International Society for Intelligence Research
2004

Charles Spearman

Program
Fifth Annual Conference
Bourbon Orleans Hotel
New Orleans, LA

Acknowledgements

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Thursday, December 2, 2004	Friday, December 3, 2004	Saturday, December 4, 2004
8:30-9:00 **Condon & Schroeder (13)** **Memory for Design**	**8:30-9:00** **McBride (31)** **Human Int. and Machine Int.**	**8:30-9:00** **Kane (27)** **Speaman's Hypothesis**
9:00-9:30 **Irwing & Lynn (25)** **Sex Diff. in General Knowledge**	**9:00-9:30** **Prokosch et al (35)** **g and Body Symmetry: Fitness**	**9:00-9:30** **Fagan & Holland (17)** **Race, Language, & Info. Processing**
9:30-10:00 **Dolan et al. (16)** **Gender Diff. in WAIS-III**	**9:30-10:00** **Bates (9)** **Asymmetry and Intelligence**	**9:30-10:00** **Templer & Arikawa (39)** **Race, Skin Color, & IQ**
10:00 -10:30 **Break**	**10:00-10:30** **Break**	**10:00-10:30** **Break**
10:30-11:00 **Johnson & Bouchard (26)** **Sex Diff.: Pred. from VPR Model**	**10:30-11:00** **Figueredo et al (18)** **Heritability of Life History**	**10:30-11:00** **McDaniel & Whetzel (32)** **IQ & Wealth of Nations**
11:00-11:30 **Lynn & Irwing (30)** **Sex Diff. in Gen. Intell. & Var.**	**11:00-11:30** **Arden & Hill (8)** **Intelligence in Preliterate Society**	**11:00-11:30** **Templer & Arikawa (38)** **Asian-White Differences**
11:30-12:00 **Camarata & Woodcock (12)** **Sex Diff. in Processing Speed**	**11:30-12:00** **Rushton & Bons (36)** **Assortative Mating & Friendship**	**11:30-12:00** **Gissberg & Rodgers (21)** **Sibship size and Birth Order**
12:00-2:00 **Lunch**	**12:00-2:00** **Lunch**	**12:00-2:00** **Lunch**
2:00-2:30 **Wicherts (41)** **Group Diff. & Meas. Invariance**	**2:00-2:30** **Harris, Johnson, Vernon, & Jang (23)** **Self-Report of Talent and IQ**	**2:00-2:30** **Lubinski, et al. (29)** **Tracking exceptional human capital**
2:30-3:00 **Brody (11)** **Cent. Of Spearman's Paper**	**2:30-3:00** **McGrew (33)** **Working Memory & Proc. Speed**	**2:30-3:00** **Wai, et al. (40)** **Vocational Achievement & Creativity**
3:00-3:30 **Gottfredson (22)** **Ten Years After *The Bell Curve***	**3:00-3:30** **Frey & Detterman (19)** **Response Complexity and *g***	**3:00-3:30** **Larsen, Hartman, & Nyborg (28)** **Stability of Intelligence Across Life**
3:30-4:00 **Hunt (24)** **Patterns of Thought**	**3:30-4:00** **McRorie & Cooper (34)** **Reflex Behavior, EMG and *g***	**3:30-4:00** **Beaujean et al (10)** ***g* & College Math Difficulties**
4:00-4:30 **Break**	**4:00-4:30** **Break**	**4:00-4:30** **Break**
4:30-5:30 **Thomas Bouchard:** **His Research** **Moderator: David Lubinski** **5:30-6:00** **Questions from Audience**	**4:30--5:00** **Stough et al (37)** **EEG & Emotional Intelligence**	**4:30-5:00** **Demetriou (15)** **An Integrated Theory**
	5:00-6:00 (14) **Invited Address: Ian Deary** **Spearman (1904) Revisited:** **Gen. Intell. And Ed. Ach.**	**5:00-5:30** **Widaman (42)** **PKU and IQ**
		5:30-6:00 **Gartman, Detterman, & Frey (20)** **ACT and Cognitive Ability**
6:00-7:30 Elsevier Reception	**Numbers in ( ) indicate the page** **of the abstract in the program.**	

International Society for Intelligence Research (ISIR) Program
2004

(Numbers in parentheses refer to page of abstract)

Thursday, December 2, 2004

Papers (8:30-10:00) Gender Differences
Chair: Detterman

8:30-9:00   Condon and Schroeder (13)
Memory for design: An overlooked mental ability

9:00-9:30   Irwing and Lynn (25)
Sex differences in general knowledge

9:30-10:00   C. Dolan, J. Wicherts, R. Colom, F. Abad, and D. Hessen (16)
Gender differences in the WAIS-III Spanish standardization data

10:00-10:30 **Break**

Papers (10:30-12:00) Gender Differences (Continued)
Chair: Hunt

10:30-11:00 Johnson and Bouchard (26)
Sex differences in mental abilities: Examining predictions from the VPR model

11:00-11:30 Lynn and Irwing (30)
Sex differences in general intelligence and in the variability of intelligence

11:30-12:00 Camarata and Woodcock (12)
Sex differences in processing speed: Developmental effects in males and females

12:00-2:00   **Lunch**

Papers (2:00-4:00) Theory
Chair: Fagan

2:00-2:30   Wicherts (41)
Stereotype threat and group differences in test performance: A question of measurement invariance

2:30-3:00   Brody (11)
A centennial examination of Spearman's paper

3:00-3:30   Gottfredson (22)
The sociology of intelligence ten years after *The Bell Curve*

3:30-4:00   Hunt (24)
Patterns of thought

4:00-4:30   **Break**

4:30- 5:30   **An interview with Thomas Bouchard: His research**
Thomas Bouchard, Jr.
Interviewer: David Lubinski

5:30-6:00   Questions from the audience

6:00-7:30   **Reception – St. Mary's Courtyard– Courtesy of Elsevier**

Friday, December 3, 2004

Papers (8:30-10:00) Evolution and Intelligence
Chair: Condon

8:30-9:00   McBride (31)
Human intelligence levels are robust, but as human brains become more closely coupled with intelligent machines, means and variance in "net" intelligence will increase, not decrease

9:00-9:30   Prokosch, Yeo, and Miller (35)
Intelligence tests with higher g-loadings show higher correlations with body symmetry: Evidence for a general fitness factor mediated by developmental stability

9:30-10:00   Bates (9)
Fluctuating asymmetry and intelligence: Replication and discussion

10:00-10:30   **Break**

Papers (10:30-12:00) Evolution and Intelligence (Continued)
Chair: Gottfredson

10:30-11:00   Figueredo, Vasquez, Brumbach, and Schneider (18)
               The heritability of life history strategy: The K-factor, covitality, and personality

11:00-11:30   Arden and Hill (8)
               What is intelligence good for in a preliterate society?

