See Powerpoint version for notes for each slide
http://www.udel.edu/educ/gottfredson/reprints/2013ISIR.pptx/

Empirical Treasure, Lost and Found

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December 12, 2013

Imagine

…that someone told you this.

"If all 13-year-olds took the same 15-minute test (WASI), I could give you each child's odds for all these adult outcomes *without* knowing anything else about them."

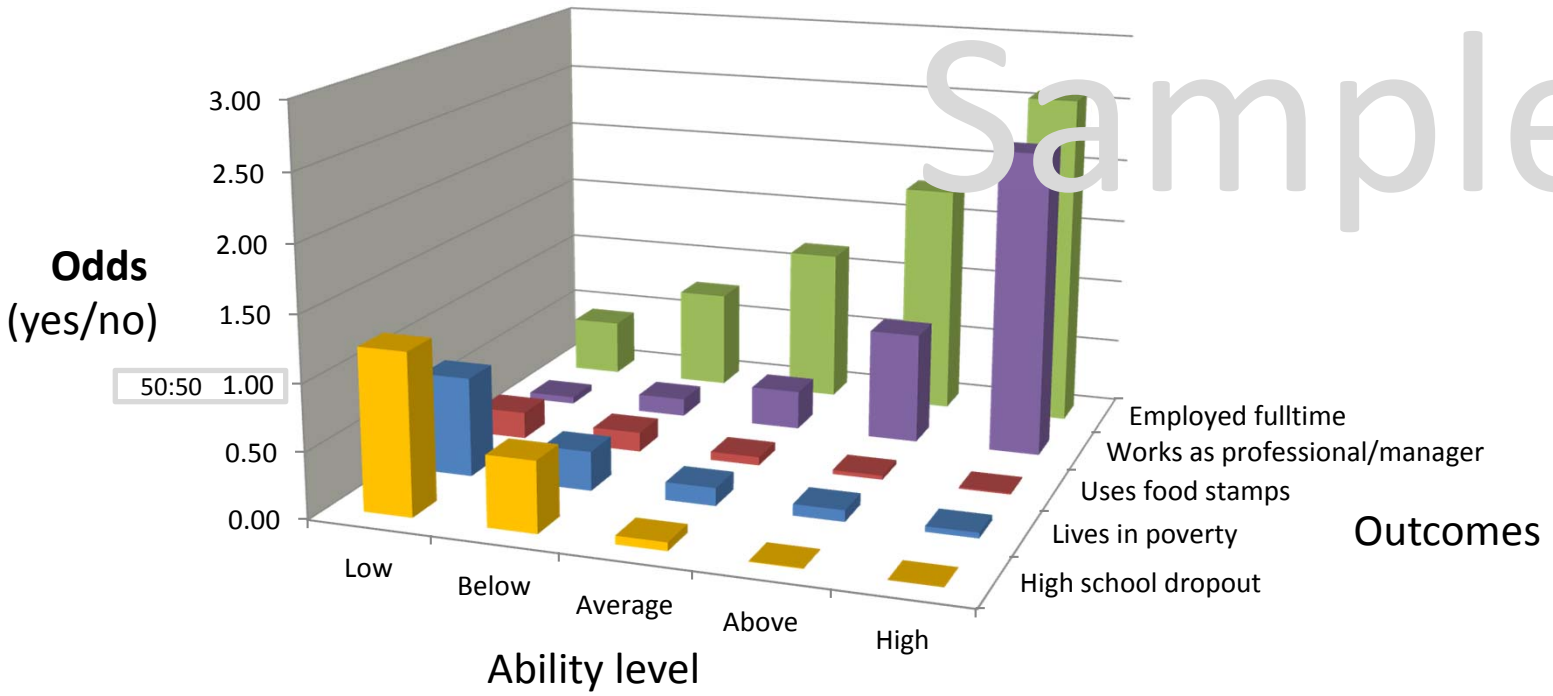
- Drops out of high school,
- Holds mostly unskilled jobs, skilled jobs vs. professional jobs
- Performs those jobs well
- Lives in poverty

AND

- Can find a particular intersection on a map, or grams of carbohydrate per serving on a food label
- Adheres to a medical treatment regimen for diabetes or other chronic illness
- Dies prematurely

Miraculous? Would you bet against this odds-maker? Don't!

Actual landscape of odds, by outcome and IQ*



* Source of data: Gottfredson, 1997, p.118 (young adults) and p.116 (all adults)

Now imagine

…that this person also claims that:

"With just one more piece of information, I can tell you how to improve the worst odds—without changing IQ and without leveling social resources.

AND

It would save thousands if not millions of lives, and millions if not billions of health care dollars."

Miraculous? Credible??

Yes, and *g* is the key!

