International Society for Intelligence Research 2007

Franciscus Donders

Program
Eighth Annual Conference
NH Central Station Hotel
Amsterdam, Netherlands

Acknowledgements

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Short Schedule for ISIR 2007
(#) = Page of Abstract - All Papers in Schipol 1-3

Time	Thursday, Dec. 13	Time	Friday, Dec. 14	Time	Saturday, Dec. 15
8:00-8:20	Johnson (29) Genetic and Env. Influences	8:00-8:20	Beaujean (13) CFA & Flynn Effect	8:00-8:20	Kanazawa (32) Correlates of National IQ
8:20-840	van der Sluis (66) Enviornmental Moderation	8:20-8:40	Condon (15) Flynn Effect and Spatioal Abil.	8:20-8:40	Lynn (36) IQ and Religion
8:40-9:00	Posthuma (48) Intelligence & Genes	8:40-9:00	Reynolds (50) Factor Mix. Model & SLODR	8:40-9:00	Meisenberg (40) IQ, Fertility, & Mortality
9:00-9:20	McDaniel (39) IQ Estimates for Counties	9:00-9:20	Tal (57) Mating Success	9:00-9:20	te Nijenhuis (58) Blindness, Deprivation, & IQ
9:20-9:40	Raven (49) Uses and Abuses of Raven	9:20-9:40	Deary (18) Scottish Ed. Research 1925-50	9:20-9:40	Nyborg (45) IQ, Sex Hormones & Delinq.
9:40-10:00	Break	9:40-10:00	Break	9:40-10:00	Break
10:00-10:20	Deary (19) Info. Porcessing and Inflamation	10:00-10:20	Dolan (21) g as 1st Order vs. Hiher Order	10:00-10:20	Rindermann (51) IQ & Philosophy of Life
10:20-10:40	Modig-Wennerstad (41) Offspring IQ and Parental Mort.	10:20-10:40	Molenaar (42) Detecting Sex Differences	10:20-10:40	Rushton (53) G and E Group Differences
10:40-11:00	Beaujean (12) IQ and Helath Outcome in Adol.	10:40-11:00	Wicherts (72) Measurement Bias & IQ	10:40-11:00	Steppan (56) Prot. Achievement Ethic
11:00-11:20	Deary (17) Childhood IQ and Death	11:00-11:20	Johnson Discussant	11:00-11:20	Vinogradov (67) Self-Emploment Among Imm.
11:20-11:40	Gottfredson (26) Psychometrics of Health Self-Care	11:20-11:40	Legree (34) Situational Judgment Tests	11:20-11:40	Flynn Discussant
11:40-12:00	Lubinski Discussant	11:40-12:00	Wai (68) Spatial Ability, STEM, & Arts	11:40-12:00	Johnson (30) Sex Diff. in Variability
12:00-1:30	Lunch	12:00-1:30	Lunch	12:00-1:30	Lunch
1:30-1:50	Weeda (69) Diffusion Model & Worst Perf.	1:30-1:50	Park (46) Quant. Reasoning & Patents	1:30-1:50	Irwing (28) Group Diff. in Latent Means
1:50-2:10	Frey (25) Cognitive Complexity	1:50-2:10	Madhyastha (37) Market for Cognitive Skills	1:50-2:10	Schweizer (54) WM & STM
2:10-2:30	Madison (38) IQ & Tapping Variability	2:10-2:30	Hunt (27) Recruitment Modeling	2:10-2:30	Necka (44) Gf, Exec. Cont., & Prob. Sol.
2:30-2:50	Luo (35) Pred. Power of WM and Learning	2:30-2:50	Demetriou (20) Development of g	2:30-2:50	Kan (31) Cyrstallized not Crystallized
2:50-3:10	Tucker-Drob (63) Centrality of Cognitive Contorl	2:50-3:10	Mouyi (43) Develop. Stages in Reasoning	2:50-3:10	Spinks (55) Premorbid Short Measures
3:10-3:30	Koenig (33) Diff. In Down Synd & FraX	3:10-3:30	Break	3:10-3:30	Break
3:30-4:00	Break	3:30-3:50	van der Maas (65) Age Diff. and Mutualism	3:30-3:50	Davis (16) Culture-Free Test?
4:00-5:30	Distinguished Contrib. Inter. James Flynn -Int. by Lubinski	3:50-4:10	Toffanin (62) Synchronization	3:50-4:10	Fagan (23) SAT so Time Consuming?
6:00-7:30	Elsevier Reception Bar	4:10-4:30	Ullén (64) Brain Correlates of Tapping	4:10-4:30	Templer (61) Neuropsychological Spect.
		4:30-4:50	Colom (14) Brain Correlates of Gf & Gc	4:30-4:50	Figueredo (24) Exec. Funct., IQ, & Temp.
		5:00-6:00	Invited Address Robert Plomin (47) Where are genes hiding?	4:50-5:10	Wenner (70) Exec. Func.., IQ, & Dev. Beh.
				5:10-5:30	Templer (60) Muslim vs. non-Muslim IQ
				5:30-5:50	Templer (59) New World IQ and Color

Symposium =Shaded

International Society for Intelligence Research (ISIR) Program
2007

(Numbers in parentheses refer to page of abstract)

All sessions will be in the Schipol 1-3 with registration directly outside Schipol 1-3.

Thursday, December 13, 2006

Papers (8:00-10:30): Misc.
Chair: Detterman

8:00-8:20   Johnson and Bouchard (29)
             Genetic and environmental influences on the wrong model of cognitive ability.

8:20-8:40   van der Sluis, Willemsen, de Geus, Boomsma, and Posthuma (66)
             Environmental moderation of the heritability of IQ in adults.

8:40-9:00   Posthuma (48)
             Intelligence and genes: Current status and future directions.

9:00-9:20   McDaniel and Ployhart (39)
             IQ estimates for countries and independent cities in the Commonwealth of Virginia.

9:20-9:40   Raven (49)
             Uses and abuses of the Raven Progressive Matrices

9:40-10:00   **Break**

10:00-10:20 Deary, Gow, Corley, Brett, and Starr (19)
             Speed of information processing, lifetime cognition, and inflammation.

10:20-10:40 Modig-Wennerstad, Silventoinen, Batty, Tynelius, Bergman, and Rasmussen (41)
             Offspring intelligence and parental morality.

Symposium(10:40-12:00): Cognitive Epidemiology (11)
Chair: Beaujean and Frisby

10:40-11:00   Beaujean and Frisby (12)
              The role of intelligence in predicting health outcomes in adolescents.

11:00-11:20   Deary, Gale, Pattie, and Batty (17)
              Childhood intelligence and personality, and death in the Scottish nation.

11:20-11:40   Gottfredson (26)
              Psychometric properties of health self-care.

11:40-12:00   Lubinski
              Discussant

12:00-1:30   **Lunch**

Papers(1:30-3:30): Cognition and Intelligence
Chair: Hunt

1:30-1:50   Weeda, Wagenmakers, and Huizenga (69)
              Empirical support for the diffusion model account of the worst performance rule.

1:50-2:10   Frey (25)
              Is it possible to manipulate complexity with a single task framework? Notes from a near match-to-sample condition.

2:10-230   Madison, Forsman, Blom, Karabanov, and Ullén (38)
              IQ is correlated with variability in isochronous tapping tasks: Comparisons between different measures of timing performance.

2:30-2:50   Luo (35)
              Differential predictive power of working memory and associatve learning for various levels of intelligence.

2:50-3:10   Tucker-Drob and Salthouse (63)
              The centrality of cognitive control to cognition.

3:10-3:30   Koenig (33)
              Differences in cognitive task performance in Down Syndrome and Fragile X Syndrome.

3:30-4:00   **Break**

4:00-5:30   **Distinguished Contributor Interview**
James Flynn
Interviewed by David Lubinski

6:00-7:30   **Elsevier Reception** – Bar

Friday, December 14, 2007

Papers (8:00-9:40): Misc.
Chair: Johnson

8:00-8:20   Beaujean and Sheng (13)
Examining the Wechsler Preschool and Primary Scale of Intelligence Across time: A multi-group confirmatory factor analysis of the Flynn effect.

8:20-8:40   Condon and Schroeder (15)
Is the Flynn effect primarily a rise in spatial ability?

8:40-9:00   Reynolds (50)
Using factor mixture modeling to investigate Spearman's Law of Diminishing Returns.

9:00-9:20   Tal, Miller, and White (57)
Intelligence, openness, creativity, and mating success.

9:20-9:40   Deary, Lawn, Pattie, Brett, Bartholomew (18)
A hotbed of intelligence: the Scottish School of Educational Research.

9:40-10:00   **Break**

Symposium (10:00-11:20): Measurement Invariance and Group Differences in Intelligence Test Scores (71)
Chair: Wicherts

10:00-10:20 Dolan (21)
General intelligence as a first order factor vs. general intelligence as a higher order factor: Psychometric Implications

10:20-10:40 Molenaar and Dolan (42)
The poser to detect sex differences in intelligence test scores using multi-group covariance and mean structure analyses.

10:40-11:00   Wicherts (72)
                Measurement bias in IQ tests: Why the case is certainly not closed.

11:00-11:20   Johnson
                Discussant

Papers (11:20-3:10): Cognitive Skills and Development
Chair: Gottfredson

11:20-11:40   Legree, Psotka, Bludau, and Gray (34)
                Assessing occupational knowledge using situational judgment tests derived from
                job analysis questionnaires.

11:40-12:00   Wai, Lubinski, and Benbow (68)
                Spatial ability for STEM and visual arts: Over fifty years of cumulative
                psychological knowledge highlights its longstanding neglect and an
                implementation problem in education.

12:00-1:30   **Lunch**

1:30-1:50   Park, Lubinski, and Benbow (46)
                Among doctorates quantitative reasoning assessments conducted 25 years earlier
                (by age 13) predict patents and scientific publications.

1:50-2:10   Madhyastha and Hunt (37)
                The coming market for cognitive skills.

2:10-2:30   Hunt and Madhyastha (27)
                Recruitment modeling.

2:30-2:50   Demetriou (20)
                Modeling the structure and development of g.

2:50-3:10   Mouyi (43)
                Tracing developmental stages in reasoning ability.

3:10-3:30   **Break**

Papers (3:30-4:50): Intelligence and the Brain
Chair: Deary

3:30-3:50   van der Maas and Kan (65)
                Age differentiation and the mutualism model of general intelligence.

3:50-4:10 Toffanin,. Johnson, De Jong, and Martens (62)
In the beginning there was synchronization: Genesis of a neural correlate of processing differences.

4:10-4:30 Ullén, Forsman, Blom, Karabanov, and Madison (64)
IQ and variability in isochronous tapping tasks have overlapping neuroanatomical correlates in the brain's white substance.

4:30-4:50 Colom, Haier, Head, Jung, Álvarez-Linera, Quiroga, Abad, Escorial, Martin-Loeches, and Shih (14)
Brain correlates of fluid, crystallized, and spatial intelligence: Preliminary findings.

5:00-6:00 **Invited Address**
Robert Plomin (47)
Where are those genes for intelligence hiding?

Saturday, December 15, 2007

Symposium (8:00-11:40): International Differences in Intelligence
Chairs: Rindermann and Lynn (52)

8:00-8:20 Kanazawa (32)
Correlates of national IQ.

8:20-8:40 Lynn, Harvey, and Nyborg (36)
Intelligence and religion.

8:40-9:00 Meisenberg (40)
From the cradle to the grave: Effects of intelligence on fertility and mortality.

9:00-9:20 te Nijenhuis, van Rijk, and Kämper (58)
Blindness, deprivation, and IQ: A meta-analysis.

9:20-9:40 Nyborg (45)
Religion, IQ, sex hormones, and delinquency: Application of the general trait covariance model.

9:40-10:00 **Break**

10:00-10:20 Rindermann (51)
Philosophies of life as religious, cultural, and political beliefs and their relationship to intelligence.

10:20-10:40   Rushton, Bons, Vernon, and Čvorović (53)
              Genetic and environmental contributions to group differences on the Raven's
              Progressive Matrices estimated from twins reared together and apart.

10:40-11:00   Steppan (56)
              The influence of Protestant achievement ethic on test results in a g-based medical
              school aptitude test (EMS) in Switzerland, Germany, and Austria.

11:00-11:20   Vinogradov and Kolvereid (67)
              Cultural background, home country national intelligence and self-emplyment
              rates among immigrants in Norway.