11:30-12:00   Rushton and Bons (36)
               Assortative mating and friendship in twins: Evidence for genetic similarity

12:00-2:00   **Lunch**

Papers (2:00-5:00) Understanding *g*
Chair: Bates

2:00-2:30   Harris, Johnson, Vernon, and Jang (23)
               Self-Report talents and measured intelligence: Phenotypic, genetic, and
               environmental relationships

2:30-3:00   McGrew (33)
               Working Memory and processing speed as causal explanations of *g:* A CHC-
               based investigation across the lifespan

3:00-3:30   Frey and Detterman (19)
               Another look at task complexity: Complexity and *g*-loadings

3:30-4:00   McRorie and Cooper (34)
               Reflex behavior, electromyography (EMG), and general mental ability

4:00-4:30   **Break**

4:30-5:00   Stough, Tarasuik, and Ciorciari (37)
               Variations in EEG spectra and alpha coherence associated with emotional
               intelligence

5:00-6:00   **Invited Address**
               Ian Deary (14)
               Spearman (1904) revisited: General intelligence and educational achievement
               Introduced by Arthur Jensen

Saturday, December 4, 2004

Papers (8:30-10:00) Group Differences
Chair: Rodgers

8:30-9:00   Kane (27)
             Spearman's hypothesis: Implications for practice in a diverse society

9:00-9:30   Fagan and Holland (17)
             Race, native language, information processing ability, and IQ

9:30-10:00   Templer and Arikawa (39)
             Contribution of race and skin color in international distribution of mean IQ

10:00-10:30 **Break**

Papers (10:30-12:00) Group Differences (Continued)
Chair: Brody

10:30-11:00 McDaniel and Whetzel (32)
             IQ and wealth of nations: Prediction of GDP not dependent on precise g
             estimates

11:00-11:30 Templer and Arikawa (38)
             Asian-White differences in aptitude and difficulty of chosen academic discipline

11:30-12:00 Gissberg and Rodgers (21)
             Are past findings of the effects of sibship size and birth of a sibling on
             IQ/cognitive ability spurious? Examining causal links using SEM on NLSY

12:00-2:00   **Lunch**

Papers (2:00-4:00) Intelligence and Achievement
Chair: Stough

2:00-2:30   Lubinski, Benbow, Webb, and Bleske-Rechek (29)
             Tracking exceptional human capital

2:30-3:00   Wai, Lubinski, and Benbow (40)
             Vocational achievement and creativity among intellectually precocious youth: An
             age 13 to age 33 longitudinal study

3:00-3:30   Larsen, Hartman, and Nyborg (28)
            The stability of general, verbal, and arithmetic intelligence from early adulthood
            to middle age: A large-scale longitudinal study

3:30-4:00   Beaujean, Knoop, and Holliday (10)
            Is Spearman's *g* related to math difficulties in college students?

4:00-4:30   **Break**

Papers (4:30-6:00) Misc. Papers
Chair: Detterman

4:30-5:00   Demetriou (15)
            Mental processing, thinking, and self-awareness: Towards and integrated theory

5:00-5:30   Widaman (42)
            Prenatal exposure to phenylalanine influences infant and childhood intellectual
            outcomes: Results from the PKU collaborative study

5:30-6:00   Gartman, Detterman, and Frey (20)
            ACT and cognitive abilities

What is Intelligence Good For in a Pre-Literate Society?

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and
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Galton has outpaced Darwin in studies of human intelligence. Researchers have made more progress in the psychometric measurement of cognitive abilities than in deriving testable hypotheses about the selection pressures and evolutionary benefits of intelligence. Here we report on intelligence differences within a group of largely non-literate hunter-gatherers living in Paraguay. The Aché are modern people, but their lives more closely approximate human ancestral species-typical life than does ours. We compare IQ-type test scores (Koh's Block Design and Raven's Coloured Matrices) from 160 members of the Aché community with scores on their foraging ability, reproductive success and social status, referenced by 28 years worth of quantitative and qualitative data collected by a native-language speaking anthropologist.

Fluctuating Asymmetry and Intelligence: Replication & Discussion

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The general ability factor of intelligence may reflect general biological fitness. If so, g-loaded measures such as Raven's Progressive Matrices should be related to morphological (bodily) measures of fitness such as fluctuating asymmetry (FA: left-right asymmetry of an set of typically left-right symmetrical body traits such as finger lengths). This relationship was replicated in two independent samples, which revealed correlations between FA and Raven's scores of 0.414 and 0.289 respectively. The second sample included a head size as a variable and this significantly predicted Raven's in a regression analysis. However this correlation was reduced when FA was entered into the regression, suggesting that the head size—IQ correlation is in part or in total a function of an overarching fitness "f factor", influencing the growth and maintenance of both bodily systems including the brain.

Is Spearman's *g* Related to Math Difficulties in College Students?

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The purpose of this study is to assess whether the psychometric symptomatology evidenced in college students with math difficulties is a function of General Intelligence (*g*, Spearman, 1904). For this study, 170 college students with self-identified math difficulties (i.e., failure or near-failure of a college-level Algebra class) were given a battery of three psychometric tests: Wechsler Memory Scale-III, Wechsler Adult Intelligence Scale-III, and selected math and reading subtests of the Woodcock Johnson-III Tests of Achievement. Using Schmid and Leiman's (1957) method for extracting a higher-order factor structure, a single second-order factor (*g*) and four first-order factors (Crystallized, Fluid, Visual, and Auditory; see Carroll, 1993) were extracted using various permutations of the psychometric subtests. Invariably, when math achievement subtests were not included in the analysis, the factor structure resembled that of the "normal" population (Carroll, 2003) in that *g* explained the majority of the covariance (~50-60%), with the first-order factors explaining similar amounts (~7-14%) of the residual. However, when math subtests were included in the analysis, *g* explained significantly less covariance, roughly the same amount as the Crystallized and Fluid factors (~20-30%) and just slightly more than the Auditory and Visual factors (~10-15%).

Results from this study suggest that there are multiple causes for poor math performance among college students, and that these causes are not necessarily a function of *g*. Furthermore, while *g* does predict math performance in the general population well (Aswal, 2001; Oh, 2002), results from this study seem to indicate that *g*'s predictive capability does not carry over for college students with math difficulties, at least not for tasks in which they have a diagnosable disorder.

References

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A Centennial Examination of Spearman's Paper

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Why is Spearman's paper still relevant 100 years after its initial publication? This paper addresses this question. First, the historical context for Spearman's paper is discussed. Second, the relationship between Spearman's ideas and contemporary analyses is explored. Spearman's contributions extend beyond the postulation of a g construct. Spearman's most fundamental insight was recognition of the distinction between a construct and a measure. The distinction enabled Spearman to relate his measures to the theoretical properties of the g construct. The attempt to relate the structure of a correlation matrix to an underlying theory of the structure anticipated the use of contemporary structural equation modeling as a basis for testing theoretically derived structures of relationships among diverse measures. Spearman's test of his model enabled him to decisively reject his theory. I.e. Spearman asserted that g did not explain all of the covariance in his matrix. Spearman's theory also provides support for the use of aggregate procedures based on measures with high g loadings as a basis for the development of optimal measures of intelligence.

