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PANEL II: EMPLOYMENT

BIOLOGICAL SEX DIFFERENCES IN THE WORKPLACE: REPORTS OF THE "END OF MEN" ARE GREATLY EXAGGERATED (AS ARE CLAIMS OF WOMEN'S CONTINUED INEQUALITY)

KINGSLEY R. BROWNE[*]

Common examples of perceived workplace inequality – the "glass ceiling," the "gender gap" in compensation, and occupational segregation, among others – cannot be well understood if the explanation proffered for their existence is limited exclusively to social causes such as discrimination and sexist socialization. Males and females have, on average, different sets of talents, tastes, and interests, which cause them to select somewhat different

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occupations and exhibit somewhat different workplace behaviors. Some of these sex differences have biological roots. Temperamental sex differences are found in competitiveness, dominance seeking, risk taking, and nurturance, with females tending to be more "person oriented" and males more "thing oriented." The sexes also differ in a variety of cognitive traits, including various spatial, verbal, mathematical, and mechanical abilities. Although social influences can be important, these social influences operate on (and were in fact created by) sexually dimorphic minds.

Substantial changes in the environment of a complex organism will often result in changes in its behavior. Therefore, we should not be surprised when changes in the economy or changes in the nature of work are followed by changes in workforce behavior and, hence, changes in workplace outcomes. For those keeping track of "the numbers," these changes may be characterized as either increasing or decreasing equality, depending upon the particular definition of equality selected. Moreover, whether one views a particular outcome as a harbinger of the "end of men" or a reflection of continued sexual inequality of women may be a consequence of whether the focus is on group averages or the tail end of distributions. It may turn out, for example, that even if women may do better as a group on some measures, men may still dominate at the top.

INTRODUCTION

In recent years, a spate of publications have chronicled or predicted the so-called decline of males and ascendancy of females. Most recently, Hanna Rosin has suggested it is the "end of men";[1] but at the end of the last century, Lionel Tiger was lamenting the "decline of males"[2] and Helen Fisher was celebrating the "first sex."[3] These earlier assertions were based largely on the same types of trends that Rosin describes today: changes in the workplace, in education, and in other forces, such as increasing female control over reproduction and increasing societal subsidization of child raising. A decade ago I acknowledged these trends but suggested that reports of the demise of males were greatly exaggerated:

> Nonetheless, men will continue to dominate the scarce positions at the top of hierarchies as long as it is necessary to devote decades of intense labor-market activity to obtain them, even if women come to predominate in middle-management positions and even if men also disproportionately occupy the bottom of hierarchies. Men will similarly continue to

[1] HANNA ROSIN, THE END OF MEN: AND THE RISE OF WOMEN (2012).

[2] LIONEL TIGER, THE DECLINE OF MALES: THE FIRST LOOK AT AN UNEXPECTED NEW WORLD FOR MEN AND WOMEN (1999).

[3] HELEN FISHER, THE FIRST SEX: THE NATURAL TALENTS OF WOMEN AND HOW THEY ARE CHANGING THE WORLD (1999).

> dominate math-intensive fields, as well as fields that expose workers to substantial physical risks.[4]

These residual areas of perceived inequality are commonly invoked to prove the continued existence of sex discrimination against women. It is seldom explained, however, why it is necessary to invoke discrimination to explain areas of continued male dominance while areas of female ascendancy are casually attributed to social forces or, indeed, to inherent female superiority.

The complex nature of sex differences in the evolving workplace cannot be appreciated without an understanding of inherent differences between men and women. It is certainly fair to suggest that in some – or even many – respects changes in the contemporary workplace favor women. It is probably not correct, however, to characterize these trends as a sea change that will so overwhelmingly swamp men that any areas of remaining male advantage must be laid at the doorstep of discriminating employers or residual patriarchy. The fact is that the sexes differ somewhat – *on average* – in a number of talents, tastes, and interests, and these distinctions cause them to select somewhat different occupations and exhibit somewhat different workplace behaviors.

Explanations for sex differences in employment that are based on purely extrinsic causes provide little insight into the complexity of workplace patterns. To be sure, women are not proportionately represented at the highest corporate levels. They have, however, reached near-parity among new lawyers and doctors.[5] Similarly, women do not earn, on average, as much as men do, but women who perform the same work and display the same workplace attachment as men do earn approximately the same as comparable men.[6] Women have also not made proportionate inroads in some occupations, with professions such as mechanics, firefighting, and theoretical physics continuing to include relatively few women.[7] On the other hand, women are rapidly taking over other occupational fields such as psychology, pharmacy, and veterinary medicine.[8] In seeking to explain these realities, an account that recognizes

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[4] KINGSLEY R. BROWNE, BIOLOGY AT WORK: RETHINKING SEXUAL EQUALITY 216 (2002).

[5] *See* ASS'N OF AM. MED. COLLS., U.S. MEDICAL SCHOOL APPLICANTS AND STUDENTS 1982-1983 TO 2011-2012, at 2 & fig.2 (2012), *available at* https://www.aamc.org/download/153708/data/charts1982to2012.pdf; *First Year and Total J.D. Enrollment by Gender 1947 - 2011*, AM. BAR ASS'N 1, http://www.americanbar.org/content/dam/aba/administrative/legal_education_and_admissions_to_the_bar/statistics/jd_enrollment_1yr_total_gender.authcheckdam.pdf (last visited Feb. 12, 2013).

[6] *See infra* Part III.B.

[7] *See infra* Part III.C.

[8] *See Academic Pharmacy's Vital Statistics*, AM. ASS'N COLLEGES PHARMACY, http://www.aacp.org/about/Pages/Vitalstats.aspx (last visited Feb. 12, 2013); Katie Burns, *At Veterinary Colleges, Male Students Are in the Minority*, JAVMA NEWS (Feb. 15, 2010), https://www.avma.org/News/JAVMANews/Pages/100215g.aspx. *See generally* Jenna Goudreau, *20 Surprising Jobs Women Are Taking Over*, FORBES (Mar. 7, 2011, 3:32 PM), http://www.forbes.com/sites/jennagoudreau/2011/03/07/20-surprising-jobs-women-are-taking

inherent differences between the sexes provides a more complete and nuanced explanation for these patterns than an account based entirely on sociological factors, which typically relies on ad hoc, inconsistent, and tautological explanations. The purpose of this Essay is to describe some of those differences and discuss their possible effects in the workplace, concentrating on those areas in which men are often perceived as having retained an advantage.

I. OCCUPATIONALLY RELEVANT SEX DIFFERENCES

The sexes differ, on average, in a number of both psychological and physical dimensions. Males score higher on measures of competitiveness, dominance seeking, and risk taking, while females score higher on measures of nurturance. Males substantially outperform females in mechanical ability and on some spatial and mathematical tasks, while females outperform males on other spatial and computational tasks, as well as in a number of verbal abilities. Moreover, sex differences in physical strength continue to play a role in some occupations, although their importance is greatly diminished in the modern workplace.

A. *Competitiveness and Dominance Seeking*

Males score higher than females on most measures of direct competitiveness, and competition tends to be a more positive experience for males than it is for females.[9] Adding a competitive component to a task increases both the performance and the intrinsic motivation of males but not of females. Women also experience higher levels of stress associated with competition.[10] Sex differences in competition appear in early childhood.[11] Boys display a more instrumental approach to competition than girls, being more willing to compete against friends and cooperate with teammates they do

-over.

[9] Joyce F. Benenson et al., *Greater Discomfort as a Proximate Cause of Sex Differences in Competition*, 48 MERRILL-PALMER Q. 225, 229-40 (2002); Richard Lynn, *Sex Differences in Competitiveness and the Valuation of Money in Twenty Countries*, 133 J. SOC. PSYCHOL. 507, 511 (1993) (summarizing findings from a multinational study that showed men were generally more competitive and placed more value on money than their female counterparts).

[10] Benenson et al., *supra* note 9, at 240. That difference cannot be wholly accounted for by a theory of response bias, under which women might be thought to express emotions more freely and thus appear more distressed. *See* John Mirowsky & Catherine E. Ross, *Sex Differences in Distress: Real or Artifact?*, 60 AM. SOC. REV. 449, 464-65 (1995).

[11] ELEANOR E. MACCOBY, THE TWO SEXES: GROWING UP APART, COMING TOGETHER 39 (1998) ("When in their large same-sex playgroups, boys were engaged in direct competition with other boys 50 percent of the time, while for girls in their smaller same-sex groups, direct competition occurred only 1 percent of the time.").

not like.[12] As psychologist Eleanor Maccoby has observed: "Even when with a good friend, boys take pleasure in competing to see who can do a task best or quickest, who can lift the heaviest weight, who can run faster or farther."[13] In contrast, girls often experience negative reactions to out-competing their friends.[14]

Dominance seeking is related to competitiveness. Males, from childhood, engage in more dominance behaviors, that is, behaviors designed to achieve or maintain a position of high relative status – to obtain power, influence, prerogatives, or resources.[15] When children get together, even in infancy, dominance behaviors occur,[16] and by preschool boys end up disproportionately at the top of the hierarchy in mixed-sex groups.[17]

B. *Risk Taking*

From childhood, the sexes also differ in risk taking.[18] Worldwide, the rate of accidental deaths of boys is significantly higher than that of girls,[19] and in the United States it is twice as high.[20] By adulthood the sex difference in risk taking has increased. Men predominate in such risky recreational activities as car racing, skydiving, and hang-gliding.[21] Men are also disproportionately

[12] John Evans, *Gender Differences in Children's Games: A Look at the Team Selection Process*, CANADIAN ASS'N FOR HEALTH PHYSICAL EDUC. & RECREATION J., Sept.-Oct. 1986, at 4, 7 (finding that when choosing ad hoc teams, boys tend to choose the best players, while girls tend to choose their friends).