Lost treasure of *g*—a personal account

Chronology

- Today—*g* 30 years after rediscovery
- Yesterday—Dark Ages before rediscovery
- Tomorrow—Vast opportunities ahead

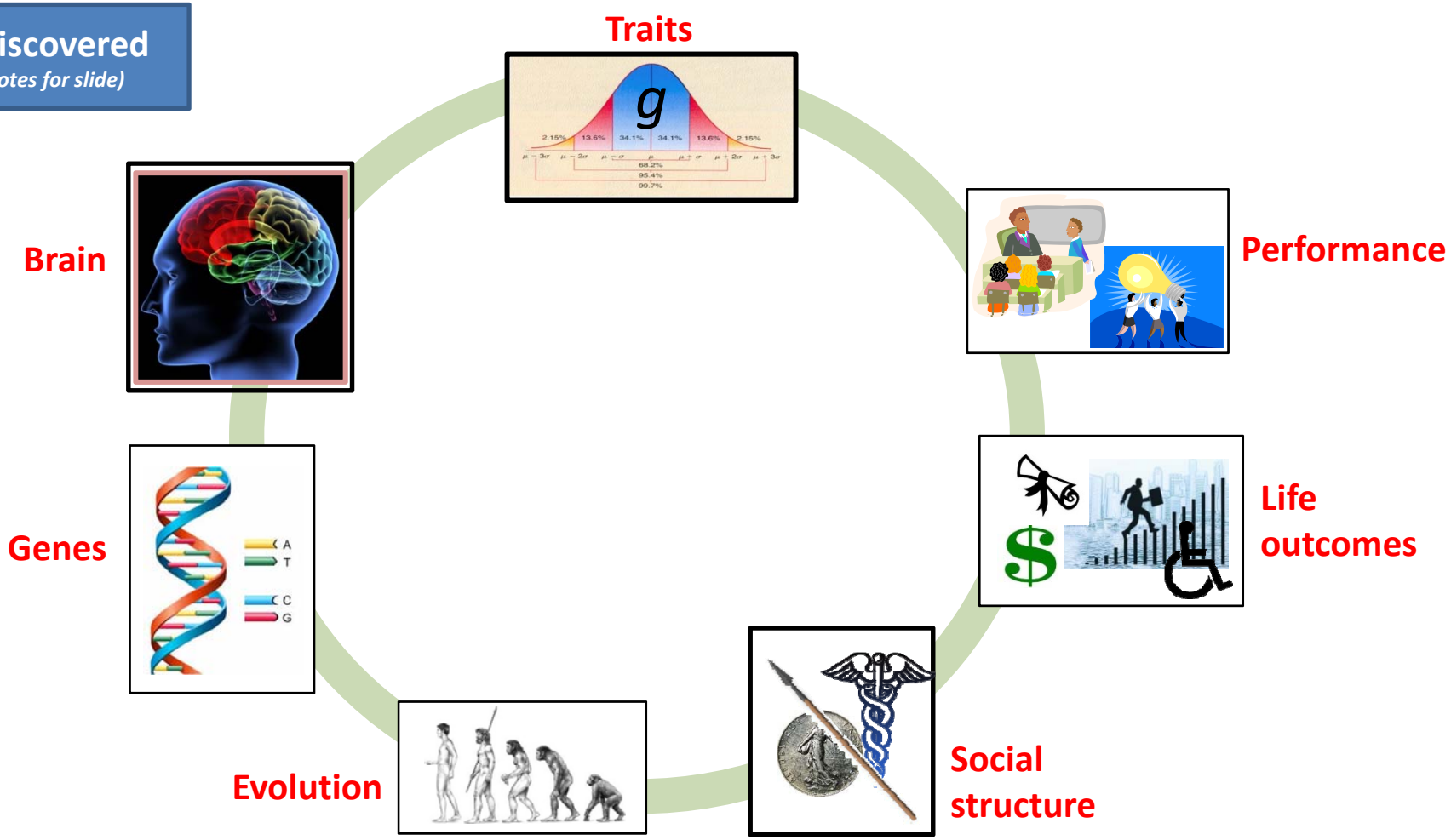
Unexpected lessons

- Complexity of everyday life
- Power of “inconsequential” effects

A story to remember

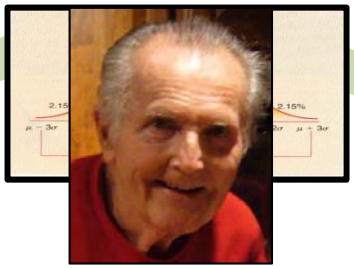
g: 30 Years of Discovery

g rediscovered
(See notes for slide)



g rediscovered
(See notes for slide)

