CONSIDERING VOCATIONAL INTERESTS IN ADVERSE IMPACT: A META-ANALYSIS OF RACE, COGNITIVE ABILITY, AND VOCATIONAL INTERESTS

BY

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ABSTRACT

Research on adverse impact (i.e., differential hiring/selection rates between minority and majority groups in employment settings) has traditionally focused on aspects of the selection systems themselves (e.g., cognitive testing, personality measurement). In contrast, by using a supply-side perspective the current research proposes to incorporate vocational interests into the study of adverse impact, to help explain how people end up applying for jobs in the first place. In order to understand how vocational interests influence adverse impact, it is necessary to determine if Blacks and Whites differ in the types of jobs they are interested in, and whether people who are interested in certain kinds of jobs have different levels of cognitive ability. In Study 1, differences between African Americans and Caucasian Americans on vocational interests were estimated via meta-analysis. It was found that Whites have stronger realistic, investigative, and artistic interests, while African Americans have stronger social interests. Various moderators of these relationships were investigated as well. In Study 2, the relationships between cognitive ability and vocational interests were meta-analyzed. Cognitive ability was found to have strong positive correlations with investigative, artistic, and social interests. Finally, in Study 3, I constructed a combined meta-analytic correlation matrix of race, vocational interests, cognitive ability, and conscientiousness, and then used mathematical formulae to assess the role of applicant vocational interests in determining subgroup differences in selection predictors under various application ratios and job types. These findings have implications for how adverse impact might differ systematically across various occupations and jobs, due to race differences in vocational interests.

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Chapter 1: Introduction

Adverse impact refers to the occurrence of a substantial difference in the selection and/or promotion rates of members of protected classes (e.g., race, gender, color, religion, national origin, age). The dissimilarities in selection ratios (i.e., the ratio of selected applicants over total applicants) are often a result of using predictor measures (such as cognitive ability tests) that result in large subgroup differences in scores. The use of cognitive ability tests in selection systems is both important and controversial: they result in higher validity in predicting job performance and higher utility in terms of the economic return-on-investment (Schmidt & Hunter, 1998; Schmidt, Shaffer, & Oh, 2008), but worse hiring and promotion rates for lower scoring groups (e.g., African Americans; Outtz, 2002; Ployhart & Holtz, 2008). Whereas ample amounts of research have sought to address adverse impact by investigating ways to both reduce subgroup differences and retain valid selection tests (Sackett, Schmitt, Ellingson, & Kabin, 2001; Schmitt & Quinn, 2010), productive solutions for addressing this important societal issue are still lacking in a variety of ways.

Figure 1 illustrates the selection pipeline, which describes a sequence of steps in the job acquisition process. In the leftmost portion of the pipeline, members of the potential applicant population end up in the applicant pool (link 1). Second, based on selection procedures that are used, individuals are chosen to be in the selected group and are extended an offer of employment (link 2). Finally, members of the selected group who chose to accept the offer become new hires (link 3). A majority of the research on adverse impact has focused on link 2, where methods of altering the selection system have been explored with the twin goals of maximizing job performance and identifying ways to allow larger numbers of minorities to be selected. Though the continued investigation and refinement of selection procedures are essential, I assert that it is

important to consider link 1, which determines how individuals end up in the applicant pool in the first place (i.e., recruiting and vocational interests).

As the presence of adverse impact is driven by the characteristics of the applicant pool when top-down selection practices are used, a promising but often overlooked suggestion is to ensure that the minority and majority group members who end up applying for particular job openings are as similar in job relevant knowledge, skills, abilities, and other characteristics (KSAOs) as possible (Murphy, Osten, & Myors, 1995). This approach takes the perspective that adverse impact is a result of not only the selection procedures, but other factors, such as the recruiting practices of the organization. More recently, Newman and Lyon (2009) explored the role of targeted recruiting for applicant attributes (e.g., cognitive ability, conscientiousness) in reducing adverse impact. Still, in learning how to create both high-quality and diverse applicant pools, the next logical step is to solidify our understanding of how individuals end up in the applicant pool—a process that some authors speculate is influenced by vocational interests (Outtz & Newman, 2010; Van Iddekinge, Roth, Putka, & Lanivich, 2011).

Vocational interests are defined as, "the expression of personality in work, hobbies, recreational activities, and preferences" (Holland, 1966, p. 3). In Holland's (1959) theory of vocational interests (discussed below), he identifies several types of interests (e.g., social interests, investigative interests). The potential connection between vocational interests and adverse impact stems from the possibility that both race and selection test scores are related to vocational interests.

Cognitive ability tests (e.g., the Wonderlic Personnel Test, the Armed Services Vocational Aptitude Battery [ASVAB], the SAT) are commonly used as selection/admissions tests. In a meta-analysis of racial subgroup differences on such cognitive ability tests, Roth,

Bevier, Bobko, Switzer, and Tyler (2001) found that Black-White differences in applicant cognitive ability decrease as the complexity of the job increases. This suggests that there could be different levels of adverse impact across different types of occupations. Applicant pool composition may be explained in large part by the idea that applicants with certain interests self-select into certain jobs (e.g., jobs with a particular degree of complexity). Because there is a dearth of research that focuses on understanding the origins of applicant pools as a source of adverse impact, little is known about how these applicant-generating mechanisms might differentially affect personnel selection outcomes across different job types. I believe that incorporating the study of vocational interests into adverse impact can be one step toward addressing this issue.

Integrating vocational interests and adverse impact requires the relationships between race, cognitive ability, and vocational interests to be examined. Therefore, I have conducted meta-analyses of the following parameters: (Study 1) the differences between Blacks and Whites on vocational interests, and (Study 2) the relationships between vocational interests and cognitive ability. In this paper, I briefly review past selection-based attempts to redress adverse impact, for the purpose of illustrating why a supply-side [applicant pool] perspective is so promising. Next, I use theory and research from counseling, developmental, and vocational psychology to hypothesize particular Black-White racial differences in vocational interests, and to also explain why relationships between cognitive ability and vocational interests are expected. In Study 3, I combine the results of Studies 1 and 2 with those from several published meta-analytic efforts to produce a population correlation matrix among race, interests, cognitive ability, and conscientiousness. This meta-matrix is then used as a basis for Study 3, a mathematical demonstration in which I show how—under the straightforward assumption that

individuals tend to apply to jobs that suit their interests—the interest-based job attraction system directly gives rise to applicant pool parameters (e.g., subgroup differences in applicant cognitive ability) that drive the adverse impact problem in particular job contexts. This allows for Black-White differences in applicant pool cognitive ability and conscientiousness to be specified as a function of Black-White differences in vocational interests. Overall, this research seeks to demonstrate the role vocational interests can play in understanding and potentially reducing adverse impact.

Chapter 2: Literature Review

Adverse Impact

What Is Adverse Impact?

A selection procedure is thought to have adverse impact if it disproportionately screens out members of protected classes (Zedeck, 2010). As one signal of whether this disproportional effect on different groups exists, the four-fifths (80%) rule has been applied, where the selection ratio for the group with the lowest selection rate (usually the minority group) needs to be at least 80% of the selection ratio for the group with the highest selection rate (usually the majority group; U.S. Equal Opportunity Employment Commission et al., 1978). The four-fifths rule is a commonly used rule of thumb for detecting adverse impact, though a calculation of whether the majority and minority group selection ratios are statistically significantly different from each other may also be used (Bobko & Roth, 2010). Generally, selection ratios in organizations range from 30% to 70% of applicants (Schmidt & Hunter, 1998), and adverse impact is more likely to occur when selection ratios are lower (Hattrup, Rock, & Scalia, 1997). The extent to which organizations relatively value performance and/or minority hiring can determine whether certain selection ratios are desirable (De Corte, Lievens, & Sackett, 2007; Sackett & Roth, 1996). Adverse impact is considered to be an initial indicator that an organization's selection system may need to be investigated further; its presence alone is not sufficient for concluding that discrimination has occurred.

If adverse impact has been detected, it becomes necessary for the organization to provide evidence of the validity of the selection system and consider whether alternative selection practices with similar validity but less adverse impact need to be employed. However, the validity evidence for cognitive ability tests and the concept of validity generalization (i.e., meta-

analytic findings can be used as evidence for the validity of a selection procedure across selection contexts, making new data collection efforts unnecessary in some cases; Schmidt & Hunter, 1977; Schmitt & Sinha, 2010; see Newman, Jacobs, & Bartram, 2007) make suitable alternatives with equal validities difficult to find. Schmidt and Hunter's (1998) review of meta-analytic findings in the selection literature yielded the conclusion that cognitive ability tests are the strongest predictor of job performance across different types of jobs, are lower in cost than other methods (e.g., work samples, structured interviews, assessment centers), and do not tap into the prior job knowledge of the applicant. Whereas this review has occasionally been criticized (e.g., some of the included selection procedures indicated the construct that was being assessed while others indicated the method; Arthur & Villado, 2008), the deduction that cognitive ability tests are currently the most valid predictor of performance is well supported.

Cognitive ability tests predict job performance in all types of occupations at multiple levels of occupational prestige (Schmidt & Hunter, 2004), as well as occupational attainment (Judge, Higgins, Thorensen, & Barrick, 1999). In addition, verbal, quantitative, and spatial abilities in early adolescence are directly linked to educational and vocational trajectories over 20 years (Shea, Lubinski, & Benbow, 2001). The construct of cognitive ability is defined as the collection of knowledge, skills, learning sets, and abstraction propensities belonging to a person (Humphreys, 1984). According to Carroll's (1993) three-stratum structure, cognitive ability can be conceptualized via a hierarchical factor model. At the top level of this factor model (Stratum III), the broadest cognitive construct is *g*, or general mental ability. At the middle level of Carroll's model (Stratum II), there is fluid intelligence (the ability to elicit complex associations among information) and crystallized knowledge (an individual's learned base of knowledge; Catell, 1971). Also included in Stratum II are narrower domains, such as memory, visual

perception, auditory perception, cognitive speed, processing speed, and retrieval. Stratum I, the narrowest level, includes more specific abilities such as word knowledge, reading comprehension, mathematical reasoning, inductive reasoning, and deductive reasoning. Tests such as the Wonderlic Personnel Test, Raven's Progressive Matrices, Watson-Glaser Test of Critical Reasoning, and the ASVAB can be used to assess both general and more specific abilities (Chernyshenko, Stark, & Drasgow, 2010). Because of the importance of cognitive ability in predicting job performance—coupled with the well-known large Black-White mean differences on these tests (d = 1.0 in employment settings; Roth et al., 2001)—there has been a presumed tradeoff between diversity and job performance of new hires (De Corte et al., 2007; Sackett et al., 2001). As such, researchers have investigated many methods of reducing adverse impact with the goal of maximizing the prediction of performance, while still maintaining a diverse workforce.

Previous Attempts to Reduce Adverse Impact

Strategies for reducing adverse impact have been extensively studied in the selection literature. When there are subgroup differences on the predictor constructs or measurement methods, this leads to a lower probability that minorities will be chosen when top-down selection referral is utilized (Ployhart & Holtz, 2008). However, it has also been found that the Black-White differences on assessment centers, structured interviews, biographical data, situational judgment tests, and work samples tests are much smaller than the differences found on paper and pencil cognitive ability tests (Dean, Roth, & Bobko, 2008; Chan & Schmitt, 1997; Whitney & Schmitt, 1997; Huffcutt & Roth, 1998; Roth, Bobko, McFarland, & Buster, 2008). Additionally, non-cognitive and personality variables such as conscientiousness have been found to have

negligible (near-zero) Black-White subgroup differences (Foldes, Duehr, & Ones, 2008), but to also predict job performance (Barrick & Mount, 1991).

Because of this, studies have been conducted to understand how various selection predictors should be combined into a single composite in order to reduce adverse impact. Sackett and Ellingson (1997), Schmitt, Rogers, Chan, Sheppard, and Jennings (1997), and Bobko, Roth, and Potosky (1999) each utilized a correlation matrix based on meta-analytic validity coefficients in order to model subgroup differences under various weightings of the predictor variables. This design is also common in simulation studies of adverse impact (e.g., Zickar & Slaughter, 2002). In general, sizeable reductions in subgroup differences and adverse impact have been attributed to: using alternative predictors (e.g., personality), assessing a full range of KSAOs, using grade point averages instead of cognitive ability test scores, banding scores (i.e., considering test scores within a given range as equivalent), using constructed response test formats instead of multiple choice, and minimizing verbal requirements in the selection process (for jobs demonstrating that the verbal job requirements could be removed based on results of a job analysis), (see Berry, Gruys, & Sackett, 2006; Hough, Oswald, & Ployhart, 2001; Ryan, Ployhart, & Friedel, 1998; Campion, Outtz, Zedeck, Schmidt, Kehoe, Murphy, & Guion, 2001; Arthur, Edwards, & Barrett, 2002; Sackett, Schmidt, Ellingson, & Kabin, 2001; cf. Ployhart & Holtz, 2008).

In contrast to previous research that only considered a single stage selection process and/or regression- and unit-weighting approaches when modeling the effects of predictors on the presence of adverse impact, Finch, Edwards, and Wallace (2009) investigated multistage selection processes and determined that some combinations of selection predictors and methods allow for lower levels of adverse impact while still maintaining some validity. As a tool for practitioners, DeCorte et al. (2007) applied Pareto-optimal tradeoffs to developing selection

systems, in which the various weighting combinations for predicting multiple outcomes can be compared, to investigated the extent to which one outcome (e.g., criterion validity/job performance) can maximized at each level of the other outcome (e.g., adverse impact ratio/diversity), and vice versa.

Whereas support for alternative selection strategies has been found, research has also shown that it is not a good idea to rely on these selection strategies alone. Schmitt et al. (1997) found that the number of predictors, how high the correlations between the predictors are, and the subgroup differences on the predictors influence both the validity of the entire selection system and subgroup differences on performance in the selection system. Potosky, Bobko, and Roth (2005) showed that adding a single predictor to a cognitive ability test does not greatly reduce subgroup differences and does not significantly decrease adverse impact. Roth, Bobko, and Switzer (2006) found that when predictors with higher group differences are used (e.g., cognitive ability tests) in concert with methods with lower group differences (e.g., structured interviews), organizations are still expected to violate the 4/5ths rule 75% of the time (also see Sackett & Ellingson, 1997). Besides, weighting personality measures more than cognitive ability may only reduce adverse impact at high selection ratios, when the job is not very selective (Ryan, et al., 1998). This means that weighting strategies can often provide negligible benefits in terms of reducing adverse impact, and can potentially reduce aggregate job performance (given a particular set of applicant pool characteristics).

Adverse impact is also influenced by which areas of performance the organization emphasizes. Under the theory that job performance is a multidimensional construct (Campbell, McCloy, Oppler, & Sager, 1993; Borman & Motowidlo, 1997; Murphy & Shiarella, 1997), some researchers have advocated weighting the predictor variables (cognitive vs. non-cognitive) *and*

criterion variables (task vs. contextual performance) in order to potentially reduce adverse impact (DeCorte & Lievens, 2003; Hattrup, Rock, & Scalia, 1998). The higher task performance is weighted relative to contextual performance in the criterion, the higher cognitive ability needs to be weighted in the predictor composite relative to personality (Sackett et al., 2001). Hattrup et al. (1998) found that adverse impact is most pronounced when only task performance is used as the criterion. However, adverse impact decreases when contextual performance is added to the criterion and/or is given more weight in the criterion composite. Also, organizations may be interested in pursuing multiple goals beyond maximum performance, including having an organizational workforce that is more likely to engage in organizational citizenship behavior, is less likely to engage in counterproductive work behavior and withdrawal, and which demographically represents both the customer base and the surrounding area in which the organization resides (Murphy, 2010).

The findings reviewed above suggest that there are only limited reductions in adverse impact that can come from altering how selection systems are created, using the selection tools currently available. Advances are being made regarding the assessment of cognitive ability in employment contexts, where tests designed to demonstrate lower Black-White differences in test scores, but high validity are being developed (Goldstein, Scherbaum, & Yusko, 2010). In addition, new research suggests that the Black-White gap in performance on intelligence tests has narrowed over the course of thirty years (Dickens & Flynn, 2006; Nisbett, Aronson, Blair, Dickens, Flynn, Halpern, & Turkheimer, 2012). Though this work appears to be promising and warrants continued research efforts, there are more immediate ways that adverse impact can be reduced (Outtz & Newman, 2010). Recently, Newman and Lyon (2009) attempted to address adverse impact through diversity recruiting—specifically focusing on the work-related characteristics

and job qualifications of the diverse applicant pool (link 1 in Figure 1), as opposed to the selection procedures (link 2 in Figure 1).

Diversity Recruiting: An Initial Consideration of Supply Side Issues

When recruiting, organizations have the general goal of increasing the size of the applicant pool so that desired individuals can be selected to fill job vacancies (Rynes, 1991). In developing a recruitment strategy, one specific aim is to determine what KSAOs are essential to performing the jobs that need to be filled and to recruit individuals with those attributes (Breaugh & Starke, 2000). If diversity within the organization is important, recruiting for that purpose has typically been considered as a separate recruiting issue/strategy. In identifying ways to increase organizational attraction among gender and racial/ethnic minorities, research has considered various recruitment approaches, including exploring the effects of visual and descriptive diversity in recruiting brochures and websites, descriptions of affirmative action plans, descriptions of the organization's approach to managing diversity, and similarity in demographic characteristics between recruiters and applicants (e.g., Williams & Bauer, 1994; Thomas & Wise, 1999; Slaughter, Sinar, & Bachiochi, 2002; Avery, 2003; Brooks, Guidroz, & Chakrabarti, 2009; Walker, Feild, Giles, Armenakis, & Bernerth, 2009). This research is important, as it is essential to understand how minority group members perceive the information that the organization communicates to potential applicants, especially as it pertains to how valued the minority applicants would be if they later became a part of the organization (Avery & McKay, 2006). On the other hand, although a consideration of these strategies is important for increasing the sheer numbers of minorities who are applying for jobs, the actual job-related qualifications of the applicants are typically ignored in the research literature on minority recruiting (see review by Newman, Jones, Fraley, Lyon, & Mullaney, *in press*).

In bridging the adverse impact and diversity recruiting literatures, Newman and Lyon (2009) suggested that a method for reducing adverse impact (i.e., differences in selection ratios of minority and majority groups) was to target *recruitment* efforts so that minorities who ended up applying for jobs would be more likely to succeed in the selection process, thus yielding higher minority selection ratios. Using a mathematical demonstration, they concluded that recruiting for cognitive ability among all demographic groups, but targeting recruiting for conscientiousness within African Americans yielded the best tradeoff in terms of fulfilling both diversity and performance-related goals. Further, with a college student sample, they found that the wording of job advertisements could influence whether minority individuals with favorable traits (cognitive ability, conscientious personality) would apply for the job. Specifically, the applicant qualities requested by the advertisement (e.g., smart and conscientious) as well as how the company is described (e.g., innovative company) could increase the probability of applying among African Americans with high conscientiousness.

Shifting the study of adverse impact from the selection phase to the recruiting phase marks a renewed focus on the applicant pool (Murphy et al., 1995), or a supply-side perspective. This supply side perspective on adverse impact has demonstrated promise in terms of its implications for increasing adverse impact ratios and improving diversity in organizations. Recruiting is an organizational intervention that can be used to influence who from the general population ends up in the applicant pool. It is therefore important to consider aspects and qualifications of the would-be job applicant when conducting recruiting interventions (Newman et al., *in press*). As suggested by Outtz and Newman (2010), vocational interests, specifically Black-White differences in vocational interests, may give us a better understanding of how people end up applying for jobs. Whereas race itself should not be considered as an explanatory variable for

how groups differ (Helms, Jernigan, & Mascher, 2005), there are other variables that covary with race that can be considered once this initial area is examined. As adverse impact has typically been studied without specific job contexts in mind (Outtz & Newman, 2010), exploring the relationship between adverse impact and vocational interests is essential to understanding how to obtain the applicant pools that simultaneously increase diversity in organizations, reduce adverse impact, and maximize job performance.

Vocational Interests

Theories of Vocational Interests and Career Choice

Holland's theory of vocational interests. From a dispositional perspective, interests capture the situations and contexts in which an individual chooses to spend his/her time performing desired behaviors and obtaining associated outcomes (Rounds, 1995). According to Holland (1958, p. 336), "the choice of an occupation is an expressive act which reflects the person's motivation, knowledge, personality, and ability." The most prevalent theory of vocational interests is Holland's (1959, 1997) theory of person and environment. According to this theory, both vocational interests and work environments can be meaningfully classified into six types: realistic, investigative, artistic, social, enterprising, and conventional (RIASEC). Realistic individuals enjoy performing systematic activities involving the use of objects, tools, machines, and/or animals. Investigative individuals prefer engaging in the creative investigation of physical, biological and cultural occurrences. Artistic types enjoy creating art forms and products that allow the expression of artistic capabilities (e.g., art, music, drama, writing). Social individuals enjoy helping, informing, training, and developing others. Enterprising types prefer to lead and persuade others in order to reach economic goals. Lastly, conventional types prefer the controlled and systematic maintenance of data.

Holland's theory further explains that people seek to place themselves in environments that allow their work personalities to be conveyed. These interests form a hexagonal structure (see Figure 2) which implies that the adjacent interest types are more similar than those far apart. Moreover, the congruence between an individual's vocational interests and the work environment should lead to higher satisfaction and performance. This is consistent with Dawis and Lofquist's (1984) theory of work adjustment, which emphasizes that adjustment and satisfaction are the results of employees' needs being met by their occupational environment. All individuals lie somewhere within the hexagon, and those lying closer to the periphery have more clearly defined interests than those lying toward the middle of the hexagon. From birth, the development of an individual's vocational personality types is based on the interaction between aspects of the person (e.g., heredity, activities, interests, competencies, dispositions) and environment (e.g., home, school, relations, friends). These early experiences influence various characteristics of a person, including their self-concepts, values, and preferences for occupations/occupational roles (Holland, 1997).

Though there is empirical evidence that supports the existence of the six personality types, there is not as much support for the presence of the six *environmental* types (Gottfredson & Richards, 1999). Substantial empirical support for the RIASEC structure has been found, primarily with measures designed to assess the six types (Tracey & Rounds, 1993). Interest measures have primarily been developed and refined for the purpose of classifying people into jobs as opposed to being used for selection purposes. Generally, the RIASEC structure of vocational interests has been consistently observed in large representative samples of students, children, and adults (Rounds & Day, 1999) and has been found to be stable over a person's lifespan (Low, Yoon, Roberts, & Rounds, 2005). In terms of gender, men tend to show higher

realistic and investigative interests, and women show higher social, artistic and conventional interests (Su, Rounds, & Armstrong, 2009). One criticism of Holland's theory is that while there is a focus on why the vocational choice occurs and what the outcomes of the choice are, there is little consideration of why individuals develop certain vocational personality types (Brown, 2002). Fortunately, others have proposed theoretical explanations of the antecedents of vocational interests, which are especially germane to the current work. Gottfredson's theory of circumscription and compromise (Gottfredson, 1996) and Lent's social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994; 2002) are two theories of career choice that go into more detail about the processes that take place in childhood that influence which occupational aspirations children and adolescents develop.

Theories of career choice in children and adolescents. According to Gottfredson's (1996; 2002) theory of circumscription and compromise, individuals have a self-concept, which includes elements such as abilities, personality, gender, values, and social class. They also have images of occupations, or occupational stereotypes of how people in occupations behave, the work that they do, and what types of people should perform those jobs. In choosing which occupation to pursue, an individual determines how compatible the occupations are with her/his self-concept. Acceptable occupational aspirations are based on both *compatibility* and *accessibility*. Beginning in early childhood and continuing past adolescence, individuals first narrow their acceptable occupational aspirations through circumscription, and they then choose less compatible options that are more accessible through compromise. Circumscription takes place over time as an individual develops and becomes oriented to sex roles, occupational prestige, social class, and a realization of how they want to be perceived by others, leading them to reject unacceptable options. Compromise (which can vary from minor to extreme) is based on

occupational accessibility, and can take place when external barriers are predicted or after they arise.

In comparison to the theory of circumscription and compromise, SCCT (Lent et al., 1994; 2000) focuses on the interchange among self-efficacy, outcome expectations, and personal goals in self-regulated behavior, and deemphasizes the direct role of abilities and values (Lent, Brown, & Hackett, 2002). It is based on Bandura's (1986) social cognitive theory and applies the idea of self-referent thought and social processes to career decision-making. In SCCT, self-efficacy "involves a dynamic set of self-beliefs that are specific to particular performance domains and that interact in a complex way with other person, behavior, and environmental factors" (Lent et al., 2002, p 262). According to this theory, self-efficacy expectations and outcome expectations directly affect occupational interests, which then influence the goals that one sets for activity involvement. Goals influence activity selection and practice, which ultimately affect performance outcomes, such as goal attainment and skill development. This process includes a feedback loop between performance outcomes and the sources of self-efficacy and outcome expectations, as this process takes place repeatedly over a person's lifetime. Abilities and values only influence vocational interests through self-efficacy and outcome expectations, according to the model. Support for this model has been found across racial/ethnic groups, and across academic/interest areas (Fouad, 2007).