Spearman's paper also contains an experimental analysis of the g construct and asserts that intelligence is related to sensory discrimination ability. In his words, "the *common and essential element in the Intelligences coincides with the common and essential element in the Sensory Functions*" (italics in original). My paper ends with a brief consideration of contemporary efforts to relate psychometric indices to a core information processing ability. The viability of Spearman's identification of a common and essential element in experimentally derived measures that is related to g is assessed.

Sex Differences in Processing Speed: Developmental Effects in Males and Females

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The purpose of this study was to compare the cognitive abilities and selected achievement performance of females and males across the lifespan on standardization samples of broad cognitive abilities in a total of 1,987 participants (1102 females, 885 males) from the WJ-III, 4,253 participants (2,014 males, 2,239 females) from the WJ-R, and 4,225 participants (1,964 males and 2,261 females) from the WJ-77 were compared for sex differences. Preschool through adult cohorts were included in the analyses. The results indicated that males scored significantly lower than females on estimates of Gs (processing speed) in all three normative samples, with the largest difference evident in adolescent subgroups. A secondary finding was significantly higher scores for males on estimates of comprehension knowledge (Gc) in all three samples. Follow-up analyses of the achievement tests also indicated lower performance for males on speeded tests such as visual matching, reading fluency and writing fluency. There was a high degree of concordance across tests and no sex difference in were observed in overall estimates of general intellectual ability (GIA) on the WJ-III. The educational implications of these findings will be discussed with an emphasis on the adolescent (high school) cohort.

Memory for Design: An Overlooked Mental Ability

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The purpose of this presentation is to examine pertinent validation data for the Johnson O'Connor Research Foundation's (JOCRF's) Memory for Design test. Similar tests involving short-term memory for line designs have been used in neuropsychology for assessment of gross brain deficiencies. We will show that for the JOCRF test, individual differences in the normal range have a meaningful pattern of relationships with other cognitive abilities and several biographical criteria.

The JOCRF Memory for Design test shows adequate reliability (.80), with a typical bell-shaped distribution of raw scores. The age curve resembles that for general spatial ability, with a substantial decline in performance across adulthood. Regarding gender differences, males show a small advantage, less than generally observed for spatial-ability tests. Regarding construct validity, SEM analyses with a hierarchical model show that Memory for Design loads on Spatial (.45) and Memory (.40) factors. It is also strongly related to g ($r = .67$), which we attribute to a suspected relationship with working memory. With respect to choice of college major, Memory for Design shows a substantial degree of discrimination between majors involving space and design, such as engineering and architecture, versus non-spatial majors such as the humanities and social sciences. Similarly, among occupational groups, examinees in engineering and architecture excel on the test relative to those in non-spatial fields such as accounting, education, and sales. Finally, Memory for Design is not simply a proxy for g because partialling g from scores on Memory for Design lessens but does not eliminate the relationships with college major and occupation.

Based on these results, we see the JOCRF Memory for Design test as a valid measure of a type of visual memory that may fill a role that conventional memory and spatial tests do not fill. Further research is needed to identify the mechanisms through which Memory for Design is associated with life outcomes.

Spearman (1904) Revisited: General Intelligence and Educational Achievement

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In Spearman's original (1904) study, he examined the associations among school examination results, teacher's estimates of intelligence, and sensory discrimination. Here, the intelligence-educational achievement relationship is re-examined in a population-representative, prospective study. Approximately 70,000 children took the Cognitive Abilities Test (CAT) battery at entry to secondary school (year 7). At the end of year 11, in 2002, their GCSE results were obtained and linked with their CAT scores. The associations between the general factor (g) from the CAT battery and the results from 25 different GCSE results are presented. The associations between a verbal ability factor, unrelated to g are shown. Also, GCSE results are compared for boys and girls, and between different types of schools (local authority and grant-maintained.) GCSE results are modelled with respect to g, verbal ability, age, school type and sex. Apart from being large, prospective, using a comprehensive ability battery, and being population representative, the study also has the advantage of using National Examinations which are taken when all of the population is still in education.

Mental Processing, Thinking, and Self-awareness: Towards an Integrated Theory

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This presentation summarizes a series of studies directed to the integration of the information processing, the differential, and the developmental modeling of the mind into an overarching theory. Specifically, one set of studies investigated longitudinally the relations between several dimensions that are considered important by all three traditions. Namely, processing efficiency, working memory, and thinking. Participants, aged from 8 to 16 years, were tested with a large array of tasks addressed to these three dimensions.

Confirmatory factor analysis indicated that these dimensions are organized in a three-stratum hierarchy. Structural equation modeling indicated that the dimensions are interrelated in a cascade fashion so that more fundamental dimensions are part of more complex dimensions. That is, processing efficiency predicts the condition of working memory, which, in turn is related to the condition of different thinking domains.

Growth and dynamic modeling suggested that all dimensions as well as their relations change systematically with time. Mixture growth modeling suggested that there are four types of developing persons, each being defined by a different combination of performance in these aspects of the mind. Some types were more efficient and stable developers than others. These analyses indicated that processing efficiency is the developmental factor whereas working memory is the individual differences factor in regard to thinking.

Another set of studies investigated the relations between processing efficiency and self-awareness. In these studies four groups of participants were examined. (i) Efficient processors and efficient reasoners, (ii) efficient processors and weak reasoners, (iii) weak processors and efficient reasoners, and (iv) weak processors and weak reasoners. These participants were tested by a specifically designed inventory that probes self-representation about these dimensions. The results suggested that processing and reasoning efficiency are directly represented in one's cognitive self-concept. That is, efficient processors and efficient reasoners represent themselves as more powerful reasonsers than persons who are weak processors and weak reasoners.

These findings are discussed from the point of view of information processing, differential, and developmental models of intelligence and the self and an integrative model is proposed. The model describes how the various processes are interwoven during development. The implications for current cognitive science and psychometric theories of intelligence are discussed. The implications about possible connections between cognitive science and the study of self are also discussed.

Gender Differences in the WAIS-III Spanish Standardization Data

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We investigated gender differences in the WAIS-III in a Spanish standardization sample (281 women, 307 males, aged 16 to 34 years). We fitted both first order common factor models and second order common factor models subject to strict factorial invariance. The second order model includes general intelligence (g) as a second order common factor. The results indicate that gender differences are due mainly to the WAIS-III common factors Working Memory (WM) and Perceptual Organization (PO). The second order common factor (g) does not contribute to the observed differences in subtest means. The results are of theoretical interest in the light of the Ankney-Rushton anomaly.

