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The Stability of Vocational Interests From Early Adolescence to Middle Adulthood: A Quantitative Review of Longitudinal Studies

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The present meta-analysis examined the stability of vocational interests from early adolescence (age 12) to middle adulthood (age 40). Stability was represented by rank-order and profile correlations. Interest stability remained unchanged during much of adolescence and increased dramatically during the college years (age 18–21.9), where it remained for the next 2 decades. Analyses of potential moderators showed that retest time interval was negatively related to interest stability and that rank-order stability was less stable than profile stability. Although cohort standings did not moderate stability, interests of the 1940s birth cohort were less stable than those of other cohorts. Furthermore, interests reflecting hands-on physical activities and self-expressive/artistic activities were more stable than scientific, social, enterprising, and clerical interests. Vocational interests showed substantial continuity over time, as evidenced by their higher longitudinal stability when compared with rank-order stability of personality traits. The findings are discussed in the context of psychosocial development.

Keywords: vocational interests, stability, consistency, personality traits, longitudinal

Vocational interests are one of the most enduring and compelling areas of individual differences (Lubinski & Dawis, 1995) and the most popular means for characterizing, comparing, and matching persons and environments (Hogan & Blake, 1996). Interests have received substantial empirical attention in areas of vocational choice (Holland, 1997), educational and vocational counseling (Walsh & Osipow, 1986), career development (Oleski & Subich, 1996), personnel selection (Hogan & Blake, 1996), motivation (Ton & Hansen, 2001), job satisfaction (Assouline & Meir, 1987), job stress (Edwards & Rothbard, 1999), and occupational success (Clark, 1961). Since the pioneering work of Holland (1958, 1997, Kuder (1939, 1977), and Strong (1933, 1938) in the development of interest inventories, vocational interest assessment now constitutes a major portion of psychological testing within the United States (Watkins, Campbell, & McGregor, 1988). Results from these assessments are used in informing decisions ranging from selection of educational majors and careers, to midcareer changes, to organizational hiring and training practices, to retirement planning (Harmon, Hansen, Borgen, & Hammer, 1994). The degree of continuity and change in vocational interests across the life course has important ramifications for theory, research, and practice in several areas of psychology. The central purpose of the present study is to systematically examine the stability of vocational interests across the life course by conducting a meta-analytic review.

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An individual's life course is often described through his or her commitments to various roles and identities at different stages and his or her negotiation of stage-specific life tasks (e.g., Erikson, 1950; Levinson, 1986). As a major determinant of career choice and entry (Fouad, 1999), vocational interests play a pivotal role in the range and type of roles a person undertakes, as well as his or her social interactions. Much of an individual's waking time is spent at work or in preparation for work, and work settings make up a substantial portion of the environments afforded by communities. Furthermore, an individual's status in society is largely determined by his or her occupational choice (Dornbusch, Glasgow, & Lin, 1996). Sociological surveys indicate that a large number of interpersonal ties are formed at work (Marks, 1994), and employees are especially likely to have ties to others who occupy the same job (Ibarra, 1995). The stability of vocational interests is important for all theoretical and empirical considerations of the construct, especially its primary purpose in matching the individual with educational and work environments, because "extreme fluctuations in interest areas of young persons over a period of time would defeat any predictions based on them" (Herzberg, Bouton, & Steiner, 1954, p. 90). Knowledge of interest stability is critical to understanding how the role and meaning of work evolve over time and can aid in elaborating theories and models in developmental and vocational psychology.

All three previous reviews of interest stability (Campbell, 1971; Strong, 1943; Swanson, 1999) have focused on the Strong Interest Inventory (Harmon et al., 1994) and have relied on qualitative summaries. The reviewers have concluded that vocational interests are very stable in adulthood. However, because of their qualitative nature, they did not provide an empirical estimate of the stability and could not examine at what point during adulthood interests reach peak stability. The researchers have arrived at the common assumed point of ages 25–30 years by "eyeballing" selected articles. Furthermore, little is known about whether stability changes

after that time and, if it does change, at what stage of the life course. The current study addresses previous qualitative shortfalls through a quantitative meta-analytic review of the literature that provides estimates of vocational stability from early adolescence to middle adulthood. In addition, the present quantitative methodology permits the testing of a wide range of potential moderators in a simultaneous fashion—which was never done in previous qualitative reviews or in single-sample longitudinal studies. Because of the historical emphasis on assessment in vocational interest research, stability has been largely construed as the test–retest reliability of inventories, with most test–retest intervals spanning a few weeks to a couple of months. In line with our focus on vocational interest stability from a trait perspective, only studies with retest intervals of a year or greater were included in the meta-analyses.

What Are Vocational Interests?

Interests have been studied from a situational and a dispositional point of view. Situational interests are transitory and context specific and are connected to emotional states aroused by specific features of an activity (Hidi, Renninger, & Krapp, 1992). Studied primarily within educational research, situational interests are related to students' attention to material and persistence on learning tasks (Schraw & Lehman, 2001). Conversely, interests are also construed as an individual's psychological disposition associated with his or her preferences for activities and actions. Both individual or academic interests in educational research and vocational interests in vocational/industrial–organizational psychology stem from the dispositional perspective. Academic interests are associated with facilitative effects on cognitive functioning, learning, and academic achievement (Schiefele, Krapp, & Winteler, 1992), whereas vocational interests, the focus of the present study, are premised on facilitating the fit between people and their environment to improve occupational success and satisfaction. In essence, academic interests and vocational interests refer to the same dispositional attribute. School subject preferences and choices are systematically related to vocational interests (Elsworth, Harvey-Beavis, Ainley, & Fabris, 1999), and vocational interests have been systematically related to technical and college-level fields of study (Rosen, Holmberg, & Holland, 1994). The present study can complement the research within educational psychology by charting the developmental trajectory of interests beyond an individual's typical school-age years.

Conceptual Perspectives

Because of its pragmatic focus on person–environment fit, vocational interest research has historically centered on the construction, validation, and interpretation of psychometric scales and instruments. Early research concentrated on the empirical definition of vocational interests as indirect measures of the similarity of response patterns between an individual and a normative sample; interests were simply the scores on an interest inventory. As a result of the "dustbowl empiricism" tradition, conceptual developments of vocational interest as a psychological construct are dwarfed by the extensive empirical literature. Without a consistent theory of the nature of interests, researchers have used explanations of interest inventory scales, theories of career development, and descriptions of the origin of interests as substitutes for definitions of vocational interest (Dawis, 1991). In their most fundamental form, interests are simply constellations of likes and dislikes leading to consistent patterns of behavior (Strong, 1943)—they are enduring attitudes toward certain objects or events that cause one to attend to these objects or events. A survey of the empirical literature revealed three additional qualities of vocational interests: (a) Interests possess dispositional qualities, meaning that they are relatively enduring over time; (b) they influence behavior through motivational processes; and (c) they are reflective a person's identity or self-concept. These three attributes, or some combination of the three, are encompassed in most contemporary perspectives of vocational interests (Savickas, 1999).

The dispositional view of vocational interests is supported by previous reviews (Campbell, 1971; Strong, 1955) of the Strong Vocational Interest Blank (Strong, 1933, 1938) that indicate an impressive stability of adults' interests over time. The wide acceptance in individual-differences psychology of vocational interests as a dispositional attribute[1] (Lubinski, 2000) is evidenced by the extensive literature on the associations between interests and personality traits (Barrick, Mount, & Gupta, 2003; Larson, Rottinghaus, & Borgen, 2002), as well as their influences on a variety of outcomes. In a structural meta-analysis of the relations of personality traits with vocational interests, Mount, Barrick, Tippie, Scullen, and Rounds (2005) found that personality and interests composed two types of motivational constructs—(a) striving for self-growth versus accomplishment strivings and (b) interacting with people versus interacting with things. The dispositional qualities of vocational interests are further supported by behavioral genetic studies (Lykken, Bouchard, McGue, & Tellegen, 1993; Moloney, Bouchard, & Segal, 1991), which have attributed 40%–50% of interest variance to genetic factors.

Interests are often associated with needs and values within the family of motivational constructs (Eccles & Wigfield, 2002)—differing primarily in their breadth and level of abstraction, with needs usually at the top and interests at the bottom of the abstraction hierarchy. Super (1995), for instance, defined interests as preferences for activities in which individuals expect to attain their values, whereas values are conceptualized as objectives sought to satisfy needs. With regard to discrimination among these distinct but overlapping constructs,

> attitudes appear to be the most general construct and refer to favorable-unfavorable (accept-reject) orientation toward attitude objects. Needs and values refer to the importance-unimportance to the subject of the stimulus object. By contrast, preferences and interests refer to the dimension of liking-disliking for the stimulus object. (Dawis, 1980, p. 77)

As an aspect of the motivational matrix, interests are involved in the instigation and sustenance of human behavior, influencing individuals' choice, effort, and persistence in activities (Pintrich & Schunk, 2002). Vocational interests' role as a major determinant of

[1] To maintain terminological consistency and minimize confusion, we label purported long-term psychological attributes of an individual as *dispositions* or *dispositional attributes*. All references to *traits* are associated solely with personality traits, which are restricted, in this article, to an aspect of a person's disposition associated with the Big Five organization of personality.

choice is evidenced by the robust relation between interests and occupational membership. In a review of the literature, Fouad (1999) reported that "somewhere between 40% and 60% of individuals are in occupations that may be predicted from their inventory results" (p. 202). In line with conceptualizations that a person's activity choice is related to his or her beliefs about how he or she will do on that activity (Bandura, 1997) and the incentives or reasons for doing that activity (Ryan & Deci, 2000), research has found self-efficacy beliefs and outcome expectations to correlate with interest ratings in corresponding activity areas (Lopez, Lent, Brown, & Gore, 1997). The motivational nature of interests in regulating an individual's persistence and effort in his or her occupations has also received considerable empirical support. When workers' vocational interests are well matched (or congruent) with their work environment, the workers are more likely to stay in their job (Oleski & Subich, 1996) and less likely to likely to contemplate changing their job (Vaitenas & Wiener, 1977). The goodness of fit (or congruence) between individuals' vocational interests and their work environment is also related to effort, as demonstrated by correlations between interest congruence and favorable performance ratings (Barge & Hough, 1988). In addition, motivation theories posit positive psychological and affective responses to need fulfillment. Similar to the findings from self-determination theory that fulfillment of needs facilitates adjustment (Ryan & Deci, 2000), research has found that vocational interest congruence is related to increased adjustment, higher self-esteem, and greater satisfaction (Assouline & Meir, 1987; Celeste, Walsh, & Raote, 1995; Walsh & Russell, 1969).

Despite their dispositional qualities, interests do continue to develop. They are especially influenced by evaluations of significant others, reinforcements, and attributions for one's own behavior. Evidence indicates that vocational interests change in response to pressures in the environment. People change their interests in response to the positive and negative environmental reinforcements they receive. For example, parents shape their children's interests by controlling the type of activities the children are exposed to and, through their interactions, influence their children's perceptions of appropriate careers (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001). Change in our interests are also likely triggered by the assimilation of new role demands, by watching others and ourselves, as well as by responding to feedback from those around us. Meir and Navon (1992), for instance, found newly employed bank tellers to shift toward conventional interest profiles after half a year of employment. The tellers' level of congruence was, in turn, highly associated with their supervisors' evaluation of their performance. Social and cultural forces are also powerful influences, affecting barriers and supports to goal fulfillment as well as determining what individuals construe as important. The effects of these forces are evidenced in differences in the types of vocational interests expressed across genders (Betz & Schifano, 2000; Eccles, 1993), racial/ethnic groups (Leong, 1995), and levels of socioeconomic status (Bandura et al., 2001). Macrolevel factors such as economics and public policy also contribute to the development of interests (Blustein, Phillips, Jobin-Davis, Finkelberg, & Roarke, 1997). As such, interests' role in bridging an individual's psychological and physical world is in line with contemporary views of self-concept as a "person's perceptions regarding himself or herself . . . [that] are formed through experience with and interpretations of one's environment" (Marsh, 1990, p. 83).

Operational Perspectives

At the operational level, vocational interests are most commonly inferred from a person's responses to interest inventories (Dawis, 1991). Vocational interest inventories ask respondents to indicate their likes and dislikes for items that usually include variety of work- and nonwork-related activities and occupational titles. A good example is the Strong Interest Inventory (Harmon et al., 1994). Respondents indicate on a 3-point scale whether they like, are indifferent to, or dislike 317 items. Strong Interest Inventory illustrative items (in parentheses) include occupational titles (e.g., computer programmer, accountant, paralegal), school subjects (e.g., botany, literature, statistics, nature study), activities (e.g., cooking, meeting and directing people, discussing the purposes in life), leisure activities (e.g., jazz or rock concerts, skiing, camping), types of people (e.g., military officers, nonconformists, outspoken people with new ideas), preferences between two activities (e.g., outside work vs. inside work, music and art events vs. athletic events, taking a chance vs. playing it safe), self-rating of characteristic (e.g., "usually start activities of my group," "prefer working alone rather than on committees," "have mechanical ingenuity"), and preferences between dimensions of work (e.g., ideas vs. data, things vs. people).

