Fourteenth Annual Conference of the International Society for Intelligence Research (ISIR)
Melbourne, Australia
December 12-14, 2013

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The Board would like to thank all the ISIR committees for their hard work in making this conference possible.

We also thank Elsevier for helping to sponsor the Reception.

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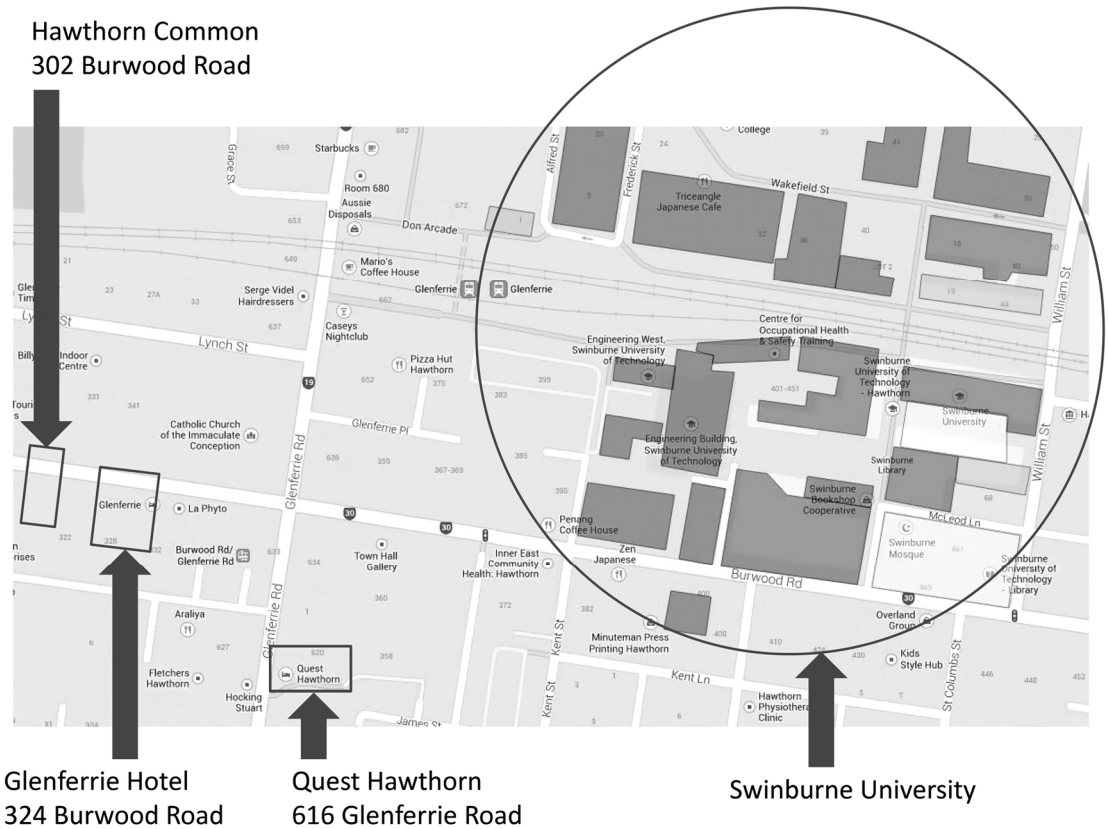
1941-2013


Hawthorn Common
302 Burwood Road
Starbucks
Room 680
Aussie Disposals
Don Arcade
Mario's Coffee House
Glenferrie
Serge Videl Hairdressers
Caseys Nightclub
Lynch St
Pizza Hut Hawthorn
Indoor Centre
Catholic Church of the Immaculate Conception
Glenferrie Rd
Glenferrie Pl
Glenferrie
La Phyto
Burwood Rd/ Glenferrie Rd
Town Hall Gallery
Inner East Community Health: Hawthorn
Araliya
Fletchers Hawthorn
Hocking Stuart
Quest Hawthorn
Penang Coffee House
Zen Japanese
Minuteman Press Printing Hawthorn
Burwood Rd
Kent St
Kent Ln
James St
Overland Group
Kids Style Hub
St Columbs St
Hawthorn Physiotherapy Clinic
Alfred St
Frederick St
Wakefield St
Triceangle Japanese Cafe
College
William St
Centre for Occupational Health & Safety Training
Engineering West, Swinburne University of Technology
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Engineering Building, Swinburne University of Technology
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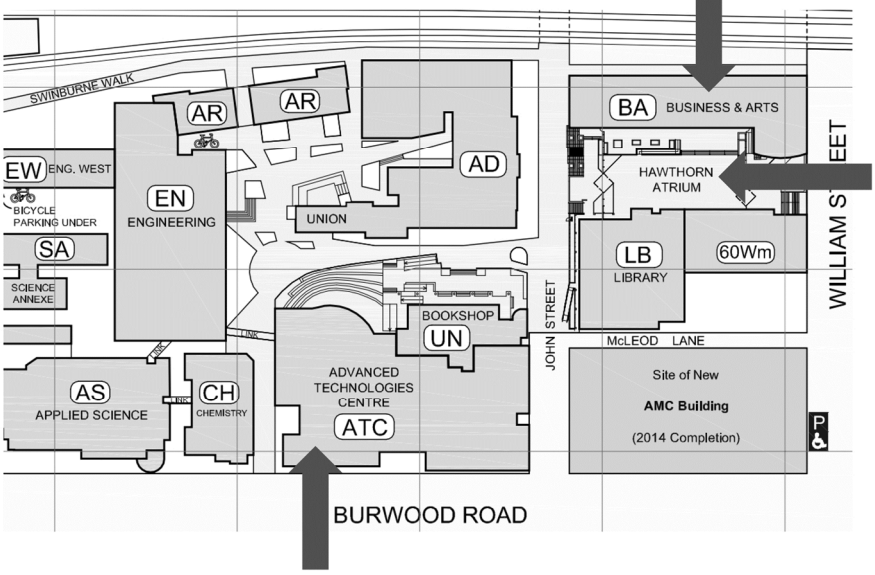
Talks @ BA201
12th & 13th December 2013
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SA
SCIENCE ANNEXE
BOOKSHOP
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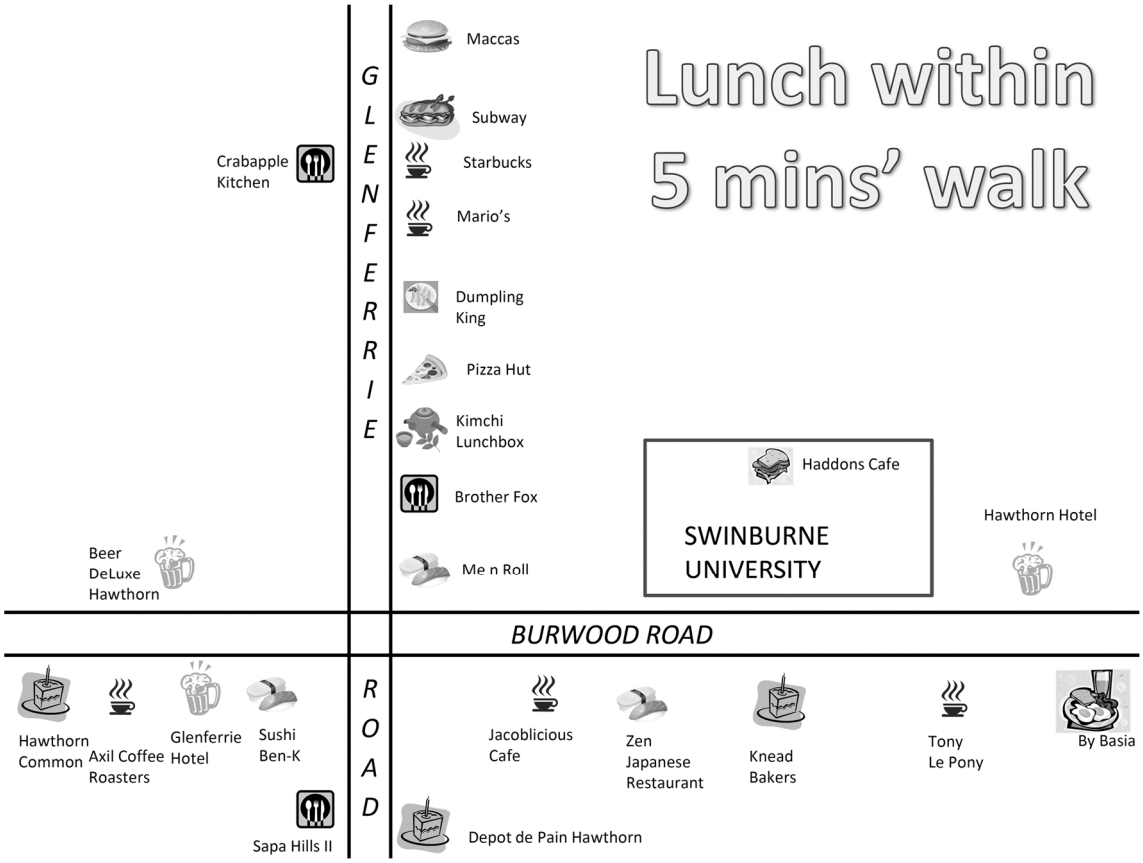
AS APPLIED SCIENCE
CH CHEMISTRY
ADVANCED TECHNOLOGIES CENTRE
ATC
BA BUSINESS & ARTS
HAWTHORN ATRIUM
LB LIBRARY
60Wm
JOHN STREET
McLEOD LANE
Site of New
AMC Building
(2014 Completion)
WILLIAM STREET
BURWOOD ROAD
Elsevier Reception,
Poster Sessions
12th December 2013
Talks @ ATC101
14th December 2013


Lunch within 5 mins' walk
GLENFERRIE ROAD
BURWOOD ROAD
Maccas
Subway
Starbucks
Mario's
Dumpling King
Pizza Hut
Kimchi Lunchbox
Brother Fox
Me n Roll
Crabapple Kitchen
Beer DeLuxe Hawthorn
Haddons Cafe
SWINBURNE UNIVERSITY
Hawthorn Hotel
Hawthorn Common
Axil Coffee Roasters
Glenferrie Hotel
Sushi Ben-K
Sapa Hills II
Jacoblicious Cafe
Zen Japanese Restaurant
Knead Bakers
Tony Le Pony
By Basia
Depot de Pain Hawthorn

Short schedule for ISIR 2013

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DAY 1: Thursday, Dec. 12

@BA201

8:20–8:30 Opening Remarks
George Collins

8:30–9:30 Lifetime Achievement Award:
Linda Gottfredson (90)

9:30–10:00 Break

10:00–11:20 Talks: Basic Predictors

10:00–10:20 Neubauer (51)
Neural Efficiency

10:20–10:40 Frey (41)
Perceived Workload

10:40–11:00 Giofrè (43)
Working Memory

11:00–11:20 Mosing (50)
Musical Discrimination&IQ

11:20–12:20 Dodonova &Dodonov (60)
Worst Performance Rule Symp.

11:20–11:40 Dodonova (61)
Sources of WPR

11:40–12:00 Borter (62)
WPR & Task Difficulty

12:00–12:20 Dodonov (63)
WPR & Accuracy

12:20–1:50 Lunch
Luncheon for Awardees

1:50–2:50 President's Invited Address:
Nick Martin (92)

2:50–4:10 Talks: Genetics

2:50–3:10 Bates (38)
SES & Heritability of IQ

3:10–3:30 Hill (44)
Functional SNPs & IQ

3:30–3:50 Luciano (47)
Rare Genetic Variants & g

3:50–4:10 Plomin (52)
Genetics of Low IQ

4:10–4:40 Break

4:40–5:30 Business Meeting

5:30–6:30 Interview:
Nicholas Mackintosh

6:30–9:00 Elsevier Reception, Poster Sessions
(see the next page)

DAY 2: Friday, Dec. 13

@BA201

7:00–8:20 Student breakfast with Lifetime Achievement Awardee

8:20–10:00 Stankov & Nettelbeck (64)
Confidence & IQ Symp.

8:20–8:40 Stankov (65)
Non-Cognitive Predictors

8:40–9:00 Kleitman (66)
IQ & Confidence

9:00–9:20 Jackson (67)
Decision-Making

9:20–9:40 Lee (68)
Confidence & Achievement

9:40–10:00 Welsh (69)
Anchoring

10:00–10:30 Break

10:30–11:30 Talks: g &Special Abilities

10:30–10:50 Gignac (42)
Mutualism Theory of g

10:50–11:10 Coyle (39)
Ability Tilt on SAT & ACT

11:10–11:30 Song (55)
IQ, Creativity & Processing

11:30–12:30 Pase, Stough, & Bates (70)
CHC Taxonomy Symp.

11:30–11:50 Pase (71)
Cattell-Horn-Caroll Model

11:50–12:10 Stough(72)
Smart Drug Effects

12:10–12:30 Scholey (73)
Natural Medicines & CHC

12:30–2:00 Lunch

2:00–2:40 Talks: Life Outcomes

2:00–2:20 de Manzano (49)
Creative Achievement

2:20–2:40 Kell (45)
Life Outcomes in Gifted

2:40–3:40 Talks: Health & Aging

2:40–3:00 Sörberg (56)
IQ, Health & Mortality

3:00–3:20 Macpherson (48)
Dietary Interventions

3:20–3:40 Ritchie (54)
Alcohol Consumption

3:40–4:10 Break

4:10–5:30 Arden & Plotnik (74)
IQ in Non-Humans Symp.

4:10–4:30 Arden (75)
g in Dogs

4:30–5:10 Plotnik (76)
The Elephant Model

5:10–5:30 Taylor (77)
Tool-Making Crows

5:30-6:30 Keynote Address
Randall Engle (93)

6:30-9:00 Conference Banquet

DAY 3: Saturday, Dec. 14

@ATC101

8:20–8:40 Talk: Survey of Expert Opinion
Rindermann (53)

8:40–9:40 Holden Memorial Address on Science Writing:
Elizabeth Finkel (94)

9:40–10:10 Break

10:10–12:00 President's Symposium (83)

10:10–10:35 Lubinski (84)
SMPY 40 Years Later

10:35–10:50 Makel (85)
Profound Intellectual Talent

10:50–11:10 Plomin (86)
Genetics of High Abilities

11:10–11:30 Tellier (87)
DNA Sequencing

11:30–11:50 Lee (88)
Fourth Law of Behavior Genetics

11:50–12:00 Q&A

12:00–1:30 Lunch

1:30–2:50 Kovas & Malykh (78)
Self-Concept, Motivation & Achievement Symp

1:30–1:50 Kovas (79)
Motivation to Learn

1:50–2:10 Morosanova (80)
Self-Regulation

2:10–2:30 Ovcharova (81)
Abilities in Different School Populations

2:30–2:50 Voronin (82)
Academic Self-Concept

2:50–3:20 Break

3:20–4:20 Talks: Other Associations

3:20–3:40 Ledovaya (46)
Metaphors & IQ

3:40–4:00 Findlay (40)
Emotional Intelligence

4:00–4:20 Woodley (57)
Selection & Dysgenics

4:20–4:40 Carroll Student Award
ISIR Student Award
Best Poster Award

International Society for Intelligence Research (ISIR) 2013 Program: Posters

Thursday. December 12

6:30 – 9:00 P.M.

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P1: Posters, generally about Structure and Measurement

P1.1: What one intelligence test measures: The distinct roles of working memory and rule induction in matrix reasoning. *Patrick Loesche* & Marcus Hasselhorn* (23)

P1.2: Does education boost general intelligence (g) or specific cognitive abilities? *Stuart J. Ritchie* et al.* (29)

P1.3: Structure of the Woodcock-Johnson III Cognitive in a Clinical Sample. *Marley W. Watkins & Tracy Strickland* (35)

P1.4: Cross-Cultural Validity of IQ Tests among African Children: Artificial or Accurate Measure of Intelligence? *Cissé Dramé** (20)

P1.5: Investigating causal direction in neuroimaging studies of cognitive ability; an application of non-normal structural equation modelling. *Tom Booth et al.* (17)

P1.6: Outliers Matter, Distance-Based Weighting Helps:Some Examples Based on Speed-Ability Associations. *Yury S. Dodonov & Yulia A. Dodonova* (19)

P2: Posters, generally about Effects of Substances on Cognition

P2.1: Low levels of lead exposure may impact children's general intelligence. *Rachel M. Earl et al.*(21)

P2.2: Bacopa monnieri in child and adolescent populations with and without developmental dysfunction. *James D Kean* et al.* (22)

P2.3: The chronic effects of Bacopa, Pycnogenol and an antioxidant/micronutrient combination formula on cognitive and cardiovascular function in a healthy older population. *Con Stough et al.* (33)

P2.4: An investigation of the influence of antioxidant defense genes on cognitive ability in older individuals. *Karen J. Nolidin* et al.* (28)

P2.5: The cognitive enhancing effects of acute and chronic curcumin supplementation in a healthy elderly population. *Katherine H. M. Cox* et al.* (18)

P2.6: A Preliminary Study Investigating the Effects of Resveratrol on Cognitive Function. *Andrew Scholey et al.* (31)

P2.7: Neurocognitive effects of multivitamin supplementation: A behavioural and fMRI study. *David J. White et al.* (36)

Posters - cont.

P2.8: Cognitive Performance Following Alcohol and Energy Drink. *Sarah Benson* et al.* (15)

P2.9: Effects of alcohol consumption on academic performance. *Joris C. Verster et al.* (34)

P3: Posters, generally about Emotional Intelligence, Personality and Metacognition

P3.1: Emotional Intelligence and Scholastic Achievement in Preadolescent Children. *Clare E W Billings et al.* (16)

P3.2: Adolescent Peer-Relations and Emotional Intelligence. *Justine E. Lomas et al.* (24)

P3.3: Emotional Intelligence, victimisation, bullying behaviours and attitudes: a replication and extension. *Chantelle M. Schokman et al.* (30)

P3.4: Challenging the intelligence compensation theory: Are conscientiousness and intelligence really negatively correlated? *Aja L. Murray* et al.* (27)

P3.5: Cognitive abilities, self-regulation and academic achievements of gifted students. *Varvara I. Morosanova et al.* (26)

P3.6: Knowing the knowing: Exploring the relationship between metacognition and intelligence. *John H. Song & Brooke Nickeas* (32)

P4: Posters, generally about Intelligence in a Broader Context

P4.1: The role of Intelligence on the human development *Tatiana A. Badaró** (13)

P4.2: Expert opinion on the causes of international differences in intelligence – 2013 survey of expert opinion on intelligence. *David Becker* et al.* (14)

P4.3: The Rule-Dependence Model: a New Model for Secular IQ Gains. *Elijah Z. Armstrong & Michael A. Woodley* (12)

P4.4: Investigating relationships between cognition and life history in a sample of 6364 individuals. *Guy Madison et al.* (25)

Reception and poster sessions will be held at Hawthorn/Library Atrium

International Society for Intelligence Research (ISIR) 2013 Program: Talks

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Thursday, December 12 (Day 1), BA201

8:20 – 8:30 AM	**Opening Ceremony** *Professor George Collins, Deputy Vice Chancellor for Research, Swinburne University*
8:30 – 9:30 AM	**Lifetime Achievement Award:** *Linda Gottfredson* **Empirical Treasure, Lost and Found (90)**
9:30 – 10:00 AM	**Coffee Break**
10:00 – 11:20 AM	**T1: Talks, generally about basic predictors** Chair: *Aljoscha C. Neubauer*
10:00 – 10:20 AM	T1.1: Neural efficiency as a function of task demands. *Aljoscha C. Neubauer et al.* (51)
10:20 – 10:40 AM	T1.2: Perceived workload and performance in difficult nonverbal cognitive tasks predict academic achievement. *Meredith C. Frey & Cynthia Laurie-Rose* (41)
10:40 – 11:00 AM	T1.3: The structure of working memory and how it relates to intelligence in children. *David Giofrè et al.* (43)
11:00 – 11:20 AM	T1.4: Genetic and environmental influences on the relationship between musical discrimination tasks and IQ. *Miriam A. Mosing et al.* (50)
11:20 – 12:20 AM	**Symposium 1: Worst performance rule: sources, moderating variables and implications for intelligence research (60)** Organizers: *Yulia A. Dodonova & Yury S. Dodonov*
11:20 – 11:40 AM	S1.1: Are slowest response times more g-loaded than fastest reactions? Evidence, hypotheses and implications of worst performance rule**.** *Yulia A. Dodonova et al.* (61)
11:40 – 12:00 AM	S1.2: Cognitive tasks with increasing complexity: should worst performance rule be taken into account? *Natalie Borter* et al.* (62)
12:00 – 12:20 AM	S1.3: Slowest and fastest responses are not equally good predictors of intelligence, but does accuracy matter? *Yury S. Dodonov et al.* (63)
12:20 – 1:50 PM	**Lunch**
	Luncheon hosted by ISIR officers for Lifetime Achievement Awardee, Distinguished Contributions Awardee, Keynote Speaker, President's Invited Speaker and Holden Science Writer *Glenferrie Hotel* *324 Burwood Road*

Thursday - cont.

