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Thursday December 5, 2002	Friday December 6, 2002	Saturday December 7, 2002
8:30-9:00 (33) McRorie & Cooper Synaptic Transmission Correlates	**8:30-9:00 (34)** Mingroni Test of Heterosis Hypothesis	**8:30-9:00 (15)** DePryck Evolution of Intelligence
9:00-930 (32) McDaniel & Nguyen Meta-analysis of MRI Brain Vol.	**9:00-930 (13)** Condon & Schroeder Is the Flynn Effect Slowing Down	**9:00-930 (28)** Lopes Construct Validity of DAS
9:30-10:00 (21) Haier Entorhinal Cortex Hyper-metab.	**9:30-10:00 (42)** Rodgers and Gissberg Flynn Effect and NLSY Data	**9:30-10:00 (20)** Gregg Intelligence and Learning Disab.
10:00-10:30 (41) Rae, Digey, McEwan, & Bates Creatine Improves Brain Perf.	**10:00-10:30 (25)** Hunt Dykens and Flynn Model	**10:00-10:30 (10)** Beaudecel, Brocke, & Liepmann Fluid and Crystallized Intelligence
10:30-1045 Break	**10:30-1045 Break**	**10:30-1045 Break**
10:45-11:15 (27) Johnson, Bouchard, McGue, Krueger, & Gottesman *g* Factors from three Batteries	**10:45-11:15 (22)** Haier Is *g* Only in the Frontal Lobe?	**10:45-11:15 (44)** Skuy, Frijon, & Rushton African and non-African Students
11:15-11:45 (26) Jackson Evaluating *g* in the SAT	**11:15-11:45 (18)** Galley *g* and Looking Behavior	**11:15-11:45 (16)** Fagan & Holland Equal Opportunity and Race
11:45-12:15 (30) Luo, Thompson, & Detterman Between and Within-Age *g* variab.	**11:45-12:15 (29)** Luo, Thompson, & Detterman Basic Ingredients of *g*	**11:45-12:15 (31)** McBride Argument for Sex Differences
12:15 – 1:30 Lunch	**12:15 – 1:30 Lunch**	**12:15 – 1:30 Lunch**
1:30-2:30 – Invited Address Sternberg Successful Intelligence	**1:30-2:30 – Invited Address** Jensen Mental Chronometry	**1:30-2:30 – Invited Address** Bouchard Increase in Heritability with Age
2:30–3:00 (23) Hanus & Fagan Motivation, IQ, & Achievement	**2:30–3:00 (17)** Frey & Detterman Task Complexity and Stim. Disc	**2:30–3:00 (36)** Gottfredson *g*, Jobs, and Life
3:00-3:30 (11) Bleske-Rechek, Lubinski, Benbow Advanced Placement of Talented	**3:00-3:30 (19)** Gilmore Symbol-Digit Substitution	**3:00-3:30 (37)** Nyborg IQ and *g*: Sex differences
3:30-3:45 – Break	**3:30-3:45 – Break**	**3:30-3:45 – Break**
3:45-4:15 (24) Hendrix Resilience in High Risk Adults	**3:45-4:15 (43)** Deary, Bell, Bell, Campbell, Fazal Sensory Discrimination and Intell.	**3:45-4:15 (38)** Jensen (Rushton) Jensen film clip
4:15-4:45 (45) Webb, Lubinski, & Benbow Math-Science Aspirations	**4:15-4:45 (9)** Ruthsatz, Hanus, & Tiu What is Musical Intelligence?	**4:15-4:45 (39)** Rushton Black-White Differences
4:45-5:15 (12) Brody Does Education Influence Intell.	**4:45-5:15 (15)** Bates Auditory Inspection Time	**4:45-5:15 (40)** Miele Jensenism and Skepticism
NOTE: Numbers in () indicate page number of abstract.	**5:15-6:30 – Julian Stanley** Interviewed by Camilla Benbow	
	6:30-7:00 Reception in Lobby	
	7:00-8:00 Dinner in Atrium	

International Society for Intelligence Research (ISIR) Program 2002

(Numbers in parentheses refer to page of abstract)

Thursday, December 5, 2002

Paper Session (8:30-10:30) Biological Processes
Chair: Stough

8:30-9:00 McRorie and Cooper (33)
Synaptic transmission correlates of general mental ability.

9:00-9:30 McDaniel and Nguyen (32)
A meta-analysis of the relationship between MRI-assessed brain volume and intelligence.

9:30-10:00 Haeir (21)
Entorhinal cortex hyper-metabolism in non-demented adulstw with Down Syndrome.

10:00-10:30 Rae, Digney, McEwan, & Bates (41)
Oral creatine monohydrate supplementation improves brain performance: a double-blind, placebo-controlled, cross-over trial.

10:30-10:45 **Break**

Paper Session (10:45-12:15) General Intelligence I
Chair: Fagan

10:45-11:15 Johnson, Bouchard, McGue, Krueger, and Gottesman (27)
Correlations of *g* factors from three mental test batteries.

11:15-11:45 Jackson (26)
Evaluating *g* in the SAT: Inplications for the sex differences and interpretations of verbal and quantitative aptitude.

11:45-12:15 Luo, Thompson, and Detterman (30)
The principle governing the between-age and within-age *g* variability.

12:15-1:30 **Lunch**

Invited Address
Chair: Deary

1:30-2:30 Robert J. Sternberg
Converging operations in the construct validation of the theory of successful intelligence.

Paper Session (2:30-5:15) IQ, Achievement, and Education
Chair: Lubinski

2:30-3:00 Hanus and Fagan (23)
The effect of motivation and intelligence on achievement.

3:00-3:30 Bleske-Rechek, Lubinski, and Benbow (11)
Importance of advanced placement: Intellectually talented individuals report on their high school experiences.

3:30-3:45 **Break**

3:45-4:15 Hendrix (24)
Childhood intelligence and behavior problems: Predictors of resilience in high-risk young adults.

4:15-4:45 Webb, Lubinski, and Benbow (45)
Mathematically facile adolescents with math-science aspirations: New perspectives on their educational and vocational development.

4:45-5:15 Brody (12)
Does education influence intelligence?

Friday, December 6, 2002

Paper Sesion (8:30-10:30) The Flynn Effect
Chair: Brody

8:30-9:00 Mingroni (34)
A test of the heterosis hypothesis.

9:00-9:30 Condon and Schroeder (13)
Is the Flynn effect slowing down? An examination of recent data for *g* and specific abilities.

9:30-10:00 Rodgers and Gissberg (42)
Identification of a Flynn effect in the National Longitudinal Survey of Youth (NLSY) data.

10:00-10:30 Hunt (25)
Modeling environmental and genetic influence on intelligence test scores: Corrections and identifiability issues in Dykens and Flynn model of cohort effects.

10:30-10:45 **Break**

Paper Session (10:45-12:15) General Intelligence II
Chair: Gottfredson

10:45-11:00 Haier (22)
Is *g* only in the frontal lobe?

11:15-11:45 Galley (18)
g-loading as a tool for searching basic processes in a looking behavior task.

11:45-12:15 Luo, Thompson, and Detterman (29)
The basic ingredients of g: Proecessing speed, working memory, and long-term memory.

12:15-1:30 **Lunch**

Invited Address
Chair: Nyborg

1:30-2:30 Arthur R. Jensen
The crucial importance of mental chronometry for the science of mental abilities.

Paper Session (2:30-5:15) Cognitive Processes and Intelligence
Chair: Haier

2:30-3:00 Frey and Detterman (17)
Task complexity in stimulus discrimination.

3:00-3:30 Gilmore (19)
Symbol-digit substitution test: Componential analysis and age effects.

3:30-3:45 **Break**

3:45-4:15 Deary, Bell, Bell, Campbell, and Fazal (14)
Sensory discrimination and intelligence: Testing Spearman's other hypothesis a century after *g*.

4:15-4:45 Ruthsatz, Hanus, and Tiu (43)
What is musical intelligence?

4:45-5:15 Bates (9)
Auditory inspection time: New doubt on attention and masking theories of *g*.

Special Event (5:15-6:30) A Conversation with Julian Stanley
Chair: Benbow

5:15-6:30 Camilla Benbow will interview Julian Stanley about his career.

6:30-7:00 **Reception in lobby of Wyatt Hall.**

7:00-8:00 **Dinner in Atrium**

Saturday, December 7, 2002

Paper Session (8:30-10:30) Psychometric and Evolutionary Conceptions of Intelligence

Chair: Luo

8:30-9:00 DePryck (15)
Non-linear aspects of the evolution of intelligence.