The Strong Interest Inventory items, as well as items in other interest inventories, can be grouped into scales that assess a person's vocational interests at three levels of generality—occupational, basic, and general. Scoring the Strong Interest Inventory items, for instance, yields 211 occupational scales (e.g., Electrician, Chemist, Architect, Physical Therapist, Buyer, Credit Manager) with 102 pairs with separate scales for men and women and 7 scales for occupations represented by one gender; 25 basic interest scales (e.g., Mechanical Activities, Teaching, Writing, Science); and 6 general interest scale scores, called General Occupational Themes (i.e., Realistic, Investigative, Artistic, Social, Enterprising, and Conventional). Most vocational interest inventories do not measure interests at all three generality levels (occupational, basic, and general). Typically, inventories report scores for one type of scale. For example, the Self-Directed Search (Holland, 1994) and Unisex American College Testing Interest Inventory (UNIACT; Swaney, 1995) report general interest scores for Holland's (1958, 1997) RIASEC types, and the earlier form of the Strong Interest Inventory—the Strong Vocational Interest Blank (Strong, 1933, 1938)—reported only occupational interest scores.

Occupational scales are the earliest form of interest scales and consist of items that often lack a cohesive identity but maximally discriminate workers in a specific occupation from workers in other occupations (Burisch, 1984). Often called empirical keys, the items composing the occupational scales are selected only because they differentiate among occupations. An occupational scale measures interests at the most specific level of generality by comparing a respondent's interests with those of people within the referenced occupation. Let us consider the interest in selling. An occupational scale would address a specific sales occupation—for instance, a life insurance agent. The items included in the life insurance agent occupational scale are items that differentiate life insurance agents from other occupations, such as engineers, physicians, authors, social workers, accountants, and so on. A respondent's score on the life insurance agent occupational scale indicates how similar

the person's interests are to those of men or women in this occupation.

Researchers form basic interest scales and general interest scales by grouping items into scales with homogeneous content on the basis of theory, statistical clustering, or a combination of both. Basic interest scales occupy the level of abstraction between occupational scales and general interest scales and characterize a shared property of an activity (e.g., selling, teaching, technical writing), and they are often implied in the objects of interest (e.g., mathematics, physical science, religion). For example, a basic interest scale assessing sales would include items such as selling real estate, selling clothes in a department store, being a sales representative for a retail business, persuading people to buy merchandise, and so on. General interest scales have the broadest bandwidth. They reflect the dimensions within interest models such as Holland's (1997) interest types, Roe's (1956) interest categories, and Prediger's (1982) theory-based dimensions, measuring broad interest areas that reference many kinds of occupations. Broader than a basic interest scale, a general interest scale includes items from several basic interest areas. The Enterprising scale in the Strong Interest Inventory, for instance, is a general interest scale and includes items from the basic interests of public speaking, law, politics, merchandising, sales, and organizational management.

Paralleling developments in personality and intelligence research, researchers have proposed a number of classifications to organize the vocational interest domain and to provide the means of integrating results across studies and inventories (Rounds & Day, 1999). Of these frameworks, Holland's (1958, 1997) and Kuder's (1939, 1977) interest models are the most widely adopted in interest measurement and have generated most of the research on stability (Swanson, 1999). Both models organize the interest domain into theoretical categories by assuming certain structures of likenesses and differences among the myriad of activities and occupations in work. For example, one of the most basic structural claims is that people who enjoy working with people will not enjoy occupations that involve working mostly with things. They would probably prefer teaching in an elementary school to assembling children's tricycles. On this basis, Holland argued that most people's interests can be categorized into six types, referred to collectively as RIASEC: (a) realistic (interest in working with things and gadgets, interest in working outdoors, need for structure), (b) investigative (interest in science, e.g., mathematics and the physical sciences; work independently), (c) artistic (interest in creative expression, e.g., writing and the arts; little need for structure), (d) social (interest in people, drawn toward the helping professions), (e) enterprising (prefer leadership roles aimed at achieving economic objectives), and (f) conventional (prefer well-structured environment and chain of command, tend to be a follower rather than a leader). Using the same organizational principles as Holland, Kuder's model is described by 10 preferences: scientific, artistic, literary, social services, musical, outdoor, computational, clerical, persuasive, and mechanical. The difference between models, in essence, is in Kuder's finer differentiation of the domain through the expansion of Holland's realistic type into outdoor and mechanical preferences; Holland's artistic type into literary, artistic, and musical preferences; and Holland's conventional type into clerical and computational preferences. Given their conceptual similarities (Rounds & Day, 1999; Zytowski, 2003), there is little reason to expect stability differences between the models.

Vocational Interest Stability

Research on trait continuity in both vocational interests (Swanson, 1999) and personality (Caspi & Roberts, 1999; Roberts, Helson, & Klohnen, 2002) has demonstrated the disjuncture between group- and individual-level change. Individual differences in change can be and are often unrelated to population indices of change—the apparent stability of an interest at the group level may mask large but mutually canceling changes at the individual level. For example, a 16-year-old adolescent may become less interested in outdoor activities or in tinkering with tools and more interested in working with people than when she was 12. At the individual level, the configuration of her interests has changed across time. But if her preferences for working with her hands rank first among her peers at both ages, she has not changed in relative terms. Nonetheless, examinations of consistency and change at both the group and the individual level are complementary rather than contradictory; researchers should ideally jointly consider both perspectives when assessing stability. In interest research, group-level change is most commonly assessed through rank-order correlations, typified by test–retest reliabilities of scale scores; individual-level change (or ipsative stability; Caspi & Roberts, 1999) is evaluated through correlations of the configurations (or profiles) of salient interest areas for the same individual at different time points. Few studies have examined the commensurability of both indices (i.e., rank-order and profile correlations). As such, we consider them jointly and separately in the present study.

Children are exposed to occupational images at an early age, and their interests are frequently elicited through inquires about their aspirations (e.g., "What do you want to be when you grow up?"). There is general consensus that vocational interests emerge during childhood (Tracey, 2001) and become progressively more stable as individuals develop through adolescence (e.g., Marcia, 1980; Vondracek, 1993)—in part because of increasing self-awareness (Amundson, 1995), academic and workplace skill development (D. A. Phillips & Zimmerman, 1990), knowledge of occupations (Walls, 2000), and educational opportunities (Betz & Schifano, 2000). Todt and Schreiber (1998), in their model of interest development, proposed a series of stages through which individuals become increasingly conscious of the social structure, as well as their own abilities and talents—which leads to the progressive organization of interests that are in line with this knowledge. The notion that adolescents become more certain of their interests with age has received empirical support (e.g., Cook et al., 1996; Csikszentmihalyi & Schneider, 2000) and has been integrated into career development theories (e.g., Ginzberg, Ginsberg, Axelrod, & Herma, 1951; Super, Savickas, & Super, 1996).

In general, vocational interests are assumed to stop changing (or change very little) after the ages of 25 to 30 (Campbell, 1971; Hansen, 1984; Swanson, 1999)—a chronological milestone first articulated by Strong (1943, 1951). Previous reviews (Campbell, 1971; Strong, 1955) of the Strong Vocational Interest Blank indicate an impressive stability of adults' interests over time, with the average test–retest correlations for the occupational scales ranging from .91 for test–retest intervals of 2 weeks to not less than .60 for intervals over 20 years. Results of test–retest studies using various

versions of the Strong inventory demonstrate robustness in interest stability, both in scores for single persons over time (profile correlations; e.g., Swanson & Hansen, 1988) and in the relative placement of individuals within a group (rank-order correlations; Strong, 1951). Vocational training and occupational experiences were also found to have little effect on the interests of college students over a period of 10 years. Similar to longitudinal studies on other dispositional attributes, the age of the first testing and the test–retest time interval appear to be the primary determinants of interest stability (Strong, 1951). Similar trends have been observed in representative sample studies using census data—there is an increase in career stability between adolescence and adulthood, and many changes in careers are characterized by transitions within the same major Holland (1958, 1997) interest type (G. D. Gottfredson, 1977; L. S. Gottfredson & Becker, 1981). By charting the age trajectory of interest stability, the present study evaluates three widely held ideas of vocational interest development: (a) Interests are relatively unstable at the beginning of adolescence and become gradually more stable with age, (b) reaching peak stability between age 25 and 30, (c) after which they change very little, if at all.

The Present Study

The purpose of the present article is to examine the stability of vocational interests beginning from early adolescence to middle adulthood by conducting a meta-analytic review. Broadly speaking, individuals' interests reflect preferences for behaviors, situations, contexts in which activities occur, and the outcomes associated with the preferred activities (Rounds, 1995). In addition, they are part of individuals' self-concept and play important roles in organizing and maintaining effort in daily activities as well as in long-term planning.

To emphasize our focus on the long-term stability of interest and reduce potential carry-over effects that might inflate stability estimates, we restricted analyses to studies with test–retest intervals of at least a year. Estimates of interindividual (rank-order correlations) and intraindividual (profile correlations) stability of vocational interests were drawn from 66 longitudinal studies and grouped into age-range categories associated with developmental transitions. Adolescence is associated with numerous social, cognitive, and biological changes. Continuity and change can thus be better observed if the period from age 11 to age 21 is considered in several phases rather than a single developmental stage (Task Force on Education of Young Adolescents, 1989). In accordance with research emphasizing the impact of school transitions on adolescent development (Eccles et al., 1993), we divided the period of adolescence into four categories encompassing transitions between elementary school, middle school, high school, and college. On the basis of Levinson's (1986) suggestion that adulthood is punctuated by approximately 5-year periods of stability and instability, we divided the subsequent period after college into half-decade segments. In accord with the prevailing perspective in vocational interest development, we expected interest stability to be relatively low at the end of childhood and to increase linearly over adolescence into the college years before reaching a peak around ages 25 to 30.

We also tested the effect of cohort standing on vocational interest stability. The face and place of work have changed dramatically over the last century, but there has been little research on the impact of these changes on interest development. This has led some researchers (e.g., Savickas, 2005) to argue for a contextual approach to career development under the premise that individuals' vocational interests have become more dynamic in response to today's rapidly changing work environment. Differences in interest stability between cohorts might be affected at two major levels. On the level of the individual, people living through a certain period share the cultural values of that time, such as the meaning of work and the centrality of work to one's identity. At the structural and organizational levels, changes in the nature of work over the last century have led to historical shifts in access to educational/occupational resources and opportunities, especially for women and ethnic minorities. For example, prior to World War II, only about 20% of the U.S. workforce was female, and these women were primarily employed in the fields of school teaching, factory work, and domestic service. The war, however, opened the labor market, as women entered jobs that were previously held by men and were typically closed to women. One possibility, then, is that the stability of women's vocational interests increased over the decades as more women were able to engage in activities of their choice. To investigate whether historical context had different effects on the stability of women's interests compared with men's, we segregated the cohort estimates by gender.

In addition, a number of variables that have been proposed to be moderators of vocational interest stability were systemically examined: (a) initial testing age, (b) test–retest interval, (c) gender, (d) coefficient type, (e) scale generality, and (f) interest models. The age of the initial assessment and the time interval between assessments have been found to be the largest determinants of stability across a range of individual-differences variables (e.g., Roberts & DelVecchio, 2000; Trzesniewski, Donnellan, & Robbins, 2003). As such, any examination of longitudinal research must take into account the potential influences of these two factors on obtained effect sizes. Gender was examined as a moderator because recent research (Eccles, 1994) has suggested that women may be more likely to change their interests according to environmental pressures. As previously mentioned, changes in individuals' interests can be observed at a group or at an individual level. We tested whether interest changes assessed at the group level were different from changes at the individual level, quantified respectively by rank-ordered correlations and profile correlations.

We also evaluated the hypothesis that interest stability is moderated by generality of the measuring scale. General interests and basic interests parallel Meehl's (1986) view of source and surface trait distinction. Source traits are more basic than surface traits, and they underlie surface traits. General interests are similar to source traits, as the elements of the activity family are dissimilar, and an internal entity is postulated to explain their covariation. Basic interests, like surface traits, have similar elements of the activity family. In line with Meehl's (1986) trait ideas, environment factors are expected to have the least degree of influence on general interests. Thus, we expected general interests to be more stable than basic interests, which should, in turn, be more stable than occupational interests. To examine whether stability was affected by the manner in which the interest domain was organized, we contrasted Holland's (1958, 1997) interest model with Kuder's (1939, 1977) 10 preferences model. Insofar as both classifications are adequate representations of the interest domain,

interest stability should not differ between models. We extended the comparisons to include the categories within both classifications to test whether type of vocational interest affects temporal stability.