Race, Native Language, Information Processing Ability and IQ

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American Whites, African-Americans and non-native speakers of English were tested for their knowledge of the meanings of English words used on a standard IQ test. Each group was also tested for their ability to process information made equally available to all by exposing them to unfamiliar faces and then testing their recognition memory for those faces. Word knowledge varied with race, native language, and information processing ability. White Americans knew more about the meanings of words tested on standard IQ tests than did African–Americans and those for whom English was a second language. Considering all participants, recognition memory was positively associated with vocabulary size. Thus, IQ scores based on word knowledge will vary with cultural circumstance and with information processing ability. However, in the present study, the ability to process new information was found to be independent of race or language background. The results of the present study can be understood in the light of a theory that defines the IQ score as a measure of knowledge. Intelligence is defined as information processing ability. Knowledge is the result of one's information processing ability in interaction with the information provided by one's culture. IQ scores (knowledge) vary with race and linguistic background (culture). Information processing ability (intelligence) does not vary with race and linguistic background (culture)

The Heritability of Life History Strategy: The K-Factor, Covitality, and Personality

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A selection of human behavioral and cognitive traits from the MIDUS survey (Brim et al., 2000) was used to perform a psychometric and behavioral genetic test of life history theory. The MIDUS survey consisted of a telephone interview and two follow-up mail surveys given to a nationally representative sample over a one year period in 1995. The survey was limited to English speakers in the United States between the ages of 25 and 74. The MIDUS survey contains data on singletons as well as on a genetically informative sample of MZ and DZ twins.

Starting with the MIDUS singleton data, twenty scales were constructed using items from the MIDUS survey hypothesized to measure cognitive and behavioral dimensions theoretically related to life history strategy. These scales were used to construct a single common factor, the K-Factor, which accounted for 66% of the reliable variance in the scales. Another common factor, Covitality, was constructed from five scales for physical and psychological well-being. Finally, a single general factor, Personality, was constructed from scales for the Big Five personality traits. The K-Factor, Covitality factor, and general Personality factor were found to be significantly correlated with each other, supporting a single higher-order common factor. The "Super-K Factor" constructed had factor loadings of .79 on the K-Factor, .55 on the Covitality factor, and .72 on the Personality factor.

Using the MIDUS MZ and DZ twin data, these results were replicated. Only same-sex DZ twins were used for maximal comparability. Constructed the same way as for the singleton data, at first ignoring the fact that they were twins, the 20-scale K-Factor accounted for 72% of the reliable variance in the twin data. The Covitality factor and the general Personality factor were also replicated and again found to be significantly correlated with both each other and with the K-Factor. Thus, the Super-K Factor was also replicated, with factor loadings of .82 on the K-Factor, .60 on the Covitality factor, and .75 on the Personality factor in the twin data. Using the Falconer (1989) formula for estimating heritabilities for each of these common factors, the estimated heritability of the K-Factor was .60, that of the Covitality Factor was .55, and that of the general Personality Factor was .59; the heritability of the Super-K Factor as a whole was .66. A higher-order factor analysis of the genetic correlations between these three lower-order factors yielded Super-K Factor loadings of .83 on the K-Factor, .78 on the Covitality factor, and .87 on the Personality factor. The heritabilities of the individual scales were also estimated but were generally lower than those for the common factors.

These findings suggest that, as predicted by evolutionary ecological theory, a single higher-order common factor exists that underlies the covariance among a wide array of behavioral and cognitive life history traits and is highly heritable. Given the significant correlations of many life history traits to general intelligence, as documented in sources such as *The Bell Curve* (Herrnstein & Murray, 1994), this general factor for life history strategy should be of great interest to intelligence researchers.

Another Look at Task Complexity: Response Complexity and *g*-Loadings

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Previous research presented at this conference attempted to address the relationship between elementary cognitive task complexity and *g*-loadings. It was demonstrated that, while changes in the complexity of a simple task tended to result in corresponding changes in the task's mean decision times (DTs), there was not a systematic change in the correlations between DT and IQ. These results held if complexity was defined either as increased information load (i.e. number of choices in a choice RT task) or as increased processing requirements. The present study attempted to conceptualize complexity differently: as the processes required at response rather than decision. Subjects were presented with four tasks: one standard choice RT paradigm and three variants of the typical RT task. The variants consisted of a simple motor complication (pressing the F key before making a response) and two complications also requiring numeric judgments (indicating low/high or odd/even numbers before making a response). Although these judgments were required only at the response phase, all variants of the standard RT task had an effect on decision times. Results of this study were consistent with previous research in that, although complication of response resulted in systematic changes in mean DT, there were no corresponding changes in DT x IQ correlations.

ACT and Cognitive Abilities

Katherine Gartman, Douglas K. Detterman, and Meredith Frey

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Research on the SAT has shown a substantial correlation with measures of g such as the Armed Services Vocational Aptitude Battery (ASVAB). Another widely administered test for college admission is the American College Test (ACT). Using the National Longitudinal Survey of Youth 1979, measures of g were derived from the ASVAB and correlated with the ACT scores of 1075 participants. The resulting correlation was .77. The ACT also shows a significant correlation with the SAT and several small-N IQ tests. A more recent sample consisting of ACT scores and the Raven's APM is currently being collected. Though research is ongoing, it appears that IQ can be accurately estimated from ACT scores.

Are Past Findings of the Effects of Sibship Size and Birth of a Sibling on IQ/Cognitive Ability Spurious? Examining Causal Links Using SEM on the NLSY

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Previous researchers (e.g. Anastasi, 1956; Higgins, Reed, & Reed, 1962; Belmont & Marolla, 1973; Guo & VanWey, 1999) have found a consistent negative correlation between sibship size and IQ/cognitive ability. The confluence model (Zajonc, 1975; Zajonc, 2001) and the resource dilution model (Blake, 1981; Downey, 1995; 2001; Armor, 2001) predict a decrease in children's IQ/cognitive ability following the birth of a child. The purpose of this study was to examine the negative correlation between sibship size and IQ/cognitive ability on a large, representative national sample of children: the children of the females in the National Longitudinal Survey of Youth (1979). The children were analyzed cross-sectionally through structural equation modeling in 1986, 1992, 1996, and 2000. The children were also analyzed longitudinally between 1986 and 1992, between 1990 and 1994, and between 1990 and 1998 using both multigroup MIMIC models and growth curve analyses with covariates. Cross-sectional results yielded consistent patterns showing a significant negative effect of sibship size on IQ/cognitive ability. Longitudinal SEM analyses, in contrast, found no effects of the birth of a sibling on cognitive ability. Future studies should examine the possible non-linear relationship between sibship size and cognitive ability, look at the developmental effects of children's home environment, and investigate other possible mediating or moderating variables such as child temperament.

The Sociology of Intelligence Ten Years After *The Bell Curve*

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Jensen distinguishes between the vertical and horizontal study of general intelligence. The former refers to the biological underpinnings of variation in *g* and the latter to the ways in which that variation shapes the behavior of individuals and populations. Vertical research on *g* is burgeoning, and draws scientists from diverse disciplines in brain research and other biological sciences. In contrast, psychometrically-informed horizontal research on *g* tends to mobilize fervent opposition rather considered inquiry from its sister disciplines in the social sciences. Sociologists, in particular, were among the most vocal in denouncing Herrnstein and Murray's science following publication of *The Bell Curve* in 1994. Claiming hegemony in all matters sociological while maintaining resolute ignorance about *g,* sociologists continue to be the biggest impediment to a sociology of intelligence. This presentation first discusses why a sociology of intelligence is critical to the study of intelligence more broadly, describes the nascent field's major advances in the last decade, suggests strategies for its long-term development, and reviews ways of neutralizing the usual tactics meant to discredit psychometrically-informed research on the social implications of genetically-rooted variation in *g*.

