the IP in tandem with other assessments (e.g., values and abilities) when making career decisions. In addition to using the web-based version delivered through *My Next Move*, private and public organizations and application developers are encouraged to incorporate the IP using O*NET Web Services (https://services.onetcenter.org/).

Research Applications with the O*NET Interest Profiler

The Interest Profiler can be used for a variety of research purposes. Institutions using the IP as a decision-making aid for career or educational guidance may wish to study the benefits of its use for outcomes such as career readiness or decision-making confidence (e.g., Koys, 2017; Metzinger & Berg, 2015). Research studies can also utilize the IP to assess outcomes associated with interest fit/misfit. Participants' interest scores can be compared to the interests associated with their academic major or career to provide an index of person-environment fit. Occupational Interest Profiles (OIP's) from O*NET are available for use as a standardized measure of vocational interests at the occupation-level. Researchers can investigative whether individuals with higher levels of fit experience greater satisfaction, performance, or retention in their academic or career environment (e.g., Earl, 2018; Phan & Rounds, 2018; Wiegand, 2018).

In addition to the possibilities described above, prior research has utilized the Interest Profiler in a variety of other ways. Studies using the IP have examined research questions related to the structure of vocational interests (e.g., Tay, Su, & Rounds, 2011), measurement models for interests (Tay, Drasgow, Rounds, & Williams, 2009), the interest profiles of professionals working in specific careers (Neukrug, Sparkman, & Moe, 2017), and associations between interests and other individual differences (e.g., personality, values, skills, and abilities; Anthoney & Armstrong, 2010; Almeida, Ahmetoglu, & Chamorro-Premuzic, 2014; Dobson, Gardner, Metx, & Gore, 2014; Nagel, Watts, Murphy, & Lilienfeld). Organizations can also use the Interest Profiler for research aimed at better understanding the extent to which employees enjoy performing their job tasks. Such studies could inform management practices or job crafting within organizations (e.g., Barrick & Parks-Leduc, 2019). In summary, researchers and practitioners are encouraged to use the Interest Profiler, technical reports, and OIP data for a variety of research-related purposes.

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CHAPTER 2

Interest Profiler Forms, Versions, and Linkage to Occupations

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This chapter provides an overview of the history and development of the O*NET Interest Profiler, covering the following major topics:

- The history of the Interest Profiler from 1999 to 2019
- How the interest items were developed to represent work in the United States
- An overview of the three main forms of the Interest Profiler
- Existing technical reports supporting psychometric properties and item development
- Development of Occupational Information Profiles (OIPS) for the O*NET-SOC system
- The process for linking client's IP results to OIPs using computer algorithms

O*NET researchers began with a model (Holland, 1997) and a large, representative pool of interest items covering work in the United States. Because the items were well crafted and representative of work, researchers were able to develop three Interest Profiler (IP) forms assessing facets of Holland's RIASEC types. The three main forms of the IP each have different versions designed for use in applied settings. The primary difference between the three forms is the number of items and delivery format. The IP Long Form contains 180 items and was retired in September 2018. Its replacements are the IP Short Form and Mini-IP. The Short Form contains 60 items and is available in paper-and-pencil format and delivered electronically through the *My Next Move* and *Mi Proximo Paso* websites. The Mini-IP contains 30 items and is designed for use with mobile applications. Table 1 provides an overview of all O*NET Interest Profiler instruments and versions.

Table 1. *O*NET Interest Profiler Forms, Versions, and Corresponding Technical Reports*

Form	Version	Items	Scoring	Technical Report Supporting Psychometric Properties
Interest Profiler Long Form (IP Long Form)	Paper-and-pencil (P & P)	180	Self-scored	Rounds, Walker, Day, Hubert, Lewis, & Rivkin (1999)
	Computerized	180	Computerized	Rounds, Mazzeo, Smith, Hubert, Lewis, & Rivkin (1999)
Interest Profiler Short Form (IP Short Form)	Paper-and-pencil (P & P)	60	Self-scored	Rounds, Hoff, Chu, Lewis, & Gregory (2018)
	Web-based version, English- and Spanish-language	60	Computer-scored	Rounds, Su, Lewis, & Rivkin (2010)
Mini Interest Profiler (Mini-IP)	Mobile version	30	Computer-scored	Rounds, Wee, Cao, Song, & Lewis (2016)

Note. The IP Short Form, Web-based version is delivered through the *My Next Move* and *Mi Proximo Paso*. The IP Short Form and Mini-IP are available for developer integration through O*NET Web Services/Technical Documentation. The IP Long Form was retired in September 2018.

History of the Interest Profiler Development

The O*NET Interest Profiler (IP) has a 20-year history beginning with the development of the 180-item, self-scored, paper-and-pencil form (Rounds, Walker, Day, Hubert, Lewis, & Rivkin, 1999a). Shortly afterwards the IP was computerized (Rounds, Mazzeo, Smith, Hubert, Lewis, & Rivkin, 1999b). The IP Long Form was retired in September 2018 and has been replaced by the IP Short Form and Mini-IP. In 2010, a 60-item short form of the IP was developed for use in settings where it is helpful to have an interest measure that can be completed in a shorter period of time and is more suitable for web-based delivery (Rounds, Su, Lewis, and Rivkin, 2010). Use of the Interest Profiler has increased dramatically after the introduction of the Short Form Web-based measure on the *My Next Move* site. Recently, a paper-and pencil (P & P) version of the Short Form was developed that can be administered in settings without computer or internet-access (Rounds, Hoff, Chu, Gregory, & Lewis, 2018). In 2016, a 30-item Mini Interest Profiler (Rounds, Wee, Cao, Song, & Lewis, 2016) was developed for use with mobile devices.

Interest Item Development

Interest Profiler items are updated to represent a broad range of work performed in different occupations. Item development for the Interest Profiler began with the creation of an initial list of 569 items covering a wide range of work activities and occupations (Lewis & Rivkin, 1999; see also Chapter 4). The initial list was created by developing new items and compiling existing items from existing interest inventories supported and/or developed by the U.S Department of Labor (i.e., the USES Interest Inventory, the Interest Checklist, and the Job Search Inventory, New York State Job Service, 1985). Trained judges critically reviewed items from existing inventories to remove non-work activities and outdated or biased items that may be offensive to individuals or subgroups.

The initial item list was used in a series of validation studies which eventually led to the creation of the 180-item Long Form (Rounds et al, 1999a; 1999b). The 180 items meet high standards that are among the most comprehensive in the field of vocational interest measurement. Specifically, each item passed a series of seven screens, including retranslation, sensitivity, comprehensibility, familiarity, training requirement, duplication, and copyright. The six RIASEC scales of the Long Form each contain 30 items, which serve as the backbone for the Short-Form and Mini-IP.

The IP Short-Form and Mini-IP were both developed with the goal of reducing the time required to complete the assessment while retaining psychometric properties. The IP Short Form has 10-items per RIASEC scale, while the Mini-IP has 5-items per scale. The results from a series of validation studies support the psychometric properties (reliability and validity) of the interest items and corresponding RIASEC scales. Clients who take the Interest Profiler multiple times will receive similar results on each occasion. In addition, clients' results show consistent patterns of correlations with other reputable interest inventories and the structure of the interest scales adhere to the RIASEC model (Holland, 1997).

Interest Profiler Forms

For each form (Long, Short, Mini) and version (Paper-and-Pencil, Web-based) of the Interest Profiler, research has been conducted to evaluate the psychometric properties of the RIASEC scores. Table 2 summarizes the ongoing series of research reports supporting the psychometric properties of each form and version of the IP. Table 2 also summarizes research reports related to interest profile data on O*NET OnLine. All research reports are available for download in the online O*NET Resource Center (https://www.onetcenter.org/research.html?c=IP_CIP).

Interest Profiler (IP) Long Form
The Interest Profiler Long Form was introduced in 1999 as a replacement for the USES Interest Inventory (U.S. Department of Labor, 1981) and the Interest Checklist (U.S. Department of Labor, 1979). Four primary goals were addressed: (a) create an instrument that reliably and accurately measures the Holland (1985) typology, (b) develop a fair and unbiased instrument to ensure that language and content was inoffensive and familiar to the population of client users, (c) provide clients with examples of work activities representing the entire world of work, and (d) develop a self-administered, self-interpreted instrument.

Eight research phases were conducted in support of the development of the instrument, each of which required multiple steps and the participation of a wide variety of staff, contractors, and pilot sites (Lewis & Rivkin, 1999). Extensive efforts were made to include client and counselor input at each stage of the development process. Studies were also conducted to provide construct validity and reliability evidence (Rounds, Walker, Day, Hubert, Lewis, & Rivkin, 1999). Shortly after the paper-and-pencil version was developed, a computerized version of IP Long Form was released (Rounds, Mazzeo, Smith, Hubert, Lewis, & Rivkin, 1999). The computerized version did not require self-scoring and allowed for a more complex algorithm to match clients and occupations (McCloy, Campbell, Oswald, Lewis, & Rivkin, 1999). A unique strength of the IP's matching algorithm is that it utilizes the client's entire interest profile to match results to complete Occupational Interest Profiles (Gregory & Lewis, 2016; Kroustalis, Lewis, & Rivkin, 2010).

Interest Profiler (IP) Short Form
The Interest Profiler Short Form was introduced in 2010. The Short Form, Web-based version is currently delivered through the My Next Move website (https://www.mynextmove.org/). The instrument is also available in the Spanish language through the Mi Proximo Paso website (https://www.miproximopaso.org/). The primary purpose for developing the measure was to create a shorter measure that adequately sampled the RIASEC domains while retaining a hexagonal structure (Rounds, Su, Lewis, and Rivkin, 2010). Brevity is particularly important for online interest assessments because longer questionnaires can lead to reduced participation rates and weaker answer quality (e.g., Galesic & Bosnjak, 2009). Short forms are also advantageous in group counseling and workshop settings where participants take brief assessments and then discuss results as a group. The IP Short Form Web-based version was developed using iterative multidimensional scaling and item evaluation from trained judges (see Chapter 4 for further details).

Table 2. *Overview of Technical Reports Related to the Development of O*NET Interest Profiler Forms and Versions*

Technical Report Title	Year	Authors	Interest Profiler Version	Purpose
Development of the O*NET Interest Profiler	1999	Lewis & Rivkin	IP Long Form	Introduces IP and describes first seven phases of development
O*NET Interest Profiler: Reliability, Validity, and Self-Scoring	1999	Rounds, Walker, Day, Hubert, Lewis, & Rivkin	IP Long Form: P & P version	Summarizes a study evaluating the psychometric properties of the IP Long Form P & P and the self-scoring aspect of the instrument
O*NET Computerized Interest Profiler: Reliability, Validity, and Comparability	1999	Rounds, Mazzeo, Smith, Hubert, Lewis, & Rivkin	IP Long Form: Computerized version	Summarizes research on the psychometric properties of the IP Long Form Computerized version and its comparability with the P & P version
O*NET Interest Profiler Short Form Psychometric Characteristics: Summary	2010	Rounds, Su, Lewis, & Rivkin	IP Short Form: Web-based version	Summarizes initial development research to create a short form of the Interest Profiler
Examining the Efficacy of Emoji Anchors for the O*NET Interest Profiler Short Form	2016	Rounds, Phan, Amrhein, & Lewis	IP Short Form: Web-based version	Summarizes two studies designed to test the validity of an emoji-anchored Interest Profiler Short Form
Development of an O*NET Mini Interest Profiler (Mini-IP) for Mobile Devices: Psychometric Characteristics	2016	Rounds, Wee, Cao, Song, & Lewis	Mini-IP	Summarizes the developmental research to create a 30-item Mini Interest Profiler (Mini-IP)
O*NET Interest Profiler Short Form Paper-and-Pencil Version: Evaluation of Self-Scoring and Psychometric Characteristics	2018	Rounds, Hoff, Chu, Lewis, & Gregory	IP Short Form: P & P version	Summarizes initial research into the self-scoring accuracy and psychometric properties of a Paper-and-Pencil (P & P) version of the Interest Profiler Short Form

Note. The IP Long Form was retired in September 2018. Its replacements are the IP Short Form and Mini-IP.

In 2018, a paper-and-pencil (P & P) version of the Short Form was introduced (Rounds et al., 2018). The main difference between the P & P version and the Web-based version is the method of scoring and response scale. For the P & P version, the participant is asked to check activities they would like to do using a dichotomous response scale. Participants then sum the total number of checks to compute their scores for each RIASEC scale. This differs from the Web-based version that uses 5-point, emoji scale anchors (Rounds, Phan, Amrhein, & Lewis, 2016) with RIASEC scale scores summed and matched to occupations by a computer algorithm. The self-scoring P & P version of the Interest Profiler is necessary for situations where computers are unavailable. Sites that need a paper-and-pencil version are, for example, schools and correctional facilities.

Mini-Interest Profiler (IP)

The Mini-Interest Profiler was introduced in 2016 for use in mobile settings where it is beneficial to have an interest measure that can be completed rapidly and easily. The Mini-IP helps increase the accessibility of the O*NET Interest Profiler to a younger, more tech-savvy audience.

The measure was developed using item selection criteria based on Item Response Theory, RIASEC structural fidelity, content coverage, and gender balance to reduce the length of the scale (Rounds, Wee, Cao, Song, & Lewis, 2016). Five items were selected for each RIASEC scale to ensure that the final measure was not too short that reliability and validity would be significantly compromised. Although item reduction comes with an inherent decrease in scale reliability (Smith, McCarthy, & Anderson, 2000), the Mini-IP is a psychometrically sound measure. Research has supported the convergent validity of the Mini-IP with the IP Short Form, as equivalent scales from two measures are highly correlated.

In summary, the Mini-Interest Profiler is more flexible regarding when and where it can be administered. However, the IP Short Form should still be the preferred measure of choice when time is less of a constraint. In addition, both forms can be incorporated by application developers and private and public organizations via O*NET Web Services (https://services.onetcenter.org/) or by leveraging the available technical reports.

Occupational Interest Profiles (OIPs) and the O*NET-SOC

Occupational Interest Profiles (OIPs) provide an important link between Interest Profiler client assessments and the O*NET-SOC System. The O*NET-SOC is based on the Standard Occupational Classification (SOC) system (National Center for O*NET Development, 2010; Office of Management and Budget, 2000). The O*NET-SOC 2010 taxonomy includes 1,110 occupational titles, 974 of which represent O*NET occupations for which the O*NET program collects data. Data and occupational information are collected on a wide variety of variables and scales, such as occupational characteristics and worker requirements drawn from the O*NET Content Model (http://www.onetcenter.org/content.html).

As part of the content model, Occupational Interest Profiles (OIPs) were developed based on Holland's (1997) interest-based classification of six work environments—Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). The development of OIPs is unique in vocational assessment and classification research, being the first effort to create full, numerical profiles for occupations, with ratings on all six RIASEC environments.

Table 3 summarizes technical reports that describe the development of OIPs for O*NET-SOC occupations. Initial O*NET research on vocational interests and occupational environments was completed in the late 1990s by Rounds, Smith, Hubert, Lewis, and Rivkin (1999). Trained subject matter experts with experience in vocational interest research generated ratings for 1,122 occupations based on the most recent occupational data in the O*NET database. Each OIP consists of six numerical scores in an invariant order (R-I-A-S-E-C) indicating how descriptive and characteristic the occupation is for these six work environments. The OIPs generated by the subject matter experts showed appreciable reliability, structural validity, and reasonable distribution across occupations supporting the use of Subject Matter Expert (SME) rating methodology for development of OIPs using RIASEC interests.

After the initial development of OIPs for the O*NET 98 Analyst Database, several important changes were made to the database structure and content (Rounds, Armstrong, Liao, Lewis, & Rivkin, 2008). Most importantly, the initial classification system for occupations based on the Occupational Employment Statistics (OES) classification was converted to the new Standard Occupational Classification (SOC) system in version 3.0 of the database. In addition, the O*NET program identified approximately 100 New and Emerging (N & E) Occupations related to High Growth Industries that needed OIP information. These changes led to the decision to develop new RIASEC-based OIP data for all occupations in the O*NET database. The same methodology used for the initial development of OIPs (Rounds et al., 1999) was applied, leading to the second generation of OIPs for 900+ occupations. The overall mean value for Goodman-Kruskal's Gamma (Goodman & Kruskal, 1979) was .76, indicating a high degree of reliability for the ratings across the occupational analysts. Structural validity evidence for the OIP ratings showed that the overall pattern of results was consistent with Holland's theoretical model (Rounds, Armstrong, Liao, Lewis, & Rivkin, 2008).

Table 3. *Overview of Technical Reports Related to the Development of Occupational Interest Profiles (OIPs) for O*NET-SOC Occupations*

Technical Report Title	Year	Authors	Purpose
Development of Occupational Interest Profiles for O*NET	1999	Rounds, Smith, Hubert, Lewis, & Rivkin	Describes the development of Occupational Interest Profiles (OIPs) for the 1172 Occupational Units (OUs) included in O*NET
Second Generation Occupational Interest Profiles for the O*NET System: Summary	2008	Rounds, Armstrong, Liao, Lewis, & Rivkin	Describes updates in the development of Occupational Interest Profiles (OIPs) since 1999
Occupational Interest Profiles for New and Emerging Occupations in the O*NET System: Summary	2013	Rounds, Su, Lewis, & Rivkin	Summarize the effort to populate Occupational Interest Profiles (OIPs) for 83 O*NET-SOC occupations included within the O*NET- SOC 2010 Taxonomy

In 2013, OIPs were populated for 83 additional O*NET-SOC occupations that were recently included within the O*NET- SOC 2010 Taxonomy (National Center for O*NET Development, 2010). Rounds, Su, Lewis, and Rivkin (2013) followed the methodology used by Rounds et al. (1999) to generate RIASEC interest profiles for the new occupations. The research design for generating OIPs involved using SMEs to obtain RIASEC score profiles. The study was composed of three phases: a) initial development of materials for rating the OIPs for the occupations, b) training the SMEs to use the rating materials in a reliable and accurate manner, and c) the main rating study in which OIPs for the 83 O*NET occupations were created. To assess the degree of inter- rater agreement, rater-by-rater cross-classification tables were constructed using the obtained raw score ratings for each of the RIASEC categories. For each pair of raters, a separate cross-classification table was constructed. Goodman-Kruskal's Gamma (Goodman & Kruskal, 1954) was computed to assess inter-rater agreement. The overall mean value for Gamma was .86, indicating a high degree of reliability among ratings of the three occupational analysts and considerable consistency among raters across both the RIASEC categories and occupations.

In summary, occupational interest profiles were developed for each O*NET-SOC occupation using ratings from trained subject matter experts following a standardized methodology. The development of OIPs enables direct linkage of occupations with score profiles generated from the IP Short Form and Mini-IP.

Person-Occupation Interest Matching

The main goal of the Interest Profiler (IP) is to identify a set of O*NET-SOC occupations that best correspond to a client's interests. To meet this goal, a computer algorithm compares a client's assessment results from the IP to O*NET Occupational Interest Profiles (OIPs). Table 4 summarizes the technical reports describing the development of linking procedures between client assessment profiles and OIPs.

Table 4. *Overview of Technical Reports Linking Client Assessment Profiles from the Interest Profiler to Occupational Interest Profiles (OIPs)*

Technical Report Title	Year	Authors	Purpose
Linking Client Assessment Profiles to O*NET Occupational Profiles	1999	McCloy, Campbell, Lewis, & Rivkin	Describes how client assessment profiles (including the O*NET IP) are linked to O*NET Occupational Unit profiles
Linking Client Assessment Profiles to O*NET® Occupational Profiles Within the O*NET Interest Profiler Short Form	2010	Kroustalis, Lewis, & Rivkin	Provides an update of McCloy, Campbell, Lewis, & Rivkin (1999) focusing on linking IP Short-Form profiles to Occupational Interest Profiles (OIPs)
Linking Client Assessment Profiles to O*NET Occupational Profiles Within the O*NET Interest Profiler Short Form and Mini Interest Profiler (Mini-IP)	2016	Gregory & Lewis	Provides an update of Kroustalis, Lewis, & Rivkin (2010) focusing on linking IP Short-Form and Mini-IP profiles to Occupational Interest Profiles (OIPs)

The O*NET-SOC occupations deemed most promising are those with OIPs calculated to be most similar with the client interest profile (Gregory & Lewis, 2016). A computer algorithm determines profile similarity for the Mini-IP and IP Short Form, Web-based version (English- and Spanish-language). The computerized scoring of the Mini-IP and IP Short Form, Web-based version allows for a complex array of mathematical calculations to be performed virtually instantaneously.

When linking a client's interests to OIPs, it is important that the comparisons are based on the *shape* or *pattern* of the scores, rather than the absolute *level* or *amount* of each score. In other words, the goal is to direct a client to occupations that tend to have the same high and low interests (i.e., the same pattern). There is no concern about directing a client to explore occupations that are "under" or "over" the level of interest.

When a client generates a score profile from the Mini-IP and IP Short Form, the correlation coefficient serves as the index of correspondence. The correlation between a client's profile (*X*) and an occupational profile (*Y*) is given mathematically as follows:

$$r_{XY} = \frac{\Sigma(X - \overline{X})(Y - \overline{Y})}{N\sigma_X\sigma_Y}$$

where $\overline{X}$ and $\overline{Y}$ and σ_X and σ_Y are the means and standard deviations of *X* and *Y*, respectively, and *N* is the number of scores to be correlated (i.e., the number of scores constituting the client's profile). Note that σ represents variability of the *sample* at hand and uses a divisor of *N*. The correlation indexes the similarity of the shape (but not the level) between the client and occupation profiles. The correlation can range from -1.0 to +1.0. A correlation of +1.0 indicates that the rank orders of client and O*NET-SOC occupational profile scores are identical, whereas a correlation of -1.0 indicates that the rank order of client scores is opposite the rank order of O*NET-SOC occupational profile scores.

To demonstrate how the correlation coefficient is used, Figure 1 contains two O*NET-SOC occupation-specific interest profiles and one client interest profile. The client profile correlates perfectly with the profiles of occupation 1 and occupation 4 (r = 1.0). Therefore, O*NET-SOC occupations 1 and 4 would be targeted as promising areas for career exploration. Figure 2 contains the same client profile, but two different O*NET-SOC occupation profiles. While the level of these O*NET-SOC occupational patterns are similar to the client profile, there is less correspondence between the pattern of client profile and the profiles for occupation 2 and occupation 3 (r = -1.0 and -.27, respectively). Therefore, these occupations would not be targeted for career exploration.

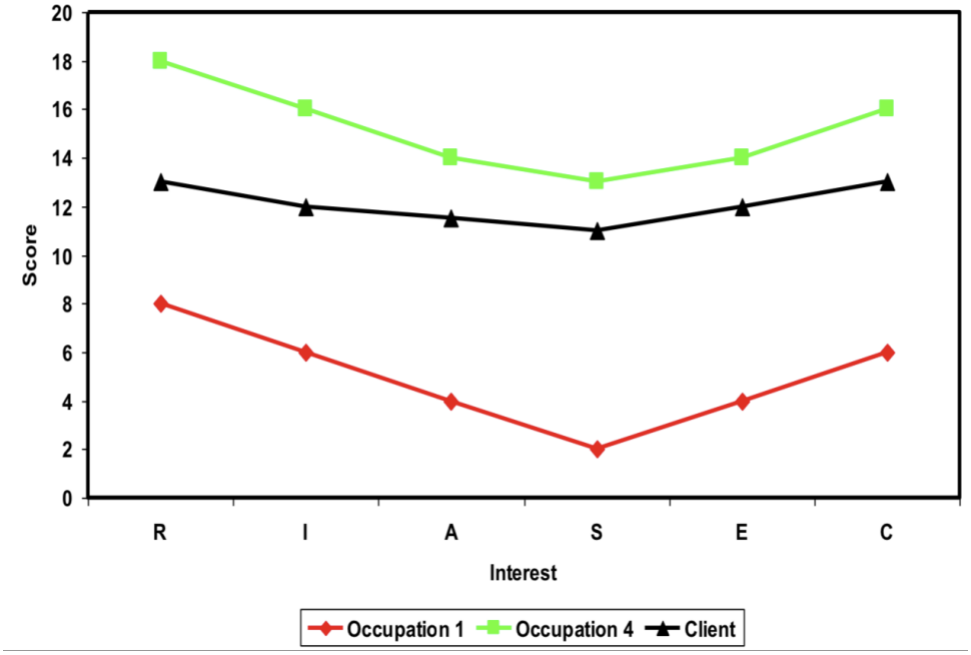

Figure 1. Sample Client and Occupational Profiles for the O*NET Interest Profiler Short Form and Mini-IP: High Correlations

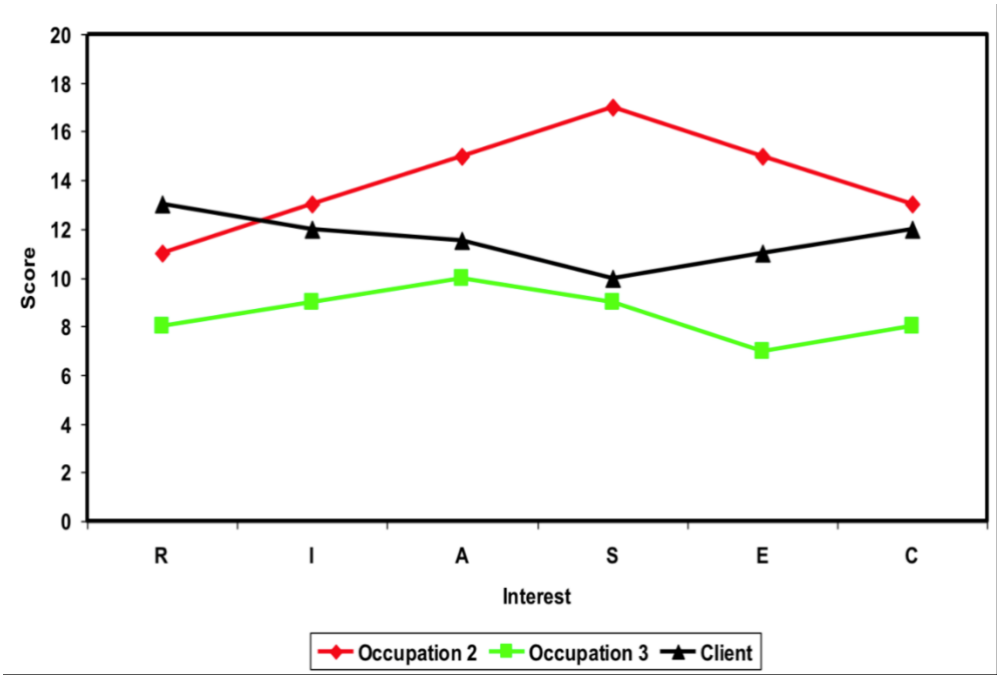

Figure 2. Sample Client and Occupational Profiles for the O*NET Interest Profiler Short Form and Mini-IP: Low Correlations

After calculating the correlation coefficient between the client score profile and each O*NET-SOC occupation score profile, the scoring program applies a series of decision rules to display results. Occupations that satisfy the decision rules appear on the client's score report, as described below:

1. Occupations are presented by Job Zone.

2. O*NET-SOC occupations for which the client/O*NET-SOC occupation profile correlation is notably high are identified as "very strong" matches.