Whereas the theory of circumscription and compromise and the SCCT both account for career choice processes from childhood, they do not overtly address the role that race plays in the occupational aspirations of children (Hughes & Bigler, 2007). This is important in trying to better understand adverse impact from an applicant pool perspective, specifically in terms of how Black-White differences in vocational interests emerge. It has been well established that

vocational exploration begins in childhood (Savickas, 2002; Super, 1990), and that children's career aspirations are shaped by factors such as their parents' economic standing, expectations of the children, and education (Fouad, 2007). Although disparities in educational and career attainment between African Americans and Caucasian Americans in the United States can be attributed to historical events, economic exploitation, systematic oppression, and unequal opportunities (Feagin, 2006; Garcia-Coll et al., 1996; Newman, Hanges, & Outtz, 2007), this only captures part of the reason why group-level differences in interests would occur. Next, I explicitly explore the role of race in children's occupational aspirations as well as research on Black-White differences in vocational interests.

Race and Vocational Interests

Why are Black-White differences in vocational interests expected?

Hughes and Bigler's model of occupational aspirations in African American children. Previously, it has only been implied that there are differences in the vocational development of African-Americans versus Caucasian-Americans (Hartung, Porfeli, & Vondracek, 2005). However, Hughes and Bigler (2007) established a developmental model of the effects of race on occupational judgments and aspirations in children that provides an explanation for why differences in vocational interests across races would occur. They argue that growing up in the United States allows children to develop occupational schemata ("internal representations that contain children's knowledge of, and beliefs about, the world of work;" Hughes & Bigler, 2007, p. 405) that are racialized. They identify three major processes that lead to race differences in occupational aspirations: formation of racialized occupational schemata, development of race-based occupational stereotypes and biases, and meta-awareness of race-based occupational stereotypes and biases (see Figure 3).

According to the model, racialized occupational schemata (ROS) are formed in children due to the psychological salience of race as well as the racially stratified occupational models that children are exposed to. Research in developmental psychology demonstrates that race differences are distinguishable very early in life, even among infants (Levy, 2003), and race continues to influence how children perceive the world as they age (Bracken & Crain, 1994). In addition, the information communicated about occupational roles from the media (e.g., television, Internet) and the people in the child's environment (e.g., parents, family members, neighbors) also serve to influence his/her ROS. For example, a sample of high and low SES African American children ages 6-11 indicated that African Americans were more likely to perform lower status jobs than Caucasian Americans (Bigler, Averhart, & Liben, 2003). Hughes and Bigler (2007) hypothesize that ROS influence children's academic and occupational self-efficacy.

Next, the model identifies the development of race-based occupational stereotypes and biases (DSB) as the second process that influences race differences in occupational aspirations. DSB is thought to arise from children's physical exposure to how work is demographically distributed and messages about race and the workforce. Some children think that the stratification of the workforce by race is standard and appropriate (e.g., Frost & Diamond, 1979). For example, in a sample of African American children ages 6-11, Hughes, Rodriguez, and Smith (2006) found that 24% reported, "only White people should be president." DSB is thought to influence academic and occupational values and outcome expectations (Hughes & Bigler, 2007).

The last process in the model is meta-awareness of race-based stereotypes and biases (MSB). This develops as children grow older and become aware of the racial stereotypes and biases that are present in their culture and endorsed by others. The perception of obstructions (e.g., racial

discrimination) in achieving a desired career is thought to influence occupational aspirations. For example, the discrepancy between the occupations that African American children expect to hold and aspire to hold are much larger than the discrepancies of European American children (Cook, Church, Ajanaku, Shadish, Kim, & Cohen, 1996). MSB is thought to emerge from messages that children receive from various sources (e.g., parents) about what to expect regarding racial bias and stereotypes. Hughes and Bigler (2007) hypothesize that MSB influence children's academic and occupational self-efficacy and outcome expectations.

In sum, the influence of ROS, DSB, and MSB on academic and occupational values, self-efficacy, and outcome expectations ultimately influence race differences in occupational aspirations. Though this theoretical model is incomplete in that it does not account for the influence of gender or socioeconomic status on career choice, it does articulate why race differences in vocational interests can be expected. It takes into account the culture, opportunity structure, and socialization experiences of African Americans, which have also been thought to influence Black-White differences in vocational interests (Carter & Swanson, 1990). The results of empirical studies involving race and career choice are consistent with this model, as the representation of African Americans in occupations and perceptions of barriers have all been found to influence the perceived career options of African American youth. Also, self-efficacy has also been found to affect the career goals of African American youth. These contextual variables are thought to explain why Black-White differences in vocational interests may exist.

Representation in occupations. Research in counseling, developmental, and educational psychology have considered the effects of occupational representation and role modeling on the career aspirations of children. In terms of college major, African American students are more likely to major in the social sciences and seek employment in social occupations (Thomas,

1985), and less likely to obtain degrees in and seek employment in science and engineering (Maton & Hrabowski, 2004). Bowman (1995) concluded that there are stereotypes about the types of jobs that African Americans have (e.g., education, social work, government), and there is a limited perception of opportunities outside of those jobs due to lower numbers of visible role models in fields that lie outside of the stereotypes. This is consistent with current labor statistics, as African Americans make up only 8.4% of U.S. citizens who perform management and professional jobs and 29.2% of U.S. citizens who perform service and production/transportation jobs (U.S. Bureau of Labor Statistics, 2011). Similarly, Blacks also have less opportunity to branch out from usual career trajectories, as they are dependent on racially segregated job networks (Wilson, 2007). Social networks in career decision making are important, as they explain variance in job choice over and above general preferences and specific academic preparation (Rynes & Cable, 2003). Differences in occupational representation, opportunities for role modeling, and segregated social networks appear to contribute to the formation and persistence of racialized occupational schemata and race based occupational stereotypes.

Perceived career barriers and discrimination. Anticipated barriers to pursuing careers have also been found to influence career related variables in African Americans. Ogbu (1978) suggested that Blacks may perceive more discrimination and fewer opportunities in terms of the occupations they can pursue. In a meta-analysis of racial/ethnic differences in occupational aspirations and barriers, Fouad and Byars-Winston (2005) found that while there were few differences in aspirations between Whites and racial/ethnic minorities, there were significant differences in the perceptions of barriers. Consistent with the notion of career compromise in Gottfredson's theory of circumscription and compromise, greater perceptions of barriers can result in racial/ethnic minorities being unsure about career options or abandoning them

altogether. Specifically, Leal-Muniz and Constantine (2005) found that perceived career barriers predicted the tendency to foreclose on career options in a sample of Mexican American college students, and Constantine, Wallace, and Kindaichi (2005) found that perceived career barriers positively predicted career indecision in African American high school students. In comparing the perceptions of barriers and discrimination of Black and White students, Chung and Harmon (1999) found that Blacks perceived lower occupational opportunities and higher discrimination than their White counterparts. In a separate sample of African American students, Chung and Harmon (1999) found a negative relationship between perceptions of discrimination in certain occupations and the percentage of African Americans in those occupations. It is fair to conclude that the existence of perceived career barriers and discrimination also allow for the perpetuation of race based occupational stereotypes and biases.

Self-efficacy. As a key component of SCCT, self-efficacy has implications for the career options that African Americans choose to pursue. Tracey and Hopkins (2001) found that interests and self-efficacy accounted for 31% of the variance in occupational choice, and this was true across racial/ethnic groups[1]. Witherspoon and Speight (2009) examined the differences in self-efficacy for careers traditionally occupied by African Americans ("traditional occupations") in comparison to those where African Americans had lower representation. In terms of gender, their results showed that Black women were more interested in traditional occupations than Black men. There was also a positive relationship between self-efficacy and interests in traditional occupations, for both genders. However, these authors also found that as self-efficacy in non-traditional occupations increased, interests in traditional occupations decreased. Quimby,

[1] Interestingly, the authors also demonstrated that the relationship between interests and occupational choice, as well as the relationship between self-efficacy and occupational choice, were weaker for African Americans in comparison to other racial/ethnic groups (Tracey & Hopkins, 2001).

Wolfson, and Seyala (2007) found that investigative self-efficacy (as measured by the Skills Confidence Inventory; Betz, Harmon, & Borgen, 1996) was the only significant predictor of interest in environmental careers among African-Americans. In a sample of upper level African American high school students, Lease (2006) found that the strength of the relationship between self-efficacy and the consideration of careers in traditional occupations depended on the number of perceived educational and career related barriers. Specifically, when barriers were low, occupational self-efficacy and interest both predicted which traditional occupations were considered; when perceived barriers were high, self-efficacy no longer significantly predicted which occupations were considered. A similar pattern was found in predicting the consideration of non-representative careers. Overall, self-efficacy towards certain careers can also contribute to the occupational representation of African Americans, therefore influencing racialized occupational schemata and race based occupational stereotypes.

Previous empirical investigations of Black-White differences in vocational interests

Although it is clear that there are differences in the ways that career goals and aspirations develop in African Americans and Whites, the extent to which there are differences in vocational interests is less clear. In terms of the appropriateness of Holland's model for racial/ethnic minorities, there continues to be controversy over whether the traditional RIASEC structure can be appropriately applied to minority groups (Armstrong & Rounds, 2008). It is first important to consider the appropriateness of Holland's model for racial/ethnic minorities, as there continues to be controversy over whether the traditional RIASEC structure can be appropriately applied to minority groups (Rounds & Armstrong, 2008). Beyond this, it is important to consider whether there are mean-level differences in RIASEC interests between Blacks and Whites.

Holland's RIASEC structure in Blacks and Whites. Research by Day and Rounds (1998) and Fouad, Harmon, and Borgen (1997) concluded that the RIASEC structure fit African American, Mexican American, Asian American, Native American, and Caucasian American samples. On the other hand, in a reanalysis of the data from the aforementioned studies (16 correlation matrices), Armstrong, Hubert, and Rounds (2003) concluded that the RIASEC model had a better psychometric fit with Caucasian American and Asian American samples, than with African American and Latino/a samples, meaning the RIASEC model may be less salient for some groups than others. Though not finding group differences at the scale level, differential bundling analyses conducted by Fouad and Walker (2005) on the Strong Interest Inventory also suggested that ethnic minorities were responding to the items based on their interests as well as an underlying variable (e.g., culture) on which they differed from Whites (Foaud & Walker, 2005).

However, in a large sample (N = 69,987) study, Tracey and Robbins (2005) found that the circular structure of interests was invariant across all ethnic groups and genders from eighth to twelfth grade. There were also no race differences in the parameters of a longitudinal model of interest stability fit to the data, which included paths from Grade 8 to Grade 10 and Grade 10 to Grade 12 interests, as well as a direct path from Grade 8 to Grade 12 interests. Fouad and Mohler (2004) also found no differences in the predicted circular models of RIASEC interests across racial/ethnic groups. Although the current study is focusing on mean differences between African Americans and Whites on vocational interests, these inconsistencies suggest that more work is needed towards improving the construct validity of interest measures for racial and ethnically diverse populations (Armstrong & Rounds, 2008).

Mean differences in Holland's RIASEC interests between Blacks and Whites. Earlier research on Black-White differences in vocational interests observed different patterns in mean level differences in vocational interests--mainly that Blacks expressed stronger social, enterprising, and conventional interests, whereas Whites exhibited stronger interests in realistic, investigative, and artistic areas (Carter & Swanson, 1990). For example, Hines (1983) found that Black women had higher conventional scores and lower realistic, investigative, and artistic scores than the women-in-general group. Also, Black men had higher social, enterprising, and conventional scores, and lower investigative interests than the men-in-general group. In a sample of graduate and undergraduate students, Yura (1985) found that Blacks had higher social and conventional scores, while Whites had higher realistic scores. Doughtie, Chang, Alston, Wakefield, and Yom (1976) also concluded that Blacks registered higher social, enterprising, and conventional scores than Whites. In explaining the presence of higher social interests, Miller, Spring, and Wells (1988) suggested that African Americans may consider social environments to be more prestigious than realistic or conventional occupations, but more accessible than enterprising, artistic, or investigative jobs.

More recent investigations of Black-White differences in vocational interests have drawn similar conclusions. Initially, Fouad (2002) concluded that racial/ethnic differences in interests were negligible in comparison to gender differences. Later, Armstrong, Fouad, Rounds and Hubert (2010) reanalyzed Fouad's (2002) large-scale dataset in order to examine both race and gender group differences in interest profiles. They found that White men scored highest on realistic interests and lowest on artistic, and Black men scored highest on social interests and lowest on artistic. White women scored highest on artistic and lowest on realistic, while Black women scored highest on social and lowest on realistic. Tracey and Robbins (2005) also

concluded that African Americans score higher on social, enterprising, and conventional interests than Caucasian Americans.

Given the past evidence on Black-White differences in RIASEC types, I hypothesize that these effects will replicate in the current study (i.e., Blacks having stronger preferences for Social, Enterprising, and Conventional; Whites having stronger preferences for Realistic, Artistic, and Investigative). That is, given the psychological salience of race, racially stratified occupation models, and occupational stereotyping messages articulated in the theoretical model of Hughes and Bigler (2007; Figure 3), it is to be expected that African Americans will tend to develop racialized occupational schemata and stereotypes that in turn give rise to values, self-efficacy, and outcome expectations supporting a preference for social, enterprising, and conventional occupations. To date, no meta-analysis has explored Black-White differences in vocational interests.

> *Hypothesis 1: Black respondents will express greater (a) Social, (b) Enterprising, and (c) Conventional vocational interests, compared to White respondents.*
>
> *Hypothesis 2: White respondents will express greater (a) Realistic, (b) Investigative, and (c) Artistic vocational interests, compared to Black respondents.*

Moderator variables

There are several substantive and methodological variables that might relate to the effect sizes observed in each study, including gender, cohort, the developmental stage at which the participant took the vocational interest inventory, age of sample, education level, vocational interest inventory used, published vs. unpublished studies, whether the sample came from a single- or multi-site data collection, and how the sample was recruited. A rationale for the investigation of each moderator variable is provided below.

Gender. The question of whether the occupational landscapes for men and women within each racial group are different is important to consider. As mentioned above, there are large gender differences in the vocational interests of men and women, suggesting that men and women are likely to gravitate towards different types of jobs (Su et al., 2009). While arguments for the main effects of race and gender on vocational interests can be made independently, it is also important to recognize that these group-level variables do not exist in a vacuum and that various characteristics of individuals interact in order to influence their occupational choices. Speaking to this issue, Foaud and Kantemneni (2008) proposed a model that incorporates the various contextual variables that can influence an individuals' career choice. They argue that various individual- (e.g., interests, abilities, personality), group- (e.g., race, gender, socio-economic status), and societal-level (e.g., culture, opportunity-structure, labor market) variables affect career choices and decisions at different points in a person's life. It is important to consider gender as a moderator of Black-White differences in vocational interests in terms of whether the nature of Black-White differences are the same for both males and females.

Some occupational trends also provide some support for the notion that race and gender interact to influence employment outcomes. In comparing occupational data from both 1983 and 2002, Mintz and Krymkowski (2010) found that the interaction between race and gender significantly predicted various occupational outcomes. For example, during both years, white men were more likely to work in jobs that had higher pay, required more training, and higher authority than the jobs of White women and both Black men and women. In addition, while women were more like men in both racial groups to have higher education, the gap in educational attainment between men and women was much larger among Blacks than Whites.

Additionally, Wilson (2012) found that African American women were less likely than White women to move into professional/technical jobs and managerial/administrative jobs.

On the other hand, there is some evidence that race by gender interactions with wage/salary data do not hold when industry/occupation is controlled for (Browne, Hewitt, Tiggs, & Green, 2001). Therefore, it is uncertain whether gender and race will interact to yield differences in vocational interests, or what the nature of the interaction would be. There are no specific expectations of how gender will influence the size of specific race differences in vocational interests.

Cohort. Over the past fifty years, there have been vast changes to the world of work in the United States, including the types of jobs needed to support a continuously modernizing world (Savickas, 2002). Over this time, there have also been changes in the types of jobs performed by African Americans (Amott & Matthaei, 1996). Consistent with Hughes and Bigler (2007), changes in the occupations presented to children in their environment may engender differences in vocational interests over time. Therefore, the birth cohort of the sample is expected to influence Black-White differences in vocational interests. There are no expected patterns for the how the results will vary by cohort.

Developmental stage when inventory was administered and age. These moderators allow for the investigation of differences in the vocational interests of Blacks and Whites based on age and life stage (e.g., high school, college, adulthood, etc.). The development of vocational interests begins in childhood and continues through adolescence (Holland, 1997). However, significant life changes such as graduating from high school, starting college, or entering the workforce can also shape interests and allow for more freedom in exploring them (Armstrong & Rounds, 2008). Low et al. (2005) found that the stability of vocational interests increase between

adolescence (around age 12) and early adulthood (around age 30), and then decrease through middle adulthood (around age 40). While these results do not allow for specific expectations regarding mean-level differences in interests based on age to be made, they suggest that subgroup differences in interests may be influenced by age and developmental stage.

Education level. Consistent with the idea that a person's age or life-stage can influence their interests, education level may influence Black-White differences in interests as well. Although some of the developmental-stage groupings are based on the educational phase that the person is in, people only have consistency between their education level and life-stage if they continue their education at the same rate that they age and develop. For example, there are adults who only have a grade school education. The differences in developmental and occupational opportunities afforded to those at different education levels could also lead to differences in interests across those education levels. For example, attending college may allow a person to choose courses, hobbies, and friendships that further develop their interests (Armstrong & Rounds, 2008), while those who do not attend college may not have the same chance. Academic motivation and educational performance have also been found to influence the occupational aspirations of individuals across cultures and ethnicities (Hughes & Bigler, 2007). Therefore, the extent to which there are differences in vocational interests between African Americans and Whites may differ based on the education level of the sample.

Interest inventory. There is a sizeable number of interest inventories that have been developed over the past century to assist individuals with making their occupational choices. Some inventories differ in the level of specificity with which they assess interests (e.g., occupational, basic, and general interest scales; Rounds, 1995). While the current research is focusing on differences on general interest scales, there are other differences in how inventories

have been created and refined over the years that could influence Black-White differences in interests across the inventories. For example, some of the inventories (e.g., Strong Interest Inventory) are scored by the test publisher and provide results based on norms. Other inventories (e.g., Self-Directed Search, Interest Finder) are self-scored by the test taker. There are also differences in the response options that respondents have in order to indicate their interest in activities. A major source of differences in scores across the inventories is whether the test was revised to remove gender differences in the items in order to make the inventory more sex-balanced. Some inventories (e.g., UNIACT) have been revised to remove sex differences, while others (e.g., Self-Directed Search) have not been revised with this purpose (see Su, et al., 2009 for a discussion of the controversy surrounding gender-balanced interest inventories). Because of the varying factors that may result in differences based on the inventory completed, the vocational interest inventory used is expected to influence the effect sizes for Black-White differences observed across the samples.

Publication status, single-site vs. multiple-site data collection, and methods of recruiting sample. This set of moderators captures the extent to which various characteristics of the samples influence the differences found. For example, the results from published studies may differ from the results found in a dissertation. Also, if a sample is randomly sampled from multiple locations as opposed to coming from one school, the results may be different. Lastly, the results from a convenience sample from the researcher's university may diverge from the results from a sample recruited by an interest inventory publisher.

Cognitive Ability and Vocational Interests

In continuing to understand the implications of vocational interests for adverse impact, it is also necessary to examine the relationship between vocational interests and cognitive ability, as adverse impact toward African Americans usually emerges when cognitive ability pre-

employment tests are used. It has already been established that job complexity influences the positive relationship between cognitive ability and performance (Schmidt & Hunter, 2004), as well as the magnitude of Black-White differences in cognitive ability (Roth et al., 2001). Therefore, considering the relationship between cognitive ability and vocational interests may allow us to understand the extent of adverse impact in different types of jobs (e.g., jobs at different complexity levels). As it has been established that the development of vocational interests and career aspirations begins in childhood, whether individuals with certain interests possess higher ability is also theoretically important to determine, especially when using vocational interests to help explain the origins of adverse impact.

Why is a relationship between cognitive ability and vocational interests expected?

Multiple theoretical models predict a relationship between vocational interests and both personality and cognitive ability. The socio-analytic model of identity development (Hogan, 1982; Hogan & Roberts, 2000) hypothesizes that both personality traits and abilities influence the development of interests. Specifically, a person's ability and personality influence how s/he interacts in an environment, and these experiences shape how s/he becomes interested in spending her/his time. Individual differences can also be fostered in the opposite direction, for instance, with interests influencing the environment that a person places him or herself into, where personality and abilities are able to be developed (Roberts, Caspi, & Moffitt, 2003; Schooler, 2001). Regardless of the direction in which individual differences influence each other, a consideration of ability, personality, and interests allows for a clearer picture of how a person will behave in educational and work environments (Armstrong, Day, McVay & Rounds, 2008). Focusing on these relationship between abilities, interests, and occupations, empirically derived theories by Ackerman and colleagues (e.g., Ackerman, 1996; Ackerman & Heggestad, 1997),

Armstrong and colleagues (e.g., Anthoney & Armstrong, 2010; Armstrong et al., 2008) and Gottfredson (1986) have outlined how interests and abilities are expected to interact.

Integrated models of individual differences. Proposed as a theory of adult intelligence spanning from adolescence through late adulthood, Ackerman's (1996) theory of intelligence-as-process, personality, interests, and intelligence-as-knowledge (PPIK) takes into account how specific personality traits and interest types are related to specific knowledge domains (see Figure 4). Only individual difference variables that are thought to relate to intelligence are included in the model: realistic, investigative, and artistic interests, openness, and typical intellectual engagement (TIE; refers to "how much intellectual effort the individual is likely to put forth, whether in school or at a job," Ackerman & Heggestad, 1997, p. 222). The first part of the theory hypothesizes a link between intelligence-as-process and intelligence-as-knowledge. Intelligence-as-process refers to a person's information processing abilities (and is thought to influence fluid intelligence), whereas intelligence-as-knowledge refers to acquired knowledge (and is thought to influence crystallized intelligence). Both intelligence-as-process and intelligence-as-knowledge are thought to influence a person's realistic, investigative, and artistic interests, as well as their openness and TIE. These variables then influence a person's academic knowledge domains, including physical science, mathematics, arts, literature, and social science.

In explaining how these relationships between individual difference variables come to exist, Ackerman's (1996) PPIK theory posits that interests and abilities develop simultaneously, as abilities decide how successful a person will be at a task, and personality and interests influence how motivated a person is in pursuing the task. Abilities and interests then concurrently dictate whether a person is successful at acquiring knowledge in a particular domain. Given this, a broader consideration of how more of the RIASEC interests, five factor

model personality traits, and Stratum I and II (Carroll's model) abilities are related is described by Ackerman and Heggestad (1997). These authors marshal evidence for four trait complexes, based on considerable observed correlations between the individual difference variables within each complex. Holland's RIASEC model is used as a framework around which the other individual difference traits are organized. As shown in Figure 5, the first trait complex, called "Social," includes: social and enterprising interests, extraversion, social potency, and well-being traits, and no communalities with any specific abilities. The second trait complex called "Clerical/Conventional," includes conventional interests, control, conscientiousness, and traditionalism traits, and perceptual speed ability. The third trait complex called "Science/Math," includes realistic and investigative interests, visual perception and math reasoning abilities, and no personality traits. The last trait complex called "Intellectual/Cultural," includes investigative and artistic interests, openness, absorption, and TIE traits, and crystallized intelligence and ideational fluency ability.

Building on Ackerman and Heggestad's (1997) work, Armstrong et al. (2008) statistically integrated individual differences into Holland's model with property vector fitting, creating an "Atlas of Individual Differences." Property vector fitting allowed for an assembling of the structure of interests and other individual difference variables and a comparison of the placement of the variables relative to each other (Armstrong et al., 2010). Mathematics knowledge, numerical ability and spatial orientation were fitted in the realistic interest space, while science knowledge, form perception, complex problem solving, and intelligence fit into the investigative interest space. Critical thinking ability fit into the artistic space, but no abilities or knowledge areas fit into the social, enterprising, or conventional interest spaces. Anthoney and Armstong (2009) expanded this work by fitting a broader range of skills to the RIASEC model.

In this case, not only were skills and abilities fit in the realistic, investigative, and artistic spaces, but also the social interest space. Specifically, skills such as teaching, oral communication, and memorization were found in the social interest area. Everything considered, Ackerman and colleagues and Armstrong and colleagues have explored how vocational interests and cognitive abilities are interrelated and expanded our knowledge of how individual difference variables influence each other.

Identification of ability requirements for occupations. In contrast to the above work that sought to characterize the relationships between ability and interest constructs, an alternative, relevant approach has been undertaken that involves the determination of cognitive ability requirements for specific jobs. Gottfredson (1986) documented the creation of occupational aptitude patterns (OAPs) using U.S. Employment Service data. The Dictionary of Occupational Titles (DOT; U.S. Department of Labor, 1977) organized the 12,000 DOT titles into sixty-six work groups. Four hundred sixty of the occupations in the DOT had aptitude ratings and were used in creating OAPs for each work group. Cut scores for the specific aptitude batteries for each occupation were created based on the mean and standard deviation of worker scores, validities of the aptitude scores, and judgments based on job analysis data (e.g., worker functions, working conditions, physical demands, etc.). Sixty-six OAPs were created in all and grouped into thirteen smaller clusters (see Figure 6). The thirteen clusters are divided into four categories that vary in the nature of the work across the categories, but vary in ability requirements (general and/or specific) within each category. They are also characterized by specific vocational interest types. Oswald and Ferstl (1999) found additional support for the organization of occupations based on the OAP map. After classifying items from the Occupations section of the Strong Interest

Inventory into the thirteen clusters, four factors emerged that mirrored the four categories of clusters identified by Gottfredson (1986).