Self-Report Talents and Measured Intelligence: Phenotypic, Genetic, and Environmental Relationships

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The relationship between self-report talents and measured intelligence was examined at both the phenotypic (zero-order) level as well as at the genetic and environmental levels. Twins and siblings ($\underline{N}$ = 516) completed a self-report talent questionnaire and a group-administered timed intelligence test. A factor analysis of the talent questions revealed 10 factors, including: an interest in politics, interpersonal relationships, practical tasks, intellectual pursuits, academic skills, entrepreneur/business, domestic skills, vocal abilities, and creative talents. At the phenotypic level, the correlations between the talent factor scores and intelligence ranged from zero to .43. Heritability estimates of the talent factors found that genetic components accounted for 42% to 68% of the variance. The relationship between the two areas at the genetic level was found to range between .01 and .56. The environmental correlations were found to range from .01 to .33. The results suggest that self-report talent scores are related to measured intelligence, and that some of these observed relationships may have a common genetic basis while others are from a common environmental factor.

Patterns of Thought

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The study of individual differences in both cognition and personality has been greatly influenced by the idea of ordered, and even linearly ordered, responses. Some answers are more correct than others, some people are smarter than others, some people are more neurotic, extroverted, conscientious, etc. than others. This conceptualization has lead to powerful statistical tools for analyzing such data. There has also been feedback, a 'good theory' has become one for which the statistical tools provide a reasonable answer. While there is a good deal to be said for such reasoning, there are other situations in which answers are qualitatively different but not clearly ordered. People can display consistent patterns of thinking in such situations, without one pattern necessarily indicating a smarter person than other patterns do. However we have lacked tools to analyze such data. In this talk I will present the problem formally, present some new tools for analyzing qualitative cognitive and personality data, and illustrate their use with examples drawn from problem solving in physics and in politics.

Sex Differences in General Knowledge

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It has become well-established that there are sex in differences in a number of primary or second order abilities. Males are on average better than females at spatial orientation, visualization, mathematical reasoning, and mechanical aptitude, while females are on average better than males on object location memory, perceptual speed, word fluency, numerical calculation, spelling, foreign languages and manual dexterity). In this paper we propose that there is also a sex differences in general knowledge that has hitherto been largely unrecognised and does not appear in any of the sex books on intelligence or on sex differences in cognitive abilities by Cattell, Eysenck, Brody, Mackintosh, Halpern, Jensen and Kimura.

The paper is in three parts. First, we present a meta-analysis of sex differences in general knowledge, the results of which show that males have more general knowledge than females by approximately $d=.5$. Second, we analyse sex differences in 18 domains of general knowledge and show (in studies not yet published) that sex differences vary with different kinds of general knowledge. We show here that males have more general knowledge than females in domains concerned with inter-male competition, either between individuals or groups, while females have more general knowledge than males in domains concerned nurturing and provision. Third, we propose an evolutionary theory to explain the existence of these sex differences in different kinds of general knowledge.

Sex Differences in Mental Abilities: Examining Predictions from the VPR Model

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Sex differences in mental ability have long intrigued psychologists. Traditional analyses have examined mean and variance differences in scores on tests of general and specific abilities. More sophisticated analyses have addressed sex differences in factor structures, g-loadings, and differential functioning of test items that might explain the observed mean differences. The empirical data support the conclusion that there is little if any sex difference in general ability, but men tend to do better on visuospatial tasks while women tend to do better on tests of verbal usage and perceptual speed. Here, we integrate these overall findings with predictions from our proposed model of the structure of mental ability, the Verbal-Perceptual-Rotation (VPR) model.

The VPR model is hierarchical, with a g factor that contributes strongly to broad verbal, perceptual, and mental rotation abilities, which in turn contribute to more specialized abilities. The verbal and perceptual abilities, though separable, are highly correlated, as are the perceptual and mental rotation abilities. The verbal and mental rotation abilities, however, are much less correlated. This suggests that, absent the overall influence of g, residual verbal and mental rotation abilities might be largely independent or even negatively correlated. This implies that sex differences in these residual abilities might be greater than those observed in the full test scores. If these residual abilities reflect somewhat separable modules in the brain, we might also expect them to be influenced by genetic factors independent of genetic influence on the general factor. We explore these predictions in the Minnesota Study of Twins Reared Apart.

Spearman's Hypothesis:
Implications for Practice in a Diverse Society

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Spearman (1927) offered that differences between Blacks and Whites in psychometric test scores are primarily attributable to a difference in general intelligence. This phenomenon, in which group differences are a function of the test's loadings on the general factor, has been termed Spearman's Hypothesis (Jensen, 1998). Rushton (1998) broadened its conceptualization, demonstrating that that g (specifically a test's g loading) is the best predictor of that test's correlation with a given variable (i.e., the Jensen Effect). Spearman's Hypothesis has garnered considerable substantiation (Rushton, 2002) and criticism (Horn, 1997) in the research literature.

Many of the criticisms of Spearman's Hypothesis dwell on the perception that intelligence is a construct laden with cultural content. Therefore, any observed group differences are easily attributable to societal inequality (e.g., disenfranchisement, poverty, & stigma). The present evaluates Spearman's Hypothesis in light of a culture free measure of intelligence. Standardization data from the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) are used in this study. For a number of reasons, the UNIT is ideally suited to the purpose of this study. First, the UNIT is based on Jensen's Level I/Level II Theory, in which the complexity and nature of tests are conceived in terms of their demand of general intelligence. Second, in contrast to existing language-free tests, which tend to be unidimensional in their assessment of cognitive ability, the UNIT also assesses multiple facets of intelligence. Third, the nonverbal administration and response format of the UNIT offers a more comprehensive measure of intelligence for children who are hearing impaired or not fluent in a community's dominant language. Finally, the standardization and psychometric properties of the UNIT have been termed excellent (Plake & Impara, 2001).

Data will be analyzed in the straightforward fashion adopted by Jensen (1998) and others (e.g., Linn & Owen, 1994): (a) exploratory factor analyses of the psychometric data are carried out separately for representative samples of each group; (b) factorial invariance over groups is established by calculating measures of factorial congruence; (c) group differences are standardized; (d) these standardized differences in means are correlated with the g factor loadings of the respective subtest; (e) these procedures are then repeated, with the aim being to determine the relative contribution of factors exclusive of Spearman's g in explaining any observed differences in performance.

The study's contribution to the construct validity of the Jensen Effect, as well as the implications for the nonverbal assessment of intelligence, scholastic performance, and occupational/societal outcomes will be discussed.

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The Stability of General, Verbal, and Arithmetic Intelligence from Early Adulthood to Middle Age: A Large-Scale Longitudinal Study

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The study of age-related stability or change in intelligence presents specific methodological problems. Cross-sectional studies may, for instance, confuse generation differences with age-related change.