1:50 – 2:50 PM	**President's Invited Address:** *Nick Martin* **(92)**
	Emerging Evidence on the Molecular Genetics of Cognition
2:50 – 4:10 PM	**T2: Talks, generally about genetics** Chair: *Yulia Kovas*
2:50 – 3:10 PM	T2.1: When does socioeconomic status moderate the heritability of IQ? Data from Australia and the USA. *Timothy C. Bates et al.* (38)
3:10 – 3:30 PM	T2.2: Do functional SNPs show an enriched association for intelligence? *W. David Hill* et al.* (44)
3:30 – 3:50 PM	T2.3: A pilot study of rare genetic variants and g. *Michelle Luciano et al.* (47)
3:50 – 4:10 PM	T2.4: The genetics of low IQ and diagnosed mental retardation: 370,000 sibling pairs and 9000 twin pairs. *Robert Plomin et al.* (52)
4:10 – 4:40 PM	**Coffee Break**
4:40 – 5:30 PM	**Business Meeting**
5:30 – 6:30 PM	**Interview with recipient of Distinguished Contributor Award:** *Nicholas Mackintosh*
6:30 – 9:00 PM	**Elsevier Reception and Posters (11-36)**
	Hawthorn/Library Atrium

Friday, December 13 (Day 2), BA201

7:00 – 8:20 AM	**Student breakfast with Lifetime Achievement Awardee Linda Gottfredson** *Quest Hawthorn 616 Glenferrie Road*
8:20 – 10:00 AM	**Symposium 2: The relationship between confidence, intelligence, academic achievement and decision-making (64)** *Organizers: Lazar Stankov & Ted Nettelbeck*
8:20 – 8:40 AM	S2.1: Noncognitive predictors of intelligence and academic achievement. *Lazar Stankov* (65)
8:40 – 9:00 AM	S2.2: Intelligence and confidence in relationship to competence, arrogance and close-mindedness. *Sabina Kleitman* (66)
9:00 – 9:20 AM	S2.3: Intelligence and confidence as respective predictors of quality and erroneous decision-making. *Simon A Jackson* & Sabina Kleitman* (67)
9:20 – 9:40 AM	S2.4: Confidence: a better predictor of academic achievement than self-efficacy, self-concept and anxiety? *Lazar Stankov, Jihyun Lee et al.(*68)
9:40 – 10:00 AM	S2.5: Individual differences in anchoring: Traits and experience *Matthew B Welsh et al.* (69)
10:00 – 10:30 AM	**Coffee Break**
10:30 – 11:30 AM	**T3: Talks, generally about g and special abilities** Chair: *Linda Gottfredson*
10:30 – 10:50 AM	T3.1: An Empirical Test of the Dynamic Mutualism Theory of g. *Gilles E. Gignac* (42)
10:50 – 11:10 AM	T3.2: Validity of Ability Tilt on the SAT and ACT. *Thomas R. Coyle et al.* (39)
11:10 – 11:30 AM	T3.3: Exploring the relationship between intelligence, creativity, inspection time, and inhibition. *John H. Song & John G. Chetwynd* (55)
11:30 – 12:30 AM	**Symposium 3: Contemporary applications of the Cattell-Horn-Carroll cognitive taxonomy (70)** *Organizers: Mathew Pase, Con Stough & Timothy C Bates*
11:30 – 11:50 AM	S3.1: An overview of the Cattell-Horn-Caroll model of cognition: implications for contemporary use. *Mathew Pase* & Con Stough* (71)
11:50 – 12:10 AM	S3.2: Understanding smart drug effects using the Cattell-Horn-Caroll model of cognition. *Con Stough et al.* (72)
12:10 – 12:30 AM	S3.3: Understanding the effects of natural medicines and substances using the Cattell-Horn-Caroll model of cognition. *Andrew Scholey et al.* (73)

Friday – cont.

12:30 – 2:00 PM	**Lunch**
2:00 – 2:40 PM	**T4: Talks, generally about life outcomes** Chair: *Aljoscha C. Neubauer*
2:00 – 2:20 PM	T4.1: Associations between creative achievement in scientific and artistic domains, intelligence, personality and sex. *Örjan de Manzano et al.* (49)
2:20 – 2:40 PM	T4.2: "Wrecked by Success?" No! Linkages of Career Accomplishment, Health, and Relationship Satisfaction among the Gifted. *Harrison J. Kell et al.* (45)
2:40 – 3:40 PM	**T5: Talks, generally about health and aging** Chair: *Aljoscha C. Neubauer*
2:40 – 3:00 PM	T5.1: Intelligence and somatic health in early adulthood, and mortality up to age 59 -a longitudinal study of 49 000 men. *Alma Sörberg* et al.* (56)
3:00 – 3:20 PM	T5.2: Dietary interventions to offset cognitive decline. *Helen N. Macpherson et al.* (48)
3:20 – 3:40 PM	T5.3: Alcohol consumption and lifetime change in cognitive ability: A Mendelian randomization study. *Stuart J. Ritchie* et al.* (54)
3:40 – 4:10 PM	**Coffee Break**
4:10 – 5:30 PM	**S4: Intelligence in non human animals (74)** *Organizers: Rosalind Arden & Joshua Plotnik*
4:10 – 4:30 PM	S4.1: Fetch! g in dogs. *Rosalind Arden et al.* (75)
4:30 – 5:10 PM	S4.2: Big Brains, Big Smarts? The Elephant Model for The Study of Convergent Cognitive Evolution Across Species *Joshua M. Plotnik* (76)
5:10 – 5:30 PM	S4.3: What can tool-making crows teach us about our minds? *Alex H Taylor* (77)
5:30 – 6:30 PM	**Keynote Speaker:** *Randall W. Engle* **(93)**
	Working memory capacity as a mediating variable.
6:30 – 7:00 PM	**Pre-Dinner Drinks**
	Deck HawthornCommon 302 Burwood Road
7:00 – 9:00 PM	**Conference Banquet**
	HawthornCommon 302 Burwood Road

Saturday, December 14 (Day 3), ATC101

8:20 – 8:40 AM	**T6: Talk, Survey of Expert Opinion** T6.1: 2013 survey of expert opinion on intelligence. *Heiner Rindermann et al.* (53)
8:40 – 9:40 AM	**Holden Memorial Address on Science Writing:**
	Elizabeth Finkel **(94) Navigating the Straits: when Scientists Disagree**
9:40 – 10:10 AM	**Coffee Break**
10:10 – 12:00 AM	**PS: President's Symposium (83)**
	The Study of Mathematically Precocious Youth, DNA Sequencing, Genetics, and the Phenotypic Accomplishments of Profound Intellectual Talent at Midlife
10:10 – 10:35 AM	PS.1: Forty Years Later:What Happens to Mathematically Precocious Youth Identified at Age 12? *David Lubinski et al.* (84)
10:35 – 10:50 AM	PS.2: Profound Intellectual Talent: A Compelling Phenotype for Behavioral Genetics and Neuroscience Inquiry. *Matthew C. Makel et al.* (85)
10:50 – 11:10 AM	PS.3: The Genetics of High Cognitive Abilities. *Robert Plomin et al.* (86)
11:10 – 11:30 AM	PS.4: Petaflop Computer Clusters Crunch Genomes of Giant Minds: Collection, Sequencing, Analysis of the World's Largest Extreme-IQ Genomic Cohort. *Laurent Tellier et al.* (87)
11:30 – 11:50 AM	PS.5: The Fourth Law of Behavior Genetics. *James J. Lee & Christopher F. Chabris* (88)
11:50 – 12:00 AM	*Questions & Answers*
12:00 – 1:30 PM	**Lunch**
1:30 – 2:50 PM	**Symposium 5: Sources of individual differences in academic self-concept, motivation, and achievement in different cultures and ability groups (78)** *Organizers: Yulia Kovas & Sergey Malykh*
1:30 – 1:50 PM	S5.1: Why do children differ in motivation to learn? Insights from a large twin study. *Yulia Kovas et al.* (79)
1:50 – 2:10 PM	S5.2: Individual differences in conscious self-regulation and cognitive characteristics as predictors of academic achievement *Varvara Morosanova et al.* (80)
2:10 – 2:30 PM	S5.3: Is the structure of interrelationships among intelligence, cognitive abilities and achievement different in selected, self-selected, and unselected school populations? *Olga Ovcharova* et al.* (81)
2:30 – 2:50 PM	S5.4: Testing internal/external frame of reference model across academic domains and school years. *Ivan Voronin* et al.* (82)

Saturday – cont.

2:50 – 3:20 PM	**Coffee Break**
3:20 – 4:20 PM	**T7: Talks, generally about associations with other variables** Chair: *Aljoscha C. Neubauer*
3:20 – 3:40 PM	T7.1: Metaphorical representations of psychological concepts in students and their relation with verbal and nonverbal intelligence. *Yanina Ledovaya & Ksenia Mikhalchenko* (46)
3:40 – 4:00 PM	T7.2: Emotional intelligence mediates the relationship between humour styles and psychological well-being. *Bruce Findlay & Robyn Brown* (40)
4:00 – 4:20 PM	T7.3: Climatic variability, group selection and dysgenics: Testing a multi-level selection model. *Michael Woodley et al.* (57)
4:20 – 4:40 PM	**Announcement of ISIR Best Poster Award**
	Announcement of ISIR Prize for Best Student Paper
	Announcement of John B. Carroll Award for Research Methodology

POSTERS

Abstracts are organized in alphabetical order

The Rule-Dependence Model: a New Model for Secular IQ Gains

Elijah Z. Armstrong[1], Michael A. Woodley[2]

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[2]*Umeå University*

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Novelty. The audience will learn about a theory linking the ability to process rules to the Flynn effect. Beforehand, specific proximate causes of the Flynn effect have been understudied. This presentation identifies a plausible such proximate cause - the ability to process, infer, reapply, and note the existence of repeated patterns or pieces of information (for example, solution rules on the Raven's Progressive matrices). The presentation will cover both general increases in this capacity and exposure to specific rules that are duplicated on IQ tests.

Importance. The rule-dependence model is a possible cause of the Flynn effect, which makes it extremely theoretically important. It also identifies specific environmental factors that may increase rule-processing capacity, and the real-world effects of these factors.

Methods. We found a sample of studies giving Flynn effects on 14 diverse tests and subtests. Using the method of correlated vectors, we found that Flynn effect magnitudes correlated to rule dependence (as rated on a 1-4 point scale) at .597, $p < 0.05$.

The Role of Intelligence on the Human Development

Tatiana A. Badaró

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Novelty. This research has established a link between intelligence and Integral human development. The adopted methodology was a bibliographical research from a survey of the scientific production of the themes involved, characterized, therefore a literature review. The State-of-the-art analysis of these two topics, led to confirmation of initial hypothesis that there is a directly proportional relationship among intelligence and Integral human development, demonstrating that both implicit theories about intelligence as those relating to Human Development tend to be incorporated into the culture as a defining aspect of reality, hence of the socio-educational setting. It is concluded, therefore, that urges the moment that intelligence can be treated as what it really is, a human faculty that allows 1) self-knowledge; 2) easy adaptation to the environment into which it is inserted; and 3) creativity, to then be able to commit the full human development.

Importance. Intelligence is a subject of the psychology of great social impact and therefore is characterized as one of the main themes of the area. Overall, society demonstrates to know concepts and definitions of intelligence, but there is still the question of what intelligence really is and what its main features.

In the early days of scientific study on this topic, dualists such as Descartes, Spinoza and Bayle defined Intelligence as a faculty inherent in the spirit, and one of its highest forms would be the language. The emergence of intelligence is therefore a legacy of evolution, which, again according to this stream, is not a matter of degree or quantity, but a qualitative matter (Khalfa, 1996).

Methods. Our work aims to investigate the contributions of theoretical and practical study of intelligence for the human development, by demonstrating the need, relevance and urgency of the work of intelligence to it, but mostly we propose the implementation of educational activities in educational institutions of any levels for the development of human intelligence.

Therefore we conducted qualitative research as indicated by Rey Gonzalez (1997, 1999, 2004, 2007). It is evident that this was done based on our perception of the apparent change in conceptions of human development on the part of individuals who participated in the course Essays on Intelligence, for this reason this course was chosen by us to be the key point of this discussion.

Expert Opinion on the Causes of International Differences in Intelligence – 2013 Survey of Expert Opinion on Intelligence

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Novelty. We examined expert opinions of the causes of international differences in intelligence using responses from a larger survey (in these questions N≈60; overview on the 2013 survey of expert opinion on intelligence presented in Rindermann et al. at ISIR 2013). In the present study, expert opinions of international and group differences in intelligence were evaluated in the following regions and countries: Finland, East Asia, sub-Sahara Africa, Southern Europe (compared to North-Western-Middle Europe/NWME), Arabian-Muslim World (compared to NWME), Latin America (compared to North America), Israel (compared to NWME), Jews in the Western world, Roma in Europe, and immigrants from the Middle East in Europe. The following causes of international differences in intelligence were evaluated: culture (religion, tradition, etc.), genes (evolution), quantity of education, quality of education, wealth, health, geography, current climate, politics, modernization, sampling error, test knowledge, discrimination, test bias, and migration (the last three with possible negative or positive effects).

Importance. Intelligence research addresses global differences in cultural, political, economic, social and psychological disparities. According to the experts in our sample, the most important causes of international differences in intelligence were quality of education, followed by quantity of education, health, wealth, genes, modernization, culture, test knowledge, politics, sampling error, migration, test bias, geography, discrimination, and current climate. Group differences in intelligence between specific regions and ethnic groups were most strongly attributed to differences in education. Ratings of the causes of intelligence varied across the following countries: Finland (stronger focus on quality of education), East Asia (relatively strong focus on culture, quantity of education, and genes), sub-Sahara Africa (relatively strong politics), Arabian-Muslim World (culture), Roma (culture), Israel (migration, culture, and genes), and Jews (genes and culture).

Methods. The survey of expert opinions consisted of 62 main questions with follow-up questions and space for comments. Experts were sampled from publications addressing intelligence (including Intelligence), cognitive abilities, and student achievement. Notice of the study was emailed to ISIR members and posted to the ISSID homepage, and colleagues were asked to inform other researchers about the study. Only people who received a participation code could participate. The present study was based on responses from about 60 experts to questions concerning international and group differences in intelligence. Experts rated the importance of possible causes of intelligence (e.g., education, genes, and culture) and could provide comments for each item.

Cognitive Performance Following Alcohol and Energy Drink

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Novelty. Alcohol consumption has consistently demonstrated impairment to information processing, particularly demonstrated by an increase in errors made while processing speed remains unaffected. This relationship is characteristic of a speed-accuracy trade-off (SATO). Since caffeine enhances cognitive performance, there is concern that consumers mix alcohol with caffeinated beverages to reverse or mask some of the impairment effects associated with alcohol intoxication. The current study found that alcohol increased [processing errors while reaction time remained unaffected. The addition of the energy drink to the alcohol did not result in any reversal of cognitive impairment.

Importance. If the addition of energy drink to alcohol masks the effects of intoxication, consumers may stay out later drinking more alcohol or even feel capable of driving even though breath alcohol concentrations may be high. Very little research supports the suggestion that the addition of energy drink to alcohol can reverse cognitive impairment caused by intoxication, however, this notion is regularly supported in the media. It is important that consumers are aware of the cognitive effects to avoid any false expectations.

Methods. This study used a factorial, double-blind, placebo-controlled and crossover design. Participants were randomised to a treatment sequence consisting of alcohol (0.6 g/kg) energy drink (250 ml), alcohol and energy drink (0.6 g/kg and 250 ml) and placebo. Participants completed an array of computerised cognitive tasks at baseline and 45, 90 and 180 minutes post treatment.

Emotional Intelligence and Scholastic Achievement in Preadolescent Children

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Novelty. The results of the current study shows that Emotional Intelligence, a particular type of intelligence based on Mayer and Salovey's (1997) model, can be reliably measured in pre-adolescent children. Emotional Intelligence was also shown to relate to important educational outcomes for pre-adolescents such as their scholastic achievement overall and specifically in literacy and numeracy.This is the first study showing a relationship between an ability based measure of EI for pre-adolescents and scholastic performance. This suggests that basic emotional processing abilities are important for the development of knowledge.

Importance. We now know that Emotional Intelligence can be assessed in preadolescent children and that this assessment relates to important educational outcomes. This knowledge can help in the assessment of children's Emotional Intelligence as part of a holistic assessment of their education development. The ability to assess Emotional Intelligence in pre-adolescent children also allows us to assess the impact of Emotional Intelligence development programs for this age group. Improving educational attainment in primary school children is a vital area for educational psychology and the community in general.

Methods. The study was correlational in nature, investigating the association between branches of children's Emotional Intelligence and outcomes of scholastic performance. Significant positive correlates were found between all scholastic achievement variables (literacy, numeracy, overall achievement) and the 'Understanding and Analysing Emotions' branch of the model, suggest that Emotional Intelligence is related to scholastic achievement in this age group.

Investigating Causal Direction in Neuroimaging Studies of Cognitive Ability; an Application of non-Normal Structural Equation Modelling

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Novelty. The current paper discusses the flow of causality from neuroimaging markers to performance on cognitive ability measures. We discuss the use of non-normal structural equation modelling (nnSEM) as a method for explicitly testing the assumption that the brain is a primary causal agent of cognitive performance. nnSEM uses higher order moments to identify models which would not be comparable using conventional SEM or regression methods. We demonstrate nnSEM using the example of white matter lesions and processing speed. It is generally assumed that the increased presence of white matter lesions, specifically here in ageing, is one of the causal drivers of decline in cognitive performance. Using data from the Lothian Birth Cohort 1936 (n=650), nnSEM models suggested that the best fitting, and thus most plausible causal model, was one in which white matter lesion volume predicted simple reaction time mean score.

Importance. Researchers often wish to provide causal interpretations in the presence of cross-sectional associations. This is not possible. Whilst the use of nnSEM cannot prove causality, it provides a methodology which, when data are suitable, can discern between competing models which posit competing causal hypotheses. The current paper provides a proof in principle of such an application.

Methods. The current work makes no explicit claims, but presents nnSEM as a potentially useful methodology for assessing the causal direction of cross-sectional associations between neuroanatomical variables and cognitive ability. nnSEM is a relatively new methodology which is yet to be widely applied in research contexts. We suggest here that some neuroimaging and cognitive variables are meaningfully skewed and or kurtotic, making this area of research one which is suited to applications of nnSEM. We acknowledge and discuss some limitations with the method which requires further research through simulation studies.

The Cognitive Enhancing Effects of Acute and Chronic Curcumin Supplementation in a Healthy Elderly Population

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Novelty. Around the world millions of people take dietary supplements in an attempt to improve health, mood and cognitive function. Curcumin, a polyphenol found in the spice turmeric, has been shown to exhibit a great variety of health benefits which may extend to improving cognitive function.

To our knowledge this is the first study to investigate the potential cognitive enhancing effects of curcumin supplementation in a healthy elderly population. This poster will present findings showing acute and chronic facilitatory effects of curcumin supplementation on working memory and attention resulting in improved task performance. Curcumin supplementation may also reduce the strain of undertaking cognitive demanding tasks.