The first set of clusters, "dealing with physical relations" (P1-P5) encompasses realistic and investigative interests; the maintaining bureaucratic order clusters (B1-B3) encompass conventional and enterprising interests; the dealing with social and economic relations clusters (S1-S3) involve enterprising and social interests; and the performing clusters (A1-A2) involve artistic interests. The OAP map is ordered so that the first cluster in a category requires the highest levels of ability and the last cluster in a category requires the lowest ability levels. Within the dealing with physical relations category, the first few clusters (e.g., physicians, engineers, scientists) contain investigative job titles, and the last few clusters (e.g., cooks, assembly workers, manual laborers) include realistic job titles, suggesting that performing investigative jobs require more cognitive abilities whereas performing realistic jobs requires less of cognitive abilities and more of physical abilities. Within the dealing with social and economic relations category, the higher level clusters contain more enterprising job titles (e.g., lawyers, lobbyists, salespeople) and require higher cognitive abilities, while the lower level contain more social job titles (e.g., flight attendant, nurse aide) and require average cognitive abilities. The clusters in the maintaining bureaucratic order category contain enterprising and conventional job titles and require average cognitive abilities. The two performing clusters represent artistic job titles and require average cognitive abilities.

Gottfredson's (1986) theory about job aptitude requirements suggest that jobs are organized around the amount of cognitive ability required to perform them, with more complex higher level jobs requiring incumbents to have higher cognitive ability, and less complex lower level jobs requiring incumbents to have lower cognitive ability. Based on the organization of the

OAP map, it appears that investigative, artistic, and social occupations are higher in cognitive complexity (though social occupations have a wider range of cognitive complexity than the others), realistic and conventional occupations are lower in cognitive complexity, and enterprising occupations include the broadest range of cognitive complexity (Reeve & Heggestad, 2004). In all, this suggests that jobs that allow for the expression of certain vocational interests vary in cognitive complexity.

Considering that other individual differences besides cognitive ability are surely useful in placing individuals into jobs (Oswald & Ferstl, 1999), Gottfredson's (1986) results still suggest that cognitive ability is a useful classification variable as well. Though not linking results to vocational interests, Converse, Oswald, Gillespie, Field, and Bizot (2004) used the Occupational Information Network (O*NET) database to organize and match individuals with jobs based on their cognitive ability. Also, using latent class analysis Johnson and Bouchard (2009) found that the extent to which people group together in occupations is better explained by their general ability than by their interests. This research is consistent with the gravitational hypothesis, which posits that individuals are attracted to occupations that match their levels of cognitive ability (McCormick, DeNisi, & Shaw, 1979). In support of this hypothesis, Wilk and Sackett (1997) found that over time, individuals with higher cognitive ability moved toward more complex jobs, while individuals lower in cognitive ability ended up in less complex jobs.

Previous empirical investigations of vocational interests and cognitive ability.

While work by Ackerman and Heggestad (1997) and Gottfredson (1986) both agree that investigative and artistic interests are positively associated with cognitive ability, there is more empirical inconsistency with regards to realistic and social interests. I will review empirical research findings that support each perspective.

Realistic, investigative, and artistic interests and cognitive ability. In addition to the identification of the trait complexes, Ackerman and Heggestad (1997) reviewed the results of five studies exploring the relationships between vocational interests and cognitive ability. They concluded that realistic interests are positively related with spatial, math, and mechanical abilities; investigative interests are positively associated with spatial, math, and verbal abilities; artistic interests are positively associated with verbal abilities; social interests have either negative or minor relationships with abilities; enterprising interests have negative relationships with abilities; and conventional interests are only related to perceptual speed and math computation abilities. Warwas, Nagy, Watermann and Hasselhorn (2005) observed positive correlations between mathematical literacy and realistic interests, and negative correlations between mathematical literacy and both artistic and social interests. Similarly, Rolfhus and Ackerman (1999) found that having realistic interests was positively correlated with performance on technology, chemistry, physics, and tools/shop knowledge tests; investigative interests were positive correlated with world literature, biology, chemistry, technology, and tools/shop knowledge tests; artistic interests were positively correlated with performance on American literature, art, geography, music, world literature, American history, and western civilization knowledge tests; and social, enterprising, and conventional interests were not positively correlated with any knowledge tests. These findings all suggest that only realistic, investigative, and artistic interests are positively related to cognitive ability overall.

Investigative, artistic, and social interests and cognitive ability. On the other hand, Lowman and Ng (2010) found that males working in realistic jobs at a paper manufacturing company and scoring high on realistic interests had high scores on mechanical reasoning and non-verbal reasoning tests, but average scores on general and verbal intelligence. In a large college student

sample, Schmitt, Oswald, Friede, Imus, and Meritt (2007) found that realistic interests were negatively correlated with changes in academic fit and satisfaction over time, and investigative interests were positive correlated with these outcomes. Reeve and Heggestad (2004) observed positive correlations between general cognitive ability and investigative, artistic, and social interests. They also observed positive correlations between cognitive ability and interest-vocation fit among those with investigative, artistic, and social interests. Negative correlations between cognitive ability and interest fit were found among those with realistic and conventional interests. No consistent relationship between interest-vocation fit and enterprising interests emerged. Rottinghaus, Lindley, Green and Borgen (2002) found that college students who desired to pursue higher education levels were more likely to be higher in openness, conscientiousness, investigative interests, and artistic interests, and to have confidence in their investigative interests. These results suggest that only investigative, artistic, and social interests are positively related to cognitive ability.

All things considered, more research is needed to explore the relationship between cognitive ability and vocational interests. To date, no meta-analysis has been conducted on cognitive ability and vocational interests. Whereas a positive relationship between cognitive ability and both investigative and artistic interests is certainly expected, it is unclear whether a positive relationship between cognitive ability and realistic or social interests will emerge. However, as there is convincing evidence from both perspectives (considered independently), I propose competing hypotheses.

Competing Hypothesis 3:

(1) Cognitive ability will be positively related to (a) Realistic, (b) Investigative, and (c) Artistic vocational interests, and unrelated to (d) Social, (e) Enterprising, and (f) Conventional vocational interests.

or

(2) Cognitive ability will be positively related to (a) Investigative, (b) Social, and (c) Artistic vocational interests, and unrelated to (d) Realistic, (e) Enterprising, and (f) Conventional vocational interests.

Potential moderators of the cognitive ability-vocational interest correlations include type of vocational interest inventory used, the type of ability measure used, the range of work experience in the sample, the age of the sample, the sample cohort, the education level of the sample, whether the samples were reported in published or unpublished studies, and the type of sample. However, there were not enough primary studies available to conduct these moderator analyses.

Overview of Studies

The first aim of this dissertation was to determine the meta-analytic effect sizes of Black-White differences in vocational interests (Study 1). Next, I estimated the meta-analytic correlations between vocational interests and cognitive ability (Study 2). To achieve this paper's overall purpose of demonstrating the role vocational interests play in understanding applicant pool composition and adverse impact, it would be ideal to demonstrate a situation where subgroup differences in the six basic RIASEC vocational interests lead to distinct applicant pool properties across different application ratios. Therefore, Study 3 involves using results of the two sets of original meta-analyses (from Studies 1 and 2) as well as results from published meta-analyses that have established the relationship between conscientiousness and vocational interests (Mount, Barrick, Scullen, & Rounds, 2005), conscientiousness and cognitive ability (Judge, Jackson, Shaw, Scott, & Rich, 2007), race and conscientiousness (Foldes et al., 2008), and race and cognitive ability (Roth et al., 2001). These results were plugged into formulas adapted from Newman and Cottrell (2013) in order to demonstrate how applicant pool subgroup differences on predictor variables can vary as a function of (a) whether the specific job type

attracts applicants with realistic, investigative, artistic, social, enterprising, or conventional interests, (b) race differences in vocational interests, and (c) the relationships between vocational interests and the predictor variables. The results of Study 3 exhibit how vocational interests give rise to adverse impact.

Chapter 3: Study 1

Method

Literature Search Procedures

To obtain published studies for the meta-analyses, I searched various electronic databases (i.e., PsycINFO, JSTOR, Sociofile, ABI-Inform Complete, Ebsco Host) for terms denoting race (i.e., *race, ethnicity, ethnic, Black, African American, White, Caucasian, Caucasian American*) and vocational interests. I also did a search for the name of each vocational interest inventory (see Table 1 for list of all vocational interest inventories used in the literature searches).

In order to obtain unpublished studies and technical reports, I used various search methods. I searched Proquest Dissertations and Theses using the above terms in order to obtain dissertations. In addition, I obtained the means, standard deviations, and sample sizes from a number of vocational interest inventory manuals and test publisher reports (i.e., Strong Interest Inventory, UNIACT-R Interest Inventory, Self-Directed Search, Interest Profiler, Interest Finder, Ohio Vocational Interest Survey) and calculated the effect sizes from those statistics. I also did a search in the Defense Technical Information Center database (www.dtic.mil) in order to locate any research on Black-White differences in vocational interests conducted by the U.S. Department of Defense. Lastly, I searched the conference programs for the Society for Industrial/Organizational Psychology and Academy of Management conferences from the past fifteen years.

Twenty-nine studies met the inclusion criteria (described below). Because most of the studies included multiple samples, the total number of samples (k=52) is larger than the number of studies. The meta-analytic results are based on a total of 82,539 participants and 298 effect sizes.

Inclusion Criteria and Coding

I was interested in identifying primary studies that could be used to examine differences in vocational interests between Blacks and Whites. Data with samples from all age ranges and institutions (e.g., primary/secondary schools, colleges/universities, organizations) and time collection periods were considered[2]. Among published articles and dissertations, only those written in the English language were included. In addition, only studies with data collected in the United States were used.

Studies were included in this meta-analysis if they used Holland's framework of vocational interests (e.g., assessed Realistic interests, Investigative interests, etc.) in measuring vocational interests or a framework where the vocational interest types could be easily tied to Holland's framework (e.g., interest in Business Contact as a proxy for Enterprising interests in the UNI-ACT Interest Inventory; American College Testing Program, 1995). Studies that did not contain measures that assess Holland's vocational interest types (e.g., Brown, 1974) were excluded from

[2] One unpublished primary study, a dissertation by Petrella (2002), contained a reported *N* of 265,830 cases from ACT, but all were female high school juniors. This single reported primary study was so large, and its results so unusual, that including it would have substantially changed every race effect size reported in the current meta-analysis. For this reason, we double-checked the estimates therein and discovered that the agency which originally collected the data could not confirm the accuracy of the estimates reported in this single unpublished study. The Petrella study was based on the UNIACT instrument alone, which is an instrument designed to remove gender differences. Given the differences between Petrella's effect sizes and effect sizes reported in UNIACT manual (Swaney, 1995), we contacted ACT through both a formal request for data and an informal correspondence with Kyle Swaney [Senior Research Associate, ACT]. In response, the ACT was unfortunately unwilling to share their dataset, and was also unable to confirm the accuracy of Petrella's (2002) reported effect sizes. K. Swaney (personal communication, March 15, 2013) reported that "Petralla's data were based on a sample of convenience from a couple of months of testing. The samples in the 1995 manual were nationally representative." Therefore, the best nationally-representative estimates of group differences on the UNIACT inventory come from the estimates in the 1995 manual and the 2009 manual published by ACT. As such, we have followed the advice of the ACT (who collected and owns the data reported by Petrella), and excluded Petrella's (2002) dissertation from further analysis.

the meta-analysis. Studies that had vocational interest measures with only one item were also excluded (e.g., Peterson, 1987).

Primary studies must also have reported statistics that could be used to calculate effect sizes for Black-White differences in vocational interests (e.g., sample sizes, means, standard deviations, correlations, *F*-ratios from one-way ANOVAs, *t*-values, etc.). Studies that did not report the appropriate statistics (e.g., Kantamneni & Foaud, 2011) were also excluded. In addition, results that were not reported by racial group were excluded (e.g., Osborn & Reardon, 2006).

Primary studies must also have independent samples, and there were some studies that were excluded because they utilized non-independent datasets. For example, Fouad, Harmon, and Borgen (1997), Lattimore and Borgen (1999), and Fouad (2002) used data that were all randomly drawn from the Strong Interest Inventory 1994 reference group. In cases like this, I only used the study that reported estimates from the largest sample size (i.e., Fouad, et al., 1997). Also, there were some studies where the same samples completed multiple measures of vocational interests (e.g., Walsh, Woods, & Ward, 1986). In this case, the vocational interest measure that had the highest reliability was included[3].

Since unreliability in the vocational interest measure was corrected in the current meta-analyses, a reliability estimate was obtained for each study. If the reliability estimate was not provided in the study article, then the reliability reported in the vocational interest inventory manual was used. See Table 1 for a list of the reliabilities used to correct for unreliability in the vocational interest measures.

[3] For the moderator analyses that compared Black-White differences in interests across the different vocational interest inventories, I included all of the results for samples that completed multiple interest inventories—not just the results for the inventories with the highest reliabilities.

To affirm the reliability of the meta-analytic coding procedure used in the current study, an independent coder (Rong Su) recoded a random subset of 34% of the studies. There was 91% agreement between the initial codings and the independent codings provided by Dr. Su. Discrepancies were discussed and resolved.

Coding of Moderator Variables

Gender. For gender, only studies that presented their sample results by gender were included in this moderator analysis. If a sample within a study was all of one gender, then it was coded as its respective gender. Studies using samples with mixed genders that did not present results separated by gender were not included in this moderator test.

Cohort. Sample birth cohort was calculated by subtracting the average age of the sample from the year that the data were collected. The birth cohorts ranged from the 1940s to the 1990s. Due to the low number of studies in some of the decades, some of the cohorts were later collapsed for the analyses. If the average age of the sample was not indicated and a birth cohort group could not be calculated, then the study was excluded from this moderator analysis.

Developmental stage. The developmental stage of the sample when the interest inventory was administered was coded by looking at the setting in which the data were collected. If the sample consisted of students in a primary/elementary school, then the sample was coded as "Primary." The youngest sample in this category consisted of seventh graders. If the sample consisted of students in a high school, then the sample was categorized as "High School." Due to the low number of studies in the Primary category and the fact that the average age of participants in this category was 13 years old, the Primary and High School categories were combined to form "Junior/High School." If the sample comprised students on a two or four year college/university campus, the sample was categorized as "College." If participants were adults

who were not in an educational setting, the sample was categorized as "Adult." Samples that were mixed with students and adults were excluded. A sample consisting of prison inmates (i.e., Laufer, 1980) was excluded from the "Adult" category.

Age. Sample age was coded by recording the average age of the sample. Samples that did not include this information were excluded from this moderator analysis. The ages of the participants across all studies ranged from 12.7 to 44.1 years old, with an average age of 24.18 years.

Education level. Education level was coded using information on the average years of education for the sample. If the average years of education was not given, but the sample was described as consisting of students in a certain grade, then that grade was recorded as the education level. The studies were separated into the following categories: "Less than high school," "High school degree or equivalent," "Some college/technical training," "College degree," "Some graduate school," and "Mixed undergraduate and graduate students." Students in both two and four year colleges/universities were included in the "Some college/technical training" category. Due to the low number of samples in some of the categories, the samples were later grouped into "Less than college education" and "Some college education" categories. Studies that did not provide any information on the education of the samples were excluded from this moderator analysis.

Interest inventory. The vocational interest inventories administered to the samples were coded as reported (see Table 1 for a list of the inventories used by the studies included in the meta-analyses).

Publication status. The publication statuses of the studies were coded into the following categories: "Journal article," "Dissertation," and "Publisher Manual." No technical reports were included in the meta-analyses[4].

Single-site vs. multiple-site data collection. Whether the sample was coded as a single-site or multi-site data collection was based on if the sample came from multiple locations or if it was collected at one location. If the sample data were only collected in one location, then the sample was coded as single-site. If the sample data came from a national database, or were described as being a from more than one locatoin, then the sample was coded as multi-site. If information about the location was not provided, then the study was excluded from this moderator analysis.

Recruitment of sample. How the sample was recruited referred to how the researcher acquired the sample. If the sample came from an inventory manual or test publisher report, then it was coded as "Publisher." If the researcher targeted an elementary or secondary school as a research site and collected the data from that location, then the sample was coded as "School." If the sample comprised students on the researcher's campus, the sample was coded "College." If the sample was recruited by unspecified means, then the sample recruitment strategy was coded as "Other."

Computation and Analysis of Effect Sizes

Because moderators were expected to influence the size of Black-White differences in vocational interests, a random-effects model was used to estimate the meta-analytic parameters. The random effects meta-analyses were conducted using Hunter and Schmidt's (2004) procedures, correcting for sampling error and reliability attenuation in the vocational interest

[4] The only technical report (Peterson, 1987) located that examined Black-White differences in interests utilized a one item measure for each interest type. Therefore, it was not included in any of the analyses.

inventory. The sample size, means, and standard deviations for each sample, were used to calculate a sample-weighted effect size for each sample. Each effect size was corrected individually for sampling error and unreliability (see Table 1 for the vocational interests inventory reliabilities). Ninety-five percent confidence intervals and the middle 80% credibility values were calculated for each corrected effect size as well.

After observing that the calculated standard deviations of the corrected effect sizes were greater than zero, the moderator analyses were performed. Separate meta-analyses were conducted within the previously described moderator groups. In order to determine whether the corrected effect sizes within each moderator group were significantly different from each other, I used Raju and Brand's (2003) significance tests for corrected correlations. Specifically, after converting the effect sizes to correlations, I calculated *z* based on the following formula:

$$z = \frac{\hat{\rho}_1 - \hat{\rho}_2}{\sqrt{\hat{V}(\hat{\rho}_1) + \hat{V}(\hat{\rho}_2)}}, \quad (1)$$

$$\text{where } \hat{V}(\rho_{xy}) = \frac{k^2 r^2_{xx} r^2_{yy} (1 - r^2_{xy})^2}{(n-1)\hat{W}^3}. \quad (2)$$

Using an $\alpha = .05$ critical value, if *z* was less than -1.96, or greater than 1.96, the effect sizes were considered to be significantly different from each other.

The above procedures were used for all of the moderators except age, which I treated as a continuous moderator. In order to determine whether age was a moderator of Black-White differences in vocational interests, I used weighted least squares regression (Hedges & Olkin, 1985; see Steel & Kammeyer-Mueller, 2000). For each sample, I calculated a weight using the following formula:

$$w_i = \frac{1}{\sigma^2(d_i)} = \frac{2(n_i^B + n_i^W) n_i^B n_i^W}{2(n_i^B + n_i^W)^2 + n_i^B n_i^W d_i^2}, \quad (3)$$

where n_i^B = the total sample size of the Black participants, n_i^W = the total sample size of the White participants, and d_i= the sample effect size. A weighted regression analysis was executed, with the formula $d_c = X\beta + \varepsilon$, where d_c = the corrected sample size-weighted mean effect size and X = age. The Q_R statistic was then calculated to determine whether the regression coefficients for the intercept and age in predicting d_c were simultaneously zero (i.e., $\beta_1 = \beta_{age}=0$). In addition, a Q_E statistic was calculated to determine if the model that predicts the effect sizes was well specified. The 95% confidence interval around β_{age} was calculated as well. The Q_R statistic must be greater than the χ^2(df) value at the 95 percentage point in order to be significant, while the Q_E statistic must be less than the the χ^2(df) value at the 95 percentage point in order to be significant.

In order to determine the joint effects of each of the moderator groups on the corrected effect sizes, I used the same weighted least squares regression procedure described above (see Hedges & Olkin, 1985; see Steel & Kammeyer-Mueller, 2000). A weight variable was calculated for each sample using Formula 3. Dummy variables were created for each category within each moderator variable such that the study was given a 1 if the moderator category was present, and a 0 if it was not present. For example, if a sample was all male, D_{Male} was coded 1 and D_{Male} was otherwise coded 0; if a sample was all female, D_{Female} was coded 1 and D_{Female} was otherwise coded 0. Thus the dummy code D_{Female} is a sample-level moderator (not an individual-level moderator), which designates whether the sample was all-female. It is therefore mathematically possible for D_{Female} and D_{Male} dummy codes to both have positive regression coefficients simultaneously. There were twenty four moderator categories across all of the moderator groups: gender (male, female); birth cohort (1940s-1950s, 1960s, 1970s-1980s); developmental stage (junior/high school, college, adult); education level (less than college, some college or more);

interest inventory (Strong, Self-Directed Search, Vocational Preference Inventory, Ohio Vocational Interest Schedule, Other inventories); publication status (journal, dissertation, publisher manual); data collection (multi-site, single-site); recruitment source (publisher, school, campus, other). Since some of the vocational interest inventories only had 1-2 samples that used them (i.e., Mapping Vocational Challenges, Interest Profiler, Interest Finder, UNI-ACT), they were grouped together. Age was not included as a moderator category because it is continuous (as opposed to categorical) and has missing data (i.e., not all of the samples reported a mean age of the sample).

The following regression equation was estimated for each of the vocational interest types:

$\delta = b_0$ (intercept) + b_1 (male) + b_2 (female) + b_3 (1940s-1950s) + b_4 (1960s) + b_5 (1970s-1980s) + b_6 (junior/high school) + b_7 (college) + b_8 (adult) + b_9 (less than college) + b_{10} (some college or more) + b_{11} (Strong) + b_{12} (SDS) + b_{13} (VPI) + b_{14} (OVIS) + b_{15} (Other inventories) + b_{16} (journal) + b_{17} (dissertation) + b_{18} (publisher manual) + b_{19} (multi-site) + b_{20} (single-site) + b_{21} (publisher recruitment) + b_{22} (school recruitment) + b_{23} (campus recruitment) + b_{24} (other recruitment),

where δ is the corrected effect size, b_0 is the intercept, and b_1 through b_{24} are the regression weights for the moderator variables. The intercept represents the mean effect size across all of the studies before taking the moderator variables into account. The regression weights represent the size of the effect that each moderator category has on the effect sizes. All of the weighted least square regression analyses were carried out using PROC GLM in SAS.

Results and Discussion

Overall Black-White Differences in Vocational Interests

Hypothesis 1 suggested that African Americans would have stronger social, enterprising, and conventional interests than Whites, while Whites would have stronger realistic, investigative, and artistic interests than African Americans. Consistent with the hypotheses, Whites had stronger realistic ($\bar{d}$ =.23, d_c =.25, *k*=49; 95% CI did not contain zero), investigative ($\bar{d}$ =.21, d_c =.23, *k*=52; 95% CI did not contain zero), and artistic ($\bar{d}$ =.09, d_c =.09, *k*=49; 95% CI did not contain zero) interests than Blacks, although the effect size for artistic interests was much smaller. On the other hand, while Blacks had slightly stronger social ($\bar{d}$ =-.13, d_c =-.14, *k*=48; 95% CI did not contain zero) interest than Whites, they did not have stronger enterprising or conventional interests. These results are summarized in Table 2. The overall findings also suggest that moderators are present: only small percentages of variance were accounted for by sampling error and unreliability (i.e., realistic=11.78%, investigative=7.25, artistic=5.18%, social=1.99%, enterprising=2.43%, conventional=2.00%), and the corrected standard deviations suggest that there is variation in the effect sizes across studies. The results of the moderator analyses are discussed below.

Results of Moderator Analyses

Gender

The results of the gender moderator analyses are presented in Table 3. White males were found to have stronger realistic interests than Black males ($\bar{d}$ =.18, d_c =.19, *k*=20; 95% CI did not contain zero), and White females were found to have stronger realistic interests than Black females ($\bar{d}$ =.27, d_c =.29, *k*=19; 95% CI did not contain zero) However, these effect sizes did not significantly differ from each other (*z*=-1.85) and the 95% confidence intervals overlapped. A

similar pattern was found with investigative interests, where White males ($\bar{d}$ =.17, d_c =.18, *k*=20; 95% CI did not contain zero) and females ($\bar{d}$ =.25, d_c =.27, *k*=22; 95% CI did not contain zero) each have stronger investigative interests than Black males and females, but the effect sizes did not significantly differ from each other (*z*=-1.64) and the 95% confidence intervals overlap. White females were also found to have stronger artistic interests than Black females ($\bar{d}$ =.11, d_c =.11, *k*=19; 95% CI did not contain zero). There were no significant differences between Black and White males and Black and White females on social, enterprising, and conventional interests. This is also displayed graphically in Figure 7. Overall, gender was not found to moderate the size of Black-White differences in vocational interests.