9:00-9:30 Lopes (28)
The construct validity of the Differential Ability Scales (DAS) – Special Nonverbal Composite.

9:30-10:00 Gregg (20)
Intelligence measures and implications for the assessment of learning disabilities at the postsecondary level.

10:00-10:30 Beaudecel, Brocke, and Liepmann (10)
A faceted conceptualization of fluid and crystallized intelligence.

10:30-10:45 **Break**

Paper Session (10:45-12:15) Group Differences

Chair: Gilmore

10:45-11:15 Skuy, Fridjon and Rushton (44)
Background variables related to IQ test scores and university grades of first year African and non-African engineering students in South Africa.

11:15-11:45 Fagan and Holland(16)
Equal opportunity and racial differences in IQ: Evidence from tests of comprehension.

11:45-12:15 McBride (31)
A rational and empirical argument that the sexes differ (and must have differed) in intelligence (as they do in brain size).

12:15-1:30 **Lunch**

Invited Address

Chair: Lubinski

1:30-2:30 Thomas Bouchard, Jr.
The increase in heritability with age: Real of imagined?

Symposium in Honor of Arthur Jensen (2:30-5:15)
Chair and Organizer: Helmuth Nyborg

2:30-3:00 Gottfredson (36)
g, jobs, and life.

3:00-3:30 Nyborg (37)
IQ and *g*: The art of uncovering sex differences in general intelligence.

3:30-3:45 **Break**

3:45-4:15 Jensen (Rushton) (38)
How much can we boost IQ and scholastic achievement? (This is a film presentation of a debate held in 1969 at Berkley concerning the Jensen *Harvard Educational Review* (1969, 39, 1-123) article.

4:15-4:45 Rushton (39)
Thirty years of research on Black-White differences in cognitive ability.

4:45-5:15 Miele (40)
Jensenism and skepticism: Arthur Jensen as "icebreaker".

Auditory Inspection Time: New Doubt on Attention and Masking Theories of g

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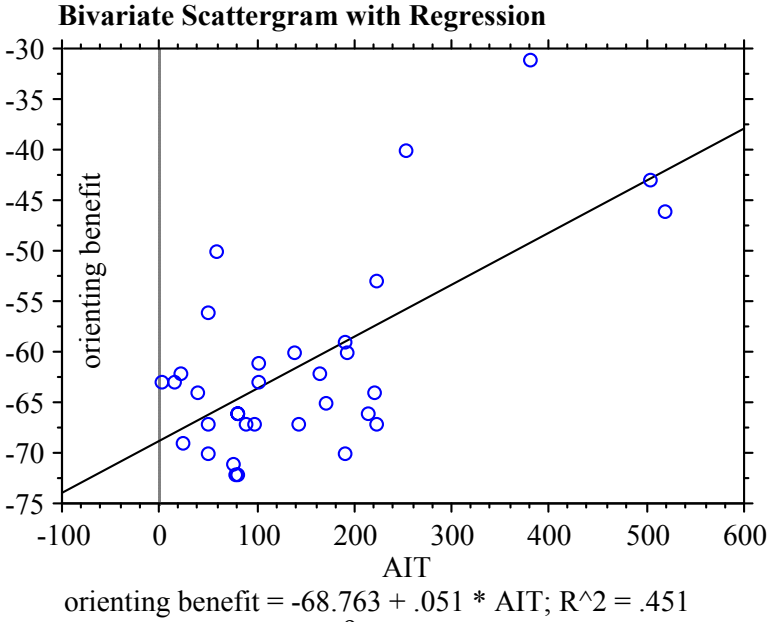
Data are presented from a series of experiments using a modified version of the auditory localization task reported by Parker, Crawford & Stephen, (1999). In two initial experiments, data are presented replicating the correlations of this auditory-location task with Raven's and with GF from the WCJ III. Additional experiments are presented briefly in which improvements are made to the task reducing click artifacts, improving adaptive testing efficiency, and contrasting pitch and volume localization cues. Next, the AIT is used to examine a prediction of the Planning, Attention, Simultaneous and Successive (PASS: Das, 2002) theory of ability derived from Luria's (1966) work. Das distinguishes between several functions including (with an example test in brackets): planning and monitoring (marking conceptually similar items from a list); vigilance, arousal, and distraction (ie., marking physically identical items in a long list), and simultaneous (spatial) and successive (usually auditory) processing (i.e., pointing to a square above a triangle). This model maps very neatly onto the well regarded theory of attention proposed by Posner, making it eminently testable. Posner distinguished three main attentional network subsystems: Alerting (brain stem-reticular function); Shifting attention (centered on the parietal lobes) and executive tasks (dependent on frontal systems). Posner's visually-presented "Attentional Network Task" was used to measure each of these functions. Contrary to Das's predictions from PASS theory that speed-tasks like inspection time should be modality specific and, should not tap performance across a range of domains (i.e., should not behave in a *g*-like manner) the auditory IT task correlated with both frontal executive performance (see figure) and equally well with the parietally-based shifting function (but not with RT gains in the brainstem-reticular system dependent Alerting task.



A Faceted Conceptualization of Fluid and Crystallized Intelligence

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It is argued that the regular use of figural reasoning tasks for the assessment of fluid intelligence (gf) leads to a contamination with figural reasoning. On the other hand crystallized intelligence (gc) is often assessed through vocabulary tests or other verbal tests which may in turn lead to a contamination with verbal intelligence. The original concept of gf and gc is primarily related to the different degree of acculturation reflected by the tasks and not to the difference between verbal and figural intelligence. In order to conceive gf and gc more independently from the figural and verbal content of the tasks a faceted conceptualization was proposed in which both gf and gc are measured by verbal, numerical, and figural tasks. Then, the content of the tasks is balanced out by means of aggregation. In order to test the intended structure, verbal, numerical, and figural reasoning tasks as well as verbal, numerical, and figural knowledge scales were administered to 661 participants (55% females). The faceted structure with verbal, numerical, and figural intelligence in one facet as well as gf and gc in the other facet could be demonstrated through confirmatory factor analysis and through multidimensional scaling. Theoretical and practical implications of these new operationalisations of gf and gc are discussed.

Importance of Advanced Placement: Intellectually Talented Individuals Report on Their High School Experiences

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The Advanced Placement (AP) program has recently received criticism. The College Board (2001) has expressed unease over a shortage of teachers qualified to teach AP courses; a committee of the National Research Council (NRC, 2002) has voiced concern that AP courses are currently taught with more emphasis on breadth of coverage than on depth of understanding; and educational policy makers (reported in Brice, 2002 & Golden, 2002) have acted on concerns that unequal access to AP courses give some students an unfair advantage when applying to selective colleges. Notwithstanding these criticisms and calls for change, high school students who succeed in AP courses are well prepared to master advanced undergraduate coursework (Breland & Oltman, 2001; Burnham & Hewitt, 1971). The objective of the current study is to evaluate the AP program from the perspective of intellectually precocious youth by examining a) their rates of involvement in AP courses, b) their views of AP courses, and c) their feelings about their high school experiences as a function of AP program availability and involvement.

We analyzed data spanning 3 decades and 5 cohorts (over 2,300 males and 1,400 females, all of whom were in the top 1% of intellectual ability). With the exception of Cohort 1, for whom AP courses were not yet widely available, over 75% of participants across cohorts took AP courses in high school. Among 601 men and 416 women with relevant data, 22-49% of participants who took an AP course in high school also nominated it as a favorite high school course. In an analysis of participants' open-ended reports of what they liked most and least in high school, we examined the responses of participants who did not have AP courses available at their high schools, and the responses of those who did. We also examined the responses of participants who took AP courses, and the responses of those who did not. Across time and context, gifted individuals viewed intellectual challenge in high school as rewarding and the lack of intellectual challenge as distressing. AP courses appear to be the best large-scale option currently available for challenging intellectually talented youth. The AP program has the added advantage of keeping talented youth with their same-age peers. It is important that future modifications to the AP program take into account its empirically documented utility for facilitating the positive development of intellectually precocious youth.

Does Education Influence Intelligence?

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Research on the influence of education on intelligence is critically reviewed. Among the studies to be considered are those that consider the influence of variations in educational tracking and curriculum on intelligence – eg. Swedish studies of variations in secondary school curriculum choice; studies of educational interventions – eg the Abecedarian Project; and studies of educational deprivation – eg DeGroot's research on the effects of educational disruptions associated with World War II in the Netherlands.