Importance. It is predicted that by 2050 approximately one third of the population of more developed nations will be over the age of 60. However it has been estimated that in the United State alone 2.3 million community dwelling adults over the age of 65 suffered limitations caused by cognitive impairment. Age related cognitive decline and age related conditions such as dementia are known to have a multifactorial etiology. Therefore therapeutics that show multiple modes of action, such as nutraceuticals, may be superior to traditional, single target pharmaceuticals in treating of such conditions. The findings of this study have valuable real world applications as they suggest that curcumin may represent readily available therapeutic agent for improving cognitive function and by extension quality of life among our growing elderly population.

Methods. This study used a randomized, double-blind, placebo-controlled design, allowing us to conclude that the benefits found with curcumin supplementation are over and above those a placebo. Assessment of cognitive functions was carried out using standardized, computerized tasks known to be sensitive to changes in cognitive function.

Outliers Matter, Distance-Based Weighting Helps: Some Examples Based on Speed-Ability Associations

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Novelty. Most of the statistical analyses applied within the field of intelligence research mathematically involve the computation of correlations between variables. However, the question of how to choose a correlation coefficient that is robust to outlying values and noisy observations is, by itself, an important methodological issue. This poster introduces a distance-weighted estimator of correlation and compares its behavior to that of conventionally used coefficients. The presented examples include empirical RT-IQ correlations as well as the results of the simulation studies.

Importance. This poster presentation provides examples of why the choice of an estimator matters in studies of speed-ability associations. First, it compares the magnitudes of the RT-IQ correlations obtained using different estimators. Second, it questions whether certain tendencies, such as the worst performance rule (an observation that the RT-IQ correlation is higher for the slowest reactions than it is for the fastest reactions obtained for the same task), are sensitive to a particular measure of correlation used in the analysis. Third, it uses simulation studies to analyze the behaviors of different correlation coefficients, including distance-weighted correlation, under conditions that are plausible for empirical distributions of the RT and intelligence scores.

Methods. Contrary to the commonly recommended robust methods that essentially implement some kind of truncation of the original distribution, distance-based weighting considers all observations while emphasizing those that lie close to each other and the downweighting distant data points. Hence, distance-based weighting does not use any statistics as input information, does not require an arbitrary threshold delimiting outlying and inlying values, and does not produce any controversy on the number of observations to be downweighted. The simulation results that are shown in this poster suggest that the distance-weighted correlation is at least no worse in its behavior under various noise conditions than the measures commonly recommended as robust statistics.

Cross-Cultural Validity of IQ Tests among African Children: Artificial or Accurate Measure of Intelligence?

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Novelty. My research work demonstrates that Western standardized IQ tests are not valid measure of intelligence across cultures.

The purpose of this study is to examine whether commonly used intelligence tests such as the Ravens Progressive Matrices are valid indices of cognitive functioning among children in Mali, Africa where previous research indicate significant sub-average intelligence, below 70. No studies have yet ventured to examine if any correlation exists between IQ score, achievement score and adaptive functioning level. The Woodcock-Johnson will be used measure their academic achievement. The Vineland Behavior Scale(VABS) will be used to indicate their adaptive functioning level. In the proposed study, tests of IQ will be compared against adaptive functioning and academic achievement, to examine whether IQ scores measured among African populations are artificially lowered or are an accurate measure of performance.

Importance. As we may know racial differences in intelligence has been by far one of the most intriguing and contested subject of a protracted discussion since the inception of standardized cognitive tests one about hundred years ago. While decades of research studies consistently show that average IQ lies below 70 in Sub-Saharan Africa (e.g, Nissan, Machover, and Kinder, 1935;Laroche, 1959; Boissiere, Knight, & Sabot 985; Fernandez-Ballesteros; Juan-Espinoza, Colom, & Calero;1997), yet no studies have ventured to examine the significant discrepancies between individuals' subaverage IQ scores and their adaptive functioning level in Africa. The question of whether IQ scores measured among African populations are artificially lowered or are an accurate measure of performance is rather important. One important consideration in this study is the social and political implications.

Methods. Approximately 200 children were recruited from a school district in Mali, West Africa. The sample was constituted of 200 African children ranged in age from 6 to 14 years old.

Three measures were used:

- Non Verbal IQ Test: Raven's Standard Progressive Matrices (RSPM)
- Adaptive Functioning Scale: Vineland Adaptive Behavior Scale (VABS)
- Achievement Test: Woodcok-Johnson (Math section)

Proposed statistical analysis: Paired-samples T-tests to compare Ravens and Vineland scores. Also multiples regression to examine how the Ravens scores, Vineland and demographics predict the WRAT math scores.

Low Levels of Lead Exposure May Impact Children's General Intelligence

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Novelty. It is already well established that exposure to lead has a negative impact on the development of intelligence. However, until recently there has been wide acceptance that levels of exposure below a concentration 10 micrograms per decilitre of blood does not constitute a risk to normal childhood development. Our results suggest that there may be no safe level of lead exposure.

Importance. Extensive evidence supports the critical importance of general intelligence as a major predictor of academic achievement and subsequent job performance. If subsequent research confirms an effect on IQ of even very low levels of exposure to lead, this will have profound implications for the long-term protection of populations living in lead-contaminated environments.

Methods. Participants were 106 children (mean = 8 years, SD = .6) and their parents living in two Australian communities where lead mining and smelting remain a source of exposure. Data were collected on a wide range of cognitive measures, including Wechsler scales and Raven Progressive Matrices for adults and children, several subtests from the Woodcock Johnson-III (children only)and other tests selected to represent the CHC model of cognitive abilities. Measures also included a range of potential social and environmental confounding factors. An unadjusted curvilinear continuous trend (correlation = -.31; $p < .001$)was found between children\'s blood lead levels and a general factor extracted from the battery of cognitive tests, suggesting that there may be no threshold safety level for exposure to lead during childhood. In covariate adjusted analyses consistent findings emerged, suggesting that even low level lead may detrimentally impact the cognitive development of children, in particular speed of information processing and long term storage and retrieval.

Bacopa Monnieri in Child and Adolescent Populations with and without Developmental Dysfunction

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Novelty. The Ayurvedic medicinal system is becoming more popular in Western medicine. Bacopa monnieri has been used in the Ayurvedic medicinal system for approximately 3000 years and is classified as a medhyarasayana, a drug used to improve memory and intellect (medhya). To date clinical trials in Western research using Bacopa have focused on adult populations in acute and chronic settings but very few have looked at a younger population and its possible benefits. A recent systematic review completed by the authors covers every clinical trial that has looked at Bacopa monnieri and its effects on the child & adolescent population. The review explores how efficacious Bacopa has been in terms of improving developmental dysfunction and increasing areas of cognitive function in the younger population.

Importance. Complementary and alternative medicines (CAM) are a common treatment avenue for parents to take for their children who might be struggling with school work, social situations, behavioural issues, developmental delay or even mild to moderate learning difficulties. Although there is an aura of safety surrounding the use of natural products to relieve symptoms associated with certain disorders, the safety and tolerability research into many of these products has been far from conclusive. Half of all parents with children diagnosed with attention-deficit/hyperactivity disorder (ADHD), will give their child CAM without the proper consultation of their child's physician. There is a need for greater restraint in the field of natural medicine to ensure the benefits and risks of every vitamin, plant extract, and natural compound can be elucidated through research and the replication of results, to ensure the safe treatment of the child and adolescent population.

Methods. The aim of current review was to summarize and assess the data from clinical trials of Bacopa monnieri and its effects on the mental health of children and adolescents. Each trial involving Bacopa monnieri in any form will be looked at in terms of its extraction process, its overall weight (mg), the percentage of bacosides in the extract (the suggested mechanism of action), the intervention time period, the population of children and adolescents on which it is being tested (clinical or non-clinical group), and the impact of any other extracts if in a combination formula. The main outcome will be the safety and tolerability of the extract being used, whether any side-effects (if any) were reported.

What one Intelligence Test Measures: the Distinct Roles of Working Memory and Rule Induction in Matrix Reasoning

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Novelty. The solution process underlying problems from Raven's APM has been conceptualized to consist of two subprocesses: rule induction and goal management. The present research aims at giving an answer to the question whether both of these subprocesses are related to working memory capacity. This was done by testing whether the correlation between Raven's APM and working memory tasks can be artificially raised by eliminating the subprocess of rule induction. The experimental design included a variation of the instructions to Raven's APM which already gave the rules necessary to solve the problems, hence making rule induction unnecessary. An effect of the rule induction affordance on the correlation between APM and working memory was confirmed in a sample of 644 secondary school students. The results suggest that the solution process in the APM is twofold (at least), and that one of the subprocesses (goal management) does almost exclusively rely on working memory capacity whereas the other (rule induction) does not.

Importance. The research that has linked working memory to gf has, to this point, mainly focused on the part that is not involved in generating rules. That is, prevailing accounts for this relationship envision some sort of information processing that involves storage, maintenance, inhibition, supervision, attention, or updating but none of these accounts can explain how a mental representation of a rule or abstract relationship is actually formed. It lies in the nature of working memory tasks that they are free of inductive processes. That is, in typical working memory tasks the participants are fully informed about the task and about the relation of the task material to a correct response. In our view, this aspect is fundamentally different from intelligence tests like the APM, where the relationship among elements is unknown to the subject.

Methods. The study combines methods from differential and cognitive psychology jointly in an experimental design. The design allows for the manipulation of a narrowly circumscribed subprocess in matrix reasoning. Teaching the rules needed to solve the problems, should make the induction of these rules unnecessary. Participants should be able to recall the rules, so they would just have to verify if any is applicable to the problem at hand and then store the intermediary result before going to the next problem. The downside of the methodology though is that a rather large test power is required to detect the predicted changes in the correlation. As a result of a test power analysis we aimed at recruiting at least 600 subjects.

Adolescent Peer-Relations and Emotional Intelligence

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Novelty. Research into schoolyard bullying has highlighted not only the undesirable prevalence of bullying behaviours exhibited by adolescents but also the associated adverse consequences. In order to better understand bullying behaviours, a pilot study was conducted to examine for the first time the relationship between emotional intelligence (EI) of adolescents, bullying behaviours and peer victimisation. Results of the study indicated that the EI dimensions of Emotions Direct Cognition and Emotional Management and Control, significantly predicted the propensity of adolescents to be subjected to peer victimisation. The EI dimension of Understanding the Emotions of Others was found to be negatively related with bullying behaviours. A larger study subsequently provided support for these findings.

Importance. The implications of these findings are particularly important in terms of managing bullying and peer victimisation within schools. The findings suggest that measures of EI may be utilised to identify students with lesser developed EI competencies. Using this information, schools may be able to identify students at greater risk of being subjected to peer victimisation. The ability to identify students at greatest risk of peer victimisation may allow for more targeted, accurate or timely intervention to protect the student from the potential harmful consequences that are associated with exposure to bullying. The ability to identify students at greater risk of being subjected to peer victimisation may also assist in the development of improved anti-bullying programs in the educational setting.

Methods. Initial correlational analysis revealed that self-reported Understanding of Emotions was significantly correlated with self-reported engagement in bullying behaviours. Further to this, a regression analysis of self-reported EI and peer relations found that the EI factors Emotions Direct Cognition and Emotional Management and Control accounted for a significant amount of variance in self-reported experience of peer victimisation.

Investigating Relationships between Cognition and Life History in a Sample of 6364 Individuals

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Novelty. A recent meta-analyses shows that life history and intelligence do not correlate at the level of latent variables (Woodley, 2011). An objection to this is based on the observation that most studies involve student convenient samples and are therefore nor population representative. Here, we explore the relations amongst a higher order cognition factor (Gc) comprised of a general creativity measure (CAQ) and a fluid intelligence measure (WMT) and a super-K factor comprised of subjective health, GFP, and the mini-K. We utilised a large twin sample (N=6364 Swedes) as the basis for creating one replicate for each group of twins in a pair. We found significant but small correlation magnitudes (.06,.07) between Gc and Super-K. Interestingly, fluid intelligence correlated negatively and significantly (-.04) with mini-K. The GFP was a significant predictor of CAQ (.17,.18) as was mini-K (.09,.07). GFP did not correlate with WMT and health correlated with WMT in only one sample (.03,.06). Health did not correlate with CAQ (-.01,-.02). These results are in line with results of meta-analysis.

Importance. Never before have life history and intelligence been studied in such a large individual differences sample. These findings indicate that contrary to predictions from differential K (i.e. that g and K should be significantly and substantively correlated) what correlations exist whilst, for the most part in the theoretically expected direction (with the exception of fluid intelligence and mini-K), are of a magnitude equivalent to that found in the meta-analysis of Woodley (2011) which supports the idea presented there that life history and cognition are largely distinct sources of individual differences in behaviour.

Methods. We used correlative analysis to explore the nomological network of associations between cognition and life history in two very large samples. Most previous research into the question have been correlative in nature owing to the small effect sizes typically recovered. Are findings are in line with these previous analyses hence the methods are sound.

Cognitive Abilities, Self-Regulation and Academic Achievements of Gifted Students

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Novelty. There is a well-known fact: intellectually gifted pupils may have poor academic achievements. The reason might be low level of their self-regulation (SR). The aim of the study was to investigate the relationship between psychometric intelligence and conscious SR of learning activity and its effect on academic achievements of gifted students.

A comparison of intellectual and regulation characteristics showed that gifted adolescents have higher levels of conscious SR.

The correlations between academic achievements and SR were slightly lower than correlation coefficients between academic achievements and intelligence, but were found in all major subjects. High academic achievements correlated positively with well-developed SR and personal characteristics (initiative and autonomy). Dependant students and students with no initiative were inferior to their peers in terms of verbal and mathematical intelligence, level of conscious SR and general level of academic achievements. Regulatory properties (initiative and autonomy) were the link between motivation, intelligence, and SR system.

Importance. We take interest in the problem of gifted children's low achievements for a reason. The results of our investigation make it possible to predict and optimize their training activities and to offer the psycho-educational recommendations to improve the learning process.

Low levels of conscious SR, as well as impulsivity, disorganization and lack of attention factors (Reis, McCoach, 2002), may prevent gifted students from fulfilling their intellectual and creative potential.

The intellectual level of gifted students is high as it is. That is why we think that the key for improving their academic performance is to focus on developing their self-regulation of learning activity. Students, who take initiative in learning process, achieve high results. It was proved that developing SR results in increase in verbal, mathematical, and, as a consequence, the overall levels of intelligence. Which leads to increased academic achievements in all major disciplines.

Methods. The study was carried out on a sample of 87 gifted and 360 "normal" students aged 14-16 years.

We used the following methods:

Questionnaire of self-regulation in learning activity (Morosanova at al., 2011) allows assessing regulatory processes and features, such as goal planning, modeling of goal-achievement conditions, programming of actions, results evaluation, regulative flexibility, independence, reliability and responsibility.

The Russian version of the Munich cognitive abilities test for gifted students - KFT (Kognitiver Fähigkeit Test). This test is designed for students who are two years ahead of their peers in general intelligence level and mental abilities. The test involves three scales - verbal (V), math (Q) and nonverbal (N).

We used the final exams results to assess academic achievements of our sample.

Challenging the Intelligence Compensation Theory: are Conscientiousness and Intelligence Really Negatively Correlated?

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Novelty. A consistently observed negative association between intelligence and conscientiousness has been explained in terms of an 'intelligence compensation theory' whereby higher conscientiousness develops in compensation for lower cognitive ability. In the present study we tested the hypothesis that a better explanation for previous observations of a negative association is the use of selected research samples which are comprised of participants with levels of educational and occupational attainment above certain thresholds. The associations between the traits in our samples - which were not selected in this way - were either zero or positive. Further, artificially introducing selection into the samples biased the associations between intelligence and conscientiousness in the negative direction. Together, these results are consistent with the hypothesis that the true association between these constructs may be zero or positive at the population level but that the use of selected research samples has resulted in the appearance of a negative association in empirical studies.

Importance. In observational studies it is uncommon for the selection processes leading to the composition of convenience samples to be explicitly considered, even less to be measured and modelled. Unless such selection processes are given due consideration, researchers risk being misled as to the direction and magnitude of the association between IQ and conscientiousness-related traits. This, in turn, can lead to the development of lines of research which are wasteful because they aim to explain what are actually non-existent phenomena.

Methods. Our methods of evaluating the correlation between IQ and our two measures of conscientiousness (the MPQ Scales of Control and Achievement-Striving) were designed to mimic the methods that have previously been employed in studies finding negative associations between IQ and Conscientiousness. Thus, we used Pearson's correlations between the scale scores on the personality measures and IQ. The primary methodological advantage of the current study was the ability to introduce selection into a sample which was unselected for the traits of interest. We did this by discarding all individuals who were below progressively increasing thresholds of educational or occupational attainment in order to mimic processes of selection into populations (e.g. undergraduate students, or assessment centre participants) to some degree dependent on educational or occupational attainment.

An Investigation of the Influence of Antioxidant Defense Genes on Cognitive Ability in Older Individuals

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Novelty. Previous research has indicated that increased oxidative stress is associated with poorer cognitive performance and ability. Oxidative stress tends to be more pronounced in older individuals, possibly due to dysregulation and poorer control of the maintenance of optimal oxidative levels. Supplementation with antioxidants has shown some promising improvements to cognitive performance, but more research is needed to investigate the body\'s own endogenous antioxidant defense mechanisms. Genetic variation within antioxidant defense genes may mediate the cognitive ageing process and predict variability in cognition and biological ageing parameters.

Importance. Old age is associated with declining cognitive abilities and increased risk of neurodegenerative disorders. Since populations around the world are living longer, determining possible risk factors related to poorer cognition in later life is important. While research suggests oxidative stress is associated with the ageing process, more research is needed to explore the possible mediating role that antioxidant defense genes play in the cognitive ageing process. Since the selected genes are related to antioxidant defense this research may help with the future development of interventions as well.

Methods. A wider range of cognitive tasks is being utilised than in previous research. This will enable better determination of which cognitive abilities are most sensitive to genetic effects. The selected SNPs have previously been associated with cognitive performance in older people, and there is the addition of being able to investigate oxidative stress markers as well.

Does Education Boost General Intelligence (G) or Specific Cognitive Abilities?

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Novelty. Previous studies using causal methods have shown that education raises cognitive ability, but the mechanism of its influence is unclear. Here, we tested whether education is associated with cognitive test score improvements via general cognitive ability (g), or via specific cognitive skills. Results from structural equation modeling of data from a large, longitudinal sample, with a measure of IQ at age 11 years and ten tests covering a diverse range of cognitive abilities taken at about age 70, indicated that the association of education with improved cognitive test scores is not mediated by g, but consists of direct links to specific cognitive subtests.

Importance. Given the importance of g in everyday life, it is extremely useful to know whether it can be improved via environmental inputs such as education. Our results showed that education did not raise g, but we argue that the domain-specific effects of education are still an important benefit. Thus, our study has the potential to defuse some of the perceived conflicts between intelligence researchers and educationalists: the two ostensibly opposing conceptualizations, of a largely general cognitive ability and a malleable IQ score, are not mutually exclusive.

Methods. The relationship between intelligence and education has been difficult to investigate in most samples, due to issues of confounding and reverse causality. To address these issues, we used a large, longitudinal sample (the Lothian Birth Cohort 1936) with IQ measured early in life and a wide range of cognitive tests (which provided a representative g-factor) taken in later life. We modelled this data using structural equation modelling, and so were able to compare complex models of education, g, and specific abilities.

Emotional Intelligence, Victimisation, Bullying Behaviours and Attitudes: a Replication and Extension

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Novelty. This study extended the literature through an examination of the relationship between attitudes towards bullying and Emotional Intelligence (EI) on outcomes of bullying, victimisation, and pro-social behaviours.

As a replication and extension of a 2012 pilot study, the present study built on the prediction model of levels of victimisation with the EI variables and attitudes towards bullying. The skills involved in management and control of emotions and attitudes towards bullying were observed to be significant predictors of victimization.