Cohort

The results of the birth cohort moderator analyses are presented in Tables 4 and 5. Because of the small number of samples in the some of the decades, the 1940s and 1950s samples were combined, and the 1970s, 1980s, and 1990s samples were combined. Whites born in the 1940s and 1950s were found to have stronger realistic ($\bar{d}$ =.23, d_c =.25, *k*=7; 95% CI did not contain zero) and investigative ($\bar{d}$ =.18, d_c =.19, *k*=10; *z*=-4.23; 95% CI did not contain zero) interests than Blacks born in that decade. However, Blacks born in the 1940s and 1950s had stronger social interests ($\bar{d}$ =-.38, d_c =-.41, *k*=7; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.27, d_c = -.30, *k*=10; 95% CI did not contain zero), and conventional ($\bar{d}$ =-.25, d_c =-.27, *k*=10; 95% CI did not contain zero) interests than Whites born in those decades. There were no significant differences in artistic interests among those born in that decade. Overall, those born in the 1940s and 1950s displayed a pattern of results for overall Black-White differences in vocational interests that was mostly consistent with Hypotheses 1 and 2.

Alternatively, Whites born in the 1960s had stronger realistic ($\bar{d}$ =.26, d_c =.27, *k*=18; 95% CI did not contain zero), investigative ($\bar{d}$ =.37, d_c =.39, *k*=18; 95% CI did not contain zero), artistic ($\bar{d}$ =.32, d_c =.34, *k*=18; 95% CI did not contain zero), social ($\bar{d}$ =.42, d_c =.44, *k*=17; 95% CI did not contain zero), enterprising ($\bar{d}$ =.46, d_c =.50, *k*=18; 95% CI did not contain zero), and conventional ($\bar{d}$ =.46, d_c =.49, *k*=18; 95% CI did not contain zero) interests than Blacks born in the 1960s. There were no significant differences between Blacks and Whites born in the 1970s, 1980s, or 1990s.

Sample birth cohort significantly moderated the size of Black-White differences in investigative, artistic, social, enterprising, and conventional interests (see Table 5). Specifically, for investigative, social, enterprising, and conventional interests, the effect sizes for those born in the 1940s-1950s are significantly different from those born in the 1960s and 1970s-1990s, and the effect sizes for those born in the 1960s are significantly different from those born in the 1970s-1990s (observed *z*s are $\leq$ -1.96 or $\geq$ 1.96; 95% CIs do not overlap). For artistic interests, the effect sizes from those born in the 1940s-1950s are significantly different from those born in the 1960s, and the effect sizes from those born in the 1960s are significantly different from those born in the 1970s-1990s (observed *z*s are $\leq$ -1.96 or $\geq$ 1.96; 95% CIs do not overlap).

Developmental stage at which interest inventory was administered

The results for the effects of developmental stage on Black-White differences in vocational interests are presented in Tables 6 and 7. Whites who were in junior high school and high school had stronger realistic ($\bar{d}$ =.20, d_c =.22, *k*=11; 95% CI did not contain zero), investigative ($\bar{d}$ =.32, d_c =.33, *k*=11; 95% CI did not contain zero), artistic ($\bar{d}$ =.22, d_c =.24, *k*=11, 95% CI did not contain zero; for college), social ($\bar{d}$ =.39, d_c =.42, *k*=11; 95% CI did not

contain zero), enterprising ($\bar{d}$ =.47, d_c =.50 *k*=9; 95% CI did not contain zero), and conventional ($\bar{d}$ =.48, d_c =.51, *k*=9; 95% CI did not contain zero) interests than Blacks in that stage.

On the other hand, among those in college, Whites had stronger realistic ($\bar{d}$ =.31, d_c =.33, *k*=19; 95% CI did not contain zero), investigative ($\bar{d}$ =.24, d_c =.25, *k*=19; 95% CI did not contain zero), and artistic ($\bar{d}$ =.15, d_c =.16, *k*=19; 95% CI did not contain zero) interests than Blacks. However, Blacks had stronger conventional ($\bar{d}$ =-.20, d_c =-.21, *k*=19; 95% CI did not contain zero). There were no significant differences in the social and enterprising interests of college Blacks and Whites.

Lastly, the adult samples showed a pattern of results consistent with Hypotheses 1 and 2. Specifically adult Whites had stronger realistic ($\bar{d}$ =.24, d_c =.26, *k*=10; 95% CI did not contain zero) and investigative ($\bar{d}$ =.19, d_c =.20, *k*=13; 95% CI did not contain zero) interests than adult Blacks, while adult Blacks had stronger social ($\bar{d}$ =-.37, d_c =-.41, *k*=10; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.27, d_c =-.31, *k*=13; 95% CI did not contain zero), and conventional ($\bar{d}$ = -.26, d_c =-.29, *k*=13; 95% CI did not contain zero) interests than adult Whites. There were no significant differences between adult Blacks and Whites on artistic interests.

Developmental stage significantly moderated the size of Black-White differences in investigative, artistic, social, enterprising, and conventional interests (see Table 7). Specifically, for social and enterprising interests, the effect sizes for those in junior high and high school were significantly different from college students and adults, and the effect sizes for those in college were significantly different from those who are adults (observed *z*s are $\leq$ -1.96 or $\geq$ 1.96; 95% CIs do not overlap). Finally, for artistic interests, the effect sizes for adults were significantly different from those in junior high and high school, and college (observed *z*s are $\leq$ -1.96 or $\geq$ 1.96; 95% CIs do not overlap). For conventional interests, the effect sizes for those in junior high

and high school were significantly different from those in college and those who were adults (observed *z*s are ≤ -1.96 or ≥ 1.96; 95% CIs do not overlap).

Age

Age was examined as a continuous moderator of the size of Black-White differences in vocational interests. The results of the weighted least squares regression are presented in Table 8. Although the confidence intervals for the age beta weights predicting Black-White differences in artistic (β = -.007; 95% CI=[-.012, -.002]), social (β = -.024; 95% CI=[-.030, -.018]), enterprising (β = -.024; 95% CI=[-.029, -.019]), and conventional interests (β = -.024; 95% CI=[-.030, -.018]) did not contain zero and the Q_R statistics were significant, each model for predicting the effect sizes for the differences in interests was not specified (i.e., artistic: Q_E = 26.35, *df* = 41, *p* > .05; social: Q_E = 286.49, *df* = 40, *p* > .05; enterprising: Q_E = 288.88, *df* = 42, *p* > .05; conventional: Q_E = 288.19, *df* = 42, *p* > .05). Therefore, there were slight effects of age on Black-White differences in artistic, social, enterprising, and conventional interests, but the data analysis model was inappropriate.

Education level

The results of the education level moderator analyses are presented in Table 9. Whites with less than a college education were found to have stronger realistic ($\bar{d}$ =.19, d_c =.21, *k*=19; 95% CI did not contain zero), investigative ($\bar{d}$ =.30, d_c =.31, *k*=19; 95% did not contain zero), artistic ($\bar{d}$ =.20, d_c =.21, *k*=19; 95% CI did not contain zero), social ($\bar{d}$ =.35, d_c =.38, *k*=19; 95% CI did not contain zero), enterprising ($\bar{d}$ =.43, d_c =.46, *k*=17; 95% did not contain zero), and conventional ($\bar{d}$ =.44, d_c =.46, *k*=17; 95% CI did not contain zero) interests than Blacks with the same education level. However, among those with at least some college education, a pattern consistent with the results hypothesized for overall Black-White differences in interests emerged.

Specifically, Whites with at least some college education had stronger realistic ($\bar{d}$ =.26, d_c =.28, *k*=25; 95% CI did not contain zero) and investigative ($\bar{d}$ =.20, d_c =.22, *k*=21; 95% CI did not contain zero) interests than Blacks with at least some college education. However, Blacks with at least some college education had stronger social ($\bar{d}$ =-.30, d_c =-.33, *k*=20; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.22, d_c =-.24, *k*=21; 95% CI did not contain zero), and conventional ($\bar{d}$ = -.23, d_c =-.26, *k*=21; 95% CI did not contain zero) interests than Whites with at least some college education. In addition, education level only moderated Black-White differences in social (*z*=19.22, 95% CIs do not overlap), enterprising (*z*=10.25, 95% CIs do not overlap), and conventional (*z*=20.07, 95% CIs do not overlap) interests. This is displayed graphically in Figure 8.

Interest inventory

The results for the moderating effect of interest inventory on Black-White differences in vocational interests are found in Tables 10 and 11. The results for those who took versions of the Strong interest inventories show patterns consistent with Hypotheses 1 and 2. Specifically, Whites had stronger realistic ($\bar{d}$ =.25, d_c =.27, *k*=23; 95% CI did not contain zero) and investigative ($\bar{d}$ =.20, d_c =.21, *k*=23; 95% CI did not contain zero) interests, while Blacks had stronger social ($\bar{d}$ =-.32, d_c =-.35, *k*=22; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.24, d_c = -.27, *k*=23; 95% CI did not contain zero), and conventional ($\bar{d}$ =-.27, d_c =-.30, *k*=23; 95% CI did not contain zero) interests. On the other hand, there were no Black-White differences in vocational interests among those who took the Self-Directed Search. African Americans who took the Vocational Preference Inventory had stronger realistic ($\bar{d}$ =-.20, d_c =-.22, *k*=6; 95% CI did not contain zero), artistic ($\bar{d}$ =-.15, d_c =-.16, *k*=4; 95% CI did not contain zero), social ($\bar{d}$ = -.42, d_c =-.46, *k*=6; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.26, d_c =-.29, *k*=6; 95% CI

did not contain zero), and conventional ($\bar{d}$ =-.48, d_c =-.52, *k*=6; 95% CI did not contain zero) interests than Whites. With the other inventories, it is hard to draw definitive conclusions given the small numbers of samples that used those inventories. The differences among the other inventories go in differing directions depending on the inventory used. Overall, interest inventory moderated Black-White differences across all interest types (see Table 10 for 95% confidence intervals and Table 11 for *z* values).

Publication status

The results for the moderating effect of publication status on Black-White differences in vocational interests are found in Tables 12 and 13. Black-White differences in interests reported in journal articles and dissertations showed patterns consistent with Hypotheses 1 and 2. For both journal articles and dissertations, Whites had stronger realistic (journal articles: $\bar{d}$ =.25, d_c =.27, *k*=23, 95% CI did not contain zero; dissertations: $\bar{d}$ =.24, d_c =.26, *k*=10, 95% CI did not contain zero) and investigative (journal articles: $\bar{d}$ =.19, d_c =.20, *k*=31, 95% CI did not contain zero; dissertations: $\bar{d}$ =.21, d_c =.22, *k*=10, 95% CI did not contain zero) interests, while Blacks had stronger social (journal articles: $\bar{d}$ =-.33, d_c =-.36, *k*=12, 95% CI did not contain zero; dissertations: $\bar{d}$ =-.30, d_c =-.32, *k*=9, 95% CI did not contain zero), enterprising (journal articles: $\bar{d}$ =-.25, d_c =-.28, *k*=29, 95% CI did not contain zero; dissertations: $\bar{d}$ =-.24, d_c =-.28, *k*=10, 95% CI did not contain zero), and conventional (journal articles: $\bar{d}$ =-.27, d_c =-.30, *k*=29, 95% CI did not contain zero; dissertations: $\bar{d}$ =-.53, d_c =-.57, *k*=10, 95% CI did not contain zero) interests. Among the samples reported in journal articles and dissertation, Blacks and Whites did not significantly differ in artistic interests. Among the samples from the inventory manuals, Whites had stronger vocational interests than Blacks across all of the types. Overall, publication status

moderated Black-White differences in artistic, social, enterprising, and conventional interests (see Table 12 for 95% confidence intervals and Table 13 for *z* values).

Single-site vs. multi-site data collection

As shown in Table 14, the extent to which the samples were from a single-site or multiple-site data collection moderated Black-White differences in social, enterprising, and conventional interests.

Recruitment source

As demonstrated in Tables 15 and 16, the method used to recruit participants moderated Black-White differences in investigative, artistic, social, enterprising, and conventional interests. Among the samples recruited by researchers on the same college campus, Whites had stronger realistic ($\bar{d}$ =.39, d_c =.42, *k*=12; 95% CI did not contain zero), investigative ($\bar{d}$ =.34, d_c =.36, *k*=12; 95% CI did not contain zero), and artistic ($\bar{d}$ =.22, d_c =.23, *k*=12; 95% CI did not contain zero) interests, while Blacks had stronger social ($\bar{d}$ =-.32, d_c =-.34, *k*=12; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.15, d_c =-.16, *k*=12; 95% CI did not contain zero), and conventional ($\bar{d}$ = -.29, d_c =-.31, *k*=12; 95% CI did not contain zero) interests. On the other hand, among the samples recruited by the publishers of the vocational interest inventories, Whites had stronger realistic ($\bar{d}$ =.23, d_c =.25, *k*=19; 95% CI did not contain zero), investigative ($\bar{d}$ =.22, d_c =.23, *k*=19; 95% CI did not contain zero), and artistic ($\bar{d}$ =.09, d_c =.10, *k*=19; 95% CI did not contain zero) interests, and there were no differences on social, enterprising, and conventional interests. Additionally, among participants in schools that were targeted by the researcher, Blacks had stronger social ($\bar{d}$ =-.23, d_c =-.24, *k*=9; 95% CI did not contain zero), enterprising ($\bar{d}$ =-.24, d_c =-.27, *k*=8; 95% CI did not contain zero), and conventional ($\bar{d}$ =-.51, d_c =-.54, *k*=8; 95% CI did not contain zero) interests, and there were no differences on realistic, investigative, and

social interests. Lastly, among those recruited through other methods, there were no differences between Blacks and Whites on realistic and investigative interests, but Blacks had stronger artistic, social, enterprising, and conventional interests. See Tables 15 and 16 for 95% confidence intervals and *z* values.

Weighted least squares regression

The results for each of the weighted least squares regression analyses predicting each of the vocational interests types are presented in Tables 17-22. The model predicting the corrected realistic effect sizes was significant ($p < .01$) and showed that taken together, female samples, using the VPI, and being published as a journal article or dissertation significantly influenced Black-White differences in realistic interests (see Table 17). The model predicting the corrected investigative effect sizes was also significant ($p < .05$), however none of the regression weights for the moderator categories were significant (see Table 18). The model predicting the corrected artistic effect sizes was not significant ($p = .16$; see Table 19). The model predicting the corrected social effect sizes was significant ($p < .001$), however none of the moderator categories significantly affected Black-White differences in social interests (see Table 20). The model predicting the corrected enterprising effect sizes was significant ($p < .001$), and demonstrated that being born in the 1960s as well as the 1970s/1980s, and using the Strong, SDS, and OVIS interest inventories influenced Black-White differences in enterprising interests (see Table 21). Lastly, the model predicting the corrected conventional effect sizes was significant ($p < .001$), and demonstrated that using the Strong and SDS interest inventories, and being published as a journal article or dissertation influenced Black-White differences in conventional interests (see Table 22).

Summary

The results of Study 1 show that across all of the studies, Whites have stronger realistic, investigative, and artistic interests; while Blacks have slightly stronger social interests. This fully confirms Hypothesis 2, but only partially confirms Hypothesis 1. Several variables were found to moderate the size and direction of Black-White differences in interests, including birth cohort, developmental stage of the sample, education level, interest inventory, publication status, single- vs. multi-site data collection, and how the study participants were recruited. Gender and age did not moderate the size of the differences.

Chapter 4: Study 2

Method

Literature Search Procedures

To obtain published studies for the meta-analyses of cognitive ability and vocational interests, I searched various electronic databases (i.e., PsycINFO, JSTOR, Sociofile, ABI-Inform Complete, Ebsco Host) for terms denoting cognitive ability (i.e., *cognitive ability, intelligence, g, spatial ability, verbal ability, math ability, grades*) and vocational interests. I also did a search for the name of each vocational interest inventory (see Table 1 for list of all vocational interest inventories).

In order to obtain unpublished studies and technical reports, I used various search methods. I searched Proquest Dissertations and Theses using the above terms in order to obtain dissertations. In addition, I did a search in the Defense Technical Information Center database (www.dtic.mil) in order to locate any research conducted by the U.S. Department of Defense. Lastly, I searched the conference programs for the Society for Industrial/Organizational Psychology and Academy of Management conferences from the past fifteen years. Twenty-one studies met the inclusion criteria (described below). Because some of the studies included multiple samples, the number of samples (k=25) is larger than the number of studies. The study results are based on a total of 41,505 participants and 140 effect sizes.

Inclusion Criteria and Coding

I was interested in identifying primary studies that could be used to examine the relationship between cognitive ability and vocational interests. As in Study 1, data with samples from all age ranges and institutions (e.g., primary/secondary schools, colleges/universities, organizations) and time collection periods were considered. In addition, studies were only included if the vocational

interest measure assessed Holland's vocational interest types (or used a framework similar to Holland's model) and were excluded if not (e.g., Bennett, Seashore, & Wesman, 1959). Studies also needed to have been written in the English language, and were excluded if not (e.g., Latorre, Postigo, 1991). In addition, data must have been gathered at the individual level as opposed to the group level.

Furthermore, studies needed to involve the relationship between vocational interests and general cognitive ability. Similar to other meta-analyses involving cognitive ability (e.g., Roth et al., 2001), if a study only included correlations (or other appropriate statistics) denoting the relationship between vocational interests and specific abilities (e.g., Ackerman, Kanfer, & Goff, 1995), then composite correlations were calculated with each vocational interest type using all of the available specific ability information from the sample.

Primary studies must also have reported correlations between cognitive ability and vocational interests, or statistics that could be converted into correlations (e.g., R^2, *t*-value, etc.), and if not were excluded (e.g., Blackman, 1983). Lastly, only independent samples were included in the meta-analyses. Some studies (e.g., Foley, 2004) included correlations between vocational interests and two separate measures of cognitive ability with the same sample. In these cases, I only included correlations with the ability measure that had the highest reliability.

To ensure reliability of the meta-analytic codes, Rong Su independently coded a random subset of 22% of the studies. There was 90% agreement between the initial coding and the second, independent codings. Discrepancies were discussed and resolved.

Analytic Procedures

Random-effects meta-analyses of the correlations between vocational interests and cognitive ability were conducted using Hunter and Schmidt's (2004) procedures. The correlations were

corrected for sampling error and reliability attenuation in both the vocational interest inventory and the cognitive ability measure (see Table 23 for the reliabilities of the vocational interest inventories and cognitive ability measures used in the studies). Ninety-five percent confidence intervals and middle 80% credibility values were also calculated for the corrected correlations.

Composite correlations between each vocational interest type and general cognitive ability were calculated using Nunnally's (1978, pp. 163-168) formula for constructing a composite correlation:

$$r_{composite} = \frac{k\bar{r}_{ability\,interests}}{\sqrt{k + k(k-1)\bar{r}_{ability\,intercorrelations}}}, (4)$$

where k = the number of ability components being composited across, $\bar{r}_{ability\,interests}$ = the average of the correlations between the specific cognitive abilities and the vocational interest type, and $\bar{r}_{ability\,intercorrelations}$ = average of the intercorrelations among the specific abilities. To estimate the reliabilities of the composited correlations, the Spearman Brown prophecy formula was used (Crocker & Algina, 1986, pp. 119):

$$\rho_{CC'} = \frac{k\rho_{ii'}}{1 + (k-1)\rho_{ii'}}, (5)$$

where k = the number of components in the composite and $\rho_{ii'}$ = the average reliability of the components. Only four studies (i.e., Ackerman, Kanfer, & Goff, 1995; Kanfer, Ackerman, & Heggestad, 1996[5]; Randahl, 1991; Rolfus & Ackeraman, 1996[6]) required composite reliabilities to be computed.

[5] For Kanfer et al. (1996), I had to assume that the ACT English and ACT Reading Comprehension tests were the measures of verbal ability, as these were the only tests listed that appeared to assess verbal ability. Therefore, I included the reliabilities of these two tests when computing the composite reliability for that study.

In some primary studies, *g* was derived through factor analysis where all of the specific factors loaded onto it, and the *g* factor correlation with each vocational interest type was reported (e.g., Carson, 1998; Reeve & Heggestad, 2004). In cases like this, the reliability was estimated to be 1 (in other words, latent factor correlations are already corrected for unreliability attenuation).

Results and Discussion

Competing Hypothesis 3 stated that cognitive ability would either be positively correlated with realistic, investigative, and artistic interests and unrelated to social, enterprising, and conventional interests; or be positively correlated with investigative, artistic, and social interests, and unrelated to realistic, enterprising, and conventional interests. As shown in Table 24, investigative ($\bar{r}$ =.34, r_c =.41, *k*=21; 95% CI did not contain zero), artistic ($\bar{r}$ =.21, r_c =.25, *k*=19; 95% CI did not contain zero), and social ($\bar{r}$ =.19, r_c =.23, *k*=19; 95% CI did not contain zero) interests have sizeable correlations with cognitive ability. Enterprising interests also have a significant correlation with vocational interests ($\bar{r}$ =.05, r_c =.06, *k*=19; 95% CI did not contain zero), which was unpredicted. On the other hand, realistic ($\bar{r}$ =.01, r_c =.01, *k*=19) and conventional ($\bar{r}$ =-.04, r_c =-.05, *k*=19) interests were not correlated with cognitive ability. Aside from the enterprising-ability correlation, only small amounts of variance were accounted for by unreliability in the cognitive ability and vocational interest measures. The standard deviations for the corrected correlations suggest that moderators may be present, however the small number of available primary studies prevented meaningful moderator groups from being formed and compared.

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[6] Ackerman and Heggestad (1997) provided the correlations between vocational interests and specific cognitive abilities that were not directly reported in Kanfer et al. (1996) and Rolfus and Ackerman (1996).

Two very large primary study samples (*N*s= 16,010 and 20,443; from Reeve and Heggestad, 2004) accounted for a substantial number of the participants across the studies. As such, Table 25 also presents the meta-analytic correlations between vocational interests and cognitive ability without the Reeve and Heggestad (2004) results. These samples came from the Project Talent database, a large-scale longitudinal research study conducted from the 1960s through the 1980s. When these samples were removed, the results of the meta-analyses changed notably, with only investigative interests having a substantial correlation with cognitive ability ($\bar{r}$ =.19, r_c =.22, *k*=19; 95% CI did not contain zero). The correlation between cognitive ability and conventional interests ($\bar{r}$ =-.04, r_c =-.05, *k*=17; 95% CI did not contain zero), however, remained the same. In contrast, the correlation between cognitive ability and social interests changed directions ($\bar{r}$ =-.06, r_c =-.07, *k*=17; 95% CI did not contain zero).

Overall, these results show that cognitive ability has the strongest relationship with investigative interests and is substantially correlated with artistic and social interests as well. There is also a small positive correlation between cognitive ability and enterprising interests. The extent to which cognitive ability was related to artistic and social interests changed based on the inclusion of Reeve and Heggestad (2004). However, the ages and characteristics of the Project Talent sample are consistent with the ages and characteristics of studies used in other meta-analyses involving cognitive ability (e.g., Roth et al., 2001; Berry, Clark, & McClure, 2011). Therefore, the results from Table 18 will be used as inputs in Study 3, where the relationships between race and both vocational interests and cognitive ability will be used to estimate adverse impact potential.

Chapter 5: Study 3

Method

Procedures

In the above sections, I have meta-analyzed two types of relationships: (a) relationships between race and vocational interests, and (b) relationships between cognitive ability and vocational interests. The question remains, how do these two types of parameters combine to affect adverse impact?

In order to answer this question (i.e., in order to determine the effect of vocational interests on adverse impact), I used formulas derived to explain indirect range restriction under a variety of selection ratios (see Newman & Cottrell, 2013). Indirect range restriction can occur when a third variable *z* influences selection outcomes due to its relationship with the selection predictor and performance criterion (Sackett & Yang, 2000). In this case, I was interested in the extent to which each vocational interest type (*z*) influenced the characteristics of the applicant pool (i.e., recruiting outcomes, represented as subgroup differences *d* in the predictor variable) across various *application ratios* (i.e., the percentage of the population applying for the job). The application ratio represents the extent to which individuals in the population with certain interests apply to jobs that are characteristic of their interests. For example, at an application ratio of .10 (i.e., 10% of the population is applying to the job), only individuals in the population who occupy the top 10% in terms of their conventional interests will apply to conventional jobs, and only individuals in the top 10% in terms of their enterprising interests are applying to enterprising jobs, etc. If the application ratio is .50, then the top 50% of individuals with conventional interests are applying to conventional jobs. If the application ratio is .99, then

individuals are generally applying to conventional jobs regardless whether they have conventional interests or not.

In particular, Newman and Cottrell (2013) have adapted the indirect range restriction formula for Thorndike's Case 3 (Sackett & Yang, 2000; Thorndike, 1949) by combining it with Dobsen's (1988) formula for the variance of a truncated normal distribution (see Schmidt, Hunter, & Urry, 1976) and the standard formula for the ordinate (height) of a normal curve, to yield the following equations (Newman & Cottrell, 2013):

(6)

$$r_{race,X\,(population)} = \frac{r_{race,X\,(applicants)} + r_{race,\text{int}\,erests}\, r_{X,\text{int}\,erests}\,(1/u^2 - 1)}{\sqrt{(1/u^2 - 1)r^2_{race,\text{int}\,erests} + 1}\sqrt{(1/u^2 - 1)r^2_{X,\text{int}\,erests} + 1}}$$

(7)

and

$$u^2 = 1 + c_{x_z} / p_c \sqrt{2\pi e^{c^2}} - (1/ p_c^2\, 2\pi e^{c^2})$$

where

u^2 = the variance ratio = variance of interests in the applicant pool divided by variance of interests in the population of potential applicants, which is a direct function of the application ratio,

p_c = the application ratio (i.e., the ratio of applicants to the number of potential applicants in the population),

and

c_{x_z} = the application cut score on z, which is a direct function of the application ratio.