[13] MACCOBY, *supra* note 11, at 39.

[14] Joyce F. Benenson & Joy Schinazi, *Sex Differences in Reactions to Outperforming Same-Sex Friends*, 22 BRIT. J. DEVELOPMENTAL PSYCHOL. 317, 328 (2004).

[15] Allan Mazur & Alan Booth, *Testosterone and Dominance in Men*, 21 BEHAV. & BRAIN SCI. 353, 359, 362 (1998).

[16] Pierrich Plusquellec et al., *Dominance Among Unfamiliar Peers Starts in Infancy*, 28 INFANT MENTAL HEALTH J. 324, 336 (2007).

[17] William R. Charlesworth & Peter La Freniere, *Dominance, Friendship, and Resource Utilization in Preschool Children's Groups*, 4 ETHOLOGY & SOCIOBIOLOGY 175, 184 (1983) (observing a group of preschoolers presented with limited access to a desirable toy (a film viewer) and finding that "[d]ominant children, in general, got significantly more viewing time than subordinate children, and boys got significantly more than girls").

[18] James P. Byrnes et al., *Gender Differences in Risk Taking: A Meta-Analysis*, 125 PSYCHOL. BULL. 367, 377 & tbl.3 (1999).

[19] WORLD HEALTH ORG., WORLD REPORT ON CHILD INJURY PREVENTION 9 (2012) (reporting that the rate of accidental death for male children under fifteen is twenty-four percent higher than that of same-aged females and that this discrepancy increases to approximately thirty-three percent for persons under twenty years of age).

[20] *See Years of Potential Life Lost from Unintentional Injuries Among Persons Aged 0-19 Years – United States, 2000-2009*, 61 MORBIDITY & MORTALITY WKLY. REP. 830, 831 tbl.1 (2012).

[21] Michael P. Schrader & Daniel L. Wann, *High-Risk Recreation: The Relationship Between Participant Characteristics and Degree of Involvement*, 22 J. SPORT BEHAV. 426,

represented in risky employment. For example, from 2003 through 2011, men made up approximately ninety-two percent of all workplace deaths in the United States each year.[22] This same pattern is reported in other countries as well.[23] Females are more averse not just to physical risk but also to social risk,[24] including certain financial risks.[25]

C. *Nurturance and Interest in Children*

Females in all societies exhibit more nurturing behavior than males, both inside and outside the family. Throughout the world, women are the primary caretakers of the young, the sick, and the old.[26] When they are young children, girls exhibit more nurturing behavior,[27] and throughout adolescence girls endorse more caring, personal values.[28] Girls' interest in infants increases substantially with puberty.[29] The more social orientation of females is also reflected in a consistently found sex difference in object-versus-person orientation. From infancy girls are more people oriented and boys more thing

429 (1999).

[22] *Fatal Occupational Injuries by Selected Characteristics, 2003-2011*, BUREAU LAB. STAT. 3, http://www.bls.gov/iif/oshwc/cfoi/all_worker.pdf (last visited Feb. 25, 2013).

[23] *See, e.g.*, S. Grazier & P.J. Sloane, *Accident Risk, Gender, Family Status and Occupational Choice in the UK*, 15 LAB. ECON. 938, 942 (2008); Yen-Hui Lin et al., *Gender and Age Distribution of Occupational Fatalities in Taiwan*, 40 ACCIDENT ANALYSIS & PREVENTION 1604, 1606 & tbl.2 (2008).

[24] Judith E. Larkin & Harvey A. Pines, *Gender and Risk in Public Performance*, 49 SEX ROLES 197, 205 (2003).

[25] Gary Charness & Uri Gneezy, *Strong Evidence for Gender Differences in Risk Taking*, 83 J. ECON. BEHAV. & ORG. 50, 57 (2012) (finding substantial sex differences in results of an investment game across countries and experimenters and reporting the "clear and consistent result" that "women make smaller investments in the risky asset than do men, and appear to be financially more risk averse"); Helga Fehr-Duda et al., *Gender, Financial Risk, and Probability Weights*, 60 THEORY & DECISION 283, 304-05 (2006) (providing evidence that "in the domain of investment decisions when the probability of a gain is of medium or large size" women are more risk averse than their male counterparts).

[26] *See* DAVID C. GEARY, MALE, FEMALE: THE EVOLUTION OF HUMAN SEX DIFFERENCES 159-61 (2d ed. 2010) (showing that mothers engage in caregiving to infants and children more often than fathers, even in nontraditional family structures and in societies without the traditional western delineation of home and work responsibilities); Susan M. Allen, *Gender Differences in Spousal Caregiving and Unmet Need for Care*, 49 J. GERONTOLOGY S187, S188 (2004).

[27] Judith E. Owen Blakemore, *Children's Nurturant Interactions with Their Infant Siblings: An Exploration of Gender Differences and Maternal Socialization*, 22 SEX ROLES 43, 55 (1990).

[28] Kimberly Badger et al., *Age and Gender Differences in Value Orientation Among American Adolescents*, 33 ADOLESCENCE 591, 595 (1998).

[29] Susan Goldberg et al., *Menarche and Interest in Infants: Biological and Social Influences*, 53 CHILD DEV. 1544, 1549 (1982).

oriented.[30] This difference persists into adulthood.[31] Even among newborns, girls are measurably more "cuddly" than boys.[32]

D. *A Digression on the Magnitude of Sex Differences and Sex Differences in Variability*

Before turning to sex differences in some objectively measurable traits, it is important to say a few words about how group differences are calculated and about differences in the extent of variability of the sexes. The magnitude of sex differences is typically reported as the male mean minus the female mean, divided by the pooled standard deviation.[33] This number is known as the "effect size" (denoted as *d*). An effect size of 1.0, for example, indicates that the male mean exceeds the female mean by a full standard deviation. In practical terms, this means that the average male exceeds the performance of eighty-four percent of females, assuming that the two groups are equally variable.

The proportions described above would be different if one group is more variable than the other.[34] On most cognitive measures, especially ones that favor males, male performance is more variable than female performance.[35] If the male and female means are identical but males are more variable than females, then at both the high and low ends of the distribution, males will outnumber females.[36] If the male mean is higher and male variability is greater, the disproportion at the higher end will be even greater.

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[30] Jennifer Connellan et al., *Sex Differences in Human Neonatal Social Perception*, 23 INFANT BEHAV. & DEV. 113, 116 (2000) ("[W]e have demonstrated that at 1 day old, human neonates demonstrate sexual dimorphism in both social and mechanical perception. Male infants show a stronger interest in mechanical objects, while female infants show a stronger interest in the face.").

[31] Adriene M. Beltz et al., *Gendered Occupational Interests: Prenatal Androgen Effects on Psychological Orientation to Things Versus People*, 60 HORMONES & BEHAV. 313, 316 (2011).

[32] Joyce F. Benenson et al., *Sex Differences in Neonates' Cuddliness*, 160 J. GENETIC PSYCHOL. 332, 339 (1999).

[33] *See* DIANE F. HALPERN, SEX DIFFERENCES IN COGNITIVE ABILITIES 79-81 (4th ed. 2012). Given the process of subtracting female values from male values, a negative effect size indicates that the female mean exceeds the male mean. *See id.*

[34] *Id.* at 71-75.

[35] *Id.* at 102-03 ("[F]emales and males are very similar when we consider the average performance, and they are highly dissimilar when we consider performance at the high and low extremes.").

[36] *Id.*; *see also* Rosalind Arden & Robert Plomin, *Sex Differences in Variance of Intelligence Across Childhood*, 41 PERSONALITY & INDIVIDUAL DIFFERENCES 39, 40 (2006) ("A small difference in variance can have a large influence on the ratio of males to females at the tails." (citation omitted)); Stephen Machin & Tuomas Pekkarinen, *Global Sex Differences in Test Score Variability*, 322 SCIENCE 1331, 1332 (2008) (finding that in most OECD countries, male variance on both mathematics and reading tests is higher than that of

Different characteristics of the male and female distributions are relevant to different questions. For example, if we want to predict whether a male or female chosen at random would be better along a given dimension, say mathematics, we would care primarily about group means. If the means are identical ($d = 0$), there would be no reason to think that a male chosen at random would perform better – or worse – than a female chosen at random, regardless of any sex difference in variability. If we wanted to investigate the extent to which sex differences in mathematical ability are responsible for sex differences in math-intensive occupations, however, we would focus not on the center but rather the extreme right tail of the distribution, where the sex ratio is likely to be substantially more affected by differences in variability than in group means.

E. *Spatial, Mathematical, and Mechanical Ability*

Males outperform females on some spatial tasks, especially mental rotation, spatial perception, spatial visualization, and targeting.[37] A meta-analysis of mental-rotation studies found an average effect size of 0.66[38] for adults, and the effect size in several studies exceeds 1.0.[39] Spatial rotation is correlated with a variety of other abilities, such as mechanical ability, map reading, way finding, mathematical reasoning, and success as a pilot.[40] Females, on the other hand, outperform males on the spatial task of "object location," that is, remembering where an object is located and identifying which objects in an array have been moved from their prior location.[41]

The sexes also differ in mathematical performance. Males excel on tests of mathematical reasoning, especially those involving abstract thinking, while females outperform males, although by smaller margins, on tests of

females and that the disparity in variance is greater in high-scoring nations than in low-scoring ones).