11:20-11:40   Flynn
              Discussant

Papers (11:40-3:10): Misc.
Chair: Wicherts

11:40-12:00   Johnson, Carothers, and Deary ((30)
              Toward and understanding of sex differences in variability in intelligence.

12:00-1:30   **Lunch**

1:30-1:50   Irwing (28)
              A two-stage procedure for location group differences in the latent means of
              higher-order factor models.

1:50-2:10   Schweizer (54)
              Components of working memory and short-term memory as sources of fluid
              intelligence.

2:10-2:30   Necka, Chuderski, and Paulewicz (44)
              Fluid intelligence, executive control, and insight problem solving: An analysis of
              causal relationships.

2:30-2:50   Kan and van der Maas (31)
              Why crystallized intelligence is not crystallized intelligence.

2:50-3:10   Spinks, McKirgan, Arndt, Caspers, Yucuis, and Pfalzgraf (55)
              IQ estimate smackdown: Comparing premorbid and short measures of IQ to the
              WAIS-III.

3:10-3:30   **Break**

3:30-3:50   Davis, Winking, Kaplan, and Gurven (16)
Does a culture-free intelligence test really exist? Raven's Colored Progressive Matrices (RCPM) and the Tsimane, a traditional and transitioning population.

3:50-4:10   Fagan, Holland and Firmin (23)
The SAT does not have to be so time consuming.

4:10-4:30   Templer (61)
Neuropsychological spectrum structure in traumatically head injured persons.

4:30-4:50   Figueredo, MacDonald, Wenner, and Howrigan (24)
Executive functions, general intelligence, life history, and temperament.

4:50-5:10   Wenner, Figueredo, Rushton, and Jacobs (70)
Executive functions, general intelligence, life history, psychopathic attitudes, and deviant behavior.

5:10-5:30   Templer (60)
The comparison of mean IQ in Muslim and non-Muslim countries.

5:30-5:50   Templer (59)
Mean IQ and skin color in the New World.

Abstracts

Symposium: Cognitive Epidemiology Overview

Organizers: A. Alexander Beaujean and Craig Frisby
Discussant: David Lubinski

The potency of intelligence in everyday life is a well-documented phenomenon (Brand, 1987; Gottfredson, 2003). Not only does cognitive ability influence job acquisition and success (Schmidt & Hunter, 1998) and educational attainment (Deary, Strand, Smith, & Fernandes, 2007), but it also plays a part in the everyday decisions we face (Gordon, 1997). Recently, a new area research called cognitive epidemiology has emerged that looks to examine the role and influence of cognitive ability in predicting health outcomes (Deary & Batty, 2006, 2007). Although a relatively nascent field, the field has already shown some powerful results. Research in this area has found that differences in cognitive ability is predictive of a host health outcomes: total hospital admissions, likelihood of developing coronary heart disease and some cancers (Deary, Whiteman, Starr, Whalley, & Fox, 2004; Heart et al, 2003), mortality (Batty, Deary, & Gottfredson, 2007), frailty (Deary et al 2004), accidental injuries (Gottfredson, 2007), prevalence of Alzheimer's disease symptoms (Scarmeas et al, 2004), as well as mental health problems (Walker et al., 2002).

A. Alexander Beaujean and Craig Frisby investigate the role of cognitive ability in influencing health outcomes in American adolescents. Using the National Longitudinal Study of Adolescent Health, a longitudinal population-based study of health outcomes in American adolescents and young adults, they investigate the role of cognitive ability, measured in 1994, in predicting health behaviors (e.g., diet, exercise habits, incidence of smoking) almost 10 years later.

Ian Deary, Catharine R. Gale, Alison Pattie, and G. David Batty investigate the role of cognitive ability and mood stability on mortality. Using the Scottish Mental Survey of 1947, they found that, using univariate models, multiple variables were predictive of mortality, but when combined in a multivariate model, only IQ and greater conscientiousness/mood stability remained significant predictors.

Linda Gottfredson conceptualizes why cognitive ability might be related to health outcomes. Approaching the psychometric properties of the *tasks* that must be performed well for effective health self-care, she discusses why health-related behaviors can be conceptualized as subtests in a life-long mental test battery, using accidental injuries and chronic illness as examples.

Symposium: Cognitive Epidemiology

The Role of Intelligence in Predicting Health Outcomes in Adolescents

A. Alexander Beaujean [a] and Craig L. Frisby [b]
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In the past decade, a new area of research has emerged that blends the field of intelligence research and epidemiology: cognitive epidemiology (Deary, 2005; Deary & Batty, 2007 cf. Lubinski, & Humphreys, 1997). Research in this area has found that individual differences in cognitive ability are predictive of many health outcomes. A large portion of this literature obtains measures of cognitive ability when the participants are young, and then relates such measures to health outcomes during mid- and late-adulthood. However, in doing so, they neglect the role of cognitive ability in influencing health outcomes during adolescence. That is, they do not address the question: does cognitive ability predict healthier lifestyles and outcomes for teenagers and young adults as it does for older adults?

Understanding of the role cognitive ability plays in health outcomes during adolescence is important to understanding the general way intelligence influences health outcomes. Specifically, are there are certain health-related behaviors that more intelligent adolescents engage in that tend to produce better long-term health outcomes (i.e., intelligence is a link in the causal chain)? Alternatively, is it the case that more physically healthy individuals tend to have fewer health problems and have higher cognitive ability (i.e., higher intelligence is a by-product of a health-prone genotype?)

Using data from the National Longitudinal Study of Adolescent Health data set, this study will examine the role of cognitive ability (as measured by the PPVT in 1994) in predicting diet and health outcomes (e.g., exercise, going to doctor regularly) in adolescents over a 10-year period of time. Alternative models will be used to better understand the role of cognitive ability and possibly important environmental variables (e.g., SES) in predicting health outcomes, as specified in figure 1.
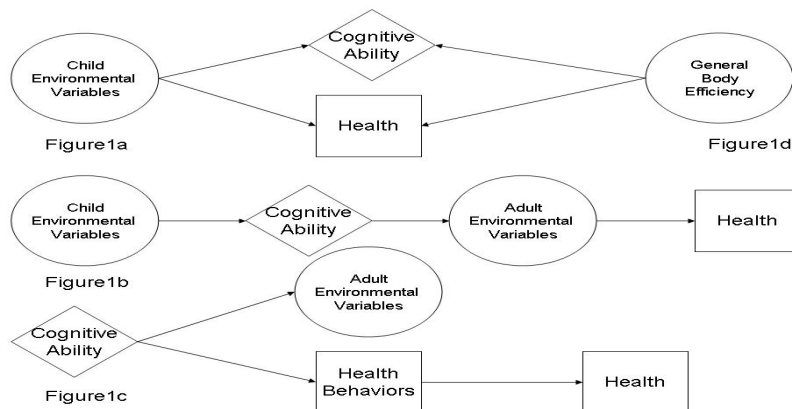
Examining the Wechsler Preschool and Primary Scale of Intelligence Across Time: A Multi-Group Confirmatory Factor Analysis of the Flynn Effect

A. Alexander Beaujean [a] and Yanyan Sheng [b]

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Since the 1980s, the Flynn Effect (i.e., the rise in IQ scores) has been an area of considerable research for those scholars studying intelligence (Flynn, 2007). While some have been investigating the magnitude of the effect or its generalizability, others have tried to investigate the putative causes for this rise. As to the latter, there have been a host of explanations proffered, ranging from genetics (heterosis), to nutrition, to changes in educational curriculum. However, one area that is seldom considered is the question of measurement invariance; that is, are the tests measuring the same way across time? The few investigations into the topic (Wicherts et al, 2004; Beaujean & Osterlind, 2007) appear to give a negative answer to this question, but analysis has been restricted to only a few instruments.

This study will take another step at filling this void by examining the reported covariance matrices of the norming samples of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI). As the WPPSI has used many of the same subtests in its latest edition (published in 2002) as it did in its first edition (published in 1967), and has tested a narrow age range (4-6 years olds), examining how these common subtests covary across time can shed insight as to whether the same factor(s) is/are being measured across time in this group, or whether the gains are unrelated to the instrument's factor structure.

Beaujean, A. & Osterlind, S. (2007). *Using Item Response Theory to assess the Flynn Effect in the National Longitudinal Study of Youth 79 Children and Young Adults Data*. Manuscript under review.

Flynn, J. (2007). *What is intelligence? Beyond the Flynn Effect*. Cambridge, UK: Cambridge University Press.

Wicherts, J. M., Dolan, C. V., Hessen, D., Oosterveld, P., Baal, G. C. M. van, Boomsma, D. I., et al. (2004). *Are intelligence tests measurement invariant over time? Investigating the nature of the Flynn Effect*. *Intelligence*, *32*, 509-537.

Brain Correlates of Fluid, Crystallized, and Spatial Intelligence: Preliminary Findings

R. Colom, [1], R. Haier, [2], K Head,.[2], R. Jung, [3], J. Álvarez-Linera, [4], M. A. Quiroga, [a][5], F. J. Abad, [1], S. Escorial, [1], M. Martín-Loeches, [5], and P. C. Shih, [1]

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405 participants completed a battery of nine tests measuring fluid (Gf), crystallized (Gc), and spatial (Gv) intelligence[*]. A sample of 100 Ss (56 females and 44 males, mean age = 19.9, SD = 1.7, age range = 18 to 27) was randomly selected for MRI scanning. We used voxel-based morphometry (VBM) to identify brain areas where gray matter volumes are positively correlated to cognitive performance (standardized and independent averages for Gf, Gc, and Gv were computed to wash out tests' specific variance). Results suggest that (a) different brain structures are related to Gf, Gc, and Gv, and (b) several brain areas nominated by the P-FIT model (Jung and Haier, 2007) are also identified in the present study. The findings strongly suggest that refined estimates of cognitive ability should be computed to reach an accurate knowledge regarding the biological base of intelligence.

Jung, R. & Haier, R. (2007). The parieto-frontal integration theory (P-FIT) of intelligence: Converging neuroimaging evidence. *Behavioural and Brain Sciences,* 30, 135-187.

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[*] Gf was measured by the Advanced Progressive Matrices Test (APM), the abstract reasoning subtest from the Differential Aptitude Test Battery (DAT-AR), and the inductive reasoning subtest from the Primary Mental Abilities Battery (PMA-R). Gc was measured by the verbal reasoning subtest from the DAT (DAT-VR), the vocabulary subtest from the PMA (PMA-V), and the numerical reasoning subtest from the DAT (DAT-NR). Gv was measured by the mental rotation subtest from the PMA (PMA-S), the spatial relations subtest from the DAT (DAT-SR), and the Rotation of Solid Figures Test.

Is the Flynn Effect Primarily a Rise in Spatial Ability?

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An extensive literature has documented the steady rise across time in performance on IQ tests, generally known as the Flynn effect. While attention has been focused on IQ and other indexes of general ability, there has been limited investigation of patterns for more-specific abilities. In this paper we use data on specific cognitive abilities to demonstrate a rise in performance on visuospatial tests across time and to evaluate whether the Flynn effect in these data is general across abilities or largely specific to spatial ability.

The Johnson O'Connor Research Foundation has administered a battery of specific-ability tests for over 50 years. We examined scores from 1989 to 2003. We found an increase of .09 standard-deviation units in scores on a general factor, which confirms that there is an upward overall trend in these data. For group factors, we found a relatively large increase of .18 *SD* units in spatial ability, a more-modest gain of .08 *SD* units for memory, and no gains for reasoning (-.04) and numerical ability (.00). Finally, we derived a nonspatial general factor from the seven nonspatial tests in our set (excluding the two spatial tests) and found that the gain in factor scores across the 14-year span was reduced to .02 *SD* units.

Thus, it appears that the rise in performance that we observed on these tests is mostly in the spatial domain. It could be the case that the greater use of visual and graphical representations of information (on computers and elsewhere in our culture) is leading to greater development of spatial ability, while general increases in ability may be smaller than some observers have thought.