Also, the standardized subgroup difference on the predictor (e.g., $d_{race,X}$, the Black-White test score difference) is a function of the correlation between race and the predictor X (and vice versa).

(8)

$$d_{race,X} = r_{race,X} \Big/ \sqrt{(1 - r_{race,X}^2)[p_B(1 - p_B)]}$$

(9)

$$r_{race,X} = d_{race,X} \Big/ \sqrt{d_{race,X}^2 + 1/p_B(1 - p_B)}$$

where p_B is the proportion of Black individuals = number of Black individuals divided by the total number of Black individuals plus White individuals.

By rearranging the first equation above, we get:

(10)

$$r_{race,X(applicants)} = r_{race,X(population)} \sqrt{(1/u^2 - 1)r_{race,\text{int } erests}^2 + 1} \sqrt{(1/u^2 - 1)r_{X,\text{int } erests}^2 + 1} - \frac{r_{race,\text{int } erests} r_{X,\text{int } erests}(1/u^2 - 1)}{\sqrt{(1/u^2 - 1)r_{race,\text{int } erests}^2 + 1} \sqrt{(1/u^2 - 1)r_{X,\text{int } erests}^2 + 1}}$$

In other words, it is possible to estimate what the subgroup *d* values for the predictor variables will be in the applicant pool (i.e., estimate adverse impact potential), as a function of the interest types that a job attracts. For example, if a job attracts investigative applicants, would we expect greater or lesser adverse impact against African American applicants? Solving for $r_{race,X(applicants)}$ (and converting it to an effect size, *d*) allows the subgroup differences between Black and White applicants on predictor X to be estimated within each type of job (e.g., realistic job, investigative job, etc.).

In addition to examining what the Black-White differences in cognitive ability would be within the applicant pools for jobs of each interest type, I also separately calculated the Black-

White applicant effect sizes (*d*) for a personality predictor (conscientiousness) as well as for a selection composite of cognitive ability and conscientiousness together.

Cognitive ability predictor input values

In solving the equations for the applicant subgroup *d* values on cognitive ability (X) for each interest job, for the current illustration I used the Black-White effect sizes for differences in each vocational interest type from the Strong interest inventory (see Table 10; realistic *d*=.27, investigative *d*=.21, artistic *d*=.05, social *d*=-.35, enterprising *d*=-.27, conventional *d*=-.30). For the Black-White difference on cognitive ability in the population, I used the $d_{race,X}$ =1.0, consistent with Roth et al. (2001). For this illustration, the proportion of the population that is Black was 10% (p_B =. 10). The application ratios (p_c) were .1, .2, .3, .4, .5, .6, .7, .8, .9, and .99. Values for the correlation between cognitive ability and vocational interests were taken from Table 18 (realistic: *r*=.01, investigative: *r* =.41, artistic: *r* =.25, social: *r* =.23, enterprising: *r* =.06, conventional: *r* =-.05).

Conscientiousness predictor input values

In solving the equations for the applicant subgroup *d* values on conscientiousness (X) for each interest job type, I used the same Black-White effect sizes on vocational interests, p_B, and p_c values described above. For the Black-White difference on cognitive ability in the population, I used the $d_{race,X}$ = -.07 value reported in Foldes et al. (2008), and converted it to an $r_{race,X}$ of -.02. The values for the meta-analytic correlations between conscientiousness and vocational interests were available from Mount et al. (2005; realistic: *r* =.05, investigative: *r* =.09, artistic: *r* =-.06, social: *r* =.07, enterprising: *r* =.08, conventional: *r* =.19).

Composite predictor input values

To calculate the applicant subgroup *d* values on the *composite* predictor X (cognitive ability plus conscientiousness) for each interest job type, I used the same Black-White effect sizes (*d*) on vocational interests, p_B, and p_c values described above. For the value of Black-White differences on the composite in the population, I calculated a composite effect size *d* using the formula from Sackett and Ellingson (1997)[7] based on the aforementioned values reported in Roth et al. (2001) and Foldes et al. (2008). The calculated composite effect size was $d_{race,X}$ = .67, which was converted to a $r_{race,X}$ of .20 using Equation 9. The values for the correlation between vocational interests and the composite predictor were calculated using Nunnally's (1978) formula described in Study 2. The cognitive ability and vocational interests correlations came from the results of Study 2, and the conscientiousness and vocational interests correlations came from Mount et al. (2005). The correlations between the composite (cognitive ability plus conscientiousness) and each interest type are as follows: realistic: *r* =.04, investigative: *r* =.36, artistic: *r* =.14, social: *r* =.22, enterprising: *r* =.10, conventional: *r* =.10).

Results and Discussion

Cognitive ability predictor

The outcome of the adverse equations described above is the Black-White subgroup *d* value in the applicant pool, as a function of: (a) the vocational interests represented in the job to which individuals are applying, (b) the population Black-White difference in vocational interests, and (c) the correlation of the selection test with the vocational interests.

[7] The formula for determining the degree of group differences present when two or more predictors are combined to form a composite are found in Sackett and Ellingson (1997).

A graph of the applicant pool Black-White subgroup differences in cognitive ability for each interest type job at each application ratio is shown in Figure 9. Owing to the larger Black-White differences on cognitive ability, the subgroup differences on cognitive ability in the applicant pool across the application ratios are large as well. However, there is some variation in the differences based on the job type. As the application ratio decreases, (i.e., as the decision to apply becomes more and more truncated on the corresponding vocational interest continuum), the expected Black-White *d* in the applicant pool can either increase (e.g., for social jobs) or decrease (e.g., for conventional jobs). Specifically, when the application ratio is .1 (i.e., the 10% of the population that has the most conventional interests decides to apply for the job), then subgroup differences (applicant pool Black-White *d*-values) for cognitive ability are smallest (*d*=.77). Applicant pool Black-White *d*-values are somewhat larger for realistic jobs (*d*=1.04), and markedly larger for enterprising (*d*=1.30), artistic (*d*=1.51), investigative (*d*=1.51), and social (*d*=2.15) jobs. On the other hand, as the application ratios increase (i.e., the decision to apply becomes less based upon interests), then applicant pool subgroup differences return closer to the population effect size (Black-White *d*=1.0).

Conscientiousness predictor.

A graph for the applicant pool Black-White subgroup differences in conscientiousness is shown in Figure 10. Because of the smaller subgroup differences on conscientiousness in the population, and the more modest relationship between conscientiousness and vocational interests (except conventional interests), the subgroup differences across the application ratios are smaller as well. When the application ratio is .1, Whites applying to conventional jobs tend to have higher conscientiousness scores than African Americans (*d*=.16), while African Americans applying to realistic and investigative jobs have higher conscientiousness scores than Whites

(*d*s=-.16 and -.19, respectively). The applicant pool effect sizes for artistic, social, and enterprising interests are closer to zero (*d*s=-.04, .05, and .03, respectively). On the other hand, when the application ratios are higher, subgroup differences across the job types converge closer to the population effect size (*d*=-.07).

Composite predictor

Figure 11 demonstrates the Black-White subgroup differences of the applicant pool on the composite predictor (cognitive ability + conscientiousness) across each vocational interest job type. The effect size (Black-White difference in the applicant pool) for the composite score is smaller than the effect size for cognitive ability alone, but still larger in magnitude. When the application ratio is .1, subgroup differences are smaller for realistic jobs (*d*=.69), and larger for investigative (*d*=.85), artistic (*d*=.84), conventional (*d*=1.03), and social (*d*=1.44) jobs. On the other hand, when the application ratios are higher, subgroup differences return closer to the population effect size (*d*=.67).

Overall, these Figures 9, 10, and 11 demonstrate that the size of applicant pool subgroup differences on the predictor variable (i.e., adverse impact potential) can be influenced by other vocational interests. These effects are a direct function of (a) the application ratio, (b) race differences in vocational interests, and (c) relationships between vocational interests and the selection predictor (e.g., cognitive ability).

Chapter 6: General Discussion

This research had the goal of incorporating vocational interests into the study of adverse impact. This effort thus sought to place a focus on the applicant pool (Murphy et al., 1995) or supply side perspective of the selection pipeline (Figure 1). In particular, an understanding of how vocational interests influence adverse impact can provide insight into identifying factors that explain how individuals end up applying for jobs in the first place (Outtz & Newman, 2009). This is necessary, as methods of reducing adverse impact that focused on altering aspects of the selection system have not been successful (Ployhart & Holtz, 2008). In connecting vocational interests and adverse impact, it was necessary to meta-analyze Black-White differences in vocational interests and the relationships between cognitive ability and vocational interests. Next, the results of the original meta-analyses involving race, cognitive ability, and vocational interests (along with published meta-analytic effects relating vocational interests to conscientiousness) were used to support a mathematical demonstration that applicant pool subgroup differences in predictor variables (i.e., Black-White *d*-values on cognitive ability, conscientiousness, and the composite) are a nonlinear function of the vocational interest personalities that are attracted by a given job type (Figures 9, 10, and 11). See Table 26 for a summary of findings.

Black-White Differences in Vocational Interests

Previous research on race differences in vocational interests (Carter & Swanson, 1990; Armstrong et al., 2010) suggested that African Americans would have stronger social, enterprising, and conventional interests, while Whites would have stronger realistic, investigative, and artistic interests. Across all the studies, this pattern of results was partially supported. Whites had stronger realistic and investigative interests, and slightly stronger artistic

interests. Blacks on the other hand only demonstrated moderately stronger social interests. However, when the studies were broken down into various moderator groups, there were some results that were more consistent with both hypotheses. In particular, individuals born in the 1940s and 1950s, individuals who were adults when they completed the interest inventories, individuals with at least some college education, and individuals who took a version of the Strong interest inventories showed a pattern where Blacks had stronger social, enterprising, and conventional interests, and Whites had stronger realistic and investigative interests. Samples published in dissertations and samples that came from the college campuses of the researcher also showed this same pattern. Differences in realistic and investigative interests generally were consistent in direction and magnitude across the moderator categories, with Whites having moderately larger interests than Blacks. On the other hand, differences in artistic, social, enterprising, and conventional interests varied greatly depending on the breakdown of the moderator group.

The investigation of birth cohort as a moderator of Black-White differences in interests is important, as the theoretical explanation for why differences would occur was based on the idea that children observe the representation of those in their immediate environment and in media representation of their racial group and have occupational aspirations stemming from that (Hughes & Bigler, 2007). This suggests that the types of jobs held by one generation influence the interests and occupational aspirations of the next generation. The results from each range of cohorts were distinct, with the hypothesized pattern of results emerging among those born in the 1940s and 1950s, Whites having stronger interests across all interest types among those born in the 1960s, and no differences being observed among those born in the 1970s-1990s. These findings would be more conclusive if based on longitudinal studies tracking mean-level changes

in interests across specific time periods. However, there are societal changes that occurred within these decades that could account for the observed differences across decades. For example, shifts in awareness and the moral sense of the American public during the Civil Rights Movement and Vietnam War resulted in demands for governmental institutions to address racial, gender, and class inequalities (Caldwell-Colbert, Parks, & Eshun, 2009). The results of a comparison of the occupational aspirations of Blacks and Whites born between 1942 and 1954 suggested that increases in the prestige of the occupational aspirations of Blacks occurred concurrently with the Civil Rights Movement (and the Women's Movement as well for Black women; Shu & Marini, 2008). This could account for some of the directional changes in Black-White differences between those born in the 1960s and 1970s-1990s, as messages reflecting the increase in occupational aspirations could have been passed down to younger generations, leading to the lack of differences among those born between the 1970s and 1990s. More studies examining differences among Blacks and Whites born in the 1980s and 1990s are needed to gain a better picture of the current workforce.

Gender did not influence the size of the Black-White differences in vocational interests. Generally, there were similarities in the direction and magnitude of the Black-White differences between males and females. Though some research previously demonstrated that the amount of salary, levels of authority, and training requirements of jobs differed across race by gender categories (e.g., Mintz & Krymkowski, 2010), the differences in interests observed in this study were not reflective of those power and privilege factors. However, there were marked differences in the magnitude and direction of the effect sizes across the different vocational interest inventories. As mentioned previously, there are differences among the inventories in terms of how vocational interests are assessed. For example, the Vocational Preference Inventory

(which showed no Black-White differences across the interest types) involves having a person indicate which vocations are appealing from a list of 84 occupations (Holland, 1997). On the other hand, on the Self-Directed Search (which showed Blacks as having stronger interests across all types except for investigative), the respondent indicates their occupational interest in various ways, including ratings of activity preferences, occupations, and competencies (Holland, 1997). Perhaps the differences across inventories, as well as the extent to which the inventories were revised to remove sex differences, accounts for the different patterns of results.

Black-White differences in vocational interests also appeared to be influenced by the developmental stages of the sample as well. The finding that Whites in junior high and high school had stronger interests of all types than Blacks may be explained by factors that disadvantage some African American youth as they prepare for the workforce. For example, there are larger proportions of African American children who attend schools with lower resources than Whites (34% vs. 4%; U.S. Department of Education, 2008). This also suggests that more occupational awareness interventions should be implemented with African American youth (Hughes & Bigler, 2007). On the other hand, racial differences in interests were shown among samples at later developmental stages. With individuals in college, Black-White differences in social and enterprising interests disappeared, and Blacks had stronger conventional interests. Among the adult samples (and also shown for samples with at least some amount of college education), Blacks had stronger social, enterprising, and conventional interests. Generally, individuals have shown increases in investigative, artistic, social, and enterprising interests between adolescence and young adulthood (Low, 2009). In adulthood, interests are also more stable than they are at earlier points in life (Low et al., 2005). This suggests that exposure

to jobs, increases in work experience, and higher amounts of education may influence interests in certain types of jobs among African Americans.

Cognitive Ability and Vocational Interests

There were competing sets of hypotheses that predicted different patterns of relationships between cognitive ability and vocational interests. Cognitive ability was either expected to have a positive relationship with only realistic, investigative, and artistic interests, or to have a positive relationship with only investigative, artistic, and social interests. Results showed that cognitive ability is most strongly related to having investigative interests, substantially related to having artistic and social interests, and very slightly positively correlated with having enterprising interests. Given the large amount of research supporting the relationship between cognitive abilities and realistic, investigative, and artistic interests (and no relationship between cognitive abilities and social, enterprising, and conventional interests; Armstrong et al., 2008; Ackerman & Heggestad, 1997), it is surprising that no relationship between realistic interests and cognitive ability was observed. Specifically, math knowledge, visual and spatial abilities, and numerical abilities were consistently found in the realistic interest space among both Ackerman and Heggestad's (1997) trait complexes and Armstrong et al.'s (2008) Atlas of Individual Differences. There were no ability areas that fit into the social interest spaces within either set of individual difference structures. Therefore, it is surprising that a relationship was found between social interests and cognitive ability as well.

Instead, the findings for the cognitive ability meta-analyses are more consistent with the predictions made using the occupational aptitude map (Gottfredson, 1986). Specifically, investigative, artistic, and social occupations are higher in cognitive complexity and require higher levels of cognitive ability to perform them, and enterprising jobs involve a broader range

of job complexities (i.e., enterprising jobs can require both low and high ability depending on the job). This suggests that those with higher levels of ability are more interested in performing the work activities characteristic of the many types of investigative, social, and artistic occupations. These findings also confirm the gravitational hypothesis, where individuals choose occupations that reflect their cognitive ability levels (McCormick et al., 1979).

Implications of Vocational Interests for Adverse Impact

In Study 3, the results of the previous two sets of meta-analyses were used in order to investigate whether Black-White differences in the simulated applicant pool existed for cognitive ability, conscientiousness, and a cognitive ability-conscientiousness composite variable. All of the results were based on an indirect range restriction formula (Newman & Cottrell, 2013) that calculated applicant pool subgroup differences based on: (a) the relationships between the predictor variables and vocational interests, population level subgroup differences on (b) the predictor and (c) each vocational interest type, (d) the proportion of African Americans in the applicant pool, and (e) the application ratio. In cases where individuals with certain interests applied to an interest-type job (assuming that at a 10% applicant ratio, individuals are applying to jobs that match their interests), the applicant subgroup differences can increase or decrease based on the type of job. For conventional jobs, Black-White subgroup differences on cognitive ability were smaller; while for social jobs, Black-White subgroup differences were much larger. Although African Americans have stronger interests towards both of these jobs, the size of the predictor subgroup differences in the applicant pool were influenced by the extent to which the interest type is related to cognitive ability; social interests are positively correlated with cognitive ability, while conventional interests are not.

With conscientiousness as the predictor variable, the size and direction of the subgroup differences seemed to be more influenced by the extent to which members of the subgroup were likely to be interested in the job. This is mainly because the Black-White differences in conscientiousness are closer to zero. Therefore, higher conscientiousness was observed among Whites when applying for conventional jobs, and higher conscientiousness was observed among Blacks when applying for realistic and investigative jobs. Lastly, with the cognitive ability-conscientiousness composite predictor, subgroup differences on the predictor were lowered, but still in favor of Whites. However, the job type that yielded the lowest subgroup differences on the composite was realistic, an interest type that African Americans are least likely to be interested in and that has negligible relationships with cognitive ability and conscientiousness. On the other hand, the subgroup differences for the social job showed the same pattern as it did for subgroup differences in cognitive ability.

While the results of this study only estimated subgroup differences in the predictor as opposed to adverse impact ratios, it is important to remember that adverse impact is a function of the subgroup differences in the applicant pool and the selection ratio (see Newman, Jacobs, & Bartram, 2007). Specifically, as the subgroup differences in the predictor increase, and the selection ratio decreases, the more likely the adverse impact ratio is to fall below .8 (4/5ths rule). As I am only considering the applicant pool characteristics (before the selection ratio is considered), only subgroup differences in applicant predictor scores can be presented. However, these differences do foreshadow what could be expected in terms of adverse impact ratios. Unfortunately, for both the cognitive ability predictor and the composite predictor, the adverse impact ratios would still likely be well below .8 (meaning that adverse impact would be present, according to the four-fifths rule). However, this study did succeed in demonstrating that

applicant pool subgroup differences can vary based on the job type. This is an important issue to examine, as adverse impact has typically been studied without specific job contexts in mind (Outtz & Newman, 2010). Particularly, these results suggest that when cognitive ability tests are used as the sole predictor, adverse impact will be lower in conventional jobs. In addition, when a cognitive ability-conscientiousness composite is used as a predictor, adverse impact will be lower in realistic jobs.

Practical Implications

The subgroup differences at the .1 application ratio represent a special case where only individuals who have a high level of interests for the particular job are applying. This exact situation may be unlikely in the real world, however it can be influenced by the extent to which targeted recruiting is used to increase the number of applicants who have certain vocational interests. Newman and Lyon (2009) found that the likelihood of applying to jobs among African Americans with desired job-related characteristics could be influenced by targeted recruitment messages. In addition, Newman et al. (in press) demonstrated how targeting recruitment efforts towards attracting minority applicants with high job qualifications can reduce adverse impact with no cost to job performance—in comparison to not recruiting for minorities, or recruiting just on demographic membership alone. To a certain extent, the results of Study 3 represent whether recruiting for jobs based on the vocational interests desired for the job can influence the subgroup *d* values on the predictor variable in the applicant pool (which can influence the extent to which adverse impact is present in the selection system). Specifically, among some types of jobs, applicant subgroup differences (*d*) were greater than the population effect size (*d*; e.g., social jobs); and for some types of jobs, applicant subgroup differences were smaller than the population effect size for the predictor (e.g., conventional jobs). Therefore, recruiting on

conventional interests may be helpful for reducing adverse impact or increasing diversity in those sorts of jobs (e.g., accountants, administrative assistants, etc.). Recruiting on vocational interests for appropriate jobs would also be beneficial beyond reducing the subgroup differences, because the extent to which the interests of the person are congruent with the vocational interests of the job (i.e., the congruence index) is correlated with task performance, organizational citizenship behavior, and persistence (Nye, Su, Rounds, & Drasgow, 2012).

Limitations and Directions for Future Research

The studies presented here have various limitations. While evidence for Black-White differences in vocational interests was presented, the design of Study 1 did not allow for conclusions to be drawn regarding whether racialized occupational schemata, race based occupational stereotypes and biases, and meta-awareness of race-based stereotypes and biases actually led to these differences. In addition, variables such as racial differences in occupational representation, perceptions of career barriers, and self-efficacy were also thought to influence the presence of race differences in interests; but their effects could not be confirmed meta-analytically either. More research is needed in order to uncover *why* race differences in vocational interests exist; as opposed to simply demonstrating that the differences exist. It is also important to note that there is variation within individual members of each racial group on vocational interests. The effect sizes reported here represent averages at the group level.

For both sets of meta-analyses, the limited number of studies that investigated the variables of interest did not allow for extensive moderator testing to be completed. For example, in the meta-analysis of Black-White differences in interests, socioeconomic status (SES) was a moderator variable that may have influenced the size of the differences (Trusty, Ng, & Plata, 2000). However, there were only a handful of studies that reported results separated by SES, so

this analysis was not possible at this time. In comparing Black-White differences across the interests by inventory type, there were unequal numbers of samples across each inventory, with an overrepresentation of versions of the Strong interest inventories. The small number of some of the inventories (e.g., the UNIACT) resulted in an "Other" category being formed. In this case, differences among all of the inventories were unable to be determined. For the cognitive ability-vocational interest meta-analysis, there were not enough studies to form moderator groups that would allow for accurate conclusions to be drawn within each level of the moderator group.

Study 3 also had various limitations as well. There are very few jobs that represent only one vocational interest type. Most jobs represent two to three different interest types (O*NET Online provides the vocational interest types and rankings for most occupations at www.onetonline.org). The same goes for individuals—most people have interests in more than one vocational interest type (Holland, 1997).

Future research is needed in order to assess the measurement equivalence of multiple racial groups on the interest inventories (Armstrong & Rounds, 2008). It is also necessary to understand the cultural factors that may lead to differential responding on the vocational interest inventory items (see Fouad & Walker, 2005). Similarly. It is important that Hughes and Bigler's (2007) full model be tested in order to determine the effects of various race-related constructs on occupational aspirations. Because individuals often have varying levels of each vocational interest type (as opposed to belonging to one type in particular), it would also be useful to meta-analyze vocational interest profiles across racial groups. The extent of group differences in interests among other racial groups (e.g., Latinos, Asians) is also an unanswered question. In particular the values resulting from an exploration of Latino-White differences in vocational interests could also be used to examine subgroup differences with the goal of understanding

adverse impact against Latinos. Continuing research on targeted recruiting in order to understand how to influence characteristics of the applicant pool is also important to consider. An examination of whether individuals can be recruited on vocational interests and work values, and whether these variables influence characteristics of the applicant pool would be the next logical step. The implications of targeted recruiting for single versus multistage selection systems would also be valuable to understand. Finally, it is important to connect the results of targeted recruiting interventions to actual selection decisions so that actual adverse impact ratios can be calculated and considered, enabling a more complete test of the selection pipeline shown in Figure 1.