Traits

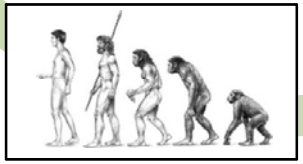


Performance

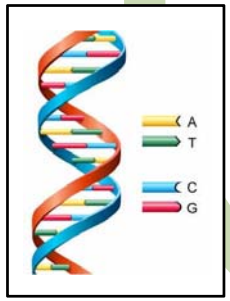
Life outcomes

Social structure

Evolution

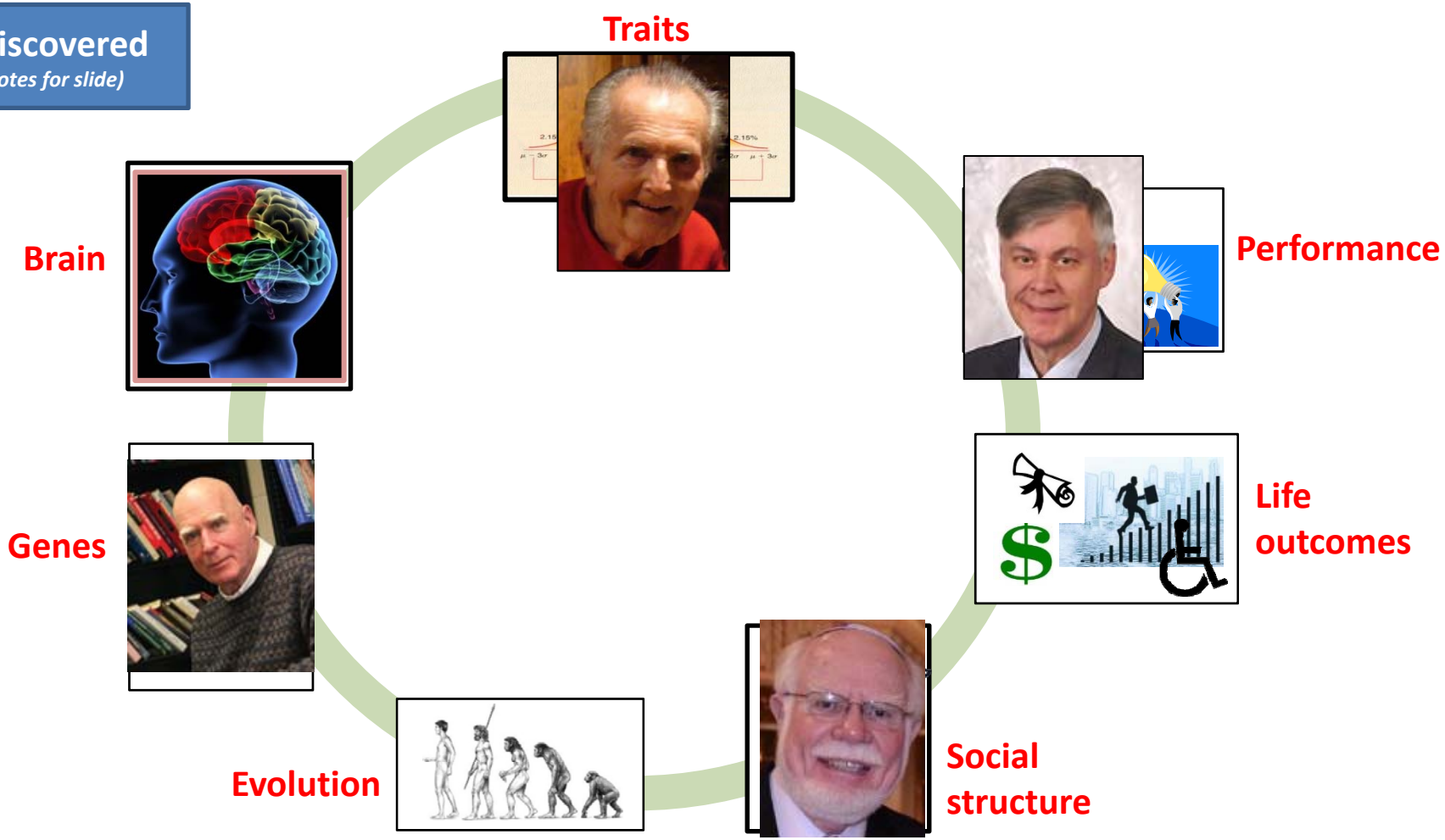


Genes



Brain

g rediscovered
(See notes for slide)