The studies are reviewed with an attempt to discover if they provide convincing evidence of enduring changes in intelligence. The studies, considered collectively, fail to provide evidence of substantial changes in intelligence that either increase or remain invariant for long periods of time. The influence of variations in education on intelligence is contrasted with the influence of variables that are present prior to the start of formal education such as parental IQ, infant information processing, and genetic influences. It is concluded that the influence of variables that are operative prior to the start of education on intelligence is stronger than the influence of education on intelligence.

Is the Flynn Effect Slowing Down? An Examination of Recent Data for *g* and Specific Abilities

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In 1984 Flynn reported striking increases in performance on intelligence tests in the twentieth century, a phenomenon that has come to be known as the Flynn Effect. The gains have been on the order of 1.3 standard deviations (*SD*s) per generation (30 years) on Raven's Matrices and about half as much on the Wechsler scales (Flynn, 1998). The research we will present here had two major objectives: First, we sought to examine the Flynn Effect from the late 1980s to the present, a period that has received little attention to date. Second, we wanted to discern whether increases in general intelligence (*g*) were paralleled by increases in specific abilities, including verbal comprehension. This research was conducted at the Johnson O'Connor Research Foundation, which studies and tests aptitudes, on 102,452 adolescent and adult examinees over a wide age range from 1986 to 2001. Thirteen tests were included in the analyses, which covered abilities such as reasoning, spatial, memory, and verbal comprehension. Our results indicate that *g* has increased a little more than one-tenth of a *SD* over the 15-year span (about .01 *SD*s per year), which is substantially smaller than the increase for *g*-type measures reported by Flynn (1984). The specific abilities increased at approximately the same rate as *g*, except for verbal comprehension, which decreased at about the same rate that the other tests increased. Teasdale and Owen (2000) found a similar slowing of gains in *g*-related measures in data collected in Denmark. They found that the continued gains have been largely among those scoring in the lower end of the distribution, but we did not find this in our data. Finally, we divided our samples for 1986, 1991, 1996, and 2001 into five-year cohorts based on birthdates. When we compared examinees of the same age from different birth cohorts, we found the same modest upward trend that we found earlier for the overall samples. In summary, like Teasdale and Owen, we found that the Flynn Effect appears to have slowed down substantially, although further investigation with other samples and measures would be valuable.

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Sensory Discrimination and Intelligence: Testing Spearman's Other Hypothesis a Century After *g*

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At the centenary of Spearman's seminal 1904 paper, his "General Intelligence" hypothesis remains one of the most influential in psychology. Less well known is the 1904 paper's other hypothesis that there is "a correspondence between what may provisionally be called 'General Discrimination' and 'General Intelligence' which works out with great approximation to *one or absoluteness*" (Spearman, 1904, p. 284, italics in original). Studies that fail to find high correlations between psychometric intelligence and single sensory discrimination tests do not falsify this other hypothesis. The present study is the first directly to address Spearman's general intelligence-general sensory discrimination hypothesis. It attempts to replicate his findings with a similar sample of 11-12 year-old schoolchildren ($N = 60$). In a well-fitting structural equation model of the data, general intelligence and general discrimination correlated .92. In a re-analysis of data published by Acton and Schroeder (2001), general intelligence and general sensory ability correlated .68 in men ($N = 432$) and women ($N = 409$). One hundred years following its conception, Spearman's other hypothesis thus achieves some confirmation. The association between intelligence and general sensory ability still requires replicating and explaining. It is unclear, for example, whether the common variance is due to high-level task demands or shared lower-level processing.

Non-linear Aspects of the Evolution of Intelligence

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Human cognition is neither static nor deterministic. Under evolutionary pressure it has evolved into a set of tools (cognitive modules and clusters of cognitive modules) capable of interacting with those aspects of reality that enhance our potential for survival. Although not yet exhaustively known in this context, the generic dynamics of these processes are rather well established.

Cognitive modules and clusters of such modules interact with proper input (the input underlying the evolutionary development) as well as actual input domains. As human beings, we generate huge amounts of actual but improper input. Our hearing has not evolved to handle rap music or ex cathedra courses, our vision not for looking at Picasso paintings. Nevertheless, we do and we seem to take great pleasure in it.

In this talk, I present an onset to an evolutionary model of cognition in general and intelligence more specifically that takes the non-linear effects of the feedback loops of human-generated output as improper input into account.

This (onset to a) model presents a complex (multi-dimensional) topology of intelligence, sensitive to initial conditions and prone to catastrophe (cfr. R.Thom) – a situation whereby large (qualitative) changes result from small, apparently continuous quantitative changes involving one or more variables controlling the system.

I argue, in general, that the non-linear aspects of intelligence contribute to explaining
a) why cultural (improper) input is so important in maximizing the cognitive potential of humans
b) the evolutionary dimension of some specific learning difficulties in terms of topographical aspects of the distribution of intelligence in terms of the effect of improper input (eg. text) in specific cognitive modules.

However, given the time restraints of the presentation, I will focus on the non-linear evolutionary aspects of the interaction between dyslexia, intelligence, and problem-solving style

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Equal Opportunity and Racial Differences in IQ: Evidence from Tests of Comprehension

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and Cynthia R. Holland
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In previous experiments, we found that differences in knowledge between Blacks and Whites for items tested on an intelligence test (the meanings of words) are eliminated if equal opportunity for exposure to the information is experimentally assured. In the two studies reported here, we tested Blacks and Whites for their comprehension of the meanings of sayings. Comprehension of some sayings was assumed to be based on generally available information (e.g. "An apple a day keeps the doctor away" as meaning "Eating good food helps you to stay healthy"). Comprehension of the meanings of other sayings required past exposure to specific information (e.g. "Home of the bean and the cod" as meaning "Boston"). The results of both experiments were consistent. When exposure to specific information was required, Whites knew more about the meanings of sayings than did Blacks. But, when comprehension was based on generally available information, Whites and Blacks did not differ.

Some participants were also given standard intelligence test items based on knowledge of vocabulary, spatial relations, and how items in a matrix should progress. Performance on these tests yielded a *g,* or "general factor" score. Our aim was to see if comprehension of sayings based on generally available knowledge (comprehension not differing by race) was, nonetheless, related to *g*. Indeed, such was the case, with $r = .50$, df, 93, $p < .0001$. In a further analysis, knowledge for sayings based on general information and knowledge for sayings based on exposure to specific information along with performance on the vocabulary, spatial knowledge, and solution of matrices tasks were entered into a factor analysis. Again, *g*, was computed. The test most highly loaded on *g* (at .77) was the comprehension of sayings based on general knowledge, the task on which Blacks and Whites did not differ.

In agreement with our past work on vocabulary knowledge, *test bias* based on comprehension was also evident. Specifically, Blacks and Whites, matched as to comprehension of sayings requiring specific knowledge differed in their comprehension of the meanings of sayings for which information was generally available. The Blacks were superior to the Whites. Finally, also in agreement with our past studies, the present results provide no support for the assumption that group differences in IQ have the same bases, in the same ratio, that underlie individual differences within a racial group (the *default hypothesis)*. Specifically, in the present study, individuals within each racial group who differed in their comprehension of sayings requiring specific information also differed in their comprehension of sayings based on general knowledge.

In general, the present results add further support to the view that the search for the causes of racial differences in IQ should be aimed at differences in information to which people in different racial groups are exposed.

Task Complexity in Stimulus Discrimination

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For years, it has been asserted that changes in correlations with *g* correspond to changes in task complexity. In order to test this, a single elementary cognitive task, stimulus discrimination (SD), was systematically varied on complexity. The subjects were presented with arrays of varying size from which they had to choose a match to a probe stimulus. Arrays ranged in size from 2 to 12 stimuli. Subjects were also tested on simple and choice reaction time (RT). SAT scores were collected as a reasonable measure of general cognitive ability. SAT by SD task correlations did not vary systematically with complexity, although decision times for SD did increase systematically with number of stimuli. RT by SAT correlations also did not vary systematically over number of choices. Finally, a principal axis factor analysis of all SD and RT tasks (with Varimax rotation) revealed 2 factors. SD loaded primarily on the first factor (.766 to .929) while RT loaded primarily on the second factor (.757 to .899), suggesting that changes in correlations previously demonstrated are most likely due to changes in the processes underlying the tasks, not in changes in task complexity.