Information about the stability of vocational interests between early adolescence and middle adulthood is important in itself to the understanding human development. In addition, vocational interests clearly share many qualities attributed to personality traits, such as the Big Five. Dimensions of human abilities, interests, and personality all play critical roles in structuring important behaviors and outcomes (Lubinski, 2000). The relations between vocational interests and personality traits have received considerable theoretical and empirical attention (Barrick et al., 2003; Larson et al., 2002), with evidence of significant and meaningful convergence (Ackerman & Heggestad, 1997; Hogan & Blake, 1999), and have been postulated to be equivalent constructs (Holland, 1958, 1997). Conversely, heritability estimates of interests were somewhat lower compared with findings on personality traits (Plomin & Caspi, 1999) and cognitive abilities (Finkel, Pedersen, McGue, & McClearn, 1995), which led other researchers (Lykken et al., 1993; Swanson, 1999) to propose that interests develop from the "precursor traits" that are closer to the genetic level (i.e., personality, intelligence). Thus, the age trajectory of personality traits should provide an appropriate benchmark for assessing vocational interest development across the life course. To this end, we compared the stability estimates of vocational interests at different life stages with personality estimates published in Roberts and DelVecchio's (2000) meta-analysis of personality stability. We reaggregated the vocational interest studies into the age categories in Roberts and DelVecchio's (2000) study to enable their comparison. Insofar as vocational interests are analogs or developmental end products of personality traits, the age trajectory of interests should mirror that of personality traits in the first case or be less stable in the latter. However, in line with our earlier expectation, we anticipated that vocational interests would stabilize much earlier in the life course compared with personality traits, which attained peak stability at late middle age (i.e., ages 50–59; Roberts & DelVecchio, 2000).

Method

Literature Search

We conducted a literature search to identify published and unpublished studies that investigated the temporal stability of vocational interests. We used several strategies to locate the relevant literature. First, we reviewed the bibliographies from three previous reviews of vocational interest stability (Campbell, 1971; Strong, 1955; J. L. Swanson, 1999). Second, we searched the PsycINFO and ERIC databases for articles published between 1914, when the first vocational interest inventory was developed by T. L. Kelley, and January 2004, using all possible combinations of the following keywords: *vocational*, *occupational*, *career, interest(s)*, *measure(s)*, *stability*, *consistency*, *continuity, permanence*, *change*, *longitudinal*, *temporal*, *developmental*, *test–retest*, and *reliability*. Third, we checked the retrieved articles for further cross-referenced articles. Fourth, we reviewed the content pages of vocational interest-related journals (*Career Development Quarterly*, *Education and Psychological Measurement*, *Journal of Applied Psychology*, *Journal of Career Assessment*, *Journal of Counseling Psychology*, *Journal of Vocational Behavior*, and *Measurement and Evaluation in Counseling and Development*) for articles of possible relevance. Finally, we included databases reported in test manuals. We retrieved a total of 232 studies.

Inclusion Criteria

We included studies if they met three criteria. First, at a minimum, each study needed to contain information on test–retest interval, sample size, age of sample, type of instrument used, and a stability index—in the form of either a rank-order correlation or a profile correlation (i.e., Pearson's correlation, Spearman's rho, or Fisher's *Z*-transformed correlation). Studies that provided only the means and/or standard deviations, letter-grade ratings, percentages, or *t* values were not included in the data analysis. Second, to emphasize the longitudinal stability of vocational interests and to reduce potential carry-over effects that could inflate estimates, we included studies with test–retest intervals greater than or equal to 1 year. Third, the studies must have been published in English.

Using the above criteria, K. S. Douglas Low and Mijung Yoon independently reviewed each retrieved article. Interrater agreement for the inclusion process was 92%. Initial disagreements were most frequently due to misclassification of dissertations and were resolved by James Rounds. Sixty-six studies satisfied the inclusion criteria. Three studies—Burnham (1942), Taylor (1942), and Taylor and Carter (1942)—constituted the earliest publications in our database. Overall, studies provided a total of 107 samples, consisted of 23,665 participants, and yielded a total of 148 stability coefficients (118 rank-order correlations, 30 profile correlations).

Study Variables

Interest stability. As previously described, we examined interest stability using rank-order correlations and profile correlations. Because Robert and DelVecchio's (2000) meta-analysis focused solely on rank-order personality consistency, we used only rank-order correlations for comparing vocational interests with personality.

Age. For our first set of analyses, we divided the period between adolescence and middle adulthood into eight age categories, reflecting early adolescence (ages 11.5–13.9), middle adolescence (ages 14–15.9), late adolescence (ages 16–17.9), the college years (ages 18–21.9), emerging adulthood (ages 22–24.9), and the subsequent half decades of adulthood through age 40. To allow comparisons with personality consistency, we recoded the studies using Robert and DelVecchio's (2000) stages—adolescence (ages 12–17.9), the college years (ages 18–21.9), the first half of young adulthood (ages 22–29), and the second half of young adulthood (ages 30–39).

Age information for each measurement period was gathered in a number of ways. The majority of studies reported mean or median age. For studies that reported a range of ages (e.g., 14–16), the midpoints of the reported age ranges were used as estimates of age. A number of studies did not report age information in numerical form but provided age-based descriptions of their samples (e.g., college sophomores). These studies were assigned to age categories that best reflect the typical ages of members of these demographic groups in the population. For example, high school students would be placed in the age 16–17.9 category, and college sophomores would be classified within the age 18–21.9 category.

Test–retest interval. We selected longitudinal studies that reported stability coefficients of 1 year or longer. Interval was coded in number of years.

Cohort. We coded cohort by subtracting the age at the time of the first assessment from the year that the first assessment was conducted in each longitudinal study. When first assessment dates were unavailable, we used the year of publication of the article as a cohort indicator. Studies were subsequently assigned to one of seven cohort groups: earlier than 1930s, 1930s, 1940s, 1950s, 1960s, 1970s, and 1980s.

Gender. The gender composition of the samples was identified and coded (0 = male, 1 = both, 2 = female).

Scale generality. The generality of the scales used in the studies was coded into three levels: general interests, basic interests, and occupational interests (coded 1, 2 and 3, respectively).

The occupational scales in the Strong Vocational Interest Blank, the Strong–Campbell Interest Inventory (Strong & Campbell, 1974), the Strong Interest Inventory, and the Kuder Occupational Interest Survey (Kuder & Zytowski, 1991) were classified as occupational interest scales; the Basic Interest scales in the Strong–Campbell Interest Inventory and the Strong Interest Inventory, as well as the career clusters in the Career Occupational Preference System Interest Inventory (Knapp & Knapp, 1984), the 23 scales of the Ohio Vocational Interest Survey (D'Costa, Winefordner, Odgers, & Koons, 1970), and the Project TALENT interest inventory scales (Flanagan et al., 1966) were classified as basic interest scales. In addition, a number of studies, most notably the work of D. P. Campbell, clustered Strong Vocational Interest Blank items with high intercorrelations into homogeneous scales (e.g., Campbell, Borgen, Eastes, Johansson, & Peterson, 1968). They were grouped under the category of basic interest scales. The General Interest Themes in the Strong–Campbell Interest Inventory and the Strong Interest Inventory, the Self-Directed Search (Holland, 1994), the Vocational Preference Inventory (Holland, 1965), the UNIACT, the Inventory of Children's Activities–Revised (Tracey & Ward, 1998), the Kuder General Interest Survey (Kuder, 1975), the Kuder Preference Record (Kuder, 1939), and the RAMAK (Meir & Barok, 1974) were classified as general interest scales. According to the criterion listed above, interrater reliability was 96%.

Interest classification. Studies that investigated interest stability at the general interest level were differentiated between Holland's (1958, 1997) and Kuder's (1939, 1977) classification of interests. According to Swanson (1999), the categories within each model may be differentially stable. We further organized the rank-order correlations by their respective categories.

Aggregation and Analyses of Effect Sizes

In our analyses, a number of studies were published on the same longitudinal sample sets. To balance the optimization of the contribution of reported results, with the sample attenuation required for sample independence, we adopted the procedure used in recent meta-analyses of trait consistency (Roberts & DelVecchio, 2000; Trzesniewski et al., 2003). Stability coefficients were aggregated by sample rather than by study.

We created aggregated databases from the overall database to test the moderating effects of age and other variables on interest stability. To test the relation between interest stability and age, we aggregated sample data within the age categories by age at the initiation of the study. For studies that reported results based on multiple waves of testing, we included only the results from nonoverlapping time intervals. For example, Strong (1951) reported six stability coefficients for ages 22–27, 22–32, 22–44, 27–32, 27–44, and 32–44, based on four times of testing (i.e., ages 22, 27, 32, and 44) of a single sample. On the basis of the above criterion, we used only three of the six coefficients, each of which represents a corresponding wave of the three waves of testing (i.e., ages 22–27, 27–32, and 32–44). If, over the same time period, stability for a sample was represented by both rank-order and profile correlations or if stability was indexed at more than one scale-generality level for the same sample, we averaged the coefficients into the age category that was represented when the initial assessment of the particular sample took place. This technique meant that each longitudinal sample could contribute an averaged coefficient to several age categories, but each sample would contribute only once to the aggregated estimate for each age period.

To compute the estimates of interest stability, we followed Hedges and Olkin's (1985) recommendations (also see Roberts & DelVecchio, 2000; Trzesniewski et al., 2003). The effect size estimates consisted of Fisher's *Z*-transformed correlation coefficients, which we then weighted by the inverse of the variance when making population estimates. We obtained the estimated population correlations (ρ) through a *Z*-to-*r* transformation of the effect size estimates. We calculated confidence intervals (CIs) and tests of heterogeneity using the formulas provided by Hedges and Olkin (1985). Using this procedure, we obtained effect size estimates for each of the eight age categories.

Similar aggregation and calculation procedures were performed on databases that were aggregated by cohort standing, type of stability coefficient, test–retest interval, gender, generality of scales, and interest classification. Similar to the age-based database, the sample data were first aggregated by potential moderator, such as gender, and then by sample. In other words, each sample could only contribute one averaged estimate of interest stability to each category within each moderator.

Although the reaggregation of samples by proposed moderators provided the means of examining the main effects these variables might have on effect size estimates, the procedure did not test for moderating effects. For instance, if there were significant differences among the categories in the database that was aggregated by gender, we could conclude that men's interests were, for instance, more stable than women's interests. However, a conclusion about the effects of gender differences on interest stability across the age categories cannot be made, because gender was not considered in the derivation of the age-based population estimates.

To account for moderators in the main categorical effect, we used a random-effects model (also known as a mixed-effects model). A mixed-effects model allowed for the inclusion of all the moderator variables simultaneously, providing us with the ability to test the independent effect of each moderator while controlling for the remaining moderators. The assumption made in fixed-effects models is that the correlation estimates are being sampled from a single population centered at a true population correlation. A mixed-effects model permits population correlations to vary from study to study, with those parameters sampled from a universe of possible parameters. The additional source of variation is accounted for by the estimation of possible residual heterogeneity—between-experiments variability of population effects accounting for heterogeneity in the effect sizes beyond that which we would expect on the basis of the moderators alone. A mixed-effects model thus provides a more stringent test of moderators by reducing the Type I errors, which can become severely inflated in the typical fixed-effects approach (Viechtbauer, in press). To examine the effects of moderating variables on stability estimates among categories (e.g., the eight age categories between adolescence and middle adulthood), we estimated the parameters of the mixed-effects model by a weighted least squares regression, using an S-Plus module developed by Viechtbauer (2004). We also tested whether each moderator was significantly related to the effect sizes and whether residual heterogeneity was present with the Q_E statistic. An insignificant Q_E statistic indicates that the effect sizes are unlikely to be affected by moderators beyond those included in the model. Finally, we reestimated population estimates that controlled for significant moderators through an analysis of covariance (ANCOVA), using the general linear model procedure in SPSS 10.0.

Results

Study Characteristics

Table 1 lists the effect sizes (Fisher's *Z*-to-*r* transformed stability coefficients) and other sample characteristics for each study in the age-aggregated database. The 66 studies included in the meta-analyses had a total of 23,665 participants and provided a total of 148 coefficients. The average study in the initial database had a time interval of 7 years ($SD = 7.34$; range = 1 to 37 years), studied college students (mean age = 18.0; $SD = 5.0$; range = 11 to 40 years), and consisted of approximately 222 participants (range = 23 to 4,000). The three most studied interest inventories were the Strong Vocational Interest Blank (Strong, 1933, 1938), the Kuder Preference Record (Kuder, 1939) and the Strong–Campbell Interest Inventory (Strong & Campbell, 1974), and they were used, respectively, by 48.3%, 20.7%, and 6.0% of the studies.