Results from this study also revealed significant associations between bullying, victimisation, pro victim attitudes and the EI dimensions Emotion Recognition and Expression (ERE), Emotion Management and Control (EMC), Understanding the Emotions of Others (UEO) and Emotions Direct Cognition (EDC).

Importance. In the context of adolescent development, EI has been suggested to be integral for successful social interaction (Romasz, Kantor & Elias, 2004), with more highly evolved EI skills serving to enhance emotional awareness, coordinate decision making and improve conflict resolution.

These results reinforce previous school based EI research findings in consistently showing that EI not only has significant associations with bullying and victimisation but is also a significant predictor of the propensity for peer victimisation and problematic behaviours (Downey et al., 2010; Lomas et al., 2012).

Investigation of the influence of EI and pro-victim attitudes on victimisation further revealed significant independent contributions to the prediction model of victimisation.

The results of this study have overall implications for the management and education of bullying and victimisation in secondary schools.

Methods. This study used three self-report measures to test its hypotheses. EI was measured using the adolescent version of the Swinburne University Emotional Intelligence Test, a validated EI measure reported to have high reliability for total EI (Luebbers et al., 2007).

Bullying behaviours were measured using the Peer Relations Questionnaire (Rigby & Slee, 1993).

Attitudes to Bullying were measured via the Shortened Version of Rigby and Slee's (1991) Attitude to Victims Scale, a reliable measure of the degree to which a person justifies bullying behaviour, supports bullies and their desire to reject children who are victims of bullying based on supposed weakness (Rigby & Slee, 1991).

Correlation and regression analyses indicated that adolescents' understanding of others emotions and recognition and accurate expression of emotions were predictive of engaging in pro-social behaviours.

A Preliminary Study Investigating the Effects of Resveratrol on Cognitive Function

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Novelty. There is evidence from preclinical studies, epidemiology and human clinical trials suggesting beneficial effects of resveratrol to systems underpinning cognitive function. Nevertheless, direct evidence of cognitive benefits from resveratrol has proved elusive. This pilot study compared mental performance in an older cohort following red wine alone or enriched with resveratrol wine. The results suggest that there are differential effects of the treatments depending on the type of task.

Importance. Over the past decade evidence has steadily accumulated suggesting that there is a j-shaped relationship between the consumption of alcoholic beverages such as wine and cognitive function. Cognitive function is defined as the intellectual or mental processes by which knowledge is acquired, including perception, attention, working memory, secondary memory and executive functioning. Cognitive functions underpin thought processes including reasoning, acts of creativity, problem-solving and possibly intuition. Dementia is a form of cognitive dysfunction whereby an individual loses the capacity to think, remember and reason due to physical changes in the brain. Currently, there are few options for the treatment of cognitive dysfunction and dementia. Simple dietary measure such as moderate wine consumption to supplement a healthy diet and exercise routine, or as an adjunct to prescription medicines when appropriate, are thus needed to maintain an ageing population.

Methods. The present study investigated the effects of a daily moderate dose of resveratrol-enhanced red wine on mood and cognitive performance in older adults using a placebo-controlled, double-blind and crossover design. Participants were randomised to consume 100 ml red wine and 100 ml resveratrol-enhanced wine over two testing sessions. Participants completed a cognitive demand battery and had blood samples taken at baseline and 45, 90 and 120 minutes post treatment.

Knowing the Knowing: Exploring the Relationship Between Metacognition and Intelligence

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Novelty. Metacognition (MC) can be defined as an individual's knowledge about their own cognitive structure or processes and having the ability to organise their structure (Akturk, 2011). Commonly examined in the context of learning situations, MC is less examined within the context of cognitive ability task performance. With this in mind, a good candidate, Raven's Progressive Matrics (RPM) presents an opportunity to examine individuals' MC related to their own performance. Due to the nature of the task whereby matrices can be solved through identification of relationships, it is well-suited to analysis of this kind. One hundred participants completed the RPM followed by an adapted MC Questionnaire specifically designed to be used in relations to RPM. Of the various sub-components of metacognition, Knowledge about Strategies significantly predicted RPM performance. In addition, self-ratings of confidence level having provided correct solutions also significantly predicted RPM performance.

Importance. Relatively few studies have examined the completion of intelligence test in relations to participants' awareness of their own cognitive structure and processes. The basic question of whether having knowledge about one's own cognitive structure and being able to organise that structure is beneficial to intelligence test performance has rarely been explored. Uniquely this opportunity arose due to the design of this particular intelligence test – Raven's Progressive Matices. Other tests, by comparison, tended to be more varied in terms of content, and format, making such studies more difficult. Ultimately, this study may be helpful in identifying or characterising individuals who performs better on intelligence tests compared to those who performed less well. It will also contribute towards knowledge about components underlying intelligence.

Methods. This is one of very few studies that examined metacognition within the context of intelligence test performance. More often, metacognition is examined within the context of learning, for example most recently, in foreign language achievement (e.g. Pishghadam & Khajavy, 2013). Through this study, it was found that having the knowledge about strategies predicts better outcome in terms of intelligence test performance. In contrast, other subcomponents of metacognition such as Knowledge about Tasks did not predict intelligence test performance. This study utilised a metacognition questionnaire that has been specifically adapted to suit the task (Raven's), rather than a generic learning-related metacognition questionnaire. The use of this method therefore enabled examination of data that is related to the task at hand.

The Chronic Effects of Bacopa, Pycnogenol and an Antioxidant/Micronutrient Combination Formula on Cognitive and Cardiovascular Function in a Healthy Older Population

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Novelty. A number of biomarkers and physiological processes involved in the ageing brain are associated with measurable changes in cognitive abilities. The current study seeks to examine markers of changes in cognitive abilities in an older population, utilising a number of cognitive tests and biological (cardiovascular, biochemical and genetic) measures.

With Australia's ageing population, interventions capable of ameliorating age-related neurocognitive change are becoming vital areas of research. Natural supplements such as Bacopa Monnieri and French Maritime Pine Bark extract have demonstrated positive effects on cognition-relevant mechanisms and in cardiovascular health.

The current study examines domains of cognitive abilities in this population, and whether nutraceutical supplementation elicits improvements to areas of learning, memory and attention. Further, the mechanisms through which these improvements are observed are also investigated.

Importance. No such studies have comprehensively examined markers of ageing and cognitive performance in a normal older population. The literature points to a need to explore the efficacy of bioactive constituents and a rigorous methodological approach that best informs researchers and consumers seeking cognitive benefit over the life span.

Methods. The study employs cognitive tasks over several visits over 52 weeks: measures involving speed of information processing, decision-making time, working memory and memory consolidation. It involves the biochemical analysis (select SNPs, telomeres, C-reactive protein, F2 isoprostanes, immunological measures), cardiovascular (blood pressure, arterial stiffness, blood flow, HDL and cholesterol), also measures of personality and intelligence (WASI, MMSE, NEO-FFI). All these measures have been utilised previously in relevant literature designed to investigate the variables relating to cognitive abilities and performance.

The three interventions used in the study (Bacopa monnieri, French Maritime Pine Bark Extract, and a novel micronutrient blend) have been associated with improvements in cognitive ability, mood, and cardiovascular health.

Effects of Alcohol Consumption on Academic Performance

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Novelty. Alcohol consumption can have various negative effects on the daily life of students, and result in not attending lectures and poor academic performance. Increased alcohol consumption has been related to poor academic performance among US students, but European data on this relationship is scarce and yielded inconclusive results. This study examined the relationship of alcohol use and misuse with academic performance of two Dutch student samples, and examined potential moderating factors such as gender or being member of a fraternity.

Importance. Alcohol abuse is a significant problem, especially among the student population. This study showed that alcohol consumption is negatively associated with academic performance, especially in male fraternity members. This knowledge is important to make students aware of the consequences of consuming too much alcohol.

Methods. Two surveys (N=1248)were conducted among Dutch university students in the cities Nijmegen and Utrecht. Weekly alcoholic consumption was recorded and the number of study credit points they earned over the past year. Students were divided into five different drinking groups (0, 1-14, 15-21, 22-42 and over 42 weekly alcoholic drinks).

The drinking groups differed significantly on number of study credit points ($p<0.0001$). Paired comparisons showed no significant difference between non-drinkers and those who consumed less than 21 alcoholic drinks a week. The other groups differed significantly from the non-drinkers ($p<0.004$). A significant negative correlation was found between the number of weekly alcoholic drinks and the earned study credit points ($r = - 0.260$, $p< 0.0001$). Males and members of fraternities or sororities consumed significantly more alcohol ($p<0.0001$), and earned significantly less study credit points ($p <0.0001$) when compared to females and non-fraternity members.

Structure of the Woodcock-Johnson III Cognitive in a Clinical Sample

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Novelty. The Woodcock-Johnson Tests of Cognitive Abilities III (WJ-III) are based on the Cattell-Horn-Carroll (CHC) theory of intelligence, which combined the Gf-Gc cognitive theories of Horn with the three-stratum theory of Carroll. The WJ-III purports to measure 7 broad cognitive abilities and one higher-order ability. Alignment of the structure of the WJ-III with its theoretical structure would provide evidence of structural validity. Many prior investigations of the WJ-III have applied confirmatory factor analysis (CFA) to data from the normative sample. Results have consisently supported the CHC structure. Some researchers have suggested that the WJ-III has been over-factored and should be analyzed with exploratory factor analytic (EFA) methods. However, there are few studies that have investigated the structure of the WJ-III among clinical samples and few investigations have included EFA methods. The current study will apply both EFA and CFA methods to WJ-III data from a clinical sample to determine if the structure of the WJ-III is consistent with CHC theory for these children.

Importance. The WJ-III is widely used in schools and clinics with children and adolescents referred for assessment to determine their eligibility for special education services. Its interpretation is based on theory and CFA results from analyses of the normative sample. Recent EFA analyses of the WJ-III school-aged normative sample failed to confirm the CFA model (Dombrowski & Watkins, 2013) and some researchers (Frazier & Youngstrom, 2007) have suggested that the WJ-III is over-factored. Additionally, children referred for evaluation differ in many ways from children who are not experiencing academic or behavioral problems. Another recent study applied CFA methods to data from students with learning disabilities and a matched sample of students without disabilities and was unable to achieve full measurement invariance (Benson & Taub, in press). Consequently, the structure of the WJ-III must be confirmed among clinical samples to allow confident use of the instrument with those children.

Methods. This study included 529 participants who were 6 to 13 years of age (M = 9.47, SD = 1.81). Of the 528 participants whose gender was specified, 62% were male and 38% were female. Participants\' race/ethnicity was around 49% white, 32% Hispanic, 8% black, 5% native American, 3% multiracial, and 3% other. Educational diagnoses included 69% with learning disabilities, 11% with speech impairments, 10% with other health impairments, 5% without a disability, 3% with emotional disabilities, and 2% with a variety of other diagnoses (e.g., autism, orthopedic, etc.). The WJ-III standard battery claims to measure 7 broad ability constructs with 7 tests whereas its extended battery claims to measure the same constructs with 14 tests. Scores from the 14 extended battery tests were included in these analyses. Both EFA (following the procedures detailed by Carroll as well as those recommended by Frazier and Youngstrom) and CFA methods were applied to ascertain the structure of this data. Results from both factor analytic methods will be reported.

Neurocognitive Effects of Multivitamin Supplementation: a Behavioural and FMRI Study

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Novelty. This research examined both the acute (single-dose) and chronic (4-week) effects of MV supplementation on neurocognition. Two double-blind, placebo-controlled studies examined, for the first time, the neural substrates of these effects using functional magnetic resonance imaging (fMRI) and Steady State Topography (SST). Findings revealed positive effects of acute doses of MV supplementation with guaraná on attentional and working memory processes, with SST recordings showing that MV + guaraná increased neural activity and processing speed while MV alone improved cortical efficiency. fMRI revealed that both supplements increased activation of a well-characterised fronto-parietal working memory network with respect to placebo. The effects of 4-weeks MV supplementation further revealed increased activation during working memory task performance within task-relevant brain regions. These findings describe, for the first time, acute and chronic activation of the human brain following multivitamin administration consistent with benefits to attentional and working memory systems.

Importance. There is growing evidence supporting the potential for multivitamin (MV) supplementation, including those with additional ingredients such as guaraná, in cognitive enhancement. However, there is little known about the mechanisms by which such supplementation may exert these positive effects. Given the widespread use of MV supplements, understanding the potential mechanisms by which MV supplementation may exert such effects represents an important step in fully understanding the impact of MV supplementation.

Methods. Two double-blind, placebo-controlled studies examined the neural substrates of MV supplementation. In the first experiment, healthy adults consumed a MV, a MV with guaraná and a placebo using a balanced, crossover design. The second experiment explored the effects of 4-weeks MV supplementation using a parallel groups design. Neurocognitive effects were explored using functional magnetic resonance imaging (fMRI) and Steady State Topography (SST), whilst mood and cognitive function were also assessed. Double-blind, placebo-controlled studies represent the gold standard in clinical trials design.

INDIVIDUAL PRESENTATIONS

Abstracts are organized in alphabetical order

Names of students eligible for the John B. Caroll Award for Research Methodology and ISIR Prize for Best Student Paper are marked with an asterisk

When Does Socioeconomic Status Moderate the Heritability of IQ? Data from Australia and the USA

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Novelty. When is the heritability of intelligence dependent on socio economic status (SES), and when it is not? US studies largely suggest that cognitive ability is more heritable among those raised in higher socioeconomic status (SES) families. However, the mechanism of this effect is unclear, and the effect may not be universal. We tested for gene × SES interaction effects on Full-scale IQ in 2,307 adolescent Australian twins (mean age 16.2 years). While mean scores in were higher among those from higher SES backgrounds, the magnitude of genetic influences on IQ, constant across the range of SES.

Importance. The heritability of intelligence was high, and unrelated to social status. This suggests that during the development of intelligence, genes multiply cultural inputs supportive of intellectual growth. It suggests also, however, that this interaction can be decoupled from parental SES, possibly via factors such as quality of school provision.

Methods. We used data from the United States (Bates Lewis, and Weiss, 2013) as well as from Australian twins to test for gene × SES interaction effects on Full-scale IQ. The Australian sample is large (over 1000 twin pairs) and representative. We explicit testing of variance components with widely accepted measures of IQ and SES.

Validity of Ability Tilt on the SAT and ACT

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Novelty. This research examined the validity of ability tilt, defined as within-subject differences in math and verbal test scores. Ability tilt was examined using the SAT and ACT, two widely used college admissions tests. The SAT and ACT produce two types of tilt: math tilt, which occurs when math scores are higher than verbal scores, and verbal tilt, which occurs when verbal scores are higher than math scores. Park et al. (2007) examined ability tilt in gifted subjects who took the SAT at age 12 and scored in the top 1%. Math tilt predicted achievements in science, technology, engineering, and math (patents obtained) 25-years later, while verbal tilt predicted achievements in arts and letters (book published). The present study examined the validity of ability tilt in subjects in the normal range of ability. Such subjects are assumed to show less cognitive specialization and lower levels of tilt (compared to gifted subjects), which may decrease tilt effects. The present study also estimated tilt effects after removing g, guaranteeing that tilt effects could not be attributed to g.

Importance. This research extends our prior research on the predictive validity of non-g factors in cognitive tests (Coyle et al., 2013). Non-g factors are unrelated or weakly related to g, which generally explains the predictive validity of mental tests. Ability tilt is a non-g factor in cognitive tests: It is unrelated (or weakly related) to g, yet, as Park et al. (2007) show, it still predicts later achievements. The present study provides further evidence of the validity of ability tilt using a representative sample (rather than gifted subjects) and extracting g with a variety of tests (rather than relying solely on the SAT). After removing g, math tilt correlated positively with math ability (measured using the ASVAB) but negatively with verbal ability, whereas the opposite pattern was observed with verbal tilt. The overall pattern is consistent with investment theories, which argue that investing in the development of a specific ability (e.g., math) improves that ability but weakens competing abilities (e.g., verbal).

Methods. Subjects (N = 1951) and test scores were drawn from the National Longitudinal Survey of Youth, a nationally representative sample of youth in the United States. Test scores included SAT and ACT scores, which were used to calculate ability tilt (math minus verbal scores), and the 12 cognitive tests of the ASVAB, which were used to estimate g. The ASVAB was also used to estimate four abilities (verbal, math, speed, and shop). These four abilities were correlated with ability tilt from the SAT and ACT after removing g, guaranteeing that ability tilt effects were not attributable to g. Thus, the observed tilt effects (which supported investment theories) were attributable to non-g factors, providing further evidence that the validity of cognitive tests is attributable to factors other than g.

Emotional Intelligence Mediates the Relationship Between Humour Styles and Psychological Well-Being

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Novelty. They will be introduced to the associations between humour use, emotional self-efficacy and psychological well-being. There is relatively little known about the relationships between intelligence in general and humour styles, and although there has been some publication about emotional intelligence and humour, self-report scales of emotional intelligence have been criticised on the grounds that people may not accurately assess their own emotional intelligence. This study found that the effects of positive humour styles (affiliative and self-enhancing) and the negative humour style of self-defeating humour on psychological well-being were partially mediated by emotional self-efficacy, a measure of what emotional intelligence people think they have. It also found that social desirability remained a significant predictor.

Importance. Humour use is ubiquitous, and its relationships with well-being have been the focus of some perhaps far-reaching claims. Learning that at least some of this relationship is mediated by emotional self-efficacy gives a more nuanced view of the association. Similarly, the importance of controlling for social desirability when using self-report measures of self-referential constructs cannot be overstated.

Methods. An international sample of 438 participants responded to an online survey including measures of humour styles (Martin et al., 2003), emotional self-efficacy (Schutte et al., 2008), psychological well-being (Ryff, 1989) and social desirability (Marlowe-Crowne, in Reynolds, 1982). The mediational effects were calculated using Preacher & Hayes' (2008) INDIRECT method of multiple regression. Implications of the results will be discussed.

Perceived Workload and Performance in Difficult Nonverbal Cognitive Tasks Predict Academic Achievement

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Novelty. Previous research presented at this conference indicated that, contrary to a faster is smarter claim, high-achieving students sometimes take longer to solve difficult nonverbal cognitive task items. The current study attempted to confirm and further explore these findings with the addition of two difficult dual-task paradigms. The first was a vigilance task under memory load and the second was a dual n-back working memory task. Along with a previously studied battery of cognitive tasks these experiments indicated, once again, that higher ability students took longer to complete difficult trials, and they responded more cautiously in some cases. Further, higher perceived mental workload in very difficult tasks was associated with higher academic achievement and ability, perhaps reflecting a more accurate appraisal of a task's demands by the higher ability students.

Importance. Despite a wealth of information about the relationship between intelligence and academic achievement, relatively little is known about the underlying cognitive components that influence academic achievement in university students. Further knowledge of these underlying processes may allow for the development of shorter, experimentally controlled assessments that can be used to make admissions decisions without measuring learned information.

Methods. Measures of speed, accuracy, and self-reported psychological workload were collected from over 100 participants at a non-selective private university. Each participant completed a 90-minute battery measuring fluid reasoning ability (from a short form of the Advanced Progressive Matrices), reaction time, stimulus discrimination (Frey, 2011), working memory (modeled after Jaeggi, et al., 2008) and attention (Helton & Russell, 2011). Psychological workload was measured at 11 points during the battery using the multidimensional NASA-TLX assessment (Hart & Staveland, 1988). Academic transcript records of grade point averages (GPA) and ACT scores were obtained from all participants, and transformed GPA was regressed onto speed, accuracy, and workload measures to investigate relationships among variables.

An Empirical Test of the Dynamic Mutualism Theory of g

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Novelty. According to the dynamic mutualism theory of the general (g) factor, the positive manifold (and the g factor) is contended to be an epiphenomenon. It is an epiphenomenon because the positive correlations between subtests (or group factors) are theorised to emerge during human development, as a consequence of mutually beneficial interactions between originally uncorrelated cognitive processes. Despite the increasing popularity of the dynamic mutualism theory of g, the theory has not yet been tested empirically.

According to dynamic mutualism theory, the general factor should not be observed in infants and should be observed to increase in strength in very young children.