3. The "very strong" match cutoff denotes correlation coefficients (r) of .729 or above, which are statistical significant with a p-value less than .05 from a one-tailed significance test. The "strong" match cutoff represents correlation coefficients ranging from of .608 to .728, which have p-values greater than .05 but less than .10 from a one-tailed significance test.

4. There are no limits on the number of O*NET-SOC occupations that may be suggested within a Job Zone.

5. The goal of the scoring program is to list a total of 10 "very strong" or "strong" occupations displayed per Job Zone. If there are not 10 "very strong" or "strong" matches to the client's interest profile available, the scoring program displays the occupations with the next highest available correlations that are not negative.

6. Occupations that are "very strong" matches are labeled as "Best Fit" within the Short Form and Mini-IP. "Strong" matches are labeled as "Great Fit." Occupations with correlations greater than or equal to .000 and less than .608 are labeled as "Good Fit." Results are sorted by fit category and presented alphabetically within each category.

7. There may be some instances where fewer than 10 occupations are displayed per Job Zone, as only a small number of occupations may be linked to the client's interests. If fewer than 7 occupations are presented per Job Zone, the following language is displayed on the score report:

   "Within this Job Zone, a small number of careers match your interest profile. Click on a different Job Zone above to see more careers linked to your interest profile."

8. Additionally, there may be occasions where no occupations are linked to a client's interest profile within a Job Zone. If this occurs, the following language is displayed on the score report:

   "Within this Job Zone, there are no careers that match your interest profile. Click on a different Job Zone above to see careers linked to your interest profile."

9. In the event that a client responds “strongly dislike” to all items on the IP, his or her profile is likely invalid. The client is instructed to review his/her responses or to re-take the tool. If this occurs, the following language is displayed on the score report:

   “You answered "strongly dislike" to all questions. Your results may not reflect your interests. Please consider retaking the Interest Profiler at a different time.

10. Clients who would like to explore additional careers beyond those identified by their interest profile are provided with a “Find More Careers” option. This option allows the client to see a list of careers related to a single interest area of choice. Occupations are linked to each individual interest area based on their interest high-point codes.

In summary, the correlation coefficient is the statistical index used to determine correspondence between a client’s interest profile and O*NET OIPs. A series of decision rules are then used to display O*NET-SOC occupations with similar interest profiles to the client’s profile. By linking clients’ interests with occupations that are “very strong” (i.e., “best fit”) and “strong matches” (i.e., “great fit”), the IP Short Form and Mini-IP can help clients consider career options, think about career education and training, and transition into new occupations more smoothly.

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CHAPTER 3

Test Administration, Scoring, and Reporting for the Interest Profiler

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This chapter discusses key aspects related to the applied use of the O*NET Interest Profiler, including:

- Appropriate ages for testing
- The amount of time required to complete each form of the Interest Profiler
- Response formats
- The scoring system for each form of the Interest Profiler
- A guide for interpreting Interest Profiler results and exploring related careers
- Additional recommendations for using the Interest Profiler in applied settings

Readers interested in comprehensive information concerning item development and validity evidence for the Interest Profiler can find additional details in chapters 4 (Development) and 6 (Validity).

Appropriate Ages for Interest Assessment

The O*NET Interest Profiler can be used with clients at a wide range of ages. The IP is often used with high school students, college students, and adults facing career transitions. Older adults approaching retirement can also benefit from taking the IP to connect their interests to new types of work or leisure activities. While there is no upper age-limit for use of the IP, caution should be taken when using the instrument with children age 14 or below. All of the items for the Interest Profiler and its various forms were developed with an eighth-grade reading level as the goal (Dale & Rourke, 1981). Two sets of readers independently reviewed all of the items to ensure that the words were comprehensible at an eight-grade reading level (when students are approximately 14-years-old).

In addition to the reading level, a lower age-limit of approximately 14-years-old is recommended because responding to interest assessments reliably requires a certain degree of experience and knowledge about the world of work. To accurately and reliably assess interests, clients must know something about the work activities that characterize different occupations, and whether they would like to actually perform those activities. Without sufficient knowledge about the world of work, perceptions about different careers may be unduly influenced by occupational stereotypes and perceived gender norms. The IP can still be useful with younger populations (i.e., children and students under the age of 14), but the focus should be on career and educational exploration. In other words, the IP can serve as a helpful tool for young students to learn about the interests associated with different jobs while acknowledging that interest development is an ongoing, lifelong process. Asking children about their career aspirations can

also be a productive exercise to introduce them to the world of work and the interests associated with different jobs.

Research shows that the stability of vocational interests generally increases with age throughout adolescence and young adulthood (Hoff, Song, Einarsdóttir, Briley, & Rounds, 2019; Low, Yoon, Roberts, & Rounds, 2005). This means that on average, 18-year-old clients who take the IP at two time points will receive more similar scores across their two assessments compared to 14-year-old clients who take the IP twice with the same amount of time in-between assessments. Prior to age 14, the stability of vocational interests is low, such that younger clients may receive different results over relatively short amounts of time. Although results may change, it may be beneficial for adolescents and young adults to take the Interest Profiler multiple times to compare results and see how their interests have changed over a period of 6 months or several years. Adults approaching the retirement transition may also wish to take the IP to reassess their interests to help plan retirement activities.

Time Required

The amount of time required to complete the Interest Profiler varies across the three main forms and the different versions of each form. The 30-item Mini-IP is the shortest of the instruments and uses only computerized scoring. Depending on the client's reading level, the Mini-IP can be completed in 3-15 minutes. Additional time should be allotted to explore the O*NET OnLine website based on one's results.

The 60-item Short Form Web-based version can be completed in 5-20 minutes. The paper-and-pencil version of the Short Form may require additional time to score the instrument. Nonetheless, the self-scoring for the Short Form is intuitive and easy. In addition, large groups with limited internet or computer access will likely find it easier and quicker to administer the P & P version of the Short Form compared to the Web-based version.

Response Format

The Long Form IP used a three-point response format where participants were asked for "like," "dislike," or "unsure" responses to the items. Subscale scores (corresponding to the six RIASEC categories) were then computed by summing the number of "like" items endorsed within each category ("dislike" and "not sure" endorsements did not contribute to subscale scores).

With the Short-Form IP, there is a difference in response formats between the P & P and Web-based versions. The P & P version uses a dichotomous response format where participants check the activities they would like to do and then sum the total number of checks to compute their scores for each RIASEC scale. This differs from the Web-based version of Short Form that uses 5-point, emoji scale anchors (Rounds, Phan, Amrhein, & Lewis, 2016) with RIASEC scale scores summed by a computer algorithm. The Mini-IP also uses 5-point emoji scale anchors and is scored using a computer algorithm (Rounds, Wee, Cao, Song, & Lewis, 2016).

Scoring

Each of the IP forms can be used as a self-scored or computer-based assessment. The self-scoring systems for the paper-and-pencil (P & P) versions are intuitive and straightforward, while the computerized versions are scored automatically through computer algorithms.

Automated Scoring Systems
In the case of the computerized assessment for the Short Form and Mini-IP, a five-point response format is used (note that the computerized Long Form retained a three-point response format). In the five-point response format, participants indicate their interest in each activity from 0 = "strongly dislike," 1 = "dislike," 2 = "unsure," 3 = "like," and 4 = "strongly like." Scores are computed by summing responses for each of the six Holland types, with a score range of 0 to 40 for the Short and 0 to 20 for the Mini. For the Long Form IP, subscale scores (corresponding to the six RIASEC categories) are computed by summing the number of "like" items endorsed within each category ("dislike" and "not sure" endorsements do not contribute to subscale scores). Scores for the RIASEC subscales may range from 0 to 30.

Self-Scoring for the IP Short Form: Paper-and-Pencil Version
The Interest Profiler Short Form paper-and-pencil version was developed so that there would be few possibilities for errors to occur during manually scoring. The instrument is completed on a single sheet (one-sided). The 60 items are organized into color-coded rows with two columns of 5 items for each RIASEC type. The participant sums the number of checked boxes for each RIASEC scale then reports the three interest areas with the highest scores as their interest profile. Thus, only simple counting skills (number of boxes checked) are necessary. Identifying and transferring RIASEC scores to a rank order of highest score to lowest score is clearly explained on the survey (for download links, see https://www.onetcenter.org/IP.html#paper-and-pencil).

Rounds, Hoff, Chu, Gregory, & Lewis (2018) found that respondents have few difficulties adding their scores for each scale and reporting the correct RIASEC high-point code. To evaluate self-scoring accuracy of the instrument, the researchers compared self-scored interests to their actual scores coded by the research team. Among two samples of participants who took the IP Short Form P & P version ($N_1 = 421$, $N_2 = 140$), only 1-3 participants, depending on the RIASEC scale, failed to correctly record summed scores for a RIASEC scale (Rounds et al., 2018; Tables 3 and 4, p. 17-18). A second possible self-scoring error concerns participants' ability to accurately report their high-point code based on the participants summed codes from the six RIASEC scales. The researchers compared the accuracy of self-reported high-point codes to the actual high-point code scored by the research team. Results indicate very high accuracy in the primary codes obtained from self-scored reports, as over 97% of participants in the two samples correctly listed their high-point code (Rounds et al., 2018; Tables 5 and 6, p. 19-20).

Overall, results of self-scoring analyses indicate that the IP Short Form P & P is easy to score and shows higher accuracy rates of self-scoring compared to other well-known interest inventories (e.g., Self-Directed Search, Miller, 1997) and self-scoring psychological assessments (Simons, Goddard, & Patton, 2002).

Self-Scoring for the Mini-IP
The Mini-IP was developed as a web-based measure intended for use with mobile devices, but can also be used as a self-scored, paper-and-pencil assessment. If used as a self-scored assessment, a dichotomous scoring system is recommended, similar to the IP Short Form. Participants are asked to sum the number of checked boxes for each RIASEC scale (out of 5 items), then report the three interest areas with the highest scores as their interest profile.

Self-Scoring for the IP Long Form: Paper-and-Pencil Version
Rounds et al (1999b) found that respondents receive similar scores on the IP, regardless of the test version (computerized vs. P&P) taken. In addition, examination of clients' ability to self-score the O*NET Interest Profiler revealed a low percentage of scoring errors and, more importantly, a minimal presence of misclassifications.

Interpreting Results from the O*NET Interest Profiler

Clients can use their results from the Interest Profiler for a variety of purposes related to career and educational planning or decision-making. For example, clients can use their IP results to learn more about their work interests, connect their interests to job tasks and work activities, explore different occupations, and experience hands-on activities related to their career interest choices. *My Next Move* and O*NET OnLine provide a variety of tools to assist individuals in interpreting and applying their IP results for different purposes.

After taking the IP, clients receive an individualized interest profile that describes the relative strength of their interests in the six RIASEC areas. Although results vary from person-to-person, most individuals have stronger interests in certain career areas compared to others. An individual's interest profile describes the relative strength of their interests in the six RIASEC domains. Interest profiles are rank-ordered such that the first letter reflects the interest scale with the highest score, followed by the second and third highest scores.

The screenshot in Figure 1 displays an example results page from the IP Short Form, Web-based version, delivered through *My Next Move* (https://www.mynextmove.org/). In this example, the client's complete interest profile is SIAREC because Social is the highest score (35), followed by Investigative (34), Artistic (28), Realistic (24), Enterprising (12), and Conventional (8). From this page, clients can click on the blue hyperlinks to learn more about any of the RIASEC interests in their interest profile.

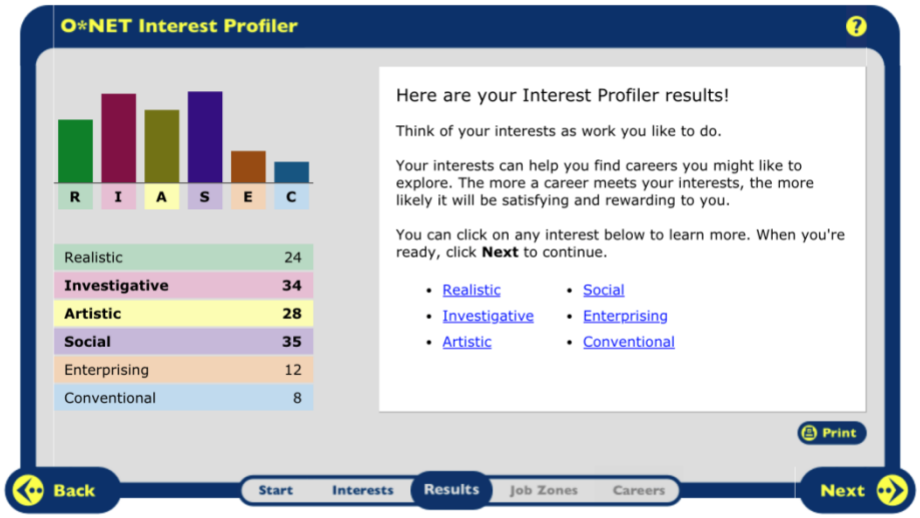

Figure 1. An example results page from the IP Short-Form, Web-based version.

After learning more about the RIASEC scales, clients are asked to select a *Job Zone* that represents the amount of education, experience, and training that they wish to pursue or have already obtained. Job zones are important because each RIASEC interest category contains occupations that require differing levels of preparation. To explore careers, clients will need to choose a *Current or Future Job Zone*. A useful exercise is to compare career options within one's current job zone versus a future job zone if a higher zone is likely to be achieved in the future. Figure 2 displays a screenshot of the page in which clients are asked to select one of five current/future job zones.

Figure 2. The 'Select a Job Zone' page following the initial display of IP results.

In this example, the client initially selected **Job Zone Three**, which describes jobs that require a medium level of preparation. On the next page, the client will receive a listing of careers that

match their interests at **Job Zone Three**. Figure 3 displays a list of careers based on the example IP results.

Figure 3. A list of careers that match the example interest profile at Job Zone Three.

Depending on the job zone selected, clients will receive different career suggestions that match their interests. Each career suggestion is linked to an O*NET occupation which provides extensive information about the occupation, including job tasks, knowledge, values, abilities, educational requirements, salaries, and more. If clients do not like the careers initially suggested, they can select a different job zone by moving the slider at the top of the page in Figure 3 ('Click to change your job zone'). Figure 4 displays the listing of careers that would be suggested at **Job Zone Five**, all of which require extensive preparation.

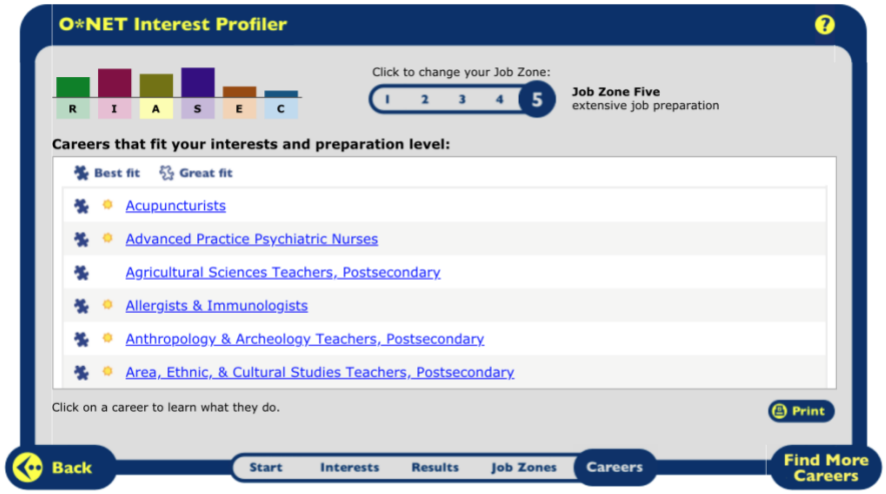

Figure 4. A list of careers that match the example interest profile at Job Zone Five.

Clients who would like to explore additional careers beyond those identified by their interest profile can benefit by clicking the "Find More Careers" option (see the lower right side of Figure 4). This option allows clients to see a list of careers related to a single interest area of choice, and may be particularly useful for clients who received few career choices related to their interests (i.e., a flat profile). Occupations are linked to each individual interest area based on their interest high-point codes. Figure 5 displays the next page that would appear if the client selected the "Find More Careers" option.

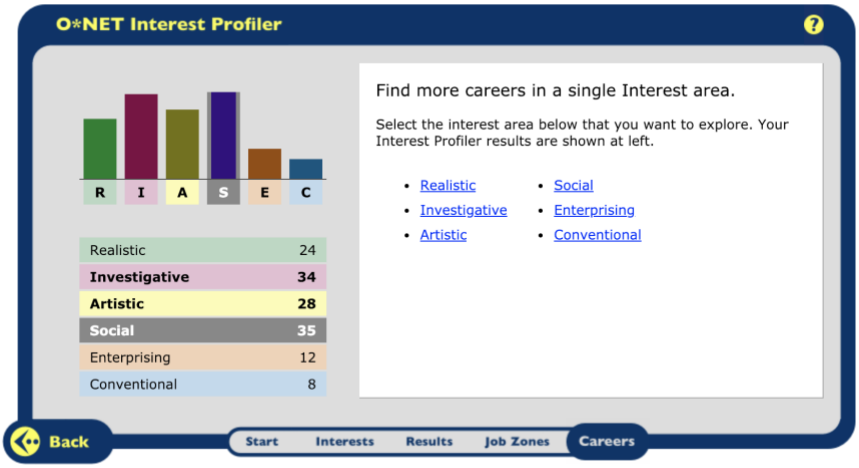

Figure 5. Clients can select a single interest area from which to see list of careers.

Clients may wish to explore numerous occupations that match their interests at different job zones. In combination, vocational interests and job zones provide a highly efficient and effective method for sorting through the wealth of career information hosted on the O*NET website.

The National Center for O*NET Development also publishes and maintains score reports and career worksheets for clients taking the paper-pencil-versions of the Interest Profiler. These resources are designed to help individuals interpret and apply their IP results without the need for internet access. The O*NET Resource Center contains download links for the complete score report and careers worksheet for the IP Short Form P & P (https://www.onetcenter.org/IP.html#paper-and-pencil).

Integration Options

The O*NET Interest Profiler offers a variety of integration options for web- and mobile-based uses (for complete information, see https://www.onetcenter.org/IP.html#integration). Organizations and application developers are encouraged to incorporate the IP using O*NET Web Services (https://services.onetcenter.org/). Developers can access the questions and scoring algorithm of the Mini-IP through O*NET Web Services. If you wish to develop new assessments based on the Mini-IP, see the Career Exploration Tools License page (https://www.onetcenter.org/license_tools.html).

As a web-based tool, the IP Short Form may be of particular interest to developers of websites or web-enabled applications. There are three main ways of integrating the Interest Profiler Short Form:

- "deep linking" to the Interest Profiler at My Next Move (https://www.mynextmove.org/)
- adding an IFrame Widget to your site
- providing scores and career suggestions through the O*NET web service API

The Spanish-language IP Short Form from Mi Próximo Paso (https://www.miproximopaso.org/) can also be added to your site.

Additional Advice on Using the O*NET Interest Profiler

In summary, the O*NET Interest Profiler is an effective tool for students, career seekers, and organizations and can be used for a variety of applied purposes (Lewis & Rivkin, 1999; Rounds et al., 2018; Rounds, Mazzeo, Smith, Hubert, Lewis, & Rivkin, 1999; Rounds, Su, Lewis, and Rivkin, 2010; Rounds, Walker, Day, Hubert, Lewis, & Rivkin, 1999; Rounds, Wee, Cao, Song, & Lewis, 2016). Nonetheless, it is important to recognize that vocational interests are one of many factors that determine career choices and success. The U.S. Department of Labor and National Center for O*NET Development offer several Career Exploration Tools available through the O*NET Resource Center (https://www.onetcenter.org/tools.html). Clients are encouraged to use the Interest Profiler in combination with other assessments (e.g., workplace readiness skills, abilities, work values) offered at their school or place of work to provide a more complete understanding of individual differences and career factors that are important to them.

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CHAPTER 4

Development of Items and Interest Profiler Forms

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This chapter describes the iterative development of the O*NET Interest Profiler from 1999 to 2018, and how this measure was refined for multiple settings and platforms: paper-and-pencil, standalone computer (retired), web-based, Spanish, and mobile (for a current overview, see https://www.onetcenter.org/IP.html). The proceeding sections explain the item development for each version of the Interest Profiler, including:

- The theoretical basis and methodology for item selection
- Validation study participants, methods, and analyses
- The rigorous and comprehensive standards for screening and selecting final items
- Rationales for test format and design
- Continued developments to the Interest Profiler

Development of the Interest Profiler Long Form

The U.S. Department of Labor's (DOL) Occupational Information Network (O*NET) endeavors to provide accurate, reliable, and up-to-date career assessment tools that allow students and workers to explore a range of contemporary jobs based on their interests. By the 1990s, the vocational assessment instruments used by the DOL were over a decade old. These measures—the U.S. Employment Service (USES) Interest Inventory (U.S. Department of Labor, 1981) and the Interest Checklist (U.S. Department of Labor, 1979a)—contained dated language and content, had archaic scoring systems that were inconvenient in self-assessment settings, lacked adequate data on reliability and validity, and no longer reflected contemporary advancements in vocational interest theory and research.

In view of this, the U.S. Department of Labor's Office of Policy and Research commissioned the development of a new instrument with five primary goals in mind:

1) Create an instrument with strong psychometric properties that reliably and accurately measure Holland's (1985a) interest types while remaining simple and self-scorable by clients
2) Create a fair and unbiased instrument with inoffensive and comprehensible language
3) Provide clients with up-to-date examples of work activities representing the entire world of work and ensure that a broad range of occupations and training-level requirements were included within the instrument
4) Develop a self-administered, self-interpretable instrument that can aid clients with career exploration on their own

5) Produce user-friendly support materials for counselors and program staff, as well as in self-assessment settings

Interest Profiler Long Form, Paper-and-Pencil Version[2]

The creation of the Interest Profiler Long Form began with pooling items from existing Department of Labor interest measures to ensure representation of a wide variety of work and activities. A total of 453 items were compiled from the USES Interest Inventory, the Interest Checklist, and the Job Search Inventory (New York State Job Service, 1985). A set of four judges trained in test development and Holland's (1985a) vocational personality theory critically reviewed each item, filtering out items that were biased or offensive to individuals or subgroups, non-work activity items (e.g., life experiences), outdated work activities, activities with a narrow focus, obsolete language, and duplicate items. 281 items remained after this review process. Judges also drafted 288 new items to cover new examples of work activities to bring the item pool to 569 items.

An initial pilot study was conducted with the 569 items to examine the items' endorsement rates. A heterogenous sample of 128 individuals (43 Male, 74 Female) of diverse ages (14-73 years) and employment statuses responded to each item. Items with extreme means or large gender differences were removed or flagged for revision. The primary reason for deleting items, however, was the comparison of endorsement rates for items with similar content. For example, among two items with similar content, the item with the more extreme endorsement rate would be eliminated. After this initial pilot study, a pool of 532 items was retained.

To ensure broad occupational representation across the world of work, items were sorted into a taxonomy of work content areas categorized by Holland's (1985a) RIASEC vocational personality types. Work content areas were derived from the Guide for Occupational Exploration (GOE; U.S. Department of Labor, 1979b). Four judges modified and assigned 68 work content areas from the GOE to the six RIASEC constructs. The taxonomy can be viewed in Table 1. In addition to being sorted into the taxonomy, items were rated according to training-level requirements in order to increase the diversity in complexity of occupations represented within each RIASEC category. Judges rated items on a 5-point training level scale ranging from 'up to and including 6 months of training' (1) to 'over 4 years of training' (5).

The taxonomy was critical in identifying content areas that lacked coverage in the current pool of items. Judges reviewed the 532 items and independently assigned them to one of the work content areas within a RIASEC category. Assignment disagreements were flagged, discussed, and resolved. With the final goal of trimming the pool to 180 items, a minimum of 100 items per RIASEC construct served as the target during item development. Areas within the taxonomy that did not meet the taxonomy goals (i.e., did not have enough items) were identified. New items were needed to fill these identified areas. A team of four item writers designed new items (written as work activities) to fill the gaps in the taxonomy. They endeavored to write these new items to be diverse in training-level requirement, inoffensive to individuals and subgroups,

2 The Paper-and-Pencil version of the O*NET Interest Profiler Long Form was retired in September 2018. It's replacement is the paper-and-pencil version of the Interest Profiler Short Form.

comprehensible to individuals from different backgrounds, and to elicit endorsement rates that fell between 10 and 90 percent.

A total of 272 new items were developed, resulting in a pool of 804 items. All items were formatted as work activity statements to be as relevant to the world of work as possible. A second pilot study on 147 individuals from employment service offices and other state agencies was conducted. Endorsement rates were once again reviewed, and items with extreme means, large gender differences, and overlapping content were considered for removal. After this second pilot study, a pool of 776 items remained.

The pool of 776 items was subjected to a comprehensive screening process designed to remove items that failed to meet the rigorous standards for inclusion in the O*NET Interest Profiler. With the exception of the development of the Jackson Vocational Interest Survey (Jackson, 1977), these standards are likely the most comprehensive screens in the field of vocational interest measurement. Each item was required to pass the seven screens presented below to be included in the next phase of the instrument development.

1. Retranslation
Five expert judges received a pool of items with no indication of the RIASEC category or work content area each item was intended to represent and were tasked with independently sorting each item to a RIASEC category. Judges discussed assignment differences when agreement on an item was less than 80%, when the assignment made by judges conflicted with the RIASEC category the items were intended to represent, or when items were flagged as problematic.

It was determined that three work content areas (Barber & Beauty Services: 9.02, Computer Technology: 2.05, Safety & Law Enforcement: 4.01) represent work activities present in multiple RIASEC categories. For example, Barber & Beauty Services - 9.02 was placed in both the Social and Enterprising constructs. The taxonomy was adjusted accordingly, leading to a total of 71 work content areas (see Table 1, work content areas identified in red).

2. Sensitivity
Six judges representing diverse race/ethnic and gender groups reviewed each item for possible biases or language that might be offensive to specific individuals or groups. The judges concluded with a list of suggested item revisions and deletions that were incorporated within the item pool.

3. Comprehensibility
An eighth-grade reading level was selected as the goal for the items. Using *The Living Word Vocabulary* (Dale & O'Rourke, 1981) as a resource, two sets of inspectors independently identified the grade level assigned to all words present in the pool of items. Agreement between the inspectors was high, and items with words exceeding an eighth-grade level were either replaced with simpler synonyms, rewritten, or left intact when no suitable replacement was available.