[37] DOREEN KIMURA, SEX AND COGNITION 64 (1999).

[38] Daniel Voyer et al., *Magnitude of Sex Differences in Spatial Abilities: A Meta-Analysis and Consideration of Critical Variables*, 117 PSYCHOL. BULL. 250, 258 tbl.4 (1995).

[39] *Id.* at 254 tbl.1 (presenting the effect sizes for forty-four studies, including several near or above 1.0); *see also* Scott Barry Kaufman, *Sex Differences in Mental Rotation and Spatial Visualization Ability: Can They Be Accounted for by Differences in Working Memory Capacity?*, 35 INTELLIGENCE 211, 217 (2007) (finding an effect size of 1.01); Yukiko Maeda & So Yoon Yoon, *A Meta-Analysis on Gender Differences in Mental Rotation Ability Measured by the Purdue Spatial Visualization Tests: Visualization of Rotations (PSVT:R)*, 25 EDUC. PSYCHOL. REV. 69, 78 tbl.2 (2013) (presenting seventy effect sizes, with eight at or exceeding 1.0).

[40] Mary Hegarty & David A. Waller, *Individual Differences in Spatial Abilities*, *in* THE CAMBRIDGE HANDBOOK OF VISUOSPATIAL THINKING 121, 121-22 (Priti Shah & Akira Miyake eds., 2005).

[41] Irwin Silverman & Marion Eals, *Sex Differences in Spatial Abilities: Evolutionary Theory and Data*, *in* THE ADAPTED MIND: EVOLUTIONARY PSYCHOLOGY AND THE GENERATION OF CULTURE 533, 536-45 (Jerome H. Barkow et al. eds., 1992).

computation.[42] The sex difference is relatively small in nationally representative samples, with effect sizes concentrating between 0.10 and 0.25.[43] Because males are more variable in performance, however, they outnumber females almost two to one in the top decile of math ability (and the ratio becomes even greater at more rarified heights).[44] Consequently, effect sizes tend to be larger in more select samples, which are drawn from the tails of the distributions. For example, on the mathematics portion of the SAT, the effect size is about 0.3.[45]

The sexes exhibit substantial differences in mechanical ability as well. On the Differential Aptitude Test, male twelfth graders outperform females on mechanical comprehension, with an effect size of around 0.9.[46] Similar results (d = 0.95) have been obtained on the Mechanical Comprehension portion of the Air Force Officer Qualification Test, which is used in the selection of candidates to be Air Force officers.[47] In the top ten percent of mechanical reasoning ability, males outnumber females approximately eight to one.[48]

F. *Verbal Ability*

Females outperform males in a number of verbal tasks, including spelling, grammar, verbal fluency, and verbal memory. In fact, the female advantage in verbal abilities exceeds the male advantage in mathematical ability in broadly representative samples.[49] In more select samples, however, the female advantage often declines or, in some cases, disappears. For example, in recent years males have regularly outperformed females on the critical reading portion of the SAT, although the effect size has been very small (ranging from

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[42] KIMURA, *supra* note 37, at 67-72.

[43] ARTHUR R. JENSEN, THE *G* FACTOR: THE SCIENCE OF MENTAL ABILITY 535 (1998).

[44] *Id.*

[45] *See* COLL. BD., 2012 COLLEGE-BOUND SENIORS: TOTAL GROUP PROFILE REPORT 1 tbls.1 & 2 (2012), *available at* http://media.collegeboard.com/digitalServices/pdf/research/TotalGroup-2012.pdf.

[46] David Lubinski & Camilla Persson Benbow, *Gender Differences in Abilities and Preferences Among the Gifted: Implications for the Math-Science Pipeline*, 1 CURRENT DIRECTIONS PSYCHOL. SCI. 61, 62 (1992) (finding an effect-size of 0.89).

[47] Thomas R. Carretta, *Group Differences on US Air Force Pilot Selection Tests*, 5 INT'L J. SELECTION & ASSESSMENT 115, 118 (1997).

[48] Larry V. Hedges & Amy Nowell, *Sex Differences in Mental Test Scores, Variability, and Numbers of High-Scoring Individuals*, 269 SCIENCE 41, 43 tbl.2 (1995).

[49] *See* CATHERINE E. FREEMAN, U.S. DEP'T OF EDUC., TRENDS IN EDUCATIONAL EQUITY OF GIRLS & WOMEN: 2004, at 36 tbl.9 (2004), *available at* http://nces.ed.gov/pubs2005/2005016.pdf (reporting that on the 2000 Program for International Student Assessment test there was, for U.S. students, a mean score differential of twenty-eight points favoring females in reading performance and a differential of just seven points favoring males in mathematics performance). For all ten OECD countries considered, the differentials were thirty-two and eleven, respectively. *Id.*

$d \approx 0.02$ to $d \approx 0.07$ in recent years).[50] Females, on the other hand, have outperformed males on the new writing portion of the test by a somewhat larger amount (ranging from $d \approx -0.10$ to -0.12).[51]

G. *Occupational Interests*

Important sex differences are also found in traits more immediately related to the workplace, specifically in occupational interests, as revealed by such instruments as the Strong Interest Inventory.[52] Reliable sex differences are exhibited on at least five of the six Holland General Occupational Themes measured by the Strong,[53] which are aspects of "vocational personalit[y]."[54] Males score substantially higher on the *Realistic* (building, working outdoors, and working with things), *Investigative* (abstract problems, science, and math), and *Enterprising* (persuasion, selling, and business) themes. Females, in contrast, score higher on the *Artistic* (art, drama, and language) and *Social* (helping and teaching) themes. The sixth theme, *Conventional* (organizing, clerical, and processing data), shows little difference between the sexes.[55] One

[50] COLL. BD., *supra* note 45, at 1 tbls.1 & 2 (reporting an effect size of $d = 0.04$); COLL. BD., 2008 COLLEGE-BOUND SENIORS: TOTAL GROUP PROFILE REPORT 1 tbls.1 & 2 (2008), *available at* http://professionals.collegeboard.com/profdownload/Total_Group_Report.pdf (reporting an effect size of $d = 0.02$); COLL. BD., 2005 COLLEGE-BOUND SENIORS: TOTAL GROUP PROFILE REPORT 1 tbls.1 & 2 (2005), *available at* http://www.collegeboard.com/prod_downloads/about/news_info/cbsenior/yr2005/2005-college-bound-seniors.pdf (reporting an effect size of $d = 0.07$).

[51] COLL. BD., *supra* note 45, at 1 tbls.1 & 2 (reporting an effect size of $d = 0.11$); COLL. BD., 2011 COLLEGE-BOUND SENIORS: TOTAL GROUP PROFILE REPORT 1 tbls.1 & 2 (2011), *available at* http://professionals.collegeboard.com/profdownload/cbs2011_total_group_report.pdf (reporting an effect size of $d = 0.12$); COLL. BD., 2007 COLLEGE-BOUND SENIORS: TOTAL GROUP PROFILE REPORT 1 tbls.1 & 2 (2007), *available at* http://www.collegeboard.com/prod_downloads/about/news_info/cbsenior/yr2007/national-report.pdf (reporting an effect size of $d = 0.10$).

[52] The Strong Interest Inventory, first published in 1927 and since revised and expanded, offers an assessment of occupational interest through reliance on 244 "[o]ccupational scales" that "measure the interests of women and men in 122" professional, nonprofessional, and technical occupations. *See* 4 THE CORSINI ENCYCLOPEDIA OF PSYCHOLOGY 1709-11 (Irving B. Weiner & W. Edward Craighead eds., 4th ed. 2010).

[53] *See, e.g.*, Jesse R. Aros et al., *Occupational Sextype and Sex Differences in Vocational Preference-Measured Interest Relationships*, 53 J. VOCATIONAL BEHAV. 227, 237 tbl.2 (1998); Richard Lippa, *Gender-Related Individual Differences and the Structure of Vocational Interests: The Importance of the People-Things Dimension*, 74 J. PERSONALITY & SOC. PSYCHOL. 996, 1002 (1998).

[54] *See generally* JOHN L. HOLLAND, MAKING VOCATIONAL CHOICES: A THEORY OF VOCATIONAL PERSONALITIES AND WORK ENVIRONMENTS (3d ed. 1997) (describing vocational interests and career paths as an expression of key personality traits rather than simple preferences).

[55] *See, e.g.*, Aros et al., *supra* note 53, at 237 tbl.2.

large study found effect sizes (absolute values) on the General Occupational Themes ranging from a very large 1.28 to a trivial 0.06: Realistic (1.28), Investigative (0.56), Artistic (-0.29), Social (-0.29), Enterprising (0.19), and Conventional (0.06).[56]

Underlying the Holland Occupational Themes are two dimensions: "People-Things" and "Ideas-Data."[57] Although sex differences on the "Ideas-Data" dimension are not consistently found, large differences are found on the "People-Things" dimension, with women tending to cluster toward the "People" end and men toward the "Things" end.[58] These findings mirror the more people-oriented tendency of females previously described. A 2009 meta-analysis of studies spanning four decades concluded that "[t]hese sex differences are remarkably consistent across age and over time."[59]

II. ORIGINS OF SEX DIFFERENCES

The existence of the above-described differences, while not without controversy, kindles less debate than their potential causes. The dispute is not about whether social factors play a role; everyone agrees that they do. Instead, the debate centers on whether biology plays anything more than a trivial role. Put another way, on one side of the debate are those who think that the human mind is inherently sexually monomorphic, so that in the absence of different social inputs the minds of males and females would operate identically, thereby leading them to make the same choices. On the other side are those who think the mind is naturally dimorphic. To those who believe the human mind is sexually dimorphic, the ultimate cause of sex differences is generally thought to be the selective advantage that the sexually disparate traits conferred on members of the two sexes,[60] while the proximate cause is, to a large extent, a story of sex hormones.