Does a Culture-Free Intelligence Test Really Exist? Raven's Colored Progressive Matrices (RCPM) and the Tsimane, a Traditional and Transitioning Population

Helen Elizabeth Davis[1], Jeff Winking[2], Hillard Kaplan[3] and Michael Gurven[4]

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The Raven's Colored Progressive Matrices (RCPM) test is often assumed to be a culturally-neutral instrument for assessing fluid intelligence, or 'g.' Other evidence indicates that schooling has a significant effect on test performance. Here I present data collected among the Tsimane, a forager-horticultural society in central Bolivia. The Tsimane are notable for variable levels of education and degrees of exposure to a market economy, which allows for fine-grained analyses of factors influencing psychometric test performance. Subjects (N=185, ages 8-18) from four communities were administered RCPM and demographic information related to health, residential patterns, parental education and wealth were collected. Results indicate that exposure to schooling and, in particular, child literacy is significantly correlated with performance on RCPM (p=.0001). Parents' ability to speak Spanish was the strongest predictor of RCPM performance. (p=0.035). These findings indicate that psychometric test performance co-varies significantly with schooling exposure and parental attributes—important considerations for Tsimane youth as they shift to a market-oriented society.

Symposium: Cognitive Epidemiology

Childhood Intelligence and Personality, and Death in the Scottish Nation

Ian J. Deary [a], Catharine R. Gale [a], Alison Pattie [a], and G. David Batty [b]

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Scores on intelligence tests and personality trait ratings, even from childhood, are associated with survival to much later in adulthood. To date, no study has provided data in a single study with the combination of childhood assessments of personality traits and intelligence; a representative national sample; a diverse range of possible confounding and mediating factors; and follow-up for death to later adulthood. In the sample examined here we previously reported sex-adjusted IQ-mortality associations only (Deary et al., 2004). A person in childhood who appears in the lower half of scores for IQ and stability of mood has a 2.5 times increased risk of death by age 64. The present study tests for a number of possible confounding and mediating variables of this association.

Deary, I. J., Whiteman, M. C., Starr, J. M., Whalley, L. J., & Fox, H. C. (2004). *The impact of childhood intelligence on later life: following up the Scottish Mental Surveys of 1932 and 1947. Journal of Personality and Social Psychology, 86*, 130-147.

A Hotbed of Intelligence: the Scottish School of Educational Research 1925-1950

Ian J. Deary [1], Martin Lawn [1], Alison Pattie [1], Caroline Brett [1], and David J. Bartholomew [2]

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Between about 1925 and 1950 the small nation of Scotland was home to an extraordinary rich output of research on intelligence—including its application to education—and intelligence researchers. Oddly, this influential 'school' of intelligence and educational research has left behind no organised archive or other collected account of its activities. Here, we describe the progress of our project, funded by the UK's Economic and Social Research Council, which is "Reconstructing a Scottish School of Educational Research from 1925-1950". The presentation will outline the following aspects.

First, there will be an account of the relevant individuals working on intelligence in Scotland during this time, including Sir Godfrey Thomson, Robert Rusk, P. E. Vernon, James Drever, John Raven, William McLelland, Derek Lawley, Walter Ledermann, and others. This will include their unusual ability to network because of the formation and unusual set-up of the Scottish Council for Research in Education.

Second, there will be a description of the discoveries and accumulation of texts, images and other artefacts that have been made during the project. This will be illustrated by many previously-undescribed and uncollected items relating to Sir Godfrey Thomson, including: a scientific commonplace book; his collection of reprints; annotated books; his extensive correspondence with the mathematician Walter Ledermann; correspondence with other researchers in intelligence, genetics and statistics; an audio recording of one of his lectures; and several other items. Recent interviews with people who worked with him between the 1930s and 1950s are exemplified. This new, growing collection provides rich material for our project, and for other current and future researchers.

Third, there will be a summary of some of the achievements of this Scottish School of Educational Research. This will include: work on the theory of human intelligence; the organisation, execution, reporting and follow up of the Scottish Mental Surveys of 1932 and 1947; their contribution to the discussion of population changes in intelligence; their contribution to the International Examinations Inquiries in the 1930s; the production and distribution of the Moray House Test series; the contribution to educational selection; and the contribution to the development of factor analysis.

The personal, local environmental and organisational factors that led to this period of unusual production and influence are discussed.

Speed of Information Processing, Lifetime Cognition, and Inflammation

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Speed of information processing plays an important part in theories of cognitive ageing. The construct is assessed using tests that are developed from a range of psychological traditions, including psychometrics, experimental psychology, and psychophysics. Here, we examine the extent to which individual differences in a variety of speed of processing tests at age about 70 are dependent upon mental ability from age 11, and on current biological factors, exemplified using a marker of systemic inflammation.

The Scottish Mental Survey of 1947 (SMS1947) collected IQ-type test scores from almost everyone born in 1936 and attending school on June 4th 1947. The test used was a version of the Moray House Test No. 12 (MHT). We recruited 1091 of the SMS1947 participants, almost 60 years later, when they were mean age 69.5. They re-took the MHT, a large battery of other mental tests, and a number of other medical, biological and questionnaire-based investigations. Special emphasis was placed on speed of information processing assessments: digit symbol, reaction time, and inspection time tasks were included. One of the blood-based investigations was an assessment of C-reactive protein, a marker of systemic inflammation, higher levels of which are associated with lower cognitive performance in old age in some previous studies (e.g. Rafnsson et al., 2007).

Rafnsson, S. B., Deary, I. J., Smith, F. B., Whiteman, M. C., Rumley, A., Lowe, G. D. O., Fowkes, F. G. R. (2007). Markers of inflammation and homeostasis, and cognitive decline: the Edinburgh Artery Study. *Journal of the American Geriatrics Society*, *55*, 700-707.

Modeling the Structure and Development of *g*

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We present two studies that investigated the structure and development of processes involved in *g*. In the first study, one hundred and forty children, about equally drawn among primary school grades 1-6 were examined by four types of Stroop-like speeded tasks addressed to processes of increasing complexity (i.e., speed of processing, perceptual discrimination, perceptual control, and conceptual control) and tasks addressed to working memory, information integration, and reasoning. The second study included 113 participants drawn among 8-, 10-, 12- and 14- year old children at first testing. These participants were tested individually three times separated by a one year interval on the processes mentioned above and also on mathematical and visuo-spatial reasoning.

Structural equation modeling showed that these processes are organized hierarchically so that simpler and more general processes are embedded in more complex processes. There are four main levels of organization: (1) processing efficiency, including general efficiency reflected by speed and more specialized executive processes reflected by control; (2) representational processes, involving sheer storage and organizational processes underlying information storage and recall; (3) reasoning, involving general inferential mechanisms; (4) domain-specific processes. Processes within organizational levels are hierarchically organized so that speed influences control, storage influences executive working memory, and general inferential processes influence reasoning in different domains. In addition, each of these levels involves processes germane to itself. The three levels are also hierarchically structured as general processing efficiency predicts working memory one year later and these, in turn, predict general reasoning and domain-specific reasoning another year latter. The implications for the general theory of intelligence and intellectual development are discussed.

Symposium: Measurement Invariance and Group Differences in Intelligence Test Scores

General Intelligence as a First Order Factor vs. General Intelligence as a Higher Order Factor: Psychometric Implications.

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In linear factor modeling of intelligence test scores, general intelligence may be specified as a first order factor (as in the bifactor or nested factor model) or as a higher order factor (as in the hierarchical factor model). It is well known that these models are nested. The aim of this talk is to discuss the psychometric implications of these possibilities in general, and specifically in studying group differences subject to measurement invariance.

This paper will not be presented. Contact the author for further information:
Culture-Fair Prediction of Academic Achievement

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The present research asked whether a racially unbiased test based on the ability to process new information predicts success in college. The research is based on a theory (Fagan, 2000) which assumes that what we know is a result of our ability to process new information and of the information provided to us by our culture. Based on these assumptions, the IQ score is seen a measure of knowledge and intelligence is defined as information processing ability. College students (N = 633) were tested for their ability to acquire new information concerning the meanings of previously unknown words, sayings, similarities, and analogies. Participants also completed a brief version of the Scholastic Assessment Test. American Whites and African-Americans who differed on the brief SAT did not differ in their ability to process information when that information was made equally accessible to both groups. Associations among performance on the culture-fair tests of new learning, the brief SAT, and objective test scores in college courses revealed that tests of new learning are culture-fair, reliable, and predictive of both numerical scores on class exams and of a brief version of the SAT, a standard test of academic aptitude. The present experiments serve as an example of how the long lived, much debated issue of culture-fair testing can be addressed by a theory which defines intelligence as information processing and by experimental studies guided by such a theory. The present research shows that a brief, reliable test of information processing can measure individual differences in cognitive ability without regard to race and could be used in the selection of candidates for advanced education or training in complex situations. Tests of information processing shown to be culture-fair may provide an incentive to achievement and bolster the hope of advancement on the part of minorities. The present experiments may make such hope a reality.

Fagan, J. F. (2000). A theory of intelligence as processing: Implications for society. *Psychology, Public Policy, and Law*, *6*, 168-179

The SAT Does Not Have to Be So Time Consuming

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The present study found that a 45 item, 50-minute version of the type of questions typically asked on the Scholastic Assessment Test (SAT) is as predictive of academic performance in college as is the standard SAT. Questions have been raised in the popular press as to the amount of time necessary to complete the SAT which is estimated at 3 hours and 45 minutes (longer for disabled students). Other reports note a sizable error rate in the current scoring process for the SAT. The present study asked if a brief, easily scored version of the SAT would be as predictive of college grades as the standard SAT. The sample included 308 students at two private universities attending classes in Psychology. Questions of the sort traditionally tested on the SAT-V and the SAT-M were taken from practice texts for the SAT-V and the SAT-M to create a brief SAT test. The brief test included 45 items, 8 tested knowledge of the meanings of words, 8 the knowledge of opposites, 8 the knowledge of analogies and 21 measured mathematical knowledge. Measures of specific academic achievement (exam performance on objective tests) were provided by the instructors of the Psychology courses. Standard SAT scores were obtained from academic records. Both the standard SAT and the brief SAT were successful in predicting academic performance. The predictions from the composite scores on each test to academic performance were virtually identical. The present results are in accord with an earlier study (Fagan & Holland, 2006) which found that a brief version of the SAT-V is as predictive of academic performance in college as is the standard SAT-V. Thus, an equally predictive, less time consuming, and more easily scored version of the SAT is possible.

Executive Functions, General Intelligence, Life History, and Temperament

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A sample of undergraduate students responded to a battery of questionnaires about their executive functions, life history strategy, and temperament, and then tested for general intelligence. An Executive Function Factor was constructed from the Behavior Rating Inventory of Executive Function-Adult version (BRIEF-A), the Dysexecutive Questionnaire (DEX), and the Executive Functions Questionnaire (EFQ). General Intelligence was measured the APM-18 Short Form of the Ravens Advanced Progressive Matrices. The Life History Factor was measured using the Arizona Life History Battery, including measures of Long-term Thinking and Planning, Parental Investment (given and received), Nepotistic Investment (given and received), Long-Term Mating Investment (given and received), Reciprocal Altruism (given and received) towards Friends and Community, and Religiosity. Effortful Control, Surgency, Negative Affect, and Orienting Sensitivity were measured by the corresponding subscales of the Adult Temperament Questionnaire.

Bivariate correlations indicated no statistically significant relationships between General Intelligence and Life History (.02) or between General Intelligence and Executive Functions (.15). However, the Executive Functions were positively correlated with Life History (.34*), Effortful Control (.50*), and Surgency (.35*), negatively correlated with Negative Affect (-.39*), and not significantly correlated with Orienting Sensitivity (.04). This suggests that the key mental abilities in the development of a K-selected ("slow") life history strategy are Executive Functions rather than General Intelligence.

Is It Possible to Manipulate Complexity Within a Single Task Framework? Notes from a Near Match-to-Sample Condition

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There is a general consensus in the literature that the more complex a task, the more g-loaded it should be. However, complexity is seldom precisely defined. The conclusion about the relationship between complexity and g-loadedness seems to be based largely on common sense conceptions of complexity. Previous research presented at this conference examined the effects of task complexity on mean decision times (DT) and g-loadings of reaction time (RT) and match-to-sample/ stimulus discrimination (SD) tasks. The results indicated that increased complexity (as defined either by information load or response complexity) affected decision times but did not have a significant effect on the g-loadings of the tasks. The current study conceptualized complexity as discrepancy between probe and target in a stimulus discrimination task. Subjects were presented with five conditions: one standard SD (SDS), two conditions of 1 square discrepancy (SDP1, SDM1), and two conditions of 2 square discrepancy (SDP2, SDM2). Results indicated that DT increased with degree of discrepancy and type of discrepancy. The g-loadings of the tasks presented a different pattern.   The less discrepant conditions (SDP1, SDM1) had higher g-loadings than either the standard condition (SDS) or the more discrepant conditions (SDP2, SDM2). Further, there appeared to be an effect of the type of discrepancy on g-loadings. Since these tasks were designed to require the same input and output processes, it is possible that these differences in g-loadings were the result of different central processes being required for successful task completion. Complexity may be more complex than it is generally presented in the literature.