To test the dynamic mutualism theory of g, the strength of the g factor was plotted across the ages of 2.5 to 90 years (N = 5,200). Although there was an observed increase in the strength of the g factor from the ages of 2.5 to approximately 10.0, the slope was so weak in magnitude that the dynamic mutualism theory of g was interpreted as largely unsupported.

Importance. The competing theories that were tested in this paper (dynamic mutualism versus g factor theory) are fundamental to the manner in which researchers think about intelligence. Also, the dynamic mutualism theory of g has gained a notable amount of popularity since its introduction in 2006. Arguably, it is important that it be tested empirically.

Methods. There are two elements of the method used in this investigation which arguably support the findings/conclusions.

First, very high quality data were used. Specifically, the Wechsler scales normative sample data are arguably second to none with respect to normal population representation. All of the analyses reported in this presentation (N = 5,200) are based on Wechsler scale normative samples.

Secondly, the method used to estimate the strength of the g factor is, arguably, modern, sophisticated, and relatively unambiguous. Specifically, when applied to a bifactor solution, omega hierarchical represents the percentage of true score variance unique to the g factor.

The Structure of Working Memory and How It Relates to Intelligence in Children

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Novelty. This study explored the structure of working memory, and its relation with intelligence in 176 typically-developing children in the 4th and 5th grades at school. Different measures of working memory (WM), and intelligence (g) were administered. Confirmatory factor analyses showed that WM involves an attentional control system and storage aspects that rely on domain-specific verbal (STM-V) and visuospatial (STM-VS) resources. The structural equation models showed that WM predicts a large portion (66%) of the variance in g, confirming that the two constructs are separable but closely related in young children. Findings also showed that only WM and STM-VS are significantly related to g, while the contribution of STM-V is moderate.

Importance. The structure of WM and its relationship with intelligence has not received enough attention in children. In the present study, we found that our data fitted poorly with a unitary WM model, and with two-factor models that were either modality dependent (distinguishing between visuospatial and verbal components) or modality independent (distinguishing between STM and WM). Our findings indicate that children's WM can be well represented by three components, which distinguishes between a WM component and two storage components relying on domain-specific verbal and visuospatial resources. This result is consistent with previous research on populations of developmental age (e.g., Alloway et al., 2009). In addition, we found that STM-VS (typically involving unfamiliar situations) predicts a unique portion of the variance not explained by active WM whereas the verbal component (i.e., STM-V) (typically involving more familiar material) is less relevant. Our results also confirm that WM predicts a substantial portion of the g variance even when the effect of STM is taken into account.

Methods. The method used was particularly appropriate for investigating the structure of WM and the relationship between intelligence and WM. For a start, a large sample of children from 4th- and 5th grades was included. Second, we used a large number of tests of WM tests, which allowed us to test several alternative WM models. Finally, in order to measure general intelligence, we used three tasks (two verbal and one visuospatial task). This allowed us to have a more robust measure of general intelligence which was, for example, not biased toward visuospatial tasks.

Do Functional SNPs Show an Enriched Association for Intelligence?

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Novelty. In the present study we examined the association of intelligence with neuronally-expressed functional Single Nucleotide Polymorphisms (SNPs), i.e. SNPs that alter gene expression and function in the brain. These include promoter SNPs, SNPs that change gene expression via microRNA binding, methylated SNPs and eQTLs: SNPs that correlate with quantitative measures of gene expression. Methylated SNPs and eQTLs were further divided according to their region of activation within the brain, including frontal cortex, temporal cortex, cerebellum and pons giving a total of 10 functional SNP sets. Using subjects in the family-based Generation Scotland sample, we tested whether any of these 10 categories of SNP show significant enrichment for fluid or crystallised intelligence by comparison with non-functional SNPs. Results to date support the idea that functional SNPs significantly enriched for association with both gf and gc compared to SNPs which do not alter gene expression in the brain. We will also present data testing whether this minority of SNPs accounts for the majority of heritability

Importance. Intelligence is heritable and predicts wealth, health and mortality. However, whilst twin studies have demonstrated that a heritable component accounts for around 50% of the variation in intelligence differences, Genome Wide Association Studies (GWAS) carried out to identify individual variants are currently too small to reliably reveal such variants. The next challenge is to identify which genetic variants contribute to variation in human intelligence. If SNPs can be pruned according to their functional role, the power of genetic studies will be enhanced, bringing the prospect of identifying small but true genetic effects on intelligence closer.

Methods. Experimentally validated promoter SNPs were extracted from dbQSNP (http://qsnp.gen.kyushu-u.ac.jp/) with the functional categories of microRNA, methylated SNPs, and eQTL SNPs being based on published literature. These functional SNP sets were analysed using robust statistics using empirical tests of significance based on simulations which account for both average background signal enrichment and preserve the linkage disequilibrium (LD) between SNP statistics. This matching strategy ensures that it is the biological group to which the SNPs belong, rather than extraneous genomic features such patterns of LD which link these functional categories to cognitive abilities.

“Wrecked by Success?” No! Linkages of Career Accomplishment, Health, and Relationship Satisfaction among the Gifted

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Novelty. Career success has long been anecdotally held to cost those who achieve it their personal relationships and their mental and physical health; Freud (1917) coined the phrase “wrecked by success.” Recent popular (e.g., Joiner, 2011) work suggests this idea enjoys widespread appeal, but it has been the subject of little empirical scrutiny. The current study examines the tenability of being “wrecked by success” in the modern economic climate using an intellectually gifted sample drawn from the Study of Mathematically Precocious Youth (SMPY). The pattern of results does not support the idea that achieving noteworthy career success must entail enormous personal cost. Overall, scores on health and relationship items did not covary significantly with objectively measured career success. When significant differences were observed, they tended to favor those who were more successful in their careers (e.g., lower divorce rates, fewer health problems). These findings indicate that intellectually gifted individuals can achieve career success without sacrificing their health and personal lives.

Importance. The modern international economy is distinguished by intense competition and pressure to produce frequent innovations in complex domains, especially STEM (Friedman, 2007). Due to their capacity to analyze and manipulate abstract symbols, intellectually gifted individuals are not only in demand in government, business, and academia, they are also those most likely to consistently be relied upon to push the boundaries of knowledge and skill. Intellectually talented individuals are not some resource to be mined (Benbow & Stanley, 1996), however, and it is appropriate to ask what the physical, mental, and interpersonal costs might be for gifted individuals who are put under intense demands to be successful in their careers. This study asks if gifted individuals handle the pressure put on them to actualize their full potential, or are they "wrecked by success" when they do so? The results of this study suggest they can handle it and that gifted individuals can thrive in their professional and personal lives without sacrificing their mental and physical health in the process.

Methods. Relationships between career success and a wide variety of well-known health and interpersonal measures was examined in a sample of 1,650 intellectually talented individuals (in the top 1% to .5% of ability). Participants were identified in early adolescence using above-level testing and followed-up periodically. Career success was assessed at midlife (mean age = 50), where participants were classified into three “success groups” according to their primary incomes. Participants also completed comprehensive surveys detailing the state of their mental, emotional, and physical health, in addition to their relationship satisfaction and family status. Large sample sizes contribute to the stability of results. The longitudinal nature of the data allows for the examination of the long-term interplay of career success and important personal variables among participants.

Metaphorical Representations of Psychological Concepts in Students and Their Relation with Verbal and Nonverbal Intelligence

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Novelty. Because metaphor is considered to be the very essence of human intelligence capacity, we investigated some characteristics of metaphor creation in connection with the level of verbal and nonverbal components of intelligence. "The essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff, Johnson, 1980, p.6). In our study the task was to create pictographical metaphors conveying the meaning of scientific psychological terms (specialized abstract concepts). The participants were the students of 1st and 4th years.

We distinguish the two objects of research. On the one hand, it is: 1) the relationship of verbal and nonverbal components of intelligence and the accuracy of metaphorical representations of psychological concepts; and on the other hand, it is: 2) the influence of verbalization of the formal definition of a psychological concept on the quality of metaphorical representation.

Thus we aimed to find if verbal or nonverbal intelligence is more important in metaphor creation; and if formal knowledge could help in metaphor creation.

Importance. There are commonsence ideas that metaphor is closely related to creativity. But the study made by our colleague M.Avanesyan showed that the ability to create a good metaphor doesn't relate to the level of creativity (Avanesyan, 2013). We aimed to test if verbal or nonverbal intelligence contribute more into good metaphor creation.

During qualitative analysis we developed two indicator of a metaphor (metaphorical representation) quality – "the meaningfulness of an image" and "metaphoricity" (how far semantically is the idea of a metaphor from the concept itself).

Our results show that:

The main contribution to the accuracy of the meaning of a concept within a metaphor is made by verbal intelligence.

Moreover, nonverbal intelligence doesn't affect neither the accuracy of metaphorical representation, nor the accuracy of formal verbal representation of an abstract concept.

"Metaphoricity" remains an "elusive" indicator: we didn't find its analogues measured by IQ testing.

Verbalization of the definition of a psychological concept doesn't promote improvement of quality of a metaphor.

Methods. The methods we used: 1)to create and to draw metaphors for 3 psychological terms – "insight", "introversion", "sensory deprivation", 2)to give the verbal definitions of these terms, 3)to draw new metaphors 4)nonverbal Raven's IQ test, 5)verbal subtest "Similarities" taken from D.Wechsler's IQ test.

Two experts evaluated the metaphorical drawings in a way similar to D. Wechsler's test system (0 pts–unsuccessful, 1 pt–partly successful, 2 pts-successful).

The idea of qualitative and quantitative analyses of formal verbal representation, as well as the indicator of "the meaningfulness of an image"–were both borrowed from M.A. Holodnaya's method "The integrated conceptual structures", but in the modified way.

By means of one-way ANOVA test we showed the relationship between the verbal intelligence and the quality of formal verbal representation (definition) with "the meaningfulness of an image" (ANOVA, p=0,006, p=0,036).

Wilcoxon's crit. showed the distinctions in the quality of "the meaningfulness of an image" "before" and "after" the formal definition verbalization (p=0,032).

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A Pilot Study of Rare Genetic Variants and G

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Novelty. Various genetic linkage, genome-wide SNP association, and genetic copy number variant studies have investigated genetic variation in cognitive ability, but no studies have investigated genetic rare variants. These may be a potentially important source of genetic variation; exome sequencing studies have already met with success in discovering novel trait-gene associations. Here, we investigate the effects of rare variants on general cognitive ability. 150 unrelated individuals from the Generation Scotland: Scottish Family Health Study were selected for high scores (>2.3 SD from the mean ability score) on a general component of intelligence (g) based on Logical Memory immediate and delayed, Digit Symbol, Verbal Fluency, and Mill Hill Vocabulary test. The DNA of these individuals was exome-sequenced and the frequency of rare genetic variants compared with those from a control sample who scored in the lower to middle range of the g distribution. The results of single-SNP and multi-SNP tests will be presented, including a discussion of the merits of these approaches and their power.

Importance. This is one of the first genetic rare variant studies of general cognitive ability and increases our understanding of the genetic architecture of general cognition.

Methods. Genetic sequencing is expensive, so we were limited to genotyping the high extreme of our sample. But these methods are becoming more affordable. Therefore, these preliminary results will be able to inform our future larger genetic rare variant study design. And the sequencing data can be integrated with existing SNP data to improve genome coverage and potential to identify genetic variants associated with cognitive ability.

Dietary Interventions to Offset Cognitive Decline

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Novelty. Cognitive decline is a feature of the normal ageing process and is exacerbated in Alzheimer's disease. Evidence suggests that vitamin intake and other dietary factors may be important for cognition as individual's age. We propose that the cognitive domains most vulnerable to age-related decline will demonstrate the greatest benefits from dietary interventions.

We have conducted several trials which have investigated the effects of multivitamin supplementation on cognitive performance in older adults. These studies have demonstrated that multivitamin supplementation improved working memory and episodic memory, both processes which decline with age. Measures of brain electrical activity (EEG) confirmed findings that memory was influenced by the multivitamin. Findings suggest that chronic multivitamin supplementation may be effective to improve neurocognition in older adults. The use of both behavioural and brain electrical activity measures of cognition enables a thorough examination of potential mechanisms of cognitive enhancement following dietary intervention.

Importance. With an ageing global population there is an increasing scientific interest in the potential of health and lifestyle interventions to improve cognitive function in the elderly. It is important to clearly differentiate interventions which are not capable of influencing cognitive function from those which have shown small or inconsistent effects due to poor choice of cognitive assessment instruments. Findings from our research into the cognitive effects of multivitamins supports our hypothesis that the cognitive processes which decline with age are most responsive to dietary intervention.

Methods. The trials were randomised, placebo-controlled and double-blind. Cognitive performance was assessed using a battery of computerised memory and attentional tasks and it was predicted that chronic treatment with a combined multivitamin and herbal supplement would enhance the cognitive domains most vulnerable to age-related decline. Measures of working memory and episodic memory were demonstrated to improve following multivitamin supplementation. A spatial working memory delayed response task was also performed during the recording of brain electrical activity (EEG). These results confirmed the finding that memory was enhanced by the multivitamin and suggested that cognitive improvements may be due to an increase in neural efficiency.

Associations Between Creative Achievement in Scientific and Artistic Domains, Intelligence, Personality and Sex

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Novelty. We correlated creative achievement scores (CAQ) from seven domains (Visual arts, Music, Dance, Theater, Writing, Invention, Science) and found positive associations between all domains. A PCA of the CAQ showed two factors with eigenvalues > 1; a general creativity factor (cf1), explaining 29% of the variance, and a second factor (cf2) separating scientific from artistic achievements, explaining 18%. In two separate models we regressed factor scores of cf1 and cf2 respectively, on IQ, big five personality, psychosis proneness, sex and age. cf1 was associated with IQ, sex (f), E, A, -C, N, O, psychosis proneness and age. Only IQ ($\beta = .14$) and O ($\beta = .45$) had a $\beta > .1$. cf2 (science) was associated with IQ, sex (m), -E and O. Only sex ($\beta = .27$) and IQ ($\beta = .21$) reached a $\beta > .1$. The domain specific results ($\beta > .1$): Visual arts – O, sex (f); Music – O, IQ; Dance – O, sex (f); Theater – O; Writing – O; Invention – O, IQ, sex (m); Science – O, IQ. In summary, O moderately predicts CAQ in all domains. IQ has a weaker general effect but is more associated with Science, Invention and Music.

Importance. Though psychometric studies on creativity suggest that creative/divergent thinking can be distinguished from fluid reasoning, individuals demonstrating eminent CAQ nonetheless typically display high levels of IQ. The precise nature and strength of the relationship between CAQ and IQ is not well understood. Nor is it clear if and to what extent the association with IQ varies between creative domains. Scientific and artistic domains will e.g. presumably pose different demands on cognitive abilities and it can be hypothesized that IQ is related to both self-selection and level of achievement. Various personality traits have also been associated with creativity, in particular O (from the Big Five Inventory), but also psychosis proneness. The importance of certain traits has also been argued to differ between creative domains but this has yet to be demonstrated in a large scale study. The prevalence of mental illness is higher among individuals within creative domains and their relatives, but it is not known how e.g. psychosis proneness actually relates to achievement.

Methods. The data were collected in a web-based survey. 32,500 twins born 1958-85 were sent personal login details by mail. The present sample included 6,603 individuals. The survey included several self-report questionnaires. For the present study, we collected CAQ (seven levels; ranging from no involvement, to amateur production, to professional excellence), in seven domains (Visual art, Dance, Music, Theater, Writing, Invention, Science); IQ using the Wiener Matrizen Test; Big Five personality, using the BFI-44, with measures of extraversion (E), agreeableness (A), conscientiousness (C), neuroticism (N), openness (O); psychosis proneness, using the positive symptoms scale of the CAPE-42; age and sex. These preliminary analyses were performed, firstly by correlating CAQ scores from different domains, secondly by doing a PCA of the CAQ scores and thirdly, by regressing factor scores from the PCA on all other variables (random split-half sample analyses, twins separated). Only results which were significant in both samples are reported.

Genetic and Environmental Influences on the Relationship Between Musical Discrimination Tasks and IQ

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Novelty. Performance on many sensory discrimination tasks is positively related to intelligence. Such associations have been demonstrated for various sensory dimensions, e.g. the pitch and loudness of auditory stimuli, and the colour and shape of visual figures. Studies using latent variable modelling suggest that a common, general discrimination ability factor may account for a substantial component of such associations, although there is also evidence for additional, more specific influences of e.g. temporal discrimination ability on intelligence. Past studies have generally focused on phenotypic associations, and little is known about the role of genetic factors for these associations. In the present study, for the first time a large genetically informative sample of Swedish twins (N=10,000) is used to explore this issue.

Importance. The study will help to elucidate fundamental mechanisms mediating individual differences in intelligence and its relationship to temporal and non-temporal sensory discrimination abilities.

Methods. More than 10,000 twin individuals completed an extensive online questionnaire that included auditory discrimination tasks as well as a timed intelligence test (the Wiener Matrizen Test), similar in construction to the Raven progressive matrices. Three auditory discrimination tasks of a type commonly used to assess music aptitude were employed, i.e. rhythm, melody and pitch discrimination. As expected, the phenotypic relationships between intelligence and the discrimination tasks were moderate and highly significant with correlations ranging between 0.22 – 0.39. The twin model allows for partitioning of the variance in and covariance between the variables into that due to genetic and environmental influences. Potential sex-differences will be explored and results will be discussed in relation to the past literature.

Neural Efficiency as a Function of Task Demands

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Novelty. The neural efficiency hypothesis describes the phenomenon that brighter individuals show lower brain activation than less bright individuals when working on the same cognitive tasks. Consequently, the same task is more easy for individuals with higher cognitive ability, but more difficult for less intelligent individuals. Since the person-specific level of task difficulty can be expected to be associated with the time and effort spent on the cognitive task, it could also be responsible for observed differences in brain activation. The present study investigated whether the brain activation-intelligence relationship still applies when more versus less intelligent individuals perform tasks with the same person-specific task difficulty.

Differences in task performance and in brain activation were only found for the subset of tasks with same sample-based task difficulty, but not when comparing tasks with the same person-specific task difficulty. These results suggest that neural efficiency reflects an ability-dependent adaption of brain activation to the respective task demands.

Importance. The results provide evidence that neural efficiency is a function of both intelligence and task demands. Results indicate that the neural efficiency hypothesis needs to be refined. According to the refined definition, neural efficiency describes the phenomenon that more intelligent individuals show lower brain activity than less intelligent ones only when working on cognitive tasks with a comparable sample-based difficulty. We hypothesize that this reflects a lower investment of mental effort due to lower person-specific challenge. However, when equal person-specific challenge is established lower versus higher IQ brains show similar brain activity levels. These results suggest that the neural efficiency phenomenon may actually be explained by the adaption of brain activation to the person-specific task demands.

Methods. In an fMRI-study, 28 lower and 30 higher intelligent individuals worked on 20 numerical inductive reasoning tasks (Arendasy et al., 2008). The used items are automatically generated Rasch-calibrated items which provide the opportunity to estimate the task difficulty relative to different levels of intelligence (Rasch, 1980). While higher intelligent participants worked on number series of medium and high difficulty, lower intelligent participants completed easy and medium difficult number series. In this manner all participants completed number series with expected mean person specific solution probability of .80 and .50, respectively. This enabled us to evaluate, whether differences in task performance and brain activation between IQ groups are attributable to group differences in person-specific solution probabilities. In addition, we were able to compare the task performance and brain activation of lower and higher intelligent participants when working on identical item set, since both groups worked on items of medium difficulty (same sample-based task difficulty).

Low IQ and Mild Mental Retardation are Heritable But Severe Mental Retardation is Not: a Genetic Analysis of 740,000 Siblings and 18,000 Twins

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Novelty. Despite the obvious societal importance of mental retardation (MR) in our increasingly technological world, the most fundamental question about the genetic and environmental origins of MR has not been definitively addressed. We will report new results showing that diagnosed mild MR (IQ 50-70) and low IQ in the general population are caused by the same genetic and environmental factors responsible for the normal range of intelligence. In contrast, most severe MR (IQ <50) is not inherited, despite hundreds of known single-gene causes of MR. Because severe MR is not inherited, its most likely causes are environmental factors, some of which are well known, such as prenatal trauma, neurotoxicity, and infections. Although severe MR is not inherited, MR is a burgeoning area of genetic research using new techniques (exome and whole genome sequencing) to identify non-inherited (de novo) mutations.