A full account of the ultimate evolutionary explanation for temperamental and cognitive sex differences is beyond the scope of this Essay.[61] In short, however, the explanation rests on different selective pressures that have acted upon the two sexes. Human males, like most other mammalian males, compete among themselves for access to mates. Therefore, males tend to be physically

[56] *See* Alan S. Kaufman & James E. McLean, *An Investigation into the Relationship Between Interests and Intelligence*, 54 J. CLINICAL PSYCHOL. 279, 286 tbl.3 (1998).

[57] Dale J. Prediger, *Dimensions Underlying Holland's Hexagon: Missing Link Between Interests and Occupations?*, 21 J. VOCATIONAL BEHAV. 259, 261 (1982).

[58] Lippa, *supra* note 53, at 1006.

[59] Rong Su et al., *Men and Things, Women and People: A Meta-Analysis of Sex Differences in Interests*, 135 PSYCHOL. BULL. 859, 880 (2009).

[60] *See generally* GEARY, *supra* note 26 (offering an explanation of sex differences as products of evolution rather than mere social constructs).

[61] My previous work provides a more detailed account. *See* BROWNE, *supra* note 4, at 117-29; Kingsley R. Browne, *Sex and Temperament in Modern Society: A Darwinian View of the Glass Ceiling and the Gender Gap*, 37 ARIZ. L. REV. 971, 985-1016 (1995).

stronger, more dominance oriented, more competitive, and more risk oriented than females, and those who succeed in the competition for mates leave more of their genes behind than those who are less successful.[62] Moreover, men have likely garnered fitness advantages through skills valuable in hunting and warfare, including the dynamic spatial perception demanded by projectile weapons[63] and spatial skills that allow a hunter to navigate directly home from a hunt rather than retracing what may have been a lengthy and circuitous route in search of prey.[64] Women, on the other hand, do not generally increase their reproductive success by having multiple mates, and the nature of mammalian reproduction has required a maternal disposition to care directly for helpless young.[65]

Whether or not the evolutionary account sketched out above is the ultimate cause of sex differences, there is powerful evidence that the differences do in fact have proximate biological causes. As described in the following Section, evidence supporting a link between many sex differences in both morphology and behavior and the actions of sex hormones is by now extremely strong, suggesting that identical environments for the two sexes (that is, eliminating "sexist socialization" and discrimination) will not result in identical behavior.

A. *Hormones: A Proximate Cause of Many Sex Differences*

One advantage that evolutionary psychologists who study sex differences have over those researchers who study other phenomena is that an adaptive, biologically based account is plausible and consistent with abundant evidence from other species. Further, much is also known about the proximate mechanisms by which these differences develop. Although the story of sex differences is complex, and social factors can be important, a major portion of that story comes from sex hormones.

Sexual differentiation of the brain is caused by the same sex hormones that cause sexual differentiation of the body: male sex hormones (androgens, primarily testosterone) and female sex hormones (primarily the estrogen estradiol). The female form, being the "default" form,[66] will develop in the absence of androgens. In fetuses, the primary source of androgens is the testes of males, although smaller amounts are produced by the adrenal glands of both sexes.[67] About seven weeks after conception, the testes of the male fetus begin

[62] *See* GEARY, *supra* note 26, at 177-212 (describing the evolutionary basis of mate preferences).

[63] *Id.* at 289-90.

[64] Irwin Silverman et al., *Evolved Mechanisms Underlying Wayfinding: Further Studies on the Hunter-Gatherer Theory of Spatial Sex Differences*, 21 EVOLUTION & HUM. BEHAV. 201, 210 (2000).

[65] GEARY, *supra* note 26, at 36-37.

[66] LINDA MEALEY, SEX DIFFERENCES: DEVELOPMENT AND EVOLUTIONARY STRATEGIES 14 (2000).

[67] Rebecca Christine Knickmeyer & Simon Baron-Cohen, *Fetal Testosterone and Sex*

producing testosterone, and there appears to be a period starting around the beginning of the second trimester that is critical for masculinization of the male brain.[68] These hormonal influences on the developing brain are known as "organizing effects."[69]

Some of the earliest evidence for organizing effects of androgens came from girls with congenital adrenal hyperplasia (CAH), a condition in which the adrenal gland produces excessive levels of androgens during fetal brain development.[70] Girls with CAH have a more masculine behavioral pattern than unaffected girls, tending to be tomboys who are more likely to play with boys and male-typical toys and who are less interested in infants and marriage than unaffected girls.[71] They perform better than unaffected girls on targeting tasks,[72] and some, but not all, studies have found that they have higher levels of spatial ability.[73] CAH females also have occupational preferences more similar to those observed in males.[74]

Differences, 82 EARLY HUM. DEV. 755, 758 (2006) (describing the sources of prenatal testosterone).

[68] HALPERN, *supra* note 33, at 182.

[69] *Id.*

[70] Phyllis W. Speiser & Perrin C. White, *Congenital Adrenal Hyperplasia*, 349 NEW ENG. J. MED. 776, 778 (2003).

[71] Catherine L. Leveroni & Sheri A. Berenbaum, *Early Androgen Effects on Interest in Infants: Evidence from Children with Congenital Adrenal Hyperplasia*, 14 DEVELOPMENTAL NEUROPSYCHOLOGY 321, 332-33 (1998); Vickie L. Pasterski et al., *Prenatal Hormones and Childhood Sex Segregation: Playmate and Play Style Preferences in Girls with Congenital Adrenal Hyperplasia*, 59 HORMONES & BEHAV. 549, 553 (2011).

[72] M. Hines et al., *Spatial Abilities Following Prenatal Androgen Abnormality: Targeting and Mental Rotations Performance in Individuals with Congenital Adrenal Hyperplasia*, 28 PSYCHONEUROENDOCRINOLOGY 1010, 1020 (2003).

[73] David A. Puts et al., *Spatial Ability and Prenatal Androgens: Meta-Analyses of Congenital Adrenal Hyperplasia and Digit Ratio (2D:4D) Studies*, 37 ARCHIVES SEXUAL BEHAV. 100, 101-02 (2008).

[74] Beltz et al., *supra* note 31, at 317; Sheri A. Berenbaum, *Effects of Early Androgens on Sex-Typed Activities and Interests in Adolescents with Congenital Adrenal Hyperplasia*, 35 HORMONES & BEHAV. 102, 106 tbl.2, 107 (1999). Conclusions from CAH studies have been challenged on the ground that the behavioral masculinization of CAH girls might be caused not by androgens but rather by differential parental treatment of the girls because of their masculinized genitals. *See, e.g.*, Wendy Wood & Alice H. Eagly, *A Cross-Cultural Analysis of the Behavior of Women and Men: Implications for the Origins of Sex Differences*, 128 PSYCHOL. BULL. 699, 720 (2002). Evidence is unkind to this argument, however. In fact, studies have shown that parents of CAH girls would prefer their daughters to show less masculine-typed behavior than they do, while parents of non-affected girls would prefer those girls to show more. Anna Servin et al., *Prenatal Androgens and Gender-Typed Behavior: A Study of Girls with Mild and Severe Forms of Congenital Adrenal Hyperplasia*, 39 DEVELOPMENTAL PSYCHOL. 440, 447 (2003). Moreover, girls with CAH receive more encouragement for female-typical play than their unaffected sisters do. *See* Vickie L. Pasterski et al., *Prenatal Hormones and Postnatal Socialization by Parents as Determinants*

Studies of hormonal levels within unaffected populations also provide support for a hormonal explanation of sex differences. For example, maternal testosterone levels during pregnancy are associated with a daughter's male-typical behavior in both childhood[75] and adulthood.[76] Studies on seven-year-old girls have also shown that some spatial abilities are correlated positively with prenatal testosterone levels in second trimester amniotic fluid,[77] as is sex-differentiated play in six- to ten-year-olds.[78] Moreover, testosterone levels in infants in the first six months after birth predict their sex-typed behavior at fourteen months.[79]

B. *Biology, Society, or Both?*

Appreciation of man's place in nature makes the purely social view of sex differences very difficult to accept, as it requires something akin to "special creation" for humans to have slipped the bonds of connection to the animal kingdom. Indeed, studies on nonhuman animals paint a picture consistent with the human data. Female mammals in a variety of species are masculinized by exposure to testosterone in utero, and males who are castrated, either chemically or surgically, prior to the critical period for psychosexual

of Male-Typical Toy Play in Girls with Congenital Adrenal Hyperplasia, 76 CHILD DEV. 264, 273 (2005).

[75] Melissa Hines et al., *Testosterone During Pregnancy and Gender Role Behavior of Preschool Children: A Longitudinal, Population Study*, 73 CHILD DEV. 1678, 1678 (2002) (finding that a mother's testosterone level during pregnancy "shows a positive, linear relationship to gender role behavior in female offspring at the age of 3.5 years").