Symposium: Cognitive Epidemiology

Psychometric Properties of Health Self-Care

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Higher-IQ children grow up to live healthier, longer lives, but health scientists strongly disagree about why this is so. For example, does higher intelligence actually provide a functional advantage in staying healthy, or might it only reflect a sounder genetic constitution or a more privileged social environment? Large observational studies find that the socioeconomic advantages do not fully account for IQ's relation with morbidity and mortality but, by themselves, such studies are causally ambiguous. A psychometric approach to health itself provides a different strategy.

An alternative approach is to examine the psychometric properties of the *tasks* that must be performed well for effective health self-care. Patients are not passive recipients of health care but must understand and implement treatment regimens in order to benefit from them, as health literacy researchers have confirmed. Non-adherence is a large problem in health care, and patients differ greatly in degree of adherence to both preventive and curative care. Crucial tasks in health self-care, such as avoiding illness and injury or managing a chronic illness, can be conceptualized as subtests in a life-long mental test battery. If higher levels of g truly are protective, then such tasks should exhibit known properties of g-loaded mental tests. They should also reproduce patterns of results predicted by them when administered under different conditions and to different kinds of populations. Accidental injury and chronic illness illustrate these principles.

Recruitment Modeling

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We address a frequently occurring problem, both in the study of intelligence and in psychology more generally. Suppose that the goal of a study is to determine differences between two groups in a trait (e.g. general intelligence). The conclusion is to be drawn about the groups in the general population. However the investigator is restricted to studying samples drawn from a non-randomly selected population. As an example, consider the issue of drawing conclusions about difference between male and female intelligence, on the basis of a study of university students. In order to draw a conclusion about the general population it is necessary to have a model of the way in which members of each group are recruited into the selected population. This is especially important if the recruitment method differs for each of the groups. If a recruitment model can be validated it can be used to infer the range of differences in the general population that would be compatible with observations in the studied population. We illustrate this by considering the problem of inferring male-female differences in intelligence in the general population from the study of differences in male and female SAT scores. We present data validating a recruitment model, and then apply the recruitment model to a published study of the distribution of SAT scores between males and females.

A Two-Stage Procedure for Locating Group Differences in the Latent Means of Higher-Order Factor Models

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There is a very general problem in individual differences which consists in identifying the location of group differences in the latent mean within a hierarchical factor structure. Typical examples include studies of ethnic and sex differences, in which the issue concerns whether the group difference is in the mean of general cognitive ability (g), or in the mean of a broad cognitive ability such as working memory, verbal reasoning, spatial visualization or perceptual speed, or some combination of these. Arguably, as yet, there is no fully satisfactory method of addressing this problem. To date, two principal methods have been suggested: (1) the method of correlated vectors pioneered by Jensen (1973) and (2) multi-group confirmatory factor models with mean structures (MGCFA) suggested by Dolan (2000). It is shown that neither of these methods provide an adequate solution. Instead, a two stage procedure is suggested comprising: (1) a test for scalar invariance at the first-order and metric invariance at higher orders, using multi-group confirmatory factor models (MGCFA); followed by (2) a higher-order multiple-indicator multiple-cause (MIMIC) model to estimate the location and magnitude of mean differences. Analyses of the second-order factor of Anxiety using the American standardization of the 16PF, 5th Edition are used to illustrate the method and provide a comparison with MGCFA based analyses. It is shown that multiple indicators are desirable for each primary factor. However, because it represents a common situation, the case in which there is only a single indicator per primary factor is also considered.

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Genetic and Environmental Influences on the Wrong Model of Cognitive Ability

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Investigators interested in the structures of cognitive ability and personality often point to the presence of stable or substantial genetic and environmental influences and correlations as evidence for the accuracy or relevance of their phenotypic models. This talk will show that even a demonstrably inaccurate structural model of cognitive ability (the fluid-crystallized model in data from the Minnesota Study of Twins Reared Apart) shows evidence of genetic and environmental influences and correlations comparable to those from a carefully tested and validated model. This calls into question the accuracy of the inference that the presence of genetic influences indicates that traits have been accurately measured. It also suggests that genetic correlations will tend to parallel phenotypic correlations, and that the underlying reasons for genetic correlations are the same as those that underlie phenotypic correlations. That is, genetic influences on one trait may also affect the other or vice versa, or genetic influences on some third trait may also affect the two traits of primary interest, and we cannot distinguish among these possibilities with the genetic correlation alone. The talk will also provide data comparing differences in cognitive ability between members of monozygotic and dizygotic twin pairs and differences between randomly matched pairs. The data indicate that, though twins are more similar than random pairs, the extent to which this is true is surprisingly small. This suggests that genetic influences on cognitive ability are more subtle than many people expect and helps to explain the difficulty we have had in identifying the genes for cognitive ability.

Toward an Understanding of Sex Differences in Variability in Intelligence

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The idea that males may be more variable than females in intelligence has a long history. In recent years it has been presented as a reason for the observation that there appears to be little if any mean sex difference in intelligence yet males tend to be over-represented at both the top and bottom ends of its overall distribution. One way this can occur is through the presence on the X-chromosome of genes related both to syndromal disorders involving diminished intellectual ability and to variation in intelligence occurring normally throughout the population. Using two population-wide surveys of mental ability in 11-year-olds in Scotland, we show that there are substantial departures from normality in the distributions of ability scores. These departures indicate there is less variability above the modal level than below it, consistent with recent findings of genes on the X-chromosome involved in mental retardation, and with a model of the population distribution of intelligence as a mixture of two essentially normal distributions. We used this model to explore the expected ratios of males to females at various points in the distribution and to estimate the proportions of variance in normally and abnormally occurring mental ability due to genes on the X-chromosome. These estimates provide clues to the biological differences between the sexes that may be manifested in the environment as sex differences in propensities to display intellectual abilities.

Why Crystallized Intelligence is Not Crystallized Intelligence

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Both the Horn-Cattell model and Carroll's three stratum model embrace the two broad higher order factors fluid intelligence (Gf) and crystallized intelligence (Gc). According to the investment theory, people invest their fluid intelligence to acquire specific problem solving strategies and skills, and knowledge. The result, the acquired abilities, is crystallized intelligence. While investment might be able to explain why some people know more than others, it fails to explain why Gc is a common factor, that is, why scores on tests that measure these abilities are correlated after Gf is partialled out. For example, investment theory does not predict why people with the same level of Gf who score high on mathematical knowledge should tend to score high on vocabulary. Hence, Gc, as found in factor analysis, is not crystallized intelligence. We propose in line with Cattell (1971, 1987) that (the quality of) education might be responsible for the correlations among tests. If so, crystallized intelligence is not a latent factor. Vice versa, if one wants to argue Gc is a latent factor, it cannot be crystallized intelligence.

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International Differences in Intelligence Symposium: Correlates of National IQ

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I first discuss my recent work in evolutionary psychology and intelligence research on the Savanna-IQ Interaction Hypothesis, which states that more intelligent individuals are better able to comprehend and deal with evolutionarily novel entities and situations than less intelligent individuals, but general intelligence has no effect on individuals' ability to comprehend and deal with evolutionarily familiar entities and situations. At the individual level, evidence shows that: 1) less intelligent individuals enjoy watching TV more than more intelligent individuals; 2) poorer families have more children than wealthier families even though they don't want to; 3) more intelligent individuals stay healthier and live longer; 4) more intelligent individuals are more likely to be liberal, atheist, and (for men) value sexual exclusivity; and 5) more intelligent individuals enjoy instrumental music more than less intelligent individuals, even though general intelligence has no effect on the enjoyment of vocal music. At the aggregate level, evidence shows that countries with higher national IQs: 1) have healthier populations that live longer; 2) are more liberal, less religious, and more monogamous; 3) engage in (evolutionarily novel) interstate wars more frequently and extensively while national IQ has no effect on the frequency and intensity of civil wars.

Differences in Cognitive Task Performance in Down Syndrome and Fragile X Syndrome

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Possible differences in cognitive profile and the factor structure of the Wechsler Adult Intelligence Scale-III (WAIS-III) were explored in two genetic syndromes that cause mild and moderate mental retardation. 40 Down Syndrome and 20 Fragile X individuals were administered the WAIS-III and a portion of the Cognitive Abilities Test (CAT), a computer-based assessment measuring performance on a variety of elementary cognitive tasks (Detterman, 1988). In the current sample, individuals with homogenous genetic disorders that result in mental retardation could be identified based on complex cognitive task performance. Further analysis revealed potential between-group differences in the relationship between WAIS-III subtest performance and more global measures of functioning such as *g*. Though the current results are hindered by low sample size, it appears that the WAIS-III subtests may be measuring different abilities in each group, and that various cognitive abilities contribute differentially to overall functioning for each syndrome. Possible causes of between-group differences are discussed.

Assessing Occupational Knowledge Using Situational Judgment Tests Derived From Job Analysis Questionnaires

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We hypothesized that job analysis questionnaires could be modified to create maximal performance measures that resemble situational judgment tests and assess occupational knowledge. For four diverse military occupations, we modified existing job analysis questionnaires that listed key job tasks and employee attributes (KSAs) to create corresponding judgment tests by requiring respondents to objectively rate task frequency and the importance of employee attributes against performance in their occupations. We quantified the adequacy of respondent ratings using consensually derived standards. Results demonstrated the Job Analysis Judgment Tests had acceptable levels of reliability (up to .69), and validity against job knowledge (up to .32), cognitive ability (up to .26) and attrition criteria (up to .28). These results are important because this approach may provide an inexpensive method for creating judgment tests to objectively assess occupational competence. Further research is needed to determine the extent to which these tests assess knowledge and ability.

Differential Predictive Power of Working Memory and Associative Learning for Various Levels of Intelligence

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In a separate recent study based on nationally representative samples in the US, the latent factors of working memory and processing speed were found to be nonlinearly related to general indexes of intelligence. The nonlinear relationship, parameterized as a negative quadratic term, effectively accounts for the phenomenon concurrently known as the "Law of Diminished Returns". More specifically, the two basic cognitive capacities, working memory in particular, conclusively predicted mild mental retardation (MMR), but their predictive power appeared to be notably weaker for the average and supra-average ranges of intelligence. Such range-dependent predictive strengths of working memory and processing speed suggest that in the average and supra-average ranges of intelligence, the underpinnings of intelligence are likely to be more complex than in the subaverage ranges, and additional cognitive capacities may be needed to adequately explain the variability in intelligence.

In the present study, the cognitive capacity of associative learning was investigated along with working memory and processing speed for its predictive power both in the full range of intelligence and with reference to various ability ranges. The study was conducted in a Chinese primary school sample with about 140 children diagnosed of MMR and about 900 in the same age range without MMR. In the full range with the MMR subgroup properly weighted down, the working memory factor accounted for about 75% of the variability in the general factor superposing the WISC verbal and performance factors and an achievement factor, and the associative learning factor defined by Visual-Auditory Learning and Word Pairs added a significant amount of explained variability (about 10%) to the general factor above the working memory and processing speed factors. Moreover, the additional predictive power of associative learning manifested mostly in the average and supra-average ranges, but not in the MMR range. The substantial unique contributions made by the associative learning predictors in the multiple regression models in truncated-ranges and in the logistic regression models with various IQ cutoffs as binary dependent measures occurred exclusively in the higher ability ranges. These results seemed to highlight a relatively complex picture about the cognitive underpinnings of intelligence: the capacities of working memory, associative learning, and processing speed seem to contribute nonlinearly to intelligence and their roles appear to be more independent of one another in the average and supra-average ranges of intelligence.

International Differences in Intelligence Symposium: Intelligence and Religion

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Evidence is reviewed pointing to a negative relationship between intelligence and religion in the United States and Great Britain. We examine whether this negative relationship between intelligence and religious behavior is present between nations. We find that in a sample of 137 countries the correlation between national IQ and belief in religion in God is $r=-.60$.