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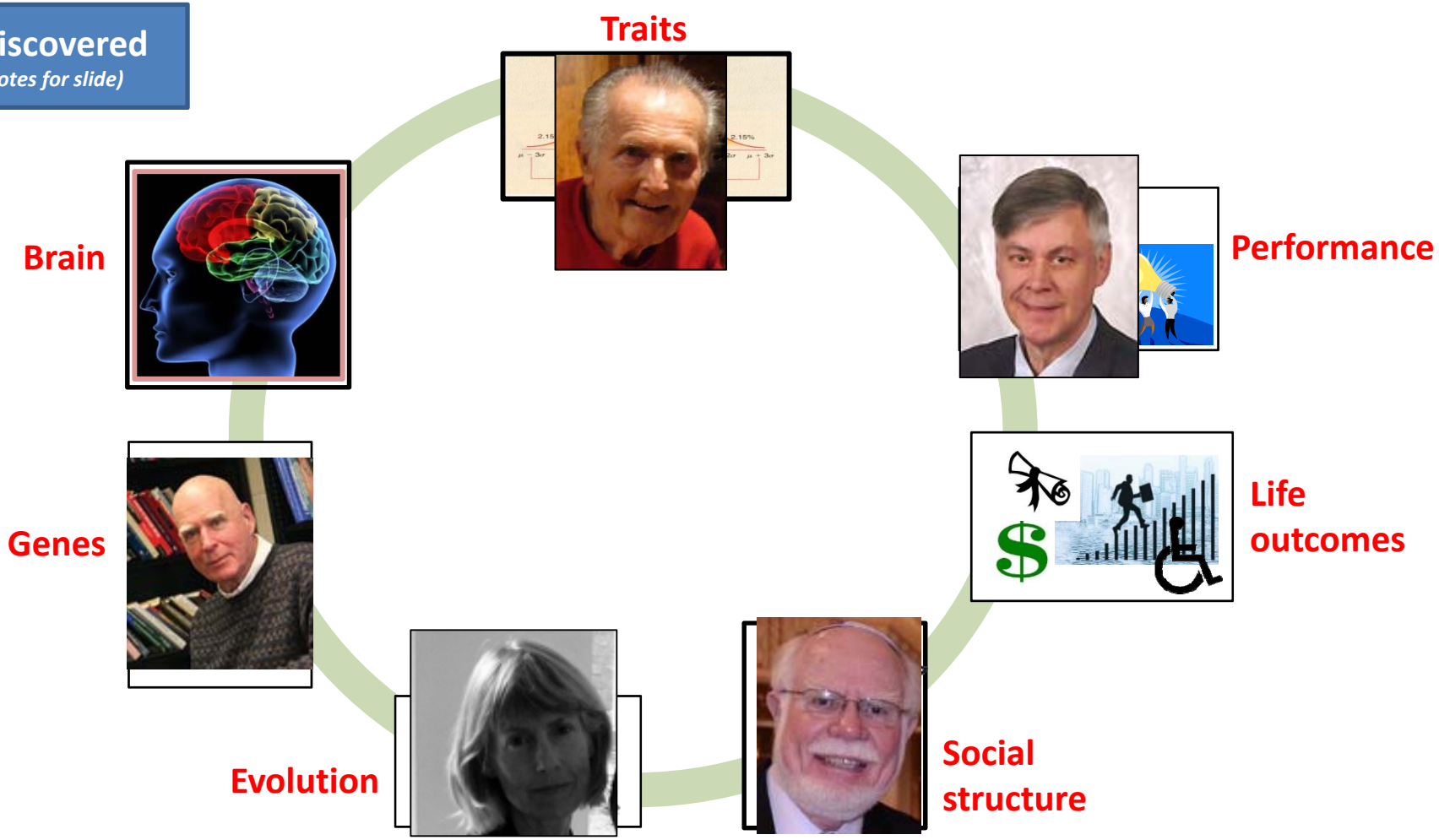

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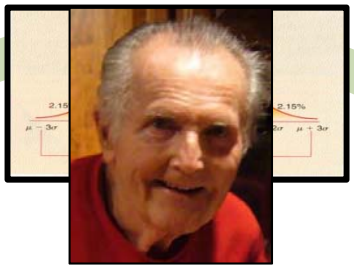
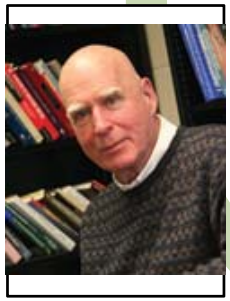


Performance

Life outcomes

Social structure

Evolution



Genes

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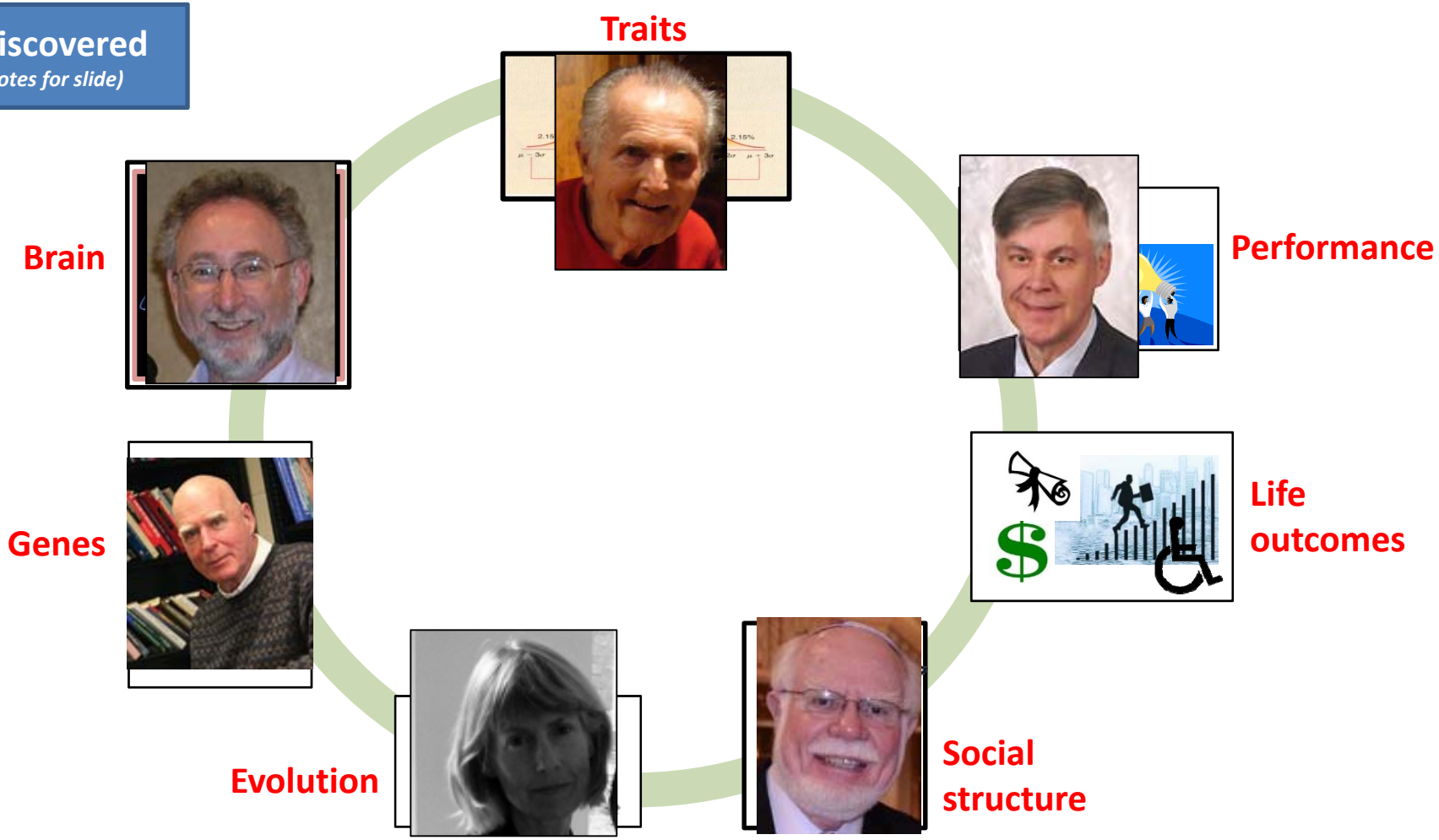