g-Loading as a Tool for Searching Basic Processes in a Looking Behavior Task

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'Probably the best we can do in purely psychological terms is to say that *g* reflects the speed and efficiency of information processing' wrote Jensen (2002, p.153. If 'efficiency' taps on a more general dimension of behavior regulation than it would require some 'inhibition of irrelevant behavior'. 'Inhibition' as a psychological concept experiences a renewed interest in cognitive and developmental psychology (Harnishfeger 1995; Dempster and Corkill 1999), and 'inhibition' seems to have neuropsychological correlates in the prefrontal executive system (Van der Molen 2000, Stuss, Shallice et al. 1995). The prefrontal areas in the brain are found heavily involved in 'intelligent' behavior as to be seen in neuroimaging pictures (Duncan, Seitz et al. 2000). In our lab we had accumulated experiences with a saccadic tracking task ('the jumping point'), several parameters of which showed correlations to the IQ, as we had reported previously (Galley and Galley 1999) and in the last two conferences of ISIR. But in the past we had looked for the pooled responses in this task neglecting the changes which regularly can be seen over the increasing frequency of the stimulus. Regarding these changes there are several indicators of inhibition of some behavioral categories by different ones. Reactive responses are regularly replaced by anticipatoric ones showing some competition, which implicates reciprocal inhibition of supposed different cortical centers of reflexive vs. anticipatoric saccades in the parietal vs. frontal cortex. Therefore we made a in depth analysis of the saccadic tracking task behavior ('the jumping point') of 325 subjects, which additionally had taken an intelligence test (HAWIE, the German Wechsler test). The apparent simple tracking task showed in further analysis that there are three modes of response behavior, represented by anticipatoric or reactive normal or reactive express response saccades which are defined by their latency to the stimulus. Over the increasing stimulus frequency anticipatoric and express behavior seemed to win the competition over the reactive mode. Correlations to the g-factor showed a negative sign for anticipation at low stimulus frequency but a positive one at higher frequency, which can be interpreted that inhibition of the anticipatoric behavior at the beginning of this task is the more efficient strategy adopted by the more intelligent person. There are to be shown several other relations between the parameters which seems to demand for the effectiveness of some inhibition and all these theoretically inhibitory relations are accompanied by increasing values of the g-factor correlations. It is concluded that indicators of inhibition are good candidates in search for the basic processes in the nervous system which makes behavior more or less intelligent.

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Galley, N. and L. Galley (1999). Saccadic latency and fixation durations as indicators of mental speed. Personality Psychology in Europe. I. Mervielde, I. Deary, F. De Fruyt and F. Ostendorf, Tilburg University Press**:** 221-234.

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Symbol-Digit Substitution Test: Componential Analysis and Age Effects

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Coding tasks have a long history in psychology because of their simplicity of administration and their sensitivity to individual differences related to complex cognitive performance. Despite their widespread use there is not agreement on what coding tests measure. The present study approached this question by applying a method of componential analysis introduced by Royer (1971). Symbols were altered on 20 symbol-digit substitution forms to permit the independent evaluation of three information processing components: feature encoding, memory, and visual search. A test-retest paradigm demonstrated that the symbol manipulation reliably influenced performance in each of the information processing domains. A subsequent tachistoscopic, visual search experiment demonstrated the validity of the characterization of participants as good or poor searchers on the basis of their symbol-digit performance.

A third experiment examined the sensory deficit hypothesis of age changes in coding tasks. The spatial contrast sensitivity deficit of older adults was simulated on multiple symbol-digit substitution forms by applying a digital adaptive filter. The young adults in the age-simulated contrast condition performed worse than the young adults in the normal contrast condition. The pattern of results matched the age effects reported in previous studies. Specifically, the age-related reduction in spatial contrast sensitivity appeared to affect the speed of visual search.

The study illustrates the utility of creating a multi-form coding test for evaluating individual differences in feature encoding, memory, and visual search capabilities. It also offers direct support for the hypothesis that sensory deficits affect performance on intelligence tasks, such as digit-symbol substitution. December 6 or 7

Intelligence Measures and Implications for the Assessment of Learning Disabilities at the Postsecondary Level

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The atmosphere today in higher education is extremely litigious, particularly regarding issues of accommodating students with documented learning disabilities. Recent court cases illustrate the nature of disagreements among professionals, across and within disciplines, as to what should define a functional limitation, the appropriate eligibility model, and the technical adequacy of specific psychometric instruments for the postsecondary population. Yet it is clear that universities can require that the documentation to support requested accommodations for learning disabilities be current and comprehensive. Intelligence measures remain a significant component of the majority of eligibility models, and therefore decision-making, for determining who is qualified to receive accommodations due to learning disabilities at the postsecondary level. Professionals must be careful that the inferences they draw from intelligence scores are defensible, specifically for the postsecondary population with learning disabilities.

The purpose of this study was twofold: (a) to investigate the construct validity of the three most commonly used intelligence measures with college students with and without learning disabilities (i.e., Wechsler Adult Intelligence Scale-III (WAIS-III), Wechsler,1997; Kaufman Adolescent and Adult Intelligence Test (KAIT), Kaufman & Kaufman,1993;and Woodcock-Johnson Battery, Third Edition (WJ III)Woodcock, McGrew & Mather, 2001; and (b) to investigate the relationship between the WJ III Cognitive Clusters and the WAIS-III Index scales. A total of 101 college students with documented learning disabilities and 100 college students without disabilities participated in the study. All the participants participated in a rigorous psychological assessment to determine their status in either group (disabled/nondisabled).

The results of the study provide strong evidence of construct validity for the WJ III General Intellectual Ability composite score for students with and without disabilities. Interestingly, differences were found between and within the groups across all the intellectual measures investigated. Findings provide evidence that the students with learning disabilities were processing information across the cognitive measures quite differently than their nondisabled peers. Specific implications for assessment and accommodations are discussed.

Entorhinal Cortex Hyper-metabolism in Non-Demented Adults with Down Syndrome

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Previous functional imaging research has indicated that people with mild mental retardation and people with Down syndrome (DS) have increased cortical brain activity, consistent with a hypothesis of brain inefficiency as a correlate of low intelligence. Adults with DS also are at increased risk for dementia, when assessed independently from low IQ, and therefore provide an opportunity to identify patterns of brain activity which may precede dementia. Comparing the patterns in DS to those in Alzheimer's disease (AD) may help determine if the origin and sequence of brain changes are the same in both conditions. We compared regional cerebral glucose metabolic rate (GMR) among middle-aged, non-demented people with DS (N=19), people with moderate AD, and appropriate age-matched controls using positron emission tomography (PET) while subjects performed a cognitive task. Using SPM conjunction analyses, results showed (1) that both the DS and the AD groups had lower GMR than their respective controls primarily in posterior cingulate and (2) that the DS had *higher* GMR in the same areas of entorhinal cortex where the AD group had lower GMR. These results suggest that the dementia found in DS and AD may have different neuro-pathologies in their earliest stages involving entorhinal areas. These findings also may have implications for understanding the relationship between intelligence and dementia.

Is "g" Only in the Frontal Lobe?

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Brain imaging can help identify the functional neuroanatomy of general intelligence (i.e. *"g"*) and indicate how brain areas salient to *g* relate to information processing. Although some functional brain imaging studies suggest that *g* is primarily related to frontal lobe activity, other studies show a more complex story. An important question is whether individual differences in *g* among subjects are related to brain function even when non-reasoning tasks are studied. If so, this would imply that individuals with high *g* scores may process information differently even when no reasoning or problem solving is required. To further investigate this, we administered the Raven's Advanced Progressive Matrices (RAPM) test, a strong correlate of g, to 22 normal subjects and then measured glucose metabolic activity with PET while the subjects viewed videos, a task with no inherent reasoning or problem solving. Individual RAPM scores were correlated with regional brain activity using statistical parametric mapping (SPM99). RAPM scores correlated ($p = 0.02$, corrected for multiple comparisons) with activity in the left temporal/occipital association cortex (BA37/19) and with other temporal/occipital cortical areas ($p<.001$, uncorrected). Subsequent exploratory analyses of the interaction between high and low RAPM scorers and intra-brain correlations with the left BA37/19 cluster, revealed high RAPM scorers had a stronger correlation between left BA37/19 activity and the left anterior cingulate/medial frontal gyrus ($p < 0.001$, uncorrected). These data provide evidence that individual differences in intelligence correlate to brain function even when the brain is engaged in non-reasoning tasks and suggest that areas other than those in the frontal cortex may play an important role in understanding the neuroanatomy of *g*.