The present study eliminated generation effects through the use of a longitudinal design, where 4.300+ males were given 5 cognitive tests in their early adulthood and 14 tests when middle aged.

General intelligence measures (g) were extracted from the 5 early and 19 later tests, and specific verbal and arithmetic scores were obtained as well.

We found that g was highly stable from early adulthood to middle age ($r = 0.85$), and so were verbal and arithmetic scores ($r = 0.80$). However, verbal scores increased significantly over time, whereas arithmetic scores showed no changes.

We concluded that early general intelligence g, derived from just 5 tests, predicts ability later in life with a certainty that equals the reliability of the tests. Arithmetic skill did not develop over time, but verbal skills increased. This might reflect training-related optimizing of genotypic dispositions. Our findings dovetail nicely with the outcome of other longitudinal studies.

Tracking Exceptional Human Capital

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Two cohorts from the Study of Mathematically Precocious Youth (SMPY), now in their mid-thirties, were tracked longitudinally and examined along a broad spectrum of life experiences, including their educational-vocational development and their personal relationship and family choices. One cohort of participants was identified by SMPY in 1992 as first- or second-year graduate students enrolled in highly-ranked (top 15) U.S. mathematics, engineering, and physical science programs. These graduate students, who were among the nation's most able scientists-in-training, were surveyed 10 years subsequently (299 males, 287 females). The second cohort of participants was identified by SMPY in the early 1980s through talent searches on the basis of their performance on the Scholastic Aptitude Test (SAT) taken before the age of 13. Students with scores that placed them within the top 1 in 10,000 in either mathematical (SAT-Math $\geq$ 700) or verbal (SAT-Verbal $\geq$ 630) reasoning ability were surveyed 20 years subsequently (286 males, 94 females).

The professional accomplishments of both the graduate sample and the top 1 in 10,000 sample were outstanding by any standard. Both groups secured tenure track positions at U.S. universities ranked within the top 50 at comparable rates (6% of male and 4% of female graduate students; 5% of male and 9% of female top 1 in 10,000 participants). However, the income of the top 1 in 10,000 participants was significantly greater than that of the participants identified as graduate students, even though the former were almost two years younger (33.6 versus 35.4 years old, respectively): Approximately 30% of male and 16% of female participants identified as graduate students reported annual personal incomes exceeding $100,000; however, 37% of male and 21% of female participants in the top 1 in 10,000 sample did so. Moreover, whereas less than 1% of male and female participants identified as graduate students reported annual incomes of $250,000 or more, 8% of male and 2% of female participants in the top 1 in 10,000 did.

Rates of reproduction for both samples are equally noteworthy. The mean number of biological children for male and female graduate students was 0.83 and 0.82, respectively. The mean number of biological children for male and female top 1 in 10,000 participants was 0.61 and 0.44, respectively. The observed reproduction rates are markedly below the norm for this age group, even for people who have earned Bachelor's degrees. A closer look at these participants revealed that whereas approximately half of male and female graduate students had no children (51% for each), two-thirds of the top 1 in 10,000 participants had no children (65% of males and 69% of females).

Sex Differences in General Intelligence and in the Variability of Intelligence

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Throughout the twentieth century it has been repeatedly asserted by leading authorities that there is no average sex difference in general intelligence but that the variance is greater in males. Herrnstein and Murray (1994, p. 275) accurately summarized the consensus: "the consistent story has been that men and women have nearly identical IQs but that men have a broader distribution…the larger variation among men means that there are more men than women at either extreme of the IQ distribution".

In this paper we contend that both these propositions are incorrect. We present a variety of evidence to show that, contrary to the position maintained by Terman, Spearman, Cattell, Eysenck, Brody, Mackintosh, Halpern, Jensen and many others, males have slightly higher average general intelligence (however defined) than females, that the advantage of males increases from the age of 16 and reaches approximately 5 IQ points among adults. The evidence to be presented comes from numerous samples on the Wechsler tests, the Progressive Matrices and other sources. Mean and covariance structures analysis represents our preferred method, where possible, though we will present analyses based on the method of vectors, and factor analyses which represent the effect of sex in terms of point biserial correlations calculated for each subtest. The relative psychometric properties of the different approaches will be considered. We also present a variety of evidence to show that there is no sex difference in the variance of intelligence.

Human Intelligence Levels are Robust, but as Human Brains become More Closely Coupled with Intelligent Machines, Means and Variances in 'Net' Intelligence Will Increase, not Decrease

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Although claims of secular gains in intelligence (*g*) have been made, and (many believe) successfully disputed, little scientific attention has been devoted to 'net' intelligence profile gains that are represented by human-machine dyads. This is interesting, particularly as machinery becomes smaller, swifter, optimized in real time to its host's emotional state, and able to connect (also in real time) to virtually limitless resources. Based on a review of military-sponsored research progress, it is conceivable that digital machinery will increasingly augment human cognition, and in fact, it will be embedded so efficiently as to defy detection under normal circumstances. Some would reason or hope that human intelligence, 'augmented' through such cognitive technology, might realize a decrease in 'net' variability within and between groups. I claim that just the opposite is occurring and will accelerate—that is, information technology amplifies not only individual and mean performance, it also increases variability. Part of the phenomenon relates to the statistical (by-product) realization that a distribution transformed by a multiplier reveals a revised variance that is the square of the multiplier. This can be called crescoskedasticity. More substantively, it is reasonable that closely-coupled digital technology simply will be exploited more, by more intelligent, rather than by less intelligent people, producing an accelerating gap in 'net intelligence'. The latter is not a new finding; variability in human intelligence by its nature is about variability in the development and exploitation of tools. However, exploitation of embedded informational tools provides a new dynamic because of the dramatic increase provided by intelligent processing for 'connected but untethered' humans. I review the evidence for the foregoing and argue that *g* will only increase as a feature for mate, and employee selection.

IQ & Wealth of Nations: Prediction of GDP Not Dependent on Precise *g* Estimates

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In their book, *IQ and the Wealth of Nations*, Lynn and Vanhanen (2002) proposed the hypothesis that "the intelligence of the populations has been a major factor responsible for the national differences in economic growth and for the gap in per capita income between rich and poor nations." (p. xv). Throughout the book, they show that there are large differences in intelligence among nations and that these differences are causally related to economic growth. To test empirically their hypothesis, they computed the correlations between national IQ and real gross domestic product per capita (1998). They then regressed national income in 1998 on IQs using a linear model and accounted for 38 percent of the variance. This paper responds to questions that have been raised about the accuracy of Lynn and Vanhanen's conclusions due to the limited data available to estimate national mean IQ (Ervik, 2003; Volken 2003), particularly for the non-industrial nations and African countries which are typically assigned very low mean IQ values.