4. Familiarity
The work activities described by the items within the final version of the instrument needed to be recognizable (i.e., familiar) to a broad range of communities. Eight focus groups from four regions of the country were tasked with rating the familiarity of each item on a 5-point scale, ranging from 'not familiar' (1) to 'very familiar' (5). A total of 254 individuals from different ethnicities and education levels participated (127 Male, 127 Females; ages ranged from 18-70). The mean and mode familiarity ratings of both the total sample and sub-samples were used to remove items (in general, the cutoff was a mean of 2.0 or below). Focus group discussions also yielded a wealth of qualitative data related to: (a) the currency of the items, (b) the variety of the items, (c) missing work activities, and (d) recommendations related to specific items.

5. Training Requirement
This screening was conducted to ensure that items represented the broad range of training requirements specified by the taxonomy. Two panels of nine occupational analysts with expert knowledge of the Specific Vocational Preparation scale (SVP; U.S. Department of Labor, 1991) rated the amount of vocational training required to perform the work activity described by items in a subset of the item pool. Analysts in both panels rated 229 common items. Mean ratings on the common items were compared. The ratings between the two panels were very similar. The average mean difference between panel ratings was .06, and the correlation between the ratings was .98. The mean, mode, and standard deviation of each item's training level assignment were used to remove items from areas of the taxonomy that were over-represented (i.e., work content areas). The goal was to maximize the variance of training levels represented by items within each RIASEC category.

6. Duplication
A team of four judges reviewed the pool to eliminate items with identical or nearly identical content. For example, "type a memo" and "type a letter" would be considered nearly identical, and only one would be retained.

7. Copyright
Items were compared with those in the (1) Interest-Finder (Defense Manpower Data Center, 1995), (2) Self-Directed Search (Holland, 1985b), (3) Strong Interest Inventory (Hansen and Campbell, 1985), and (4) UNIACT-R (American College Testing Program, 1995). Two inspectors independently identified duplicate and near duplicate items. Agreement between the inspectors was extremely high, with the few discrepancies being resolved by the team of inspectors. All items that represented potential copyright infringements were removed.

Once the item screening process was complete, a pool of 500 items remained. These items were subjected to a large-scale item tryout study to gather information on the psychometric properties of the items in the tryout pool. Items with the highest reliability, lowest bias, and strongest construct validity would then be flagged for inclusion in the O*NET Interest Profiler.

A total of 1,123 participants across six states provided useable responses to the validation study. The sample was diverse in sex (529 Male, 594 Female), race/ethnicity (38% African American, 33% White, 25% Hispanic, 4% Other), age (individuals in their twenties totaled 30%; thirties,

27%; forties and fifties, 25%; teens, 15%; and sixties or greater, 3%) and education (individuals with high school degree, 47%; college through bachelors' degree, 27%; less than high school degree, 21%; and at least some graduate school, 5%). Unemployed workers represented 39% of the sample.

Participants were administered one of two mirrored forms of the O*NET Interest Profiler and the Interest-Finder (Wall, Wise & Baker, 1996). The Interest Finder is a self-scoring measure designed to help individuals discover their work-related RIASEC interests. RIASEC scale correlations between the Interest Profiler and Interest Finder were calculated to establish construct validity via comparisons with an already reputable interest measure. Counterbalancing of interest measures was used to prevent order effects. Data were collected between October and December of 1996.

The validation study showed that the O*NET Interest Profiler had good internal consistency and validity as a measure of RIASEC interests. All six scales demonstrated a high degree of internal reliability, with coefficient alphas ranging from .95 to .97. Although the rank order of the scale means was different between the Interest Profiler and Interest Finder, examination of the instruments' scale intercorrelations reveals a very high correlation between corresponding scales (.71 to .86), and low correlation between non-matching scales. These correlational relations provide evidence for both convergent and discriminant validity. Both measures also showed similar gender, racial and ethnic balance in endorsement rates within each RIASEC scale.

The data from the validation study was also used for item evaluation. Items with endorsement rates lower than 10% and higher than 75% were eliminated. Gender, Minority vs. non-minority, and ethnic comparisons of endorsement rates were also conducted. Items with endorsement rate differences greater than .30 were eliminated. Internal consistencies of items were also calculated for each RIASEC scale. Items with corrected item-to-total correlations below .30 were eliminated. An item pool of 461 items was retained after these screens.

Items were then ranked according to their conformity to Holland's (1985a) hexagonal model using a correlational algorithm. Holland's model states that a Realistic item, for example, should correlate most highly with its target scale, next strongest with its adjacent scales (Investigative & Conventional), less strongly with its alternative scales (Artistic & Enterprising), and least strongly with its opposite scale (Social). The algorithm applied was:

> 1-target scale correlation – { (.5* opposite scale correlation) – [1.5* (alternate scale correlation 1 + alternate scale correlation 2)] – [.1 * (adjacent scale correlation 1 + adjacent scale correlation 2)]}.

Items were eliminated if their corrected target scale correlation was less than their correlation with another scale. Next, four judges with psychometric backgrounds and training in Holland's vocational theory and the O*NET Interest Profiler Taxonomy independently made qualitative selection of items based on the item-to-scale correlations, gender and race/ethnic endorsement

rate differences, training level requirement ratings, and work content area assignments. Judges discussed their respective selections and agreed on an initial selection of 30-items per scale.

Starting with the initial 30-item scales, different item combinations within scales were examined to maximize the empirical relationships of items within scales, as well as to minimize the relationship of each item with non-target scale totals. Accordingly, an item was replaced if its removal increased the scale internal reliability (coefficient alpha) or if the item's target scale correlation was less than its correlation with another scale. Six scales composed of 30 items each were finalized. Twenty-nine of the total 180 items were original items drawn from the three existing DOL interest instruments.

The final step in the design of the O*NET Interest Profiler was to decide on a format and layout that could be reliably hand-scored by clients to produce accurate and reliable interest profiles. The format should also allow the instrument to be easily reviewed and updated in future digital versions.

The 3-point Like, Unsure, Dislike response format was selected due to its simplicity in hand-scoring and because it maintained continuity with formats of existing DOL instruments. Developers felt the 'Unsure' response was essential to allow clients to avoid making a 'forced choice' between two responses that did not adequately capture their interests. Counselors also expressed a preference for the ability to identify work activities that their clients were not aware of or had questions about so they could work with their clients to clarify and update them. Items that repeatedly result in 'Unsure' responses could also be reviewed for revision in future versions of the Interest Profiler.

A wide variety of item layouts were explored. The final layout was a presentation of 15 columns of 12 interest items each. Within each column, sets of items representing one of the interest categories are presented in the order: Realistic, Investigative, Artistic, Social, Enterprising, Conventional. Horizontal color bands distinguish the items representing each RIASEC category. The color bands serve to aid in the scoring of the instrument as well as allow clients to go back and review the work activity statements within a particular RIASEC construct once they have completed the instrument.

Additionally, a small focus group session ($N = 80$) was conducted to evaluate users' ability to understand the O*NET Interest Profiler, its scoring, and its instructions. Participants generally expressed high approval to take the instrument again and recommend it to their friends. The focus group discussions revealed that while some participants relied on visual instructions to understand the Interest Profiler, others found them distracting. Thus, the final version of the Interest Profiler used a "middle of the road" emphasis on visual instructions.

Interest Profiler Long Form, Computerized Version[3]

To extend the reach of the Interest Profiler to wider audiences and expand the settings in which the Interest Profiler can be administered, a computerized form of the Interest Profiler, called the IP Long Form, Computerized version was commissioned by the U.S. Department of Labor in 1999 (Rounds, Mazzeo, Smith, Hubert, Lewis & Rivkin, 1999). The computerized version of the Interest Profiler offered several advantages over the paper-and-pencil version. First, the automated scoring provides participants with accurate and virtually instant feedback about their vocational interests. Second, the career counseling tool can be conveniently administered in computer labs prevalent in schools and career centers. Third, the computerized version of the Interest Profiler is more environmentally-friendly.

The content (e.g. items, response scale) of the Computerized Interest Profiler (CIP) was identical to that of the paper-and-pencil version of the Interest Profiler Long Form, except that it was presented on a computer screen. Respondents could answer each item by using either a mouse or computer keyboard. Unlike the paper-and-pencil version, the CIP did not allow respondents to skip items. Scoring of the CIP was identical to that of the paper-and-pencil version, as described above, except that the subscales were automatically calculated by the program.

During its development, the CIP was evaluated for its test-retest reliability and comparability with the paper-and-pencil version of the Interest Profiler. A test-retest sample of 125 participants from North Carolina Employment and Security Offices were administered the CIP twice within 28-35 days. Cross-classification analysis of the test-retest sample indicated that the CIP yielded stable high-point RIASEC codes across administrations (Cohen's Coefficient Kappa = .67, hit rate = 75.2%).

A second study was conducted to examine if individuals would achieve the same results on both the CIP and the paper-and-pencil version of the Interest Profiler Long Form. 463 participants from employment and security offices in four states (New York, California, Michigan and North Carolina) completed both the CIP and pen and paper version in counterbalanced order. Results showed very similar internal consistency in scales for both versions (α = .93 to .96). A multidimensional scaling analysis also showed that both versions possessed similar structural validity. Correlations among matching RIASEC scales across test versions were very high (> .93), and further analysis showed that the two versions were highly comparable, with both measures yielding consistent primary code classifications (Cohen's Coefficient Kappa = .75, hit rate = 79.8%). Participants generally completed the CIP faster than the paper-and-pencil version, and 78.4% provided feedback that they preferred the computer format over the pen and paper format, while 17.5% would take either version.

3 The Computerized version of the O*NET Interest Profiler Long Form was retired in September 2018. It's replacement is the web-based version of the Interest Profiler Short Form or the Mini Interest Profiler.

Development of the Interest Profiler Short Form

In 2010, a 60-item version of the Interest Profiler, called the Interest Profiler Short Form was developed (Rounds, Su, Lewis, & Rivkin, 2010). The developers of the Short Form had four primary goals in mind:

1) Develop a shortened version of the Interest Profiler that can be used in consulting settings, where it is more practical to have measures that can be completed within 20 minutes.
2) The Short Form should adhere to the structure of the RIASEC model (Holland, 1997) with broad item coverage, while maintaining similar levels of reliability as the Long Form.
3) Select items to increase the endorsement rate for the Enterprising scale since previous research (Rounds, Walker, Day, Hubert, Lewis & Rivkin, 1999) indicated that the Enterprising scale had lower endorsement rates relative to the other five scales
4) Reduce the length to make suitable for web-based delivery to further leverage technology (e.g., more complicated response scale)

An iterative procedure was used to select items from the 180-item Interest Profiler to maintain construct validity of Holland's (1997) RIASEC typology. Using a large and diverse dataset (N = 1,061) that had been used in the validation of the Interest Profiler Long Form (Rounds, Walker, Day, Hubert, Lewis & Rivkin, 1999), researchers performed multidimensional scaling (Kruskal & Wish, 1978) on the inter-item correlation matrix. This process visualizes the relation of each item relative to each other item on a two-dimensional space. Items similar in content coverage would be clustered close to each other. In the context of the interest items, there tends to be six clusters representing each RIASEC type. Item selection for the Interest Profiler Short Form was based on the items' locations within each RIASEC cluster and between each RIASEC cluster according to the hexagonal model. The selection process worked both forward (adding items) and backward (deleting items). The developers recreated the spatial map when 20, 15, and 10 items were selected per RIASEC scale. For Enterprising items, the mean endorsement rate was an additional criterion used for item selection. These analyses and judgments yielded 10-item RIASEC scales.

The preliminary 10-item RIASEC scales underwent a final examination by a panel of three judges who had extensive backgrounds in vocational psychology and test construction. With information on all 180-items of the Long Form, they re-examined item means, standard deviations, item cross-correlations with RIASEC scale scores from both the Interest Profiler and Interest Finder (Wall & Baker, 1997), and two-dimensional spatial item maps for the 180 items of the Interest Profiler Long Form. At the RIASEC scale level, they also examined the reliabilities for the 10-item RIASEC scales and cross-correlations and cross-classification of the Interest Profiler Short Form with Interest Finder RIASEC scales. This review resulted in four items being replaced on four different RIASEC scales.

Interest Profiler Short Form, Web-based Version

A computerized version of the Interest Profiler Short Form was adapted for use with the launch of the *My Next Move* website in February 2011. In addition, a Spanish-language version of the IP Short Form was released when Mi Proximo Paso, a version of My Next Move tailored for a Spanish-speaking audience, was launched in February 2013. *My Next Move* and *Mi Proximo Paso* are subsidiary websites for O*NET that aid individuals in career exploration and planning. Both English- and Spanish-language versions are available for developers via O*NET Web Services. The English-version of the IP Short form was made available for developers in June 2012. The Spanish-version was made available in September 2013.

In the development of a web-based format, the developers of the Interest Profiler Short Form made the decision to switch from a three-point response format to a five-point scale where participants rated their interest in each item from 0 = "strongly dislike," 1 = "dislike," 2 = "unsure," 3 = "like," and 4 = "strongly like". Scores would then be computed by summing responses for each of the six Holland types with a score range of 0 to 40. This decision was based, in part, on the rationale given by Donnay, Morris, Schaubhut, and Thompson (2005) in the revision of the Strong Interest Inventory from a response format of three options to five options. With fewer items for the Short Form, increasing the response options to five points may improve the internal consistency reliability and accuracy of measurement. In 2017, O*NET introduced the use of emoji anchors into the Web-based version of the Short Form (see 'Development of Mini Interest Profiler', below).

There was also one minor item change between the Web-based and original versions. In the original version, item 36 ("Load computer software into a large computer network") was identified as outdated by many O*NET customers. Consultation with IT experts led the item to be reworded to its current form, " Install software across computers on a large network."

Interest Profiler Short Form, Paper-and-Pencil Version

In 2018, a paper-and-pencil (P & P) version of the Interest Profiler Short Form was developed. The main difference between the P & P version and the Web-based version is the method of scoring and response format. For the P & P version, the participant is asked to check *activities you would like to do.* These checked activities for each RIASEC type are summed yielding raw scores. The self-scoring P & P version of the Interest Profiler is necessary for multiple situations where computers are unavailable. Sites that need a paper-and-pencil form are, for example, schools and correctional facilities.

The Interest Profiler P & P and current Web-based versions use the same 60 items. Both IP versions, however, have one item that is different from the original developmental version of the Web-based IP (Rounds, Su, Lewis, & Rivkin, 2010). The one revised item is from the Social scale (New item: "Teach sign language to people who are deaf or hard of hearing". Old item: "Teach sign language to people with hearing disabilities"; c.f., Dunn & Andrews, 2015). This change was made based on the rationale of including only culturally appropriate and inoffensive phrasing towards people with disabilities (Dunn & Andrews, 2015). The new version of the

Interest Profiler was validated using two samples of individuals from correctional facilities (N = 421) and schools (N = 140) (Rounds, Hoff, Chu, Lewis & Gregory, 2018). Results showed that both versions of the Interest Profiler maintained high levels of reliability and internal consistency reliability, and respondents had little to no difficulty in self-scoring and reporting their high-point codes.

Development of the Mini Interest Profiler

In 2016, advancements in mobile technology spurred the Department of Labor to look into the possibility of an even shorter version of the Interest Profiler that could be quickly and easily be completed on cellphones and other mobile devices. There are several benefits of creating an even shorter, 30-item 'Mini' Interest Profiler. A 30-item interest measure is more flexible regarding when and where it can be administered. For example, short measures are more suitable to include as part of a longer survey or a large-scale panel study where participants are assessed on multiple constructs. It is also more practical to administer short measures through portable mobile devices. Attention span while on mobile phones is markedly lower than on computers, averaging about 72 seconds (Budiu, 2015). Attention on mobile is often fragmented in short sessions, and individuals often explore content on their mobile phones while commuting. Furthermore, the way items are presented on small phone screens disallow comparable density of items to paper-and-pencil tests (web-based surveys typically require more "pages" than paper tests; Stanton, Sinar, Balzer, & Smith, 2002). The increased number of pages to scroll through can be more tedious and give the illusion that a test is longer than its paper-and-pencil version.

For the development of the Mini Interest Profiler, the same dataset (N = 1,061; Rounds et al., 1999) used to develop the Short Form was used to develop the Mini-IP (Rounds, Wee, Cao, Song & Lewis, 2016). Data from items in the 60-item Interest Profiler Short Form were subjected to three different filtering methods: Item Response Theory, Multidimensional Scaling, and Content and Gender Balance.

1. Item Response Theory

Item Response Theory (IRT) analysis involves the use of mathematical models to represent the relationship between an individual's observed responses to scale items and the true underlying trait score (Hambleton & Swaminathan, 1985, 1991). In IRT, the underlying trait (e.g. realistic interests) is commonly designated with the Greek letter theta (θ). An individual's probability of endorsing an item can then be modeled in terms of his or her underlying trait level and several item characteristics such as discrimination (a) and difficulty (b). By applying an IRT measurement model to RIASEC scale data comprising responses from individuals with varying trait levels, one can estimate the item parameters (a & b) that provide information on how well the item assesses the entire continuum of an interest dimension.

Results for the IRT item analysis are presented in Tables 2a to 2f. The item discrimination parameter (a) represents an item's ability to differentiate between individuals with similar but not identical trait levels. By selecting high-discrimination items, it is possible to create scales with fewer items and relatively high measurement precision. The item difficulty parameter (b) represents the trait level of an individual who will endorse the item with a 50% chance. While

the concept of item difficulty in interest measures is somewhat disjoint, *b*-values across items will inform us on the extent to which the scale suitably assesses individuals with different levels of interests. Having a balanced distribution of items across difficulty levels can prevent inaccurate measurement of individuals with relatively extreme interests. In sum, by applying item response principles to each item within the individual RIASEC scales, O*NET researchers were able to select the most discriminating items while maintaining a balanced distribution of item difficulty and avoiding items with overlapping content.

BILOG Software (Thissen, 1991) was used to estimate the 2-Parameter Logistic Model item parameters (*a* & *b*) for each item within the RIASEC dimensions. Model fit and local independence was assessed using Stark's (2001) MODFIT program. Items with extremely low discrimination ($a < .60$) were disregarded for selection.

2. Multidimensional Scaling

Multidimensional scaling methods used in the shortening of the Interest Profiler Long Form to Short Form were also used to select items from the Short Form to be included in the Mini Form. Items were selected based on their locations in the two-dimensional space according to Holland's RIASEC model. In other words, the item-level multidimensional scaling output was used to decide on different combinations of 5 items for each RIASEC scale such that the scale-level multidimensional scaling output satisfactorily reproduced Holland's RIASEC hexagon. The selection process was both backwards (deleting items) and forward (adding items). For example, while the four Social 'teaching' items (S1, S6, S7, & S10) had very similar discrimination parameters, researchers selected the item that made the final Social scale roughly equidistant to the Enterprising scale and Artistic scale.

3. Content Coverage and Gender Balance

The remaining criteria used for item selection were to ensure balanced content coverage of the selected items and minimize gender differences within RIASEC scales. Three judges with experience in vocational psychology and test construction checked each selected item for redundancy of verbs and activities. For example, there were three items in the Investigative scale describing activities conducted within science labs (I8 [Work in a biology lab, $a = 1.77$], I10 [Do laboratory tests to identify diseases, $a = 1.6$] and I5 [Examine blood samples using a microscope, $a = 1.31$]. Although all 3 items have high discrimination parameters, Researchers selected only one item to represent the laboratory context based on RIASEC structure and gender balance. Both the IRT analysis and judges' discussions indicated that only one of the three lab items should be included in the Mini-IP. Analysis of gender balance involved calculating effect sizes for the mean differences between males and females for each item and then selecting items such that the net gender difference for each RIASEC scale was acceptably small (Su, Rounds, & Armstrong, 2009).

The result of these item selection criteria shortened the Interest Profiler Short Form to 30-items (5 items per RIASEC scale). This 30-item Mini Interest Profiler was validated using new data from a sample of 600 participants collected online through Amazon's Mechanical Turk. From the results of this validation study, no additional changes to the instrument were deemed necessary. The Mini Interest Profiler maintained the same format and scoring method as the

Online Interest Profiler Short Form. Participants indicate their interest in each activity from 0 = "strongly dislike," 1 = "dislike," 2 = "unsure," 3 = "like," and 4 = "strongly like" and scores are computed by summing responses for each of the six Holland types with a score range of 0 to 20.

Substitution of Response Options with Emojis

Emojis are ideograms commonly used in text messaging and email platforms (e.g., Facebook, Android text messaging, Gmail). These simple images most commonly depict faces expressing different affective responses (e.g., smiley face). In 2016, O*NET explored the possibility of using emojis as scale anchors for their online Interest Profiler Short Form and Mini-IP. In addition to being compact and ideal for use on small screens, similarly constructed "face rating scales" are often preferred by respondents (Champion et al., 2010) and may even be more accurate at capturing affective responses in some populations (Kunin, 1955; Izard, 2007; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006).

Rounds, Phan, Amrhein, & Lewis (2016) compared the equivalence of using the Interest Profiler Short Form with emoji scales versus the traditional five-point response scale. In two studies, they found that emoji response scales did not compromise the psychometric properties of the scale, nor interfere with the structural validity of Holland's (1992) model of interests.

In 2017, O*NET officially introduced the use of emoji anchors in their online version of the Interest Profiler Short Form at www.mynextmove.org/explore/ip. The following emojis were used to represent different intensity of likes and dislike:

-  = **Strongly Dislike**
-  = **Dislike**
-  = **Unsure**
-  = **Like**
-  = **Strongly Like**

The same emoji anchors are available to developers who wish to use the Mini Interest Profiler.

Summary and Continued Development of the Interest Profiler

Since its inception in 1999, the O*NET Interest Profiler has undergone many iterative changes to its length, content, and format in order to maintain the highest standards of accuracy, validity, reliability, and relevancy. With the advent of new technologies, new jobs are constantly being created, while old job descriptions and workplace practices are rapidly evolving (Casey, 1999). O*NET recognizes the continued need to keep up with these changes and update items as activity statements become outdated or when what is considered proper, inoffensive language changes with the times. The Interest Profiler now offers 60-item and 30-item versions that can be

administered through paper-and-pencil formats and using computers or mobile devices. O*NET will continue to monitor new technological and workplace advancements and make necessary changes to continue to provide high quality career counseling and assessment to its users.

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Table 1. *Interest Profiler Taxonomy*

Realistic	**Investigative**	**Artistic**	**Social**	**Enterprising**	**Conventional**
03.01 Plants and Animals	02.01 Physical Sciences	01.01 Literary Arts	04.01 Safety & Law Enforcement	08.01 Sales Technology	08.09 Material Control
03.03 Animal Training Services	02.02 Life Sciences	01.02 Visual Arts	09.01 Hospitality Services	08.02 General Sales	07.01 Administrative Detail
04.02 Security Services	02.03 Medical Sciences	01.03 Performing Arts: Drama	09.02 Barber & Beauty Services	08.03 Vending	07.02 Mathematical Detail
05.04 Airplane & Ship Operation	02.04 Laboratory Technology	01.04 Performing Arts: Music	10.01 Social Services	09.05 Attendant/Customer Services	07.03 Financial Detail
05.05 Craft Technology	02.05 Computer Technology	01.05 Performing Arts: Dance	10.02 Nursing, Therapy, & Specialized Teaching Services	11.04 Law	07.04 Oral Communications
05.06 Systems Operations	05.01 Engineering	01.06 Craft Arts	10.03 Child & Adult Care	11.05 Business Administration	07.05 Records Processing
05.07 Quality Control: Mechanical	05.02 Mechanical Systems Management	01.08 Modeling	11.02 Educational & Library Services	11.06 Finance Buy & Sell	07.06 Clerical Machine Operation

05.08 Land & Water Vehicle Operation	05.03 Engineering Technology	12.02 Physical Feats	12.01 Sports	11.07 Service Administration	07.07 Clerical Handling
05.10 Crafts	11.01 Mathematics & Statistics			11.09 Promotion	2.05 Computer Technology
05.11 Equipment Operation	11.03 Social Research			11.11 Business Management	
05.12 Basic Mechanics	11.06 Finance: Design & Interpretation			11.12 Contracts & Claims	
06.01 Production Technology	11.08 Communications			9.02 Barber & Beauty Services	
06.02 Production Work	11.10 Regulations Enforcement				
06.03 Quality Control: Industrial	12.00 General Research				
09.03 Passenger Services	4.01 Safety & Law				

Note. Items in Red were moved after retranslation screening.

Table 2a. *Item Parameters for Short-IP Realistic Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	**Build kitchen cabinets**	1.29	0.19	0.50	0.50	0.23	0.42
2	Lay brick or tile	1.35	0.57	0.42	0.50	0.23	0.42
3	**Repair household appliances**	1.63	0.26	0.51	0.50	0.25	0.43
4	Raise fish in a fish hatchery	0.70	1.40	0.40	0.49	0.16	0.37
5	**Assemble electronic parts**	1.22	0.43	0.54	0.50	0.25	0.43
6	**Drive a truck to deliver packages to offices and homes**	1.08	0.30	0.54	0.50	0.29	0.45
7	**Test the quality of parts before shipment**	1.03	0.19	0.49	0.50	0.26	0.44
8	Repair and install locks	1.62	0.45	0.44	0.50	0.16	0.37
9	Set up and operate machines to make products	1.32	0.43	0.46	0.50	0.19	0.39
10	Put out forest fires	0.75	0.54	0.47	0.50	0.19	0.39

Note. Items in bold were selected for the Mini-IP.

Table 2b. *Item Parameters for Short-IP Investigative Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	**Develop a new medicine**	1.27	-0.16	0.55	0.50	0.45	0.50
2	**Study ways to reduce water pollution**	1.04	0.01	0.53	0.50	0.45	0.50
3	**Conduct chemical experiments**	1.25	0.34	0.44	0.50	0.31	0.46
4	Study the movement of planets	1.10	0.20	0.52	0.50	0.34	0.47
5	**Examine blood samples using a microscope**	1.31	0.25	0.37	0.48	0.40	0.49
6	Investigate the cause of a fire	0.71	-0.07	0.62	0.49	0.44	0.50
7	**Develop a way to better predict the weather**	0.88	0.17	0.48	0.50	0.34	0.47
8	Work in a biology lab	1.77	0.22	0.42	0.49	0.39	0.49
9	Invent a replacement for sugar	0.88	0.50	0.36	0.48	0.30	0.46
10	Do laboratory tests to identify diseases	1.60	0.05	0.40	0.49	0.43	0.50

Note. Items in bold were selected for the Mini-IP.

Table 2c. *Item Parameters for Short-IP Artistic Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	**Write books or plays**	1.18	0.15	0.44	0.5	0.56	0.5
2	Play a musical instrument	0.91	-0.26	0.62	0.49	0.61	0.49
3	**Compose or arrange music**	1.37	0.3	0.41	0.49	0.35	0.48
4	Draw pictures	0.79	-0.08	0.53	0.5	0.53	0.5
5	**Create special effects for movies**	1.2	-0.27	0.68	0.47	0.49	0.5
6	**Paint sets for plays**	0.8	0.35	0.35	0.48	0.42	0.49
7	**Write scripts for movies or television shows**	1.56	0.05	0.45	0.5	0.47	0.5
8	Perform jazz or tap dance	0.84	0.72	0.25	0.44	0.33	0.47
9	Sing in a band	1.13	0.38	0.42	0.49	0.4	0.49
10	Edit movies	1.28	-0.11	0.46	0.5	0.41	0.49

Note. Items in bold were selected for the Mini-IP.