The most striking finding was the lack of studies examining vocational interests in adulthood. The vast majority of studies

Table 1
Longitudinal Studies of Vocational Interest Stability

Authors	N[a]	Stability coefficient	Interval	Age category	Cohort standing	Measure	Scale generality	Gender	Method	Sample description
Adams (1957)	57	.63	3.00	2	1940s	KPR	G	M and F	R	9th graders
Allen (1991)	32	.71	4.00	4	1960s	SCII	G	F	R	College freshmen
Athelstan & Paul (1971)	1,583	.70	4.00	5	1930s	SVIB	O	M and F	R	Medical school students
Barak & Meir (1974)	223	.40	7.00	3	1940s	RAMAK	G	F	R	High school students
	160	.54	7.00	3	1940s	RAMAK	G	M	P	High school students
Benjamin (1968)	229	.42	31.00	4	<1930s	SVIB	O	M and F	R	College freshmen
Burnham (1942)	144	.71	3.00	4	<1930s	SVIB	O	M and F	R	College freshmen
Campbell (1966)	48	.65	30.00	8	<1930s	SVIB	O	M and F	R	Bankers
Campbell (1971)	56	.58	3.50	3	1940s	SVIB	B	F	R	College freshmen
	56	.59	10.00	3	1950s	SVIB	B	F	R	College freshmen
	1,214	.44	37.00	3	<1930s	SVIB	B, O	M	R	Adolescents
	38	.66	4.00	4	1950s	SVIB	O	F	R	College freshmen
	91	.51	27.50	4	<1930s	SVIB	B, O	F	R	College freshmen
	137	.76	9.67	4	<1930s	SVIB	B	M	R	College freshmen
	123	.59	10.00	4	1930s	SVIB	O	M	R	College students
	126	.59	3.50	4	1950s	SVIB	B	M	R	College students
	130	.69	9.67	4	<1930s	SVIB	B	M	R	College students
	91	.73	3.50	5	1930s	SVIB	O	M	R	Medical school students
	106	.68	3.50	5	1930s	SVIB	O	M	R	Medical school students
	82	.65	3.50	5	1930s	SVIB	O	M	R	Medical school students
	98	.48	17.00	7	<1930s	SVIB	B	M	R	Veterinarians
Campbell et al. (1968)	189	.68	3.00	4	1950s	SVIB	B, O	M	R	College freshmen
Campbell & Soliman (1968)	138	.65	20.50	8	<1930s	SVIB	B, O	F	R	Psychologists
Canning et al. (1941)	64	.57	2.00	2	<1930s	SVIB	O	M	R	10th graders
Cisney (1944, 1945)	77	.49	3.00	2	<1930s	SVIB	O	F	R	9th graders
	72	.54	3.00	2	<1930s	SVIB	O	F	R	9th graders
	74	.73	2.00	2	<1930s	SVIB	O	M	R, P	9th graders
	58.5	.69	2.00	2	<1930s	SVIB	O	M	R, P	9th graders
	64	.76	1.00	3	<1930s	SVIB	O	M	R	11th graders
	47	.69	1.00	3	<1930s	SVIB	O	M	R	11th graders
Cooley (1967)	1,590	.51	3.00	2	1940s	TALENT	B	F	R	Project TALENT participants
	1,466	.51	3.00	2	1940s	TALENT	B	M	R	Project TALENT participants
Dolliver et al. (1975)	163	.47	12.00	4	1950s	SVIB	O	M and F	R	College students
Dolliver & Will (1977)	23	.32	10.00	4	1940s	SVIB	O	M and F	R	College students
Gehman & Gehman (1968)	93	.58	4.00	4	1950s	KPR	O	M and F	R	College students
Hansen & Stocco (1980)	70	.72	3.00	2	1960s	SCII	G, B, O	M and F	R, P	9th graders
	479.25	.68	3.50	4	1960s	SCII	G, B, O	M and F	R	College students
Hawkes (1978)	362	.59	2.00	2	1950s	OVIS	B	F	R	Junior high school students
	297	.54	2.00	2	1950s	OVIS	B	M	R	Junior high school students
Herzberg & Bouton (1954)	68	.69	4.09	3	1930s	KPR	G	F	R	High school students
	62	.64	4.39	3	1930s	KPR	G	M	R	High school students
Herzberg et al. (1954)	48	.67	2.86	3	1930s	KPR	G	F	R	College-bound high school students
	74	.75	2.40	3	1930s	KPR	G	F	R	Work-bound high school students
	101	.67	2.84	3	1930s	KPR	G	M	R	College-bound high school students
	49	.69	2.35	3	1930s	KPR	G	M	R	Work-bound high school students
Holland (1965)	204	.45	4.00	3	1940s	VPI	G	F	R	National Merit finalists
	432	.53	4.00	3	1940s	VPI	G	M	R	National Merit finalists
	26	.78	1.00	4	1940s	VPI	G	M and F	R	College freshmen
Holland (1979)	52	.75	1.00	5	1950s	SDS	G	F	R	Teachers in training
	27	.84	1.00	5	1950s	SDS	G	M	R	Teachers in training

Table 1 (*continued*)

Authors	N[a]	Stability coefficient	Interval	Age category	Cohort standing	Measure	Scale generality	Gender	Method	Sample description
Hoyt (1960)	121	.61	4.00	3	1930s	SVIB	O	M and F	P	12th graders
Johannson & Campbell (1971)	334	.70	3.00	4	1940s	SVIB	O	M	R	College freshmen
Knapp & Knapp (1984)	241	.61	1.00	1	1960s	COPS	B	F	R	7th graders
	256	.53	1.00	1	1960s	COPS	B	M	R	7th graders
Kuder (1975)	328	.47	4.00	1	1940s	KGIS	G	F	R	6th–7th graders
	311	.50	4.00	1	1940s	KGIS	G	M	R	6th–7th graders
Long & Perry (1953)	32	.40	3.00	4	1930s	KPR	G	M and F	R	College freshmen
Lubinski et al. (1995)	162	.47	15.00	1	1960s	SCII	G, B, O	M and F	R, P	Mathematically gifted students
McCoy (1955)	177	.68	1.75	2	1940s	KPR	G	F	R	9th graders
	56	.62	3.08	2	1940s	KPR	G	F	R	9th graders
	142	.75	1.83	2	1940s	KPR	G	M	R	9th graders
	57	.59	3.08	2	1940s	KPR	G	M	R	9th graders
	33	.68	2.33	3	1930s	KPR	G	F	R	10th graders
	29	.71	2.17	3	1930s	KPR	G	M	R	10th graders
Mullis et al. (1998)	271	.62	3.00	2	1970s	SCII	G, B	M and F	R	High school students
Nichols (1967)	204	.50	4.00	3	1940s	VPI	G	F	R	National Merit finalists
	432	.55	4.00	3	1940s	VPI	G	M	R	National Merit finalists
Nolting (1967)[b]	327	.52	9.00	3	1950s	SVIB	B	F	R	College freshmen
O'Brien (1974)	102	.74	2.70	4	1950s	SVIB	O	M and F	P	College freshmen
Onischenko (1979)	129	.39	14.00	4	1930s	KOIS	O	M	R	College students
Petrik (1969)	58	.40	4.00	4	1940s	SVIB	O	F	R	College freshmen
	26	.60	4.00	4	1940s	SVIB	O	F	R	College freshmen
	56	.59	4.00	4	1940s	SVIB	O	M	R	College freshmen
	45	.49	4.00	4	1940s	SVIB	O	M	R	College freshmen
Powers (1954, 1956)	109	.78	10.50	7	<1930s	SVIB	O	M	R, P	Unemployed men
Reid (1951)	145	.80	1.25	4	1930s	KPR	G	M and F	P	College freshmen
Rhode (1971)[b]	37	.41	11.00	4	1940s	SVIB	B	M	R	College freshmen
Rohe & Krause (1998)	96	.77	11.00	7	1940s	SII	O	M	R, P	Spinal injury patients
Rosenberg (1953)	86	.60	2.67	2	1930s	KPR	G	F	R	Junior high school students
	91	.59	2.67	2	1930s	KPR	G	M	R	Junior high school students
Schletzer (1967)	172	.60	9.00	3	1930s	SVIB	O	M	R	High school students
Silvey (1951)	250	.73	2.00	4	1930s	KPR	G	F	R	College freshmen
	267	.73	2.00	4	1930s	KPR	G	M	R	College freshmen
Sprinkle (1961)	143	.70	6.50	4	1930s	SVIB	O	M	P	College freshmen and sophomores
Stordahl (1954)	111	.71	2.25	3	1930s	SVIB	O	M	R, P	High school students
	70	.72	2.25	3	1930s	SVIB	O	M	R, P	High school students
Strong (1951)[b]	183	.82	18.78	4	<1930s	SVIB	B, O	M	R	College students
	93.5	.76	10.00	6	<1930s	SVIB	B	M	R	Originally tested in college
	50	.87	11.00	6	<1930s	SVIB	O	M	R	Originally tested in college
	50	.88	12.00	7	<1930s	SVIB	O	M	R	Originally tested in college
Strong (1955)	194.5	.73	22.00	5	<1930s	SVIB	O	M	R, P	Graduate students
Swanson & Hansen (1988)	242	.68	12.00	3	1950s	SVIB	O	F	P	College freshmen
	167	.68	12.00	3	1950s	SVIB	O	M	P	College freshmen
Taylor (1942)	62	.90	4.00	2	<1930s	SVIB	O	F	R	Middle school seniors
	64	.86	4.00	2	<1930s	SVIB	O	M	R	Middle school seniors
Taylor & Carter (1942)	58	.74	1.00	3	<1930s	SVIB	O	F	P	11th graders
Thomas (1955)	81	.64	15.00	4	<1930s	SVIB	O	F	R	College sophomores
Tracey (2002)	221	.77	1.00	1	1980s	ICA-R	G	M	R	5th graders
	126	.49	1.00	1	1980s	ICA-R	G	M	R	7th graders
Tracey et al. (2005)	4,000	.54	1.00	2	1980s	UNIACT	G	M and F	R	8th graders
	4,000	.65	1.00	3	1980s	UNIACT	G	M and F	R	8th graders
Trimble (1965)	152	.51	10.00	3	1940s	SVIB	B	M	R	High school seniors
Trinkhaus (1952)	212	.58	14.50	4	<1930s	SVIB	O	M	R	College freshmen
Van Dusen (1940)	73	.59	3.50	4	<1930s	SVIB	O	M	R	College freshmen
Verburg (1952)[b]	47	.61	22.00	8	<1930s	SVIB	B, O	M and F	R	Secretaries

(table continued)

Table 1 (*continued*)

Authors	N[a]	Stability coefficient	Interval	Age category	Cohort standing	Measure	Scale generality	Gender	Method	Sample description
Williamson & Bordin (1950)[b]	93	.46	26.00	4	<1930s	SVIB	B	M	R	College freshmen
Wright & Scarborough (1958)	205	.75	2.00	4	1940s	KPR	G	F	R	College freshmen
	174	.73	2.00	4	1940s	KPR	G	M	R	College freshmen
	105	.68	4.00	4	1940s	KPR	G	F	R	College freshmen
	125	.65	4.00	4	1940s	KPR	G	M	R	College freshmen
Zytowski (1976)	163	.52	12.00	1	1960s	KOIS	O	M	P	13-year-olds
	173	.63	12.00	2	1960s	KOIS	O	M	P	15-year-olds
	110	.57	18.00	2	1960s	KOIS	O	M	P	15-year-olds
	175	.65	12.00	3	1950s	KOIS	O	M	P	17-year-olds
	108	.73	12.00	4	1950s	KOIS	O	M	P	20-year-olds

Note. Effect sizes are Fisher's *Z*-transformed correlations. Age category represents age at initiation of wave of longitudinal assessment. Age categories were coded as follows: 1 = 12–13.9 years; 2 = 14–15.9 years; 3 = 16–17.9 years; 4 = 18–21.9 years; 5 = 22–24.9 years; 6 = 25–29.9 years; 7 = 30–34.9 years; 8 = 35–40 years. KPR = Kuder Preference Record; G = general interests; M = male; F = female; R = rank-order correlations; SCII = Strong–Campbell Interest Inventory; SVIB = Strong Vocational Interest Bank; O = occupational interests; RAMAK = Hebrew abbreviation for list of occupations; B = basic interests; P = profile correlations; TALENT = Project TALENT Interest Inventory; OVIS = Ohio Vocational Interest Survey; VPI = Vocational Preference Inventory; SDS = Self-Directed Search; COPS = Career Occupational Preference System Interest Inventory; KGIS = Kuder General Interest Survey; KOIS = Kuder Occupational Interest Survey; SII = Strong Interest Inventory; ICA-R = Inventory of Children's Activities–Revised; UNIACT = Unisex American College Testing Interest Inventory.