We evaluated concerns about the estimated mean IQs in two ways. First, we set all IQ values below 90 to equal 90. We did this because concerns about the accuracy of the *g* values focus on the very low *g* values. This recoded IQ variable improves the prediction of real gross domestic product per capita to 46% of the variance explained by *g*. Our truncated analysis suggests that any mean IQ less than 90, on average, is a detriment to real gross domestic product per capita regardless of its specific value. Second, we trichotomized the IQ distribution. Countries with mean IQs under 90 were assigned a value of 1, mean IQs in the 90s a value of 2, and mean IQs 100 and above a value of 3. This trichotomized IQ variable accounted for 44% real gross domestic product per capita. This analysis shows that even very approximate estimates of IQ are excellent predictors of real gross domestic product per capita.

Our analyses showed that a non-linear equation explained meaningfully more variance than the linear model. Using the Lynn & Vanhanen estimated mean IQ data, the linear equation accounted for 38% of the variance while the quadratic equation accounted for 45% of the variance. When we set all the IQ estimates below 90 to equal 90, the linear equation accounted for 46% of the variance while the quadratic equation accounted for 48%. For the trichotomized IQ variables, both the linear and quadratic equation accounted for 44%.

In summary, debates about the exact mean IQ of any country are not detrimental to Lynn and Vanhannen's arguments concerning the impact of IQ on real gross domestic product per capita. Whether one uses the mean IQ values used by Lynn and Vanhannen or the two versions of the adjusted IQ data presented here, the mean IQ of countries is a major predictor of real gross domestic product per capita.

Working Memory and Processing Speed as Causal Explanations of *g*: A CHC-based Investigation across the Lifespan

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One of the most intriguing findings resulting from the marriage of contemporary psychometric (Cattell-Horn-Carroll [CHC] *Gf-Gc* theory) and information processing research and theories, first reported by Kyllonen and Christal,[1] is that "individual differences in working memory capacity may be what are responsible for individual differences in general ability."[2] Since 1990, the construct of working memory (WM) has played a central role in hypothesized explanations of many complex cognitive operations (e.g., language comprehension, reading and mathematics, reasoning or general intelligence, long term memory performance). In addition, some studies have included processing speed (*Gs*) as a direct precursor to WM. Missing from this research literature, and addressed by the current investigation, are studies that include a broader array of invariant CHC indicators in large age-differentiated nationally representative samples.

Select tests from the CHC-designed WJ III Cognitive battery[3] were used to investigate the direct and indirect causal relations between measures of information processing efficiency (*Gs* - processing speed; *Gsm* – memory span and working memory) and *g*. *g* was operationally defined by five CHC latent factors (*Gf*, *Gc, Glr, Ga*, and *Gv*). Causal latent variable models were specified and evaluated in five large age-differentiated nationally representative samples (covering ages 6 through 90+ years of age).

The results are consistent with the extant WM→*g* research literature. Across all five samples, the WM→ *g* direct effect path ranged from .73 to .93. A trend for the WM→*g* path to decrease with increasing age (.93 to .73) was observed. Also of interest was the finding that *Gs* did not demonstrate a direct effect on *g* in the childhood samples. However, starting at late adolescence, *Gs* demonstrated significant and increasingly larger (with age) direct effects on *g*. The total (direct+indirect) effects of *Gs* on *g* ranged from .60 to .81. Collectively the total effects of *Gs* and WM accounted for 76 % to 86 % of the CHC defined *g*-factor. The results from the current investigation, which improves upon prior research vis-à-vis the use of the identical construct indicators in large samples across most of the lifespan, continues to support the strong relationship between measures of cognitive efficiency (*Gs* and working memory) and complex cognitive performance (e.g., *Gf* and *g*).

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Reflex Behaviour, Electromyography (EMG), and General Mental Ability

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The literature relating response time measures to intelligence remains inconclusive. There are several early reports of associations between mental ability and speed of nerve conduction in the patellar reflex arc. However although the Eysenck/Jensen 'speed of neural processing' theory should suggest a link between reflex latency and g, later studies generally failed to replicate. The reflex arc is the nervous pathway along which nerve impulses travel to produce a reflex action. Far from measuring cognitive function, this involuntary contraction of a muscle is an automatic reaction to stimulus impressions on a sensory nerve – a measure of the capacity to respond rapidly. The knee-jerk reflex represents the most basic of motor responses and is thus an important measure of response time as far as intelligence research is concerned. McRorie and Cooper (2003) found a link between patellar reflex speed and Raven's Matrices scores. However a later study (McRorie & Cooper, 2004) failed to replicate. This investigation used a more sophisticated methodology: the latency of the underlying muscle contraction was assessed via electromyography (EMG). Two auditory inspection time (IT) tasks provided indirect measures of speed of neural transmission, and cognitive ability was assessed using the Wide Range Intelligence Test. Results from a pilot study are reported, and the theoretical implications discussed.

Intelligence Tests with Higher *g*-Loadings Show Higher Correlations with Body Symmetry: Evidence for a General Fitness Factor Mediated by Developmental Stability

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Just as body symmetry reveals developmental stability at the morphological level, general intelligence may reveal developmental stability at the level of brain development and cognitive functioning. These two forms of developmental stability may overlap by tapping into a "general fitness factor". If so, then intellectual tests with higher *g*-loadings should show higher correlations with a composite measure of body symmetry. We tested this prediction in 78 young males, by measuring their left-right symmetry at 10 body points, and administering five cognitive tests with diverse *g*-loadings. As predicted, we found a significant ($\underline{z} = 3.64$, $\underline{p} < .003$) relationship between each test's rank order *g*-loading and its body-symmetry association. We also found a substantial correlation ($\underline{r} = .39$, $p < .01$) between body symmetry and our most highly *g*-loaded test (Ravens Advanced Progressive Matrices). General intelligence is apparently a valid indicator of general developmental stability and heritable fitness, which may partly explain its social and sexual attractiveness.

Assortative Mating and Friendship in Twins: Evidence for Genetic Similarity

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This study examines the genetic and environmental contribution to people's preference for similarity, including intellectual similarity, in spouses and friends. On 130 personality, attitude, and demographic questions (including education, occupation, income, and cognitive structure), 174 pairs of monozygotic (MZ) twins resembled each other ($r = 0.55$) more than did 148 pairs of dizygotic (DZ) twins ($r = 0.33$), 322 pairs of spouses ($r = 0.32$), or 563 pairs of best friends ($r = 0.22$). Each MZ twin also chose a more similar spouse and best friend to his cotwin than did each DZ twin (mean rs = 0.22 vs 0.09). The twins' preference for similarity was between 10 and 30% due to the twins' genes, 10% due to the twins' common environment, and over 60% due to the twins' unique (non-shared) environment. Partner similarity was more pronounced on the more heritable items. It is concluded that people are genetically inclined to choose as social partners those who resemble themselves at a genetic level.

Variations in EEG spectra and alpha coherence associated with Emotional Intelligence

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Previous Research has outlined both a theoretical basis for EI as well as significant empirical relationships relating to important outcome variables of leadership, satisfaction with life and other life related criteria. However, little is known about the biological basis of this construct. An exploratory study was performed to investigate whether a biological basis of EI could be established. EEG from 24 participants aged between 18 and 44 (M=24.79, SD=6.08), was recorded whilst completing an ability based computerized EI task (Mayer, Salovey, Caruso Emotional Intelligence Test –MSCEIT). Participants also completed the self-report Swinburne University Emotional Intelligence Test (SUEIT). Participants were separated into a high and low EI groups based on their scores on the SUEIT. The topographical distribution of brain activity for the two groups demonstrated differences in both EEG spectra and Alpha coherence. Implications for the construct validity of emotional intelligence is discussed.