Table 2d. *Item Parameters for Short-IP Social Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	Teach an individual an exercise routine	0.96	0.12	0.39	0.49	0.53	0.5
2	**Help people with personal or emotional problems**	1.38	-0.4	0.58	0.49	0.75	0.44
3	**Give career guidance to people**	1.14	-0.35	0.49	0.5	0.62	0.49
4	**Perform rehabilitation therapy**	1.37	0.05	0.37	0.48	0.56	0.5
5	**Do volunteer work at a non-profit organization**	0.75	-0.21	0.48	0.5	0.67	0.47
6	Teach children how to play sports	0.99	-0.44	0.69	0.47	0.61	0.49
7	Teach sign language to people with hearing disabilities	0.94	0.08	0.31	0.46	0.58	0.49
8	Help conduct a group therapy session	1.06	-0.1	0.37	0.48	0.61	0.49
9	Take care of children at a day-care center	0.89	-0.01	0.27	0.44	0.57	0.5
10	**Teach a high-school class**	0.85	0.03	0.41	0.49	0.4	0.49

Note. Items in bold were selected for the Mini-IP.

Table 2e. *Item Parameters for Short-IP Enterprising Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	Buy and sell stocks and bonds	0.58	-0.04	0.45	0.5	0.38	0.49
2	Manage a retail store	2.2	-0.07	0.46	0.5	0.54	0.5
3	Operate a beauty salon or barber shop	0.99	0.45	0.18	0.39	0.4	0.49
4	**Manage a department within a large company**	1.18	-0.36	0.53	0.5	0.53	0.5
5	**Start your own business**	0.87	-1.4	0.84	0.36	0.74	0.44
6	**Negotiate business contracts**	0.95	0.16	0.5	0.5	0.39	0.49
7	Represent a client in a lawsuit	0.59	0	0.42	0.49	0.36	0.48
8	**Market a new line of clothing**	0.98	-0.14	0.4	0.49	0.48	0.5
9	**Sell merchandise at a department store**	1.26	0.23	0.27	0.44	0.38	0.49
10	Manage a clothing store	2.29	-0.07	0.37	0.48	0.46	0.5

Note. Items in bold were selected for the Mini-IP.

Table 2f. *Item Parameters for Short-IP Conventional Scale Using Developmental Sample (N = 1061)*

		2PL		Item Averages Males (*N* = 437)		Females (*N* = 624)	
Item #	Content	*a*	*b*	*M*	*SD*	*M*	*SD*
1	Develop a spreadsheet using computer software	1.03	-0.05	0.43	0.5	0.47	0.5
2	Proofread records or forms	1.18	0.15	0.31	0.46	0.49	0.5
3	**Load computer software into a large computer network**	0.92	-0.17	0.44	0.5	0.45	0.5
4	**Operate a calculator**	1.1	-0.5	0.55	0.5	0.7	0.46
5	**Keep shipping and receiving records**	1.61	-0.07	0.42	0.49	0.47	0.5
6	Calculate the wages of employees	1.7	0.05	0.35	0.48	0.48	0.5
7	**Inventory supplies using a hand-held computer**	1.19	-0.06	0.4	0.49	0.48	0.5
8	Record rent payments	1.61	-0.07	0.33	0.47	0.51	0.5
9	Keep inventory records	2.09	-0.02	0.36	0.48	0.48	0.5
10	**Stamp, sort, and distribute mail for an organization**	1.09	0.06	0.27	0.44	0.5	0.5

Note. Items in bold were selected for the Mini-IP.

CHAPTER 5

Reliability Evidence for the Interest Profiler

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This chapter summarizes the psychometric properties of the O*NET Interest Profiler with a special focus on the precision and errors of measurement (i.e., reliabilities). Specifically, reliabilities are examined for the three forms of the Interest Profiler, including the Long Form (180 items), Short Form (60 items), and Mini-IP (30 items). The proceeding sections discuss the reliability of the Interest Profiler in several parts, including:

- General introduction to reliability assessment and interpretations
- Summary of past studies that examined the reliability of the Interest Profiler
- Psychometric notes on the Interest Profiler scale development
- Empirical assessments of the Interest Profiler reliability and measurement precision

Reliability Considerations

When attempting to measure psychological variables, including vocational interests, it is critical to construct and apply psychometrically sound scales. To demonstrate the quality of a test, reliability is often assessed in several different ways.

Traditionally, reliability reflects the overall consistency of a measure; a measure is said to have a high reliability if it produces consistent results under similar conditions. Predominantly, reliability assessment procedures follow the Classical Test Theory (CTT; see Lord & Novick, 1968 for details). The most common type of reliability estimate reported in scholarly articles from the social and behavioral sciences is internal consistency. Internal consistency describes the extent to which items on a test or scale correlate with one another. It is important for items from the same scale to show a high degree of internal consistency to ensure that they are measuring the same construct. Internal consistency is most often measured using the coefficient alpha (i.e., Cronbach's alpha, following Cronbach's seminal paper in 1951; Dunn, Baguley, & Brunsden, 2014). However, recently psychometricians have advocated for reporting various other types of reliability information as well.

Cronbach's α (alpha)

In CTT, reliability is defined as the ratio of variance of the true score (i.e., something we cannot directly measure) to variance of the observed score for the trait being measured. The portion of variance in the observed score not explained by the true score is considered to be random measurement error. This means that anything that would influence error will change the

reliability of a test. Because errors and true scores are unknown, it is not possible to know the exact value of a test's reliability. Coefficient alpha serves as a "best guess" for the unknown population parameter that is the true reliability of the scale. Nunnally and Bernstein (1994) recommended a heuristic that having coefficient alphas above .70 can be generally considered the rule-of-thumb cut-off for determining good internal consistency.

McDonald's ω (omega)

As an alternative to alpha, omega has been proposed as a more sensible index of internal consistency (McDonald, 1999). The model that defines alpha assumes constant item variances for true scores, but allows true score means and error variances of items to vary (Raykov, 1997). The restrictive nature of this reliability model may be problematic. Omega makes fewer and more realistic assumptions—for example, the assumption of scale constancy or invariant response formats does not need to be met. Therefore, omega has less risk of over- or under-estimation of reliability.

Confidence Intervals for Internal Consistency

It is also recommended that bootstrapping be used to obtain confidence intervals for internal consistency estimates (Raykov, 1998). Confidence intervals are believed to be a crucial requirement for any good effect size measure, and they provide a solid foundation for interpretations of internal consistency estimates (Kelley & Preacher, 2012).

IRT-based Test Information and Conditional Standard Error

Item response theory (IRT) underpins a family of measurement models that describe the relationship between an individual's response to an item and the person's standing on a continuous latent trait. IRT models have been found to resolve longstanding problems with CTT in terms of test construction, evaluation, administration, and scoring (Embretson & Reise, 2000). To use IRT models to assess scales, an important concept is the information function (Birnbaum, 1968). Both items and scales have information functions. Item information indicates the relative ability of an item to distinguish among trait scores at various locations along the trait continuum. Summing all item information across scales yields scale (or test) information. Test information provides a visual guide of where along the trait continuum a test is most informative, and it is also inversely related to the conditional standard error of measurement. As compared to CTT, where test reliability is assumed to be constant for all trait scores, test information in IRT shows that measurement precision can differ along various ranges of the latent trait (Reise & Waller, 2002).

Prior Studies with the Interest Profiler

Numerous research studies since 1999 have used the Interest Profiler. Table 1 displays a summary table of the reliability estimates for studies using the Interest Profiler. Although advanced reliability assessment procedures have been proposed, not many studies have incorporated the various reliability estimation techniques. Out of the 35 studies surveyed, the

coefficient alphas across the six RIASEC interest domains show an adequate level of reliability. Also as expected, shorter forms of the Interest Profiler have lower estimates of reliability (i.e. smaller alpha coefficients). Estimates of Cronbach's alpha were typically above .90 for the 180-item Long Form, above .80 for the 60-item Short Form, and above .70 for the 30-item Mini-IP.

Psychometric Notes on Interest Profiler Scale Development

Interest Profiler Long Form (Computer-Administered and Paper-and-Pencil)

The Interest Profiler Long Form (IP Long Form) consists of 180 items and measures 6 RIASEC domains with 30 items each. The development report (Rounds, Walker et al., 1999) showed that the Interest Profiler had very high internal consistency across the six RIASEC scales, with estimates ranging from .93 to .96.

Test-retest examination showed that the coefficient alphas for the different time points, and the means and standard deviations, are very similar across time points, with the reliability estimates at the second time-point (after an approximate one-month lapse) ranging from .91 to .97. The test-retest correlations for the Interest Profiler RIASEC scales range from .81 to .92, indicating that scores based on theInterest Profiler is also reliable over time.

Interest Profiler Short Form, Web-based Version

The Web-based version of the Interest Profiler Short Form (IP Short Form, Web-based version) consists of 60 items and is perhaps the most commonly administered form of the O*NET Interest Profiler. As indicated in the scale development report, with a developmental sample of 1,061 participants, and a test-retest sample of 132 participants, the Interest Profiler Short Form showed sufficient internal consistency and high stability across time (see Rounds, Su, Lewis, & Rivkin, 2010). Specifically, coefficient alphas for the Short Form range from .78 to .87 (M = .81) with the total developmental sample. In addition, in the test-retest sample coefficient alphas ranged from .78 to .89 (M = .84) at Time 1 and from .82 to .90 (M = .86) at Time 2. Test-retest correlations showed high correlations between the two time points, ranging from .78 to .86 (M = .82).

Interest Profiler Mobile Form (Mini-IP)

The Mini Interest Profiler is a 30-item measure designed to assess interests on mobile platforms. The development report showed that the coefficient alphas ranged from .70 to .75 (M = .75; see Rounds, Wee, Cao, Song, & Lewis, 2016). In addition, for a separate validation sample, the five-item per scale Mini-IP yields coefficient alpha ranging from .74 to .81, indicating that the Mini-IP has adequate level of internal consistency.

Interest Profiler Reliability Examination

To incorporate various other types of reliability information for different forms of the Interest Profiler, empirical data sets were acquired and reanalyzed for the current manual. Coefficients alpha and categorical omega, along with their confidence intervals, were calculated with bias corrections and accelerated bootstrapping with 1,000 rounds of random sampling.

Interest Profiler Short Form (Web-based version) – Adult sample

Table 2a shows the alpha and omega reliability estimates for the Interest Profiler Short Form in a sample of 575 adults. Alpha coefficients ranged from .84 to .90 with the lower-bounds of bootstrapped confidence intervals above .82 for all RIASEC scales. Omega coefficients ranged from .90 to .94 with the lower bounds of bootstrapped confidence intervals above .88. These two reliability estimates showed that the Short Form has high internal consistency.

Figure 1 shows the conditional standard errors and test information of the IP Short Form by RIASEC domains for the 575 adults. Results show that at the mid-range of the trait continuum, the standard errors are small and the test information is peaking. This indicates that the scale scores can be estimated reliably for the majority of people on the continuum. This is consistent with IRT research that people at the middle range of the trait continuum—usually within one standard deviation of the mean—are often estimated more precisely.

Interest Profiler Short Form (Paper-and-Pencil) – Incarcerated sample

Table 2b shows the alpha and omega estimates for the IP Short Form in an incarcerated sample of 420 adults. Alpha coefficients ranged from .73 to .83, with the lower bounds of bootstrapped confidence intervals all above .69. Omega coefficients ranged from .75 to .87, with the lower bounds of bootstrapped confidence intervals all above .69 as well. These estimates indicate that the paper-and-pencil version of the IP Short Form has relatively high internal consistency.

Figure 2 shows the IRT conditional standard errors and test information of the IP Short Form in the incarcerated sample for the six domains. From the plots, it can be inferred that interest scores can be estimated relatively reliably for people in the mid-positive range of the trait continuum because the conditional standard error curves have the lowest points, and test information curves have the highest peaks, in that range.

Interest Profiler Mobile Form (Mini-IP)

Table 2c shows the alpha and omega estimates for the Mini-IP in a sample of 575 adults. Alpha coefficients ranged from .74 to .81 with the lower bounds of bootstrapped confidence intervals all above .70. Omega coefficients ranged from .76 to .83 with the lower bounds of bootstrapped confidence intervals all above .72. These two estimates showed that the Mobile Form has high internal consistency.

Figure 3 shows the conditional standard errors and the test information of the Mini-IP in the current sample for the six RIASEC domains. Results show that at the low-to-mid positive range of the trait continuum, the standard errors are small and the test information is high, indicating that the scale scores can be estimated reliably for most people on the continuum.

Interest Profiler Long Form (Paper & Pencil)

Table 2d shows the alpha and omega estimates for the original IP Long Form in a sample of 435 adults. Alpha coefficients ranged from .93 to .96, with the lower bounds of all confidence intervals above .92. Omega coefficients also ranged from .93 to .96, with the lower bounds of all confidence intervals above .92. These estimates indicate that the Long Form has very high internal consistency.

Figure 4 shows the conditional standard errors and test information of the IP Long Form in a sample of 435 adults for the six RIASEC domains. Results show that at the mid-range of the trait continuum, the standard errors are small and the test information peaks, indicating that the scale scores can be estimated with precision for the majority of people on the continuum.

Summary

This chapter examines the reliability from three perspectives (i.e., alpha, omega, and IRT) for the three forms (i.e., Short Form, Long Form, and Mobile Form) of the Interest Profiler. Results consistently show that the Interest Profiler generally has high internal consistencies and can be a reliable measure for the majority of people on the trait continuum for the RIASEC domains.

Table 1. *Interest Profiler reliability studies: Summary of Cronbach's alphas*

Study	Sample composition	Sample size	Rating scale points	IP measure	R	I	A	S	E	C	Note
Almeida, Ahmetoglu, & Chamorro-Premuzic, 2014	Employed adults	565	5	IP-60	0.88	0.91	0.86	0.83	0.82	0.87	
Anthoney & Armstrong, 2010	College students	1020	5	IP-180			0.87				Only reported mean reliability
Armstrong & Anthoney, 2009	College students	1186	5	IP-180			0.88				Only reported mean reliability
Armstrong, Allison, & Rounds , 2008	College students	494	5	IP-180	0.95	0.95	0.96	0.95	0.93	0.97	
Armstrong, Allison, & Rounds , 2008	College students	322	5	IP-180	0.96	0.96	0.96	0.96	0.93	0.97	
Condon, 2014	Online sample	14882	NA	IP-60	0.86	0.88	0.84	0.80	0.82	0.85	Block missing by design
Dobson, 2010	High school students	57032	3	IP-180	0.95	0.95	0.95	0.95	0.93	0.96	Same data as in Dobson et al., 2014
Dobson, Gardner, Metz, & Gore, 2014	High school students	57032	3	IP-180	0.95	0.95	0.95	0.95	0.93	0.96	
Jonason, Wee, Li, & Jackson, 2014	Employed adults	424	5	IP-60			0.88				only reported mean reliability
Lee, 2016	College students	495	5	IP-60	0.90	0.90	0.90	0.90	0.89	0.92	
Lewis & Rivkin, 1999	Mixed sample	1123	3	IP-180	0.95	0.95	0.96	0.96	0.95	0.97	
Nagel, Watts, Murphy, & Lilienfeld, 2018	US MTurk	426	NA	IP-60	0.97	0.96	0.95	0.97	0.97	0.98	

Neukrug, Sparkman, & Moe, 2017	Human services professionals	355	5	IP-60	0.89	0.92	0.88	0.79	0.89	0.91	
Rounds, Hoff, Chu, Lewis, & Gregory, 2018	Incarcerated sample	421	2	IP-60	0.73	0.81	0.75	0.78	0.77	0.83	
Rounds, Hoff, Chu, Lewis, & Gregory, 2018	School sample	140	2	IP-60	0.60	0.70	0.69	0.68	0.72	0.79	
Rounds, Wee, Cao, Song, Lewis, 2016	Mixed sample	1061	3	IP-60	0.78	0.82	0.78	0.78	0.87	0.83	Same data as in Tay et al., 2009
Rounds, Wee, Cao, Song, Lewis, 2016	Mixed sample	1061	3	IP-30	0.73	0.74	0.75	0.70	0.71	0.74	
Rounds, Wee, Cao, Song, Lewis, 2016	Mixed sample	575	5	IP-60	0.88	0.90	0.90	0.89	0.89	0.90	Based on the same sample
Rounds, Wee, Cao, Song, Lewis, 2016	Mixed sample	575	5	IP-30	0.81	0.80	0.81	0.79	0.74	0.79	
Rounds, Phan, Amrhein, & Lewis, 2016	College students	149	5	IP-60	0.89	0.89	0.88	0.87	0.84	0.92	
Rounds, Phan, Amrhein, & Lewis, 2016	College students	144	5	IP-60	0.88	0.92	0.88	0.87	0.82	0.92	Emoji scale
Rounds, Phan, Amrhein, & Lewis, 2016	College students	151	5	IP-60	0.84	0.86	0.87	0.88	0.81	0.90	
Rounds, Phan, Amrhein, & Lewis, 2016	College students	133	5	IP-60	0.89	0.93	0.91	0.88	0.88	0.91	Emoji scale
Russell, 2007	College students	320	3	IP-180	0.95	0.94	0.93	0.94	0.91	0.95	
Tay, Su, & Rounds, 2011	Mixed sample	1061	3	IP-180	0.93	0.94	0.94	0.95	0.30	0.96	

Warlick, Ingram, Ternes, & Krieshok, 2018	College students	397	5	IP-60	0.90	0.88	0.86	0.78	0.75	0.89	
Wee, 2016	College students	510	5	IP-60			0.83				Only reported mean reliability
Wiegand & Bruno, 2018	Union workers	777	7	IP-60	0.90	0.92	0.88	0.82	0.86	0.90	
Wiegand, 2018	Employed adults	3824	6	IP-60	0.90	0.91	0.88	0.87	0.87	0.92	
Wiegand, 2018	US MTurk	1657	6	IP-60	0.89	0.91	0.89	0.86	0.84	0.90	

Table 2. *Reliability estimation of IP Short Form, Long Form, and Mini*

Measure and sample size	Factors	Cronbach's alpha			Omega categorical		
		Estimate	CI_Lower	CI_Upper	Estimate	CI_Lower	CI_Upper
(a) Short Form, Web-based N = 575	R	0.875	0.859	0.890	0.909	0.889	0.923
	I	0.894	0.879	0.908	0.913	0.896	0.924
	A	0.892	0.876	0.905	0.937	0.919	0.949
	S	0.880	0.862	0.896	0.902	0.882	0.917
	E	0.848	0.827	0.867	0.905	0.881	0.926
	C	0.897	0.883	0.910	0.923	0.902	0.935
(b) Short Form, Paper-and-Pencil N = 420	R	0.732	0.691	0.772	0.751	0.688	0.788
	I	0.814	0.779	0.844	0.825	0.771	0.856
	A	0.749	0.707	0.793	0.813	0.747	0.857
	S	0.776	0.739	0.807	0.791	0.740	0.818
	E	0.773	0.737	0.801	0.808	0.754	0.831
	C	0.831	0.802	0.858	0.867	0.818	0.888
(c) Mini-IP N = 575	R	0.809	0.777	0.833	0.821	0.784	0.846
	I	0.794	0.758	0.824	0.820	0.786	0.849
	A	0.801	0.768	0.826	0.834	0.802	0.857
	S	0.777	0.739	0.806	0.796	0.760	0.824
	E	0.735	0.698	0.768	0.758	0.715	0.791
	C	0.782	0.746	0.811	0.796	0.755	0.825
(d) IP Long Form N = 435	R	0.937	0.927	0.945	0.938	0.929	0.947
	I	0.943	0.935	0.950	0.943	0.936	0.951
	A	0.948	0.942	0.954	0.949	0.942	0.955
	S	0.951	0.945	0.957	0.952	0.946	0.958
	E	0.926	0.915	0.936	0.927	0.917	0.937
	C	0.962	0.956	0.966	0.962	0.957	0.967

Figure 1. IRT conditional standard errors and test information for the IP Short Form, Web-based version (N = 475)

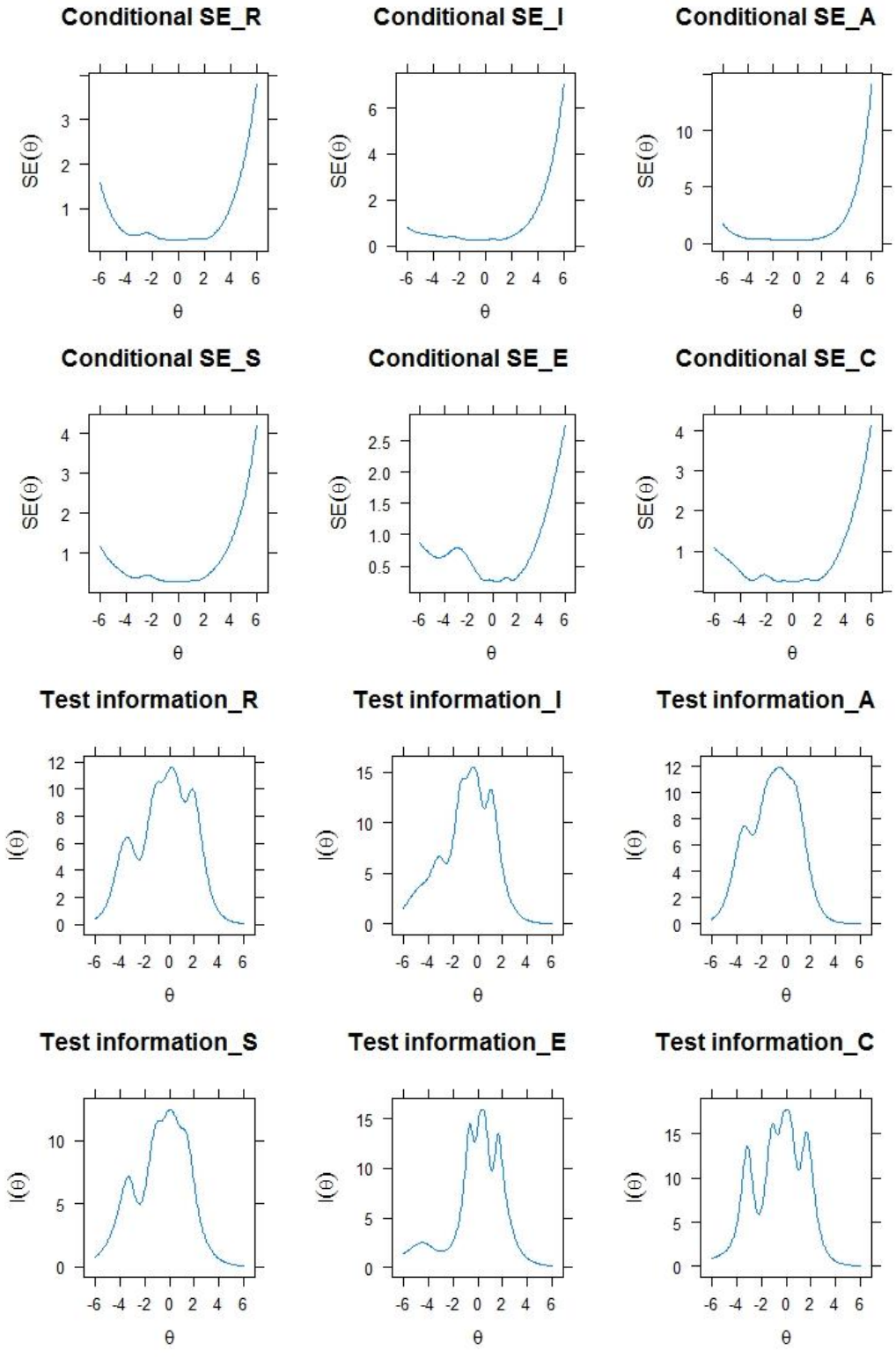


Figure 2. IRT conditional standard errors and test information for the IP Short Form, Paper & Pencil version (N = 420)

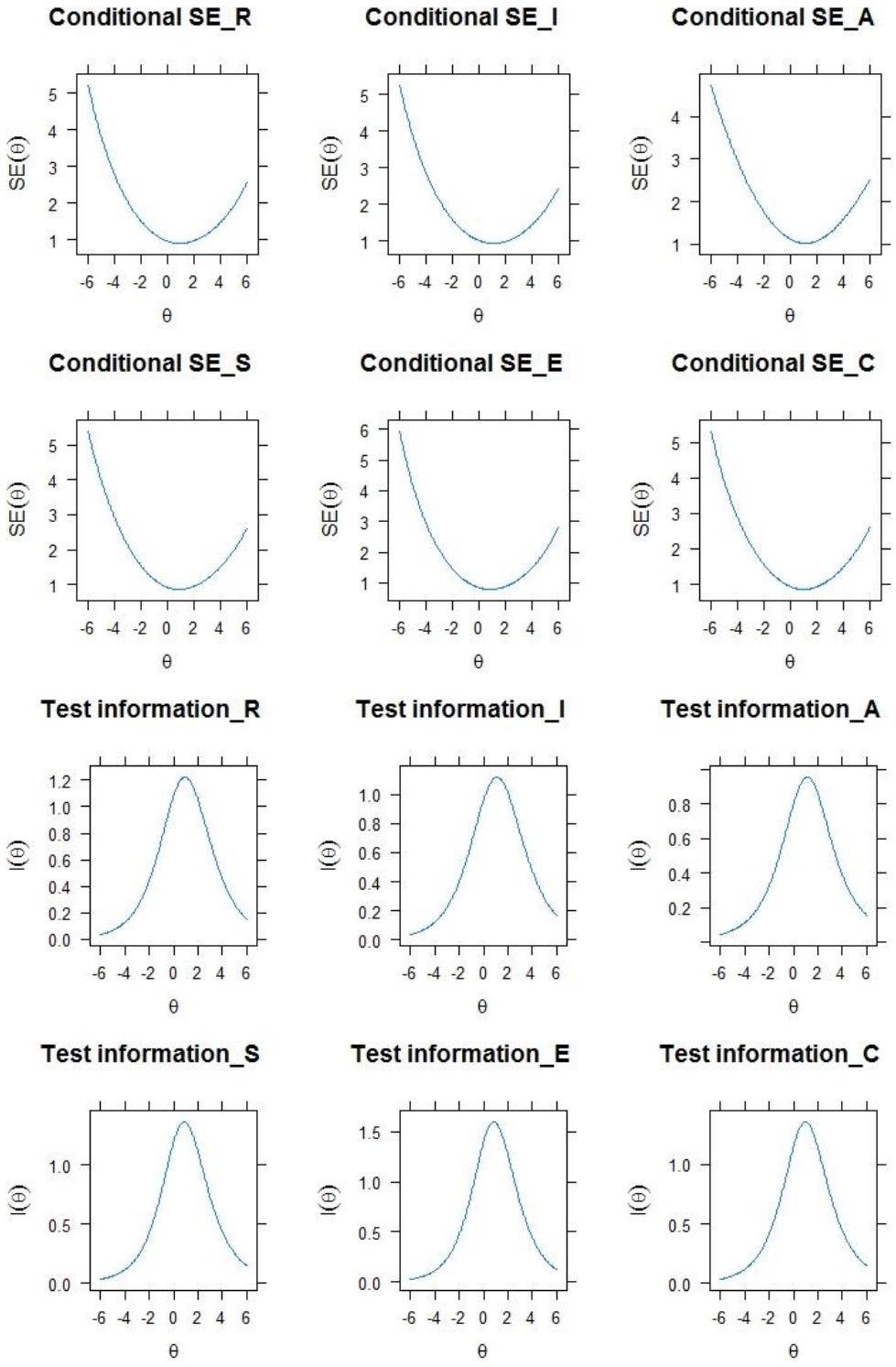


Figure 3. IRT conditional standard errors and test information for the Mini-IP (N = 575)