[a] Sample sizes may not be whole numbers because of the averaging process across scale generality and/or method. [b] Reported in Campbell (1971).

included participants in the adolescent (51.3%) or the college (40.5%) age groups. Only 7.8% of the studies, which contributed 18 (12.2%) coefficients to the overall database, examined interests after age 21.

More estimates of interest stability were obtained from male participants (44.0%) than female participants (27.6%), and a large proportion of the studies did not analyze interest stability separately for male and female participants. The majority of the coefficients (79.7%) were rank-order correlations. Almost half (46.6%) of the coefficients were derived from occupational scales, 43.9% were drawn from basic interest scales, and 9.5% came from general interest scales.

Stability Across Age

In light of prevailing theories on adolescent development, we expected vocational interest stability to increase across the four age categories constituting the adolescent years. We expected stability to peak in the young adulthood period (ages 25 to 30), as stated by Strong (1951). Figure 1 and Table 2 show the population stability estimates and their 95% CIs for each of the eight age categories. Table 2 also displays the heterogeneity estimates of vocational interest stability across the age categories from age 12 to age 40. There are several noteworthy observations about the age trajectory.[2] First, the population estimates were high (ρ = .55–.83) and can be considered large in terms of conventional definitions of effect size (Cohen, 1988). Although the estimates did not peak near unity, vocational interests remained reasonably stable from ages 12 to 40. Second, vocational interest stability remained relatively unchanged through the middle school and high school years (ρ = .55–.58).[3] For the age periods prior to the college years, all the respective stability estimates fell within each other's CIs. Third, the end of high school was marked by a large increase in the stability of vocational interests, during which the majority of these participants entered college, as evidenced by the large discrepancies between the CI for ages 16–17.9 and the CI for ages 19–21.9. Although inspection of Figure 1 suggests a curvilinear trend, such that interest stability increased from early adolescence to the first half of early adulthood (ages 25–29.9) and then decreased for the next decade, the number of samples (n = 2) and the number of sample sizes (n = 144) at ages 25–29.9 were too small to draw firm conclusions. Conversely, the .70 approximation of the population estimates for college years and periods before and after the ages 25–29.9 peak suggest that the actual peak occurred during college years (ages 18–21.9)—earlier than previously assumed.

Examination of the unadjusted CI estimates in Table 2 provides further evidence that vocational interest stability reached a plateau at ages 18–21.9. Within periods when interest stability appeared to plateau, all the respective stability estimates fell within the 95% CI estimates. However, the CIs for the immediate neighbors (i.e., 22–24.9 and 30–34.9) of ages 25–29.9 overlapped each other, with the CI of ages 30–34.9 also overlapping with the CI of ages 25–29.9. These overlapping CI estimates indicate that the stability estimate for ages 25–29.9 was likely inflated. In addition, the significant heterogeneity estimates for the earlier age categories indicate that the estimated population coefficients might vary depending on potential moderators of longitudinal stability.

Moderators of Vocational Interest Stability

We tested five potential moderators of vocational interest stability over time: time between assessments, coefficient type, cohort stand-

[2] When estimates were weighted by the inverse of the variance ($N - 3$), the larger effect size corresponded disproportionately to the population effect size. The unweighted effect sizes (i.e., .54, .62, .62, .63, .71, .83, .72, and .61, respectively) showed a marked increase after ages 12–13.9 and after ages 18–21.9 compared with the trend shown in Table 2 and Figure 1.

[3] One study (Tracey, Robbins, & Hofsess, 2005) in the 16–17.9 age category had an unusually large sample (N = 4,000). Removing the study from the analysis resulted in a decrease in population effect size for the category (ρ = .52; CI = .50–.54; ρ_{time} = .56).

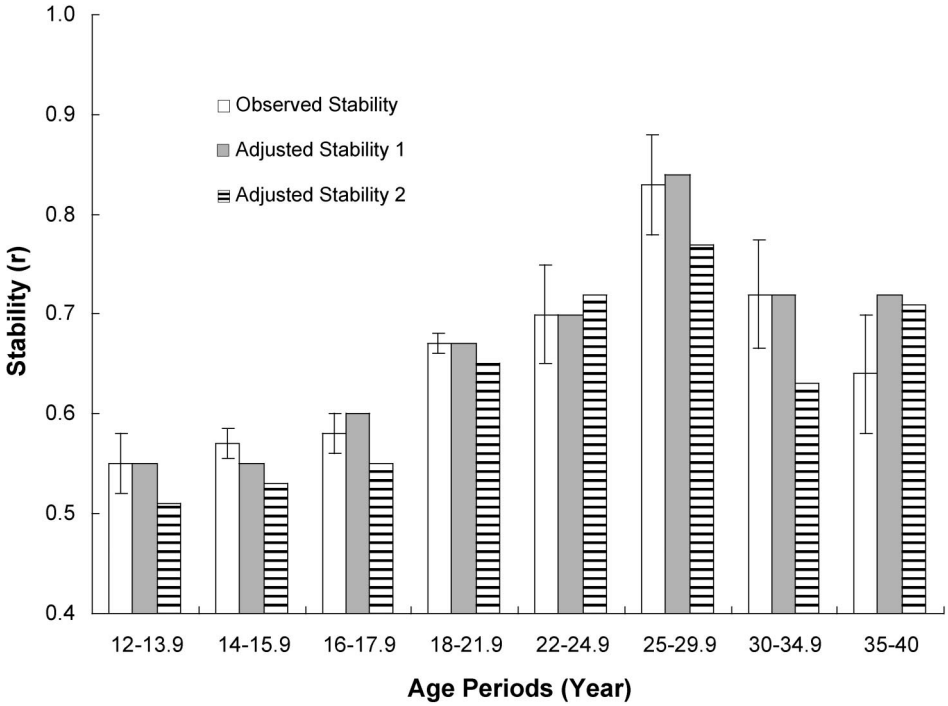

Figure 1. Population estimates of mean interest stability across age categories. Error bars indicate 95% confidence intervals for each age group. Observed Stability = unadjusted estimates; Adjusted Stability 1 = adjusted estimates with controls for time interval; Adjusted Stability 2 = adjusted estimates with profile correlations excluded and controls for time interval.

ing, gender, and scale generality. We also entered age into the mixed-effects model to control for its effect on the effect sizes. Because only a small subset of the studies ($k = 36$) provided stability information in terms of either Holland's (1958, 1997) RIASEC interests or Kuder's (1939, 1977) 10 preferences, we did not include interest classification in the moderator analysis for the stability differences between age categories. However, we subjected all variables including interest classification to analyses of moderators on their main effects on stability. Table 3 lists the parameter estimates for each variable, indicating the change in effect size per unit increase in the corresponding moderator value. In that way, we can obtain a predicted effect size for an individual by fitting his or her characteristics to the parameter estimates. Let us consider, as an example, a man born in the 1970s who was first tested at the age of 25 and was retested 2 years later. The rank-order stability of his general interests would be as follows: Intercept + .0157(age) − .0115(interval) + .1402(coefficient) + .0035(cohort) − .0116(gender) − .0410(generality) = .2835 + .0157(25) − .0115(2) + .1402(1) + .0035(6) − .0116(0) − .0410(1) = .7732 (*Z*-transformed correlation) or .65 (after *Z*-to-*r* transformation).

Because of the aggregation process, effect sizes may be the mean of more than one stability coefficient for a single sample. In

Table 2
Population Estimates of Vocational Interest Stability Across Age Categories

Age (years)	ρ	k	n	CI (ρ)	Q	ρ_{time}	ρ_{time}^{X}
12–13.9	.55	8	1,808	.52, .58	44.89*	.55	.51
14–15.9	.57	22	5,477	.55, .59	116.93*	.55	.53
16–17.9	.58	30	9,151	.56, .59	178.82*	.60	.55
18–21.9	.67	39	5,062	.66, .68	184.89*	.67	.65
22–24.9	.70	7	5,136	.66, .72	5.03	.70	.72
25–29.9	.83	2	144	.76, .87	0.52	.84	.77
30–34.9	.72	4	353	.66, .77	25.64*	.72	.63
35–40	.64	3	233	.55, .71	1.17	.72	.71

Note. ρ = estimated population correlation; k = number of samples; n = number of participants aggregated for each category; CI = 95% confidence interval for estimated population correlation; Q = heterogeneity statistic; ρ_{time} = estimated population correlation with time interval of longitudinal study controlled; ρ_{time}^{X} = estimated population correlation with profile correlations excluded and time interval of longitudinal study controlled.
* $p < .05$.

Table 3
Moderators of Vocational Interest Stability

Group	Intercept	Age	Interval	Coefficient	Cohort	Gender	Generality	Q_E
Stability with age (1)[a]	.2835	.0157*	−.0115**	.1402*	.0035	−.0116	−.0410	32.4
Stability with age (2)[b]	.5719	.0138*	−.0126**		.0087	−.0170	−.0373	30.4
Coefficient	.2967	.0167*	−.0121**		.0091	−.0060	−.0861	36.8
Cohort	.2448	.0166*	−.0129**	.1350*		−.0165	−.0845	31.5
Gender	.2445	.0163**	−.0130**	.1706*	.0031		−.0356	29.7
Generality	.4241	.0137*	−.0124**	.1999*	.0116	−.0175		33.2
Classification[c]	.4386	.0290	−.0326		.0010	−.0112		5.7

Note. Coefficient = type of coefficients (i.e., rank-ordered coefficients or profile coefficients); Generality = level of scale generality (general interests, basic interests, or occupational interests); Q_E = residual heterogeneity.
[a] Aggregation by age into eight age categories. [b] Aggregation by age into four age categories for comparison with personality traits. [c] Type of vocational interest classification: Holland (1958, 1997) versus Kuder (1939, 1977).
* $p < .05$. ** $p < .01$.

other words, test–retest interval, cohort standing, and gender remain the same for a sample within an age category regardless of aggregation, but scale generality and coefficient type may represent averages. Thus, it is important to note that significance testing for moderators may vary across different aggregations. For the present age-grouped database, age, test–retest interval, and the type of coefficient had significant relations with interest stability. Cohort, gender, and level of scale generality were not found to moderate interest stability. The test for residual heterogeneity was insignificant ($Q_E = 32.4$, $p > .05$), which suggests that the effect sizes were not influenced by moderators beyond those already included in the model.

Test–retest interval. Because the mixed-effects model only provided parameter estimates within an aggregation, we reestimated the population coefficients with an ANCOVA model with time interval as a covariate. The adjusted estimates (Figure 1 and Table 2) were obtained under the assumption that all studies lasted the average interval of 7.06 years. When the time interval between testing was taken into account, the adjusted estimates reflected a similar pattern of increase as was found for the unadjusted population estimates. In general, the adjustment had little effect on the magnitude of the population estimates, with the exception of the last age group. For ages 35–40, the population estimate increased from .64 to .71. When the estimates before and after adjustments were taken together, interest stability was demonstrated to remain relatively unchanged prior to the college years; during the college years, interest stability rose to about .70, where it remained for the subsequent 2 decades.

Type of coefficient. To account for the possible skewing of the age trajectory for interest stability because of different distributions of profile and rank-order correlations and to address the possible lack of commensurability between the two types of coefficients, we replicated population estimates across the age categories without profile correlations while controlling for test–retest interval (see $\rho_{time}{}^{X}$; Table 2). Omitting profile correlations led to a small but consistent reduction in all the stability estimates. Although conclusions about the longitudinal trajectory for interest stability cannot be drawn in this case because the omission process further reduced the samples and sample sizes of the latter age categories, the path of the adjusted interest stability trajectory approximated that of the unadjusted estimates, albeit at a reduced magnitude (see Figure 1).

The use of profile correlations and rank-order correlations represents two perspectives of longitudinal stability—an intraindividual perspective compared with a within-group perspective. In addition to its significant moderating effect on interest stability across time, the population estimate based on profile correlations (.70, CI = .68, .71) was significantly higher than the estimate for rank-order correlations (.60, CI = .59, .60), as evidenced by the lack of overlap between their respective CIs. Initial testing age and test–retest interval were the only significant moderators of coefficient category (see Table 3). The difference between the stability estimates remained unchanged when age and interval were controlled. A comparison of population estimates based only on studies ($k = 11$) reporting both types of correlations on the same scale supported the full-sample finding—the subset estimate for rank-ordered correlations (.56) was lower by a magnitude of about .10 compared with the estimate for profile correlations (.65).

Cohort. Although cohort did not moderate interest stability across the age categories, the mixed-effects analysis tested moderators under a linear model assumption; as such, a closer examination with studies reaggregated by cohort was needed to detect more complex patterns in stability. When interest stability was examined among cohorts, the population estimates evidenced a saw-tooth trend, as shown in Table 4 and Figure 2—alternating between dips and peaks beginning from the first cohort born before the 1930s to the 1950s cohort. This was followed by a gradual increase in stability through the 1960s to the 1980s. Examination of the respective 95% CIs of each cohort's population estimate indicate that the cohort trajectory was defined by a significant drop in the 1940s and the gradual but linear increase in interest stability for the subsequent cohorts. An inspection of the studies within the 1940s cohort shows that the majority of the participants were in their late teens or early adulthood and were first tested in the 1960s. Although interest stability differed significantly according to cohort, this finding must be distinguished from the earlier age trajectory results (as shown in Table 3), in which cohort standing was found to have a negligible effect on stability estimates across the developmental time course.