Asian-White Differences in Aptitude and Difficulty of Chosen Academic Discipline

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The ratio of Asian to White in 45 academic disciplines correlated .09 with mean Verbal GRE of discipline, .79 with Quantitative GRE, .58 with Analytical GRE, .62 with Verbal + Quantitative + Analytical GRE, and .75 with Quantitative minus Verbal GRE. The respective correlations of ratio of males to females in discipline were .12, .83, .61, .66, and .77. The rho between the two sets of correlations is 1.00 (p<.01.) The rank order Asian/White and male/female correlation with GRE mean were also similar, and the rho between these sets of correlations is .90 (p<.05). This correlation is congruent with the contention of Lynn (1987) that the structure of Asian intelligence is to the structure of White intelligence as the structure of male intelligence is to the structure of female intelligence.

Contribution of Race and Skin Color in International Distribution of Mean IQ

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This study investigated the contribution of both race and skin color in the distribution of mean IQ in 129 countries with primarily indigenous populations. Skin color correlated most highly with mean IQ in the countries of Whites, somewhat less in the countries of Asians, and nonsignificantly in the countries Blacks. When the Black and White countries were combined, both race and skin color yielded high correlations with IQ. When the Black and Asian countries were combined, both race and skin color yielded high correlations with IQ. When White and Asian countries were combined, skin color yielded a high correlation but race did not correlate significantly with IQ. The greater importance of Black race was regarded as congruent with the generalization of Jensen (1998) that the genetic distance between Asians and Whites is less than the genetic distance of these two groups from Blacks.

Vocational Achievement and Creativity Among Intellectually Precocious Youth:
An Age 13 to Age 33 Longitudinal Study

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This study tracks intellectually precocious youth (top 1%) over 20-years. Phase I (N = 1,975) examines the significance of age 13 ability differences within the top 1% for predicting doctorates, income, and patents at age 33. Phase II (N = 439) evaluates the robustness of discriminant functions developed earlier, based on age 13 ability and preference assessments, and calibrated using age 23 educational criteria, but extended here to predict occupational group membership at age 33. Positive findings on above-level assessment using the Scholastic Assessment Test (SAT) and conventional preference inventories in educational settings, generalize to vocational settings. Precocious manifestations of abilities and preferences portend individual differences in exceptional achievement and creativity in the world of work; they also predict the qualitative nature of these accomplishments.

Stereotype Threat and Group Differences in Test Performance: A Question of Measurement Invariance

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Stereotypes concerning the academic proficiency of certain groups (e.g., "women are bad at mathematics") are quite ubiquitous in western society. Recent studies within social psychology indicate that such stereotypes can give rise to a pressure that can negatively affect test performance of persons to whom these stereotypes apply (e.g., African American students). Such a pressure to unwillingly satisfy to a negative stereotype is denoted by Stereotype Threat (ST; Steele, 1997). ST effects on test performance have been shown to be a robust experimental effect with generalizations to different groups, manipulations, and various achievement and intelligence tests (e.g., Raven's APM). Given the widespread use of standardized achievement and intelligence tests in college admission and job selection, ST may have serious social and personal consequences. Furthermore, ST research appears to shed new light on race and sex differences in achievement and intelligence test scores (see, e.g., Steele, 1997). However, the degree to which ST generalizes to test-settings outside the laboratory appears hard to investigate.

The aim of this presentation is to relate ST theory to the psychometric concept of measurement invariance (Meredith, 1993), and to show that ST effects on test performance may be viewed as a source of measurement bias. As such, ST effects are detectable by means of multi-group confirmatory factor analysis. This enables research into the generalizability of ST effects to real-life or high-stakes testing. The modeling approach is described in detail, and applied to data of two experiments in which the amount of ST for women and Dutch minorities was manipulated. Results indicate that ST results in measurement bias of achievement and intelligence tests.

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Prenatal Exposure to Phenylalanine Influences Infant and Childhood Intellectual Outcomes: Results from the Maternal PKU Collaborative Study

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The potentially devastating effects of phenylketonuria (PKU) have been well known for over 50 years. Quite normal at birth, children with PKU showed a pronounced decline in mental ability during the first six years of life, a decline that proved permanent. In the early 1950's, a diet was developed that was low on foods that contain protein and included dietary supplements to ensure proper nutrition; if children remained on the diet, the negative effects on intelligence were eliminated. In 1963, a newborn screening test was developed to identify infants with PKU, and screening is currently practiced worldwide. With the screening test and diet, the disastrous effects of the genetic defects associated with PKU appeared eradicable.

Many female infants with PKU were treated with the proper diet and developed normal levels of intelligence. When these females entered young adulthood, they had offspring of their own. Surprisingly, many infants born to mothers with PKU exhibited symptoms of PKU, such as low intelligence, regardless of whether the infants themselves had PKU. To study this problem, the Maternal PKU Collaborative (MPKUC) Study was initiated in 1984 and is a comprehensive study of the progress of each pregnancy as well as a wide range of outcomes by the offspring.

In the current research, we modeled the relations of maternal demographic variables (IQ, SES, and age), pregnancy mediator variables (phenylalanine, or PHE, in the mother's blood during pregnancy, weight gain during pregnancy, weeks gestation), and birth outcomes (birth length, weight, and head circumference), on infant and child intellectual outcomes at 1 year and 2 years (MDI and PDI from the Bayley Scales of Infant Development), 4 years (overall IQ from the McCarthy Scales), and 7 years of age (the Verbal, Performance, and Full Scale IQs from the WISC). A series of structural equation models were fit to the data. Results showed the following: (a) mother's IQ had a strong ($\exists$=-.25) direct effect on PHE level during pregnancy, (b) PHE level during pregnancy had a strong ($\exists$= -.41) direct effect on the Bayley MDI at 2 years and a moderate ($\exists$=-.26) direct effect on the McCarthy IQ at 4 years, (c) PHE level during pregnancy had a strong direct effect ($\exists$= -.37) even after controlling for the MDI at 2 years and McCarthy at 4 years, and (d) all effects of mother's IQ on later child intelligence measures were mediated by PHE level during pregnancy. Supplementary two-piece linear spline analyses documented that child intelligence was affected only if average PHE level in the mother's blood during pregnancy was 6 mg/dl or higher.

These results have implications for understanding prenatal influences on intelligence and for understanding how genetic influences across generations are mediated by biological variables that are controllable through environmental manipulation. In the case of maternal PKU, the mother has the genetic defect, but passes on the teratogenic effects of the defect through the prenatal environment she provides to her developing fetus. However, if the mother adheres closely to the prescribed medical diet and maintains low PHE levels during pregnancy (an environmental manipulation), the teratogenic effects of the genetic defect do not appear.

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