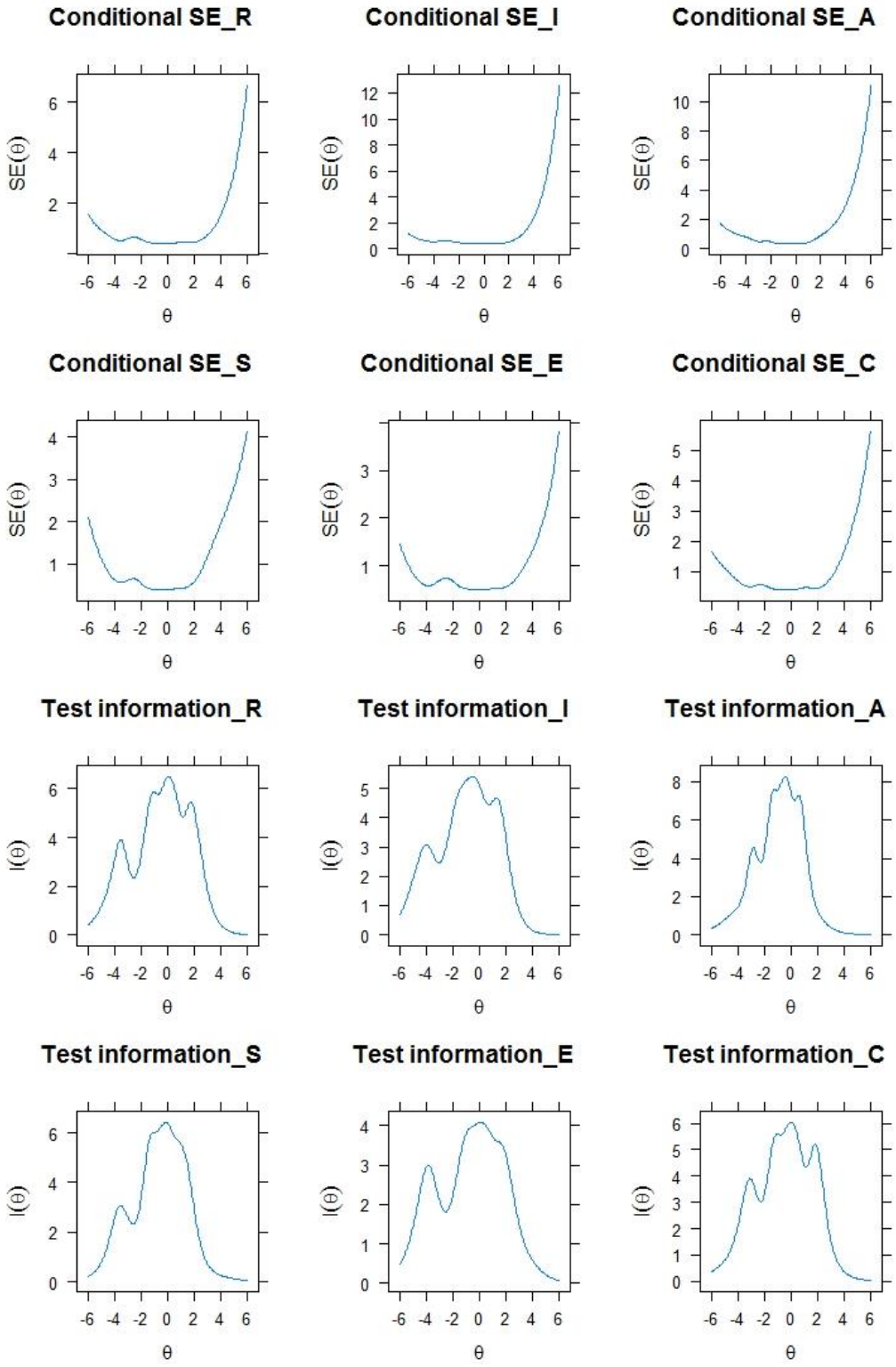
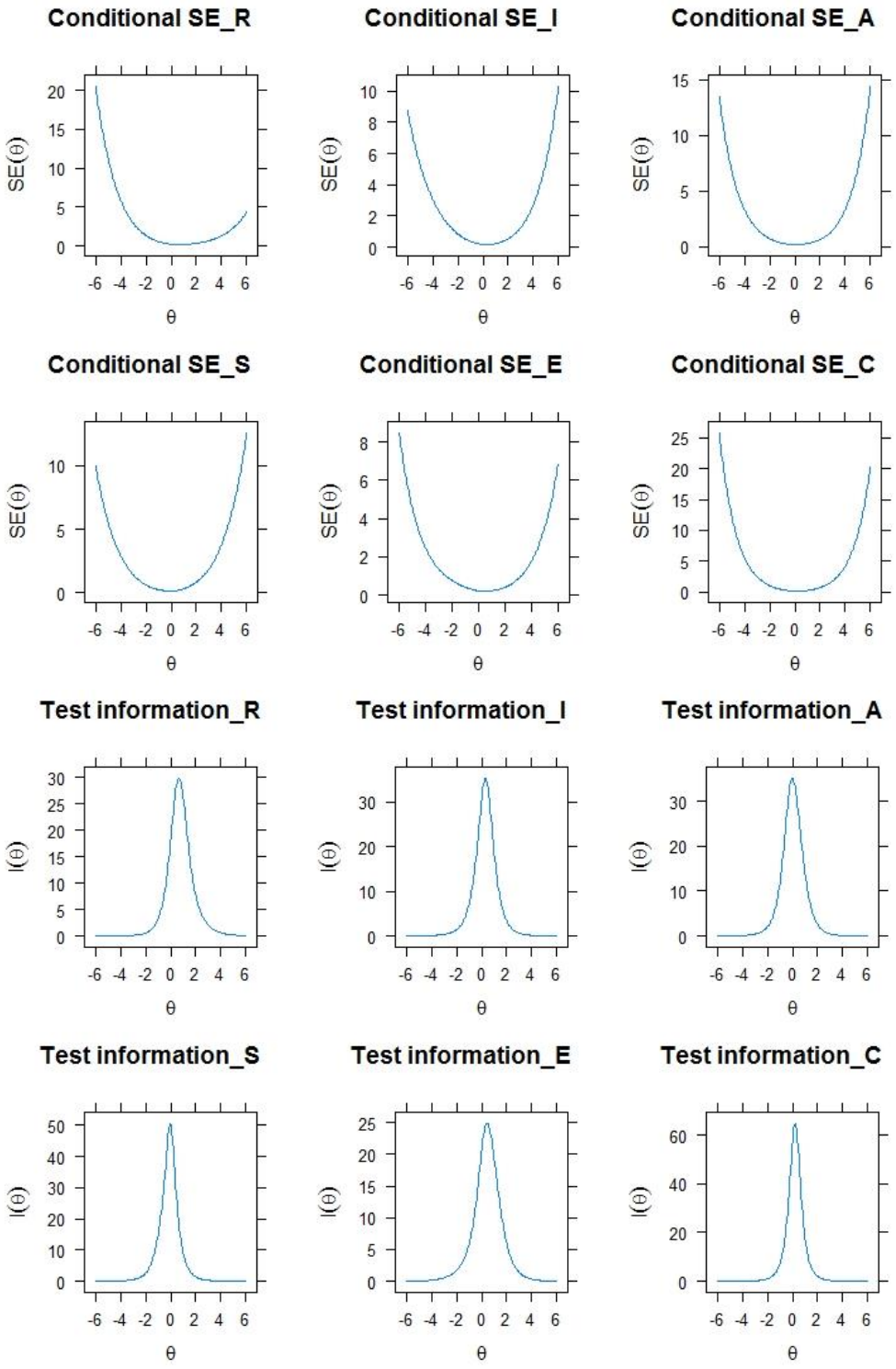


Figure 4. IRT conditional standard errors and test information for the IP Long Form (N = 435)



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CHAPTER 6

Validity Evidence for the Interest Profiler

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The validity chapter describes the following for each form and version of the Interest Profiler (IP)

- Sample descriptions for studies used to validate the IP
- Different types of validity examined
- Results from each type of validity analysis
- Self-scoring accuracy for Paper & Pencil forms of the IP
- Implications drawn from the validity studies

A series of studies were conducted to examine the psychometric properties of the Interest Profiler. These studies have generally used participant samples that are broadly representative of people seeking employment. This chapter summarizes existing research reports and integrates evidence about the validity of each form and version of the Interest Profiler. The chapter begins by discussing validity studies on the IP Long Form, followed by the IP Short Form, and Mini-IP. Overall, all forms of the Interest Profiler fit Holland's (1997) circular RIASEC structure and show expected convergent and discriminant relations with RIASEC scales from other interest inventories. In addition, the Paper-and-Pencil versions of the Long and Short Forms allow test takers to accurately conduct self-scoring and calculate their results.

Validity of the Interest Profiler Long Form

The Interest Profiler Long Form has both a paper-and-pencil (P & P) version and a computer-administered version. The two versions have the same content, but the items are presented on a computer for the IP Long Form, Computer-Administered Version (CIP). For both versions, a set of analyses were conducted to assess the validity of the measure. Two reports investigated the validity of the Interest Profiler Long Form: Rounds, Walker, Day, Hubert, Lewis, and Rivkin (1999) focused on the paper-and-pencil version, and Rounds, Mazzeo, Smith, Hubert, Lewis and Rivkin (1999) focused on the computer-administered version.

The Interest Profiler Long Form, Paper-and-Pencil version (IP Long Form, P & P) was the first vocational interest measure developed and it comprises of 180 items. Several analyses were conducted to assess the convergent and structural validity for the IP Long Form, P & P. Overall, results revealed that the IP Long Form, P & P fits the circular structure of interests and shows high convergent validity with existing interest measures. Self-scoring analyses revealed that people were able to correctly calculate their scores for the Interest Profiler. In addition, analyses conducted to investigate the validity of CIP showed that the CIP is highly comparable to the IP Long Form, P & P.

Interest Profiler Long Form, Paper-and-Pencil Version

Sample. To develop and examine the psychometric properties of the IP Long Form, Paper-and-Pencil version, Rounds, Walker, Day, Hubert, Lewis, and Rivkin (1999) used the sample shown in Table 1. These 1,061 participants were collected from four states: Michigan, New York, North Carolina, and Utah. Data collection sites included employment service offices, high schools, junior colleges, technical-trade schools, universities, and government agencies. The sample represents a wide range of people in career development situations, particularly those seeking employment positions that require lower levels of formal training or education. The sample was 41% male and 59% female. Participants were heterogeneous in terms of ethnic diversity (25% African- American, 59% White non-Hispanics, 10% Hispanic, and 6% members of other racial/ethnic groups). These participants were paid $15 each to reimburse them for travel expenses.

Table 1. *Description of Developmental Sample*

Characteristic	n	%
Gender		
Male	437	41.19
Female	624	58.81
Age		
18 or less	101	9.55
19 to 22	171	16.16
23 to 30	257	24.29
31 to 40	250	23.63
41 to 50	181	17.11
> 50	98	9.26
Education		
Less than high school	216	20.55
High school degree	405	38.53
Some college to BA	386	36.73
> 16 years	44	4.19
Ethnicity		
White	620	58.99
African American	264	25.12
Hispanic	107	10.18
Native American	27	2.57
Asian or Pacific Is.	16	1.52
Other	17	1.62
Employment status		
Unemployed	658	62.43
Part-time	216	20.49
Full-time	179	16.98
Military	1	.09
Student status		
High school	83	26.69
Junior coll/vocational	84	27.01
College	144	46.30
Region		
East (New York)	292	27.52
West (Utah	272	25.64
North (Michigan)	217	20.45
South (North Carolina)	280	26.39

Note. N = 1061. Column n's may not always sum up to total N because of missing data.

Procedure. To assess validity and reliability, participants were recruited to take both the IP Long Form, P & P and an established RIASEC Interest measure—the Interest Finder (Wall, Wise, & Baker, 1996; Wall & Baker, 1997) for comparison. Participants were separated into two groups: one group first took the non-self-scoring IP Long Form, P & P and then the self-scoring Interest Finder; the other group first took the non-self-scoring Interest Finder and then the self-scoring IP Long Form, P & P. In both groups, participants took the non-self-scoring measures first in order to avoid biases in their responses to the second measure if they had known their interest scores.

Scoring. Self-scoring analyses were conducted to assess whether participants were able to accurately calculate their own scores. For both measures, a difference score (true score – self-score) was calculated to determine whether a participant counted the number of likes correctly. "True scores" were calculated by a computerized count of the number of likes. For the IP Long Form, P & P, 89-92% of participants correctly counted their like responses depending on the RIASEC type. This accuracy is comparable to the accuracy of the Interest Finder and suggests that self-scoring is an accurate method for both measures.

Convergent Validity. To assess the convergent validity of the Interest Profiler Long Form, P & P, participants' scores from the IP were compared to their scores from the Interest Finder. Scores were compared in terms of cross-correlation matrices, cross-classification analyses, and profile analyses. Convergent validity was supported by showing that the IP Long Form, P & P measures similar constructs to existing vocational interest measures (i.e., the Interest Finder).

Cross-correlations between the six RIASEC scales were calculated from the IP Long Form, P & P and the Interest Finder. Because both measures were designed to measure Holland's (1997) RIASEC types, matching interest scales from the two measures were expected to show the highest correlations with each other. Matching interest scale correlations are positioned on the main diagonal of the cross-correlation table. As shown in Table 2 below, the highest correlations are in the main diagonal, compared to the off-diagonal correlations, supporting the convergent validity of the two measures. Cross-correlations along the main diagonal ranged from .73 (Enterprising) to 0.84 (Conventional).

Table 2. *Cross Correlations between Interest Profiler and Interest Finder RIASEC Scales*

Interest Profiler	Interest Finder R	I	A	S	E	C
R	**.80**	.32	.18	.17	.23	.14
I	.29	**.79**	.48	.42	.41	.15
A	.16	.30	**.83**	.48	.51	.15
S	.17	.28	.37	**.77**	.41	.34
E	.29	.24	.41	.49	**.73**	.46
C	.09	.12	.17	.33	.38	**.84**

Note. *N* = 1061. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional

Cross-classification analyses using high-point codes were also conducted to assess the comparability of the two measures. High-point codes reflect the strongest (i.e., dominant) interest scale for each participant. Table 3 displays results of high-point code agreement from the two measures. In general, there was considerable agreement among high point codes, as indicated by the bolded values along the main diagonal. Some discrepancies were found with the classification for enterprising high-point codes.

Table 3. *Cross-Classification of the RIASEC High Point Codes for the Interest Profiler & Interest Finder*

Interest Profiler	Interest Finder						
	R	I	A	S	E	C	Total *N*
R	**75**	5	0	4	11	3	98
I	10	**134**	12	7	26	9	198
A	14	15	**91**	23	33	12	188
S	16	30	9	**136**	39	41	271
E	4	4	1	5	**39**	10	63
C	7	8	7	13	27	**181**	243
Total *N*	126	196	120	188	175	256	1061
				Row Percents			
	R	I	A	S	E	C	Total *N*
R	**76.53**	5.10	0.0	4.08	11.22	3.06	98
I	5.05	**67.68**	6.06	3.54	13.13	4.55	198
A	7.45	7.98	**48.40**	12.23	17.55	6.38	188
S	5.90	11.07	3.32	**50.19**	14.39	15.13	271
E	6.35	6.35	1.59	7.94	**61.91**	15.87	63
C	2.88	3.29	2.88	5.35	11.11	**74.49**	243
Total %	11.88	18.47	11.31	17.72	16.49	24.13	
Total *N*	126	196	120	188	175	256	1061
				Column Percents			
	R	I	A	S	E	C	Total %	Total *N*
R	**59.52**	2.55	0.0	2.13	6.29	1.17	9.24	98
I	7.93	**68.37**	10.00	3.72	14.86	3.52	18.66	198
A	11.11	7.65	**75.83**	12.23	18.86	4.69	17.72	188
S	12.70	15.31	7.50	**72.34**	22.29	16.02	25.54	271
E	3.18	2.04	0.83	2.66	**22.29**	3.91	5.94	63
C	5.56	4.08	5.83	6.92	15.43	**70.70**	22.90	243
Total *N*	126	196	120	188	175	256		1061

Note. Cohen Coefficient Kappa = 0.54, R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Profile analyses were carried out to examine the degree of parallelism between the two measures. A high degree of parallelism indicates that the two measures would provide the same participant with similar results. In the profile analysis, a participant's score on each scale of the instrument was the dependent variable, and the interest measure (Interest Profiler or Interest Finder) and RIASEC scale category were the independent variables. An absence of an interaction between measurements indicates comparability between the two interest measures.

Table 4 displays the results for the profile analysis. The interaction term is significant, which means that the two measures are not perfectly comparable. Investigative, artistic, and social scales for the two measures have similar means, while the other three scales do not. The largest difference was observed between the two enterprising scales and the next largest is realistic scales.

Overall, the cross-correlation matrix, cross-classification analyses, and profile analysis showed that the IP Long Form, P & P has strong convergent validity with the Interest Finder on most interest types.

Table 4. *Analysis of Variance for Interest Profiler/Interest Finder and RIASEC Codes*

Source	*df*	SS	MS	*F*	*p*-value
Scale	1	11.573	11.573	312.750	.000
Error	1060	39.223	.037		
RIASEC	5	31.742	6.348	66.210	.000*
Error	5300	508.189	.096		
Scale*RIASEC	5	8.360	1.673	127.568	.000*
Error	5300	69.466	.013		

*Geisser-Greenhouse/Huynh-Feldt corrections or Wilks lamda provide *p*-values of the same magnitude

Listing of Means:	R	I	A	S	E	C	Marginal Mean
IP	.30	.45	.44	.52	.37	.44	.42
IF	.40	.45	.46	.53	.52	.50	.48
Marginal Mean	.35	.45	.45	.52	.45	.47	.45

Listing of Standard Deviations:	R	I	A	S	E	C
IP	.26	.30	.30	.31	.27	.33
IF	.26	.30	.27	.27	.27	.31

Note. R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Structural Validity. The structural validity of the IP Long Form, P & P was examined through Principal Component Analysis, Randomization tests, and Multidimensional Scaling. Principal Component Analysis (PCA) was conducted on both the IP Long Form, P & P and the Interest Finder for two purposes. First, PCA was conducted to examine whether the Interest Profiler sufficiently minimized a yeah-saying and nay-saying response style. Second, PCA examined whether the IP Long Form, P & P meet the traditional benchmarks for the size of the general factor and the substantive factors. Each PCA analysis was conducted on the correlation matrices (N =1,061) and each extracted three factors, one general factor and two substantive factors.

Yea-saying and nay-saying response styles refer to respondent's tendency to always agree or disagree with the interest item. The first general factor extracted from PCA had been considered to reflect such response styles and a larger general factor could be an indicator of response bias (Jackson, 1977; Prediger, 1982; also, see Wee, 2016). Because the IP Long Form, P & P was designed to minimize a yea-saying and nay-say response style, it was expected that the general factor extracted from Interest Profiler would be smaller than the general factor extracted from the Interest Finder. Indeed, the results showed that the IP Long Form, P & P has a smaller general factor (eigenvalue = 2.62, total variance accounted for = 43.60%) compared to the general factor extracted from Interest Finder (eigenvalue = 2.96, total variance accounted for = 49.47%). The two substantive factors extracted for the IP Long Form, P & P (variance accounted for = 17.10%; 14.49%) also compares favorably with previous benchmarks (Prediger, 1982).

Randomization tests were conducted to assess whether the structure of the RIASEC scales adheres to Holland's circular model. The tests were carried out for both the IP Long Form, P & P and the Interest Finder. The Holland (1997) RIASEC model has a circular structure which indicates a particular pattern of relations among the six interest types. For example, Realistic is expected to have higher correlations with Investigative and Conventional scales and lowest correlation with Social scale. Therefore, the intercorrelations of scales within each measure were used to conduct randomization tests.

A correspondence index (CI) was reported as the result of the randomization test. CI's ranged from -1.00 to +1.00 where +1.00 indicates a perfect model-data fit. The results show that Interest Profiler (CI = .40) was a less optimal fit to the hypothesized circular structure of RIASEC model compared to the Interest Finder (CI = .60). A closer look at the intercorrelations for the Interest Profiler suggested an issue with the Enterprising scale: the correlation between the Enterprising scale and the Artistic scale was higher than the correlation between the Enterprising scale and the Social scale. Also, for both the Interest Profiler and Interest Finder, the Realistic and Conventional scales had lower intercorrelations than between the Realistic and Enterprising scales, which is a typical finding in the RIASEC structural literature (Rounds & Day, 1999).

Table 5. *RIASEC Scale Intercorrelations for the Interest Profiler (lower-triangular portion) and Interest Finder (upper-triangular portion)*

	R	I	A	S	E	C
R	--	.43	.27	.25	.29	.19
I	.31	--	.46	.43	.41	.22
A	.17	.45	--	.57	.53	.23
S	.17	.38	.38	--	.62	.42
E	.36	.30	.49	.45	--	.45
C	.10	.13	.17	.33	.50	--

Note. N = 1061. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional. Randomization test: Interest Profiler CI = .40, p = .02; Interest Finder CI = .60, p = .02

Multidimensional Scaling (MDS) is applied to visualize the relations between interest types in a two-dimensional space. It is a more direct way to examine whether the structure of the IP Long Form, P & P's RIASEC scales fit with Holland's circular model. Within-measure intercorrelation matrices for the IP Long Form, P & P and the Interest Finder were used to conduct separate multidimensional scaling analyses.

Two-dimensional solutions fitted the data well and Table 6 displays the coordinates for both solutions. For the IP Long Form, P & P, the solution explained 94% of the variation (RSQ = .94). Figures 1 and 2 display the solutions graphically. The circular RIASEC structure was clear for both measures. However, for the Interest Profiler and Interest Finder, the Enterprising scale was not in an ideal position given the RIASEC hexagon. For the Interest Profiler, the Enterprising scale was found toward the center of the plot, reflecting its stronger than expected relation with the Realistic and Artistic scales. For the Interest Finder, the Enterprising scale is barely differentiated from the Social scale. For both measures, the distance between the Realistic and Conventional scale was greater than would be expected given a circular structure, a finding that has been replicated in several meta-structural studies (Tracey & Rounds, 1992; Rounds & Tracey, 1993).

Multidimensional scaling was also conducted on the intercorrelation matrix between the Interest Profiler and the Interest Finder, and the two-dimensional solution has an RSQ = .95. Two-dimension coordinates are given in Table 7. Figure 3 graphically displays the results and shows that the corresponding RIASEC scales of the two measures cluster together in a circular fashion, providing strong support that these two interest inventories assess the same RIASEC domains.

Table 6. *Two-Dimensional MDS Coordinate Values for the RIASEC Scales of the Interest Profiler and Interest Finder*

	Interest Profiler		Interest Finder	
	I	II	I	II
R	.97	1.02	1.23	.76
I	.74	-.36	.74	-.27
A	.19	-.89	.05	-.90
S	-.44	-.59	-.49	-.33
E	-.25	.20	-.48	-.14
C	-1.22	.62	-1.05	.88

Note. $N = 1061$. The Profiler and Finder were scaled separately. Interest Profiler Kruskal STRESS = .09 and RSQ = .94. Interest Finder Kruskal STRESS = .02 and RSQ = 1.00. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Figure 1.

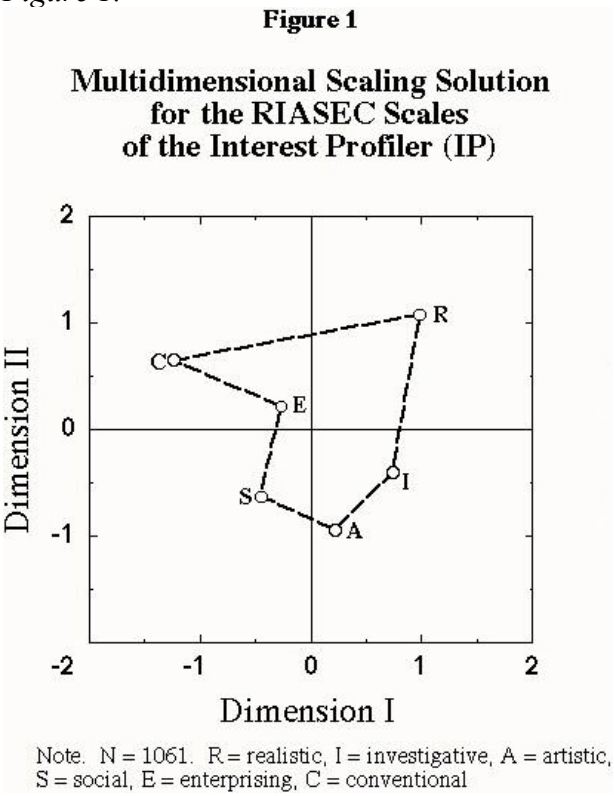


Figure 2.