Importance. Molecular genetic research attempting to identify de novo mutations responsible for MR will benefit from focusing on severe MR (IQ < 50), which is not inherited. Although research on de novo mutations is an exciting new direction for identifying causes of severe MR, severe MR is fortunately rare (.001). Much more of the societal burden of intellectual disability lies with mild MR, which is the low extreme of the same genetic and environmental factors responsible for the normal distribution of intelligence. In other words, genes responsible for the substantial heritability of intelligence are the same genes responsible for MR. Finding genes for MR other than severe MR will involve the same problems faced throughout the life sciences for common disorders and complex traits: many genes of very small effect and 'missing heritability'. A possible advantage for IQ is that it has a high end as well as a low end: It might be easier finding genes associated with high IQ than low IQ, even though these genes are expected to be associated with low IQ as well as MR.

Methods. We used data from 3 million 18-year-old males assessed for cognitive abilities as part of compulsory military service in Sweden 1950-1990, which included 370,000 sibling pairs and 9000 twin pairs. We then linked these individuals to the Swedish National Patient Register to identify 308 siblings with a diagnosis of severe MR and 813 siblings with a diagnosis of mild MR. Two major findings emerged from our analyses of sibling and twin correlations and concordances and model-fitting. First, severe MR is not heritable in that siblings of individuals with severe MR had IQ means and variances not significantly different from the population. Second, mild MR as well as the lowest 3% of IQ scores in the population is familial, heritable, and caused by the same genetic and environmental factors responsible for the normal distribution of intelligence.

2013 Survey of Expert Opinion on Intelligence

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Novelty. In 1988 (conducted 1984), Snyderman and Rothman published a survey of expert opinions on intelligence and its treatment by the media. Since their survey, new findings have appeared in the literature. To examine current opinions of experts, we created a new questionnaire ("Expert Questionnaire on Cognitive Ability"), partly based on the questions of Snyderman and Rothman, reflecting the current state of research. We added questions on contemporary topics such as the FLynn effect and international intelligence comparisons. Other questions addressed the definitions of terms (e.g., intelligence and cognitive ability); the validity of tests (e.g., WAIS/WISC, SAT, PISA); the estimation of genetic and environmental influences; the treatment of intelligence research by the media; the importance of genetic testing (e.g., DNA screening); and the development of intelligence in global regions and populations.

Reference:
Snyderman, M. & Rothman, S. (1988). The IQ controversy, the media and public policy. New Brunswick: Transaction.

Importance. We present the results of our survey and compare them with the one from Snyderman and Rothman 30 years ago. The use of the terms "intelligence", "cognitive ability", and "cognitive competence" was not uniform. However, there was broad consensus that the most important attributes of intelligence were reasoning, abstract thinking, problem solving, and the g-factor, with little importance attributed to motivation, personality, and sensory acuity. Twin studies were still rated as providing the best evidence for heritability, followed by adoption studies, molecular genetic studies, and patchwork family studies. There was broad consensus that tests show little or no bias against ethnic or social groups, with test taker motivation being seen as one factor with potential for bias. Immigrants were viewed as a group that might be disadvantaged by the use of tests. Intelligence was rated as being most important in special education planning, followed by decisions at universities, primary and secondary schools, and work. Concerns were expressed about the treatment of intelligence by the media.

Methods. The survey consisted of 62 main questions with follow-up questions and space for comments. Experts were sampled from publications addressing intelligence, cognitive abilities, and student achievement. Authors of the past 4 volumes (2010-13) in Intelligence were included. Notice of the study was emailed to ISIR members and posted to the ISSID homepage, and colleagues were asked to inform other researchers about the study. Only people who received a participation code could participate. 226 people responded (from March to July 2013); 94 people completed the questionnaire. Participants had affiliations in psychology (84%), education (7%), economics (4%), biology (4%) and sociology (2%). 38% of experts were from the US, 20% Germany, 8% UK, 8% Scandinavia, 8% Spain, 7% Canada, 3% Australia and New Zealand, and 3% from Latin America. The representativeness of the expert sample, possible biases, and reasons for not participating are discussed.

Alcohol Consumption and Lifetime Change in Cognitive Ability: A Mendelian Randomization Study

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Novelty. We used a Mendelian Randomisation design to test the hypothesis that a genetic score for alcohol processing capacity moderated the association between alcohol consumption and lifetime change in cognitive ability. We found a significant interaction between a 4-SNP alcohol metabolism genotype and alcohol consumption on lifetime cognitive change (with cognition assessed at age 11 and age 70), such that individuals with fewer rare alleles (high alcohol metabolising ability) had a positive association between alcohol consumption and successful cognitive ageing. This was not found for individuals with low metabolising ability, who declined in cognitive ability as a function of alcohol consumption.

Importance. There is widespread concern about the determinants of healthy cognitive ageing, and conflicting evidence about the cognitive and health effects of alcohol consumption. A better understanding of, first, the effects of alcohol on cognition, and second, the possible genetic mediators of this relationship, could lead to better-informed efforts to prevent cognitive decline in old age.

Methods. The Mendelian Randomisation design is a useful way to avoid the serious problems of confounding and reverse causation in observational epidemiological research, since the genetic variants involved are unrelated to possible confounders, such as socioeconomic status. Our large longitudinal sample (The Lothian Birth Cohort 1936, valid n = 800) also allowed us to control for intelligence in early life, and thus assess lifetime cognitive change, rather than intelligence measured at only one point, and also used a well-validated measure of alcohol consumption, the Food Frequency Questionnaire (FFQ).

Exploring the Relationship Between Intelligence, Creativity, Inspection Time, and Inhibition

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Novelty. The relationship between intelligence and creativity has been examined and debated relatively extensively. There were investigations about the nature of intelligence-creativity relationship which were examined through higher order latent variables, personality, executive processes, and strategy-use. The present study examines the relationship between intelligence and creativity through the use of higher level inhibitory processes measures and elementary cognitive tasks. A sample of largely university students completed computerised Raven's Progressive Matrices, Unusual Uses task, Self-rated creativity measure, inspection time task, Stroop and Latent Inhibition task. The results showed that intelligence, as measured using Raven's Progressive Matrices was significantly predicted only by inspection time, but not inhibition variables, or creativity measured using Unusual Uses task and Self-rated Creativity score. The result suggests that apart from inspection time, other inhibitory processes do not significantly contribute toward intelligence.

Importance. Formal definitions of intelligence have often included problem-solving ability. However, therein lay the tension between intelligence and creativity. The former often involves completion of problems with a unique solution whereas creativity encourages generation of multiple solutions. In order to derive a correct solution an intelligent individual would engage in some selection processes. To do so successfully, it may be that inhibition processes which prevents competing solutions from distracting the individual would be necessary. On the contrary, creativity, would usually involve generating as many solutions as possible. These are higher level processes. The current study will add to the current knowledge in this field by examining inhibition processes as higher level processes, but it has also include the use of an elementary cognitive task. It will lead to further refinement of research methodologies and further examination of important variables explaining the intelligence-creativity relationship.

Methods. Although it is moderately small in sample size, this ambitious and labour intensive study examined intelligence as measured by Raven's Progressive Matrices; Creativity as measured subjectively and objectively through Self-rated Creativity scale, and Unusual Uses task respectively; two types of inhibition processes using Cognitive Inhibition (Stroop task) and a Latent Inhibition task; and processing speed measured using elementary cognitive task – Inspection time. The number of variables examined here enables a unique opportunity to explore the relationship between these variable, notably between intelligence and creativity. Multiple regression analyses enabled examination of the ability of various variables in predicting intelligence.

Intelligence and Somatic Health in Early Adulthood, and Mortality up to Age 59 -a Longitudinal Study of 49 000 Men

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Novelty. The association between intelligence in youth and later illness and early death is established, but the mechanisms underlying these associations are not fully understood (Calvin et al, 2011). One suggestion is that higher bodily system integrity promotes faster intellectual processing as well as better health, and thus act as a confounder in the association (Deary, 2012). We found that among a broad range of clinical diagnoses in youth, several were cross-sectionally associated with intelligence. However, the prevalence of somatic disorders in youth did not explain the association between intelligence and later mortality.

Importance. Bodily system integrity, as potential underlying factor in the association between IQ and mortality, is difficult to examine directly. Here, we had the opportunity to investigate if somatic diagnoses in youth, a plausible indicator of system integrity, would affect the association. This would indicate that the path from lower intelligence to early death is noticeable already in youth, and thus provide some evidence of system integrity at play. A better understanding of how intelligence predicts illness and death is crucial for appropriate prevention and treatment, and yields valuable pointers for further research in cognitive epidemiology.

Methods. In a cohort comprising 49 321 Swedish men born 1949-51, IQ test performance and medical diagnoses were recorded at the two-day conscription process in 1969-70, at ages 18-20. In the thorough medical examination, any diagnoses were given according to the ICD-8, the diagnostic system used at that time. The National Cause of Death Register provided information on all-cause mortality up to age 59 (3351 cases). We adjusted for socioeconomic position in childhood by record linkage with the national census in 1960.

Although several diagnostic groups (by ICD-8 chapters) were associated with IQ, adjusting for somatic diagnoses had minimal impact on the association of IQ with later mortality. Since bodily system integrity is suggested to manifest as reduced health as well as lower IQ, this finding lends limited support for the hypothesis of bodily system integrity as an underlying cause for the association between intelligence and mortality. Implications and alternative interpretations will be discussed.

Climatic Variability, Group Selection and Dysgenics: Testing a Multi-Level Selection Model

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Novelty. A multi-level selection model published recently by Woodley and Figueredo proposes that climatic changes have historically affected the direction of gene-frequency changes for g via their alternating impact on group vs. individual level fitness. In the West, colder environments imposed high extrinsic mortality on peasantry, whilst also creating fitness opportunities for those with higher-g. This also encouraged group selection for ultra high-g but low-fitness geniuses, whose innovations facilitated range expansion (i.e. colonialism).

Warmer environments led to lower mortality amongst those with low-g. Concomitant social and scientific innovations (i.e. welfare, medicine) further increased the mildness of Western environments, leading to diminished group selection, coupled with greater individual level selection for those with low-g responding to the fitness-incentives provided by the improved ecology, in addition to individual level selection against those with high-g, whose fitness diminished in the face of improved fertility control and redistributionist economic policy.

Importance. Multiple indexes of major innovation in science and technology indicate a pronounced per capita decline commencing in the latter half of the 19th century. Indexes of per capita scientific genius show a similar decline. Woodley and Figueredo, using hierarchical structural equations modelling, found that both of these trends relate to simulated declines in heritable g estimated on the basis of the negative relationship between fertility and IQ throughout this period. Recently, much attention was paid to the finding that simple reaction time performance seems to have been slowing throughout this same period, suggesting that the dysgenic decline in g predicted in previous works might be an actuality. These findings are all consistent with the multi-level selection model as described above.

Understanding how these ecological factors might explicitly relate to real changes in the patterns of selective pressure is important for understanding the interconnected and varied nature of the determinants of accelerating adaptive biological and cultural evolution amongst Holocene populations.

Methods. Here we test the multi-level selection model over the last 1.5 centuries using a cascade General Linear Model. Climate warming is operationalized using three convergent indicators of global temperature anomaly means spanning the period from 1859 to 1975. A lexical approach to measuring historical attitudes was used to determine group selection strength in the US+UK. Three convergent group selection \'loaded\' words were selected, and their diminishing frequencies across printed matter were measured using Google Ngram. Declining g was measured using meta-analytically matched simple reaction time trend data from the UK+US corrected for various sources of error, spanning the period 1889 to 1993. US+UK innovations were taken from a database of global innovations and weighted on the basis of US+UK population growth.

The model: Climate warming -> Group selected attitudes (with a lag of ten years) -> Declining g (with a lag of one generation) -> Innovation rates; fit excellently. The fit improved when war years were excluded from the innovation index. This is consistent with the model.

SIMPOSIA

Abstracts are organized in order of presentation time

Names of students eligible for the John B. Caroll Award for Research Methodology and ISIR Prize for Best Student Paper are marked with an asterisk

SYMPOSIUM 1

Worst Performance Rule: Sources, Moderating Variables, and Implications for Intelligence Research

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To obtain a reliable measure of the speed of information processing, elementary cognitive tasks (ECTs) are designed to include multiply repeated trials, for which response times (RTs) are recorded. This produces a set of individual-level RTs, which do not necessarily equally well predict cognitive ability. A frequently observed effect is that when individual-level RTs are ordered from fastest to slowest, the slowest RTs produce higher correlations with cognitive ability than the fastest RTs. This effect is called the worst performance rule (WPR). An explanation for WPR suggested by previous studies has implied that individuals differ in efficiency of memory and attention, or in some basic characteristics of neuron functioning, and this is what matters when both ECTs and intelligence-like tests are performed. However, previous studies on WPR have been too rare to accumulate consistent evidence of its causes, confounding the variables and the implications for an analysis of the association between intelligence and the speed of processing of various ECTs.

Taken together, the three papers of this symposium reconsider the issue of different RT-IQ associations reported for best- and worst-performance trials and discuss their possible causes and implications for studies examining the association between cognitive ability and the speed of information processing. In the first paper, **Yulia Dodonova** analyzes a set of elementary cognitive tasks and questions whether WPR is indeed present in these tasks and whether it can be explained via the effect of confounding variables and statistical artifacts.

In the second paper, **Natalie Borter** discusses the implications of WPR when analyzing individual performance in tasks of varying complexity. Such tasks imply that individual differences in the speed of basic constant processes and task-specific experimentally-induced processes can be analyzed at the latent level, and their associations with cognitive ability can be evaluated. However, as shown in this study, averaging across best and worst trials within each complexity level can mask another source of variance, which can also be meaningful and can provide additional insights into the associations between the speed of task processing and intelligence.

Finally, a paper by **Yury Dodonov** analyzes WPR-like effects in the context of speed-accuracy relations that are always present when a participant performs speeded tasks. This study suggests that accuracy rate is another factor that must be considered in any WPR-type analysis of associations between individual-level response times and intelligence.

Are the Slowest Response Times More G-Loaded Than the Fastest Reactions? Evidence, Hypotheses, and Implications of the Worst Performance Rule

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Novelty. The worst performance rule (WPR) suggests that when response times (RTs) obtained for repeated trials of a speeded task are ordered from fastest to slowest, the slowest RTs are more strongly correlated with cognitive ability than the fastest RTs. If the rule truly holds, this raises important questions about what lies beyond the conventionally analyzed correlations between average processing speed and cognitive ability. However, to accept that the slowest RT trials are indeed higher g-loaded, one should rule out the possibility that the effect is caused by some source of statistical artifact or is confounded by some other meaningful effect. Previous studies have been too rare to provide sufficient evidence that would allow for critically testing the hypotheses on the underlying causes of the WPR. Hence, this study reconsiders the issue of variations in RT-IQ correlations across multiply-repeated RT trials. Based on data obtained from a set of elementary cognitive tasks (ECTs), it questions whether there is indeed a WPR-like effect and (if yes) whether this effect can be explained via various confounding variables.

Importance. The observation that the slowest RTs obtained during the processing of various ECTs seem to be better predictors of g than the fastest RT reactions readily suggests that the explanations are related to cognitive variables, such as lapses in memory and attention (e.g., Larson & Alderton, 1990) or neuron errors (e.g., see Coyle, 2003), which are hypothesized to be more frequent in low-ability individuals then in high-ability individuals. If so, the WPR provides insights into the nature of the association between intelligence and speed of information processing. However, such an interpretation is meaningful if and only if the WPR is not an artifact in a statistical sense. Therefore, this study considers the possible non-cognitive sources of WPR and discusses the implications of WPR for studies examining speed-ability associations.

Methods. The ECTs analyzed in this study included simple RT, choice RT, and different versions of discrimination RT (e.g., discrimination between shapes or colors). Intelligence entered the analysis as a single score (Raven's APM) or a sum score based on a number of subtests. Data were obtained from samples of high school and college students. In addition, the simulated variables were involved where appropriately to differentiate between the g-related effects and the purely statistical effects. Various possible explanations for WPR were considered, including trial sequence effects (e.g., the sequence number of a trial in a set, switching between responses vs. repetition of the same response) and statistical issues (e.g., the skewness of the sample distribution of the respective variables). In addition, the question of whether WPR is indeed truer for more difficult tasks compared to easier tasks, as suggested by previous studies, is addressed.

Cognitive Tasks With Increasing Complexity: Should Worst Performance Rule Be Taken Into Account?

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Novelty. Homogenous tasks with increasing complexity imply that observed RT variance can be decomposed into parts that represent (1) a constant process representing basic aspects of information processing unrelated to the experimentally manipulated task complexity and (2) an experimental process increasing with task complexity. In contrast the worst performance rule (WPR) states that on cognitive task with multiple trials, worst performance trials predict general intelligence (g) better than best performance trials. Previous studies suggested that with increasing task complexity, WPR may be more pronounced. This conclusion, however, was mainly based on comparisons between tasks that largely differed in demands, not only in complexity. The present study is the first one to explicitly address the question of whether WPR-like effects vary with task complexity. It, thus, focuses on the question of whether WPR-related effects affect task performance, interpretability of baseline RT, and experimentally-induced RT-change, as well as their associations with intelligence.

Importance. Performance measures obtained from cognitive tasks may represent not only the concept of interest but can also be considered an outcome of various underlying processes and, thus, result in so-called impure measurements. With our approach, we could avoid the impurity problem and investigate the influence of two different sources of variance (i.e., complexity manipulation and processes unrelated to the complexity manipulation) on psychometric intelligence. In 2003, Coyle reviewed evidence, theory, and alternative hypotheses of the WPR and stressed complexity as a possible mediating factor. He ended with a call for research on the causes of the WPR and for research on the correlates of best performance. Therefore, in addition, WRP-like effects were included in the model and the links to the two different sources of variance as well as to psychometric intelligence were investigated.

Methods. Three computerized, homogenous cognitive tasks with increasing complexity as well as a paper pencil version of Cattell's Culture Fair Test (CFT-20) were completed by 130 participants (mostly students). From the four subtests of CFT-20, a latent psychometric intelligence factor was extracted. For the cognitive tasks two latent variables were modeled: One latent variable represented the constant process and, therefore, factor loadings were fixed to equal unity for all conditions. The other latent variable represented the shape of the experimental process and factor loadings were therefore fixed according to a strictly increasing function to reflect the increasing task complexity. With this approach, the links between the latent intelligence factor and the experimental and non-experimental process were investigated. In addition, worst performance analysis was incorporated by either explicit modeling of an additional latent variable or by comparing models based on worst- and best-performance indexes.

The Slowest and Fastest Responses are Not Equally Good Predictors of Intelligence, But Does Accuracy Matter?

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Novelty. A commonly acknowledged problem in studies on individual differences in processing speed and speed-ability associations is that, when performing elementary cognitive tasks (ECTs), each participant necessarily adopts some speed-accuracy strategy. Moreover, a participant can speed up or slow down while processing the same task, thus compromising or emphasizing the accuracy of responding. On the other hand, individual-level RTs are not equally good predictors of intelligence; those responses that are slowest seem to be better predictors of ability than the fastest responses, an observation known as the worst performance rule (WPR). However, previous WPR-type analyses considered only RTs (or only accuracy rate), thus discarding the other important source of information. To our knowledge, this is the first study to analyze how speed-ability association changes for RTs obtained across trials of a speeded task while simultaneously considering speed-accuracy associations.

Importance. This study suggests that the accuracy of responding might act as an explanatory mechanism for WPR or, more generally, for any tendency of some individual-level RTs to be more g-loaded than other RTs obtained within the same task. In addition, the study raises an important question by seeking to determine what measure of RT most adequately represents the individual-level speed of processing in studies on individual differences. Our results suggest that the indexes of processing speed are most meaningful when the accuracy rate is simultaneously taken into account in the computations. The implications for studies on speed-ability associations are discussed.