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Tables

Table 1

List of Vocational Interest Inventories Used in Literature Search and Reliabilities of Vocational Interest Inventories Used in Study 1 Meta-Analyses

Inventories Used in Studies Included in the Meta-analyses		
Name of Vocational Interest Inventory	Reliabilities of measures	Source of Reliabilities
Strong Interest Inventory	R-.86, I-.87, A-.89, S-.85, E-.80, C-.83	Harmon, Hansen, Borgan, Hammer (1994)
	R-.86, I-.87, A-.89, S-.85, E-.80, C-.83	Donnay, Morris, Schaubhut, & Thompson (2005)
Strong-Campbell Interest Inventory	R-.86, I-.87, A-.86, S-.85, E-.80, C-.83	Hansen & Campbell (1985)
Self-Directed Search	R-.92, I-.92, A-.92, S-.92, E-.92, C-.93	Holland (1979)
Vocational Preference Inventory	R-.92, I-.87, A-.88, S-.83, E-.80, C-.85	Holland (1977)
UNIACT-R Interest Inventory	R-.86, I-.91, A-.88, S-.85, E-.85, C-.90	American College Testing Program (1995)
O*NET Interest Profiler	R-.93, I-.94, A-.94, S-.95, E-.93, C-.96	U.S. Dept. of Labor (2000)
Ohio Vocational Interest Survey	R-.90, I-.90, A-.90, S-.90, E-.90, C-.90	Winefordner (1983)
Mapping Vocational Challenges	R-.74, I-.74, A-.67, S-.75	Turner & Lapan (2002)
Interest Finder	R-.93, I-95, A-.94, S-.94, E-.95, C-.96	Wall, Wise & Baker (1996)

Inventories Searched For But Not Used By Studies in the Meta-analyses		
Career Decision Making System	World of Work Inventory	USES Interest Inventory
Career Interest Inventory	ACT Vocational Interest Profile	MDS Vocational Interest Exploration System
Career Occupational Preference System	Kuder Career Search with Person Match	Reading-Free Vocational Interest Inventory
Gordon Occupational Check List	Harrington-O'Shea Career Decision-Making System	Career Assessment Inventory
Guildford-Zimmerman Interest Inventory	California Occupational Preference System Interest Inventory	Kuder Preference Record

Table 1 continued

Interest Determination, Exploration, and Assessment System	Career Occupational Preference System Interest Inventory	Kuder General Interest Scale
Jackson Vocational Interest Survey	Occupational Aptitude Survey and Interest Schedule	Kuder Occupational Interests Scale
Vocational Interest Inventory	Wide Range Interest and Occupation Test	Kuder Career Search

Table 2

Overall Meta-Analytic Estimates of Black-White Differences in Vocational Interests

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic	49	10,347	72,081	**.23**	**.25**	.16	11.78	.21, .29	.05, .45
Investigative	52	9,729	72,137	**.21**	**.23**	.21	7.25	.17, .28	-.04, .49
Artistic	49	10,347	72,081	**.09**	**.09**	.24	5.18	.03, .16	-.21, .40
Social	48	9,969	71,454	**-.13**	**-.14**	.40	1.99	-.25, -.02	-.65, .38
Enterprising	50	9,633	71,545	-.06	-.06	.39	2.43	-.16, .05	-.55, .44
Conventional	50	10,292	71,985	-.07	-.07	.41	2.00	-.18, .04	-.60, .45

Note. *k* = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 3

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Gender

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*	*z*
Realistic										
Male	20	3,260	27,883	**.18**	**.19**	.14	15.42	.13, .25	.01, .37	
Female	19	4,570	28,965	**.27**	**.29**	.38	2.11	.12, .46	-.20, .77	-1.85
Investigative										
Male	20	2,587	27,883	**.17**	**.18**	.27	4.48	.06, .30	-.16, .53	
Female	22	4,625	29,021	**.25**	**.27**	.36	2.84	.12, .42	-.17, .71	-1.64
Artistic										
Male	20	3,260	27,883	.04	.04	.32	3.20	-.10, .18	-.36, .45	
Female	19	4,570	28,965	**.11**	**.11**	.18	8.44	.03, .19	-.12, .34	-1.02
Social										
Male	19	2,882	27,256	-.12	-.12	.54	1.16	-.36, .12	-.81, .57	
Female	19	4,570	28,965	-.11	-.11	.35	2.51	-.27, .05	-.56, .34	-.11
Enterprising										
Male	20	3,260	27,883	-.03	-.02	.47	1.72	-.23, .18	-.62, .57	
Female	25	5,663	42,245	-.08	-.08	.49	1.32	-.27, .11	-.71, .54	.48
Conventional										
Male	20	3,260	27,883	-.07	-.07	.47	1.63	-.27, .13	-.66, .53	
Female	22	4,625	29,021	.05	.06	.76	.62	-.26, .37	-.91, 1.02	-1.67

Note. k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively; z = the significance of the difference between the corrected correlations in each moderator group (if the observed z is $\leq$ -1.96 or $\geq$ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 4

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Birth Cohort

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic									
1940s-1950s	4	947	37,431	**.23**	**.25**	.06	15.06	.19, .31	.18, .32
1960s	15	3,242	15,884	**.26**	**.27**	.22	7.47	.16, .39	-.01, .56
1970s-1980s	8	3,718	4,273	.10	.11	.15	20.48	.00, .21	-.08, .30
Investigative									
1940s-1950s	4	947	37,431	**.18**	**.20**^{ab}	.09	6.75	.11, .28	.08, .31
1960s	15	3,242	15,884	**.37**	**.39**^{ac}	.28	4.95	.25, .53	.04, .75
1970s-1980s	8	3,718	4,273	.01	.01^{bc}	.15	18.80	-.09, .11	-.18, .20
Artistic									
1940s-1950s	4	947	37,431	-.02	-.03^{a}	.12	3.79	-.14, .09	-.17, .12
1960s	15	3,242	15,884	**.32**	**.34**^{ab}	.27	5.16	.21, .48	.00, .69
1970s-1980s	8	3,718	4,273	.00	.00^{b}	.16	17.33	-.11, .11	-.21, .20
Social									
1940s-1950s	4	947	37,431	**-.38**	**-.41**^{ab}	.06	14.03	-.47, -.35	-.49, -.33
1960s	14	3,160	15,584	**.42**	**.45**^{ac}	.37	2.71	.26, .64	-.02, .91
1970s-1980s	8	3,718	4,273	-.01	-.01^{bc}	.22	10.16	-.18, .14	-.30, .27
Enterprising									
1940s-1950s	4	947	37,431	**-.27**	**-.30**^{ab}	.03	45.86	-.33, -.27	-.34, -.26
1960s	15	3,242	15,884	**.47**	**.51**^{ac}	.29	4.41	.36, .65	.13, .88
1970s-1980s	8	3,718	4,273	.10	.11^{bc}	.29	6.20	-.10, .31	-.27, .48
Conventional									
1940s-1950s	4	947	37,431	**-.24**	**-.27**^{ab}	.08	8.18	-.35, -.19	-.37, -.16
1960s	15	3,242	15,884	**.47**	**.50**^{ac}	.38	2.63	.31, .69	.02, .99
1970s-1980s	8	3,718	4,273	.05	.05^{bc}	.34	4.27	-.18, .29	-.38, .49

Note. The moderator categories (i.e., 1940s-1950s, 1960s, and 1970s-1980s) represent the range of birth years of the participants in each sample; *k* = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the

Table 4 Continued

corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the *z* statistics indicated in the table below). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 5

Calculated z values for the Birth Cohort Moderator Categories

Cohort	Cohort	*z*
Realistic		
1940s-1950s	1960s	-.45
1940s-1950s	1970s-1990s	1.54
1960s	1970s-1990s	1.66
Investigative		
1940s-1950s	1960s	-4.23*
1940s-1950s	1970s-1990s	2.17*
1960s	1970s-1990s	4.17*
Artistic		
1940s-1950s	1960s	-7.97*
1940s-1950s	1970s-1990s	.25
1960s	1970s-1990s	3.93*
Social		
1940s-1950s	1960s	-24.89*
1940s-1950s	1970s-1990s	-3.47*
1960s	1970s-1990s	5.43*
Enterprising		
1940s-1950s	1960s	-22.96*
1940s-1950s	1970s-1990s	-2.75*
1960s	1970s-1990s	5.17*
Conventional		
1940s-1950s	1960s	-21.38*
1940s-1950s	1970s-1990s	-2.63*
1960s	1970s-1990s	5.51*

Note. z = the significance of the difference between the corrected correlations in each moderator group (if the observed *z* is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). *z* values that are greater than 1.96 or less than -1.96 have asterisks.

Table 6

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Developmental Stage at Which Inventory Was Administered

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic									
Junior/HS	11	4,323	13,101	**.20**	**.22**	.20	7.34	.10, .34	-.04, .48
College	19	2,693	12,235	**.31**	**.33**	.14	23.95	.27, .39	.16, .51
Adult	10	1,495	42,209	**.24**	**.26**	.08	15.76	.21, .30	.16, .35
Investigative									
Junior/HS	11	4,323	13,101	**.32**	**.33**[a]	.32	3.00	.14, .52	-.08, .74
College	19	2,693	12,235	**.24**	**.25**	.17	16.65	.17, .33	.03, .47
Adult	13	1,550	42,265	**.19**	**.20**[a]	.12	9.67	.14, .26	.05, .35
Artistic									
Junior/HS	11	4,323	13,101	**.22**	**.24**[a]	.31	3.17	.05, .24	-.16, .64
College	19	2,693	12,235	**.15**	**.16**[b]	.25	8.34	.04, .27	-.17, .48
Adult	10	1,495	42,209	-.01	-.01[ab]	.15	4.87	-.10, .08	-.19, .18
Social									
Junior/HS	11	4,323	13,101	**.39**	**.42**[ab]	.35	2.55	.21, .62	-.03, .86
College	18	2,611	11,935	-.09	-.10[ac]	.27	7.38	-.22, .03	-.44, .25
Adult	10	1,495	42,209	**-.37**	**-.41**[bc]	.07	20.41	-.44, -.37	-.49, -.32
Enterprising									
Junior/HS	9	3,554	12,509	**.47**	**.50**[ab]	.28	3.57	.32, .68	.14, .85
College	19	2,693	12,235	-.09	-.09[ac]	.30	6.65	-.23, .04	-.47, .29
Adult	13	1,550	42,265	**-.27**	**-.31**[bc]	.06	30.11	-.34, -.27	-.38, -.23
Conventional									
Junior/HS	9	4,213	12,949	**.48**	**.51**[ab]	.31	2.83	.31, .70	.12, .89
College	19	2,693	12,235	**-.20**	**-.21**[a]	.42	3.48	-.39, -.02	-.73, .32
Adult	13	1,550	42,265	**-.26**	**-.29**[b]	.10	12.67	-.34, -.23	-.42, -.16

Note. The "Junior/HS" moderator category includes study participants who were in Junior High School or High School (i.e., 7th-12th grade); the "College" moderator category includes study participants who are in two- or four-year colleges/universities; the "Adult" moderator category includes study participants who are employed adults; *k* = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-

Table 6 Continued

weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the *z* statistics indicated in the table below). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 7

Calculated z values for the Developmental Stage Moderator Categories

Developmental Stage	Developmental Stage	*z*
Realistic		
Junior/HS	College	-.74
Junior/HS	Adult	-.26
College	Adult	1.51
Investigative		
Junior/HS	College	1.23
Junior/HS	Adult	2.69*
College	Adult	.83
Artistic		
Junior/HS	College	1.00
Junior/HS	Adult	4.44*
College	Adult	2.29*
Social		
Junior/HS	College	6.52*
Junior/HS	Adult	21.85*
College	Adult	4.07*
Enterprising		
Junior/HS	College	7.24*
Junior/HS	Adult	21.11*
College	Adult	2.65*
Conventional		
Junior/HS	College	10.97*
Junior/HS	Adult	21.25*
College	Adult	1.25

Note. z = the significance of the difference between the corrected correlations in each moderator group (if the observed *z* is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). *z* values that are greater than 1.96 or less than -1.96 have asterisks.

Table 8

Weighted Least Squares Multiple Regression Results for Testing Age as a Moderator of Black-White Differences in Vocational Interests

Variable	*k*	N_B	N_W	β_{age}	*SE* (β_{age})	*95% CI*	Q_R	Q_E	*df*
Realistic	43	8,573	59,010	.001	.002	-.004, .006	.61	356.55	2, 41
Investigative	46	7,955	59,066	-.005	.002	-.010, -.000	14.90	446.87	2, 44
Artistic	43	8,573	59,010	-.007	.003	-.012, -.002	26.35	491.57	2, 41
Social	42	8,195	59,383	-.024	.003	-.030, -.018	286.49	641.81	2, 40
Enterprising	44	7,859	58,474	-.024	.003	-.029, -.019	288.88	589.99	2, 42
Conventional	44	8,518	58,914	-.024	.003	-.030, -.018	288.19	800.23	2, 42

Note. k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; *SE* (β_{age}) = the standard error of β_{age}; *95% CI* = lower and upper bounds of the 95% confidence interval around β_{age}; Q_R = test statistic for determining whether the regression coefficients for the intercept and age in predicting d_c are simultaneously zero (i.e., $\beta_1 = \beta_{age} = 0$); Q_E = test statistic for determining model specification; *df* = degrees of freedom (Q_R, Q_E); see Hedges & Olkin (1985). The Q_R statistic must be greater than the χ^2(df) value at the 95 percentage point in order to be significant, while the Q_E statistic must be less than the the χ^2(df) value at the 95 percentage point in order to be significant.

Table 9

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Reported Education Level

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*	*z*
Realistic										
Less than college	19	4,672	13,453	**.19**	**.21**	.21	13.24	.11, .30	-.06, .48	
Some college	25	4,686	51,021	**.26**	**.28**	.11	17.27	.24, .32	.14, .42	-1.33
Investigative										
Less than college	19	4,672	13,453	**.30**	**.31**[a]	.33	4.60	.16, .46	-.11, .74	
Some college	21	4,241	50,349	**.20**	**.22**[a]	.11	15.52	.17, .26	.08, .35	2.07
Artistic										
Less than college	19	4,672	13,453	**.20**	**.21**[a]	.34	4.60	.06, .37	-.22, .65	
Some college	21	4,241	50,349	.03	.03[a]	.18	5.53	-.05, .11	-.21, .67	2.80
Social										
Less than college	19	4,672	13,453	**.35**	**.38**[a]	.39	3.54	.20, .56	-.12, .88	
Some college	20	4,159	50,049	**-.30**	**-.33**[a]	.20	4.87	-.41, -.24	-.58, -.06	19.22
Enterprising										
Less than college	17	3,903	12,861	**.43**	**.46**[a]	.33	4.48	.30, .62	.03, .89	
Some college	21	4,241	50,349	**-.22**	**-.24**[a]	.18	6.36	-.32, -.16	-.48, -.01	10.25
Conventional										
Less than college	17	4,562	13,301	**.44**	**.46**[a]	.37	3.38	.29, .64	-.01, .94	
Some college	21	4,241	50,349	**-.23**	**-.26**[a]	.23	4.00	-.35, -.16	-.55, .04	20.07

Note. The "less than college" moderator category includes samples where the participants have less than a college education (i.e., high school diploma and less than high school education); the "some college" moderator category indicates that the participants in the samples had at least some years of college education (i.e., participants with some college education, college degrees, and some graduate school education); *k* = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for

Table 9 Continued

sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively; *z* = the significance of the difference between the corrected correlations in each moderator group (if the observed *z* is $\leq$ -1.96 or $\geq$ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the calculated *z* statistics). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 10

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Vocational Interest Inventory

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic									
Strong	23	4,837	53,332	**.25**	**.27**[ab]	.12	13.68	.22, .32	.12, .42
SDS	9	426	2,801	.01	.01[ac]	.23	20.44	-.14, .16	-.29, .31
VPI	6	412	318	**-.20**	**-.22**[bd]	.25	49.70	-.42, -.02	-.54, .10
OVIS	4	1,440	11,582	**.30**	**.32**	.08	20.87	.24, .40	.22, .42
UNIACT	2	2,745	2,454	.04	.04	.09	32.45	-.08, .16	-.07, .15
MVC	2	2,855	2,606	.02	.02	.16	14.50	-.14, .17	-.19, .22
IP	2	264	620	**.33**	**.34**	.00	--	.00, .00	.00, .00
IF	1	113	822	**.21**	**.21**	.00	--	.00, .00	.00, .00
Investigative									
Strong	23	4,164	53,332	**.20**	**.21**	.13	11.93	.16, .26	.05, .37
SDS	14	510	2,880	-.02	-.02[a]	.23	29.54	-.14, .10	-.31, .27
VPI	4	383	295	-.02	-.02	.08	93.37	-.10, .05	-.12, .08
OVIS	4	1,440	11,582	**.49**	**.52**	.15	6.10	.37, .67	.32, .72
UNIACT	2	2,745	2,454	.00	.00	.12	11.63	-.16, .17	-.15, .16
MVC	2	2,855	2,606	-.01	-.01	.16	13.14	-.17, .14	-.21, .19
IP	2	264	620	**.06**	**.06**	.00	--	.00, .00	.00, .00
IF	1	113	822	**-.01**	**-.01**	.00	--	.00, .00	.00, .00
Artistic									
Strong	23	4,837	53,332	.04	.05[a]	.18	6.09	-.03, .12	-.18, .27
SDS	9	426	2,801	.01	.01[b]	.26	16.78	-.16, .18	-.33, .34
VPI	6	412	318	**-.15**	**-.16**[c]	.00	115.79	-.16, -.16	-.16, -.16
OVIS	4	1,440	11,582	**.35**	**.37**	.25	2.38	.13, .62	.05, .69
UNIACT	2	2,745	2,454	-.01	-.01	.04	66.54	-.06, .05	-.06, .04
MVC	2	2,855	2,606	-.05	-.05	.22	8.41	-.26, .17	-.32, .23
IP	2	264	620	**.44**	**.46**	.00	--	.00, .00	.00, .00
IF	1	113	822	**-.13**	**-.14**	.00	--	.00, .00	.00, .00
Social									
Strong	22	4,459	52,705	**-.32**	**-.35**[ab]	.13	10.92	-.40, -.29	-.52, -.18
SDS	9	426	2,801	-.07	-.08[acd]	.27	15.77	-.25, .10	-.42, .27
VPI	6	412	318	**-.42**	**-.46**[ce]	.22	55.69	-.63, -.29	-.74, -.19
OVIS	4	1,440	11,582	**.57**	**.60**	.24	2.52	.36, .84	.29, .91
UNIACT	2	2,745	2,454	**.12**	**.13**	.00	--	.00, .00	.00, .00
MVC	2	2,855	2,606	**-.69**	**-.80**	.00	--	.00, .00	.00, .00
IP	2	264	620	**.71**	**.72**	.00	--	.00, .00	.00, .00
IF	1	113	822	**-.13**	**-.13**	.00	--	.00, .00	.00, .00
Enterprising									
Strong	23	4,837	53,332	**-.24**	**-.27**[a]	.10	19.82	-.31, -.22	-.40, -.13
SDS	12	481	2,857	-.02	-.02[b]	.46	7.72	-.28, .23	-.61, .56

Table 10 Continued

VPI	6	412	318	**-.26**	**-.29**[c]	.09	101.98	-.37, -.22	-.41, -.17
OVIS	4	1,440	11,582	**.58**	**.62**	.17	4.86	.45, .79	.39, .84
UNIACT	2	2,745	2,454	**.26**	**.28**	.06	41.81	.19, .37	.21, .37
IP	2	264	620	**.85**	**.88**	.00	--	.00, .00	.00, .00
IF	1	113	822	**-.13**	**-.13**	.00	--	.00, .00	.00, .00
Conventional									
Strong	23	4,837	53,332	**-.27**	**-.30**[ab]	.12	14.05	-.35, -.25	-.45, -.15
SDS	12	481	2,857	.01	.01[acd]	.39	10.61	-.21, .23	-.48, .50
VPI	6	412	318	**-.48**	**-.52**[ce]	.00	234.25	-.52, -.52	-.52, -.52
OVIS	4	1,440	11,582	**.67**	**.71**	.04	51.51	.67, .75	.66, .76
UNIACT	2	2,745	2,454	**.27**	**.28**	.05	45.22	.21, .35	.22, .34
IP	2	264	620	**.52**	**.53**	.00	--	.00, .00	.00, .00
IF	1	113	822	**-.18**	**-.18**	.00	--	.00, .00	.00, .00

Note. The "Strong" moderator category includes samples from studies using any version of the Strong Interest Inventory; the "SDS" moderator category includes samples from studies using the Self-Directed Search Interest Inventory; the "VPI" moderator category includes samples from studies using the Vocational Preference Inventory; the "OVIS" moderator category includes samples using the Ohio Vocational Interest Inventory; the "UNIACT" moderator category includes samples using the UNIACT Interest Inventory; the "MVC" moderator category includes samples using the Mapping Vocational Challenges Interest Inventory; the "IP" moderator category includes samples using the Interest Profiler; the "IF" moderator category includes samples using the Interest Finder; k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect

Table 10 Continued

size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the *z* statistics indicated in the table below). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 11

Calculated z values for the Vocational Interest Inventory Moderator Categories

Inventory Name	Inventory Name	*z*
Realistic		
Strong	Self-Directed Search	2.31*
Strong	Vocational Preference Inv.	2.65*
Strong	Other Inventory	.71
Self-Directed Search	Vocational Preference Inv.	1.06
Self-Directed Search	Other Inventories	-1.94
Vocational Preference Inv.	Other Inventories	-2.43*
Investigative		
Strong	Self-Directed Search	1.62
Strong	Vocational Preference Inv.	1.37
Strong	Other Inventory	-1.86
Self-Directed Search	Vocational Preference Inv.	.03
Self-Directed Search	Other Inventories	-2.23*
Vocational Preference Inv.	Other Inventories	-1.88
Artistic		
Strong	Self-Directed Search	.32
Strong	Vocational Preference Inv.	1.07
Strong	Other Inventory	-.36
Self-Directed Search	Vocational Preference Inv.	.76
Self-Directed Search	Other Inventories	-1.98*
Vocational Preference Inv.	Other Inventories	-2.10*
Social		
Strong	Self-Directed Search	-2.43*
Strong	Vocational Preference Inv.	.78
Strong	Other Inventory	-22.87*
Self-Directed Search	Vocational Preference Inv.	2.16*
Self-Directed Search	Other Inventories	-4.51*
Vocational Preference Inv.	Other Inventories	-6.37*
Enterprising		
Strong	Self-Directed Search	-1.88
Strong	Vocational Preference Inv.	.15
Strong	Other Inventory	-21.51*
Self-Directed Search	Vocational Preference Inv.	1.26
Self-Directed Search	Other Inventories	-4.15*
Vocational Preference Inv.	Other Inventories	-4.60*
Conventional		
Strong	Self-Directed Search	-2.41*
Strong	Vocational Preference Inv.	1.67
Strong	Other Inventory	-25.78*
Self-Directed Search	Vocational Preference Inv.	2.95*
Self-Directed Search	Other Inventories	-4.08*

Table 11 Continued

Vocational Preference Inv.	Other Inventories	-8.32*

Note. z = the significance of the difference between the corrected correlations in each moderator group (if the observed z is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). z values that are greater than 1.96 or less than -1.96 have asterisks.

Table 12

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Publication Status

Variable	*k*	N_B	N_W	D	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic									
Journal article	28	4,466	53,395	**.25**	**.27**	.12	17.14	.23, .31	.12, .42
Dissertation	10	843	1673	**.24**	**.26**	.30	19.15	.07, .45	-.12, .65
Inv. Manual	11	5,038	17,013	**.18**	**.19**	.20	6.99	.08, .31	-.06, .45
Investigative									
Journal article	31	4,521	53,451	**.19**	**.20**[a]	.14	13.97	.15, .25	.03, .38
Dissertation	10	677	1673	**.21**	**.22**	.19	19.15	.10, .33	-.03, .46
Inv. Manual	11	5,038	17,013	**.28**	**.30**[a]	.30	2.64	.12, .48	-.09, .68
Artistic									
Journal article	28	4,466	53,395	.03	.03 [a]	.18	7.60	-.04, .09	-.20, .26
Dissertation	10	843	1673	.09	.09	.46	8.65	-.19, .38	-.50, .68
Inv. Manual	11	5,038	17,013	**.24**	**.25** [a]	.26	3.69	.10, .41	-.08, .59
Social									
Journal article	28	4,466	53,395	**-.33**	**-.36** [a]	.12	17.53	-.40, -.32	-.51, -.21
Dissertation	9	701	1313	**-.30**	**-.32**[b]	.15	50.05	-.42, -.22	-.51, -.13
Inv. Manual	11	5,038	17,013	**.41**	**.44** [ab]	.30	3.00	.26, .61	.05, .82
Enterprising									
Journal article	29	4,411	53,299	**-.25**	**-.28**[a]	.07	39.73	-.31, -.25	-.37, -.18
Dissertation	10	843	1673	**-.24**	**-.28**[b]	.35	19.15	-.49, -.06	-.72, .18
Inv. Manual	11	4,379	16,573	**.49**	**.52**[ab]	.22	4.93	.39, .65	.23, .81
Conventional									
Journal article	29	4,411	53,299	**-.27**	**-.30**[ab]	.10	24.90	-.34, -.26	-.43, -.18
Dissertation	10	843	1673	**-.53**	**-.57**[ac]	.00	19.15	-.57, -.57	-.57, -.57
Inv. Manual	11	5,038	17,013	**.51**	**.54**[bc]	.21	5.29	.42, .67	.27, .81

Note. The "journal article" moderator category includes samples from studies that were published in peer-reviewed journals; the "dissertation" moderator category includes samples from studies that were dissertations; the "inv. manual" moderator category includes samples from vocational interests inventory manuals; k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-

Table 12 Continued

weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the *z* statistics indicated in the table below). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 13

Calculated z values for the Publication Status Moderator Categories

Publication Type	Publication Type	*z*
Realistic		
Dissertation	Journal	-.07
Dissertation	Inventory Manual	.55
Journal	Inventory Manual	1.48
Investigative		
Dissertation	Journal	.13
Dissertation	Inventory Manual	-.63
Journal	Inventory Manual	-1.98
Artistic		
Dissertation	Journal	.45
Dissertation	Inventory Manual	-1.17
Journal	Inventory Manual	-3.68*
Social		
Dissertation	Journal	.37
Dissertation	Inventory Manual	-6.68*
Journal	Inventory Manual	-24.46*
Enterprising		
Dissertation	Journal	.04
Dissertation	Inventory Manual	-6.93*
Journal	Inventory Manual	-22.89*
Conventional		
Dissertation	Journal	-3.96*
Dissertation	Inventory Manual	-16.96*
Journal	Inventory Manual	-25.72*

Note. z = the significance of the difference between the corrected correlations in each moderator group (if the observed *z* is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). *z* values that are greater than 1.96 or less than -1.96 have asterisks.