[76] J. Richard Udry et al., *Androgen Effects on Women's Gendered Behaviour*, 27 J. BIOSOCIAL SCI. 359, 360 (1995) ("Results showed that the higher the prenatal and adult androgen exposures, the more masculinised the women's gendered behaviours.").

[77] Gina M. Grimshaw et al., *Mental Rotation at 7 Years: Relations with Prenatal Testosterone Levels and Spatial Play Experiences*, 29 BRAIN & COGNITION 85, 95 (1995) (finding that "higher levels of prenatal [testosterone] are related to shorter response times and faster rates of rotation among girls who use a rotational strategy").

[78] Bonnie Auyeung et al., *Fetal Testosterone Predicts Sexually Differentiated Childhood Behavior in Girls and in Boys*, 20 PSYCHOL. SCI. 144, 145-47 (2009). Circulating levels of sex hormones at and after puberty also cause "activational effects" which play an additional role in behavior. *See* Catherine Gouchie & Doreen Kimura, *The Relationship Between Testosterone Levels and Cognitive Ability Patterns*, 16 PSYCHONEUROENDOCRINOLOGY 323, 331 (1991) (describing how "activational effects" caused by hormonal fluctuations may influence spatial ability within a particular individual over time, such as by increasing females' spatial ability during low-estrogen phases of menstruation); Elizabeth Hampson, *Variations in Sex-Related Cognitive Abilities Across the Menstrual Cycle*, 14 BRAIN & COGNITION 26, 37-40 (1990); Mazur & Booth, *supra* note 15, at 355; Cheryl M. McCormick & Sarah M. Teillon, *Menstrual Cycle Variation in Spatial Ability: Relation to Salivary Cortisol Levels*, 39 HORMONES & BEHAV. 29, 34-35 (2001).

[79] Annamarja Lamminmäki et al., *Testosterone Measured in Infancy Predicts Subsequent Sex-Typed Behavior in Boys and in Girls*, 61 HORMONES & BEHAV. 611, 614 (2012).

differentiation develop stereotypic female behaviors.[80] Female monkeys show cognitive changes across the menstrual cycle similar to those found in women,[81] and young male and female monkeys exhibit the same sex-typed toy preferences that young children do.[82]

There are additional reasons to be suspicious of a purely sociological account. Many sex differences appear early in life, some as early as infancy, before a child has had an opportunity to absorb social expectations of sex-appropriate behavior.[83] Across the globe, consistent sex differences are found,[84] and people hold the same stereotypes of men and women.[85] Moreover, if the purely social account were true, one would expect that sex differences

[80] Robert F. Goy et al., *Behavioral Masculinization Is Independent of Genital Masculinization in Prenatally Androgenized Female Rhesus Macaques*, 22 HORMONES & BEHAV. 552, 566, 568-69 (1988); William C. Young et al., *Hormones and Sexual Behavior*, 143 SCIENCE 212, 215-17 (1964).

[81] Agnès Lacreuse et al., *Fluctuations in Spatial Recognition Memory Across the Menstrual Cycle in Female Rhesus Monkeys*, 26 PSYCHONEUROENDOCRINOLOGY 623, 634 (2001).

[82] Janice M. Hassett et al., *Sex Differences in Rhesus Monkey Toy Preferences Parallel Those of Children*, 54 HORMONES & BEHAV. 359, 363 (2008).

[83] *See, e.g.*, Gerianne M. Alexander et al., *Sex Differences in Infants' Visual Interest in Toys*, 38 ARCHIVES SEXUAL BEHAV. 427, 430 (2009) (concluding that "the emergence of sex-linked toy preferences does not require the cognitive abilities to support gender identity and the recognition of gender-congruent behavior"); Anne Campbell et al., *Infants' Visual Preference for Sex-Congruent Babies, Children, Toys and Activities: A Longitudinal Study*, 28 BRIT. J. DEVELOPMENTAL PSYCHOL. 479, 494 (2000) (suggesting that because observed toy preferences precede the ability to discriminate between sexes, these preferences are unlikely to be socially created); David S. Moore & Scott P. Johnson, *Mental Rotation in Human Infants*, 19 PSYCHOL. SCI. 1063, 1065 (2008); David S. Moore & Scott P. Johnson, *Mental Rotation of Dynamic, Three-Dimensional Stimuli by 3-Month-Old Infants*, 16 INFANCY 435, 441-42 (2011); Paul C. Quinn & Lynn S. Liben, *A Sex Difference in Mental Rotation in Young Infants*, 19 PSYCHOL. SCI. 1067, 1069-70 (2008); Lisa A. Serbin et al., *Gender Stereotyping in Infancy: Visual Preferences for and Knowledge of Gender-Stereotyped Toys in the Second Year*, 25 INT'L J. BEHAV. DEV. 7, 11 (2001) (concluding that "boys' and girls' visual preferences for vehicles and dolls, respectively, emerge earlier than their association of these toys with gender categories"); Anna Servin et al., *Sex Differences in 1-, 3-, and 5-Year-Olds' Toy Choice in a Structured Play-Session*, 40 SCANDINAVIAN J. PSYCHOL. 43, 48 (1999) (suggesting that the findings that one-year-olds differ in toy preferences and that no sex-typed reinforcement from parents could be detected "are in line with the biological view of the origins of sex differences in play behavior").

[84] GEARY, *supra* note 26, at 252 ("Across nations, generations, political ideologies, and income levels, men have a stronger social dominance orientation and women a social equality orientation . . . .").

[85] JOHN E. WILLIAMS & DEBORAH L. BEST, MEASURING SEX STEREOTYPES: A MULTINATION STUDY 225-45 (1990) (concluding that "[t]he high degree of correspondence in cross-cultural stereotypes may be sufficient to warrant their consideration as variform universals" (citation omitted)).

would be smaller in more sexually egalitarian countries, yet the opposite is often found. For example, sex differences in spatial rotation[86] and personality[87] are actually greater in countries with greater levels of sexual equality.

Some might argue that the existence of widespread stereotypes supports the view that sex differences are socially constructed. But stereotypes are just generalizations, and typically accurate ones at that.[88] If substantial sex differences do exist, it would indeed be very strange if no one had noticed them and furthermore never allowed them to affect expectations. For instance, there is a stereotype that basketball players are tall – and people do in fact expect them to be tall – but that hardly shows that basketball players are tall *because* of the stereotype. Despite the apparently widespread assumption that stereotypes tend to be both inaccurate and extreme, a recent study found that people's perceptions about sex differences in cognitive ability are in fact accurate as to the existence and direction of these differences, but that they actually *underestimate* the size of the difference.[89]

III. THE EFFECT OF SEX DIFFERENCES ON OCCUPATIONAL OUTCOMES

It should not be surprising that all of the above-described sex differences can produce further sex differences in occupational outcomes. According to the "Theory of Work Adjustment,"[90] two dimensions of correspondence between the individual and the job are required for a successful match, *satisfactoriness* and *satisfaction*.[91] The former involves correspondence of the individual's abilities and the demands of the occupation, while the latter entails

[86] Richard A. Lippa et al., *Sex Differences in Mental Rotation and Line Angle Judgments Are Positively Associated with Gender Equality and Economic Development Across 53 Nations*, 39 ARCHIVES SEXUAL BEHAV. 990, 995 (2010).

[87] Paul T. Costa Jr. et al., *Gender Differences in Personality Traits Across Cultures: Robust and Surprising Findings*, 81 J. PERSONALITY & SOC. PSYCHOL. 322, 329 (2001); David P. Schmitt et al., *Why Can't a Man Be More Like a Woman? Sex Differences in Big Five Personality Traits Across 55 Cultures*, 94 J. PERSONALITY & SOC. PSYCHOL. 168, 178 (2008).

[88] *See generally* LEE J. JUSSIM, SOCIAL PERCEPTION AND SOCIAL REALITY: WHY ACCURACY DOMINATES BIAS AND SELF-FULFILLING PROPHECY 422 (2012) ("The power of expectations to distort social beliefs through biases and to create actual social reality through self-fulfilling prophecies is, in general, so small, fragile, and fleeting that it is quite difficult to make a convincing case based on a complete and careful reading of the actual scientific data that such effects likely constitute a major source of inequality. . . . [Instead, the idea that they do] is either wrong in its particulars (depending on the particular claim) or so systematically distorts and overstates the evidence regarding the power and expectancies of stereotypes that it is fundamentally not credible.").

[89] Diane F. Halpern et al., *Beliefs About Cognitive Gender Differences: Accurate for Direction, Underestimated for Size*, 64 SEX ROLES 336, 344-45 (2011).

[90] RENÉ V. DAWIS & LLOYD H. LOFQUIST, A PSYCHOLOGICAL THEORY OF WORK ADJUSTMENT: AN INDIVIDUAL-DIFFERENCES MODEL AND ITS APPLICATIONS 53-68 (1984).

[91] *Id.* at 55-56.

correspondence of the occupational rewards – compensation, working conditions, type of work – and the individual's values and interests.[92] This "theory" thus reflects the commonsense proposition that people gravitate toward, and do best at, jobs for which they have the skills and ability and that provide them the types of satisfactions they desire.