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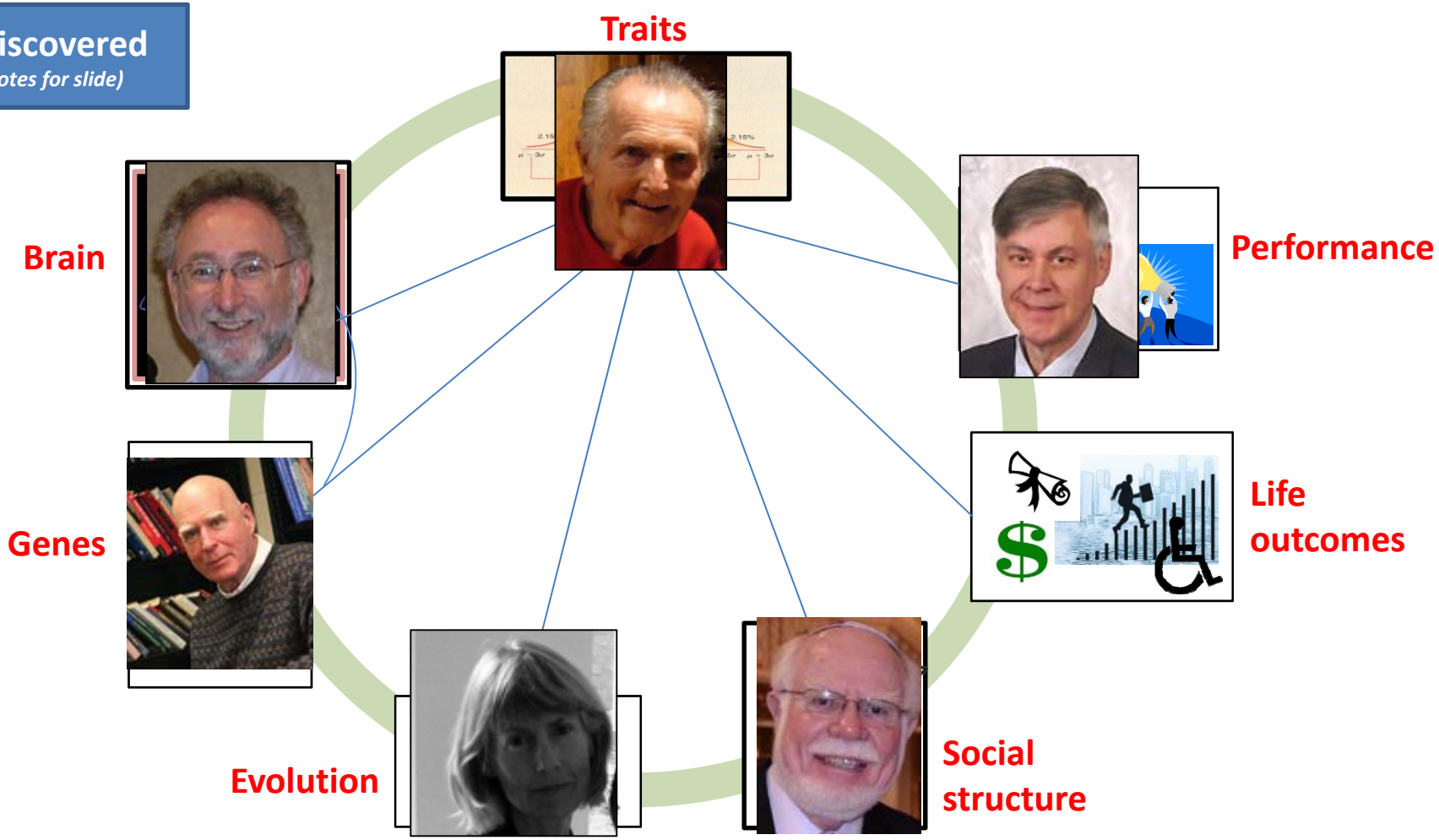