Table 14

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Single-Site vs. Multiple-Site Data Collection

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*	*z*
Realistic										
Multi-site	19	8,403	68,881	**.23**	**.25**	.12	7.86	.19, .31	.09, .41	
Single-site	30	1,944	3,200	**.23**	**.25**	.40	17.17	.11, .40	-.26, .76	-.05
Investigative										
Multi-site	19	7,739	68,881	**.22**	**.23**	.18	3.66	.15, .32	-.00, .47	
Single-site	33	1,999	3,256	.11	.12	.41	17.04	-.02, .25	-.41, .64	.81
Artistic										
Multi-site	19	8,403	68,881	.09	.10	.05	2.83	.00, .19	-.17, .36	
Single-site	30	1,944	3,200	.02	.03	.50	10.91	-.15, .21	-.62, .67	.43
Social										
Multi-site	19	8,107	68,554	-.12	-.12 [a]	.40	.81	-.30, .06	-.64, .39	
Single-site	29	1,862	2,900	-.31	-.34 [a]	.25	39.54	-.42, .25	-.64, -.03	2.92
Enterprising										
Multi-site	19	7,744	68,441	-.05	-.04 [a]	.38	.98	-.22, .13	-.54, .45	
Single-site	31	1,889	3,104	-.26	-.28 [a]	.32	21.96	-.40, .17	-.70, .13	2.32
Conventional										
Multi-site	19	8,403	68,881	-.05	-.04 [a]	.41	.82	-.23, .14	-.56, .48	
Single-site	31	1,889	3,104	-.44	-.48 [a]	.21	35.90	-.55 .40	-.74, -.21	5.41

Note. The "Multi-site" moderator category includes samples where the participants were from a sample that came from more than one research location; the "Single-site" moderator category includes samples where the participants were from a sample collected from one research location; k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively; z = the significance of the

Table 14 Continued

difference between the corrected correlations in each moderator group (if the observed *z* is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the calculated *z* statistics). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 15

Meta-Analytic Estimates of Black-White Differences in Vocational Interests by Recruitment Source

Variable	*k*	N_B	N_W	d	d_c	SD_{dc}	*% VE*	*95% CI*	*80% CV*
Realistic									
Publisher	19	8,403	68,881	**.23**	**.25**	.12	7.86	.19, .31	.09, .41
School	10	827	1,828	.20	.21	.41	11.04	-.02, .48	-.29, .75
Campus	12	813	1,003	**.39**	**.42**	.33	26.62	.23, .60	-.00, .83
Other	8	304	369	-.07	-.08	.31	44.41	-.29, .14	-.47, .32
Investigative									
Publisher	19	7,739	68,881	**.22**	**.23**[a]	.18	3.66	.15, .32	-.00, .47
School	10	827	1,828	.05	.05	.39	11.57	-.19, .29	-.45, .55
Campus	12	813	1,003	**.34**	**.36**[b]	.26	36.72	.22, .51	.03, .69
Other	11	345	425	-.23	-.24[ab]	.41	32.69	-.47, .00	-.75, .28
Artistic									
Publisher	19	8,403	68,881	**.09**	**.10**[a]	.21	2.83	.00, .19	-.17, .36
School	10	827	1,828	-.00	.01[b]	.57	5.89	-.34, .36	-.72, .73
Campus	12	813	1,003	**.22**	**.23**[c]	.34	23.86	.04, .42	-.20, .66
Other	8	304	369	**-.43**	**-.44**[abc]	.17	71.57	-.58, -.38	-.68, -.24
Social									
Publisher	19	8,107	68,554	-.12	-.12[a]	.40	.81	-.30, .06	-.64, .39
School	9	745	1,528	**-.23**	**-.24**[b]	.19	40.89	-.36, -.12	-.48, .00
Campus	12	813	1,003	**-.32**	**-.34**	.21	48.55	-.46, -.22	-.66, -.07
Other	8	304	369	**-.60**	**-.64**[ab]	.20	68.56	-.78, -.50	-.90, -.38
Enterprising									
Publisher	19	7,744	68,441	-.05	-.04[ab]	.38	.98	-.21, .13	-.53, .45
School	8	717	1,676	**-.24**	**-.27**[ac]	.36	9.05	-.52, -.02	-.74, .20
Campus	12	813	1,003	**-.15**	**-.16**[d]	.12	84.66	-.24, -.09	-.32, -.01
Other	11	359	425	**-.55**	**-.59**[bcd]	.31	48.76	-.78, -.41	-.99, -.19
Conventional									
Publisher	19	8,403	68,881	-.05	-.04[abc]	.41	.82	-.22, .14	-.56, .48
School	8	717	1,676	**-.51**	**-.54**[a]	.13	21.71	-.64, -.45	-.71, -.37
Campus	12	813	1,003	**-.29**	**-.31**[bd]	.15	69.14	-.40, -.23	-.51, -.12
Other	11	359	425	**-.60**	**-.63**[cd]	.25	62.34	-.78, -.49	-.95, -.32

Note. The "Publisher" moderator category includes study participants who were recruited for participation in the study by the test publisher; the "School" moderator category includes study participants who attended primary/secondary schools that the research identified as a research site; the "Campus" moderator category includes study participants who were students at the researcher's college/university campus; the "Other" moderator category includes study

Table 15 Continued

participants who were selected for participation in the study through any other method; k = number of samples; N_B = number of Black participants in all samples; N_W = number of White participants in all samples; d = mean sample size-weighted effect size; $d = \frac{\bar{x}_{White} - \bar{x}_{Black}}{s_{Pooled}}$; d_c = mean sample size-weighted effect size corrected for sampling error and unreliability in vocational interest measure; SD_{dc} = sample size-weighted standard deviations of d_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean effect size; *80% CV* = 10% and 90% credibility values for the distribution of δ, respectively. Superscripts in the d_c column that are the same letter indicate that the correlations significantly differ (based on the *z* statistics indicated in the table below). Significant effect sizes are presented in boldface. Effect sizes that are negative indicate that Blacks have higher scores.

Table 16

Calculated z values for Recruitment Source Moderator Categories

Recruitment Source	Recruitment Source	*z*
Realistic		
Publisher	School	.19
Publisher	Campus	-1.69
Publisher	Researcher	1.40
School	Campus	-.84
School	Researcher	1.18
Campus	Researcher	1.73
Investigative		
Publisher	School	1.34
Publisher	Campus	-.32
Publisher	Researcher	2.25*
School	Campus	-1.40
School	Researcher	1.17
Campus	Researcher	2.28*
Artistic		
Publisher	School	.70
Publisher	Campus	-.94
Publisher	Researcher	3.77*
School	Campus	-1.20
School	Researcher	2.30*
Campus	Researcher	3.43*
Social		
Publisher	School	.98
Publisher	Campus	1.83
Publisher	Researcher	4.67*
School	Campus	.61
School	Researcher	2.45*
Campus	Researcher	1.82
Enterprising		
Publisher	School	2.04*
Publisher	Campus	.75
Publisher	Researcher	5.11*
School	Campus	-.54
School	Researcher	2.10*
Campus	Researcher	2.17*
Conventional		
Publisher	School	6.57*
Publisher	Campus	2.10*
Publisher	Researcher	6.02*
School	Campus	-1.57
School	Researcher	.72

Table 16 Continued

College	Adult	1.97*

Note. z = the significance of the difference between the corrected correlations in each moderator group (if the observed z is ≤ -1.96 or ≥ 1.96, the observed corrected correlations are significantly different from each other; see Raju & Brand, 2003). z values that are greater than 1.96 or less than -1.96 have asterisks.

Table 17

Parameter Estimates for Moderator Variables in Predicting Corrected Realistic Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	-.39
Male	.34
Female	.48*
1940s-1950s Birth Cohort	-.18
1960s Birth Cohort	.02
1970s-1980s Birth Cohort	.13
Junior/High School Developmental Stage	.03
College Developmental Stage	-.09
Adult Developmental Stage	-.37
Less than College Education Level	-.42
Some College or Greater Education Level	-.23
Strong Interest Inventory	-.08
Self-Directed Search	-.26
Vocational Preference Inventory	-.74*
Ohio Vocational Interest Schedule	.42
Other Vocational Interest Inventories	.00
Journal Publication Status	.86*
Dissertation Publication Status	.94*
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.23
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	-.24
Campus Recruitment Source	.04
Other Recruitment Source	.00

Note. $k = 46$. $R^2 = .67$. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 18

Parameter Estimates for Moderator Variables in Predicting Corrected Investigative Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	-.88
Male	.20
Female	.29
1940s-1950s Birth Cohort	.35
1960s Birth Cohort	.20
1970s-1980s Birth Cohort	.01
Junior/High School Developmental Stage	.26
College Developmental Stage	.54
Adult Developmental Stage	-.06
Less than College Education Level	-.15
Some College or Greater Education Level	-.57
Strong Interest Inventory	.15
Self-Directed Search	-.07
Vocational Preference Inventory	-.04
Ohio Vocational Interest Schedule	.38
Other Vocational Interest Inventories	.00
Journal Publication Status	.53
Dissertation Publication Status	.60
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.48
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	.00
Campus Recruitment Source	.22
Other Recruitment Source	.00

Note. $k = 45$. R^2=.66. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 19

Parameter Estimates for Moderator Variables in Predicting Corrected Artistic Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	-.57
Male	.71*
Female	.65*
1940s-1950s Birth Cohort	.96
1960s Birth Cohort	.16
1970s-1980s Birth Cohort	.22
Junior/High School Developmental Stage	.77
College Developmental Stage	1.17
Adult Developmental Stage	-.61
Less than College Education Level	-1.25
Some College or Greater Education Level	-1.76*
Strong Interest Inventory	.37
Self-Directed Search	-.13
Vocational Preference Inventory	-.06
Ohio Vocational Interest Schedule	.48
Other Vocational Interest Inventories	.00
Journal Publication Status	.83*
Dissertation Publication Status	.81
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.13
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	-.43
Campus Recruitment Source	-.50
Other Recruitment Source	.00

Note. $k = 45$. R^2=.54. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 20

Parameter Estimates for Moderator Variables in Predicting Corrected Social Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	.37
Male	.15
Female	.05
1940s-1950s Birth Cohort	.79
1960s Birth Cohort	.09
1970s-1980s Birth Cohort	-.46
Junior/High School Developmental Stage	.25
College Developmental Stage	.86
Adult Developmental Stage	-.26
Less than College Education Level	-.16
Some College or Greater Education Level	-.95
Strong Interest Inventory	-.25
Self-Directed Search	-.37
Vocational Preference Inventory	-.50
Ohio Vocational Interest Schedule	-.06
Other Vocational Interest Inventories	.00
Journal Publication Status	-.25
Dissertation Publication Status	.04
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.06
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	-.38
Campus Recruitment Source	-.37
Other Recruitment Source	.00

Note. $k = 44$. R^2=.88. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 21

Parameter Estimates for Moderator Variables in Predicting Corrected Enterprising Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	.22
Male	-.15
Female	-.15
1940s-1950s Birth Cohort	.51
1960s Birth Cohort	.42*
1970s-1980s Birth Cohort	-.72*
Junior/High School Developmental Stage	-.01
College Developmental Stage	.66
Adult Developmental Stage	.20
Less than College Education Level	.54
Some College or Greater Education Level	-.34
Strong Interest Inventory	-.67*
Self-Directed Search	-.64*
Vocational Preference Inventory	-.53
Ohio Vocational Interest Schedule	-.76*
Other Vocational Interest Inventories	.00
Journal Publication Status	-.45
Dissertation Publication Status	-.44
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.39
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	.29
Campus Recruitment Source	.21
Other Recruitment Source	.00

Note. $k = 43$. R^2=.90. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 22

Parameter Estimates for Moderator Variables in Predicting Corrected Conventional Effect Sizes with Weighted Least Squares Regression

Predictors	Regression Coefficient
Intercept	.39
Male	-.08
Female	-.03
1940s-1950s Birth Cohort	.32
1960s Birth Cohort	.03
1970s-1980s Birth Cohort	-.34
Junior/High School Developmental Stage	.06
College Developmental Stage	.18
Adult Developmental Stage	.00
Less than College Education Level	.03
Some College or Greater Education Level	-.16
Strong Interest Inventory	-.38*
Self-Directed Search	-.28*
Vocational Preference Inventory	-.29
Ohio Vocational Interest Schedule	.08
Other Vocational Interest Inventories	.00
Journal Publication Status	-.57*
Dissertation Publication Status	-.79*
Publisher Manual Publication Status	.00
Multi-Site Data Collection	.18
Single-Site Data Collection	.00
Publisher Recruitment Source	.00
School Recruitment Source	.16
Campus Recruitment Source	.31
Other Recruitment Source	.00

Note. $k = 43$. R^2=.97. The meta-analytic effect sizes were corrected for unreliability and sampling error. The regression coefficients are unstandardized and represent the model regressing the corrected correlations onto the dummy variables for each category of each moderator variable. Age is excluded as a moderator because it is continuous and has missing data.

*$p < .05$

Table 23

Reliabilities of Vocational Interests and Cognitive Ability Measures Used in Study 2 Meta-Analyses

Name of Measure	Reliabilities of measures	Source of Reliabilities
	Vocational Interests Inventories	
Self-Directed Search-Revised	R-.92, I-.92, A-.92, S-.92, E-.92, C-.92	Holland (1979)
Self-Directed Search	R-.88, I-.89, A-.90, S-.88, E-.89, C-.88	Lokan (1988)
Harrington-O'Shea Career Decision Making System	R-.93, I-.93, A-.93, S-.93, E-.93, C-.93	Harrington & O'Shea (1981)
AIST General Interest Structure Test	R-.87, I-.87, A-.87, S-.87, E-.87, C-.87	Bergmann & Eder (2005)
Project TALENT Interest Inventory	R-.88, I-.9, A-.9, S-.87, E-.89, C-.88	Flanagan (1972)
Strong Vocational Interest Blank	R-.82, I-.78, A-.87, S-.82, E-.8, C-.79	Campbell (1971)
Work Preference Survey	R-.9, I-.86, A-.86, S-.85, E-.82, C-.81	Van Iddekinge et al. (2011)
Strong Interest Inventory	R-.86, I-.87, A-.89, S-.85, E-.80, C-.83	Harmon, Hansen, Borgan, Hammer (1994)
UNIACT Unisex Interest Inventory	R-.86, I-.91, A-.88, S-.85, E-.85, C-.90	American College Testing Program (1995)
O*NET Interest Profiler	R-.93, I-.94, A-.94, S-.95, E-.93, C-.96	U.S. Dept. of Labor (2000)
ACT Assessment	R-.93, I-.93, A-.93, S-.93, E-.93, C-.93	American College Testing Program (1981)
Interest Finder	R-.93, I-.95, A-.94, S-.94, E-.95, C-.96	Wall, Wise & Baker (1996)
	Cognitive Ability Measures	
Ball Aptitude Battery	General ability factor*	The Ball Foundation (1995)
Wechsler Adult Intelligence Scale-Revised	Total score: .97	Weschler (1981)
PL-PQ	General abilities: .92	Acer (1981)
Woodcock-Johnson Third Edition	General abilities: .98	Woodcock, Mather, & McGrew (2001)
Intelligence Structure Analysis	General intelligence: .97	ITB & Gittler (2004)
Project TALENT Ability Battery	General ability factor*	Flanagan (1972)
Aptitude Assessment Battery	Composite: .98	Ackerman & Kanfer (1993)

Table 23 Continued

Wonderlic Personnel Test	General intelligence: .87	Wonderlic Personnel Test (1992)
General Aptitude Test Battery	Composite: .99	Buckner (1962)
Occupational Aptitude Survey and Interest Schedule	General ability: .90	Parker (1991)
ACT	Composite: .85	American College Testing Program (1973)
Armed Forces Vocational Aptitude Battery	Overall (AFQT): .92	Welsh, Kucinkas, & Curran (1990)

Note. When a general ability factor was created from other specific abilities, the reliability of the cognitive ability measure was estimated to be 1. If a range of reliability values was indicated, then the highest reliability in the range was used in correcting for reliability attenuation.

Table 24

Overall Meta-Analytic Estimates of the Relationship Between Cognitive Ability and Vocational Interests

Variable	*k*	*N*	r	r_c	SD_{rc}	*% VE*	*95% CI*	*80% CV*
Realistic	19	40,438	.01	.01	.14	3.45	-.06, .09	-.16, .19
Investigative	21	40,878	**.34**	**.41**	.10	5.68	.36, .46	.28, .53
Artistic	19	40,483	**.21**	**.25**	.09	6.28	.20, .30	.13, .37
Social	19	40,483	**.19**	**.23**	.11	4.90	.17, .29	.09 .37
Enterprising	19	40,483	**.05**	**.06**	.04	25.54	.04, .09	.00, .12
Conventional	19	40,483	-.04	-.05	.09	7.30	-.09, .00	-.16, .07

Note. *k* = number of samples; *N* = number of participants in all samples; r =mean sample size-weighted correlation; r_c = mean sample size-weighted correlation corrected for sampling error and unreliability in vocational interest measure and cognitive ability measure; SD_{rc} = sample size-weighted standard deviations of r_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean correlation; *80% CV* = 10% and 90% credibility values for the distribution of ρ, respectively. Significant correlations are presented in boldface.

Table 25

Overall Meta-Analytic Estimates of the Relationship Between Cognitive Ability and Vocational Interests Excluding Reeve and Heggestad (2004)

Variable	*k*	*N*	r	r_c	SD_{rc}	*% VE*	*95% CI*	*80% CV*
Realistic	17	3,985	.04	.04	.14	23.43	-.04, .12	-.14, .22
Investigative	19	4,425	**.19**	**.22**	.08	47.35	.18, .26	.12, .32
Artistic	17	4,030	.04	.05	.07	51.11	.00, .09	-.05, .14
Social	17	4,030	**-.06**	**-.07**	.08	57.14	-.11, -.04	-.16, .01
Enterprising	17	4,030	-.04	-.05	.09	44.79	-.10, .00	-.16, .06
Conventional	17	4,030	**-.04**	**-.04**	.07	56.95	-.08, -.01	-.13, .04

Note. *k* = number of samples; *N* = number of participants in all samples; r =mean sample size-weighted correlation; r_c = mean sample size-weighted correlation corrected for sampling error and unreliability in vocational interest measure and cognitive ability measure; SD_{rc} = sample size-weighted standard deviations of r_c; *%VE* = percent of variance attributed to sampling error and unreliability; *95% CI* = lower and upper bounds of the 95% confidence interval around the corrected mean correlation; *80% CV* = 10% and 90% credibility values for the distribution of ρ, respectively. Significant correlations are presented in boldface.

Table 26

Summary of Findings for Studies 1, 2, and 3

Study 1 Findings
1. Across all studies, Whites have stronger realistic, investigative, and artistic interests than African Americans. 2. Across all studies, African Americans have slightly larger social interests. 3. Among those who took one of the versions of the Strong interest inventories, Whites had stronger realistic and investigative interests, while African Americans had stronger social, enterprising, and conventional interests. 4. Cohort, developmental stage, education level, interest inventory, publication status, and recruitment source moderated the size of Black-White differences in vocational interests. 5. Gender, whether the sample was nationally representative, and age did not moderate Black-White differences in vocational interests.
Study 2 Findings
1. Investigative, artistic, social, and (to a smaller extent) enterprising interests were positively correlated with cognitive ability. 2. Realistic and conventional interests were uncorrelated with cognitive ability.
Study 3 Findings
1. Applicant pool subgroup differences on cognitive ability were smallest for conventional jobs and largest for social jobs. 2. Applicant pool subgroup differences on conscientiousness favored Whites for conventional jobs and African Americans for realistic and investigative jobs. 3. Applicant pool subgroup differences on the cognitive ability-conscientiousness composite predictor were smallest for realistic jobs and largest for social jobs.

Figures

Figure 1. The selection pipeline factoring in recruiting, vocational interests, and selection procedures.

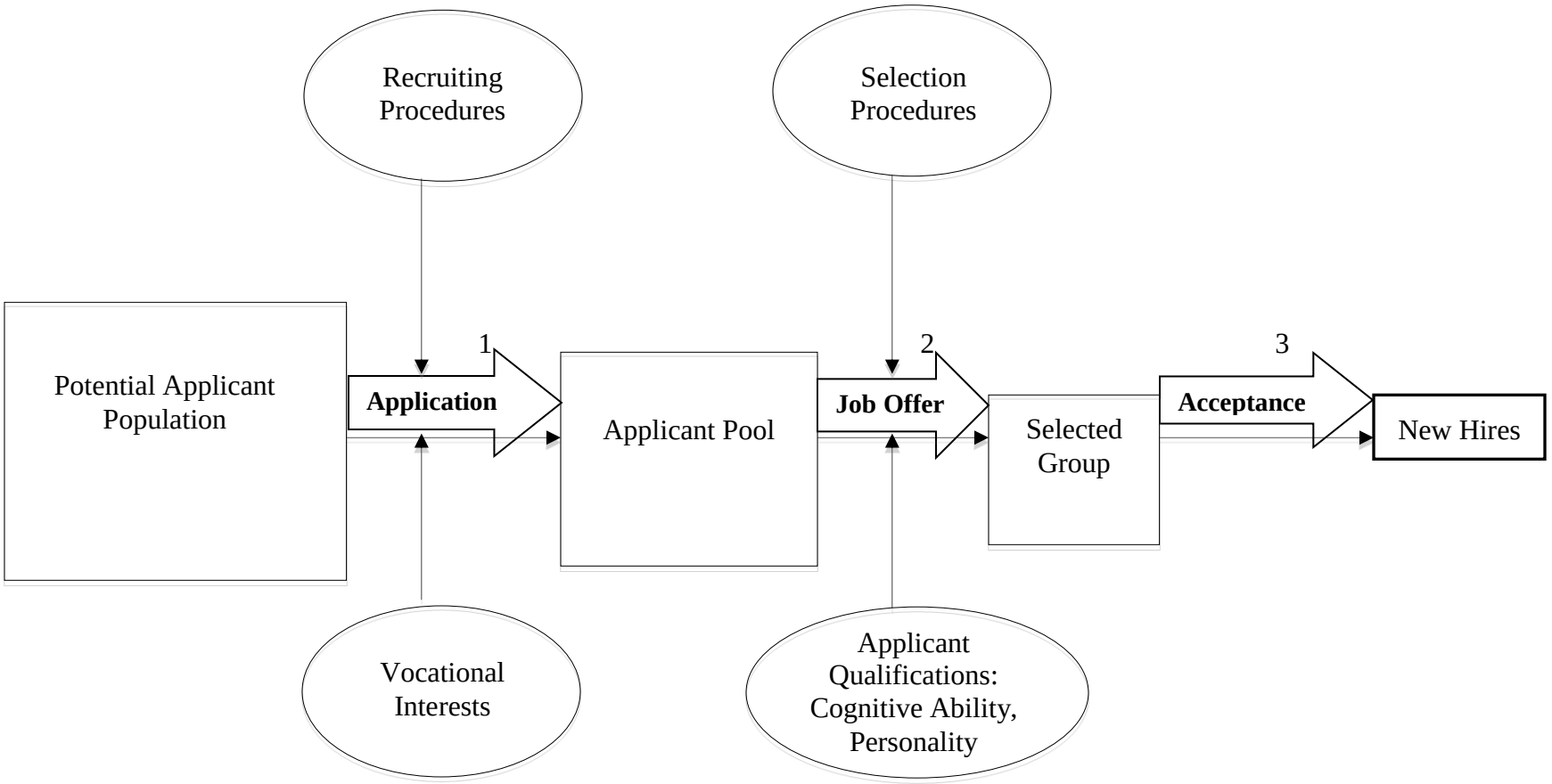

Figure 2. Holland's (1997) hexagonal model.

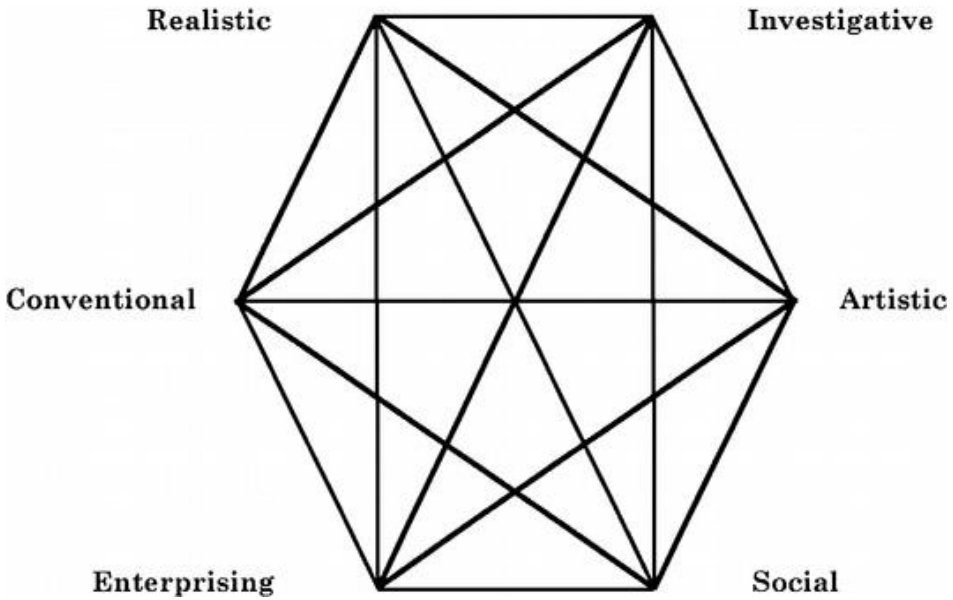

Figure 3. A developmental model of the effects of race on occupational judgments and aspirations (from Hughes & Bigler, 2007).