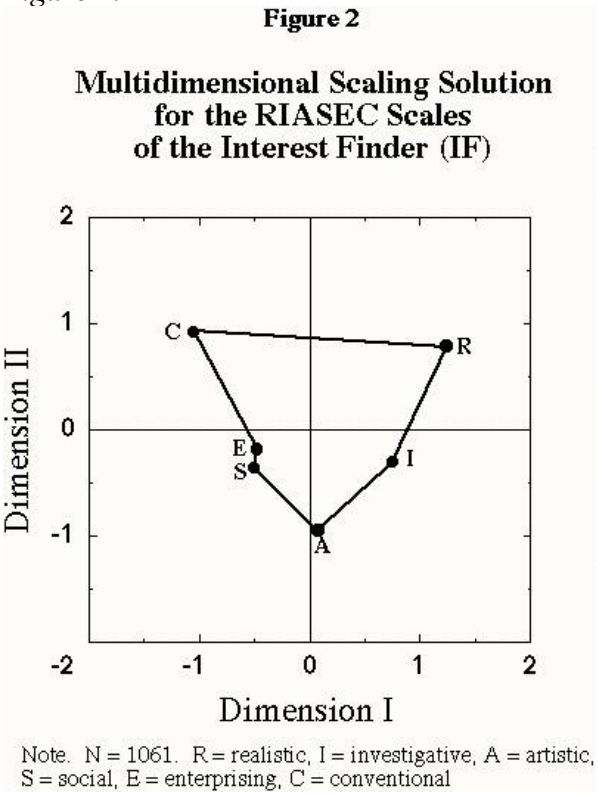


Table 7. *Two-Dimensional MDS Solution for the RIASEC Scales of the Interest Profiler and Interest Finder*

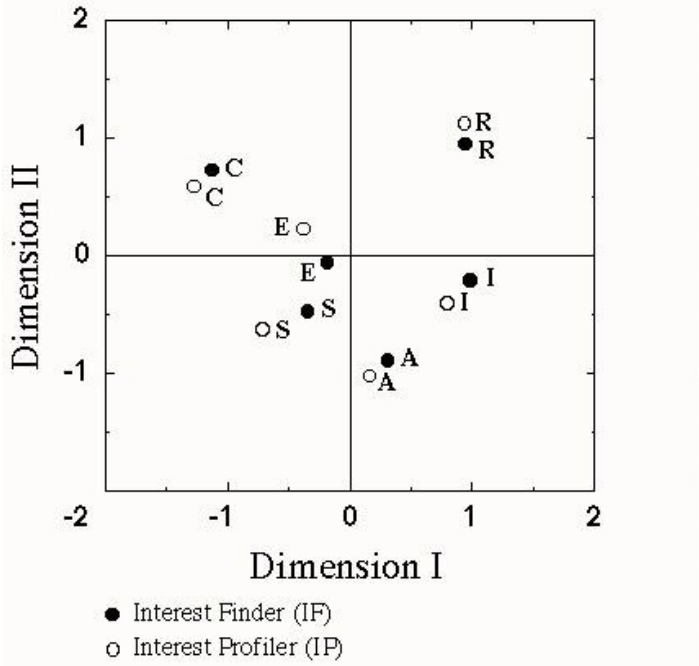
		I	II
IP			
	R	.91	1.08
	I	.78	-.38
	A	.15	-.97
	S	-.69	-.58
	E	-.38	.23
	C	-1.28	.56
IF			
	R	.91	.90
	I	.96	-.18
	A	.29	-.83
	S	-.33	-.41
	E	-.18	-.02
	C	-1.12	.61

Note. *N* = 1061. Kruskal STRESS = .09 and RSQ = .95. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Figure 3.

Figure 3

Multidimensional Scaling Solution for the RIASEC Scales of the Interest Profiler (IP) and Interest Finder (IF)



Note. N = 1061. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, V = conventional

Interest Profiler Long Form, Computer-Administer Version

Rounds, Mazzeo, Smith, Hubert, Lewis and Rivkin (1999) investigated the validity of the Computer-Administered Interest Profiler (CIP). The CIP shares the same content as the IP Long Form, P & P, but the items are presented on a computer screen and it does not allow respondents to skip items. In order to assess the comparability between the CIP and the IP Long Form, P&P, a total of 435 participants were recruited and completed both measures. The majority of the participants were female (61.4%), and most of the participants were unemployed and did not hold a bachelor's degree.

To assess the convergent validity of CIP, circular scale scores were calculated between the CIP and IP Long Form, P & P. Circular scale score is a value ranging from 0 to 3 that indicates the similarity of a pair of codes with respect to their proximity on the RIASEC hexagonal structure. Perfectly matched codes would receive a circular scale score of 3, while the most dissimilar codes (e.g., R vs. S) receive a scale score of 0. Circular scale scores were calculated between participants' CIP scores and their ideal and current occupation interest profiles. Circular scale scores were also calculated between participants' IP Long Form, P & P scores and their ideal and current occupation interest profiles. Results presented in Table 8 suggest that the two IP versions yielded almost exact fits to current and ideal occupations. Furthermore, as expected, ideal occupations were more likely than current occupations (or last job held) to agree with participants' first-letter IP code ($p < .001$).

Profile congruence indices were also calculated to assess the comparability between the two versions of the IP Long Form. A high congruence index indicates that the CIP and P & P versions would give the same participant similar results. Iachan M Index (Iachan, 1984a, 1984b), the Brown and Gore C index (Brown & Gore, 1994), and a revised version of the Brown and Gore C index (C-rev) were the three profile congruence indices calculated for this analysis. All three indices gave very high values (.76 to .90) when comparing the profiles from each IP version, indicating a high degree of profile similarity and convergent validity. Profile Analysis and cross-correlation matrices were also used to assess the comparability between the two versions of the IP and both analyses showed that the CIP is highly similar to the IP Long Form, P & P. In summary, the P & P and computer-administered version of the IP Long Form yield similar RIASEC scores and can be used interchangeably.

Table 8. *Means and Standard Deviations of Circular Scale Scores*

	Current occupation		Ideal occupation	
	M	*SD*	*M*	*SD*
Paper & Pencil IP	1.60	1.04	1.90	1.03
Computerized IP	1.59	1.03	1.90	1.02

Note. $n = 435$ for current and ideal occupation and $n = 362$ for Self-Description Questionnaire (SDQ).

Validity of the Interest Profiler Short Form

In this section of the validity chapter, we focus on the validity analyses of the O*NET Interest Profiler Short Form (IP Short Form). The IP Short Form was developed by selecting 60-items from the IP Long Form's 180 items, with 10 items per RIASEC scale. The IP Short Form was developed to be a more efficient and practical tool to assess interests, and also to select items that could improve model fit and the endorsement rate on the Enterprising scale. Two reports investigated the validity of the Interest Profiler Short Form: Rounds, Su, Lewis and Rivkin (2010) focused on the web-based IP Short Form and Rounds, Hoff, Chu, Lewis and Gregory (2018) focused on the Paper-and-Pencil (P & P) version. A series of analyses were done to assess the convergent and structural validity of the IP Short Form, with the IP Long Form and the Interest Finder serving as comparisons.

Overall, the IP Short Form RIASEC scores are highly comparable with the IP Long Form and the Interest Finder RIASEC scores. The IP Short Form has excellent fit with Holland's RIASEC structure and it showed better endorsements on the Enterprising scale compared to the IP Long Form. Additionally, research using emoji anchors for the IP Short Form showed higher predictive validity towards job satisfaction compare to the traditional lexical item anchors (Phan, Amrhein, Rounds, & Lewis, 2017).

Besides the two versions of the O*NET IP Short Form, other short interest measures have been created from the initial 180 Interest Profiler items. For example, Armstrong, Allison, and Rounds (2008) documented the development and validation of two 8-item RIASEC scales that are comprised of selected items from the 180 IP items. The purpose for developing these scales was to provide brief, public-domain RIASEC measures that could be used in research studies. The authors illustrated strong reliability and validity for both IP scales, providing evidence that Interest Profiler items are excellent reflections of the RIASEC construct domains. Beyond developing shorter interest measures, IP items had also been used to show the duality of vocational personality (Phan & Rounds, 2018).

Interest Profiler Short Form, Web-based Version

Sample. To develop and examine psychometric properties of the IP Short Form, Rounds, Su, Lewis and Rivkin (2010) used the sample collected for the initial development of Interest Profiler Long Form, P & P Version (see Table 1).

Scoring. Different from the Interest Profiler Long Form, the web-based IP Short Form has a five-point response format. Participants indicated their interest in each activity item from 0 = "strongly dislike," 1 = "dislike," 2 = "unsure," 3 = "like," and 4 = "strongly like." Scores are computed by summing responses for each of the six Holland types with a score range of 0 to 40.

Convergent Validity. To assess the convergent validity of the Interest Profiler Short Form, participants' scores from the IP Short Form were compared to their scores from the IP Long Form and the Interest Finder. Scores were compared in terms of cross-correlation matrices, cross-classification analyses, and profile analyses. Convergent validity was supported by

showing that the IP Short Form, P &P measures similar constructs to both the IP Long Form and the Interest Finder (Wall & Baker, 1997).

Cross-correlations between the six RIASEC scales calculated from 1) the IP Short Form and the IP Long Form and 2) the IP Short Form and the Interest Finder were examined. Because all three measures were designed to measure Holland's RIASEC types, matching interest scales from either two measures were expected to show the highest correlations with each other. These matching interest correlations are positioned on the diagonal of the two correlation matrices. For the IP Short Form and the IP Long Form, matching interest correlations ranged from .90 (Social) to .95 (Conventional); for the IP Short Form and the Interest Finder, matching interest correlations ranged from .74 (Social) to .82 (Conventional). Importantly, the IP Short Form and the Interest Finder have similar patterns of correlations for the R-I-S-E scores, indicating that the E items now tap very similar covariation as the remaining scales.

Table 9. *Cross Correlations of the Interest Profiler Short Form with the Long Form and Interest Finder*

IP-SF	Interest Profiler Long Form						Interest Finder					
	R	I	A	S	E	C	R	I	A	S	E	C
R	.91	.27	.13	.14	.33	.15	.76	.30	.16	.14	.22	.19
I	.34	.92	.38	.33	.26	.12	.31	.77	.41	.35	.35	.15
A	.20	.48	.91	.32	.41	.16	.20	.35	.80	.41	.44	.15
S	.11	.38	.42	.90	.42	.35	.12	.27	.41	.74	.41	.33
E	.23	.29	.48	.43	.92	.50	.20	.22	.40	.48	.75	.45
C	.18	.15	.14	.29	.47	.95	.17	.15	.15	.29	.35	.82

Note. N = 1061. R = realistic, IP-SF = Interest Profiler Short Form; I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Profile analyses were conducted to examine whether two measures would provide the same participant with similar results. In the profile analyses, if the participants' interest scores aren't significantly predicted by the interaction effect between two measurements, this would indicate that these two measures have good comparability. The results of the profile analyses for the Short Form compared to the Long Form and the Interest Finder are given in Table 10 and Table 11, respectively.

A significant interaction term was present for both pairs of measures, indicating that the IP Short Form profiles were slightly different than the profiles for the IP Long Form and Interest Finder. Importantly, the interaction term for the IP Short Form and the Interest Finder was much smaller compared to that between the IP Long Form and the Interest Finder, suggesting a considerable improved in fit of the RIASEC profiles. Looking at mean scale scores, the IP Short Form and Long Form were very similar, except for a notably higher Enterprising scale score for the Short Form. This indicates that the item selection in the development of the Short Form successfully increased the endorsement rate for the Enterprising scale. The difference between the mean Enterprising scale scores was substantially reduced between the IP Short Form and the Interest Finder, compared to the Long Form and the Interest Finder. These results suggest that even though slight differences exist among the three measures, the IP Short Form showed higher convergent validity with the Interest Finder compared to the IP Long Form.

Table 10. *Analysis of Variance for Interest Profiler Short Form/Long Form and RIASEC Codes*

Source	*df*	SS	MS	*F*	*p*-value
Inventory	1	17.295	17.295	161.872	.000
Error	1060	113.251	.107		
RIASEC	5	29.394	5.879	96.595	.000*
Error	5300	322.558	.061		
Inventory*RIASEC	5	5.527	1.105	25.793	.000*
Error	5300	227.148	.043		

*Geisser-Greenhouse/Huynh-Feldt corrections or Wilks lamda provide *p*-values of the same magnitude

Listing of Means:	R	I	A	S	E	C	Marginal Mean
IP Short	.33	.42	.46	.53	.46	.46	.44
IP Long	.30	.45	.44	.52	.37	.44	.42
Marginal Mean	.32	.44	.45	.53	.42	.45	.43

Listing of Standard Deviations:	R	I	A	S	E	C
IP Short	.27	.31	.29	.28	.30	.33
IF Long	.26	.30	.30	.31	.27	.33

Note. R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Table 11. *Analysis of Variance for Interest Profiler Short Form/Interest Finder and RIASEC Codes*

Source	*df*	SS	MS	*F*	*p*-value
Inventory	1	5.85	5.85	71.205	.000
Error	1060	87.079	.082		
RIASEC	5	28.034	5.607	89.357	.000*
Error	5300	332.55	.063		
Inventory*RIASEC	5	5.74	1.148	27.887	.000*
Error	5300	218.193	.041		

*Geisser-Greenhouse/Huynh-Feldt corrections or Wilks lamda provide *p*-values of the same magnitude

Listing of Means:	R	I	A	S	E	C	Marginal Mean
IP	.33	.42	.46	.53	.46	.46	.44
IF	.40	.46	.46	.53	.52	.50	.48
Marginal Mean	.36	.44	.46	.53	.49	.48	.46

Listing of Standard Deviations:	R	I	A	S	E	C
IP	.27	.31	.29	.28	.30	.33
IF	.26	.30	.27	.27	.27	.31

Note. R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Cross-classification analyses using high-point codes were also conducted to assess the comparability between the IP Short Form, IP Long Form, and the Interest Finder. The results of the cross-classification analyses are given in Tables 12 and 13, respectively. As shown in the tables, the number of participants classified as Enterprising substantially increased in the IP Short Form (N = 145) compared to the Long Form (N = 64). This, in turn, led to a simultaneous increase in the number of participants classified as Enterprising by both the IP Short Form and Interest Finder (N = 39 for the Long Form; c.f., N = 98 for the Short Form).

Cohen's (1960) Kappa coefficient was calculated as an index to evaluate agreement between two measures. A Kappa value smaller than .40 represents "poor" agreement, .41-.59 "fair," .60-.74 "good," and .75-1.00 "excellent" (Cicchetti, Bronen, Spencer, Haut, Berg, Oliver, & Tyrer, 2006; Fleiss, Levin, & Paik, 2003). The IP Short Form and Long Form had a Kappa coefficient of .74; the IP Short Form and the Interest Finder had a Kappa coefficient of .59. Both pairs of measures showed impressive agreement with each other compare to traditional standards (Russell, 2007).

Table 12. *Cross-Classification of the RIASEC High Point Codes for the Interest Profiler Short Form and Long Form*

IP Short Form	IP Long Form						
	R	I	A	S	E	C	Total *N*
R	**85**	3	1	5	0	2	96
I	3	**142**	4	11	0	0	160
A	1	19	**133**	6	2	3	164
S	0	13	14	**209**	2	9	247
E	7	10	26	23	**59**	20	145
C	3	9	12	20	1	**204**	249
Total *N*	99	196	190	274	64	238	1061

Row Percents

	R	I	A	S	E	C	Total *N*
R	**88.54**	3.13	1.04	5.21	0.00	2.08	96
I	1.88	**88.75**	2.50	6.88	0.00	0.00	160
A	0.61	11.59	**81.10**	3.66	1.22	1.83	164
S	0.00	5.26	5.76	**84.62**	0.81	3.64	247
E	4.83	6.90	17.93	15.86	**40.69**	13.79	145
C	1.20	3.61	4.82	8.03	0.40	**81.93**	249
Total %	9.33	18.47	17.91	25.82	6.03	22.43	
Total *N*	99	196	190	274	64	238	1061

Column Percents

	R	I	A	S	E	C	Total %	Total *N*
R	**85.86**	1.53	0.53	1.82	0.00	0.84	9.05	96
I	3.03	**72.45**	2.11	4.01	0.00	0.00	15.08	160
A	1.01	9.69	**70.00**	2.19	3.13	1.26	15.46	164
S	0.00	6.63	7.37	**76.28**	3.13	3.78	23.28	247
E	7.07	5.10	13.68	8.39	**92.19**	8.40	13.67	145
C	3.03	4.59	6.32	7.30	1.56	**85.71**	23.47	249
Total *N*	99	196	190	274	64	238		1061

Note. Cohen Coefficient Kappa = 0.54, R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Table 13. *Cross-Classification of the RIASEC High Point Codes for the Interest Profiler Short Form and Interest Finder*

IP Short Form	Interest Finder						
	R	I	A	S	E	C	Total *N*
R	**83**	4	1	2	7	2	99
I	4	**123**	4	8	10	4	153
A	12	19	**80**	16	15	5	147
S	9	27	11	**130**	29	28	234
E	6	9	8	18	**98**	32	171
C	10	18	11	7	22	**189**	257
Total *N*	124	200	115	181	181	260	1061

Row Percents

	R	I	A	S	E	C	Total *N*
R	**83.84**	4.04	1.01	2.02	7.07	2.02	99
I	2.61	**80.39**	2.61	5.23	6.54	2.61	153
A	8.16	12.93	**54.42**	10.88	10.20	3.40	147
S	3.85	11.54	4.70	**55.56**	12.39	11.97	234
E	3.51	5.26	4.68	10.53	**57.31**	18.71	171
C	3.89	7.00	4.28	2.72	8.56	**73.54**	257
Total %	11.69	18.85	10.84	17.06	17.06	24.51	
Total *N*	124	200	115	181	181	260	1061

Column Percents

	R	I	A	S	E	C	Total %	Total *N*
R	**66.94**	2.00	0.87	1.10	3.87	0.77	9.33	99
I	3.23	**61.50**	3.48	4.42	5.52	1.54	14.42	153
A	9.68	9.50	**69.57**	8.84	8.29	1.92	13.85	147
S	7.26	13.50	9.57	**71.82**	16.02	10.77	22.05	234
E	4.84	4.50	6.96	9.94	**54.14**	12.31	16.12	171
C	8.06	9.00	9.57	3.87	12.15	**72.69**	24.22	257
Total *N*	124	200	115	181	181	260		1061

Note. Cohen Coefficient Kappa = 0.54, R = Realistic, I = Investigative, A = Artistic, S = Social, E = Enterprising, C = Conventional

Structural Validity. The structural validity of the IP Short Form was examined through Randomization Tests, Multidimensional Scaling (MDS), and Circular Unidimensional Scaling (CUS). Each set of analyses assessed whether the IP Short Form fit with the hypothesized circular RIASEC structure. The same set of analyses were also conducted on the IP Long Form as a comparison. Such comparisons were useful because the Short Form attempts to address two issues previously found in the Long Form: 1) the Enterprising scale was more highly correlated with Artistic scale than the Social scale; and 2) the Realistic scale was more highly correlated with the Enterprising scale than the Conventional scale.

Randomization tests were conducted on the intercorrelation matrices for both the IP Short Form and Long Form to examine whether the two measures correspond to the hypothesized order of RIASEC. Correspondence index (CI) was reported as the result of the randomization test and it is ranged from -1.00 to +1.00 with more positive values indicating the data has a better fit to the hypothesized order. The results showed that indeed the Short Form (CI = .69, p = .02) has a better fit to the circular RIASEC structure compared to the Long Form (CI = .40, p = .02). The Short Form also had a higher CI compared to the benchmark value (CI = .67; Rounds & Tracey, 1996), which suggested that the Short Form fit the RIASEC model better than many other RIASEC measures.

Table 14. *RIASEC Scale Intercorrelations for the Interest Profiler Short Form (lower-triangle) and Long Form (upper-triangle)*

	R	I	A	S	E	C
R	--	.31	.17	.17	.36	.10
I	.31	--	.45	.38	.30	.13
A	.18	.41	--	.38	.49	.17
S	.10	.31	.37	--	.45	.33
E	.22	.26	.40	.41	--	.50
C	.22	.14	.15	.30	.46	--

Note. N = 1061. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional. Randomization test: Interest Profiler Short Form CI = .69, p = .02; Interest Profiler Long Form CI = .40, p = .02.

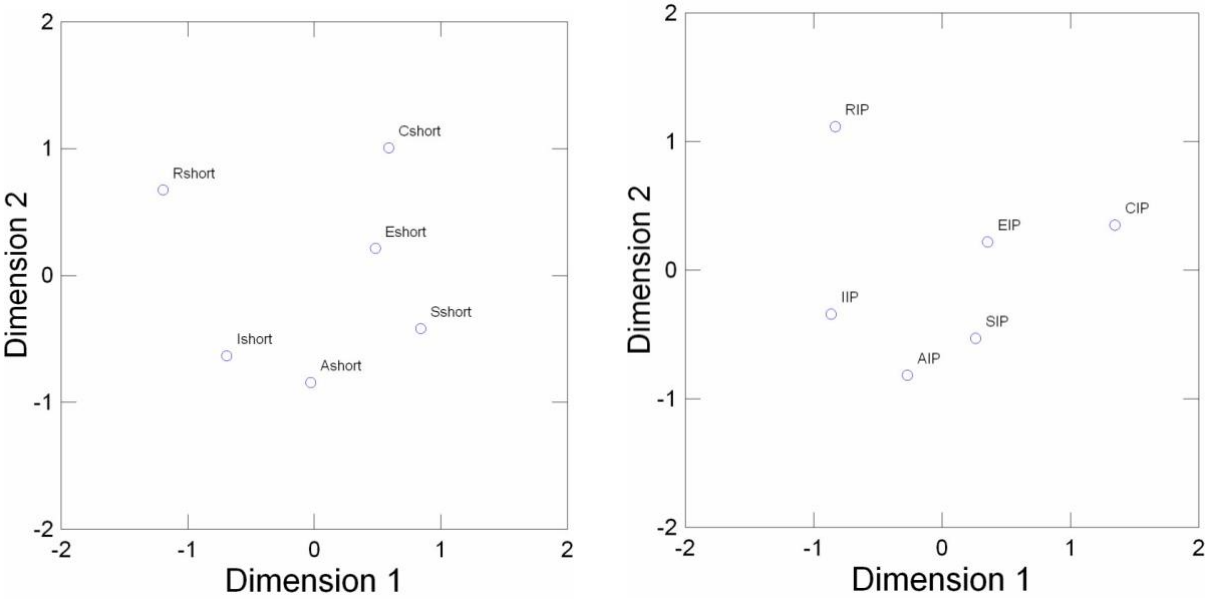
Multidimensional Scaling (MDS) is a more direct way to visually examine whether the structure of the IP Short Form fit with Holland's (1997) circular model. Separate MDS analyses were conducted on the IP Short Form and the Long Form. A two-dimensional solution fit the data well, explaining 93% of the variation in the Long Form and 99% of the variation in the Short Form. The two-dimensional coordinates are shown in Table 15. Figure 4 displays the results graphically and shows that a circular RIASEC structure was evident for both measures. For the Long Form, the Enterprising scale was found near the center of the plot, reflecting its stronger than expected relation with the Realistic and Artistic scales; whereas the Short Form improved on this issue and has the Enterprising scale more to the periphery. For both measures, the distance between the Realistic scale and the Conventional scale was greater than would be expected given a circular structure, a typical finding in the RIASEC structural literature (Rounds & Day, 1999).

Table 15. *Two-Dimensional MDS Coordinate Values for the Interest Profiler Short Form and Long Form*

	IP Long Form		IP Short Form	
	I	II	I	II
R	-1.20	.68	-.83	1.12
I	-.69	-.63	-.86	-.34
A	-.03	-.84	-.27	-.82
S	.84	-.42	-.26	-.53
E	.48	.22	.36	.22
C	.59	1.01	1.35	.35

Note. *N* = 1061. The Short Form and Long Form were scaled separately. Interest Profiler Short Form: Kruskal STRESS = .03 and RSQ = .99; Interest Profiler Long Form: Kruskal STRESS = .09 and RSQ = .93.R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Figure 4. Multi-dimensional Scaling Solutions for the IP Short Form (Left) and IP Long Form, Computerized Version (right)



Circular Unidimensional Scaling (CUS) also allows for a direct visual examination of the relations between interest types in a measure. Separate CUS analyses were conducted on the IP Short Form and Long Form. The circular structure of the Short Form was supported by results shown in Table 16. A circular model explained 86.48% of the variance in the Short Form, much higher than the cut-off value of 60% which indicates a good model fit (Armstrong, Hubert, & Rounds, 2003) and a major improvement in fit compared to 60.14% for the Long Form.

Table 16. *Circular Unidimensional Scaling Coordinate Values for the RIASEC Scales of the Interest Profiler Short Form and Long From*

	IP Short Form			
IP Long Form				
R	-.0934	-.0909	-.0629	-.0859
I	-.0803	.1027	.0980	-.0415
A	.0000	.1304	.1034	.0255
S	.0938	.0906	.0668	.0829
E	.1292	.0173	.0000	.1065
C	.1100	-.0700	-.0463	.0959

Note. N = 1061. The IP Short Form and Long Form were scaled separately. Interest Profiler Short Form: VAF = 0.8648; Interest Profiler Long Form: VAF = 0.6014. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Gender Differences. To assess the difference between males and females on each of the RIASEC interest types, Cohen's *d*-values were calculated as effect sizes for gender differences within each interest type. A positive *d*-value indicates that males had higher scores on a certain interest type, and a negative *d*-value indicates that females had a higher score. As shown in Table 17, on the IP Short Form males had higher scores for the Realistic and the Investigative scales (*d* = .86 and *d* = .26, respectively), and females had higher scores for the Social (*d* = - .59) and the Conventional scales (*d* = -.36). Gender differences for the Artistic and Enterprising scales were minimal (*d* = .00, and *d* = -.07, respectively). The IP Short Form and the Long Form had similar patterns of mean-level gender differences for RIASEC scales, with the only exception that the Short Form had smaller gender differences for the Conventional scale (*d* = -.36) as compared to the Long Form (*d* = -.53). The magnitude of these gender differences is similar to previous meta-analytic results, with the exception that Artistic interests showed minimal gender differences in meta-analytic comparisons (Su, Rounds, & Armstrong, 2009).

Table 17. *Gender Difference Effect Sizes (d) for the Interest Profiler Short Form and Long Form RIASEC Scales Compared to Su, Rounds, and Armstrong (2009) Meta-Analytic Review*

	R	I	A	S	E	C
IP Short	.86	.26	.00	-.59	-.07	-.36
IP Long	.93	.21	-.05	-.54	.06	-.53
Meta-Analytic Results	.84	.26	-.35	-.68	.04	-.33

Note. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Interest Profiler Short Form, Paper-and-Pencil Version

Rounds, Hoff, Chu, Lewis, and Gregory (2018) investigated the validity of the IP Short Form, paper-and-pencil Version (IP Short Form, P & P). The IP Short Form, P & P comprises of the same 60 items as the IP Short Form, web-based version. The P & P version is a practical tool for people who may not have easy access to computers (e.g., students or incarcerated individuals).

Sample. A sample of incarcerated individuals (N = 421) was used as the primary dataset for evaluating psychometric characteristics and self-scoring accuracy for the IP Short Form, P & P. Table 18 shows demographic information for the sample. Participants were surveyed at a range of correctional facilities located in the Eastern United States. The incarcerated individuals sample was 69% male and 31% female, and 85% of the participants were between the ages of 23 to 50 (M age = 35.19; SD = 9.99). The breakdown of race and ethnicity was 56% White, 32% Hispanic, 8% American Indian or Alaska Native, 15% African American, and 3% other.