Methods. This study analyses ECT-performance for two types of tasks: discrimination tasks, wherein stimuli were presented until a response occurred, and a memory-type task, wherein participants had to judge the identity of the test stimuli when a probe was briefly presented. The samples consisted of high school and college students; Raven's APM and Amthauer's IST were used as intelligence tests. For the discrimination tasks, the RT-IQ correlations were consistent with WPR: they were higher for the slowest responses than they were for the fastest responses. For the memory-type task, the U-shaped relations between the speed of responding and the magnitude of the RT-IQ correlation were observed; contrary to the WPR, there seemed to be some "optimal" speed of responding (corresponding to the most g-loaded RTs), while both the fastest and the slowest reactions were not as strongly related to ability level. Importantly, for both types of tasks the accuracy rate was consistently highest for the responses given at the speed level that was optimal for the respective task. In other words, most g-loaded RTs were those for which the highest accuracy rate was observed, regardless of the shape of the RT-IQ and the RT-accuracy associations.

SYMPOSIUM 2

The Relationship between Confidence, Intelligence, Academic Achievement and Decision-Making

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The aim of this symposium is to present findings from several recent studies carried out in Singapore (Nanyang University) and Australia (The University of Sydney, University of Western Sydney, University of Adelaide). These studies have focused on the relationship between one's confidence in the accuracy of the answer to a cognitive test item and measures of intelligence, educational achievement and decision-making. They also include a range of measures of thinking styles, self-beliefs and personality.

The **Stankov** paper is an overview of recent findings showing that non-cognitive measures can be ordered with respect to their predictive validity. Many e.g., measures of motivation, depression, and most personality traits - are poor predictors of intelligence and achievement. Measures of self-beliefs - self-efficacy, self-concept and anxiety - have moderate correlations with cognitive performance but tend to be domain-specific. The best predictors of any kind of cognitive performance are measures of confidence that can capture a major part of predictive validity of the self-beliefs.

The **Kleitman** paper explores the latent structure of intelligence and confidence, along with a broad range of self-report measures of need for structure, outward assuredness, rigid thinking, openness to experience and metacognitive beliefs. The findings highlight the distinctions and relationships between intelligence, arrogance, and rigid thinking.

The **Jackson** paper examines the generality of metacognitive and decision-making measures derived from a variety of intelligence tests, as well as the predictive validity of intelligence and metacognitive constructs to the quality and types of decisions made. The particular decision making task is tailored along the lines of a test taking scenario.

The **J. Lee** paper report the results from a study that assessed confidence together with scales measuring self-belief (i.e., self-efficacy, different kinds of self-concepts, and anxiety) among the 15-year old students from Singapore. A distinct confidence factor was identified in the domains of mathematics and English. The results show that confidence is: a) a robust individual differences dimension and it captures much of the predictive variance of other self-beliefs that are, in turn, among the best known predictors of achievement.

The **Welsh** paper is focused on anchoring a well-known effect leading to bias in estimation in various decision-making contexts. Anchoring was examined in a simulated poker-like card game. While there were few significant demographic and cognitive predictors of the overall performance, cognitive ability measures and decision styles were related to decreases in anchoring susceptibility over the period od practice in playing the card game.

Noncognitive Predictors of Intelligence and Academic Achievement

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Novelty. Recent evidence about the relationship between cognitive tests and psychological noncognitive variables is reviewed. Noncognitive measures can be ordered with respect to their predictive validity. Many are poor predictors of intelligence and achievement. Measures of rationality, selfassessment of intelligence, Openness to Experience and self-concept correlate up to .35 with cognitive performance. Some domain-specific self-beliefs (self-efficacy and anxiety) have correlations with appropriate achievement tests that can reach .45. The best predictors of any kind of cognitive performance are measures of confidence (frequently reported correlations of .45 and above) that can capture a major part of predictive validity of the three self-beliefs. The role of self-beliefs has attracted much interest in education but their role in predicting performance on tests of fluid intelligence is likely to be low. However, self-beliefs and confidence in particular may prove to be the most potent noncognitive influences on the development of acculturated knowledge that is captured by measures of Gc.

Importance. There is a plethora of noncognitive constructs studied by educational and organizational psychologists that is claimed to influence cognitive performance. This paper points out that many of these constructs have low predictive validity and should be withdrawn from further consideration. The most important appear to be self-belief constructs and confidence in particular.

Methods. This is a review paper that summarizes the outcomes from several studies by ourselves and others. There is no presentation of new empirical data.

Intelligence and Confidence in Relationship to Competence, Arrogance and Close-Mindedness

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Novelty. Using hierarchical CFA, this research investigated the higher-order relationships between Intelligence, self-assessments of ability (confidence and various self-beliefs) and a range of personality and thinking style measures. The findings demonstrated that Intelligence and self-assessments of ability defined a broad second-order Competence factor. However, when not linked to Intelligence, these self-beliefs also defined a broad second-order Arrogance factor along with first-order Outward Assuredness and Openness dimensions. Competence and Arrogance factors were unrelated. Results also revealed a second-order Rigid Thinking factor defined by a need for structure and rigid thinking styles. It shared a strong negative correlation with Competence and a moderate positive correlation with Arrogance. Overall, Intelligence shared no relationship with Arrogant/Decisive traits, but low Intelligence was associated with Rigid thinking styles. Furthermore, self-assessments of ability can define two orthogonal higher-order traits: Competence and Arrogance.

Importance. The accurate assessment of our own abilities is important for a range of outcomes, including decision-making, learning and academic achievement. For example, well-calibrated confidence in one's various Intellectual abilities is needed to select university courses that suit those abilities. Similarly, accurate self-beliefs play key significance in decision-making. It is therefore important to understanding how Intelligence relates to those assessments, as well as the broader network of constructs that may influence them (thinking styles and personality).

Methods. Over 500 undergraduate psychology students completed a range of Intelligence tests accompanied by confidence ratings, along with a broad range of self-report measures of need for structure, outward assuredness, rigid thinking, openness to experience and metacognitive beliefs. The sample was split. EFA and hierarchical CFA were used. The Exploratory Factor Analysis was used to identify first order factors using the first half of the sample. Confirmatory Factor Analysis was conducted to replicate these factors and then investigate their higher order relationships.

Intelligence and Confidence as Respective Predictors of Quality and Erroneous Decision-Making

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Novelty. This research investigated the predictive relationships of Intelligence and Confidence, and its traditional and novel derived indices, on decision-making behaviour. The results demonstrated that Intelligence was the strongest incremental predictor of quality decision-making (Optimal and Realistic), while confidence variables were best predictive of the types of decision errors participants made in a typical test-taking scenario (Incompetent or Hesitant). This implies that Intelligence sets a threshold for the quality of an individual's decisions while confidence controls decision behaviour. In turn, we consider Intelligence as a construct responsible for the formation of accurate judgements upon which decision behaviour is based.

Importance. Decision-making is a complex process of making choices in order to achieve our goals, and identifying the psychological constructs that contribute to this process can be of great importance. Intelligence is often considered to be a suitable proxy for decision-making competence. For example, Intelligence tests are routinely administered for selection/profiling purposes in the workplace. However, beyond being considered desirable, the role that intelligence plays in the decision-making process is poorly understood.

Methods. A preliminary sample of 116 undergraduate psychology students completed three intelligence tests, with all items being accompanied by confidence ratings and a decision to submit the answer for marking. On each test, participants were scored for accuracy (Intelligence), confidence, a range of calibration indices, and four decision tendencies: Optimal, Realistic, Incompetent and Hesitant. The decision tendency variables were regressed on Intelligence and the confidence variables in a hierarchical fashion to assess their incremental validity.

Confidence: A Better Predictor of Academic Achievement than Self-Efficacy, Self-Concept and Anxiety?

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Novelty. In this paper we report the results from a study that assessed Confidence together with scales measuring self-beliefs (i.e., self-efficacy, different kinds of self-concepts, and anxiety) among the 15-year old students from Singapore.. A distinct Confidence factor was identified in the domains of Mathematics (N = 1940) and English (N = 1786). Our results show that Confidence is: a) a robust individual differences dimension; b) that can be combined with accuracy information to obtain bias scores that may be useful for group comparisons and for identification of misconceptions about particular topics. Confidence as studied in our work to date has been c) the best predictor of achievement in both Mathematics and English; d) is related to both cognitive and self-beliefs measures; and e) it captures much of the predictive variance of other self-beliefs that are, in turn, among the best known predictors of achievement.

Importance. It provides evidence that confidence is likely to be a general factor and it shows that it is a better predictor of cognitive performance than other non-cognitive traits.

Methods. It reports the data based on some 4000 15-years old students from Singapore. Factor analysis and regression analyses are used to support the claims.

Individual Differences in Anchoring: Traits and Experience

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Novelty. Anchoring is a well-known effect leading to bias in estimation in various decision-making contexts. Previous research examining the role of individual differences in anchoring susceptibility has found weak and unreliable results. In this study anchoring was examined in a simulated poker-like card game, among people with varying levels of academic achievement and using a wide variety of psychometric tests for both cognitive ability and decision style/personality factors. Overall, anchoring susceptibility was largely unrelated to demographic and cognitive measures but weakly correlated to measures of preference and aptitude for rationality. Performance generally improved during the course of the card game task, suggesting that participants became less susceptible to anchoring with experience and these improvements were weakly-to-moderately related to demographic, cognitive and decision style measures. That is, while there were few significant predictors of overall performance, cognitive ability measures and decision styles were related to decreases in anchoring susceptibility.

Importance. These results suggest that the conclusion from the judgement and decision making (JDM) literature that intelligence is a poor predictor of bias susceptibility may have been premature.

The observation that cognitive ability predicts not anchoring susceptibility but rather changes in that susceptibility over time underlines the need for better measures of individual differences in peoples\' responses to different biases.

Additionally, the paper highlights the fact that many JDM papers have relied solely on correlates of general intelligence such as self-reported SAT scores, which may underestimate the relationship between bias susceptibility and more specific cognitive abilites.

Methods. Given the overreliance of previous JDM research on very general measures of intelligence and the resultant conclusion that biases are better predcited by decision style or personality measures, our methodology included a number of measures of specific cognitive abilities including Gs and Gq from the Catell-Horn-Carroll model, Working Memory and an Executive Functioning measure for comparison with various decision style measures previously related to bias susceptibility.

The anchoring measure was also a methodological improvement over many previous studies, which have generally looked at only group differences in anchoring. By developing a poker-like game to test for anchoring bias, we were able to have participants complete 140 anchoring tasks with known correct answers and thus track their susceptibility to the anchoring bias, controlling for the effect of participant knowledge.

SYMPOSIUM 3

Contemporary Applications of the Cattell-Horn-Carroll Cognitive Taxonomy

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Cognitive tests ranging from paper and pencil to computerised measures are implemented across many different scientific disciplines. In areas such as clinical nutrition, psychopharmacology and medicine, cognitive tests are often used to measure the effect of a specific intervention on a set of cognitive processes. In these studies it is commonplace for cognitive test results to be grouped into a set of broader cognitive factors prior to statistical analysis. By limiting the number of cognitive outcomes this method reduces the number of statistical comparisons, reducing the risk of a type-I error. However, the grouping of cognitive test results is often executed in an arbitrary manner without justification from either a validated cognitive taxonomy or factor analysis. Both Carroll's model of human cognitive ability and the Cattell-Horn-Carroll model of intelligence provide empirically based taxonomies of human cognition. These models provide a cognitive "map" that can be used to guide the handling and analysis of cognitive outcomes in any discipline that deals with cognitive test data. This talk will provide an overview of cognitive taxonomies and discuss how their application can improve the standardization and validity of cognitive outcomes in disciplines such as psychopharmacology and nutrition.

In the first talk by **Matthew Pase** the general Carroll framework for cognition is outlined. Within this framework, several data sets from recent studies (ranging from cardiovascular, fish oil and vitamin interventions are mapped onto the framework. The mapping of these relationships onto the Carroll model provides a unique ability to understand differences across intervention studies that have utilized a variety of different cognitive and intelligence assessments.

In the second presentation, **Con Stough** maps the differential cognitive effects of different pharmaceutical cognitive enhancers including Modafinil and amphetamines on to the Carroll framework. The general area of cognitive enhancers is at present difficult to summarise because of the vast heterogeneity in different cognitive assessments used across pharmaceutical trials. The effects of amphetamines for instance are particularly difficult to understand because of the variety of methodologies used in previous studies. the Carroll framework allow a clearer understanding of what cognitive components are changed by amphetamine and other pharmaceutical cognitive enhancers.

In the third presentation **Andrew Scholey** uses the Carroll framework to map the cognitive effects of a wide range of natural substances. The cognitive effects from a range of both acute and chronic acting neutraceuticals are examined.

The three presentations taken together illustrate the contemporary use of a comprehensive model of human intelligence.

An Overview of The Cattell-Horn-Caroll Model of Cognition: Implications for Contemporary Use

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Novelty. The Cattell-Horn-Carroll model of intelligence is a comprehensive model of cognitive abilities. It has been grossly underused in contemporary research utilizing cognitive assessments. As such there are many different cognitive tests and batteries all measuring different components of cognition and these are routinely used across many different areas of research with often results that are hard to interpret. The Cattell-Horn-Carroll model provides a cognitive 'map' that can be used to guide the handling and analysis of cognitive outcomes in any discipline that deals with cognitive test data. This talk will provide an overview of cognitive taxonomies and discuss how their application can improve the standardization and validity of cognitive outcomes in disciplines such as psychopharmacology and nutrition.

Importance. There is growing dispute about the relationship between cognition and many different other areas. For instance it is difficult to know whether fish oil supplementation improves cognitive functioning because different studies utilize different measures of cognition and therefore assess different aspects of cognition thus making comparison between studies very difficult. By utilizing the Cattell-Horn-Carroll model it is possible to map the different results on to the different components of intelligence and to make better conclusions about cognitive effects. The talk will provide a framework in which we can apply this model to a range of interesting cognitive phenomena.

Methods. The methodology of this talk utilizes an analysis of the Cattell-Horn-Carroll model. It then maps data from clinical trials studying relationships between cardiovascular processes, pharmacological interventions and cognition. Thus it utilizes data from several randomized controlled trials and assesses relationships between these variables.

Understanding Smart Drug Effects Using the Cattell-Horn-Caroll Model of Cognition

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Novelty. Presently there is no consensus about whether pharmaceutical drugs such as Modafinil and amphetamines improve cognitive performance and if they do which cognitive processes they specifically enhance (if any). One of the reasons why there is no consensus in this area of research is because different studies examining the effects of cognitive enhancing pharmaceutical drugs have utilized different methodologies and therefore different cognitive measures. By utilizing the Cattell-Horn-Carroll model of cognition it is possible to map the results from different studies on to a coherent cognitive framework and to ascertain at which level of the model (if any) that there may be a cognitive enhancement. This information will be helpful in the design of future studies developing cognitive enhancing drugs as well as contributing to a better understanding of the cognitive effects of current drugs.

Importance. Amphetamines and other pharmaceutical drugs are widely abused in our society. They are currently being taken by a wide cross-section of the community to improve intelligence and cognitive performance. However little is known about their effectiveness. The presentation will provide some conclusions using the Carroll framework about the effectiveness and specificity of action in improving human intelligence. This information is important and may influence drug usage and drug development.

Methods. The presentation will utilize data from randomized controlled trials (RCTs)using pharmaceutical drugs. Results will be mainly taken from well controlled scientific studies and then mapped onto the Carroll cognitive framework.

Understanding the Effects of Natural Medicines and Substances Using the Cattell-Horn-Caroll Model of Cognition

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Novelty. As well as a pharmaceutical approach to cognitive enhancement there is growing evidence that nutraceuticals (natural medicines and nutritional supplements) may also improve cognitive function. These effects are likely to involve multiple biological processes. This paper will review evidence for this poly-pharmacological approach to cognition enhancement in the context of the Carroll framework and compare these effects from pharmaceutical approaches.

Importance. A huge number of people in our community take natural supplements for cognitive enhancement usually without any empirical evidence. This talk will present the growing evidence base and mechanisms for cognitive enhancement from natural products and map these effects using the Carroll model.

Methods. We will utilize data from Randomized Controlled Trials (RCTs) from our group and elsewhere. The talk will briefly consider methodological shortcomings of certain trials.

SYMPOSIUM 4

Intelligence in Non Human Animals

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The ubiquity of g in humans raises many questions to students of evolutionary theory. Is g a uniquely human construct? Is it an ability or adaptation that emerged at a discernible point in our phylogeny? What selection pressures influence g, and what fitness optimum/optima are associated with it? These questions are not answered and rarely asked. The reason for this is simple: intelligence research in humans is mostly the child of Francis Galton and has focused on individual differences; animal cognition is mostly the child of Charles Darwin and is mostly directed towards the species-typical. Researchers from these two fields generally do not attend the same conferences; publish in the same journals, nor realise how much each has to offer/learn from the other.

Although g has received a great deal of psychometric attention, it merits attention from evolutionary-minded researchers. The many and varied phenotypic correlates of g in humans suggest that it has a positive relationship with fitness. In humans g is associated positively with fitness-related characters such as better health, higher life expectancy, sperm quality, (and xxx in inversely with minor health abnormalities). Higher g reduces the risk of alzheimer's disease, psychopathology and dementia. This raises several causal possibilities. Advantage may beget advantage: auspicious family backgrounds may promote the likelihood of bright, healthy children through non genetic pathways, genetic pathways or a mixture of both. It would be useful to know to what extent g, independently of socio-economic background, is a fundamental cause in the matrix of phenotypic benefits. Animal models of g will be a useful aid to answering this question and others pertaining to ageing.

Fetch! G in Dogs

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Novelty. We assessed individual differences in cognitive abilities in one breed of domestic dog (Border Collie) to find out whether there is a g factor of general intelligence in dogs. We administered four configurations of a detour test and repeated trials of two choice tasks (pointing and quantity). We used confirmatory factor analysis to test alternative models explaining test performance. The best fitting model was a hierarchical model with three lower-order factors for the detour time, choice time, and choice score and a higher order factor accounting for 40% of the reliable variance in performance. Dogs that completed the detour tasks quickly also tended to score higher on the choice tasks and take less time to make a choice; this could be explained by a general intelligence factor.

Importance. Animal models of g are currently restricted to humans and mice. Learning about the phylogeny of g will inform us about its evolutionary history.

In addition to species-specific cognitive traits many animals show within-species variation in cognitive ability. In humans most of the variation in ability in different cognitive domains can be explained by single underlying g factor. Whether cognitive abilities are domain general or domain specific has implications for the evolution and function of cognitive traits.

Methods. We used confirmatory factor analysis to test different models against our data.

SYMPOSIA

Big Brains, Big Smarts? The Elephant Model for The Study of Convergent Cognitive Evolution Across Species

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Novelty. To help understand the evolution of intelligence in humans, psychologists have, for nearly a century, looked to the study of non-human primates, particularly chimpanzees, for answers. By studying specific markers of physical (tool-use, causal reasoning, problem-solving) and social (cooperation, perspective taking, empathy) intelligence in non-human primates, scientists have gained a better understanding of the evolutionary trajectory of complex cognition. Within the past twenty years, however, the field of animal cognition has expanded beyond primates to species that have also demonstrated remarkable intellectual capacity. Animals such as dolphins, elephants and the corvid bird family use tools, reason causally, engage in complex cooperation, and take the perspective of others. These capacities most likely evolved through convergent cognitive evolution, a process by which evolutionarily distant species evolve similar intelligence as a result of similar environmental pressures.

Importance. The study of convergent cognitive evolution provides an interesting avenue for understanding what drives the evolution of intelligence in animals, including humans, and how such intelligence may be expressed across species.

Methods. In this talk, I will focus primarily on the study of cooperation in animals from a proximate perspective, using elephants as an example. How do elephants "think" about cooperation, and does any of their cooperative behavior mimic that of humans? I will briefly review recent research on cooperative problem-solving, and behavioral economics (including inequity and prosociality) in a number of animal species, including my own work on elephants in Thailand. The continued study of animal intelligence provides a window into the evolution of the mind, and increasing evidence against the argument that complex cognition is uniquely human.