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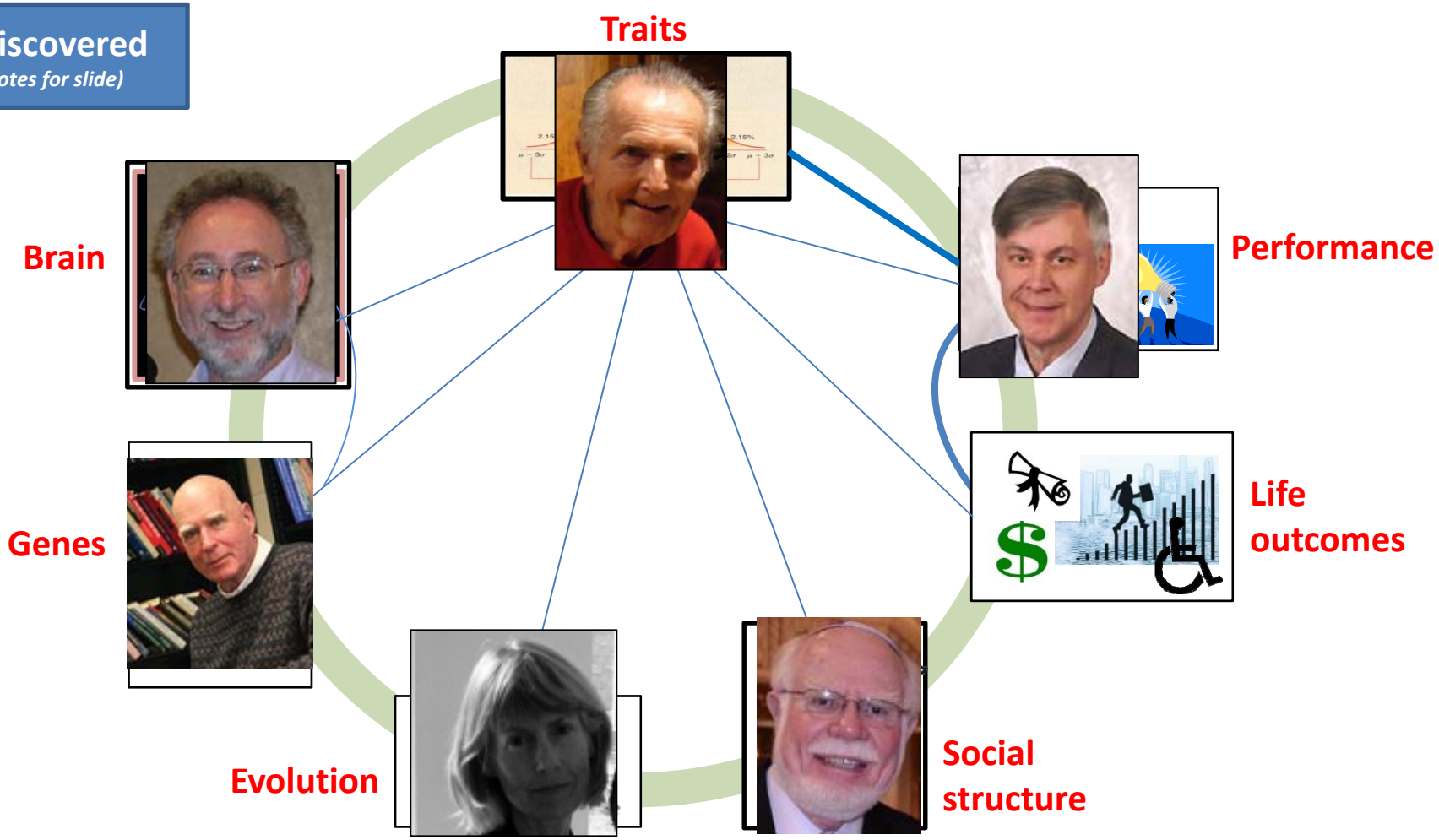