The Coming Market for Cognitive Skills

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Many commentators have worried that the coming workforce will have a shortage of cognitive skills. Worries have been expressed strongly in the developed countries, especially the US and EU. General statements have often stressed shortage of very high level talent, especially scientists and engineers. We believe a more detailed quantitative analysis is required. We will present a detailed analysis of the cognitive skills required for a large segment of the jobs in the US workforce, based upon a model similar to Johnson and Bouchard's VPR model. We then consider the distribution of cognitive skills in 15 year olds, using the Programme for International Student Assessment (PISA) database. Comparing the two, we find that the shortages in the US workforce will come at the middle rather than upper level of general intelligence. However this argument does not consider how people are selected for (or select) jobs. We consider two different job-person allocation models. By simulated annealing, we develop a model that maximizes overall societal output. Using a 'greedy' allocation algorithm, we consider an allocation policy in which each person maximizes his/her individual income, after considering the jobs that are available. These two different policies lead to different patterns of skill overages and shortages. However neither policy produces a shortage of basic skills at the top level of jobs. Therefore any anticipated shortage of high level skills must be due to failure to receive appropriate training at a level beyond high school, rather than a deficiency in the high school system itself.

IQ Is Correlated With Variability in Isochronous Tapping Tasks: Comparisons between Different Measures of Timing Performance

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Variability of reaction time (RT) in elementary cognitive tasks correlates negatively with intelligence (see e.g. [1]). Interestingly, recent studies combining choice RT tasks and temporal discrimination/judgement tasks suggest that variability in temporal processing in the millisecond range may be a factor underlying both RT variability and intelligence: the timing tasks correlated better with intelligence than the RT measures; the portion of intelligence explained by the RT tasks predominantly represented variance also explained by the temporal tasks; and the unique contribution of timing performance to intelligence was larger than that of the RT tasks [2-3]. Here, we tested whether IQ correlates with a simple timing task, isochronous serial interval production (ISIP), i.e. self-paced tapping. ISIP is of interest from at least two respects in this context. First, it does not include explicit instructions to process temporal information in working memory. Second, the structure of the temporal variability is not confounded by random response-stimulus intervals, as is often the case in RT paradigms.

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IQ Estimates for Counties and Independent Cities in the Commonwealth of Virginia

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Human capital is often estimated for geographical units such as nations (Kalaitzidakis, Mamuneas, Savvides, & Stengos, 2001). Most human capital measures are limited because they do not directly assess the knowledge and skills possessed by the population. Intelligence (IQ) is a measure of human capital that directly assesses the cognitive ability of individuals. In recent years, various authors have offered estimates of mean IQ for various nations (Hunt & Wittmann, in press; Lynn and Vanhanen, 2002, 2006; Rindermann, 2007) and for geographical sub-units, such as states (McDaniel, 2005; Kanazawa, 2005). These mean IQ estimates can be viewed as measures of the intellectual human capital of a geographical area. This paper offers estimates of IQ for the counties and independent cities in the Commonwealth of Virginia, one of the 50 states in the United States. We discuss the strengths and limitations of the estimates and review likely antecedents and consequences of county and independent city IQ. Finally, the paper offers a research agenda for improving the estimates of local IQ and for understanding the role of IQ in predicting other important county and city variables.

International Differences in Intelligence Symposium: From the Cradle to the Grave: Effects of Intelligence on Fertility and Mortality

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During the demographic transition, a reduction of mortality is followed by a reduction of fertility (Kirk, 1996). Both processes are correlated with mass education, rising prosperity and rising IQ. However, the relative importance of these factors for changes in mortality and fertility is unknown. Because today's countries are at different stages of the demographic transition, the correlates of reduced mortality and fertility can be assessed in cross-sectional studies at the country level. The current between-country differentials of fertility and pre-reproductive mortality will reduce the average IQ of the world population by 3.74 points per generation. A Flynn effect of 1.3 IQ points per decade is required to neutralize this demographic effect and maintain the intelligence of the world population at its present level.

Kirk, D. (1996). Demographic transition theory. *Population Studies, 50*, 361-387.

Offspring Intelligence and Parental Mortality

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Intelligence assessed in childhood or in early adulthood has been shown to be inversely associated with all-cause and cause specific mortality in populations followed into middle age and older age. One of the early studies showed that cognitive ability in childhood was inversely associated with all-cause mortality and all cardiovascular diseases (CVD) and coronary heart disease (CHD) mortality during 25 years of follow-up. It is noteworthy that the referred studies have shown that the association between IQ and risk of mortality remains, although attenuated, after adjustment for adult socioeconomic position. Childhood socioeconomic position has even weaker effect on the association between IQ and mortality. It is thus clear that IQ has effects on mortality risks that cannot be entirely explained by socio-economic circumstances in childhood or in adulthood.

The above referred studies have been conducted on own IQ and own mortality. In this study we have used offspring (sons) IQ and their parents' mortality. Analyses of associations between offspring's IQ and parental mortality in biological and non-biological family relations may shed light on genetic and environmental influences.

In a cohort of 931 825 Swedish men, IQ of offspring was measured at age 18 at military conscription and mothers and father were followed, on average, for 21.2 years and 19.7 years, respectively, with respect to all-cause and cause-specific mortality (cardiovascular disease, coronary heart disease, stroke and diabetes). The analyses were conducted by proportional hazards regression with adjustment for parental occupation, education and income.

In adjusted analyses using IQ as a continuous variable over a standard nine point scale, hazards ratio (HR) for all-cause mortality was 0.96 (95% CI 0.96, 0.96) for fathers and 0.95 (0.95, 0.95) for mothers, indicating a 4-5% lower mortality risk per unit increase in IQ over the nine point scale. The corresponding HRs were 0.99 (0.97, 1.00) for step-fathers and 0.97 (0.95, 0.99) for step-mothers. In adjusted analyses, HRs for CVD mortality among fathers and mothers were 0.97 (0.96, 0.97) and 0.94 (0.93, 0.94), respectively. The corresponding HRs for diabetes mortality were 0.91 (0.89, 0.92) among fathers and 0.85 (0.83, 0.87) among mothers.

The associations found in non-biological family relationships suggest shared environmental influences and/or assortative mating. Stronger IQ-mortality associations in biological than non-biological relationships suggest genetic influences. Stronger inverse offspring's IQ - parental mortality associations in mothers than in fathers might be due to environmental factors or epigenetic mechanisms.

Symposium: Measurement Invariance and Group Differences in Intelligence Test Scores

The Power to Detect Sex Differences in Intelligence Test Scores Using Multi-Group Covariance and Mean Structure Analyses.

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Two recent studies by van der Sluis et al. (2006) and Dolan et al. (2006) used Multi-Group Covariance and Mean Structure Analyses (MG-CMSA) to detect sex differences in WAIS-III intelligence test scores. Differences were found to be due to the first order common factors: Perceptual Organisation, Perceptual Speed, and Working Memory. However, no differences were found on the second order, general intelligence factor, g, while some authors argue that g is a source of sex differences in intelligence. As empirical evidence from multivariate test scores seems absent for this statement, this raises the question of whether sex differences on g are truly absent, or whether MG-CMSA lacks statistical power to detect it. Therefore, we studied the power to detect sex differences in intelligence test scores using MG-CMSA. In the present talk, it is explained how we used the Likelihood Difference Test (LDT) to calculate power. Next, results are presented and implications are discussed.

Tracing Developmental Stages in Reasoning Ability

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Reasoning ability is central to intelligence. Individual differences in reasoning are strongly associated with efficiency of information processing and the management of the working memory resources. To study these relations, we examined 386 participants about equally drawn among each of the years 6 to 11. These participants were examined with a large array of inductive and deductive reasoning tasks design to tap different levels of complexity and also by tasks addressed to processing efficiency (speed and control of information processing) and working memory. Performance on the reasoning battery was subjected to Rasch analysis. This analysis suggested the existence of three developmental stages. Each stage was identified with respect to the complexity of syllogistic processes and the cognitive profile of the participants assigned to each stage. Specifically, cognitive complexity was specified in reference to the semantics, the procedures, and the mental constructs embedded in each reasoning task. The cognitive profile of the participants belonging to each stage was specified in reference to the speed and control of processing, and the executive functions of working memory. ANOVA revealed that the three developmental stages of reasoning ability differ significantly in the cognitive parameters mentioned above. That is, the pattern of differences between stages in the cognitive parameters mentioned above suggested the presence of a representational shift from the first to the second stage which allows the reasoners to be engaged in more demanding situations and deal with more complex information. The shift from the second to the third stage was softer. That is, speed and control of processing do not change significantly and there are only limited changes in working memory capacity. These findings suggest that the cognitive parameters are more vital during the first and the second reasoning stages in that they enable the construction of arguments based on simple inferential schemas. The efficiency in dealing logical fallacies, which is attained during the third stage, is attributed to the specificities of the reasoning procedure per se, as for example the available repertoire of mental rules or the access to mental models' alternatives.

Fluid Intelligence, Executive Control, and Insight Problem Solving: An Analysis of Causal Relationships

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We asked 112 participants (48 males, 64 females) to complete a large battery of cognitive tasks. There were three measures of general fluid intelligence: Raven's matrices and two verbal analogy tests. A number of short insight-problems, supplemented by the remote association test, served as measures of individual differences in the insight problem solving ability. Finally, five elementary cognitive tasks were administered in order to measure the efficiency of executive control: task switching, working memory updating, response inhibition, goal monitoring, and dual tasking. We tried to find answers to the following questions: (1) Is executive control related to fluid intelligence, as postulated by some theories (e.g., Engle et al., 1999); (2) Is the insight problem ability dependent on fluid intelligence, and what is the strength of such a relationship; (3) Is executive control important for insight problem solving? Structural equation modeling (SEM) allowed us to construct three latent variables: fluid intelligence, executive control, and insight problem solving ability. It appeared that general fluid intelligence accounted for insight problem solving (0.87) and executive control (0.76), being an important causal factor for both cognitive variables.

International Differences in Intelligence Symposium: Religion, IQ, Sex Hormones, and Delinquency: Application of the General Trait Covariance Model

Helmuth Nyborg

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Religion plays a role for many people, and religious persuasion correlates with multiple parameters such as delinquent behavior, moral values, education and income. There is, however, considerable disagreement about the direction of the relationships. Some find that religious persuasion reduces criminal behavior, whereas others emphasize that religion encourages crime in dense populations (e.g. Heaton, 2006) or immoral behavior such as war. Some philosophers assume that a world without religion would work as well as one with, because humans live by a universal set of moral value. In any case, mediating mechanisms are rarely looked for, and many empirical studies suffer from sample bias and/or small samples. This raises the need for establishing a coherent causal framework for integrating the relevant elements in a model that generates testable predictions for large representative samples. One such model is the General Trait Covariance model (GTC; Nyborg, 1994). Briefly, the GTC model classifies females and males into 5 estro- or androtypes in accordance with their plasma sex hormone levels. The model predicts, among other things, that high plasma hormone levels relate to increased sexual differentiation and inversely to IQ and education. A recent study, representing 15 million American adolescents, indicated that religious groups in the United States differ significantly in average IQ (Nyborg, 2007). In that case, the GTC model predicts long education, high income, and high moral values in high IQ liberal denominations and vice versa in the low IQ dogmatic denominations. The latter are also expected to show more delinquent behavior. The model further predicts that male academic religious leaders will have higher than average IQ and lower plasma testosterone level. These predictions were tested with data drawn from several large-scale studies. Results, generalizations, and limitations of the study will be discussed.

Heaton, P. (2006). Does religion really reduce crime? *Journal of Law and Economics, vol. XLIX (April),* 147-172.

Nyborg, H. (1994). *Hormones, sex, and society: The science of physiology*. Westport, CT.: Praeger.

Nyborg, H. (2007). Religiosity and intelligence within and across races. In J. Hennig, M. Reuter, C. Montag & P. Netter (Eds.). *Abstracts of the 13th Biennial Meeting of the International Society for the Study of Individual Differences (ISSID)*, Giessen, Germany, July 22-27 (p. 75).

Among Doctorates Quantitative Reasoning Assessments Conducted 25 Years Earlier (by age 13) Predict Patents and Scientific Publications

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A sample of 2,409 intellectually talented adolescents (top 1%) were assessed on the SAT-M by age 13 and tracked longitudinally for over 25 years. Using patents and scientific publications as criteria for scientific and technological accomplishment, the proportion of participants with at least one such accomplishment in adulthood increased as a function of these early SAT-M assessments. When this relationship was restricted to those who subsequently earned doctorates (i.e., the 530 participants who earned a MD, JD, or PhD), it persisted. Across multiple social science disciplines, appraisals of human capital frequently do not go beyond conceptualizing those with advanced educational degrees categorically, but individual differences within such groupings are vast and psychological meaningful; among doctorates, utilizing information about psychological diversity can enhance our understanding of differential creative production in science and technology.