A second sample consisting of 140 students was also used to evaluate self-scoring. Table 19 shows demographic information for the school sample after removing seven outliers older than age 25. The sample was 55% male and 45% female and the majority of students (73%) were 16-18 years old when tested. The breakdown of race and ethnicity in the school sample was 52% White, 35% Hispanic, 11% American Indian or Alaska Native, 10% African American, and 8% other.

Table 18. *Description of Incarcerated Sample*

Characteristic	N	%
Gender		
Male	288	68.57
Female	132	31.43
Age		
19 to 22	22	5.25
23 to 30	112	26.73
31 to 40	159	37.95
41 to 50	84	20.05
51 to 60	38	9.07
61 to 70	4	0.72
> 70	1	0.24
Education		
Less than High School Degree	122	29.33
High school degree or equivalent	186	44.71
Some college, but no degree	86	20.67
Associate's Degree	12	2.88
Bachelor's Degree	6	1.44
Graduate Degree	4	0.96
Ethnicity		
White	234	55.58
Hispanic	135	32.07
American Indian or Alaska Native	35	8.31
Asian	3	0.71
African American	63	14.96
Native Hawaiian or other Pacific Isl.	8	1.90
Employment		
Full-time Employee	92	22.44
Part-time Employee	16	3.90
Not Employed currently	291	70.98
Retired	11	2.68

Note. Ethnicity percentages exceed 100% because participants could select more than one

Table 19. *Description of School Sample*

Characteristic	N	%
Gender		
Male	74	55.40
Female	59	44.60
Age		
15 or less	26	19.55
16 to 18	97	72.93
19 to 22	10	7.52
Grade		
9th grade	34	24.29
10th grade	28	20.00
11th grade	26	18.57
12 grade	45	32.14
Ethnicity		
White	69	0.52
Hispanic	46	0.35
American Indian or Alaska Native	14	0.11
Asian	8	0.06
African American	13	0.10
Native Hawaiian or other Pacific Isl.	2	0.02
Employment (S)		
Currently have a job	25	0.19
Previously had a job	21	0.16
Never had a job	85	0.64

Note. Ethnicity percentages exceed 100% because participants could select more than one category.

Scoring. The IP Short Form, P & P is self-scored by participants. Each item asks participants to check the box if they are interested in the activity. The participant then sums the number of checked boxes for each RIASEC scale to report the three interest areas with the highest scores as their interest profile.

A difference score (self-score – true score) was used to analyze the accuracy of self-scoring for the IP Short Form, P & P. Across RIASEC scales, 97 - 99% of participants had a difference score of 0, which means that they correctly calculated their scores. Among the 421 incarcerated participants who took the IP Short Form, P & P, only 1-3 participants, depending on the RIASEC scale, failed to record summed scores for a RIASEC scale. These results show that the instrument is easy to score and self-scoring has high accuracy rates compared to other well-known interest inventories and the Interest Profiler Long Form.

Convergent Validity. To assess the convergent validity of the IP Short Form, P & P, participants' scores from the measure were compared to the interest profiles of their last job and career aspirations. A person's interests were hypothesized to reflect his/her career aspiration. Thus, convergent validity would be supported when people's interest profiles relate strongly to the interest profiles of their aspired career.

Cross-Classification analyses were conducted to assess the similarity between people's primary interest types and their career aspiration. Table 20 displays the results of the cross-classification analysis on high-point codes from the IP Short Form, P & P with the career aspirations of incarcerated individuals. The main diagonal of Table 20 shows the hit rate across RIASEC codes. Overall, the hit rate was 137/334 = 41.02%, which compares similarly with the Self-Directed Search hit rates with career aspirations (SDS; Holland, Fritzsche, & Powell, 1994, p. 29) and meta-analytic hit rate estimates of 43.8% (Hanna & Rounds, 2019).

Table 20. *Cross-Classification of the RIASEC High-Point Codes for the Interest Profiler Short Form (P & P) and Career Aspirations for Incarcerated Sample*

	Career Aspiration							
Interest	Count							
Profiler	R	I	A	S	E	C	Total N	Total %
R	**61**	3	1	3	9	3	80	23.95
I	9	**8**	1	5	3	2	28	8.38
A	12	1	**8**	2	4	4	31	9.28
S	23	3	4	**39**	12	9	90	26.95
E	31	3	5	15	**18**	6	78	23.35
C	10	1	0	5	8	**3**	27	8.08
Total N	146	19	19	69	54	27	334	100.00
Total %	43.71	5.69	5.69	20.66	16.17	8.08	100.00	

	Row Percent					
	R	I	A	S	E	C
R	76.25	3.75	1.25	3.75	11.25	3.75
I	32.14	28.57	3.57	17.86	10.71	7.14
A	38.71	3.23	25.81	6.45	12.90	12.90
S	25.56	3.33	4.44	43.33	13.33	10.00
E	39.74	3.85	6.41	19.23	23.08	7.69
C	37.04	3.70	0.00	18.52	29.63	11.11

	Column Percent					
	R	I	A	S	E	C
R	41.78	15.79	5.26	4.35	16.67	11.11
I	6.16	42.11	5.26	7.25	5.56	7.41
A	8.22	5.26	42.11	2.90	7.41	14.81
S	15.75	15.79	21.05	56.52	22.22	33.33
E	21.23	15.79	26.32	21.74	33.33	22.22
C	6.85	5.26	0.00	7.25	14.81	11.11

Profile correlation reflects the degree of similarity between two sets of interest profiles, taking scores on all six interest types into consideration. Profile correlation values range from -1.00 to 1.00, with values closer to +1.00 indicating greater similarity. Because interests are associated with participants' career plans, we expected IP Short Form, P & P scores to be more highly related to their career aspiration compared to their last job. As expected, the profile correlation between participants' IP Short Form, P & P interest profiles and the interest profiles of their career aspirations (r = .24) was higher than the profile correlation between their interest profiles with their last job (r = .15).

Table 21. *Profile Correlations of the Interest Profiler Short Form (P & P)*

	Last Job	Career Aspiration
Mean	0.15	0.24
SD	0.44	0.43

Note. Incarcerated: N = 332 (Career Aspirations), *N* = 326 (Last Job). Interest profiles for last jobs, and career aspirations were based on O*NET occupational categories (coded from self-reported responses).

Structural Validity. The structural validity of the IP Short Form, P & P was examined through Randomization Tests, Multidimensional Scaling (MDS), and Circular Unidimensional Scaling (CUS). Randomization tests were conducted to test whether the IP Short Form, P & P fit with the hypothesized RIASEC order. The IP Short Form, P & P version had a CI of .61 (p = .02), which was comparable to the IP Short Form Web-based version (CI = .68). Both versions of the IP Short Form fit Holland's model well comparing to the traditional benchmark (CI = .70; Rounds & Tracey, 1996).

Table 22. *RIASEC Scale Intercorrelations for the Interest Profiler Short Form (P & P) for Incarcerated Sample*

	R	I	A	S	E	C
R	--					
I	0.31	--				
A	0.32	0.46	--			
S	0.26	0.45	0.49	--		
E	0.29	0.38	0.42	0.48	--	
C	0.33	0.32	0.29	0.46	0.50	--

Note. *N* = 421 (Incarcerated individuals). Randomization test: *CI* = 0.61 *p*= 0.02

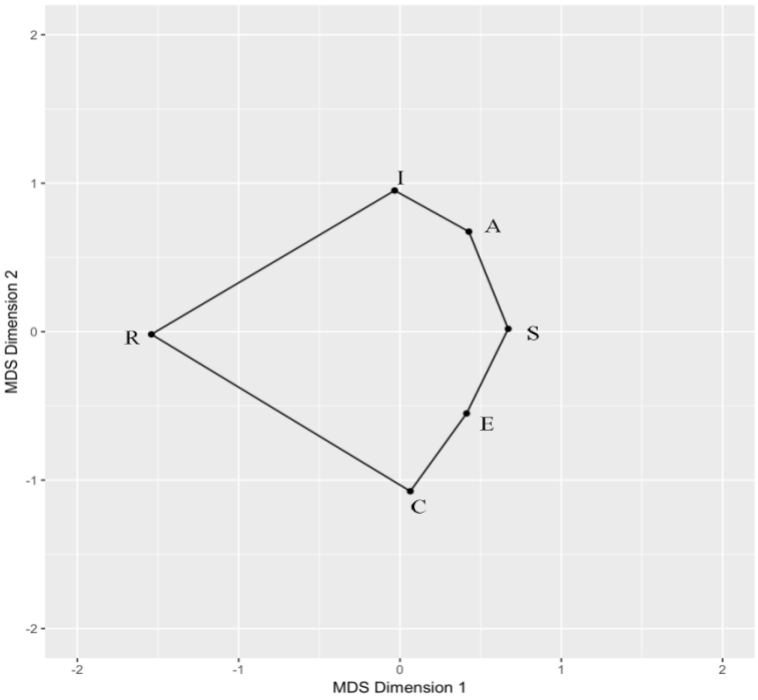
Multidimensional Scaling (MDS) provides a visual display of relations among interest types and tests whether the IP Short Form, P & P fit with the hypothesized circular RIASEC model. A two-dimensional solution fit the data well, explaining 98% of the variation among the RIASEC scales. The coordinates are shown in Table 23, and Figure 5 displays the scale values for RIASEC interests graphically. A circular RIASEC structure was evident for the IP scales. As shown in the figure, the distance between the Realistic scale and the Investigative and Conventional scales was greater than would be expected given a circular structure. The distance between Realistic and Conventional is a typical finding in the RIASEC structural literature (Rounds & Day, 1999).

Table 23. *Two-Dimensional MDS Coordinate Values for the Interest Profiler Short Form (P & P) for Incarcerated Sample*

	I	II
R	-1.54	-0.02
I	-0.03	0.95
A	0.43	0.67
S	0.67	0.02
E	0.41	-0.55
C	0.06	-1.08

Note. $N = 421$, *Stress* = 0.05, *RSQ* = 0.98.

Figure 5. Multidimensional Scaling Solution for the Interest Profiler Short Form, P & P for Incarcerated Sample.



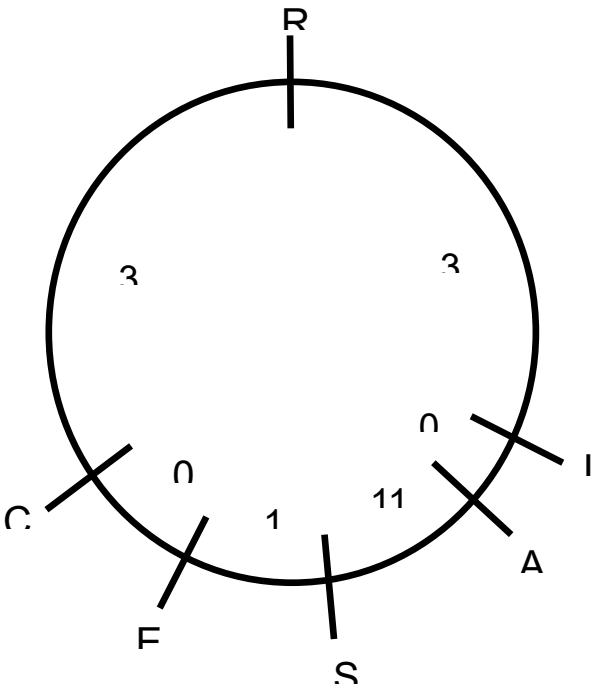
Circular Unidimensional Scaling (CUS) examines whether the six interest types from the IP Short Form, P & P relate to each other in the hypothesized order as points positioned on a circle. The circular structure of the RIASEC scales for the IP Short Form, P & P was further supported by the CUS results, as shown in Table 24. The circular model explained 90% of the variance in the IP Short Form, P & P, much higher than the cut-off value of 60% that indicates a good model fit (Armstrong, Hubert, & Rounds, 2003). These results indicated that the IP Short Form, P & P version has a close fit to a circular RIASEC structure. Figure 6 displays the results graphically and again shows that the distance between the realistic scale and the investigative and conventional scales was greater than would expected given a circular structure.

Table 24. *Circular Unidimensional Scaling Coordinate Values for the RIASEC Scales of the Interest Profiler Short Form (P & P) for Incarcerated Sample*

	I	II
R	0.00	0.10
I	0.09	0.04
A	0.07	-0.07
S	0.01	-0.10
E	-0.05	-0.08
C	-0.09	-0.05

Note. $N = 421$, $VAF = 0.90$.

Figure 6. Circular Unidimensional Scaling Solution for the Interest Profiler Short Form (P & P) for Incarcerated Sample.



Gender Differences. Standardized difference scores (*d*-values) among the RIASEC for males and females are presented in Table 25. Positive values indicate stronger male preferences and positive values indicate stronger female preferences. The *d*-values illustrated that males had higher scores on Realistic scale (*d* = 0.70), while females had higher scores on Social (*d* = -.35), Conventional (*d* = -.22), Investigative (*d* = -.16), and Enterprising (*d* = -.15) scales. Gender differences on the Artistic scale were minimal (*d* = .05). The magnitude of these gender differences is smaller compared to previous meta-analytic estimates (Su, Rounds, & Armstrong, 2009).

Table 25. *Gender Difference (d) by RIASEC Scale Score for Incarcerated Sample*

	R	I	A	S	E	C
d	0.70	-0.16	0.05	-0.35	-0.15	-0.22

Note. *d* represents the standardized difference scores between male and female participants. Positive values indicate stronger male preferences; negative values indicate stronger female preferences.

Validity of the Mini Interest Profiler (Mini-IP)

The Mini Interest Profiler (Mini-IP) comprises of 30 items selected from the Interest Profiler Short Form. The impetus for further shortening the Interest Profiler was to develop brief RIASEC scales for use in mobile settings where it is ideal to have an interest measure that can be completed rapidly and easily. Rounds, Wee, Ming, Cao, Song and Lewis (2016) describe the development of the measure (see Chapter 4, Development) and provide validity evidence for the Mini-IP.

Sample. To assess the comparability between the Mini-IP and the IP Short Form, a validation sample consisting of 600 participants were recruited through Amazon's Mechanical Turk (https://www.mturk.com). Besides the two IP measures, participants also took a 20-item Big Five personality measure (Mini-IPIP Scales; Donnellan et al., 2006). After data cleaning, the final sample had 575 participants (298 males, 276 females). The age of the participants ranged from 18 years-old to 65 years-old (*M* = 35.66, *SD* = 11.38), and 95.8% of the sample was employed. In terms of ethnicity, 77% of the sample referred to themselves as White, 9.4% were African-American, 9% were Asian, and 7.3% were Hispanic or Latino. All demographic information for the sample is presented in Table 26.

Table 26. *Description of Amazon Mturk Validation Sample*

Characteristic	n	%
Gender		
Male	298	51.8
Female	276	48.0
Age		
18 or less	1	0.2
19 to 22	40	7.0
23 to 30	198	34.4
31 to 40	165	28.7
41 to 50	92	17.0
51 to 60	57	9.9
61 to 65	22	3.8
Race		
White	443	77.0
Asian	52	9.0
Black or African American	54	9.4
American Indian or Alaskan Native	5	0.9
Native Hawaiian or Other Pacific Islander	2	0.3
Other	17	3.0
Ethnicity		
Hispanic or Latino	42	7.3
Not Hispanic or Latino	532	92.5
Employment Status		
Not employed (including students)	19	3.3
Employed	551	95.8
Missing	5	0.9

Note. $N = 575$. Column n's may not always sum up to the total N because of missing data

Convergent Validity. To assess the convergent validity of the Mini-Interest Profiler, participants' scores from the Mini-IP were compared to their scores from the IP Short Form, P & P. Matching interest scales from the two measures were expected to show high correlations. As shown in Table 27, the correlations for matching interests, which are positioned on the main diagonal, ranged from .95 to .96. This provides strong support for the convergent validity of the Mini-IP with the IP Short Form.

Table 27. *Cross Correlations of the 30-Item Mini Interest Profiler and the 60-Item Interest Profiler Short Form for the Validation Sample*

		30-Item Mini Interest Profiler					
		R	I	A	S	E	C
60-Item Interest Profiler Short Form	R	.95	.38	.11	.12	.25	.47
	I	.29	.96	.28	.27	.21	.17
	A	.09	.25	.96	.41	.27	.05
	S	.12	.25	.41	.95	.41	.13
	E	.23	.17	.24	.39	.95	.34
	C	.41	.14	.06	.12	.33	.95

Note. $N = 575$. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

To further assess the convergent validity of the Mini-IP, correlations between RIASEC scales of the Mini-IP and a brief measure of Big Five personality traits were compared to past meta-analytic correlations between interest and personality traits. As expected, Social and Enterprising interests were significantly correlated with Extraversion ($r = .28$ and .34, respectively), and Investigative and Artistic interests were correlated significantly with Openness ($r = .15$ and .35, respectively). These correlations were very similar to those reported in past meta-analyses (Barrick, Mount, & Gupta, 2003; Larson. Rottinghaus, & Borgen, 2002). Furthermore, the personality-by-interest correlation matrix for the Mini-IP was very similar to the correlation matrix for the IP Short Form, P & P (see Table 28), providing further support for the convergent validity of Mini-IP.

Table 28. *Personality Trait by RIASEC Scale Correlations for the 30-Item Mini Interest Profiler and the 60-Item Interest Profiler Short Form for the Validation Sample*

	30-Item Mini Interest Profiler					
	R	I	A	S	E	C
Extraversion	-.02	.08	.07	.28*	.34*	-.12*
Agreeableness	-.04	.06	.21*	.40*	.08	-.01
Conscientiousness	-.01	-.07	-.05	-.05	.10*	.00
Neuroticism	-.04	-.02	.04	-.01	-.13*	.06
Intellect	.06	.15*	.35*	.16*	.10*	-.05
	60-Item Interest Profiler Short Form					
	R	I	A	S	E	C
Extraversion	.00	.10*	.10*	.28*	.32*	-.11*
Agreeableness	-.04	.08	.22*	.38*	.08	-.01
Conscientiousness	-.02	-.07	-.05	-.04	.09*	.03
Neuroticism	-.03	-.00	.05	-.02	-.10*	.06
Intellect	.07	.18*	.31*	.13*	.05	-.08

Note. $N = 575$. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional. * = $p < .05$.

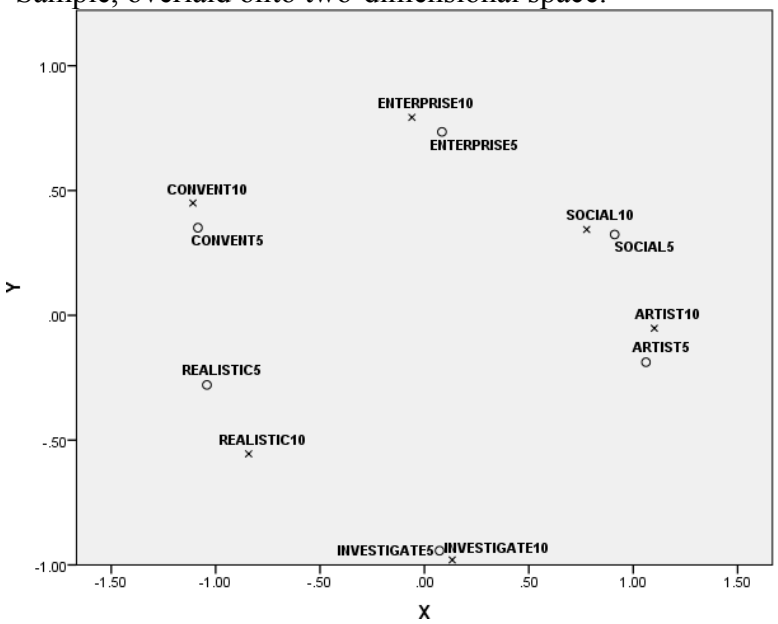
Structural Validity. The structural validity of the Mini-IP was examined through Multidimensional Scaling (MDS). MDS was conducted with both the Mini-IP and IP Short Form to examine 1) whether interest types in the Mini-IP and the IP Short Form fit with the hypothesized circular model, and 2) whether Mini-IP and IP Short Form would give similar two-dimensional structure for the six interest types.

Two-dimension solutions fitted the validation data well. For the Mini-IP, the solution explained 99% of the variance; for the Short Form, the solution explained 99% of the variance. The coordinates for the two-dimensional solution is presented in Table 29. Figure 7 graphically displays the results. The circular structure was apparent for both measures, and each scale from one of measures was closely positioned to the same scale from the other measure. These results gave strong support for both the structural and convergent validity of the Mini-IP.

Table 29. MDS Coordinate Values

	30-Item Mini-IP		60-Item Short-IP	
R	-1.04	-0.28	-0.84	-0.56
I	0.07	-0.94	0.13	-0.98
A	1.06	-0.19	1.10	-0.05
S	0.91	0.32	0.78	0.34
E	0.08	0.74	-0.06	0.79
C	-1.09	0.35	-1.11	0.45
	I	**II**	**I**	**II**

Figure 7. Multidimensional Scaling of the RIASEC subscale correlation matrix for both the 30-Item Mini Interest Profiler and the 60-item Interest Profiler Short Form for the Validation Sample, overlaid onto two-dimensional space.



Note. The Short Form and Mini-IP were scaled separately. Numbers next to the subscales indicate the number of items in the RIASEC subscale. Interest Profiler Short Form: Kruskal STRESS = .02 and RSQ = .99; 30-Item Mini Interest Profiler: Kruskal STRESS < .01 and RSQ = .99. R = realistic, I = investigative, A = artistic, S = social, E = enterprising, C = conventional.

Gender Differences. Standardized difference scores (*d*-values) were calculated to illustrate gender differences for RIASEC scales. A positive *d*-value indicates males have a higher score on the interest scale, and a negative *d*-value indicates that females have higher scores.

For both the IP Short Form and Mini-IP, males had higher scores on the Realistic (*d* = .62 for the Short-IP and .60 for the Mini-IP) and Investigative scale s(d = .18 and .19) while females had higher scores on the Social (d = -.43 and -.41) and Conventional scales (d = -.12 and .00). Gender differences were minimal for both Artistic and Enterprising scales. These gender differences are smaller than those from meta-analytic estimates (Su, Rounds, and Armstrong, 2009).

Table 30. *Scale-level Reliability and Gender Balance for Validation Sample*

	30-Item Mini-IP		60-item Short-IP	
	Gender Effect Size (*d*)		Gender Effect Size (*d*)	
Scale		Alpha		Alpha
R	0.60	0.81	0.62	0.88
I	0.19	0.80	0.18	0.90
A	-0.34	0.81	-0.35	0.90
S	-0.41	0.79	-0.43	0.89
E	-0.03	0.74	-0.08	0.85
C	0.00	0.79	-0.12	0.90

Note. *N* = 575. R = realistic, I = investigative, A = artistic, S= Social, E =enterprising, C = conventional.

Summary

In summary, the validity of the Interest Profiler has been evaluated in multiple ways. Drawing from the initial 180 items, shorter forms of the Interest Profiler have been developed, including the 60-item Interest Profiler Short Form (Computer-Administered and Paper-and-Pencil) and the 30-item Mini Interest Profiler. All forms of the IP fit Holland's (1997) circular structure of RIASEC interests and show expected convergent and discriminant relations with RIASEC scales from other interest inventories. For Paper-and-Pencil versions of the IP, test takers were able to accurately conduct self-scoring.

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CHAPTER 7

Interest Profiler Linkage to O*NET Occupations

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In this chapter, we focus on the development of Occupational Interest Profiles (OIPs) and how clients' interest assessment profiles are linked to O*NET-SOC occupational profiles by means of the Interest Profiler. Specifically, the proceeding sections cover the following content:

- Three different methods to develop OIPs
- Development of the initial O*NET OIPs
- Reliability and validity evidence for the initial O*NET OIPs
- Updates of the O*NET OIPs
- A very brief introduction to different versions of the Interest Profiler
- A brief overview of the O*NET-SOC occupations
- How O*NET links person-profiles to OIPs

Introduction

We first discuss the development of Occupational Interest Profiles (OIPs), including reliability, validity, and updates. Then, we elaborate on the methodology of linking individuals' RIASEC profiles to OIPs and how recommendations of occupations are generated. Through this chapter, we hope to help practitioners and researchers gain a deeper understanding of the O*NET system.

The Occupational Information Network (O*NET) is a comprehensive system for the collection, organization, description, and dissemination of data on attributes of occupations. O*NET provides information at different levels of detail, thus enabling both human resources professionals, career counselors, and job seekers to make use of the information for a variety of purposes. For example, human resources professionals can refine recruitment and training goals, develop appropriate job descriptions, and align organizational development with workplace needs using information provided by O*NET. Job seekers can use O*NET to explore their vocational interests, work values, and identify occupations that fit their interests and values, thus making effective career decisions.

O*NET data are organized around the Content Model, which is a skills-based structure for specifying information about the world of work in the O*NET database (Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1999). As an important part of the Content Model, Occupational Interest Profiles (OIPs) were developed based on Holland's model of vocational

interests and work environments. Specifically, Holland (1985, 1997) proposed six types of interests and six types of work environments: Realistic (R), Artistic (A), Social (S), Enterprising (E), and Conventional (C), collectively referred to as RIASEC. Holland's theory is based on the idea that we can describe individuals' vocational interests and characteristics of a particular job in a unified framework. OIPs are a collection of different occupations' interest scores on each RIASEC category. Professionals and researchers can use this information to quantify the degree of fit between an individual's interests and a particular job. Person-occupation interest fit has been found to be positively related to job performance (Nye, Su, Rounds, & Drasgow, 2012, 2017) and career success (Rounds & Su, 2014).

To make full use of the O*NET system, RIASEC scores are needed for both persons and occupations. On the person side, O*NET has developed three forms of the Interest Profiler (Rounds, Mazzeo et al.,1999; Rounds, Wee, Cao, Song, & Lewis, 2016; Rounds, Su, Lewis, & Rivkin, 2010; Rounds, Walker et al., 1999) to assess individuals' standing on these six types of vocational interests. On the occupation side, OIPs were developed in the late 1990s (Rounds, Smith et al., 1999) and updated in 2008 (Rounds, Armstrong, Liao, Lewis, & Rivkin, 2008) and 2013 (Rounds, Su, Lewis, & Rivkin, 2013). The original OIPs were based on the Occupational Employment Statistics (OES) classification while the updated OIPs switched to the new Standard Occupational Classification (SOC) system in version 3.0 of the database. In addition, some new and emerging occupations were identified and incorporated into the updated OIPs.

Development of O*NET OIPs

Methods of Developing OIPs

There have been at least three methods proposed to develop RIASEC profiles for occupations, including: 1) incumbent, 2) empirical, and 3) judgement (Rounds, Smith et al., 1999). The incumbent method is based on the idea that people make the environment (Holland, 1997). It involves administering a RIASEC measure to a representative sample of workers from a specific occupation and averaging across workers for each RIASEC type. These average scores are treated as the RIASEC scores for that occupation. Usually, a three-letter code corresponding to the top three RIASEC scores is assigned to each occupation. However, the incumbent method is limited in that a representative employed sample is needed for each of the thousand occupations, making it an expensive and time-consuming method.