Table 4
Population Estimates of Vocational Interest Stability Across Cohorts

Cohort	ρ	k	n	CI (ρ)	Q	$\rho_{time,\ age}^{\ X}$
Before 1930s	.58 (.58/.60)	27 (16/7)	4,156 (3,105/583)	.56, .60	122.61*	.67 (.67/.68)
1930s	.67 (.64/.67)	35 (14/5)	4,066 (1,359/309)	.65, .69	36.79*	.67 (.65/.66)
1940s	.55 (.56/.53)	30 (15/12)	7,357 (4,019/3,232)	.54, .57	140.52*	.55 (.55/.54)
1950s	.62 (.61/.60)	17 (5/6)	2,624 (717/1,077)	.59, .64	61.55*	.62 (.60/.60)
1960s	.61 (.59/.62)	9 (5/2)	1,822 (256/273)	.58, .64	24.18*	.63 (.60/.61)
1970s	.67	3	635	.63, .71	16.11	.68
1980s	.65	3	4,347	.64, .67	4.97	.64

Note. Estimates and cohort information for men and women are in parentheses, with men listed before women. ρ = estimated population correlation; k = number of samples; n = number of participants aggregated for each category; CI = 95% confidence interval for estimated population correlation; Q = heterogeneity statistic; $\rho_{time,\ age}^{\ X}$ = estimated population correlation with profile correlations excluded and controls for time interval of longitudinal study and age of sample.
* $p < .05$.

Because of organizational and structural changes over the past century that largely affected the work of women, we also investigated cohort differences by gender. We were able to obtain effect sizes for women and men up to the 1960s. Samples in the 1970s and the 1980s did not report stability coefficients separately for men and women. As indicated in Table 4, both men and women evidenced cohort trends that mirrored the overall trend. Present findings for cohort trends broken down by gender must be interpreted with caution because of the attenuation of samples and sample sizes for the more recent cohorts. Nonetheless, the close resemblance of both trends to each other and to the overall trend (which included mixed-gender samples) suggests that the overall trend is representative of both genders. Initial testing age, test–retest interval, and coefficient type were found to be the only significant moderators in the cohort-based aggregation. The overall trend as well as the trends for men and women remained unchanged after we controlled for all three moderators.

Gender. Congruent with gender's lack of a significant moderating effect on the age trajectory of interests, there were no significant differences between the population estimates for samples of men and women (see Table 5). Longitudinal studies of men and women obtained the same level of interest stability at .58. Age, test–retest interval, and coefficient types were the only significant moderators of interest stability between men and women (see Table 3). No differences emerged between population estimates for both groups of studies after we controlled for age and test–retest interval in an analysis that excluded profile correlations.

Scale generality. Although scale generality was not a significant moderator within the age trajectory, there were significant

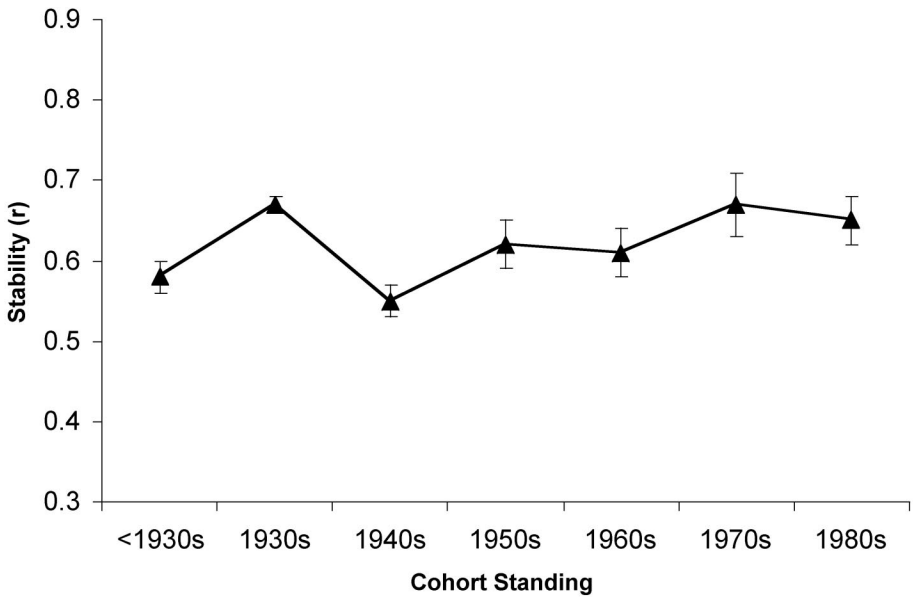

Figure 2. Population estimates of mean interest stability across cohorts. Error bars indicate 95% confidence intervals for each cohort category.

Table 5
Population Estimates of Interest Stability for Level of Change, Gender, and Scale Generality

Moderator	ρ	k	n	CI (ρ)	Q	$\rho_{time,age}$	$\rho_{time,age}^{X}$
Type of coefficient							
Rank order	.60	99	18,158	.59, .60	513.45*	.51	
Profile	.70	27	3,185	.68, .71	113.27*	.70	
Gender							
Men	.58	49	8,931	.56, .59	467.00*		.58
Women	.58	32	5,470	.56, .60	161.27*		.59
Scale generality							
General interests	.59	38	9,555	.58, .61	61.48*		.60
Basic interests	.57	33	9,303	.55, .58	432.32*		.59
Occupational interests	.63	56	9,923	.62, .65	318.85*		.61

Note. ρ = estimated population correlation; k = number of samples; n = number of participants aggregated for each category; CI = 95% confidence interval for estimated population correlation; Q = heterogeneity statistic; $\rho_{time,\ age}$ = estimated population correlation with controls for time interval of longitudinal study and age of sample; $\rho_{time,\ age}^{X}$ = estimated population correlation with profile correlations excluded and controls for time interval of longitudinal study and age of sample.
* $p < .05$.

differences in the stability of vocational interests according to the generality of the scale by which they were measured. We expected general interests to be the most stable, followed by basic interests, with occupational interests being the most likely to change across time. Contrary to our expectations, the stability estimate for basic interests was the lowest at .57, sandwiched by significantly higher estimates for general interests (.59) and occupational interests (.63). Moderator analysis indicated that age, test–retest interval, and coefficient types had significant effects on stability estimates among the three generality levels (see Table 3). When we dropped profile correlations and controlled for age and test–retest interval, the population estimates for basic interests and general interests increased to .59 and .60, respectively, whereas the estimate for occupational interests decreased to .61. The differences in stability among scale generalities were attenuated and were statistically insignificant.

Interest classification. We tested whether stability of interests differed across different interest classifications. Because only a small subset of the studies examined the stability of interests in terms of Holland's (1958, 1997) six interest types (k = 12) or Kuder's (1939, 1977) 10 activity preferences (k = 24), we excluded interest classification from the mixed-effects model. Instead, we examined its relation to interest stability solely by contrasting the stability estimates of Holland's interest types with the estimates of Kuder's activity preferences (see Table 6).

Because of their conceptual similarities, stability estimates were not expected to vary significantly between models. The population estimate for the mean stability of Kuder's (1939, 1977) 10 activity preferences, though higher at .65, was not statistically different from the mean stability of Holland's (1958, 1997) six interest types (.61). Both Holland's and Kuder's classifications are at the level of general interests, and only rank-order correlations were reported—thus, scale generality and coefficient type were excluded from the moderator analysis. Unlike previous analyses, none of the moderators were found to significantly affect stability estimates between the two interest models (see Table 3).

We next examined the stability of each of Holland's (1958, 1997) interest types (i.e., realistic, investigative, artistic, social, enterprising, and conventional) and Kuder's (1939, 1977) activity preferences (i.e., mechanical, computational, scientific, persuasive, artistic, literary, musical, social service, clerical, and outdoor). For the 12 studies that reported all six Holland types, the population estimate for the stability of realistic interests was the highest at .67. Artistic interests demonstrated comparable stability at .65, followed by social interests (.62), investigative interests (.60), conventional interests (.57), and enterprising interests (.54). An inspection of the CIs as shown in Table 6 reveals that realistic and artistic interests were more stable than enterprising and conventional interests.

Table 6
Population Estimates of Interest Stability for Holland (1958, 1997) and Kuder (1939, 1977) Classifications

Interest taxonomy	ρ	k	n	CI (ρ)	Q
Holland	.61	12	2,483	.58, .63	
Realistic	.67			.64, .69	56.41*
Investigative	.60			.58, .63	121.72*
Artistic	.65			.63, .68	112.26*
Social	.62			.60, .64	66.64*
Enterprising	.54			.51, .57	63.60*
Conventional	.57			.54, .59	84.11*
Kuder	.65	24	2,927	.63, .68	
Mechanical	.69			.67, .70	170.50*
Computational	.63			.61, .66	123.16*
Scientific	.67			.65, .69	151.03*
Persuasive	.62			.60, .65	122.22*
Artistic	.71			.69, .73	126.50*
Literary	.62			.60, .65	98.41*
Musical	.68			.66, .70	104.01*
Social service	.63			.61, .66	96.27*
Clerical	.65			.62, .67	126.32*
Outdoor[a]	.68			.64, .70	59.42

Note. ρ = estimated population correlation; k = number of samples; n = number of participants aggregated for each category; CI = 95% confidence interval for estimated population correlation; Q = heterogeneity statistic.
[a] Estimate for Kuder's outdoor domain was based on aggregation of 11 samples (n = 1,313).
* $p < .05$.

To examine the stability of Kuder's (1939, 1977) activity preferences, we aggregated coefficients from 24 samples measured with the Kuder Preference Record and Kuder General Interest Survey. Because older measures of Kuder's activity preferences did not include the Outdoor subscale, the estimated stability for the outdoor interest was based on an attenuated sample of 11 studies. We used the conversions provided by the manual for the Kuder Occupational Interest Survey (Kuder & Zytowski, 1991) to further explicate the stability of Kuder's preferences in relation to the Holland (1958, 1997) RIASEC categories. The stability estimates for Kuder's activity preferences are presented in Table 6 as well. As observed for the Holland categories, artistic preferences (.71) were the most stable of the 10 Kuder activity preference areas and are reflective of Holland's artistic interests. Furthermore, the other Kuder activity preferences with comparatively high stability estimates were mechanical (.69) and outdoor (.68), both of which reflect Holland's realistic type, and musical (.68), which constitutes an additional contribution to Holland's artistic interest. The activity preferences that were the least stable were persuasive (.62), literary (.62), computational (.63), and social service (.63). Persuasive preferences reflect Holland's enterprising interest, whereas computational preferences reflect Holland's conventional interest, and their low stability estimates are consistent with findings for their congruent Holland interests. However, Kuder's literary preference, which is an aspect of Holland's artistic interest, was somewhat inconsistent compared with the moderate stability of Holland's artistic estimate.

Stability of Vocational Interests and Personality Traits

We next sought to compare the rank-order stability of interests with that of personality traits. Using Roberts and DelVecchio's (2000) meta-analysis of personality consistency as a yardstick, we created a new age-aggregated interest database using only rank-order correlations, across four consecutive age periods within Roberts and DelVecchio's (2000) meta-analysis: adolescence (ages 12–17.9), the college years (ages 18–21.9), the 1st decade of young adulthood (ages 22–29), and the latter half of young adulthood (ages 30–39). The mean time interval and the mean age of the samples for the present study and Roberts and DelVecchio's (2000) study are equivalent—interval, $t(295) = 0.36$; age, $t(295) = 0.19$—allowing for meaningful comparisons.

When the stability estimates for vocational interests and personality traits are juxtaposed in Table 7 and Figure 3, several observations can be made. First, vocational interests were markedly more stable than personality traits from ages 12 to 29. With the exception of the last age category, there were no overlaps between interest and personality for each age group's CIs. Second, the differences in stability between vocational interests and personality traits were accentuated by the transition from adolescence to the college years—interests became progressively more stable than personality traits as individuals developed from adolescents to young adults. Vocational interests remained more stable than personality for ages 22–29, but both estimates converged at about .62 during the second half of young adulthood. Because the second age-based aggregation included only rank-ordered correlations, age and test–retest intervals were the only significant moderators (see Table 3).