The Effect of Motivation and Intelligence on Achievement

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In the present study, we explored the contributions of motivation and intelligence to the prediction of individual differences in achievement. Participants included 87 students enrolled in an undergraduate psychology course. Study 1 included 43 participants enrolled in the spring semester. Study 2 included 44 students that were enrolled in the same course, with the same instructor, the following fall semester. For all participants, English was their native language. The students took three exams, completed a motivation survey, and three IQ measures. Participant's scores for three exams in the undergraduate psychology course were used as the achievement measure. The participants in both Study 1 and Study 2 took the same exams. Exams were multiple choice tests based 40% on the readings and 60%on the class lectures. Exams were not cumulative. The exams were taken at successive thirds of the course and students were made aware of the test grades after each test. The motivation survey was a 38 question measure of motivation for academic success derived from four surveys: the Work and Family Orientation Scale, Spence and Helmreich (1983); the Motivated Strategies for Learning Questionnaire, Pintrich et al (1991); the Achievement Goal Questionnaire, Elliot and Church (1997); the Motive to Avoid Failure Scale, Hagvet and Benson (1997). In Study 1, the motivation survey was given after the third exam. In Study 2, the motivation survey was given on the first day of class. Participants completed three measures of IQ: the Peabody Picture Vocabulary Test; Raven's Matrices; and a Spatial Ability Test. An overall general factor score (unrotated) was derived from the three IQ measures. In both studies, in accordance with the general literature, IQ was correlated with achievement. In Study 1, the correlation between IQ and achievement was .362, $p<.02$. In Study 2, the correlation between IQ and achievement was .327, $p<.03$. The relation between motivation and IQ was not clear cut. In Study 1, when motivation was measured at the end of the course, academic motivation was correlated with IQ .320, $p<.04$ sig. However, in Study 2, IQ was not significantly correlated with motivation. In Study 1, academic motivation was highly correlated with achievement at $r= .473$, $p<.001$. And a regression analysis indicated that motivation significantly predicted achievement ($t=2.80$, $p<.01$) independent of IQ. However, in Study 2, when motivation was measured prior to any knowledge of the students performance in the course motivation was not correlated with achievement at $r =.00$. For study 2, regression analysis revealed that IQ predicted achievement ($t=2.29$, .028 sig.) while motivation did not contribute significant variance to the prediction of achievement. The present experiments tell us that any relationship between motivation and achievement appears to depend on the person's knowledge about their current performance in the area of achievement being measured.

Childhood Intelligence and Behavior Problems: Predictors of Resilience in High-Risk Young Adults

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Utilizing the 1998 National Longitudinal Study of Youth's young adult sample (NLSY young adult), factors identifying resilience in the face of adversity are identified. Children who were exposed to severe poverty (i.e., living in a household that was classified below the national poverty level for 7-10 out of ten measurement occasions between 1982 and 1992)), AND who lived in a household where the father was absent for all measurement occasions between 1982 and 1992, were considered to have experienced adversity in early childhood and, therefore, will be considered at high risk for subsequent behavioral, emotional, and educational problems. Those in the high-risk group who do not display behavioral (e.g., conduct problems, delinquency), emotional (e.g., depression, withdrawal), or educational problems (e.g., failing grades, dropping out) during mid-late adolescence will be considered resilient, while those who do manifest any of these problems will be considered non-resilient. Potential protective factors that are investigated include: childhood IQ, childhood behavior problems, and quality of home environment. A series of multivariate regression analyses will first be used to investigate the relationships between adversity and protective factors on early adult outcome (age 15 to 20 years). Hierarchical linear modeling will then be used to investigate within vs. between family effects on resilience in young adults. It is hypothesized that childhood IQ and behavior problems will account for most of the variance in resilience among the subjects categorized as high risk. Preliminary analyses support this hypothesis.

Modeling Environmental and Genetic Influence on Intelligence Test Scores: Corrections and Identifiability Issues in the Dickens and Flynn Model of Cohort Effects.

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Intelligence test scores have risen in the industrialized nations for most of the 20th century. At the same time, many studies have shown that intelligence is largely inherited. These findings are sometimes seen as paradoxical, because the time period over which the rise in scores has occurred is far too short to permit population changes in genetic potential. In a previous article in this journal, Dickens and Flynn (2001) tried to resolve the paradox. They presented a mathematical model based on the ideas that genetic effects upon mental competence are low, but that high (or low) mental competence will produce a high (or low) environmental potential for intelligence. They claimed that this model is compatible both with high heritability estimates and large birth cohort effects. This paper is a reanalysis of their reasoning. Contrary to their conclusions, their model implies that the birth cohort effect is independent of the size of direct genetic impact. Therefore the rise in test scores is not evidence against genetic models. The methods originally proposed for further research on their models cannot be applied without a complete understanding of how a person's genetic constitution determines intelligence. An alternative method of analysis, which does not depend upon complete knowledge of the genetic mechanisms producing intelligence, is described. The conditions that must be met for investigation of all models of this class are discussed.

Evaluating g in the SAT: Implications for Sex Differences and Interpretations of Verbal and Quantitative Aptitude

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Employing SAT item scores for over 103,000 respondents from the fall, 1990, administration of the SAT, first principal component scores were calculated for each respondent based on principal components factor analyses of items comprising the Verbal(V), Quantitative(Q), and Total SAT scores. These were interpreted as estimates of **g**. A number of findings arose from analyses based on these scores: (a) Correlations between **g** components derived from V and Q component scores were much more highly correlated than were the commonly-used simple total V and Q scores; (b) principal component factor loadings for male and female **g** factors were highly congruent, with congruence coefficients well in excess of .99. (c) correlations of **g** with academic performance were as high or higher for component scores as for the commonly used V and Q total scores, indicating that there is little of predictive value in factors other than the first. Furthermore, V and Q **g** scores were, in general, undifferentiated in their correlations with academic outcomes; (d) when the distributions of male and female **g** scores were divided into stanines, males were over-represented for all scores above the mean and under-represented for all scores below the mean, indicating that the male-female difference is not only present for extreme scores, but throughout the distribution and that there is no evidence for higher male variability at the lower end of the distribution; (e) the male-female differences in SAT **g** scores were consistent at every stanine level across all ethnic groups evaluated, including three distinct groups of Hispanic respondents, African-Americans, Amerindians, and a number of other groups; (f) to evaluate the possibility that male and female respondents derived from differing socio-economic and educational backgrounds, male and female respondents were compared in terms of 11 different levels of father's and of mother's education and of family income. At every level of each covariate evaluated, males obtained higher SAT **g** scores than did females. Possible interpretations of these results are reviewed.

Correlations of g Factors from Three Mental Test Batteries

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That performances of individuals on tests of different mental abilities tend to be positively intercorrelated is well established. Though many have criticized it, the most commonly accepted explanation for these intercorrelations is the existence of a general intelligence factor, commonly known as "g". There is considerable empirical evidence for the existence of such a factor, and for a hierarchical structure of mental abilities (Carroll, 1993; Gustafsson & Undheim, 1996) with the g factor at the top. In addition, many argue that this g factor is highly predictive of intellectual performances of all kinds. This would suggest that the g factor measured among individuals must be independent of the specific mental ability tests used to define it. We address the extent to which this is true for 3 mental ability batteries in a heterogeneous sample of 441 adult individuals.

The sample is the Minnesota Study of Twins Reared Apart (MISTRA), a comprehensive sample of adult twins reared apart that also includes some adoptive and biological family members, friends, partners, and spouses of twins. In most cases, the twins were separated in infancy, reared in adoptive families, and not reunited until adulthood. They came from a variety of occupations and socio-economic backgrounds. Education levels ranged from less than high school to post-graduate experience. The study was initiated in 1979 and continued until 2000. The assessment consisted of a week-long battery of psychological and medical tests. It included 3 batteries of mental ability tests, the Weschler Adult Intelligence Scale, the Hawaii Battery, and the Comprehensive Ability Battery. In this study, we develop a hierarchical model of intellect for each ability battery, and measure the correlations of the latent g factors.

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The Construct Validity of the Differential Ability Scales (DAS) - Special Nonverbal Composite (SNC).

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Within the field of psychology, there is currently a lack of research that deals directly with the utility and validity of intelligence tests used with culturally diverse children.

The Differential Ability Scales (DAS) was developed with the notion that it would be comprised of a battery of tests, "consisting of a wide range of homogeneous, unidimensional subtests whose content and interrelationships would be compatible with a number of theoretical models" (Elliott, 1990, p.33). The goal of this study was to develop an understanding of the underlying factor structure of the DAS, Special Nonverbal Composite (SNC) in relation to culturally diverse children. Both exploratory (EFA) and confirmatory factor analysis (CFA) was used to examine the underlying factor structure of the DAS-SNC among the standardization sample of 208 "Black students," 150 "Hispanic students," 54 "Other minorities," and an overall "Combined minority group" of 412 subjects. Results from the "Combined minority group" provide support for interpreting the SNC along with the Verbal cluster score. Similar to the results of a previous study on the factor structure of the DAS by Kieth et. al. (1999): the 3 factor model exhibited the best overall statistical fit and the DAS did not show construct bias across groups. Implications for school psychologists are provided.