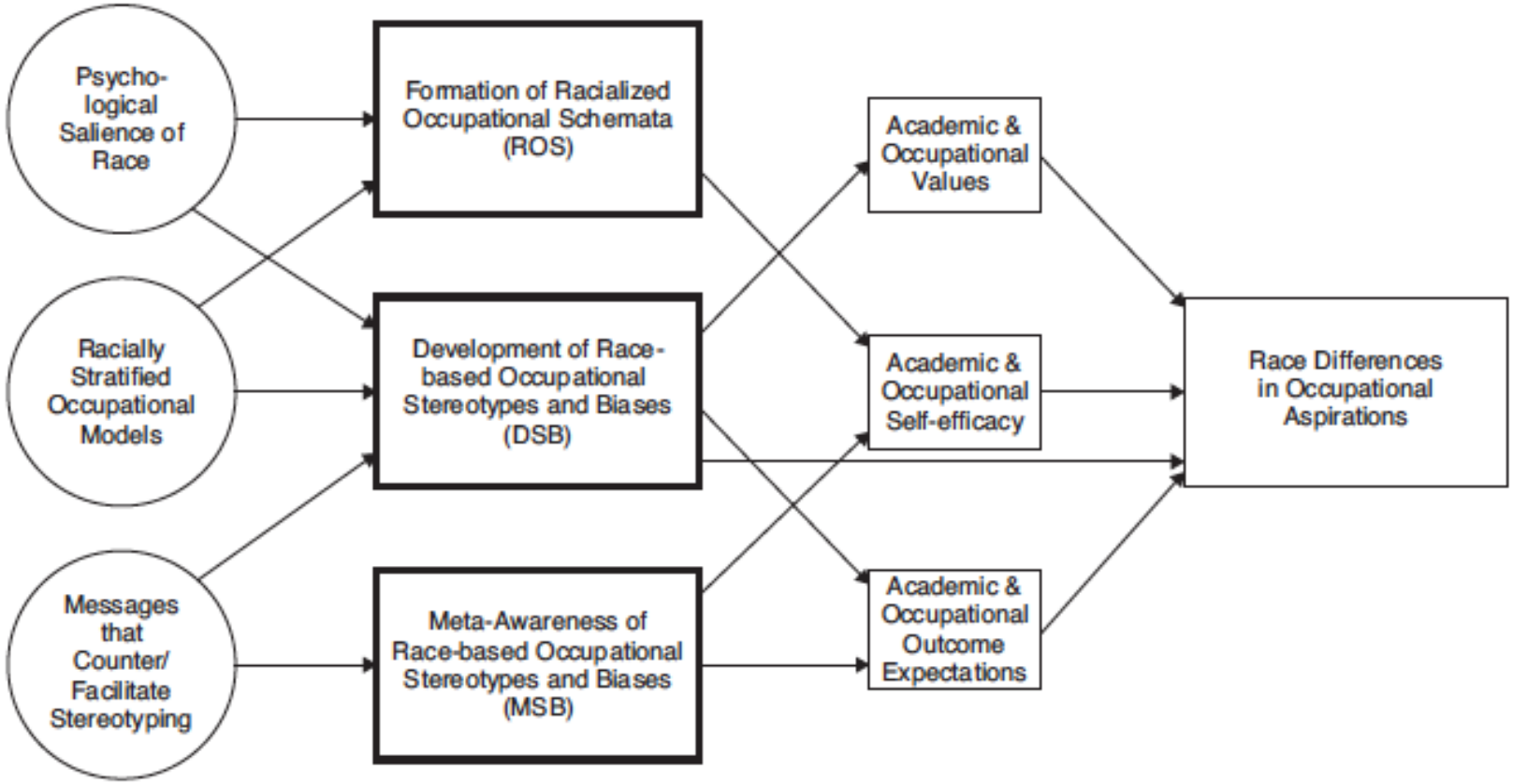

Figure 4. Intelligence-as-process, personality, interests, and intelligence-as-knowledge (from Ackerman, 1996).

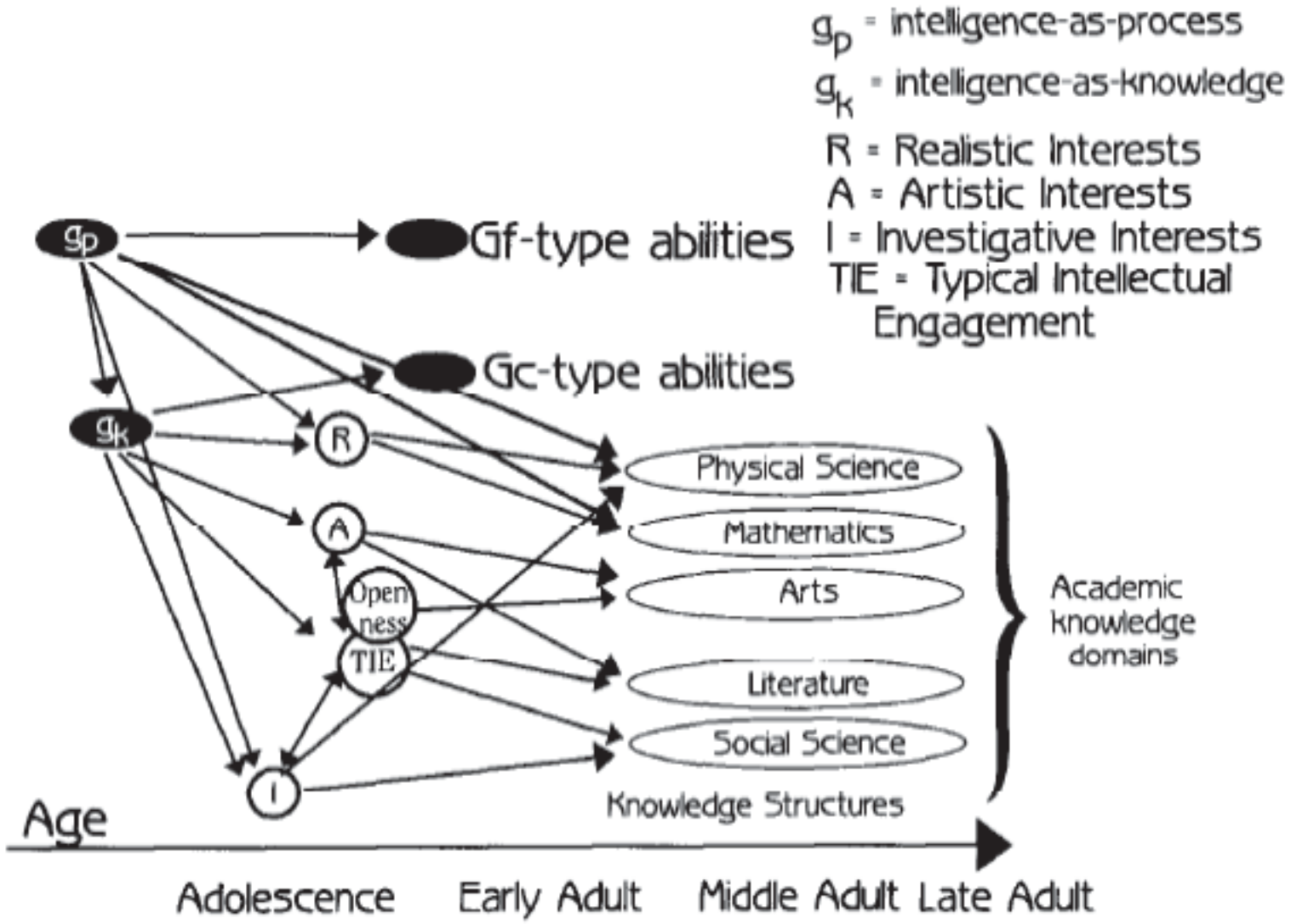

Figure 5. Trait complexes (from Ackerman & Heggestad, 1997).

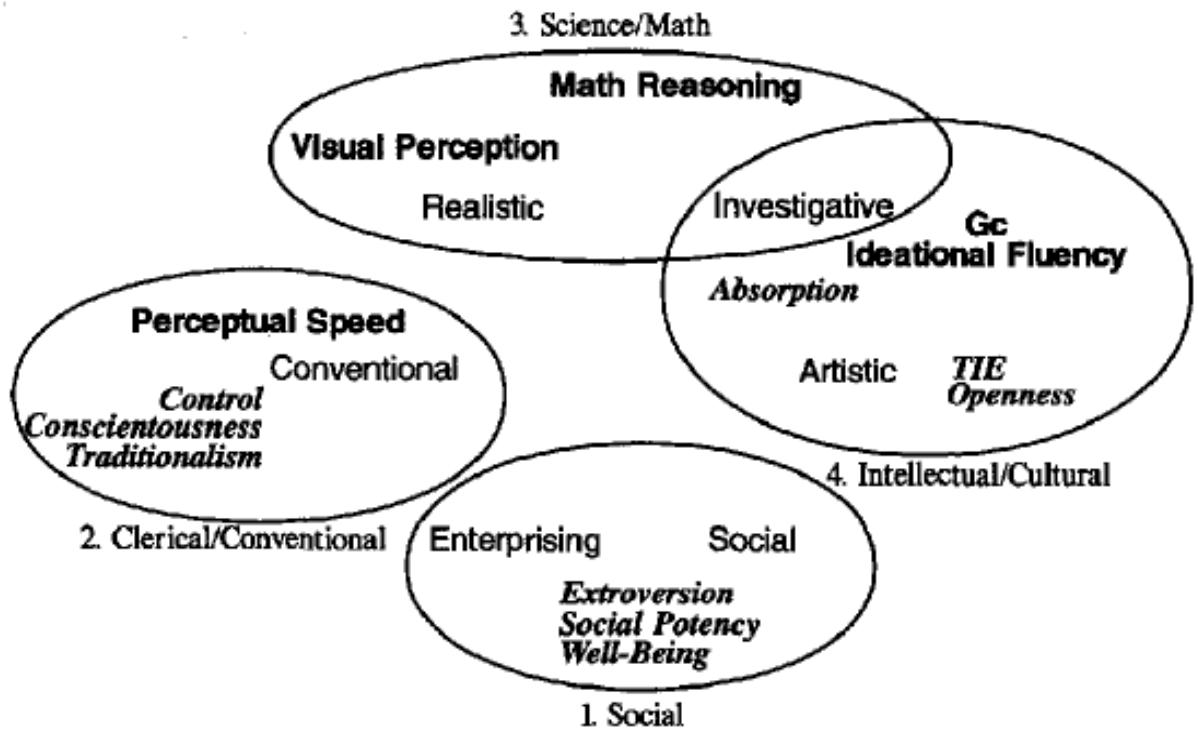

Figure 6. Occupational aptitude patterns map (from Gottfredson, 1986; reprinted in Oswald & Ferstl, 1999).

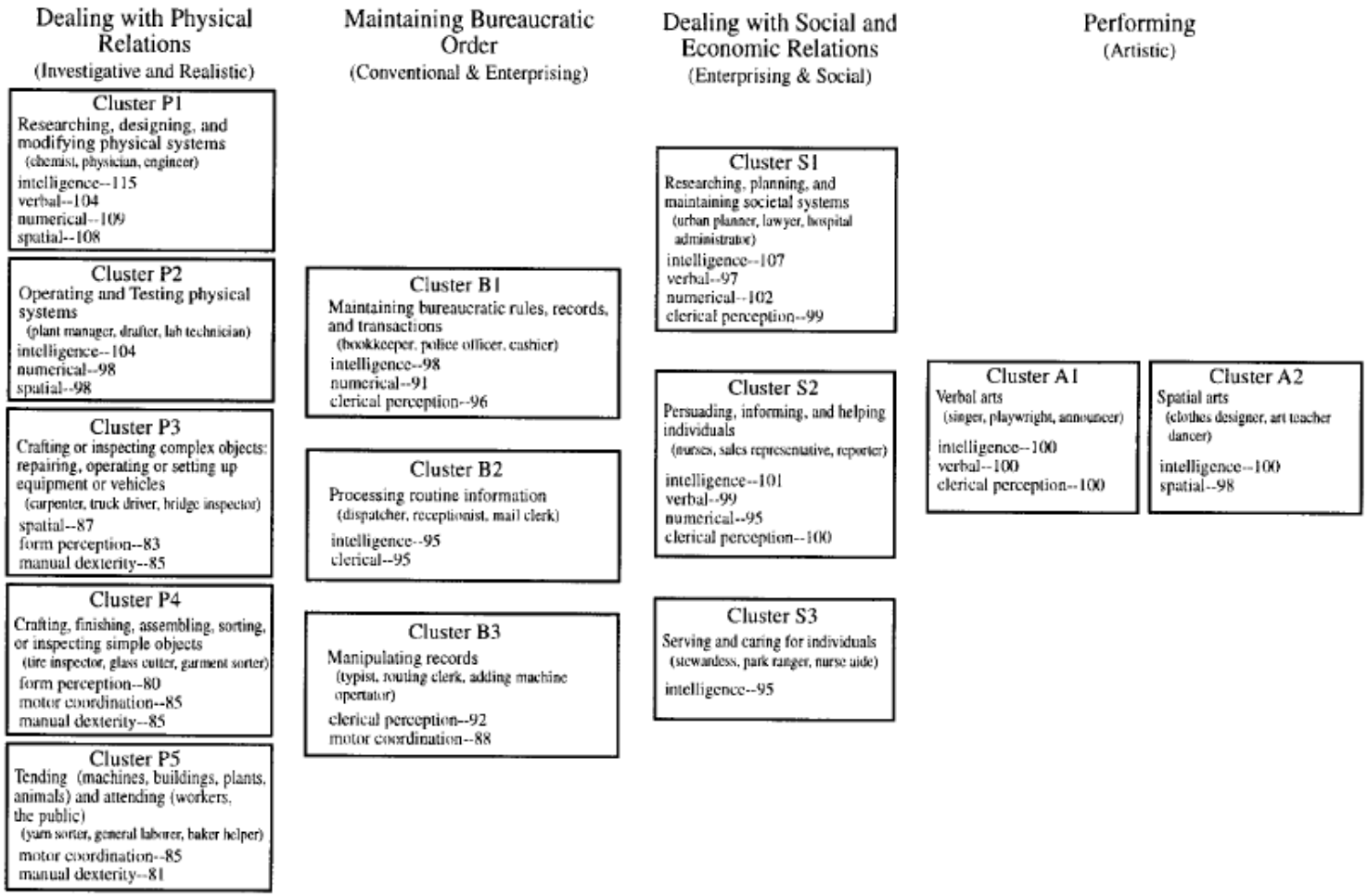

Figure 7. Black-White Differences in Vocational Interests by Gender.

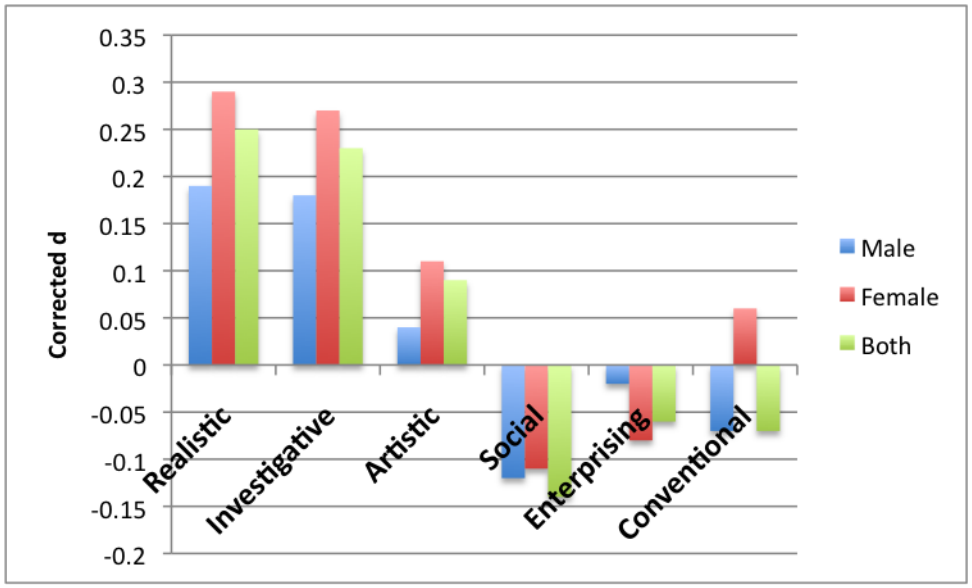

Figure 8. Black-White Differences in Vocational Interests by Education Level.

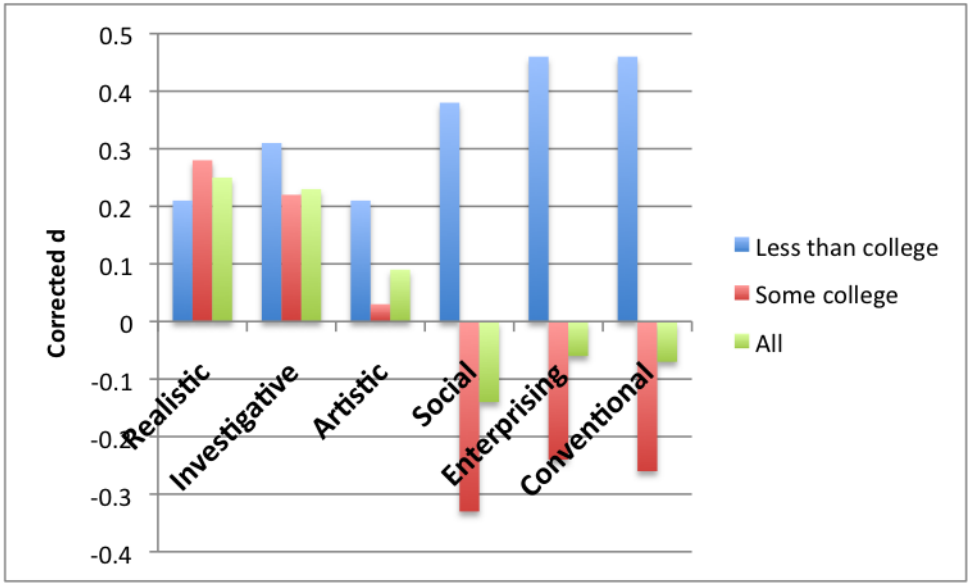

Figure 9. Applicant pool subgroup differences on cognitive ability for each interest type job.

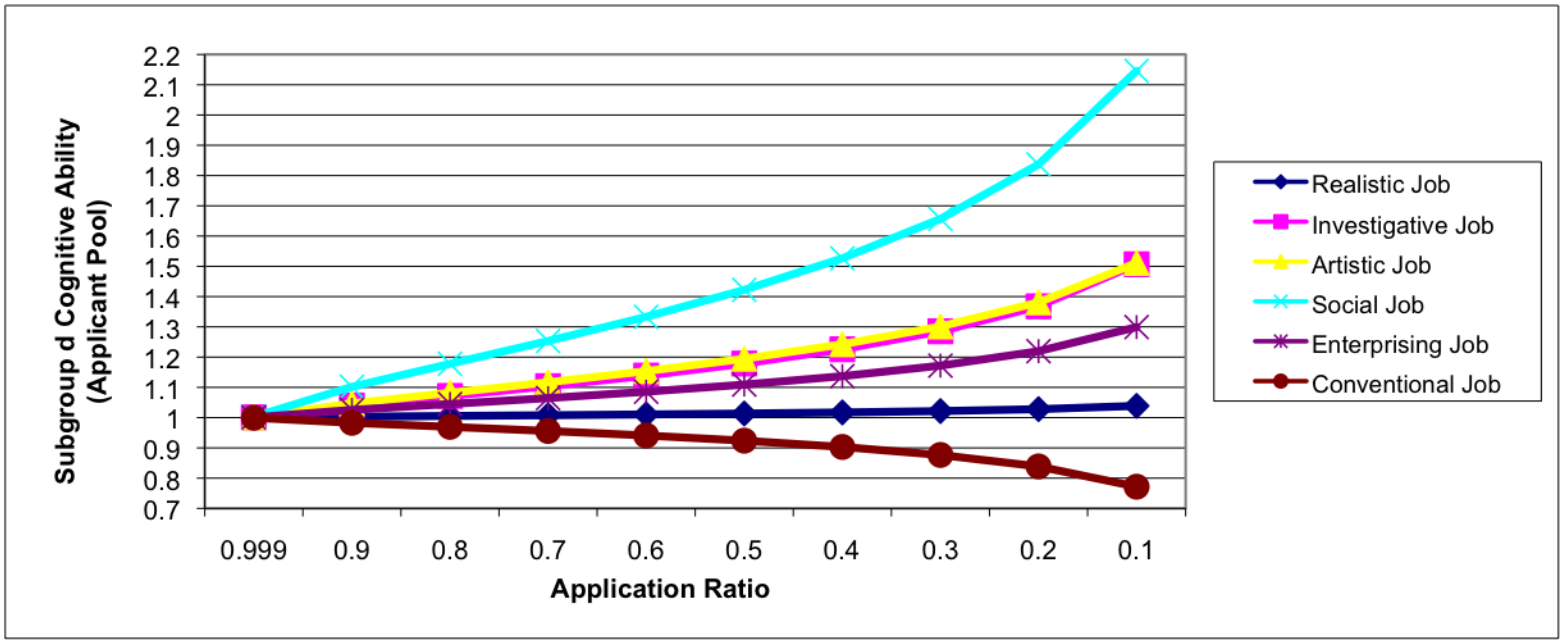

Figure 10. Applicant pool subgroup differences on conscientiousness for each interest type job.

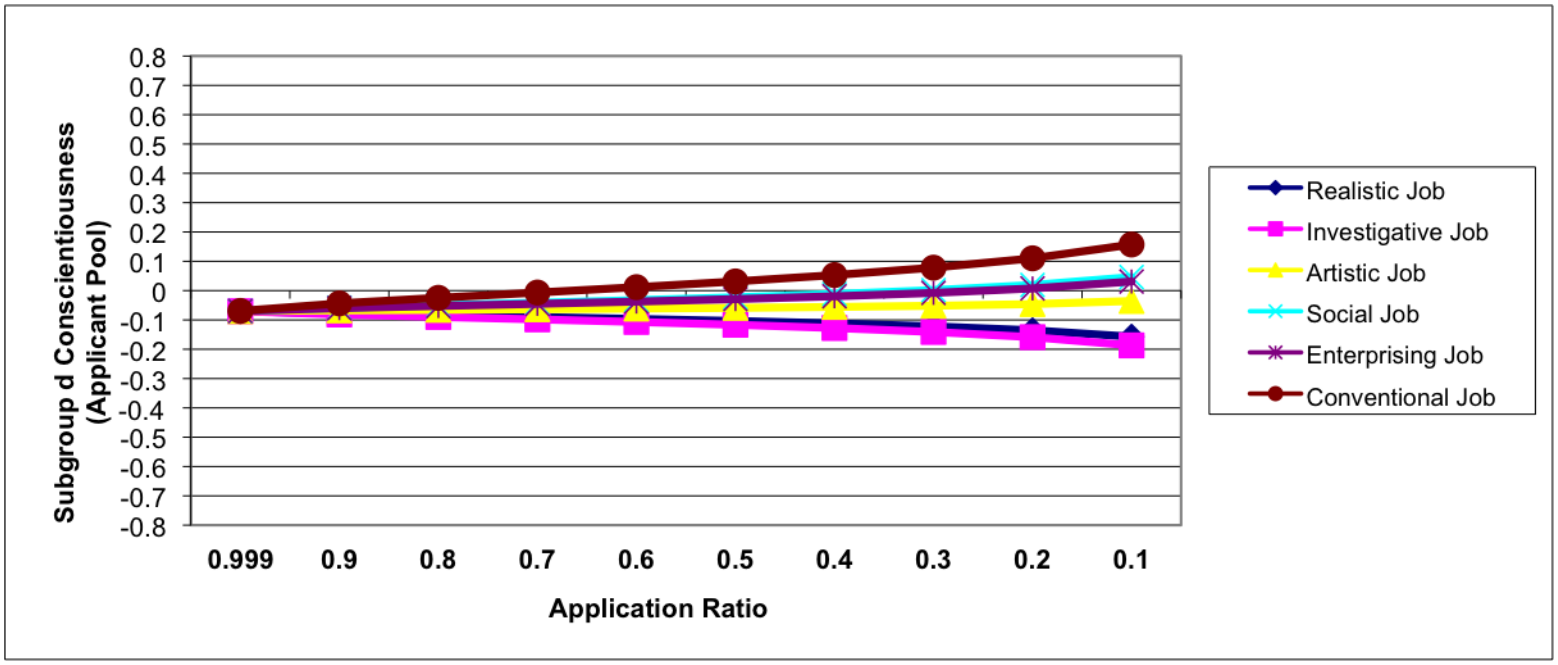

Figure 11. Applicant pool subgroup differences on the cognitive ability-conscientiousness composite for each interest type job.