Where are Those Genes for Intelligence Hiding?

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In the early 1990s, I began to use the new tools of molecular genetics in an attempt to find some of the genes (quantitative trait loci, QTLs) responsible for the high heritability of intelligence. In this talk I will present a roadmap of my 15-year quest for IQ QTLs as a personal view of the fast-moving developments in molecular genetic research on complex traits and common disorders. My strategy has been to take a systematic, genome-wide approach using association (not linkage), and taking advantage of the quantitative trait nature of IQ by comparing extreme groups of low and high IQ individuals in order to attain the power to detect associations of small effect size.

The IQ QTL Project, which began in 1992, reached the following milestones:

- An IQ association study of 100 candidate genes (1994, 1995).
- Development of DNA pooling in which DNA for low and high IQ groups could be averaged biologically rather than statistically, a cost-effective way to study the large samples needed to detect associations of small effect size (1998).
- Chromosome-wide association study of IQ using DNA pooling for markers across chromosome 6 (1998).
- Genome-wide association study of IQ using DNA pooling and 1842 markers across the genome (2001).
- Application of DNA pooling to microarrays that genotype many thousands of SNPs simultaneously (2004).
- Genome-wide association study of IQ using functional DNA markers (brain-expressed non-synonymous SNPs) (2005).
- Genome-wide association studies of IQ using 10,000-SNP microarrays (2005) and 500,000-SNP microarrays (in press).

No replicable associations emerged from the earlier studies. The later studies, especially the genome-wide association studies, indicate why: The biggest QTL effects are much smaller than anyone imagined. In our genome-wide association studies, we find no replicable associations that account for more than .4% of the variance despite 95% power to detect them. Because effect sizes are so small, it is difficult to find these associations and even more difficult to replicate them. I will present some promising recent results and talk about where we go from here in the quest for IQ QTLs.

What good are SNP associations of such small effect size? By aggregating associations in bigger and better 'QTL sets', it should be possible to reach levels of prediction useful at least for research purposes. I had not expected to spend 15 years trying to find IQ QTLs – what I really want to do is to use IQ QTL sets in 'behavioral genomic' research to understand how genes affect IQ, investigating developmental, multivariate and gene-environment issues.

Intelligence & Genes: Current Status and Future Directions

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The past decade has seen a major shift in the genetic study of human intelligence; where classic studies aimed to quantify the heritability of intelligence, current studies aim to dissect this heritability into its molecular-genetic components. Five whole-genome linkage scans have been published in the past two years (as reviewed in Posthuma and de Geus, 2006), converging on several chromosomal (or genomic) regions important to intelligence. A handful of candidate genes, some of which lie in these genomic regions, have shown significant association to intelligence. Of these genes, the *COMT* and *CHRM2* gene have been the most promising. We recently conducted finemapping and brain expression analysis within the *CHRM2* gene, narrowing the region of interest within these genes (Gosso et al., in press,a). In addition we recently found a positive heterosis effect of the *COMT* gene with intelligence, as well as an interaction between the *COMT* gene and the *DRD2* gene (Gosso et al., in press, b). The latest results on gene finding for intelligence will be presented, as well as the biological implications of these findings.

Gosso, M.F., de Geus, E.J.C., Polderman, T.J.C., Boomsma, D.I., Heutink, P., Posthuma, D. (2007). Catechol O-methyl transferase and dopamine D2 receptor gene polymorphisms: evidence of positive heterosis and gene-gene interaction on working memory functioning. *Eur J Hum Genet,* in press

Gosso, M.F., van Belzen, M., de Geus, E.J.C., Polderman, J.C., Heutink, P., Boomsma, D.I., Posthuma, D. (2006). Family based association testing provides further evidence for a role of the CHRM2 gene in cognition. *Genes Brain Behavior*, 5(8), 577-584.

Posthuma, D. & de Geus, E.J.C. (2006). Progress in the molecular genetic study of intelligence. *Cur Dir Psych*, 15(4), 151-155.

Uses and Abuses of the Raven Progressive Matrices

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Some results from our forthcoming book *Uses and Abuses of Intelligence: Studies Advancing Spearman and Raven's Quest for non-Arbitrary Metrics* will be summarised. The summary will include Taylor's re-demonstration that the correlation between the IRT-based item difficulties for the SPM established separately among black and white groups in South Africa is .98; a demonstration that the Test Characteristic Curves for the two groups are virtually identical; and evidence that, on the most pessimistic estimate, there are only three items that may function differently in the two groups.

It will also include Styles' evidence that the ICCs for a series of Piagetian tasks map directly onto the SPM ICCs. The implication is that the Piagetian modes of thought develop incrementally and in line with the development of the abilities required to handle the RPM items.

Also included is our demonstration that the TIF for the SPM+ is virtually linear, thus making it perhaps the first test to have the properties of a tape measure in the sense that difference scores at different levels of ability can be in some sense treated as equivalent. In this sense, the test can be described as offering on a non arbitrary metric. (The significance of this claim will be underlined via demonstrations of the meaninglessness of most "change" scores.)

If time permits (and perhaps a second paper should be devoted to the issue), the presentation will flow onto a discussion of the unscientific and unethical conclusions that stem from the use of what are best termed arbitrary metrics and measures in individual and programme evaluation. (As Spearman observed a century ago, "every normal man, woman, and child is a genius at something … but this cannot be demonstrated with any of the psychometric procedures in current use". Further, the tests from which his [widely misinterpreted] *g* had emerged had no place in schools since the basic function of education is to draw out and recognize the diverse talents of the pupils.) Failure to come to terms with these issues represents a widespread abuse of the concept of intelligence, the effects of which cumulate to result in a major contribution to the extinction of our species and the planet as we know it.

Raven, J. and Raven, C.J. (eds) (2007, forthcoming) *Uses and Abuses of Intelligence: Studies advancing Spearman and Raven's quest for non-arbitrary metrics.* Unionville, New York: Royal Fireworks Press; Edinburgh, Scotland: Competency Motivation Project; Budapest, Hungary: EDGE 2000.

Using Factor Mixture Modeling to Investigate Spearman's Law of Diminishing Returns

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Spearman's law of diminishing returns (SLODR) posits that at higher levels of general cognitive ability, the general factor (g) performs less well in explaining individual differences in performance on cognitive tests. In the present study, factor mixture modeling was used to investigate SLODR in the standardization sample from the Kaufman Assessment Battery for Children—Second Edition. Rather than forming ability groups by splitting the sample at a mean or median global IQ score, factor mixture models were used to uncover latent classes of individuals who differed in their level of the g factor. Group membership was based on classification procedures derived from model probabilities rather than on a cut-point determined by the researcher before the data were submitted to analysis. A second-order confirmatory factor model, consistent with three-stratum theory (Carroll, 1993), was modeled as a within-class factor structure. The fit of several models with varying number of classes and factorial invariance restrictions were compared. In addition, a sex covariate was included with the best-fitting models.

Factor mixture modeling was a useful method for the study of SLODR in this sample. More detailed descriptions of the latent classes will be provided. The findings will be related to theories of SLODR.

International Differences in Intelligence Symposium: Philosophies of Life as Religious, Cultural and Political Beliefs and their Relationship to Intelligence

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Philosophies of life (Weltanschauungen) like religious, cultural and political beliefs have developed different attitudes towards education, rationality, thinking and meritocracy. Famous is Max Weber's analysis of *Protestantism* as supporting factor for the development of Capitalism. He himself, Werner Sombart, G. W. F. Hegel or Volker Lenhart have also described positive influences of Protestantism on (fostering) education, especially on reading, which further cognitive abilities (thinking ability, knowledge and the intelligent use of knowledge). Religious and cultural factors positively or negatively relevant for education, rationality, liberty, rule of law, meritocracy, practice of thinking and by these factors for cognitive ability were also researched for *Judaism* (Weber, Sombart, Weiss, Cochran et al.), *Catholicism* (Sombart, Erlinghagen), *Confucianism* (Weber), *Islam* (Nagel, Tibi) and *Animism* (Lévy-Bruhl, Oesterdiekhoff, Signer). Some researchers (Cochran et al., Meisenberg, Murray, Weiss) even assume cultural effects via influence on genetic evolution (different reproduction rates of and different attraction for more or less intelligent people) on macro-social cognitive development.

The talk first tries to describe a theory of indirect influence of philosophies of life on cognitive development. Second this theory is applied to explain cognitive ability differences between countries and cultures observed in international intelligence (Lynn & Vanhanen) and competence (PISA etc.) studies. Third the theory is applied to explain cognitive ability differences within Germany between German states (Bundesländer). Last but not least will be discussed reverse effects of intelligence on selection, content and shaping of religious, cultural and political philosophies of life.

International Differences in Intelligence Symposium

Heiner Rindermann and Richard Lynn
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International cognitive ability studies have stimulated a lot of research about group and national differences in intelligence and related constructs like literacy: Different sources of ability measurements were compared. Cognitive ability was used as a theoretically justified and empirically confirmed explanatory variable to explain aspects and development of societies and their people (like economic growth and democracy). Conversely, genetic (evolutionary) and environmental (natural and social) factors were searched for the explanation of ability differences between groups and societies, races and cultures.

The international differences in intelligence symposium will bring together these different research questions with researchers of different theoretical point of view, completed with a commentary by an intelligence researcher famous for studies at the national level on historical development of intelligence (test results).

International Differences in Intelligence Symposium: Genetic and Environmental Contributions to Group Differences on the Raven's Progressive Matrices Estimated from Twins Reared Together and Apart

J. Philippe Rushton [1], Trudy Ann Bons [1], Philip A. Vernon [1], and Jelena Čvorović [2]

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In two studies of twins reared-apart and twins reared-together, we found that genes influence population group differences in average mental ability, just as they do individual differences within a group. Heritabilities and environmentalities were calculated for puzzles from the Raven's Colored and/or Standard Progressive Matrices, widely-used, culture-reduced tests of general intelligence. These estimates correlated with the differences among 13 diverse samples ($N = 5,572$) including the reared-apart twins, two samples of Serbian Roma (Gypsies), and East Asian, White, South Asian, Colored, and Black high school and university students in South Africa. In 55 comparisons, group differences were more pronounced on the more heritable and on the more environmental items (mean rs = 0.40 and 0.47; Ns = 58; $P < 0.05$). After controls for measurement reliability and variance in item pass rates, the heritabilities still correlated with the group differences, although the environmentalities did not. Puzzles found relatively difficult (or easy) by the twins were those found relatively difficult (or easy) by the others (mean $r = 0.87$). The results suggest population group differences are part of the normal variation expected within a universal human cognition.

Components of Working Memory and Short-Term Memory as Sources of Fluid Intelligence

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The theory-guided decomposition of reaction times and accuracy scores provides the opportunity to investigate the basis of cognitive ability from a new perspective. In an investigation the reaction times and accuracy scores of two working memory tasks and two short-term memory tasks were decomposed into three independent components. The first component represented experimentally induced cognitive processes; the second component represented processes resulting from a holistic processing strategy, and the third component subsidiary processes. These components were correlated with Raven's Advanced Progressive Matrices as measure of fluid intelligence at the latent level. The accuracy component of experimentally induced cognitive processes contributed to fluid intelligence in both working memory tasks but not in the short-term memory tasks. In reaction times only the subsidiary processes contributed to fluid intelligence irrespective of the type of task.

IQ Estimate Smackdown: Comparing Premorbid and Short Measures of IQ to the WAIS-III

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Premorbid estimates and quick assessments of general cognitive ability are frequently needed by neuropsychologists and researchers. Over the years the literature has provided a number of methods for estimating premorbid IQ. Many of these methods were developed for estimating WAIS-R IQ. The WAIS-R has been succeeded by the WAIS-III yet many of these measures are still in use. Similarly, multiple methods of quickly assessing cognitive ability have been developed over the years. Many of these methods involve a partial administration of the WAIS (i.e., giving one or more subtests), others are independent measures developed to be used instead of the WAIS materials. While these measures present overall correlations with the WAIS it is tacitly acknowledged that these estimates are most accurate within 1 standard deviation of the mean and the accuracy diminishes moving toward the tails of the distribution. However the existing literature does address how much the accuracy of these estimates diminish as you move toward the tails of the distribution. Additionally, while nearly all of these measures are compared against the WAIS, these methods have not been directly compared to one another. The current paper addresses these issues. The current paper does 3 things: 1) Published regression formulae are compared to a WAIS-III sample, showing the accuracy of each measure against the current gold standard of IQ measures. Pearson correlations and 95% confidence intervals are presented. Existing premorbid and brief assessment IQ estimates are represented in a table showing the other estimates used so the various measures can be directly compared. 2) Each measure is graphically presented against the WAIS-III data across the entire distribution of the sample. 3) The sample is divided into three groups according to their WAIS-III FSIQ score, above average IQ, average IQ, and below average IQ. Correlations and 95% confidence intervals are presented for each group to indicate how the accuracy of these estimates diminish toward the tails of the distribution.