The Basic Ingredients of *g*: Processing Speed, Working Memory, and Long-Term Memory

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Recent studies of intelligence have provided convincing evidence that the general factor of intelligence tests, or *g*, can be mostly ascribed to a few basic cognitive processing components, and that *g* can be conceptualized as an aggregate of basic components underlying all complex intellectual activities. Some important members in this core set of general processes have already been identified. For instance, processing speed and working memory have been found to jointly contribute up to 80% or more of the variability in *g*. There may be other members in the core set that need to be determined. One possible ingredient for the core set yet to be fully investigated, particularly in conjunction with processing speed and working memory, is the component of long-term memory. In the present study, we attempted to evaluate the importance of long-term memory processing to *g* in addition to processing speed and working memory using data from the concurrent normative samples (n=1250) of the Wechsler Memory Scale-III (WMS-III) and the Wechsler Adult Intelligence Scale-III (WAIS-III). The subscales of the WMS-III mainly tap the capacity of long-term memory processing, and their covariances with the WAIS-III subscales were analyzed to reveal whether long-term memory processing plays a unique role in intelligence. Multiple regression models and structural equation models were employed in the three age ranges (16-29, 30-64, and 65-89) of the normative samples of WMS-III and WAIS-III, and R^2 changes were attained from these models to evaluate the extent to which the general variability among complex intellectual ability tests can be attributed to the basic cognitive components of processing speed, working memory, and long-term memory. Results from the multiple regression models indicate that the WAIS-III and WMS-III processing speed and working memory variables can account for about 75% to 85% of the variability shared between the WAIS-III crystallized and fluid intelligence indexes, Verbal Comprehension (VC) and Perceptual Organization (PO), and with the inclusion of the WMS-III long-term memory subscales, about 80% to 90% of the VC-PO shared variability can be mediated. The structural equation models yielded similar results. The factors of processing speed and working memory can explain about 80% of *g* variability in the three age ranges, and the long-term memory factor makes a moderate unique contribution to *g* over and above the processing speed and working memory factors. The two memory factors, the long-term memory factor and the working memory factor, share a substantial amount of *g* variability with one another, but they each also appear to be distinctive ingredients in the core process set of *g*. The findings of the study further strengthen the bottom-up theory of general intelligence.

The Principle Governing the Between-Age and Within-Age *g* Variability

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Previous studies suggest that the general factor for correlations among intellectual abilities, when gauged among the same-age peers, appears to be non-unitary in nature, consisting of a number of basic cognitive components, e.g., processing speed, working memory, long-term memory, etc.. But when the comparison is made between age groups, *g* appears to be unitary, as the correlations among intellectual abilities across age ranges are almost exhaustively mediated by one single elemental component, processing speed. Such a within-age and between-age disparity in g variability raises the question whether *g* assumes distinctive identities in different settings. The principle that governs the apparent disparity needs to be clarified for a unified theory of intelligence. A possible explanation for such a disparity is that processing speed has a pervasive influence on various intellectual abilities in the full age span, but the variance of processing speed is considerably restricted within age groups, leading to a weakened role of processing speed and an increased role of other basic cognitive components, such as working memory and long-term memory, in the within-age *g* variability. In the present study, we tested the hypothesis that the observed disparity between the within-age *g* variability and the between-age *g* variability is a result of selection on the range of processing speed, and that the unitary between-age g variability becomes heterogenous within age groups because the variance of processing speed undergoes a dramatic truncation when it is measured among the same-age peers. Full age range covariances among intellectual abilities and basic cognitive components (processing speed, working memory, and long-term memory) were obtained from 520 primary school participants of the Western Reserve Twin Project data (age range: 6-12), and from 850 adults in the WMS-III and WAIS-III concurrent normative sample (age range: 30-89). Estimates from structural equation models fitted to the full age span covariances indicated a dominance of processing speed in the between-age g variability in both samples. The expected within-age covariances were then modeled according to the Lawley-Pearson selection formula as the function of range selection on the variables measured in the full age span and were fitted to the observed covariances pooled within age groups. Weights of variable selection as well as the proportion of range truncation were estimated as model parameters and their significance were tested using the maximum likelihood method. The models fit data closely, indicating the seeming disparity between the within-age covariances and the between-age covariances can be explained by the range selection of certain cognitive variables. Moreover, in both the primary school age range and the adult age range, the processing speed variables were the most dominantly weighted selection variables, supporting the hypothesis that the heterogeneity of the within-age *g* variability is mostly the product of range selection on a unitary between-age *g* underpinned exclusively by processing speed in the full age span. The findings of the present study also give rise to a broader hypothesis that the nature of *g* may vary in various settings depending on the specific range selections made on the basic cognitive processing ingredients of *g*.

A Rational and Empirical Argument that the Sexes Differ (and Must Have Differed) in Intelligence (as They Do in Brain Sizes).

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McBride (e.g., 2000) argued that despite claims to the contrary, the paradox associated with brain size differences and IQ similarities between the sexes has not been solved. In fact, the case was made that IQ scores appear to be equivalent between males and females only because of a psychometric procedure, or statistical artifact. That is, there is sex parity because tests are designed in such a way that outcomes do not challenge the presumption that the sexes have equal intelligence (as manifest in g). Evidence and arguments against this position have been put forth and recognized, credibly, prior to and after this hypothesis was offered. The current effort re-visits the controversy and provides (1) a rational case that the original IQ test – i.e., the test of survival during the ancestral evolutionary environment – may very well (or necessarily) have produced differential intelligences between the sexes, and it provides empirical cases that (2) struggle for survival in the so-called male milieu may have produced superior g among males (consistent with brain size differences), and that (3) such variation is in fact genetically sex linked. The pervasive or apparently invariant relationship found between measures of central tendency and corresponding measures of dispersal in a significant sample of biometric variables (including intelligence scores) supports the latter claim.

A Meta-Analysis of the Relationship between MRI-Assessed Brain Volume and Intelligence

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The debate concerning the relationship between head and brain size with intelligence has been on-going for over a century. Early studies primarily used external head measurements. More recent studies have examined brain volume as measured by magnetic resonance imaging (MRI). Nguyen and McDaniel (2000) andVernon et al. (2000) conducted reviews of this literature. Vernon et al. estimated the population correlation between external head measures and intelligence to be .20. Nguyen and McDaniel reported estimated population correlations between intelligence with external measures as .20 for capacity estimates, .17 for length measures, and .25 for perimeter measures. MRI studies are superior to external head measures as assessments of brain size. Vernon et al. provided an estimated population correlation of .33 for their full data set and .38 for a selected subset of studies. Nguyen and McDaniel provided an estimated population correlation of .33. Since the time of these reviews, several additional MRI and intelligence studies have been reported.

The purpose of the current study is two-fold. First, this study updates previous summaries of the relationship between MRI-assessed brain volume and intelligence by incorporating additional literature. Second, this study seeks to determine the extent to which these findings may be a function of publication bias. Publication bias is a threat to conclusions drawn from narrative or quantitative reviews if the studies reviewed are not representative of all studies conducted or all possible studies. Publication bias may be a particular problem in literatures where studies having statistically non-significant results have a lower probability of being submitted and or published than studies showing statistically significant results. An assessment of publication bias in this literature is particularly important due to allegations of selective or biased reporting of results (Cain & Vanderwolf, 1990). Our analysis employs recently-developed publication bias procedures to estimate the degree of publication bias in this literature and to provide estimates of the magnitude of the effects when results are adjusted for publication bias.

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Synaptic Transmission Correlates of General Mental Ability

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Neural conduction velocity and efficiency of synaptic transmission are two possible biological mechanisms that may underpin intelligence. Direct assessments of neural conduction velocity, without synaptic transmission, show few substantial or reliable correlations with cognitive abilities (Vernon & Mori, 1992). We therefore assessed the latencies of reflexes involving one and many synapses in order to determine whether variations in speed of synaptic conduction are related to cognitive abilities and reaction times. Nerve conduction velocity was estimated by measuring speed of nerve conduction in the patellar reflex arc, and speed of finger withdrawal following electric shock. Speed and efficiency of neural transmission were indirectly measured via simple and choice reaction time tasks. A number of hypothesized relationships were supported, however the results tend to be inconsistent. The theoretical implications of the findings are discussed.