A. *The "Glass Ceiling"*

If proportional representation is the standard, women are undoubtedly "under-represented" at the highest levels.[93] Moreover, no one could plausibly deny that sex discrimination against women exists, although in today's workplace there is also no denying that there is much discrimination in favor of women as organizations seek more "diverse" workforces. Yet, even in the absence of nefarious causes, there is no reason to assume there would be sexual parity among CEOs. Indeed, because of the previously described sex differences, such an assumption would be highly implausible.

The traits of high-level corporate executives are not randomly distributed with respect to sex, as successful executives of both sexes tend to possess a constellation of traits more characteristic of males than females. They tend to be competitive, assertive, ambitious, strongly career-oriented risk takers.[94] Because achievement opportunities are often coupled with uncertainty and the potential for loss, they may appear threatening to the risk averse.[95] Risk preferences are well known to influence occupational choices,[96] so it should not be surprising that sex differences in risk aversion have workplace implications.

Attaining the highest corporate positions requires more than just the right personality. It frequently requires decades of devotion to one's career, long hours, frequent travel, and a willingness to subordinate other things in one's

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[92] *Id.*

[93] The 2012 Catalyst Census found that women constituted 14.3% of Fortune 500 executives and 8.1% of executive top earners. RACHEL SOARES ET AL., CATALYST, 2012 CATALYST CENSUS: FORTUNE 500 WOMEN EXECUTIVE OFFICERS AND TOP EARNERS 1 (2012), *available at* http://www.catalyst.org/knowledge/2012-catalyst-census-fortune-500-women-executive-officers-and-top-earners.

[94] *See* ANN M. MORRISON ET AL., BREAKING THE GLASS CEILING: CAN WOMEN REACH THE TOP OF AMERICA'S LARGEST CORPORATIONS? 24-33 (updated ed. 1992) (discussing the attributes of successful female executives including risk taking, being "tough" and "decisive," and being willing to put job before family); Kenneth R. MacCrimmon & Donald A. Wehrung, *Characteristics of Risk Taking Executives*, 36 MGMT. SCI. 422, 423-25, 433 (1990).

[95] MARGARET HENNIG & ANNE JARDIM, THE MANAGERIAL WOMAN 27 (1977) (observing that "[m]en see risk as loss or gain; winning or losing; danger or opportunity," while "[w]omen see risk as entirely negative," and characterized by "loss, danger, injury, ruin, [and] hurt").

[96] *See, e.g.*, Charles N. Halaby, *Where Job Values Come From: Family and Schooling Background, Cognitive Ability, and Gender*, 68 AM. SOC. REV. 251, 254-57 (2003).

life, often including families. Women are less willing than men to make these investments, both because of family concerns and because the "payoff" – being "top dog" – is not valued by women as much as it is by men.[97] Women are also less willing to uproot themselves from networks of friends and relatives to relocate to a new city, a career move that is a prerequisite to advancement in many organizations.[98]

Marriage and children have different impacts on men and women. When women marry, and especially after they have children, they tend to reduce their work involvement, whereas men tend to increase theirs.[99] Many women remain out of the workforce for an extended time after childbirth,[100] and if they do return to work, many cut back on their work commitment to spend more time with their children. From an evolutionary perspective, it is unsurprising that mammalian mothers find it emotionally difficult to separate from their young, but from an economic perspective it is also unsurprising that a reduction in work commitment and slower accumulation of experience is associated with diminished workplace rewards.

B. *The "Gender Gap" in Compensation*

Many of the same factors that cause women to be underrepresented in the executive suite also affect their compensation. In 2010 the female-to-male annual earnings ratio in the United States was 0.77,[101] and in 2011 the weekly earnings ratio was 0.82.[102] Most of the pay gap occurs across occupations rather than within them,[103] suggesting that garden-variety pay discrimination

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[97] *See* Renée B. Adams & Patricia Funk, *Beyond the Glass Ceiling: Does Gender Matter?*, 58 MGMT. SCI. 219, 220 (2012) ("Male directors care more about achievement and power than female directors, and less about universalism and benevolence.").

[98] David C. Baldridge et al., *Saying 'No' to Being Uprooted: The Impact of Family and Gender on Willingness to Relocate*, 79 J. OCCUPATIONAL & ORGANIZATIONAL PSYCHOL. 131, 142-45 (2006).

[99] Thomas W. Harrell, *The Association of Marriage and MBA Earnings*, 72 PSYCHOL. REP. 955, 961-63 (1993) (finding that women, more frequently than men, wanted more time with family and less time at work; that married women in particular were less willing to work more at the expense of family than were married men; and that, overall, marriage tended to benefit men's career advancement while impeding women's).

[100] *See* FELICE N. SCHWARTZ, BREAKING WITH TRADITION: WOMEN AND WORK, THE NEW FACTS OF LIFE 73-75 (1992).

[101] CARMEN DENAVAS-WALT ET AL., U.S. DEP'T OF COMMERCE, U.S. CENSUS BUREAU, P60-243, INCOME, POVERTY, AND HEALTH INSURANCE COVERAGE IN THE UNITED STATES: 2011, at 7 (2012), *available at* http://www.census.gov/prod/2012pubs/p60-243.pdf.

[102] BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, REP. 1040, WOMEN IN THE LABOR FORCE: A DATABOOK 2 (2013), *available at* http://www.bls.gov/cps/wlf-databook-2012.pdf.

[103] Erica L. Groshen, *The Structure of the Female/Male Wage Differential: Is It Who You Are, What You Do, or Where You Work?*, 26 J. HUM. RESOURCES 457, 468 (1991) (finding that wages of men and women within the same occupational grouping vary by a mere one

(paying women less for performing the same jobs) cannot account for much of the gap.

A great many factors, often having only relatively modest effect by themselves, account for most of the gender gap. Many of these are relatively straightforward, and, like contributors to the glass ceiling, appear to reflect either psychological sex differences or, in the case of some blue-collar occupations, physical differences. In general, men tend to invest more of themselves in the workplace in order to attain both status and resources while women tend to invest more of themselves in their families and less in the workplace. Much of the wage gap, like the glass ceiling, is thus related either directly or indirectly to marriage and families.[104] Single women without children often earn about the same, or more, than single men, while married mothers earn substantially less than either married men or single women.[105]

Men earn more in part because they tend to work more hours[106] and occupy riskier jobs.[107] Indeed, the most dangerous occupations are overwhelmingly dominated by males: fisherman, logger, airplane pilot, iron or steel worker, roofer, and so forth.[108] As discussed above, each year men account for

percent).

[104] *See generally* Michelle J. Budig & Melissa J. Hodges, *Differences in Disadvantage: Variation in the Motherhood Penalty Across White Women's Earnings Distribution*, 75 AM. SOC. REV. 705 (2010).

[105] DIANE FURCHTGOTT-ROTH & CHRISTINE STOLBA, WOMEN'S FIGURES: AN ILLUSTRATED GUIDE TO THE ECONOMIC PROGRESS OF WOMEN IN AMERICA 15 (1999) ("[I]n 1991, women without children made 95 percent of men's wages, all other factors accounted for, but mothers made 75 percent of men's wages. And the wage gap has shrunk [since then] . . . ."); Francine D. Blau & Lawrence M. Kahn, *The Gender Earnings Gap: Learning from International Comparisons*, 82 AM. ECON. REV. 533, 535 (1992) (observing, in a multinational survey of worker wages, that "[t]he pay ratio is uniformly very high among single workers, ranging from 0.91 to 1.03" while at the same time "the pay gap is much larger for married workers").

[106] In 2011, for example, full-time male employees worked approximately fourteen percent more hours than full-time female employees – 40.6 hours and 35.6 hours, respectively. BUREAU OF LABOR STATISTICS, *supra* note 102, at 77 tbl.21. At the high end of hours, the disparity is even greater. *See* JOAN C. WILLIAMS & HEATHER BOUSHEY, THE THREE FACES OF WORK-FAMILY CONFLICT: THE POOR, THE PROFESSIONALS, AND THE MISSING MIDDLE 7 (2010), *available at* http://www.americanprogress.org/wp-content/uploads/issues/2010/01/pdf/threefaces.pdf (reporting that professional-managerial men are 2.7 times as likely as similarly situated women to work fifty or more hours per week).

[107] Barbara S. Kilbourne & Paula England, *Occupational Skill, Gender, and Earnings*, *in* WOMEN AND WORK: A HANDBOOK 68, 68 (Paula J. Dubeck & Kathryn Borman eds., 1996) ("The more women employed in an occupation, the less likely it is that the occupation involves hazardous or onerous working conditions.").

[108] BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, ALL CHARTS, CENSUS OF FATAL OCCUPATIONAL INJURIES, 2011, at 14-17 (2011), *available at* http://www.bls.gov/iif/oshwc/cfoi/cfch0010.pdf (illustrating the high rate of workplace fatalities in occupations dominated by men, such as fishing, logging, and roofing). Data for prior years, which show the same

approximately ninety-two percent of workplace deaths.[109] Not surprisingly, all else being equal, the compensation of risky jobs is greater than that of non-risky jobs.[110] Moreover, men have a substantially higher preference for "tournament" situations in which there are winners and losers.[111] This includes the "partnership tournament" prevalent in large law firms, under which many associates compete for a limited number of partnerships.[112] Compliance with the expectation of working long hours that is associated with tournament competitions leads, among both men and women, to higher earnings.[113] In general, men are more likely to be employed under wage schemes that have a greater component of pay contingent on performance, such as sales commissions and performance bonuses, which means that they bear more of the risk of short-run variations in performance.[114] Reinforcing the notion of a biological link, a study of over 500 MBA students found that high levels of circulating testosterone among women were associated with low risk aversion and with a higher probability of selecting a risky career in finance.[115]

Occupational field also substantially influences compensation. A recent study found that approximately ninety-five percent of the sex difference in starting salaries of new college graduates is accounted for by college major.[116] Men are more likely than women to enter quantitatively demanding fields, and

pattern, are archived and available from the Bureau of Labor Statistics. *Census of Fatal Occupational Injuries – Archived Data*, BUREAU LAB. STAT., http://www.bls.gov/iif/oshcfoi archive.htm (last modified Sept. 20, 2012).