International Differences in Intelligence Symposium: The Influence of Protestant Achievement Ethic on Test Results in a *g*-Based Medical School Aptitude Test (EMS) in Switzerland, Germany and Austria

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Between 1998 and 2006 (N=9909) applicants for medical universities in Switzerland took part in a g-based psychometric aptitude test, which proved to be more or less free of direct influences of school knowledge. The differences between mean test scores in several regions in Switzerland are very stable over time (r=.801**), so that measurement of these inter-regional differences can be considered quite exact. Protestant regions in Switzerland obtain better test-results than Catholic parts of the country. The positive influence of population density and urbanisation will also being discussed.

Switzerland, which is more homogenous than a whole continent, is a very good research area for these kinds of intelligence-sociological issues, because variables as nutrition, income, social standards, GNP, quality of education do not show broad variance within the country, as pointed out by reviewers of "cross-continental" studies before. In Switzerland, mainly Protestant, Catholic or areas with nearly equal representation exist, so that a continuum of the positive influence of Protestantism can be drawn. Moreover Switzerland was the home of Zwingli and Calvin, two important reformers in Europe, who developed their own version of Protestantism, which was – due to Weber – very conducive to the development of capitalistic structures. Today this assertion is often used to explain Switzerland's economic success.

Rindermann (2006, 2007) claimed that properties of different religions influence the aggregated intelligence level in a country. This finding can be supported by the Swiss data, but is interpreted in another way: Based on McClelland's theory of the achieving society, Protestantism leads to a highly developed <u>motivation</u> in individuals. Throughout this debate about basic comparability of intelligence and scholastic tests, focus was set on the enriching or repressive influence of cultural variables on cognitive abilities. Critical reviews mainly focused on methodological concerns, that data on an aggregated level (such as mean scores of countries) cannot be so easily used to examine the causal factors. By contrast the given survey stresses the importance of culture-mediated motivation on test-taking styles, accuracy of preparation and tries to quantify the effect of motivation levels on large-scale measurement tests. Given the fact that applicants for a medical university are highly motivated to obtain a good result and there is a real goal and a benefit, which should reinforce applicants' motivation, the proved evidence of a motivational bias between Catholics and Protestants has large implications on the interpretation of e.g. scholastic tests and large-scale tests, such as PISA, in which the participants' motivation should be significantly weaker. The quality of a countries education system cannot be judged by mean test results, if cultural test-taking styles are not taken into consideration.

Intelligence, Openness, Creativity, and Mating Success

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If human creativity evolved partly as a mental fitness indicator, to display genetic quality and general intelligence to potential sexual partners, then intelligence should predict rated creativity and creativity should predict quantitative mating success, at least among males. We conducted two studies to test these hypotheses and to examine the relationships between these, and other, individual difference variables.

Study 1: 225 University of New Mexico students (163 women, 62 men) completed a new creativity test battery composed of 6 tests of verbal creativity, and 8 tests of drawing creativity. The subjects' responses were rated independently for their creativity by 4 expert raters, who showed very high inter-rater reliability. In addition, subjects completed a measure of general intelligence (an 18-item version of Raven's Advanced Progressive Matrices), the Big Five personality traits (NEO-FFI), schizotypy (Raine's SPQ scale), and self-reported mating success (SOI).

Study 2: 66 male students at the University of New Mexico completed only the verbal creativity tasks. In addition to the Raven's, these students also completed four other intelligence tests: Miller Analogies Test, WAIS definitions, WAIS similarities, and SET (an abstract pattern-finding game). Participants in this study also completed the NEO-FFI and SOI, but not the schizotypy scale.

Results: In both studies, intelligence and openness reliably predicted verbal creativity for both sexes. In Study 1, intelligence and openness also predicted drawing creativity, and were better predictors of creativity than schizoptypy (Miller and Tal, 2007). In Study 2, although all of the intelligence measures predicted creativity, Raven's was the best predictor.

Contrary to our predictions, creativity did not predict mating success (e.g. lifetime number of sexual partners, controlling for age) among the college students, even when we combined the data from both studies. However, previous research has found that men indeed might be using creative displays to attract potential mates (Griskevicius, Cialdini, & Kenrick, 2006), and that women are preferentially mating with men who are very creative (Haselton & Miller, 2006; Nettle & Clegg, 2006). It is possible that we were not able to capture this effect in our own samples because our young students lack the choosiness for long term mating in which intelligence and creativity are known to become more important (Kenrick, Sadalla, & Groth, 1990). Alternatively, the payoffs for displaying intelligence and creativity may be in the currency of mate quality, rather than quantity, which we did not measure.

Women's short-term mating 'success' was predicted by extraversion (positively). And for men, mating success was predicted positively by extraversion and physical attractiveness, and negatively by agreeableness and conscientiousness. (419 words)

International Differences in Intelligence Symposium: Blindness, Deprivation, and IQ: A Meta-Analysis

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The genetic basis of individual within-group differences in intelligence among the majority populations of the industrial nations has been established through the use of twin studies and adoption studies. The question of the cause of the well documented difference in mean IQ test scores between ethnic groups, however, remains one of the most hotly debated issues in behavioral science. A major difficulty in resolving the question is that genetic differences and environmental (cultural, social, and economic differences) between the groups are usually confounded.

The present study examines a different group: the blind and partially sighted. One major non-genetic hypothesis, cultural deprivation, argues that the deleterious effects of a poor and non-stimulating environment increase over time, leading, for instance, to the full standard deviation difference in average test scores between Blacks and Whites in the US or between Dutch and immigrants in the Netherlands. The present study performed a meta-analysis of studies of the IQ of visually impaired children and adults. The results of our analysis demonstrated that visual deprivation showed no effect on the average IQ scores of a severely handicapped group, and therefore it disconfirmed the cumulative deficit hypothesis. Further disconfirmation of the cumulative deficit hypothesis comes from the finding that for the blind and partially sighted, any IQ deficit decreases with age, contrary to the predictions of cumulative deficit theory. Further, the fact that the severely deprived environment of visually impaired has no impact on their average IQ score makes it less likely that the arguably less deprived environment of, for instance, Blacks in the U.S. or immigrant groups in Europe is the cause of their lower mean IQs. Our meta-analytically based study makes environmental causes of group differences in IQ less plausible and therefore genetic causes less implausible.

Mean IQ and Skin Color in the New World

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The present study is an extension of the 2006 research of Templer and Arikawa who found a correlation of .92 between IQ and skin color in the 129 countries of Africa, Asia and Europe. In that study skin color was conceptualized as an index of the climates one's ancestors have lived in for thousands of years. The present research determined the relationship between skin color and IQ in 18 countries and districts in North America, South America, Australia, and the Pacific islands. Skin color ratings were performed by two university librarians using a world skin color map in an anthropological textbook. Skin color correlated .49 with IQ. The lower correlation in the "New World" was attributed to the fewer means per country so that there is less benefit from the principle of aggregation. Nevertheless, the negative congruent is congruent with the contention of Rushton and of Lynn that higher intelligence develops in colder climates.

It was observed that the "New World" IQs tended to be lower than the IQs of the "Old World" countries with the same skin color. The mean "Old World" IQs associated with various skin colors were computed.   The "New World" IQs estimated from Old World skin color were higher in 14 of the 18 comparisons. The mean IQs were 90.2 and 82.2. The lower New World mean IQs are consistent with the contention of Lynn that new mutant alleles for high intelligence are more likely to appear in larger populations.

The Comparison of Mean IQ in Muslim and Non-Muslim Countries

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The rationale for the present study is based on the unimpressive number of contemporary major scientific contributions in Muslim countries and on preliminary evidence that suggests Muslim countries tend to have lower IQs. The 44 predominantly Muslim countries had a mean IQ of 80.07 (SD = 8.75) and the 125 Non-Muslim countries 85.56 (SD = 11.78) using the Lynn and Vanhanen 2002 mean IQs. With the Lynn and Vanhanen 2006 IQs the Muslim countries had a mean of 80.23 (SD = 8.66) and the Non-Muslim countries a mean of 84.98 (SD = 12.71). With the exclusion of the predominantly Black countries the 2002 means were 84.6 (SD = 4.85) and 90.90 (SD = 8.50) respectively. The 2006 means were 84.81 (SD = 4.76) and 91.02 (SD = 8.60). The present findings were contrasted with the advanced state of science, mathematics, architecture and medicine in the Muslim empire from the 7th to the 12th century. The findings were also related to the work of Lynn and Vanhanen showing a positive relationship between IQ of nation and democratization. Although the 14 Arab countries vary greatly in per capita income, from 779 dollars to 25, 314 dollars, a positive relationship between IQ and per capita income was not found. This finding suggests that increase in national income does not invariably translate into a dramatic increase in IQ.

Neuropsychological Spectrum Structure in Traumatically Head Injured Persons

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The present study investigated the neuropsychological spectrum in traumatically head injured persons. In the conceptualization of this spectrum there is a continuum of functioning ranging from the biological foundations of behavior to acquired academic skills. There is a parallel series of tests from neurological to neuropsychological to intelligence to achievement. Previous research has found that tests on adjacent segments of the spectrum correlates more highly than tests on distal segments.

In the present research the median of intercorrelations was .72 for achievement tests, .35 for intelligence tests, and .09 for neuropsychological tests. It was inferred that brain injury alters the structure of the neuropsychological spectrum. It was suggested that there is greater brain equipotentiality as one moves from the neuropsychological to the achievement end of the spectrum. It was also suggested that, although adequate neurological and neuropsychological functioning are needed for the development of high level achievement types skills, once those skills have been acquired they possess partial autonomy. In order to rule out an alternative explanation, that is that neuropsychological tests don't correlate with each other in both normal and brain damaged persons, a study with normal participants was located. The median of 59 neuropsychological intercorrelations was .35, with only 4 under .10 and 14 less than .20.

In the Beginning There Was Synchronization: Genesis of a Neural Correlate of Processing Differences

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Neuroimaging studies have shown that neural activation patterns differ as a function of intelligence (IQ). However, these studies were conducted without controlling for the strategy used by the different IQ groups. We tested this hypothesis by recording electroencephalograms from 14 low (89<IQ<110) and 14 high (121<IQ<142) IQ individuals as they performed a sentence verification task, first with a linguistic and then an imagery strategy. Behavioral data showed that the strategies were used as instructed and higher IQ individuals tended to perform better. Analyses of the EEG rhythms in terms of instantaneous amplitude and power (event related desynchronization (ERD) in upper alpha (9.5-12.5Hz) band) showed that the use of different strategies evoked different activation patterns, but that these patterns did not differ between the two IQ groups, suggesting that care should be taken in attributing differences in neural processing to intelligence level. However an IQ-related correlate was found in ERD in the preparation interval. Thus, although processing patterns during task performance seem to depend more on the strategy used to perform the task than on IQ differences, preparation for task processing may depend on IQ.

The Centrality of Cognitive Control to Cognition

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Although factor analysis is the most commonly-used method for examining the structure of cognitive variable interrelations, multidimensional scaling (MDS) can provide visual representations of the continuous nature of interrelations among variables. Using data (N = 8,813) aggregated across 38 separate studies, MDS was applied to 16 cognitive variables representative of five well-established cognitive abilities. Consistent with past MDS applications, the results revealed a two-dimensional radex disk, with variables from reasoning tests located at the center. Measures of cognitive control (e.g., variables assessing simultaneous storage-plus-processing, and updating) were then projected onto the radex disk. These variables were found to be positioned near the center of the space, suggesting that the determinants of individual differences in cognitive control are likely to be common among many different types of cognition.

IQ and Variability in Isochronous Tapping Tasks Have Overlapping Neuroanatomical Correlates in the Brain's White Substance

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The mean and the variability of reaction time (RT) in a wide range of elementary cognitive tasks are negatively correlated with IQ (for a review see e.g. [1]). Recent studies including both choice RT tasks (Hick paradigm) and temporal discrimination/judgement tasks have reported that the latter tasks correlate better with intelligence than the RT measures, and that the portion of intelligence explained by the RT tasks predominantly represented variance also explained by the temporal tasks [2]. We have found [3] that IQ correlates with variability measures in a simple timing task, isochronous tapping. An important question prompted by these findings is whether timing variability and intelligence share neural underpinnings.