Table 7
Population Estimates of Interest Stability Versus Trait Consistency Across Age Categories

Age category	ρ	k	n	CI (ρ)	Q	ρ_{time}
Vocational interests						
12–17.9	.55	50	15,094	.53, .56	281.13*	.54
18–21.9	.64	39	4,867	.64, .67	122.02*	.63
22–29	.70	4	2,697	.65, .75	10.45*	.73
30–39	.62	5	440	.57, .69	6.84*	.68
Personality traits[a]						
12–17.9	.47	32	19,951	.46, .48	153.85*	.43
18–21.9	.51	45	11,340	.50, .52	168.15*	.54
22–29	.57	10	3,394	.54, .60	59.91*	.60
30–39	.62	8	1,055	.56, .68	107.72*	.64

Note. ρ = estimated population correlation; k = number of samples; n = number of participants aggregated for each category; CI = 95% confidence interval for estimated population correlation; Q = heterogeneity statistic; ρ_{time} = estimated population correlation with controls for time interval of longitudinal study.
[a] Data on trait consistency are from Roberts and Del Vecchio (2000).
* $p < .05$.

With the exception of the ages 30–40 estimate for interest stability, controlling for test–retest interval had little effect on most of the estimates within their respective domains. When juxtaposed, the convergence between vocational interests and personality traits at the last age group was somewhat attenuated by the estimates controlling for test–retest intervals.

The small number of samples and sample sizes must qualify the estimates of interest stability for ages 22–29 and 30–40. Nonetheless, there were a number of observable similarities and differences among the age trajectories. Both vocational interests and personality traits showed marked increases in stability during the college years, and neither approximated unity during the investigated age range. Conversely, interest stability appeared to plateau after the college years, whereas personality traits continued to increase in stability and approached the stability of vocational interests only during the advent of middle adulthood.

Discussion

The results of the present study support the idea that vocational interests are stable dispositional attributes (Berdie, 1944; Holland, 1999). Between early adolescence and middle adulthood, the trajectory of interest stability was characterized by a marked increase between the ages of 18 and 21. Vocational interests were remarkably stable for all age categories, but the stability estimates were not so high as to warrant the conclusion that no change occurred in adulthood. It appears that vocational interests are highly stable past the college years, with some indication that they retain a dynamic quality. Stability was also moderated by a number of factors, including test–retest interval, age, and level (group vs. individual) at which change was assessed. In addition, the stability estimate of the cohort born in the 1940s was significantly lower than the estimates for other cohorts of the last century. Using personality traits as a benchmark, we found that vocational interests were more

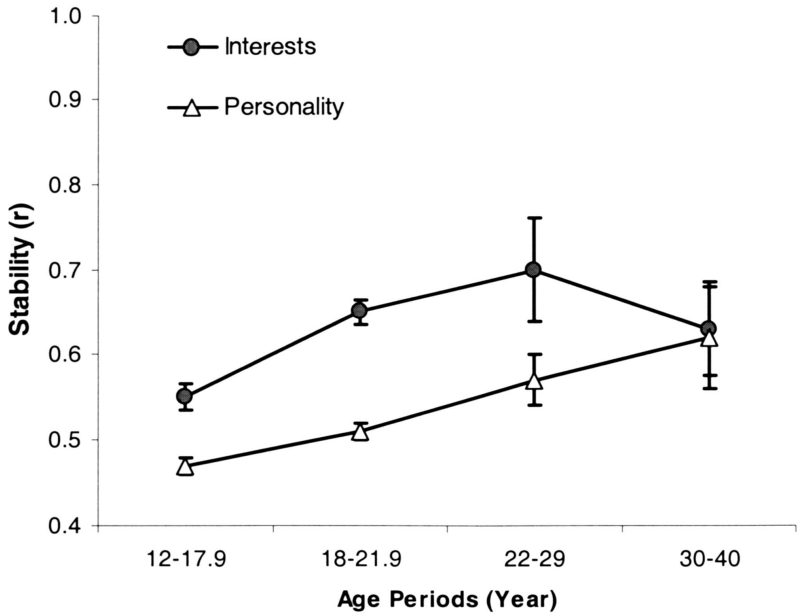

Figure 3. Comparison between interest stability and personality consistency across age groups. Error bars indicate 95% confidence intervals for each age group.

stable than personality traits from early adolescence (age 12) to middle adulthood (age 40).

Age and Vocational Interest Stability

Several aspects of the interest age trajectory are noteworthy. The first and possibly the most important finding of the present study is the high stability demonstrated by vocational interests from early adolescence to middle adulthood. Given that "if interests change from year to year, they are not trustworthy guides to the choice of a career" (Strong, 1931, p. 3), it is of no small consequence that the meta-analytic estimates from this study were quite high. These estimates indicate that vocational interests possess a level of continuity similar to those of personality traits and abilities (Tellegen, 1991). This implies that, similar to personality traits and abilities, vocational interests are likely to have effects on the paths people follow over the life course (Lubinski, 2000).

The present findings support the use of vocational interests as the means for facilitating fit between the individual and the environment from early adolescence to middle adulthood, even in age groups in which interest assessments are deemed inappropriate, that is, below age 16. The stability of adolescents' vocational interests has important implications for the conceptualization and practice of career guidance in schools. Career interventions in elementary and middle schools are largely based on helping adolescents acquire self-worth and knowledge about the world of work (National Occupational Information Coordinating Committee, 1989; Whiston & Sexton, 1998), with little emphasis on assessing vocational interests—in part because of the common belief that vocational interests before the age of 16 are too unstable to be reliable predictors of future outcomes. Similar concerns over the continuity of early adolescents' interests are reflected in popular interest inventories. For example, the Strong Interest Inventory (Harmon et al., 1994) and the Kuder Preference Record (Zytowski, 2003) recommend that long-range educational and career planning should be based only on results of adolescents above age 16. Nonetheless, these concerns are not supported by the meta-analytic estimates—educational and career decisions may in fact be made earlier than once thought possible. In another light, the early stability of adolescents' vocational interests implies that educational efforts to correct occupational misconceptions based on gender and racial stereotypes must be more intensive and begin at a much earlier age if we are to increase the parity in gender and racial representation across occupations. Given evidence indicating the impact of exploratory activities on increasing an awareness of interests (S. D. Phillips, 1992), it is perhaps not premature for educators to expose students to a wide range of vocational activities on their entry into the educational system,

Our results support a more purposeful approach to the interests of elementary and middle school students. The vocational interests of adolescents are inextricably linked to their individual and academic interests. In a review, Elsworth et al. (1999) suggested that preferences and choices for many school subject areas share thematic content in a manner that is clearly consistent with vocational interests, in particular Holland's (1958, 1997) RIASEC types. Academic interests are typically assessed by a small number of items referencing activities specific to particular school subjects. In focusing primarily on academic activities, academic interests provide little information about a person's likes and dislikes outside the school context. This can possibly lead to misrepresentation of an individual's true dispositional interest, especially in cases in which the student holds negative attitudes toward schooling in general. Conversely, items in vocational interest inventories assess preferences across a broad range of objects, activities, and contexts encountered not only in school but also in other life domains. It

might be argued that an individual's vocational interest profile is a summary of his or her behavioral repertories, life goals, values, self-beliefs, and competencies beyond the walls of the classroom. Therefore, engaging in the noncurricula activities within a vocational interest domain can serve to promote interest in similar academic activities. Vocational interests can therefore assist in the development of interventions aimed at motivating an otherwise disinterested student. In addition, the aspirations of students can be tapped through their high scores on occupational scales. By connecting subject matter with activities of aspired occupations, teachers can increase the motivation and persistence of students in those school subjects. In sum, educators can use knowledge of their students' vocational interests to provide real world contexts to school subject matter, thereby making in-class instruction more relevant to the students. This personal relevancy will likely lead to increased motivation and engagement in the classroom, as students come to understand the connections between their curricula activities and their practical environments (Pintrich & Schunk, 2002).

The second noteworthy aspect of the age trajectory is that interest stability remained relatively unchanged throughout the period prior to the college years (ages 18–21.9). This finding is contrary to our expectation and the popular belief that, with age, adolescents' vocational interests become increasingly more stable as their self-concepts crystallize over time. Trait continuity is believed (Caspi, 1998; Roberts & Caspi, 2003) to be facilitated by (a) the propensity of a person to select roles and environments that best fit his or her identity and (b) the manipulation and change of existing environment to better suit one's preferences. Vocational interest development can thus be viewed as an iterative process of increasing fit between the environment and the person—individuals choose activities and interactions that are consistent with their identity and avoid interactions that are inconsistent with their motives, goals, and values (Caspi & Roberts, 1999; Roberts & Caspi, 2003). It has been expected that as adolescents make the transition to adulthood, their vocational interests become progressively more stable as their increasing mastery of environmental changes permits better alignments between their interests and their environments (i.e., *niche picking*; Scarr & McCartney, 1983).

Why, then, did vocational interest stability remain relatively unchanged throughout the period prior to the college years? There are several possible reasons. First, there are limited opportunities for youths in U.S. schools to observe and participate in adult activities (Task Force on Education of Young Adolescents, 1989). Instructional practices are frequently removed from social contexts (Lave & Wenger, 1991), such as explanations of the rationales or their applicability to workplace situations (Rogoff, Paradise, Mejía-Arauz, Correa-Chavez, & Angelillo, 2003). The lack of change in the stability of adolescents' vocational interests prior to graduation from high school could be a reflection of how schools structure the opportunities for involvement in new and different activities. Another possibility is be that work may be a very distant prospect for many college-bound students, which would likely result in a reduced urgency and impetus for self-initiated exploration (Schneider & Stevenson, 1999). Lacking an adequate understanding of workplace roles and demands and befitted of the ability to choose alternative environments or manipulate existing ones, an adolescent is unlikely to develop a clearer picture of his or her vocational interests, in spite of growth in other aspects of self-concept (e.g., self-esteem; Trzesniewski et al., 2003).

A third important aspect of the age trajectory is that vocational interests approximate peak stability at ages 18 to 21.9—much earlier than the age range of 25 to 30 proposed by previous reviews (Campbell, 1971; Strong, 1951; Swanson, 1999) and several career development theories (Super et al., 1996). This peak is also much earlier in the life course than that found for personality traits (Roberts & DelVecchio, 2000). During this period (ages 18–22), individuals transition from high school into college or the workforce. The college student is faced with several monumental vocational decisions, the foremost of which is the decision of a major (Orndorff & Herr, 1996). Similarly, after entering an occupation, an individual has to decide whether to stay with his or her choice or to change to another occupation. Indeed, the process of simply being forced to confront one's interests—after a lengthy period in which active engagement in occupational exploration was deemphasized and discouraged—may be the stimulus for growth in stability. Moreover, previous environmental constraints are dramatically reduced, and individuals are exposed to a wide range of novel experiences, which are prerequisites to the development of more specific interests (Schmitt-Rodermund & Vondracek, 1999). Students are more able to choose the contexts, such as courses, leisure activities, part-time work, and social relationships, that are better aligned with their interests. A similar selection process occurs for those in the workforce. School-to-work youths undergo a period of "floundering" (Kerckhoff, 2002) in which they shift from job to job as both employers and workers attempt a suitable match. This is evidenced by the much shorter average job tenure (about 0.7 years) and greater mobility (4.4 jobs in 4 years) of 18–22-year-olds compared with their 23–27-year-old peers (average tenure of 1.5 years, 3.2 jobs in 4 years; U.S. Department of Labor, 2002a, 2002b). In that way, these experiences serve to deepen the characteristics that led people to the experiences in the first place, resulting in an elaboration and subsequent stabilization of the interest dispositions being rewarded by experience.

It is reasonable to expect vocational interests to increase in stability past college on the assumption that adults are progressively more able to select interest-congruent environments and are more likely to evoke stability-engendering responses from others. However, a person's talents, expectations, irreversible choices, and credentials restrict the range of movement he or she has after entry into the workforce (Holland, 1997). Employers discourage occupational change through common hiring practices and their preferences for certain qualities, such as age, race, gender, and work history (S. D. Phillips & Imhoff, 1997; Stewart & Perlow, 2001; Watkins & Subich, 1995). The large emphasis on job-specific skills and the economic rewards of specialization (e.g., better wages, continued employment; McKenzie & Lee, 1998) can lock individuals and organizations into an ongoing relationship, thereby reducing the probability of occupational changes (Wachter & Wright, 1990). In addition, decisions about career changes are not made within a social vacuum. The increased commitments to other life roles at adulthood, such as being a spouse, a parent, and/or a caregiver (Erikson, 1950; Levinson, 1986), affect the latitude an individual has in changing occupations. The constancy of environments on entering the workforce limits the frequency of new experiences as well as curtails further elaboration of fit between the individual and the environment (Downes & Kroeck, 1996). In many ways, there are similarities between the period prior to and the period after the college years. Because there are such con-

straints on the opportunities for individuals to increase the fit of their interests to their environment, interests are unlikely to increase or decrease in stability.