To circumvent this limitation, Gottfredson and Holland (1989; 1996) developed an empirical method to facilitate RIASEC classifications of all U.S occupations. The empirical method requires a set of occupations that have been assigned a single high-point RIASEC code, which is referred to as a developmental sample of occupations. Discrimination analyses are then performed on these occupations to derive a set of classification equations using the predictor variables common to all occupations. These equations are applied to the remaining non-classified occupations to estimate the probability that each occupation belongs to each of RIASEC categories. Finally, each occupation is assigned a three-letter code. The first code corresponds to the RIASEC category with the highest classification probability; the second code corresponds to the category with the second-highest classification probability; and the third code is the category

with the third-highest score. Although this method can create a comprehensive classification without the need for representative incumbents, the ordering of RIASEC beyond the first code may not be reliable because some occupations are only representative of one RIASEC environment.

The judgement method uses direct ratings of occupations by trained raters. Specifically, raters are first presented with information for each occupation, including occupational titles, job descriptions, core tasks, knowledge, and generalized work activities. After intensive training to process the information, raters judge the degree to which each RIASEC category applies to each occupation. The mean ratings across raters and RIASEC categories are used as RIASEC scores for each occupation. Usually, cutoffs are set to the OIPs to get high-point codes for each occupation. As the accuracy of the OIPs depends on the accuracy of ratings, inter-rater agreement is particularly important. Researchers have relied on Goodman-Kruskal's Gamma (Goodman & Kruskal, 1979) to judge the degree of inter-rater agreement. Higher Goodman-Kruskal's Gamma means higher degree of agreement. As detailed below, the judgement method performed better than the empirical method and has been used to develop OIPs for O*NET occupations (Rounds, Smith et al., 1999).

*Development of the Initial O*NET OIPs*

The initial OIPs for O*NET were developed in the late 1990s (Rounds, Smith et al., 1999). Originally, the development team used both empirical and the judgement methods to estimate the OIP for 1,172 occupations.

Two variants of the empirical method were used. The main difference between the two variants was the rating target. Before the O*NET system, occupations were organized using the Dictionary of Occupation Titles (DOT). O*NET later replaced the DOT and reorganized occupations into 1,172 Occupation Units (OU). The first variant (DOT-to-OU) started with the RIASEC coding of 12,748 DOT occupations. The DOT occupations were linked to their respective OU and average RIASEC profiles were computed for each OU. The second variant (OU) started by directly developing numerical RIASEC profiles for each OU. Specifically, three trained raters independently judged which one of the six RIASEC categories was most characteristic of a subset of occupations. The subset of occupations was intended as the developmental sample from which classification functions could be developed. Inter-rater agreement was high for both variants of the empirical method. The classification function was then applied to the remaining occupations to obtain the probability of membership in a particular RIASEC category for each occupation. Therefore, each occupation would have six probabilities. These probabilities were used to obtain RIASEC high-point codes. The final product was two profiles for each occupation: 1) a specific OIP containing probabilities for each RIASEC category (ranging from zero to one) and 2) an ordered RIASEC high-point code profile.

For the judgement method, three trained raters rated the entire set of 1,172 occupational units. Mean Goodman-Kruskal's Gamma was .81, indicating a high degree of agreement across raters. Therefore, the mean ratings across raters were used as the occupational profiles. In addition to the numerical profile, high-point codes were assigned to each occupation in a way analogous to

the previous method. To facilitate comparisons with the empirical method, the mean ratings were converted into proportions so that the numerical value of each element of an OIP ranges from zero to one as well.

Reliability and Validity of the Initial OIPs

Table 1 presents the probabilities/mean rating proportions of each RIASEC category for the three methods. It can be observed from Table 1 that the values obtained with the judgement method were least extreme. For example, the mean of the highest probability of each RIASEC category obtained with both empirical methods were nearly .95 and the mean for the remaining five categories was essentially zero. In comparison, the mean rating proportions for the judgment of the first-position category was .31 and the mean profile proportions of the other five categories were much more evenly distributed. None of the mean proportions for remaining categories approached zero. If we take a look at the whole distribution, we can see that 85% of the first-position probabilities were greater than .80 and 85% of the rating proportions of the first position ranged from .25 to .40. These results suggest that the judgement method provides more reliable and valid profiles. OIPs obtained from this method hold promise for counseling and research purposes.

Table 1. *Means and standard deviations of probabilities (or rated proportions) for Holland High-Point Codes by different methods*

Code	DOT-to-OU		OU		Judgement	
	M	*SD*	*M*	*SD*	*M*	*SD*
First	0.939	0.137	0.947	0.117	0.310	0.053
Second	0.055	0.123	0.044	0.098	0.200	0.027
Third	0.005	0.030	0.007	0.025	0.157	0.025
Fourth	0.001	0.009	0.002	0.009	0.131	0.017
Fifth	0.000	0.003	0.000	0.002	0.108	0.015
Sixth	0.000	0.000	0.000	0.000	0.093	0.011

Note. DOT-to-OU stands for the Dictionary of Occupational Titles to Occupational Units empirical method; OU stands for the Occupational Units empirical method; the Judgement used direct ratings.

The development team also examined the classification consistency between methods using Cohen's kappa (Cohen, 1960). Kappa above .70 is considered acceptable. It was found that one variant of the empirical method had acceptable agreement with the judgement method (Kappa = .72), while the other method produced a much different ordering of the RIASEC categories.

Additionally, the development team also assessed the external validity of different methods (see Table 2). Specifically, researchers examined the degree of agreement between the profiles obtained with the above methods with two existing sets of profiles using the Iachan Agreement

Index (Iachan, 1984). Larger values of the Iachan index indicating a higher degree of correspondence between the two sets of profiles. The two existing profiles were the Office of Employment Statistics (OES) Holland-coded profiles (Gottfredson & Holland, 1996) and the Strong Interest Inventory profiles (Harmon, Hansen, Borgen, & Hammer, 1994). As can be seen from Table 2, OIPs obtained from the judgement method showed stronger convergence with the two existing profiles than those obtained from the empirical methods.

Table 2. *Comparison Among Methods for RIASEC Coding of Occupational Units using Iachan Agreement Index*

Methods	OES		Strong	
	M	*SD*	*M*	*SD*
DOT-to-OU	18.530	8.180	18.260	8.240
Empirical OU	20.750	7.230	19.860	7.700
Judgement OU	23.280	4.550	23.110	4.510
OES			23.260	3.980

Note. Iachan agreement index varies from 0 to 28. OES scores came from Gottfredson and Holland's (1996, pp. 632-649) RIASEC coding of occupational interests for the Office of Employment Statistics. Strong refers to the RIASEC classification of occupations based on the General Occupational Theme scores from the Strong Interest Inventory (Harmon et al., 1994, pp. 377-383).

Several studies have reported convergent validity evidence for the O*NET OIPs. Eggerth, Bowles, Tunick, and Andrew (2005) compared the RIASEC code classifications from the O*NET to the Strong Interest Inventory (SII) RIASEC codes and the Dictionary of Holland Occupational Codes (DHOC; Gottfredson & Holland, 1996) using six different methods. The levels of agreement between the O*NET, SII, and DHOC were similar to agreements reported by Rounds, Smith et al. (1999). For example, Rounds, Smith et al. (1999) found a first letter agreement rate of 83.3% between the O*NET and the DHOC compared with the 78.6% rate found by Eggerth et al. (2005). Dik, Hu, and Hansen (2007) used a novel approach to compar the validity of SII, O*NET, and DHOC taxonomies for assigning Holland RIASEC codes to work environments. They compared not only mean congruence scores but also congruence relations with job satisfaction. The SII RIASEC codes were associated with stronger congruence-satisfaction relations than was the O*NET codes, which in turn was associated with stronger congruence-satisfaction relations than the DHOC. Dik et al. results are not surprising since the measure of interests used was the SII and congruence was calculated using high-point codes. RIASEC high-point codes were developed by Holland for self-scoring purposes. In comparison, the O*NET computer-aided scoring does not use high-point codes to links interest scores to occupations. Instead, congruence is assessed with a correlation coefficient using all six RIASEC scores from the Interest Profiler and OIPs.

Prediger and Swaney (2004) used the OIPs (Rounds, Smith et al., 1999) to revise the ACT World-of-Work Map (WWM). This map is how the ACT Interest Inventory links RIASEC interests to occupations and career options. The WWM is based on Holland's hexagon with two dimensions underlying the circular arrangement of RIASEC types—working with data versus ideas (D/I) and working with things versus people (T/P). In Prediger and Swaney's (2004) revision of the WWM, they used three datasets involving ratings of occupations: OIPs, job analysis data for 1,573 occupations in the USDL's *Dictionary of Occupational Titles*, and mean RIASEC interest scores for occupations from a variety of vocational interest inventories. Correlations among the WWM task dimensions showed convergence among the databases: For the D/I dimension, correlations with the OIP database were as follows: OIP ratings and job analysis data (.78 for 528 occupations), OIP ratings and employee's interests (.78 for 640 occupations and career groups). For the T/P dimension, correlations were as follows: OIP ratings and job analysis data (.81) and OIP ratings and employee's interests (.77). As reported by Prediger and Swaney (2004) these correlations are "unusually high for scores based on diverse measurement procedures" (p. 455). These results provide strong support for the validity of the OIPs.

Structural validity is another important criterion for examining the validity of different methods. The Holland model assumes that the distance between the RIASEC categories can be represented by a hexagonal structure. Researchers used multiple statistical methods to examine structural validity, including multidimensional scaling, randomization tests for circular structure, circular scaling, and K-means clustering. All four methods suggest that OIPs obtained from the judgement method were consistent with the geometric structure of the RIASEC model, thus providing strong support for the structural validity of this classification. OIPs obtained from the empirical methods did not show consistency with Holland's theoretical model.

Updates of the OIPs

Since the development of the initial OIPs, there have been several changes made to the database structure and content. For example, the initial classification system of occupations based on the OES classification was converted to the new Standard Occupational Classification (SOC) system. Although most of occupations in the OES system could be linked to the SOC system via a crosswalk process, some new occupations also emerged that are not included in the OES. These new occupations required new RIASEC ratings. In addition, data on occupations from the initial Analyst Database had been replaced with data from incumbents. These changes required updating the initial OIPs.

In 2008, the O*NET development team updated the initial OIPs based on new data available in the O*NET system using the same judgement method (Rounds et al., 2008). Specifically, two groups of trained raters, three per group, made judgements on 459 and 450 occupations, respectively. They rated the appropriateness of each Holland category for each occupation based on O*NET data for the occupation. Raters displayed a high degree of agreement with each other (mean Gamma = .76). Therefore, the mean ratings across raters was applied to occupations for each of RIASEC category. Several geometric models were fit to the OIPs and the overall pattern was in line with the RIASEC model, thus supporting the validity of these judgements. High-point

codes were assigned to each occupation following the same procedure as used in Rounds, Smith et al. (1999).

In 2013, another update was made to the second generation of OIPs (Rounds et al., 2013). This update aimed to populate OIP information for 83 new O*NET-SOC occupations identified after Rounds et al. (2008). The same procedure was used as before to obtain OIPs for the new occupations. Raters again reached high degree of agreement with each other (mean Gamma = .86). The same procedure as used in Rounds, Smith et al. (1999) was applied to obtain high-point codes for each occupation.

In sum, expert ratings provide reliable and valid information about OIPs, which serve as an important link between the O*NET system and vocational interest assessment. The O*NET team also updates OIP information to keep up with new and emerging occupations.

Applications of OIPs in Research Studies and Practice

As discussed, the OIPs have been used to update and refine the ACT World-of-Work Map (Prediger & Swaney, 2004). The most frequent use of the OIPs, however, has been in quantifying occupations and work environments to test and evaluate theories of person-environment fit. Nye, Prasada, Bradburn, and Elizondo (2018) demonstrated the potential benefits of operationalizing interest congruence using polynomial regression and OIPs. Their study used OIPs to represent work and academic environments to evaluate interest congruence in the prediction of work satisfaction and academic course performance. Similarly, OIPs have been used in studies to RIASEC-code occupations in the study of person-environment fit (e.g., Wille, Tracey, Feys, & De Fruyt, 2014) and in studies investigating the structural fit of Holland's RIASEC model (Deng, Armstrong, & Rounds, 2007). Convergence of RIASEC codes across methods have also supported the validity of the OIPs. For example, Neukrug, Sparkman, and Moe (2017) assessed members of the National Organization for Human Services (NOHS) with the IP-short form and compared the high-point RIASEC codes with O*NET OIPs. They reported very similar codes across a variety of human service occupations.

Linking Interest Profiler Results to O*NET Occupations

The O*NET® Career Exploration Tools are a set of assessment instruments that are designed to help clients learn work-related information about themselves and facilitate career search activities. Career seekers can use these tools to identify occupations that match their interests, values, abilities. In the process of self-assessment, clients are provided with O*NET-SOC occupational profiles that are linked to their personal assessment results. In the following sections, we describe how clients' vocational interest profiles are linked to O*NET-SOC OIPs with the O*NET Interest Profiler.

Interest Profiler

The O*NET Interest Profiler is available in a variety of forms (Long, Short, Mini) and versions (Paper-and-Pencil, Web-based). All Interest Profiler forms have been shown to have good

psychometric properties and can be used to generate valid RIASEC profiles (Rounds et al., 2010; Rounds et al., 2016). More details about the development and psychometric properties of the Interest Profiler can be found in Chapters 4 (development), 5 (reliability), and 6 (validity).

*O*NET-SOC Occupations*

O*NET-SOC occupations have occupational profiles obtained using the procedure described above. To facilitate career exploration, O*NET-SOC occupations are divided into five Job Zones based on the amount of education, training, and/or experience each occupation requires. Job Zones are ordered according to increasing levels of education, training, and/or experience. For example, Job Zone 1 consists of jobs that have little requirement of preparation, while Job Zone 5 requires the most education, training, and/or experience (National Center for O*NET Development, 2008).

Linking Person Profiles to Occupation Profiles

After an individual completes the Interest Profiler and is presented with a personal RIASEC profile, the RIASEC profile is then linked to Occupational Interest Profiles (OIPs). The comparison between the two types of profiles is based on the shape or pattern of the whole profiles instead of the absolute level of each score. The ultimate goal is to direct a client to occupations that have the same high and low interests (Gregory & Lewis, 2016).

O*NET system uses Pearson correlations to quantify the degree of similarity/congruence between two profiles. The formula is as follows:

$$r_{po} = \frac{\sum_{i=1}^{N}(P_i - \overline{P})(O_i - \overline{O})}{N\sigma_P\sigma_O}$$

Where P_i stand for a person's score on the i^{th} RIASEC category $\overline{P}$ stands for a person's average score across the RIASEC categories. Similarly, O_i stands for an occupation's score on the i^{th} RIASEC category and $\overline{O}$ is the average score across the six categories for that occupation. σ_P and σ_O are the standard deviation of person profile and occupation profile, respectively. N equals 6 for RIASEC profiles. This index can range from -1.0 to 1.0. A correlation of 1.0 means that the rank order of a client's profile is identical with the rank order of an occupation's interest profile, whereas a correlation of -1.0 indicates that the two profiles have exactly opposite shapes.

Once an individual's profile is input into the system, the system will compute a similarity index for each O*NET-SOC occupation and make recommendations based on these indices. The scoring program will then apply the following decision rules to generate results that appear on the client's report. Below, we describe the latest rules that are implemented in the system (Gregory & Lewis, 2016).

1. Occupations are presented by Job Zone.

2. O*NET-SOC occupations for which the client's O*NET-SOC occupation profile correlation is notably high are identified as "very strong" matches.

3. The "very strong" match cutoff denotes the value for which the statistical significance of the correlation is $p < .05$ as derived from a one-tailed significance test. The "strong" match cutoff represents the value for which the statistical significance of the correlation is $p < .10$, as derived from a one-tailed significance test.

4. The goal of the scoring program is to list a total of 10 "very strong" or "strong" occupations displayed per Job Zone. If there are not 10 "very strong" or "strong" matches to the client's interest profile available, the scoring program displays the occupations with the next highest available correlations that are not negative. There are no upper limits on the number of O*NET-SOC occupations that may be suggested within a Job Zone.

5. Occupations that are "very strong" matches are labeled as "Best Fit" within the IP Short Form and Mini-IP. "Strong" matches are labeled as "Great Fit." Occupations with correlations greater than or equal to .000 and less than .608 are labeled as "Good Fit." Results are sorted by fit category and presented alphabetically within each category.

6. There may be some instances where fewer than 10 occupations are displayed per Job Zone, as only a small number of occupations may be linked to the client's interests. If fewer than 7 occupations are presented per Job Zone, the following language is displayed on the score report:

   "*Within this Job Zone, a small number of careers match your interest profile. Click on a different Job Zone above to see more careers linked to your interest profile*."

7. Additionally, there may be occasions where no occupations are linked to a client's interest profile within a Job Zone. If this occurs, the following language is displayed on the score report:

   "*Within this Job Zone, there are no careers that match your interest profile. Click on a different Job Zone above to see careers linked to your interest profile*."

8. In the event that a client responds “strongly dislike” to all items on the Interest Profiler, his profile is likely invalid. The client is instructed to review his responses or to re-take the tool. If this occurs, the following language is displayed on the score report:

   “You answered "strongly dislike" to all questions. Your results may not reflect your interests. Please consider retaking the Interest Profiler at a different time.”

9. Clients who would like to explore additional careers beyond those identified by their interest profile are provided with a “Find More Careers” option. This option allows the client to see a list of careers related to a single interest area of choice. Occupations are linked to each individual interest area based on their interest high-point codes.

These rules ensure that clients will receive appropriate and meaningful occupation recommendations based on their vocational interest profile.

Summary

In this chapter, we discussed the development of occupational interest profiles for occupations included in the O*NET system by reviewing different methods that have been used for developing OIPs, the development of the initial OIPs and their reliability and validity, and updates to the initial OIPs. We also discussed how clients’ vocational interest profiles are linked to O*NET OIPs to facilitate career exploration and decision-making in applied settings. The development of OIPs for the Interest Profiler lays the foundation for a flexible, dynamic career exploration system that corresponds to the rapidly changing world of work.

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CHAPTER 8

International Forms and Applications of the Interest Profiler

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This chapter describes considerations for international interest assessment and cross-cultural applications of the O*NET Interest Profiler. Specifically, this chapter integrates discussion of:

- International access to the Occupational Information Network
- Cross-cultural interest assessments
- English and Spanish language versions of the Interest Profiler
- Potential applications of the Interest Profiler in facilitating cross-cultural research and career assessment

International Access to the Occupational Information Network

The Occupational Information Network (O*NET) is a premier source of occupational information in the United States, attracting both national and international users. Government agencies, policy makers, researchers, and job seekers use O*NET and its products for various purposes. O*NET collects and publishes information on over 1,000 occupations, integrating occupational information, data, assessments, and other occupational resources. Each year, there are about 50 million site visits from over 150 different countries. Table 1 lists the top 25 countries, other than the United States, visiting O*NET sites each year.

Table 1. *Top International Countries Visiting O*NET Sites*

Countries		
1. Canada	10. Taiwan	19. Italy
2. United Kingdom	11. Sweden	20. Hong Kong
3. Puerto Rico	12. South Africa	21. Malaysia
4. Germany	13. New Zealand	22. India
5. Australia	14. South Korea	23. Guam
6. Netherlands	15. France	24. Iran
7. Singapore	16. China	25. Ireland
8. Spain	17. Turkey	
9. Japan	18. Switzerland	

Note. Table adapted from Hanna, Gregory, Lewis, & Rounds (2019)

International governments, researchers, and clients visit and utilize O*NET for many purposes, including use of the O*NET occupational taxonomy, database, and products. Among O*NET's

products, the O*NET program has several career exploration tools, each designed to help clients understand aspects of their career interests and skills. The Interest Profiler (IP) in particular is a family of measures designed to help users discover work activities and occupations that they would enjoy.

Cross-Cultural Interest Assessment

In the modern economy, it is important to understand the complexities of research across cultural and national boundaries. It should not be assumed that theories and assessments derived in one culture will generalize to other cultures. Rather, theories should be subject to stringent tests in different countries and with different ethnic groups.

The Interest Profiler (IP) assesses vocational interests according to Holland's (1997) RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) types. With this purpose, the IP lends itself well to international interest assessment. Holland's (1997) theory of people and work environments has been tested in many cross-cultural applications and has generally been supported in countries across the globe.

In particular, support for Holland's circular model has been demonstrated in Europe (Einarsdóttir, Rounds, & Su, 2010; Nagy, Trautwein, & Lüdtke, 2007; Šverko, 2008; Šverko & Babarović, 2006), Australia (Taylor, Kelso, Pretty, & Power, 1980), and Asia (Fahr, Leong, & Law, 1998; Leong, Austin, Sekaran, & Komarraju, 1998; Long, Adams, & Tracey, 2005; Soh & Leong, 2001; Tak, 2004; Yang, Stokes, & Hui, 2004). This evidence supports the use of RIASEC interest measures outside of the United States. Although this research has not specifically examined the validity of the Interest Profiler in Europe or Asia, the results exhibit promising possibilities.

However, there has not been much research on extending Holland's (1997) theory into Africa or South America. One study found a lack of support for Holland's (1997) circular model in South Africa (du Toit & de Bruin, 2002). The authors noted that the high unemployment rate in the region may have skewed participants' interest responses, but there have yet to be many studies to test the validity of Holland's (1997) model in Africa. Similarly, only a few studies have investigated the validity of Holland's (1997) RIASEC model in South America. Glidden-Tracey and Parraga (1996) found that Holland's (1997) circumplex structure did not fit well with a sample of Bolivian students. In these cases, more research should be done to investigate the validity of Holland's (1997) theory in Africa and South America, including the use of the Interest Profiler for international vocational interest assessment.

O*NET Interest Profiler: English- and Spanish-Language Versions

Clients from over 50 different countries have taken advantage of the Interest Profiler and the full suite of O*NET career exploration tools. Table 2 lists the countries, other than the United States, who have requested access to the O*NET career exploration tools, including the Interest Profiler.

Table 2. *International Countries with Client Access to the O*NET Interest Profiler*

Countries		
Albania	Greece	Philippines
Angola	Guatemala	Poland
Antigua	Honduras	Puerto Rico
Australia	India	Romania
Azerbaijan	Indonesia	Saudi Arabia
Bahrain	Ireland	Singapore
Belarus	Israel	South Africa
Belgium	Italy	South Korea
Brazil	Jordan	Spain
Cameroon	Kenya	St. Vincent and the Grenadines
Canada	Lebanon	Taiwan
China	Malaysia	Thailand
Egypt	Mexico	Turkey
Ethiopia	Netherlands	Ukraine
France	New Zealand	United Kingdom
Germany	Nicaragua	Virgin Islands
Ghana	Nigeria	Zimbabwe

When clients request access to the career exploration tools, there are several versions of the O*NET Interest Profiler from which to choose depending on the client's needs. Specifically, the Interest Profiler (IP) has four different versions. Three of these versions are in English, including the O*NET Interest Profiler Long Form (IP Long Form) with 180 items, the O*NET Interest Profiler Short Form (IP Short Form) with 60 items, and the O*NET Mini Interest Profiler (Mini-IP) with 30 items. The computerized version of the IP Long Form was recently retired, but the IP Short Form has both paper-and-pencil and Web-based versions, and the Mini-IP has been implemented as a mobile version. All versions are free to use and easily accessible. Visit the O*NET Resource Center for more information (https://www.onetcenter.org/IP.html).

In addition to the English-language versions of the Interest Profiler, a Spanish-language version is available through *Mi Próximo Paso* (www.miproximopaso.org), which is the Spanish-language version of the O*NET career exploration site, *My Next Move*. The Spanish-language version of the O*NET Interest Profiler Short Form is freely available in web-based form. The Web-based version of the IP Short Form was translated into Spanish and verified by a translation team to ensure reliability and accuracy of translation. The Spanish form allows greater accessibility of the Interest Profiler not only for Spanish-speaking citizens in the United States, but also Spanish-speaking users in international contexts. Between the different language options and formats, the Interest Profiler offers many options to serve the various needs of clients across the globe.

Cross-Cultural Applications of the Interest Profiler

The widespread accessibility of the Interest Profiler makes it an excellent candidate for cross-cultural research. Any person with internet access can take the Interest Profiler free of charge, and paper-and-pencil versions can be disseminated without internet access as well. With a common metric and easily accessible items, researchers are encouraged to conduct cross-cultural research in order to establish measurement invariance, reliability, construct validity, and criterion-related validity internationally. Some specific international applications of the Interest Profiler (IP) are outlined below.

The IP is a useful tool to match one's interests to career options. Each occupation with O*NET data has an Occupational Interest Profile (OIP; Rounds, Smith, Hubert, Lewis, & Rivkin, 1999; Rounds, Armstrong, Liao, Lewis, & Rivkin, 2008). These OIPs were developed through expert scoring of occupations on all six RIASEC interest categories. The Interest Profiler is linked to occupational OIPs to recommend occupations based on an individual's interest scores (Kroustalis, Lewis, & Rivkin, 2010). This linkage is helpful for students and job seekers in many nations around the world to quickly match their interests to career options. Although occupational landscapes differ across countries, the broad list of occupational options can provide guidelines and a place to start one's job search process. International users of the Interest Profiler can also use information about RIASEC-based environments in their home country if such information is already developed.

Companies can also benefit from use of the Interest Profiler. From small businesses to global companies, interest assessments can inform human resource decision-making processes. Interests are an important predictor of outcomes like job performance and success-in-training (Nye, Su, Rounds, & Drasgow, 2012, 2017), and interests have been shown to predict career success (Rounds & Su, 2014). These outcomes are important for both internal and external hiring and promotions, so companies can utilize the Interest Profiler to assess whether employees' interests match the dominant tasks of different positions. Employees can easily access the interest profiles for their own occupation or similar occupations using O*NET OIPs, and the paper-and-pencil IP can easily be given and scored without computer-access. For international companies in particular, it is recommended to conduct a local validity study with current employees to assess whether the results of the Interest Profiler predict outcomes such as job performance.

In summary, researchers who conduct cross-cultural studies can benefit from a freely-available measure that is accessible across the world. The Interest Profiler is an excellent resource to assess RIASEC interests for individual career guidance, research studies, or organizational decision-making. For English- and Spanish-speaking countries, the IP Short Form has been pre-validated and is readily available for use. However, if translation to other languages is necessary, care should be taken to translate and back-translate the IP using a team of experts. In addition, it is also recommended to establish measurement invariance when conducting cross-cultural research, especially when participants from multiple countries are included in the sample. It is important to establish measurement invariance to ensure that interest items assess the same constructs in a similar structure in different countries, contexts, and across socio-demographic variables.

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