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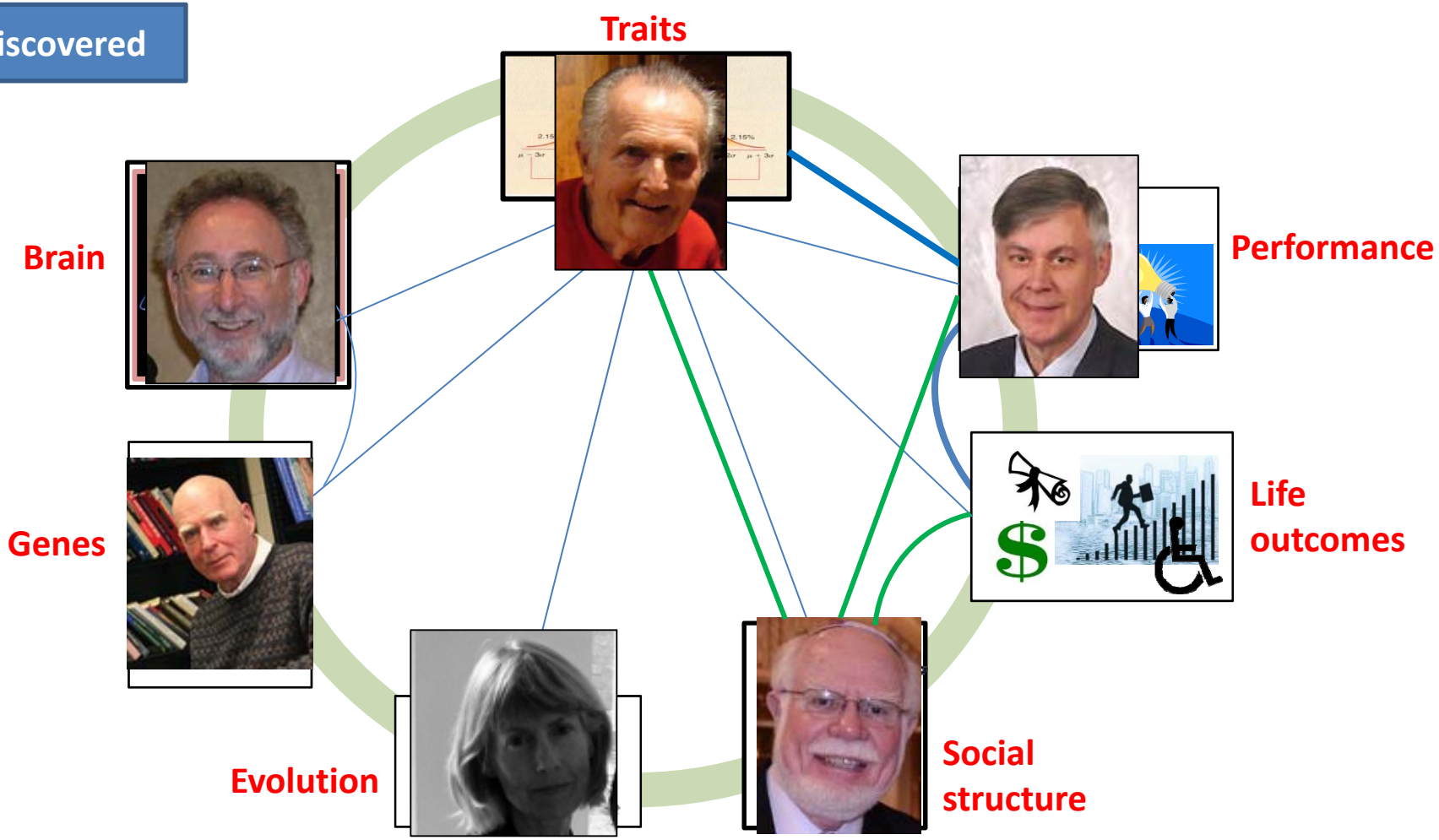

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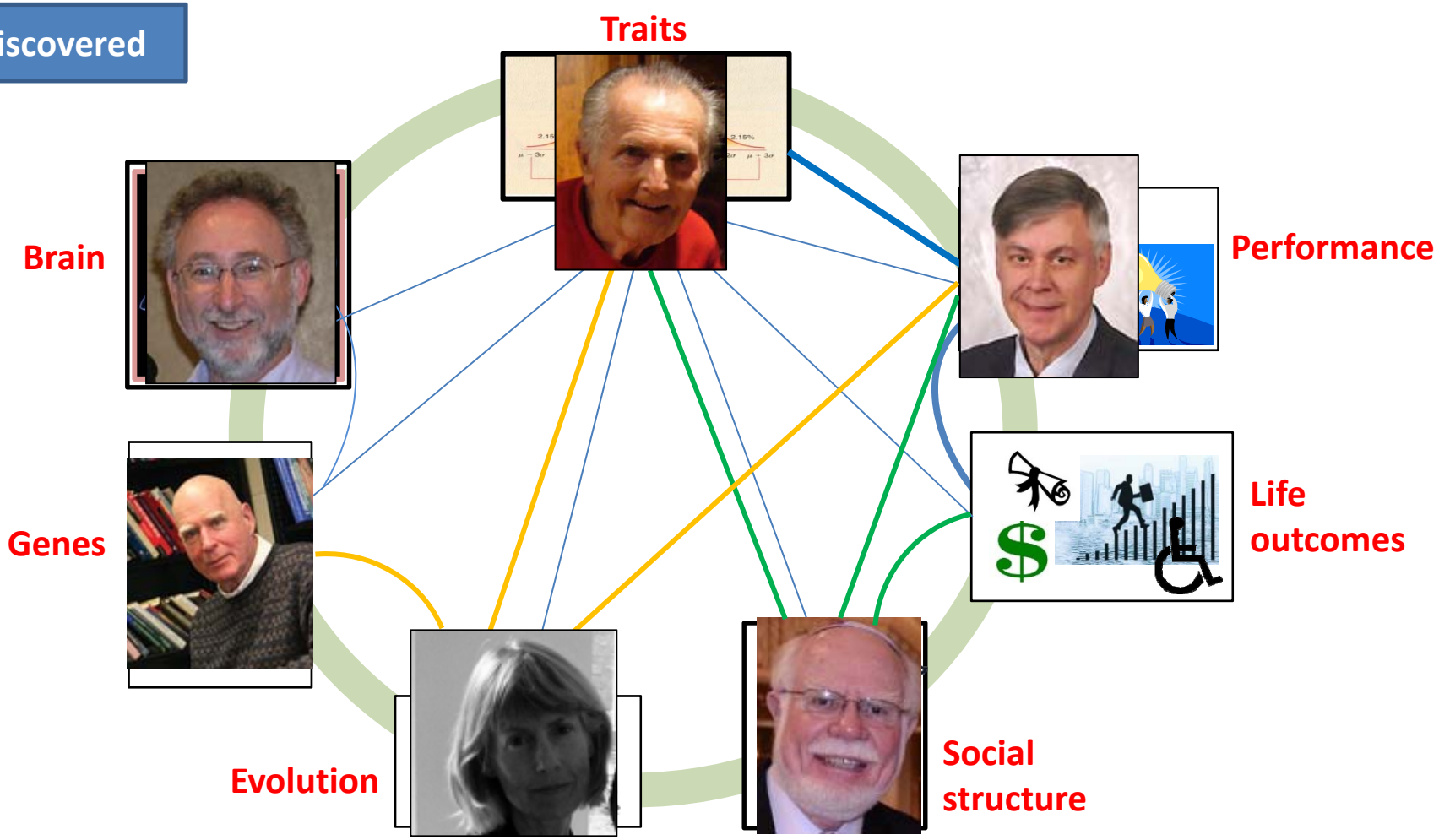