[109] *See supra* note 22 and accompanying text.

[110] *See generally* W. KIP VISCUSI, RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE 38-42 (1983) (describing the risk-premium in wages associated with hazardous employment); Randall K. Filer, *Male-Female Wage Differences: The Importance of Compensating Differentials*, 38 INDUS. & LAB. REL. REV. 426 (1985) (suggesting that the compensation associated with hazardous jobs explains a significant portion of the gender wage gap).

[111] Muriel Niederle & Lise Vesterlund, *Gender Differences in Competition*, 24 NEGOTIATION J. 447, 450 (2008).

[112] *See* MARC GALANTER & THOMAS PALAY, TOURNAMENT OF LAWYERS: THE TRANSFORMATION OF THE BIG LAW FIRM 100-01 (1991).

[113] Olivia A. O'Neill & Charles A. O'Reilly, *Careers as Tournaments: The Impact of Sex and Gendered Organizational Culture Preferences on MBAs' Income Attainment*, 31 J. ORGANIZATIONAL BEHAV. 856, 868-69 (2010).

[114] Keith W. Chauvin & Ronald A. Ash, *Gender Earnings Differentials in Total Pay, Base Pay, and Contingent Pay*, 47 INDUS. & LAB. REL. REV. 634, 647 (1994) (observing that "women are over-represented in firms with lower levels of contingent pay" and positing that "[a]t least part of the observed difference in total pay between men and women [] may reflect a premium to men for bearing more of the risk of short-run variations in their job performance than, on average, women bear").

[115] Paola Sapienza et al., *Gender Differences in Financial Risk Aversion and Career Choices Are Affected by Testosterone*, 106 PROC. NAT'L ACAD. SCI. 15,268, 15,270 (2009).

[116] Judith A. McDonald & Robert J. Thornton, *Do New Male and Female College Graduates Receive Unequal Pay?*, 42 J. HUM. RESOURCES 32, 44 (2007).

there is a substantial correlation between the quantitative demands of a field and its mean starting salary for college graduates.[117] It should be emphasized that the foregoing does not simply rest on men's higher quantitative ability. Instead, highly able men tend to pursue employment in fields that actually require high ability, while highly able women tend to distribute themselves more widely among fields,[118] a finding consistent with the view that men are more motivated by status concerns than women in selecting occupations.

The "gender gap" in compensation is largely an illusion. It mostly disappears when variables that legitimately affect compensation are considered, many of which are linked to the sex differences previously described. As discussed below, many of these same factors influence the occupations that individuals choose.

C. *Occupational Segregation: Women in "Persistently Male" Occupations*

Despite changing social mores reflecting widespread agreement that individuals should be free to pursue the occupations of their choice, a substantial amount of occupational segregation persists.[119] For example, over ninety percent of receptionists (92.5%), dieticians and nutritionists (92.6%), registered nurses (90.5%), and preschool and kindergarten teachers (97%) are female.[120] Additionally, over ninety percent of electrical (93%) and mechanical (94%) engineers, firefighters (95.7%), automotive mechanics (98.2%), and pest exterminators (98.2%) are male.[121] Some scientific fields, such as mathematics, physics, and engineering, also continue to be disproportionately male. In many respects, however, women have made breathtaking advances in the past several decades. Professions such as law and medicine are reaching parity among new entrants, and women represent over 60% of newly enrolled pharmacy students and over 75% of new veterinarians.[122] This pattern, often described as

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[117] Morton Paglin & Anthony M. Rufolo, *Heterogeneous Human Capital, Occupational Choice, and Male-Female Earnings Differences*, 8 J. LAB. ECON. 123, 129-31 (1990). Paglin and Rufolo found that quantitative ability alone accounted for eighty-two percent of the variance in earnings among various fields of new college graduates. *See id.* at 131 & tbl.1.

[118] Lubinski & Benbow, *supra* note 46, at 65 (finding that college women in programs for the gifted were as likely to choose courses in English and foreign languages as they were courses in math and science, while men enrolled overwhelmingly in math and science courses).

[119] *See generally* Kingsley R. Browne, *Evolved Sex Differences and Occupational Segregation*, 27 J. ORGANIZATIONAL BEHAV. 143 (2006) (discussing evolutionary bases for sex differences in occupational preferences).

[120] *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, REP. 1031, HIGHLIGHTS OF WOMEN'S EARNINGS IN 2010, at 14-34 tbl.2 (2011), *available at* http://www.bls.gov/cps/cpswom2010.pdf.

[121] *Id.*

[122] *See supra* notes 5-8 and accompanying text.

"progress" in some occupations but not in others, is what must be explained by any comprehensive account of occupational segregation.

Concern about under-representation of women has focused primarily on scientific, technical, and blue-collar occupations. The affected occupations are often referred to as "traditionally male" or "nontraditional," although these labels are misleading. Virtually all occupations not specifically reserved for women were "traditionally" filled mostly by men, so history alone cannot be the distinguishing factor. What does distinguish them is the *current* representation of women. The U.S. Department of Labor, for example, considers an occupation "nontraditional" if women comprise twenty-five percent or less of total employment.[123] Thus, it would be more precise to label these fields "persistently male." The central question is what it is about these occupations that has caused them to remain predominantly male at a time when so many other occupations, including prestigious ones, have become fully integrated or even predominantly female.

1. Women in Science and Technology

Although the scarcity of women in some scientific fields has been attributed to a hostility so great that it is "shocking . . . that there are any women in science at all,"[124] the reality is quite different.[125] Women's representation in scientific fields is not uniformly low, and at the doctoral level there is wide variation in female representation. In 2010 women earned 23% of the doctorates in engineering, 53% in biological sciences, and 73% in psychology.[126] In fact, there is substantial differentiation by sex even within fields. For example, women were scarce among Ph.D. recipients in mining/mineral, metallurgical, and mechanical engineering (0%, 8%, and 12%, respectively), but more heavily represented in biomedical and bioengineering, environmental health engineering, and textiles science and engineering (39%, 46%, and 56%, respectively).[127] In biology, women earned 44% of the Ph.D.s awarded in biochemistry but 77% of those in nutritional sciences.[128] In psychology, women earned 43% of the Ph.D.s in physiological psychology and psychobiology but 78% of those in developmental and child psychology and

[123] *Quick Facts on Nontraditional Occupations for Women*, U.S. DEP'T LABOR (Apr. 2009), http://www.dol.gov/wb/factsheets/nontra2008.htm.

[124] Marguerite Holloway, *A Lab of Her Own*, SCI. AM., Nov. 1993, at 94, 95 (quoting philosopher Sandra Harding, and also describing science as a "well fortified bastion of sexism").

[125] *See generally* Kingsley R. Browne, *Women in Science: Biological Factors Should Not Be Ignored*, 11 CARDOZO WOMEN'S L.J. 509 (2005).

[126] *See* THOMAS D. SNYDER & SALLY A. DILLOW, U.S. DEP'T OF EDUC., NAT'L CTR. FOR EDUC. STATISTICS, NCES 2012-001, DIGEST OF EDUCATION STATISTICS 2011, at 421 tbl.290 (2012), *available at* http://nces.ed.gov/pubs2012/2012001.pdf.

[127] *See id.*

[128] *See id.*

84% in school psychology.[129] In the social sciences, women were "under-represented" in political science (41%) but "over-represented" in anthropology and sociology (59% and 62%, respectively).[130] In the humanities, women earned only 28% of philosophy Ph.D.s but 80% of those in French language and literature.[131]

Only an odd hostility toward women would produce this variegated pattern of female representation, with each subfield being differentially hostile to women. A more plausible explanation is differential interest and ability. That is, sex differences in occupational choice reflect group differences in temperament, talents, and tastes. The disciplines and sub-disciplines in which there are relatively few women tend to be those having the lowest social dimension (engineering, physics, and mathematics) while those attracting relatively large numbers of women (anthropology, sociology, biology, developmental and child psychology, environmental health, and bioengineering) have a higher social dimension. David Lubinski and his colleagues have characterized this distinction as being between the "organic" and the "inorganic."[132] The fields avoided by women also tend to be among the most mathematically demanding. Given the relative positions of males and females on the "People-Things" dimension[133] and the disproportion of men at the very highest levels of mathematical ability, it would be surprising to find sexual parity in each of these widely differing fields.

Part of the sex difference in mathematics and science participation undoubtedly reflects the increasing sexual disparity in mathematical talent at the extreme high end of ability. Although the "gifted" are often discussed as if they were a homogeneous group, they are highly diverse in ability. The range of the top one percent of scores on a typical IQ test (≈ 135-200+) is as broad as that of the middle ninety-six percent of scores (≈ 66-134); that is, it accounts for a full one-third of the entire score distribution.[134] The combination of a higher male mean and greater variability causes males to especially outnumber females in the top quarter of the top one percent of mathematical ability, a group from which a major portion of scientists in quantitative fields derives.[135]

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[129] *See id.*

[130] *See id.*

[131] *See id.*

[132] David Lubinski et al., *Gender Differences in Engineering and the Physical Sciences Among the Gifted: An Inorganic-Organic Distinction*, *in* INTERNATIONAL HANDBOOK OF GIFTEDNESS AND TALENT 633, 634 (Kurt A. Heller et al. eds., 2d ed. 2000).