What Can Tool-Making Crows Teach Us About Our Minds?

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Novelty. One of the defining features of Homo sapiens is the complexity of our tool use and manufacture. However, it is unclear what effect these tool behaviours have had on the evolution of our minds. I will discuss recent work on the cognition of another prolific tool user, the New Caledonian crow. This species is capable of sophisticated tool behaviours including context-dependent tool use, metatool use and hook tool manufacture. These crows are, therefore, an ideal model species for understanding the effect of tool use on cognitive evolution. I will present evidence that tool behaviours do not lead to the evolution of the cognition involved in cooperation, but may lead to the evolution of sophisticated planning and causal reasoning.

Importance. Two major hypotheses for the evolution of intelligence are the social intelligence hypothesis and technical intelligence hypothesis. The social intelligence hypothesis suggests that the selection pressures created by the need to manipulate social interactions between conspecifics led to an increase in intelligence, while the technical intelligence hypothesis suggests that the need to understand how to make tools increased intelligence. Due to hominins being both highly social, and the manufactures of sophisticated tools, it is impossible to uncover how social and technical selection pressures sculpted the human mind. However, the New Caledonian crow makes tools even more sophisticated than those seen in our closest relatives, the chimpanzee, and yet is relatively unsocial. This makes it a perfect study species to for uncovering the effect that tools have had on our minds over evolutionary time.

Methods. My talk will present work from a number of papers published in highly prestigious journals. In each study discussed carefully controlled behavioural experiments allowed us to make various claims about the cognition of New Caledonian crows.

SYMPOSIUM 5

Sources of Individual Differences in Academic Self-Concept, Motivation, and Achievement in Different Cultures and Ability Groups

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The current symposium brings together four studies investigating the etiology of individual differences in different aspects of academic self-concept, motivation, and achievement, as well as the structure of interrelationships among them. The four studies provide new insights through the use of multivariate, longitudinal and/or cross-cultural data. The first study (**Kovas** et al.) applied twin methodology to investigate the relative contribution of genetic and environmental factors to variation in self-perceived ability and intrinsic motivation in different twin samples from 6 different countries. The second study (**Morosanova** et al.) investigated whether conscious self-regulation differentially contributes to different aspects of mathematical performance and achievement, above and beyond general intelligence and specific cognitive abilities. The third study (**Ovcharova** et al.) examined whether the structure of the interrelationships between intelligence, cognitive abilities, and academic achievement differs across ability and selection range. Finally, the fourth study (**Voronin** et al.) used the multivariate longitudinal cross-lag design to examine the relationships between academic self-concept and achievement in different academic domains, controlling for intelligence. Together these four studies provide new insights into the complex interrelationships between intelligence, motivation, ability, and achievement, and identify new directions for research in this important area.

Why Do Children Differ in Motivation to Learn?
Insights From a Large Twin Study

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Novelty. Academic motivation, encompassing a wide range of concepts related to individuals' educationally relevant beliefs, perceptions, interests, and attitudes plays a central role in school achievement. Research suggested that the links between motivation and achievement can largely be explained by overlapping genetic effects, some of which are also involved in intelligence. We explored the etiology of two constructs: enjoyment of learning (intrinsic motivation), and self-perceived ability (academic self-concept) for different school subjects across school years, in several thousand twins from 6 countries. The results showed a striking consistency across ages, school subjects, and cultures. Overall, these constructs were found to be moderately heritable. In terms of environmental influences, individual specific rather than family-wide or classroom-wide environmental factors contributed to variance in enjoyment and self-perceived ability. Being in the same class did not make children more similar in their enjoyment and perceived ability than those attending different classes.

Importance. These results from 6 large representative samples provide convincing evidence for the importance of non-shared environmental influences rather than family-wide or class-wide environmental influences on enjoyment of learning and self-perceived ability. Further research should focus on clarifying how the same educational environment can create different experiences for different individuals. Moreover, measures of motivation are not independent of intelligence and achievement as motivation develops partly through feedback on performance. Future multivariate genetic analyses should explore whether many of the genetic and non-shared environmental effects on enjoyment and self-perceived ability are the same as those on intelligence.

Methods. Self-reported evaluations of enjoyment and self-perceived ability, using similar measures, were collected from several thousand participants from six different twin studies: the UK twins at ages 9, 12 and 16; the Canadian twins at ages 10 and 12; Japanese twins at ages 10, 11, 12, 13 and 16; the German twins at ages 9, 11 and 13; the US twins at age 12; and the Russian twins at age 16. The relative contribution of genetic and environmental factors to variation in enjoyment and self-perceived ability were estimated from monozygotic and dizygotic intraclass correlations. For our analyses at age 9 in the UK sample we used structural equation model fitting to assess whether being in the same class for 8 or more months led to more similar level of enjoyment and perceived ability for the two twins.

Individual Differences in Conscious Self-Regulation and Cognitive Characteristics as Predictors of Academic Achievement

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Novelty. The importance of general intelligence and specific cognitive abilities for learning success has been firmly demonstrated by the existing literature. In addition, research also suggests an important role of non-cognitive factors in ensuring progress in learning. In this study, we investigated whether self-regulation contributed to students' academic success in mathematics, above and beyond intelligence and specific cognitive abilities. The results showed that self-regulation was a significant independent predictor of mathematical success, beyond the contribution of general intelligence and cognitive abilities. Moreover, we found that different aspects of mathematical success were explained by partly different cognitive and regulatory factors. We discuss the results with the view that conscious self-regulation may serve as a metacognitive factor that is involved in intellectual activity.

Importance. Understanding the complexity of the interrelationships among the factors involved in individual differences in different aspects of academic achievement can lead to progress in optimizing education.

Methods. The study used the data from 300 14-16 year old male and female students in the 9th grades from several secondary schools. We assessed cognitive abilities (spatial memory, number sense, nonverbal intelligence, and reaction time); general intelligence; as well as 4 aspects of mathematical ability and achievement, including standardized tests, school grades, and exam scores. To study the regulatory features, we used "Style of Self-Regulation of Learning Activity Questionnaire", measuring the level of self-regulation of students' learning activity. We used a grade for the year and mathematics state exam score as measures mathematical achievement. Analyses of variance examined any potential average and variance differences across different classes and schools. Multiple regression analyses examined the predictors of different aspects of mathematical success.

Is the Structure of Interrelationships among Intelligence, Cognitive Abilities and Achievement Different in Selected, Self-Selected, and Unselected School Populations?

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Novelty. Previous research has identified a number of cognitive predictors of mathematical achievement, including spatial ability, speed of information processing, spatial memory, the so called 'number sense', as well as general intelligence. However, it remains unclear whether the structure of the associations between such cognitive processes and mathematical achievement is the same across the ability spectrum. For example, does mathematical talent develop on the basis of different abilities from those supporting mathematical performance in the normal range?

Our results support previous findings of the relationship between intelligence, cognitive abilities, general intelligence, and achievement. However, the structure of the interrelationships differed across the ability spectrum. In particular, factoring in intelligence led to significant changes in this structure for the mathematically gifted students, but not for students in the normal ability range.

Importance. Better understanding of how mathematical ability develops has important implications for mathematical education overall, and for fostering mathematical talent.

Methods. The study involved 855 students, divided into 4 groups: Mathematically Gifted (371 students), Unselected (258 students), Self-selected (62 students) and Sports-selected (164 students). Mathematically gifted students were recruited from specialist Physics and Mathematics Schools, to which students are selected based on their excellence in mathematics. Unselected students came from State secondary schools. Students in the self-selected group came from a specialist Physics and Mathematics School, which can be attended by anyone. However, it is expected that only highly STEM motivated and achieving students select this school. Sports selected students came from the vocational school which selects students based on good sports achievement track record. A web-based battery of tests measured different aspects of cognitive ability and intelligence, and several measures of mathematical performance and achievement.

Testing Internal/External Frame of Reference Model across Academic Domains and School Years

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Novelty. Academic achievement reflects a wide range of factors, from general intelligence, to specific cognitive abilities, to personality and motivational factors, to educational practices. Moreover, complex interrelationships have been suggested among these different factors. Reciprocal internal/external frame of reference model (Möller et al., 2011) is aimed to describe and explain the manifold relationships between academic achievement and academic self-concept. In our study we show that these relationships do not depend on general cognitive ability. We found that positive within-domain effects and (weak) negative cross-domain effects of self-perceived ability on achievement and vice versa persist over a long period of time.

Importance. Academic self-concept is a set of personal beliefs about one\'s academic abilities and achievement. It is considered as one of the most important components of general self-concept since it is strongly associated with motivation, achievement, and life satisfaction. Within a specific domain the variability of academic self-concept is explained mostly by academic achievement in the corresponding domain (however, this effect is moderate: 0.21, Hansford & Hattie, 1982). Academic self-concept has small positive reciprocal effect on the corresponding academic achievement (Marsh & Martin, 2011). Academic self-concepts in different domains are clearly differentiated. Across domains academic achievement has negative effect on the academic self-concept. This effect is explained by the processes of social comparison and internal dimensional comparison of achievement in the development of the academic self-concept (Marsh, 1986). The reciprocal internal/external frame of the reference model was proposed to integrate these findings (Möller et al., 2011).

Methods. We used longitudinal data from the Twin Early Development Study (TEDS: Oliver & Plomin, 2007; Haworth, Davis, & Plomin, 2013) collected from the same children when they were 9, 12 and 16 years of age. One child from each twin pair was selected randomly to form the sample (7712 participants in total). Our measures of achievement were literacy and mathematics teacher ratings at 9, web tests scores at 12, and GCSE scores at 16. Language and mathematical self-concepts were assessed by questionnaires measuring self-perceived ability. The data were adjusted by sex, age, and g to exclude the potential bias. We fit a cross-lag cross-domain model to estimate within and cross-domain relationships between self-concept and achievement. For the analysis we used OpenMx package for R environment for statistical computations (Boker et al., 2011, R Development Core Team, 2012).

PRESIDENT'S SYMPOSIUM

The Study of Mathematically Precocious Youth, DNA Sequencing, Genetics, and the Phenotypic Accomplishments of Profound Intellectual Talent at Midlife

Forty Years Later:
What Happens to Mathematically Precocious Youth Identified at Age 12?

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Preliminary findings from the first midlife follow-up of 1,650 participants from the Study of Mathematically Precocious Youth's (SMPY) two oldest cohorts will be presented. During 1972-1974 and 1976-1978, participants were identified at age 12 as in the top 1% in mathematical reasoning ability. They were surveyed over the web from January 2012 to February 2013 on their accomplishments, family, and personal well-being. Particular attention will be devoted to their occupational status, creative accomplishments, and mate preferences, as well as how they invest their time currently and plan to in the future. Sex differences in occupational preferences, personal views, and life values will be reviewed. The presentation will conclude with a discussion of participants' satisfaction with their careers, personal relationships, and lives in general.

Profound Intellectual Talent:
A Compelling Phenotype for Behavioral Genetics and Neuroscience Inquiry

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Two cohorts identified before age 13 as having profound mathematical or verbal reasoning abilities (top 1 in 10,000) were tracked over three decades. One cohort (N = 320) was taken from the Study of Mathematically Precocious Youth (SMPY), the second (N = 271) was identified through Duke University's Talent Identification Program (TIP). Replicable findings across cohorts in terminal graduate degrees, occupations, and creative accomplishments underscore that above-level assessment procedures (e.g., administering college entrance exams to intellectually talented 12-year-olds) are an efficient way to identify truly extra-ordinary human potential. That the distinctiveness of their accomplishments is anticipated by early assessments of ability level and pattern could inform multidisciplinary inquiry. Studying these special populations from a behavioral genetics and neuroscience point of view could uncover underlying mechanisms that give rise to differential development among the profoundly gifted, and individual differences in intellectual talent more generally.

The Genetics of High Cognitive Abilities

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Persons with extremely high intelligence offer unique advantages for gene-hunters. Our Genetics of High Cognitive Abilities (GHCA) collaboration obtained DNA from more than 2,000 of the highest-IQ individuals in Duke University's Talent Identification Program (TIP). These individuals are estimated to have IQ scores greater than 150 and will be used as a case cohort in our High-IQ (HiQ) case-control project. We have genotyped these individuals on the Illumina Exome array (HumanExome-12v1-1_A) with 240,000 single-nucleotide polymorphisms (SNPs) in protein-coding regions of the genome. The whole genomes of these samples are also being sequenced at 40x coverage in collaboration with BGI. Although we do not as yet have results that we can report from these ongoing analyses, we are able to report the results from the first large-scale sibling and twin study of high IQ. Using cognitive assessments administered to 3 million 18-year-old males as part of compulsory military service in Sweden 1950-1990, we identified 370,00 sibling pairs and 9,000 twin pairs. The top 3% of intelligence composite scores was familial, heritable, and caused by the same genetic and environmental factors responsible for the normal distribution of intelligence. These results imply that any genetic effects identified in our HiQ project will not be 'genes for genius'; rather, they will apply to IQ throughout the distribution, including low IQ.

Petaflop Computer Clusters Crunch Genomes of Giant Minds: Collection, Sequencing, Analysis of the World's Largest Extreme-IQ Genomic Cohort

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Over 2,200 DNA samples have been gathered from subjects with very high IQ. Many (n=1,688) were assessed and identified early on, in nation-wide talent programmes. Others (n=548) have been enrolled and evaluated through protocols specially implemented by the Cognitive Genomics Lab project. The procedures applied for cohort phenotype assessment, the characteristics of the samples gathered so far, the technology involved in their treatment and sequencing, and the bioinformatics methods deployed in the genomic analysis, are reviewed. We describe the model of the genetics of intelligence, variance, and mutation used in the study design, the reasoning underlying this model, the implications on what types of variants we look for, and the prospects for the collection of further, equivalent cohorts in East Asia and Scandinavia. We state in advance that samples are currently undergoing sequencing - and resequencing - in BGI's recently acquired Complete Genomics technology, and that analysis results therefore will not be revealed prematurely in the lecture or ensuing Q&A.

The Fourth Law of Behavior Genetics

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Genome-wide association studies (GWAS), broadly understood, can utilize one of many possible approaches, including: (1) a comparison of allele frequencies in extreme cases and unselected controls; (2) the linear regression of the phenotype on gene counts in samples of unselected individuals; (3) tests of linkage and association between markers and causal variants within families. The advantages and disadvantages of these approaches are complementary, and all should be pursued by scientists interested in the genetic architecture of a particular phenotype. The advantage of the *case-control design*—discussed by the previous speakers in relation to the ongoing whole-genome sequencing of the Duke TIP cohort and high-IQ volunteers—is that in the absence of confounding it most offers the most statistical power to detect the variants of small effect that typically account for the genetic architectures of quantitative traits.

The evidence for the pervasiveness of small-effect architectures is now strong enough that we propose a "Fourth Law of Behavior Genetics": genetic variation in a typical behavioral trait is attributable to thousands of variants scattered across the human genome, each of which has a small effect. Some commentators have expressed disappointment at these small effects, which are denigrated as academic curiosities with little enduring scientific value. At first blush these claims, which cite the writings of authorities such as Paul Meehl, seem to have some merit and thus appear to throw the entire enterprise of gene hunting into disrepute. In this lecture I examine the epistemological implications of the Fourth Law and conclude that gene-mapping studies are in fact scientifically well justified.

KEYNOTES

Lifetime Achievement Award Address
Linda Gottfredson

President's Invited Address
Nicholas G. Martin

Keynote Address
Randall W. Engle

Holden Memorial Address On Science Writing
Elizabeth Finkel

LIFETIME ACHIEVEMENT AWARD ADDRESS

Linda Gottfredson

Empirical Treasure, Lost and Found

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In 1904 Charles Spearman demonstrated that human intelligence is a general capacity, that is, it aids performance in diverse activities and content domains. His discovery lay fallow until Arthur Jensen realized how profound it was. This single fact about intelligence, its generality, allowed him to predict that g's genetic roots would be dispersed in the genome and its physiological manifestations distributed across the brain. He showed at the behavioral level that individual and group differences in g generate predictable variations in performance whenever tasks require us to mentally manipulate information—learn, reason, think abstractly, "connect the dots," "figure things out," and so on. Jensen gradually built a theoretically coherent body of empirical evidence, a nomological network, integrating many types of evidence and attracting other scholars to the enterprise.

Jensen reintroduced Spearman's discovery about the time I entered graduate school (1973). It was the worst of times for objective inquiry into a trait so enmeshed in socioeconomic outcomes. Social scientists were disparaging the notion of intelligence and tests that measure it. Leading figures in my discipline, sociology, asserted that differences in ability and achievement are manufactured by elites to maintain their privileges. Some said that most everyone could do almost any job, and one that doctors could work their way up from orderly.

Their assertions violated common sense, ignored evidence in other disciplines, and assumed causal forces never demonstrated empirically. I therefore began looking

more deeply into mechanisms that might generate occupational inequality — not just differences in the occupations individuals prefer and enter, but also how today's finely graded occupational prestige hierarchy evolved in the first place. That search soon led to g and, more importantly, to asking exactly which aspects of a job magnify the advantages of higher g. The answer, found in job analyses data, was anything that increases the complexity of a job's information processing demands: irrelevant, abstract, additional, or insufficient information; ambiguity, novelty, and uncertainty; need to continually update knowledge, draw inferences, spot lurking hazards, visualize the unobservable, and much more. Complexity is also the active ingredient in IQ tests and what modern life heaps upon us. We all have to contend with its proliferating cognitive burdens, but they weigh more heavily on individuals lower on the IQ continuum or experiencing normal age-related cognitive decline.

Following g's footprints across the social landscape led me from one discipline to another, each stopover replicating my experience as a Peace Corps volunteer in South East Asia—being the proverbial Man from Mars. It always yielded unexpected insights. One was the transformative power of individually inconsequential effects that cumulate over time, tasks, or populations. Another was that we can improve the welfare of less able citizens—literally, reduce their disproportionately high odds of premature death—without having to raise their intelligence. That is what occupies me now—bringing critical tasks in health self-care within the cognitive reach of patients currently unable to perform them effectively (i.e., "non-compliant" patients).

PRESIDENT'S INVITED ADDRESS

Nicholas G. Martin

Emerging Evidence on the Molecular Genetics of Cognition

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After decades of stagnation, there have been recent dramatic advances in the genetics of cognition. These will be reviewed and future directions adumbrated.

KEYNOTE ADDRESS

Randall W. Engle

Working Memory Capacity as a Mediating Variable

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Working memory capacity has the qualities of a trait, with identifiable brain structures, neurotransmitters, and genetic factors associated with individual differences in working memory capacity. This trait is associated with performance on a huge array of real world tasks from complex learning to mind wandering to the prevention of intrusive thought. WMC can also be thought of as a state variable in that many conditions can lead to a reduction in trait WMC. Some examples are sleep deprivation, drugs, and stereotype threat. I argue for a model in which WMC at the construct level is a mediating variable for many different tasks in which control of attention is important. I will also present an argument that working memory capacity and fluid intelligence reflect two highly related but different abilities and data supporting that argument.

HOLDEN MEMORIAL ADDRESS ON SCIENCE WRITING

Elizabeth Finkel

Navigating the Straits of the Genetics of Intelligence Research

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It's a tough time to be a science writer. It's not just the constant challenge of mastering new fields in order to adjudicate between contested scientific views. There's also the distortion of scientific information by vested interests, and all of this complicated by seemingly laxer standards in science publication. One need not look far for examples: climate change, GM crops, vaccination…

But intelligence research raises the bar a whole order of magnitude—particularly research on the genetics of intelligence. Many regard it as a Pandora's Box. To some extent we have been saved from the worst by the fact that genetics has, so far, been unable to dig up the genes that underlie intelligence. That safeguard is about to be shredded as the most powerful dig in history is underway at the Beijing Genomics Institute. In this talk, I will share my trepidation as I attempt to journalistically navigate the straits of the genetics of intelligence research.

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