A Test of the Heterosis Hypothesis

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Perhaps the most puzzling question facing the field of intelligence research today is that of identifying the cause of the worldwide secular rise in IQ test scores, also known as the "Flynn effect." The genetic phenomenon heterosis, or hybrid vigor, has several distinct advantages as a potential causal factor. First, because it is a genetic mechanism, it easily explains the high heritability of IQ, the lack of any secular trend in IQ heritability, and the lack of shared environmental effects on IQ, even in adoption studies conducted on populations in the midst of ongoing secular increases in IQ. Although the above empirical findings have recently been referred to as the "IQ paradox" by Dickens and Flynn, they are really only paradoxical in the context of environmental hypotheses for the trend, not genetic hypotheses. In addition, because heterosis alters the ratio of heterozygous to homozygous loci throughout the entire genome, it would be expected to cause changes in many, perhaps most, heritable traits, which has occurred. In fact, it is difficult to find even a single heritable human trait that has clearly not undergone large secular change in parallel with IQ. These parallel trends include traits like height, age at menarche, head circumference, and myopia, just to name a few. As with IQ, these other traits have displayed the same "paradoxical" attributes of consistently high heritability and low shared environmental effects throughout long periods of steady secular change.

Because it posits a very specific causal factor, a heterosis hypothesis for the IQ trend makes several testable predictions. At the genetic level, one would expect to observe a secular rise in heterozygotes. Also, any variance in the effects of heterosis would be expected to induce a positive association between heterozygosity and IQ. In an effort to test these predictions, I have analyzed several genetic data sets, the most suitable (i.e. free of potential biases) of which involves 92 high IQ (high SAT) children and their parents (i.e. 92 parent-child trios). Contrary to expectation, the parents in this sample were found to be significantly more heterozygous than their high IQ children. Further analysis showed that most of the intergenerational difference was due to an excess of heterozygotes, above Hardy-Weinberg expectation, among the parents, rather than a deficit of heterozygotes among the children. In addition to being at odds with the expectations of the heterosis hypothesis, the finding is also puzzling in other respects. The apparent breakdown in the barriers to inter-ethnic, inter-faith, and inter-regional matings that has occurred in recent U.S. history should be causing intergenerational increases in heterozygosity, not homozygosity. Also, inbreeding studies have generally shown IQ to display positive directional dominance (i.e. inbreeding depression and hybrid vigor, not inbreeding vigor and hybrid depression), which runs counter to finding of lower heterozygosity in the high IQ children as compared to their parents. Possible explanations for the finding will be discussed, and ideas for future research along these lines will be suggested.

Nyborg Symposium:

Honorary Symposium for Professor Emeritus Arthur R. Jensen from University of California at Berkeley.

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This symposium is dedicated to Arthur Jensen for his life-long ground-breaking contribution to educational psychology and psychometrics. Jensen is inspired by such towering figures in psychology as Galton, Spearman, and Eysenck, but his many contributions, both to the London School tradition and elsewhere, are characterized by elegant elaboration and solidity going far beyond what any other living researcher has mustered.

We also wish to express our respect for Jensen's personal and professional integrity, showing up most clearly during the many vicious ad hominem attacks he has endured ever since the publication of his famous HER 1969 article: "How much can we boost IQ and scholastic achievement", and to acknowledge his never failing willingness to take ample time off to guide and support others showing an interest in the area.

Speakers in the honorary symposium are Linda Gottfredson from University of Delaware, U.S.A, Helmuth Nyborg from University of Aarhus, Denmark, and J. Philippe Rushton from University of Western Ontario, Canada. A "young" prof. Jensen will also appear in the form of video clips, cut from a symposium held on the Berkeley campus shortly after the tumultuous publication of his HER article. Finally, Frank Miele will discuss his recent interview of Arthur Jensen.

Nyborg Symposium:
g, Jobs, and Life

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Jensen has drawn attention to the fact that tests and tasks differ systematically in g loading, that is, in the degree to which they call forth *g* (general intelligence). This suggests a way to better understand the impact of differences in *g* in daily life: examine everyday tasks and broad life outcomes for their psychometric properties, including their *g* loadedness. That is, in what ways does life mimic or depart from a standardized intelligence test? The value of six specific questions is illustrated by applying them to the literatures on job performance and occupational attainment. (1) What is the distribution, by *g* loading, of the many "subtests" we take in life's extensive mental test battery? (2) To what extent do we take common vs. different "subtests" in life? (3) To what extent do our differences in *g* determine which subtests we take? (4) To what extent are life's tests standardized? (5) Do many weakly *g*-loaded activities cumulate to produce highly g-loaded life outcomes? And (6), how do a society's members (its "test takers") create and reshape the mental test battery that the society "administers" to current and new generations? Applying the life-as-a-mental-test-battery analogy to the world of work yields predictions about where and why higher *g* will be an advantage elsewhere in life. The analogy also explains why even big effects can be hard to discern in the psychometrically messy real world.

Nyborg Symposium:

IQ and *g:* The Art of Uncovering the Sex Difference in General Intelligence

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IQ researcher, who sum item scores, often find a male advantage of about 4 IQ points in *intelligence in general* (e.g. Lynn, 1994; 1999). However, researchers using factor analytic techniques to derive a *general intelligence g*-score from correlations among items sometimes find a male advantage, sometimes a female lead, and sometime no difference (e.g. Colon et al., 2000; Jensen, 1998; Nyborg, 2001).

This confusing picture suggests that commonly used methods may under certain circumstances influence the outcome, in which case the question of a real sex difference in higher order ability would be left wide open. Perhaps sample bias, test bias, and the real sex differences in lower order group factors (like verbal fluency with a female lead and 3-dimensional spatial abilities with a male lead), combine variously at the higher order level to produce unreliable sex differences in IQ, and to contaminate *g* measures derived by Principal Component (PC) or Principal Factor (PF) analyses.

This paper offers a double solution to these problems. First, IQ measures of *intelligence in general* are disqualified, as they are inherently unfit to resolve the question of a sex difference in general intelligence. Second, only a hierarchical Schmid-Leiman (SL; 1957) orthogonal transformation analysis provides an unbiased estimate of a possible sex difference in *general intelligence g*. This disqualifies PC and PF analyses as primary tools in the quest for the moderate sex difference (whereas in most other cases they will do fine).

Only two studies apply the SL transformation, and both find a modest male lead (Colon et al., 2002; Nyborg, 2001). The latter study further correlated head circumference with SL *g*. The size of the coefficient (r = .34, which is large when using a simple circumference measure, but common when using the more exact brain image volume measure) suggests, that the SL *g* transformation provides a good proxy for brain based *g*.

The paper finally discusses the exponential impact of the moderate average SL *g* sex difference (0.37 SD ≈ 5.5 IQ points) on the male-female ratio at the high end of the *g* distribution, being reinforced by the larger male SD.

Nyborg Symposium:
How Much Can We Boost IQ and Scholastic Achievement?

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Presented by P. Rushton

This session comprises a film of Arthur R. Jensen's presentation in 1969 during a debate held at Berkeley in the wake of his famous paper in the *Harvard Educational Review* (1969, Vol. 39, pp. 1-123). It begins with the Chair, Curt Stern, Prof. of Genetics and Zoology at Berkeley, introducing the panel comprising of Jensen; A. Cicourel (Sociology at Santa Barbara); Joshua Lederberg (Genetics at Stanford); A. L. Stinchcombe (Sociology at Berkeley); Wm. J. Libby (Genetics at Berkeley); and Lee Cronbach (Education at Stanford). Then Arthur Jensen outlines his answers to the questions posed to him by the editors of the *Harvard Educational Review*: (1) How effective were compensatory programs for the disadvantaged? (2) What is the nature of intelligence? (3) How much did heredity and the environment contribute to IQ and scholastic performance? (4) What was his position on social class and racial differences in intelligence? (5) What did his own research show? In the talk Jensen touches on dysgenics, the (then) still open question of the causes of race differences in IQ, and the triple interaction between intelligence, learning, and socioeconomic status?

Nyborg Symposum:
Thirty Years of Research on Black-White Differences in Cognitive Ability

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In this paper we review the main points made in Rushton and Jensen's (in press) article forthcoming in *Psychology, Public Policy, and the Law*, which examines 33 years of research on the causes of the mean Black-White IQ differences carried out since Jensen's (1969) article in the *Harvard Educational Review*. We compare the *culture-only* (0% genetic-100% environmental) and *hereditarian* (50% genetic-50% environmental) models across nine lines of evidence. These include: (1) the worldwide distribution of test scores; (2) the *g* factor of mental ability found in Africa as well as in America; (3) gene-environment architecture similarities and differences in Blacks and Whites; (4) brain size and cognitive ability; (5) trans-racial adoption studies; (6) studies of racial admixture; (7) regression to the mean effects; (8) related life-history traits; and, (9) genetic distance measures and the evolutionary origins of human races. This evidence points to some genetic component in Black-White differences in mean IQ. We also compare the culture-only and hereditarian research programs using Lakatos's (1978) philosophy of science methodology that classifies research programs as being either progressive or degenerating and we conclude that whereas the hereditarian research program has been consistently progressive, the culture-only one has too often been degenerating. We suggest that to be effective, future research into cultural factors influencing Black-White differences incorporate behavioral-genetic designs.