The Effect of Moderators on Vocational Interest Stability

The rank-order stability and the profile (ipsative) stability estimates were both high, indicating that individuals maintained relatively consistent interests and that few experienced any large transformation in their interest configuration. The estimates of profile similarity, however, were found to be higher than the estimates of rank-order stability. Although the pattern of trajectory remained largely unchanged, this had the effect of reducing the magnitude of stability estimates across age categories when profile correlations were excluded from the analysis. The similarity between the adjusted and unadjusted trajectories indicates that shifts in stability of vocational interests at different age stages are a result of developmental changes rather than psychometric artifacts of the coefficient analysis. As few studies have addressed the issue of commensurability between these two stability indices, we could only speculate about the possible mechanisms behind the differences between rank-order and profile correlations. Rank-order correlations represent the stability of individual differences within a sample of individuals over time. Claims of stability based on rank-order correlations thus rest not on the individual but on groups of individuals. Conversely, a profile correlation denotes the stability in the configuration of variables within an individual across time. A large rank-ordered correlation is dependent on all members of the group remaining relatively unchanged in their interests or on all members demonstrating an equal magnitude of change. In comparison, a large profile correlation is obtained when one individual remains relatively unchanged across time. In this context, a small change in a person's interest is more likely to have a large impact on his or her rank but will register a slight shift in his or her profile. As a consequence, rank-order correlations are smaller in magnitude compared with profile correlations.

The trend across cohorts was characterized by a significant dip in stability for individuals born in the 1940s. An examination of the studies in this cohort showed that most of the participants were high school or college students at first testing, which means that the initial assessment of their vocational interests occurred sometime in the 1960s. The 1940s cohort, the first wave of the baby boomers, came of age just when enormous changes in society were reaching a critical mass after a rather peaceful prior decade. These social and cultural changes included the civil rights movement, the Vietnam War coupled with the antiwar movement, and the countercultural movement. In some cases, these movements, especially the widespread unrest on college campuses and the exhortations to "turn on, tune in, and drop out" (Leary, 1965), could have disrupted educational and vocational plans and decisions. The experiences that typically occur between ages 18 to 22, such as choosing a major and making vocational plans, might have been postponed, leading to a smaller increase in stability. Indeed, interest stability of the 1940s cohort resembles the interest stability during middle adolescence. Unfortunately, there is no way post hoc to support one or another of these explanations.

The trend across cohorts was replicated when samples were segregated by gender. Although the male and female trends are qualified by the small samples in the later cohorts, the close similarities in trajectories among the male, female, and overall cohorts enable the extrapolation of the male and female cohort trends past the 1960s: It is unlikely that there will be significant gender differences in interest stability for men and women born in the 1970s and 1980s. This observation is further supported by the similarities between the stability estimates for men and women and by the nonsignificance of cohort standing as a moderator within the gender comparisons. Our findings are in line with those by Hansen (1988), which indicated that vocational interests for female and male norm samples as well as people in specific occupations from versions of the Strong Interest Inventory remained largely unchanged over 50 years—from the 1930s through the 1980s. During this period, the nature of work for women had changed dramatically. Prior to the 1930s, women made up 18% of the nation's workforce, but by 1947 they composed 28% of the workforce (Levitan & Johnson, 1983). By 1980, 42.5% of the nation's workers were women, and by 1990, the number of female workers was approaching 50% of the workforce, and women held 39.3% of all executive, administrative, and management jobs (Naisbitt & Aburdene, 1990). Yet, despite the dramatic increase of occupations available, Hansen (1988) found gender differences in interests to persist, especially in the realistic areas favored by men and the artistic areas favored by women. Moreover, any shifts in the vocational interests of women were matched by identical changes in the interests of men.

Taken together with Hansen's (1988) results and other findings demonstrating that changes in careers are often within the same major Holland (1948, 1997) type (G. D. Gottfredson, 1977; L. S. Gottfredson & Becker, 1981), the present cohort trends suggest that the stability of interests are minimally, if at all, affected by the increased complexity of today's workplace; modern-day workers' interests were as changeable as their peers' from most periods over the last century. Our findings can, in part, be attributed to the consistent efforts by publishers to keep their interest inventories up to date through frequent revisions. There is evidence (Armstrong, Smith, Donnay, & Rounds, 2004; Day & Rounds, 1998) indicating that vocational interests remain adequate representations of the world of work in spite of rapid technological advances, globalization of economic activity, and increasing specialization of labor of today's workplace. Given the relations between interests and satisfaction (Assouline & Meir, 1987), vocational interests continue to play an important role in a person's career development.

Although the unadjusted population estimates indicated that interests in specific occupations were more stable than broader interests (general interests and basic interests) that transcend particular situations (occupations), there were no significant differences among all three generality levels after we controlled for age, test–retest interval, and coefficient types. This finding is contrary to our expectation for general interests to be the most stable and for occupational interests to be the least stable. A possible explanation is the differences in content among the three scale types. Items in an occupational scale describe a variety of dissimilar work activities common to a specific occupation, with each item within the scale "assumed to be a miniature dimension" (Harmon et al., 1994, p. 113). Conversely, general and basic interest scales contain items that

describe similar activities. These scales are more unidimensional than the occupational scales. Any fluctuations in an underlying trait would be measured concurrently on all items within the general and basic interest scales but would only be registered by a small number of items in occupational scales.

As expected, there were no significant differences in stability between Holland's (1958, 1997) and Kuder's (1939, 1977) interest models, as both share numerous conceptual similarities. However, there were moderate differences in stability among the categories within each model. Across both models, interests that entail practical, hands-on physical activities with tangible results (i.e., Holland's realistic and Kuder's mechanical) and interests in the self-expression of ideas and concepts through different media (i.e., Holland's artistic, Kuder's artistic and musical) were the most stable compared with other interest domains. Conversely, interests in working with data and numbers (i.e., Holland's conventional and Kuder's computational) and interests in influencing and persuading others (i.e., Holland's enterprising and Kuder's persuasive) evidenced the lowest stability.

Stability of Vocational Interests and Personality Traits

The lack of overlap between samples constituting the vocational interest domain and samples in the personality trait domain prevented direct comparisons of continuity and change. Nonetheless, both age trajectories were represented by large sample sizes and provided adequate benchmarks for understanding the development of individual differences within the population. When compared, vocational interests were consistently more stable than personality traits from early adolescence to middle adulthood and attained peak stability much earlier in the life course. A number of reasons may account for the current observation.

Broadly speaking, a person's interests reflect his or her preferences for behaviors, situations, contexts in which activities occur, and the outcomes associated with the preferred activities (Rounds, 1995). In other words, when people look for environments that will optimize their chances of attaining their goals, they are motivated by their interests. Personality traits, conversely, appear to affect how a person copes with or adapts to an environment. McCrae and Costa (1999), for instance, argued that personality traits are central to problem solving, influencing the ability to make strategic alliances and to compete with others for resources. In that way, personality traits influence individuals' behaviors toward adaptive functioning in an environment, after the environment has been selected. In light of the influential roles of educational and occupational attainments on individuals' social status (Dornbusch et al., 1996; Sewell, Hauser, & Wolf, 1980), there is much greater societal and familial emphasis on future job choice (i.e., interests) than on future working styles (i.e., personality). From the time they are able to speak, children are frequently asked what careers and roles they would like to have as adults (e.g., "What do you want to be when you grow up?"), whereas it is highly unlikely that they will be asked about their aspired adult personality traits. Apart from real-life exposure, a child is also inundated, from a very young age, with cultural imagery of occupations through the media and other sources (Wright et al., 1995). As a result, children are able to articulate their aspirations from as young as age 4 (Trice & Rush, 1995). In contrast, children are much less able to describe themselves with trait terms (Rholes, Ruble, & Newman, 1990).

Because vocational interests constitute a major determinant of career choice and entry, they influence the range and type of roles a person undertakes and the social interactions entailed therein. As individuals encounter their work roles, they respond to environmental contingencies that are in place, watch the actions of others around them, reflect on their own actions, and receive feedback from their peers (Caspi & Roberts, 1999). Subsequently, personality is possibly shaped by the internalization of these role demands into the individual's self-concept (Deci & Ryan, 1990). There is empirical support for work's influences on personality development. For example, Roberts, Caspi, and Moffitt (2003) identified job characteristics that were related to longitudinal changes in personality traits even after they controlled for prework personalities. In a similar vein, Mortimer and Lorence (1979) also demonstrated that men who experienced greater autonomy in work increased in their sense of self-efficacy 10 years after graduation from college.

Several researchers (e.g., Lent, Brown, & Hackett, 1994) have posited that personality traits, through interaction with contextual affordances in the environment, shape the experiential factors influencing how individuals perceive their task competencies and the outcomes of these efforts. These self-efficacy and outcome expectations foster individuals' affinities for certain activities that, over time, become vocational interests. However, our findings appear to suggest otherwise. Although greater stability does not indicate causality, one would expect the developmental antecedent (i.e., personality traits) to be stable enough to maintain the cascade of events that result in the consequence (i.e., interests). It is more than likely that the development of individual differences is an iterative process of autocatalysis, in which growth in each area stimulates and channels growth in others. Interests emerge through individuals' experiences interacting with their environment. Personality traits affect the course of interest development by influencing how individuals react to these experiences. Conversely, by directing environmental preferences, interests impact the range of individuals' experiences, which in turn influence which personality traits are developed and refined over time. In other words, interests and personality traits develop together with the environment, forming a mutually affecting triad in which any changes in any one area will be felt in other parts of the system.

Limitations

The present study has a number of limitations that readers should consider when interpreting the findings. First, the number of samples and the sample sizes in the age categories after the college years were markedly lower than the preceding ones. Although this is a commonly encountered problem in longitudinal meta-analyses (e.g., Roberts & DelVecchio, 2000; Trzesniewski et al., 2003) and signifies the need for future research to focus outside convenient high school and college samples, it impedes our ability to draw firm conclusions about the latter life stages.

Another limitation due to convenience sampling was the high percentage of samples, especially within the earlier age categories, that were drawn from socioeducational backgrounds typical of that age. In other words, because the populations

sampled for the 18–21.9 age group were primarily college students, it can be argued that the differences between this age group and younger or older age groups reflect population rather than age-graded differences. Although the methodology in the present study does not lend itself to a clear resolution of this possibility, there is evidence to suggest that population effects, if any, are likely to be small compared with age-graded effects. For example, the 3- to 6-month reliability coefficients of occupational groups across a wide range of educational requirements (e.g., farmer cf. physician) and remuneration (e.g., social worker cf. investments manager) in the Strong Interest Inventory (Harmon et al., 1994) are remarkably similar (about .90), whereas initial testing age has been consistently demonstrated to be a major determinant on the long-term stability of dispositional attributes (e.g., Roberts & DelVecchio, 2000; Trzesniewski et al., 2003). A more specific instance was demonstrated in a study by Herzberg et al. (1954), which found few differences in stability estimates between college-bound and work-bound high school students. Nonetheless, our inability to conclusively rule out population effects points once more to the need to sample beyond the typical subject pools.

In addition, the present study also shares a common limitation prevalent in longitudinal research—the use of chronological age as a marker over the life course. As people age and as variability among similarly aged individuals increases over the life course (Dannefer, 1987), chronological age may become less useful as an index (Neugarten & Hagestad, 1976). Birren and Cunningham (1985) suggested (a) biological age or a person's current position with respect to his or her potential life span; (b) social age, which refers to the development of an individual's roles and habits with respect to other members of the society; and (c) psychological age, which reflects the behavioral capacities of individuals in adapting to changing demands. Future endeavors would benefit from the joint consideration of the different age markers. A manner in which biological, social, and psychological age can be incorporated into longitudinal research is by connecting research endeavors to stage theories of development. For example, Super et al. (1996) proposed a theory of career development that progresses and recycles through stages that not only are associated with biological age but include stage-specific tasks—mastery of which is influenced by social and psychological competencies. In that way, each stage provides three different yardsticks on which an individual's development on a specific attribute can be measured.

Conclusions

In conclusion, the results of our meta-analysis indicate that vocational interests are moderately to highly stable over the life course. The trajectory of interest stability across the life stages suggests that an individual's capacity to select trait-congruent environments is a major contributor to the degree of stability. In addition, vocational interests are more stable across time than personality traits and could be conceptualized as a dispositional construct. A large part of life-course development comes from understanding one's abilities, interests, and personality and using this information to negotiate one's environment. These person–environment interactions result in choices that often affect one's success and satisfaction across the entire life course. When individuals think about their interests, they are thinking of the critical features of different environments and the behaviors entailed in those environments. Human action is energized and directed toward attaining and maintaining environments best suited to fulfill individuals' needs. In that sense, interests describe the means and environments in which people can function optimally. Vocational interests provide a natural springboard to understanding how the individual develops and functions in a dynamic, continuous, and reciprocal process of interaction with his or her environment. Vocational interests are an essential part of studying and understanding the whole person.

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