Here, we tested if variability in tapping and IQ have overlapping neuroanatomical correlates. Thirty-three healthy male Pts (age 19-49 ys, mean 33 ys) participated in the study. IQ was measured with the Raven SPM Plus (untimed). The tapping task consisted of a series of trials, where the Pt initally tapped in synchrony with an auditory metronome and then continued with self-paced tapping. Only the continuation phase was considered. Seven different durations were employed: 215, 300, 375, 469, 586, 733, and 916 (all in ms). The mean coefficient of variation (CV) of difference scores between successive interresponse intervals was used as a measure of variability, that minimizes influences of drift (gradual changes of rate). CV correlated $r = -0.41$ ($p = 0.01$) with Raven scores [3]. T1-weighted anatomical MR images were collected with a 1.5 T scanner (GE Medical Systems). The images were processed for voxel based morphometry (VBM) with the VBM-2 toolbox in the SPM-2 software package. Modulated grey matter (GM) and white matter (WM) VBM images, where the intensity of each voxel represents regional GM/WM volume, were regressed on psychological measures.

IQ and timing variability have overlapping neuroanatomical correlates in the frontal white matter. We propose that differences in the amount of frontal connections may be one neurobiological factor underlying differences in IQ as well as variability in temporal tasks.

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Age Differentiation/Integration and the Mutualism Model of General Intelligence

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In the mutualism model of general intelligence, the positive manifold is initially weak and becomes stronger during the development of the cognitive system. This seems to be in contradiction with the age differentiation effect, i.e., a decrease of the strength of the g-factor with increasing age. Age differentiation is originally proposed by Spearman in the form of the law of diminishing returns. Also Thurstone (based on sampling), Cattel (applying the idea of investment) and Detterman (using g as a constraint) propose theoretical models for age differentiation. We will discuss these models and show that they are based on metaphors that do not necessarily predict differentiation. Where they do predict differentiation, they also predict an initial phase of integration. Our second point concerns the empirical evidence for age differentiation. We will show that the results of the relevant studies (about 60 to 80 studies in the last century) are mixed in that they sometimes support differentiation, sometimes integration, sometimes both. We shortly discuss the methodological problems of these studies. Finally we relate the empirical results to the mutualism model.

Environmental Moderation of the Heritability of IQ in Adults

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The notion that cognitive ability is under genetic pressure is no longer in dispute: many behavior genetics studies have shown that additive genetic influences explain large parts of the observed variation in cognitive functioning in both children and adults (e.g., Bratko, 1996; Devlin et al., 1997; Rijsdijk et al., 2002; Posthuma et al., 2000). In these studies, it is assumed that heritability estimates are constant across the entire range of cognitive abilities, and equal for different subgroups. However, several studies suggest that in children, heritability of cognitive ability varies with, or is moderated by e.g. parental income (Harden & Turkheimer, 2007), parental socioeconomic status (SES, Turkheimer, Haley, Waldorn, D'Onofrio, & Gottesman, 2003), and parental educational level (Rowe, Jacobson, & van den Oord, 1999). These interactions between measured environmental variables and unmeasured (i.e. latent) genetic influences are not always replicated (e.g., Nagoshi & Johnson, 2005; van den Oord & Rowe, 1997), and neither is the 'direction' of the interaction consistent across studies. Also, these studies all concern moderation of heritability in children only, and include solely environmental moderators that were not under the control of the children under investigation (e.g., parental educational level and income).

In the present study, we investigated the effect of parental educational level (i.e., past environment) on the heritability of cognitive ability in *adult* males and females. In addition, we studied the moderation effect of environmental characteristics that are chiefly under the control of the participants themselves, and are informative of the participants present environment: partners' educational level, urbanization level and mean real estate price of the participants residential area (the latter two as rough indications of incentiveness of the present environment and current income). Data on IQ (Dutch WAIS-III) and these moderators were collected in over 700 Dutch monozygotic and dizygotic twins and their siblings. Our analyses, in which sex- and age-effects were controlled for, partly confirmed the moderating effect of parental educational level, but none of the other moderating effects proved significant.

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International Differences in Intelligence Symposium: Cultural Background, Home Country National Intelligence and Self-Employment Rates among Immigrants in Norway

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The level of self-employment varies significantly among immigrants from different countries of origin. The objective of this research is to examine the relationship between home-country national intelligence, national culture, and self-employment rates among first-generation immigrants in Norway. Empirical secondary data on self-employment among immigrants from 54 countries residing in Norway in 2004 was used. Data on home country national intelligence comes from Lynn and Vanhanen (2002) study. Five different hypotheses were developed and tested using hierarchical regression analysis. Immigrants' national intelligence was found to be significantly positively associated with self-employment. This result supports the idea that immigrants from countries with high national intelligence may learn language, new business procedures, and new methods of communication more effectively and, therefore, such immigrants are more likely to start a business compared to immigrants from countries with lower national intelligence.

The findings also suggest that immigrants from countries with low power distance are more likely to become self-employed. However, other dimensions of cultural attributes, such as the home-country's uncertainty avoidance, masculinity/femininity and individualism/collectivism were not significantly associated with immigrants' self-employment rate. The study concludes with practical implications and suggestions for future research.

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Spatial Ability for STEM and Visual Arts: Over Fifty Years of Cumulative Psychological Knowledge Highlights Its Longstanding Neglect and an Implementation Problem in Education

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The importance of spatial ability for educational pursuits and the world of work were examined with particular attention devoted to STEM (science, technology, engineering & mathematics) domains and the visual arts. A three-phase study was based on a stratified random sample of U.S high school students (grades 9 through 12, N = 400,000) tracked for 11+ years. The current findings and literature reviewed: 1. solidify the generalization that spatial ability plays a critical role in developing expertise in STEM and the visual arts, 2. suggest that spatial ability could add value to modern talent searches by identifying adolescents with potential for STEM and the creative arts that are currently being missed, 3. address a longstanding issue in the "softer" areas of psychology about developing more cumulative-knowledge (Cronbach, 1975; Meehl, 1978), and 4. highlight an implementation problem in education.

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Empirical Support for the Diffusion Model Account of the Worst Performance Rule

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The worst performance rule states that slower reaction times predict ability better than do the faster reaction times. The goal of this study was to explain this worst performance rule by means of the Ratcliff diffusion model. In a two-choice RT experiment with 44 high-school students, the worst performance rule was not found in the reaction time measures. However, a diffusion model analysis yielded more insight. The diffusion model analysis showed that high IQ participants have a higher drift-rate (i.e. faster stimulus-information extraction), have a lower boundary separation (i.e. less cautious when making a response), and, perhaps surprisingly, have a higher non-decision component (i.e. all non decision related time). When correcting for these differences in non-decision time evidence for the worst performance rule was found. A diffusion model analysis yields a detailed account of IQ-related differences that is considerably more informative than the traditional analysis.

Executive Functions, General Intelligence, Life History, Psychopathic Attitudes, and Deviant Behavior

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The PALE project is conducted in collaboration with a Federally-funded local program designed to help young people develop employment skills. We constructed an Executive Functions (E) Factor from the Behavior Rating Inventory of Executive Function-Adult version (BRIEF-A), the Dysexecutive Questionnaire (DEX), and the Executive Functions Questionnaire (EFQ). General Intelligence (g) was measured with the Shipley Institute of Living Scale, including the Verbal and Abstractions subtests. We also constructed a Life History (K) Factor, a Psychopathic Attitudes (P) Factor, and a Deviant Behavior (D) Factor. The Life History (K) Factor was measured using the Arizona Life History Battery, including measures of Long-term Thinking and Planning, Parental Investment (given and received), Nepotistic Investment (given and received), Long-Term Mating Investment (given and received), Reciprocal Altruism (given and received) towards Friends and Community, and Religiosity. The Psychopathic Attitudes (P-Factor) was composed of the Lilienfeld Psychopathy Scale, the Mating Effort Scale, and the Risk-Taking Questionnaire. The Deviant Behavior (D) Factor was composed D-20 Delinquency Short Form, the LEQ-R (adapted from Zuckerman), and the DAST measure of substance abuse.

Bivariate correlations indicated no statistically significant relationships between g and Life History (K), g and Psychopathic Attitudes (P), or g and Deviant Behavior (D). However, the Executive Functions (E) Factor was positively correlated with K (.31*) and negatively correlated with D (-.27*), but not with P (-.15). These preliminary data suggest that Executive Functions, rather than General Intelligence, may be a critical predictor of both Life History and Deviant Behavior.

The Executive Functions (E) E-Factor was also significantly and positively correlated with the Multidimensional Work Ethic Profile (.29*), the Mate Value Inventory (.40*), the SF-36 measure of general physical and psychological functioning (.37*), and Impulse Control (.42*). E was significantly negatively correlated with the Hopkins Symptoms Checklist (-.55*), the ADHD screener (-.54*), Impulsive Behavior (-.35*), and Jake's Temptations (-.23*). The K-Factor also had a nearly identical pattern of correlation with these measures as E, although the correlations were generally higher in absolute value except for the correlations with the Hopkins Symptoms Checklist, the ADHD screener, and Impulsive Behavior (which was not statistically significant). Finally, g was positively correlated with the SF-36 measure of general physical and psychological functioning (.27), providing some support for Fitness Indicator Theory, but at a marginal alpha of .0589; g was also significantly negatively correlated with Impulsive Behavior (-.32*), but this was at a more persuasive alpha of .0197.

Symposium: Measurement Invariance and Group Differences in Intelligence Test Scores - Overview

Organizer: Jelte M. Wicherts – University of Amsterdam

Understanding the precise nature of group differences in intelligence test scores requires that these groups can be reasonably compared in terms of the latent traits that the tests at hand are supposed to measure. In order for a comparison of group differences in latent traits to be meaningful, it should first be established that the relation between test scores and latent cognitive variables is identical across groups. Therefore, the issue of measurement invariance is essential to the understanding of group differences in intelligence test scores. The aim of this symposium is to discuss some recent issues in the study of group differences in intelligence test scores and measurement invariance using multi-group confirmatory factor analysis (or mean and covariance structure analyses).

In the first talk, Conor Dolan will discuss two ways of implementing g in confirmatory factor analysis. He shows that the choice between those two implementations could make quite a difference in the results of factorial between-group comparisons under measurement invariance. The second talk by Dylan Molenaar is concerned with the issue of statistical power in the study of group differences in intelligence test performance, specifically in the context of sex differences in g. In the third talk, Jelte Wicherts will argue that measurement invariance of intelligence tests with respect to minorities is not an established finding, as several authors have claimed. The symposium will end with a discussion initiated by Wendy Johnson.

Symposium: Measurement Invariance and Group Differences in Intelligence Test Scores

Measurement Bias in IQ Tests: Why the Case is Certainly Not Closed.

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Several authors have claimed that measurement bias in IQ tests with respect to ethnic minority groups is no longer cause for concern (Jensen, 1980, 1998; Rushton & Jensen, 2005; Lynn, 2006; Gottfredsson et al., 1997; Neisser et al., 1996; Hartigan & Wigdor, 1980; Hunter & Schmidt, 2000). In this talk I argue that, in light of recent psychometric developments, there still remains a lot of work to be done before the issue of measurement bias can be dismissed as irrelevant. The prime reason is that empirical claims of a general lack of measurement bias, such as those by Jensen (1980), were mostly based on what are now outdated methods. For instance, Jensen (1980) did not consider measurement invariance in the common factor model. Strict factorial invariance is essential for measurement invariance, but it is rarely tested thoroughly and often fails in cross-ethnic comparisons. Furthermore, Jensen (1980) and others (Hunter & Schmidt, 2000) drew heavily on differential prediction analyses in which criteria such as job performance are regressed on test scores in order to verify whether the regression equation is identical across demographic groups. Such analyses have shown that IQ tests generally do not underpredict the job performance of ethnic minority groups. However, Millsap (1997) has shown that predictive invariance and measurement invariance are generally incompatible. One crucial implication of the distinction between measurement invariance and predictive invariance will be discussed here. Specifically, using a simple one-factor model, I show that differential prediction analyses can give rise to the false impression that a biased test is not biased. Under some generally accepted assumptions, the finding of no predictive bias actually suggests that the test at hand is biased with respect to low-scoring groups. I discuss the implications and call for more research.

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