Nyborg Symposium:
Jensenism and Skepticism: Arthur Jensen as "Icebreaker"

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The dictionary defines Jensenism as "the theory that an individual's IQ is largely due to heredity, including racial heritage." *Skeptic* magazine, where I serve as Senior Editor charged with interviewing major figures in the bio-sciences (see *The Battlegrounds of Bio-Science*. (Bloomington, IN. 1stBooks Library. 2002), defines skepticism as "the search for provisional, not metaphysical, truth through the continuous and vigorous application of the methods of science, that is, formulating hypotheses and gathering data against which to test them." The late Stephen Jay Gould, an icon of the skeptical movement, claimed to have debunked Jensenism and the entire "rotten edifice" on which it rests. But Douglas Detterman, editor of *Intelligence* devoted an entire issue of the journal – and a symposium at this conference – to honoring Jensen and his work. Such wildly varying assessments clearly invite skeptical examination and critical thinking. Which is why I wrote not an article but an entire book, *Intelligence, Race, and Genetics: Conversations with Arthur R. Jensen*, just published by Westview Press (Boulder, CO. 2002). Speaking as a professional science writer, not a research scientist, I discuss the personal and professional characteristics that allowed Arthur Jensen to serve as the "icebreaker," re-opening the nexus of race, intelligence, and genetics to serious scientific inquiry.

Oral creatine monohydrate supplementation improves brain performance: a double-blind, placebo-controlled, cross-over trial.

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Creatine supplementation is effect in enhancing muscular performance, where it acts to increase stamina in acute high-intensity tasks (as demanded from elite athletes). The primary role of creatine implicated in improved physical (muscular) performance is in cellular metabolism, where it acts to buffer cellular energy demands. Creatine plays a similar pivotal role in brain energy homeostasis where it acts as a temporal and spatial buffer for cytosolic and mitochondrial pools of the cellular energy currency, adenosine triphosphate (ATP) and its regulator, adenosine diphosphate. In this presentation, we report a test of the hypothesis that oral creatine supplementation would enhance intelligence test working memory scores. Oral creatine was administered to 45 young adult, vegetarian subjects in a double-blind, placebo-controlled, cross-over design. Creatine supplementation had a significant positive effect ($P < 0.0001$) on both working memory (backward digit span) and intelligence (Ravens Advanced Progressive Matrices). Both of these tasks require speed of processing and load *g*. It is suggested that these findings underline a dynamic and significant role of brain energy capacity in influencing brain (and mental) performance.

Identification of a Flynn Effect in the National Longitudinal Survey of Youth (NLSY) Data

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The Flynn Effect (e.g., Flynn, 1984) is an annual increase in IQ of around .33 points per year observed in developed countries since approximately 1920. There has been argument about the cause of the Flynn Effect, and a number of theories have been proposed. Rodgers (1999) noted that the search for causes of the Flynn Effect has preceded specification of the nature of the effect. We use a large national sample of 10,918 U.S. children born during the past 25 years (the NLSY-Children data) to test for a Flynn Effect in PIAT Math, PIAT Reading Recognition, PIAT Reading Comprehension, Digit Span, and PPVT scores. A Flynn Effect of approximately the predicted magnitude was observed on the raw scores for each of these outcomes measures, and on PIAT-Math when maternal IQ was controlled. Identification of a Flynn Effect in a large (and approximately representative) U.S. sample with thousands of other variables opens the door to test a number of different hypotheses about the nature of and the causes of the Flynn Effect in both environmental and biological domains.

What is Musical Intelligence?

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Almost twenty years ago Howard Gardner (1983) introduced the idea of multiple intelligences. His theory suggested that there are several intelligences that are independent of our traditional concept of general intelligence. Musical intelligence is one of the intelligences cited. However, there is a great deal of evidence that supports a relationship between general intelligence and musical ability. But, the existence of musical savants clearly supports Gardner's theory of musical skill in the absence of normal intelligence. Musical savants are individuals with mental retardation who can perform musically beyond what would be predicted given their low level of general intelligence. A paper by Ruthsatz and Detterman (under revision) examined the summation theory of achievement first proposed by Detterman and Ruthsatz (2001) in the musical domain. The theory states that achievement is influenced by at least three factors, general intelligence, domain specific skills and practice. The investigation supported the importance of each factor through a multiple regression analysis. General intelligence, domain specific skills and practice time all added significant increment to the predication of musical achievement within a self-selected high school band. There is currently a general consensus among professionals that intelligence tests are reliable and valid measures of general intelligence. Furthermore, these tests are found to be valid predictors of later life achievement. Additionally, the concept of practice time has been well defined by Ericcson and was found predictive of achievement in the musical domain. We are left to ask what is meant by domain specific skills or as Gardner called it Musical Intelligence. In his book Frames of Mind: The theory of multiple intelligences, Gardner states that at the core of musical intelligence is the ability to audiate music. Individuals who score well on tests of music audiation are identified as having musical aptitude. Musical aptitude is defined as the potential to achieve in the musical domain. The authors of tests of musical aptitude assert that they can predict who will be the most likely to benefit from musical instruction and that individuals without musical training can and often do perform at exceptional levels on tests that measure musical aptitude. The current study addresses the underpinnings behind what Gardner has labeled the core of musical intelligence, musical audiation. The study used the Gordon's Advanced Measures of music audiation and the WAIS digit-span as a measure of short- term memory. The test was administered to 63 undergraduates without musical training and 57 students at a musical institute. The results reveal that students without musical training can and did do well on the test of music audiation, but their results were highly correlated with the WAIS digit-span ($r = .87$). Unlike the findings of students at the musical institute who scored well on the test of music audiation but failed to have it correlate with their digit-span results ($r = .13$). The current study suggests that what is at the core of Gardner's theory of Musical Intelligence is short-term memory. Students at the musical institute had expanded the abilities of their memories in a domain where they had extensive practice but it failed to generalize to the digit-span. Additionally, their ability to audiate music was significantly correlated with their practice time ($r = .54$), supporting the importance of practice to musical achievement.

Background Variables Related to IQ Test Scores and University Grades of First Year African and Non-African Engineering Students in South Africa

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This paper reports on some of the background correlates of IQ test scores and academic performance measures within and between African and non-African engineering students at the University of Witwatersrand. In particular, it addresses the question of whether some of the measured difference between Africans and non-Africans found in our studies on the Raven's Progressive Matrices Tests (see Rushton & Skuy, 2000; Rushton, Skuy, & Fridjohn, 2002, in press; Skuy et al., 2002, all in *Intelligence*) can be related to educational background and socio-economic status. Questionnaire data about the educational and occupational status of their parents, the type of high school attended, and their performance in the high school matriculation examination, were collected from several hundred of the first year engineering students (Africans, Indians and Whites) in our studies. These data will be discussed in the context of the history of South Africa's African majority, which is one of extreme sociopolitical and educational disadvantage, which conduces to lowered intellectual functioning. Only in 1994 was the policy of apartheid replaced by majority rule. However, many Africans did achieve relatively high levels of occupational and academic success, in spite of apartheid, and some of the Africans in our studies were part of this group. Finally, this paper discusses the implications of the findings for the effects of change and intervention.

Mathematically Facile Adolescents with Math–Science Aspirations: New Perspectives on Their Educational and Vocational Development

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This longitudinal study tracked 1,110 adolescents identified as mathematically precocious at age 13 (top 1%) with plans for a math–science undergraduate major. Participants' high school educational experiences, abilities, and interests predicted whether their attained undergraduate degrees were within math–science or non-math–science areas. More women than men eventually completed undergraduate degrees outside math–science, but many individuals who completed non-math–science degrees ultimately chose math–science occupations (and vice versa). At age 33, the two degree groups reported commensurate and uniformly high levels of career satisfaction, success, and life satisfaction. Assessing individual differences is critical for modeling talent development and life satisfaction; it reveals that equal male–female representation across disciplines may not be as simple to accomplish as many policy discussions imply.

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