[133] *See supra* note 57 and accompanying text.

[134] Camilla Persson Benbow & David Lubinski, *Psychological Profiles of the Mathematically Talented: Some Sex Differences and Evidence Supporting Their Biological Basis*, *in* THE ORIGINS AND DEVELOPMENT OF HIGH ABILITY 44, 45 (Gregory R. Bock & Kate Ackrill eds., 1993).

[135] *See* Kimberley Ferriman Robertson et al., *Beyond the Threshold Hypothesis: Even Among the Gifted and Top Math/Science Graduate Students, Cognitive Abilities, Vocational Interests, and Lifestyle Preferences Matter for Career Choice, Performance, and*

While some assert "there is little evidence that those scoring at the very top of the range in standardized tests are likely to have more successful careers in the sciences,"[136] in fact there is powerful evidence to just that effect.[137] For example, in a large sample of the mathematically gifted, the differences in outcome between those in the top quarter of the top one percent and those in the bottom quarter of the top one percent were substantial. Those in the top quarter of the top one percent were over eighteen times as likely to have obtained a science, technology, engineering, or math (STEM) doctorate and over seven times as likely to have received tenure in a STEM field at a "Top 50" university as those in the bottom quarter.[138]

Even among those with very high ability, the sexes differ in their commitment to math and science because of differences in both interests and patterns of ability. People who score high on the *Social* Occupational Theme of the Strong Interest Inventory[139] tend not to thrive in the cloistered environment of laboratory science, while those entering math-intensive fields tend to have a "low need for people contact."[140] Males with high math aptitude tend to gravitate strongly to math and inorganic sciences, and high-math females tend to spread out among math and inorganic sciences, medical and organic sciences, and humanities and arts, because their interests are "more evenly divided among investigative, social, and artistic pursuits."[141] Moreover, another reason that high-math women often find themselves in disciplines other than math and science is that they have more options than high-math men. High-math men tend to have a relatively "tilted" pattern of abilities, with substantially higher mathematical ability relative to verbal ability, while high-math women tend also to be high in verbal ability, leading many of them into fields requiring high verbal ability.[142] Moreover, differences in spatial ability make an independent contribution, as high math and verbal ability but

Persistence, 19 CURRENT DIRECTIONS PSYCHOL. SCI. 346, 347 & fig.1 (2010).

[136] Carol B. Muller et al., Letter to the Editor, *Gender Differences and Performance in Science*, 307 SCIENCE 1043, 1043 (2005).

[137] Jonathan Wai et al., *Creativity and Occupational Accomplishments Among Intellectually Precocious Youths: An Age 13 to Age 33 Longitudinal Study*, 97 J. EDUC. PSYCHOL. 484, 489 (2005) ("[T]he data . . . on secured doctorates, math-science PhDs, income, patents, and tenure track positions at top U.S. universities collectively falsify the idea that after a certain point more ability does not matter.").

[138] Robertson et al., *supra* note 135, at 347 fig.1.

[139] *See supra* notes 52-56 and accompanying text.

[140] David Lubinski, *Reconceptualizing Gender Differences in Achievement Among the Gifted*, *in* INTERNATIONAL HANDBOOK OF RESEARCH AND DEVELOPMENT OF GIFTEDNESS AND TALENT, *supra* note 132, at 693, 701 (emphasis omitted).

[141] *Id*. at 702.

[142] David Lubinski et al., *Top 1 in 10,000: A 10-Year Follow-Up of the Profoundly Gifted*, 86 J. APPLIED PSYCHOL. 718, 723 (2001); Gregory Park et al., *Contrasting Intellectual Patterns Predict Creativity in the Arts and Sciences: Tracking Intellectually Precocious Youth over 25 Years*, 18 PSYCHOL. SCI. 948, 951 (2007).

(relatively) low spatial ability predict a career in the humanities and social sciences, whereas high math and high spatial ability but (relatively) low verbal ability predict a career in a STEM field.[143]

2. Women in Blue-Collar Occupations

Despite substantial integration of women in many white-collar occupations, including the most prestigious ones, women's low representation in blue-collar occupations has been relatively stable.[144] The percentage of women remains very low in many such occupations, including firefighter (3.6%), construction laborer (2.7%), aircraft pilot and flight engineer (5.2%), auto mechanic (1.6%), carpenter (1.4%), electrician (1.5%), and brick mason or stonemason (0.1%).[145] The conventional explanation is that society and employers have created expectations about what is "appropriate" work for women, so that women tend not to seek these jobs and that when they do, they face both discrimination and sexual harassment. These are not altogether false explanations, but they are grossly incomplete.

Women's low participation rate in most blue-collar jobs results in substantial part from the sex differences previously described. Some of the largest sex differences revealed by the Strong Interest Inventory are on the *Realistic* Occupational Theme, which measures interest in building, repairing, and working outdoors. Most blue-collar occupations are heavily oriented toward the Realistic dimension; indeed, the three-letter Holland code for virtually all blue-collar jobs begins with "R."[146] Many blue-collar occupations also require a high degree of mechanical ability, a dimension for which very large sex differences exist.

Further, physical strength continues to be demanded by many blue-collar occupations, and women generally have only one-half to two-thirds the upper-body strength of men.[147] In many studies the effect sizes are greater than 2.0, which means that there is very little overlap between the strength distributions of the two sexes, even less overlap than there is between the sexes in height.[148] Although many jobs have changed in ways that diminish the importance of

[143] Rose Mary Webb et al., *Spatial Ability: A Neglected Dimension in Talent Searches for Intellectually Precocious Youth*, 99 J. EDUC. PSYCHOL. 397, 405 (2007).

[144] Brigid O'Farrell, *Women in Blue Collar and Related Occupations at the End of the Millennium*, 39 Q. REV. ECON. & FIN. 699, 700 tbl.1 (1999).

[145] BUREAU OF LABOR STATISTICS, *supra* note 102, at 31 tbl.11.

[146] Examples include arc welder (RIS), electrician (RIE), firefighter (RES), and automobile mechanic (RCI). *See* HOLLAND, *supra* note 54, app. B at 268.

[147] *See* S.T. Pheasant, *Sex Differences in Strength – Some Observations on Their Variability*, 14 APPLIED ERGONOMICS 205, 207 & tbls.1 & 2 (1983); *see also* A.E.J. Miller et al., *Gender Differences in Strength and Muscle Fiber Characteristics*, 66 EUROPEAN J. APPLIED PHYSIOLOGY 254, 256 (1993).

[148] *See* KINGSLEY R. BROWNE, CO-ED COMBAT: THE NEW EVIDENCE THAT WOMEN SHOULD NOT FIGHT THE NATION'S WARS 19-27 (2007).

women's relative lack of strength,[149] others have not. Occupations such as bus and truck mechanic, for example, require substantial upper-body strength, not to mention a high degree of mechanical ability. These two requirements lead to an expectation that few women will be found in such positions, and the data reflect exactly that; less than one percent of bus and truck mechanics are women.[150]

CONCLUSION

Despite major changes in the workplace, many favoring women, some worry about residual areas in which men seem to retain an advantage. A double standard may underlie the worry. When women are perceived to be doing well, many observers simply conclude that women are more suited to the modern workplace than men and that their natural talents are responsible for women's advances.[151] When men are perceived to be doing well, however, many observers take as borderline blasphemy any suggestion that men may be more suited to certain jobs because of *their* natural talents; instead, blame must rest on subtle or even invisible barriers. To do otherwise is to "blame the victim."

So, does the advancement of women in the workplace represent the "end of men"? No. Men will continue to dominate in certain areas based on their talents and tastes, just as women will dominate in others. Does the fact that men will continue to be over-represented in certain areas reflect continued sexual inequality? No, unless the fact that women are overrepresented in other areas reflects inequality running the other way. If fields like psychology, pharmacy, nursing, teaching, and veterinary medicine attract disproportionately large numbers of women, it stands to reason that other fields will be left with disproportionately small numbers of women.

To be sure, no set of workplace outcomes is pre-ordained or permanent. Changes in the workplace will persist, and these changes are likely to have somewhat different impacts on the two sexes. As both Neils Bohr and Yogi Berra reputedly observed, however, predictions are difficult to make, especially about the future.[152] Thus, I will leave it to others to tell us what the workplace of the 2030s will look like.

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[149] Bruce A. Weinberg, *Computer Use and the Demand for Female Workers*, 53 INDUS. & LAB. REL. REV. 290, 305 (2000) (explaining that "increases in computer use have restructured work in ways that de-emphasize physical skill").

[150] DEPARTMENT OF LABOR STATISTICS, *supra* note 102, at 31 tbl.11.

[151] *See generally* FISHER, *supra* note 3 (discussing the various talents, skills, and advantages that the author believes uniquely position women to thrive in the twenty-first century).

[152] *See Predicting the Tech Future Is a Difficult Thing to Do*, WALL ST. J. (Dec. 19, 2012, 4:29 PM), http://online.wsj.com/article/SB10001424127887324461604578189580521759520.html.