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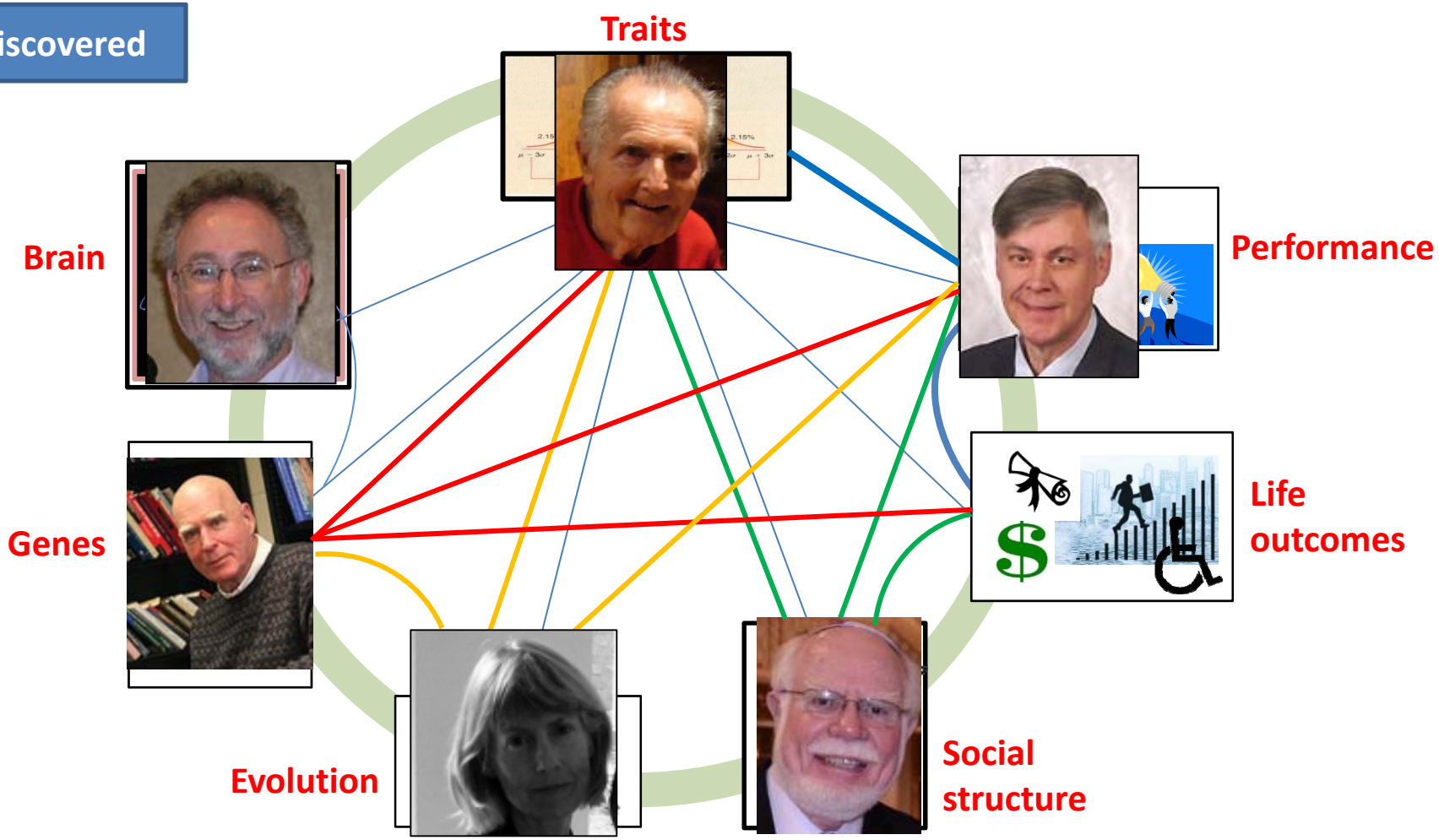

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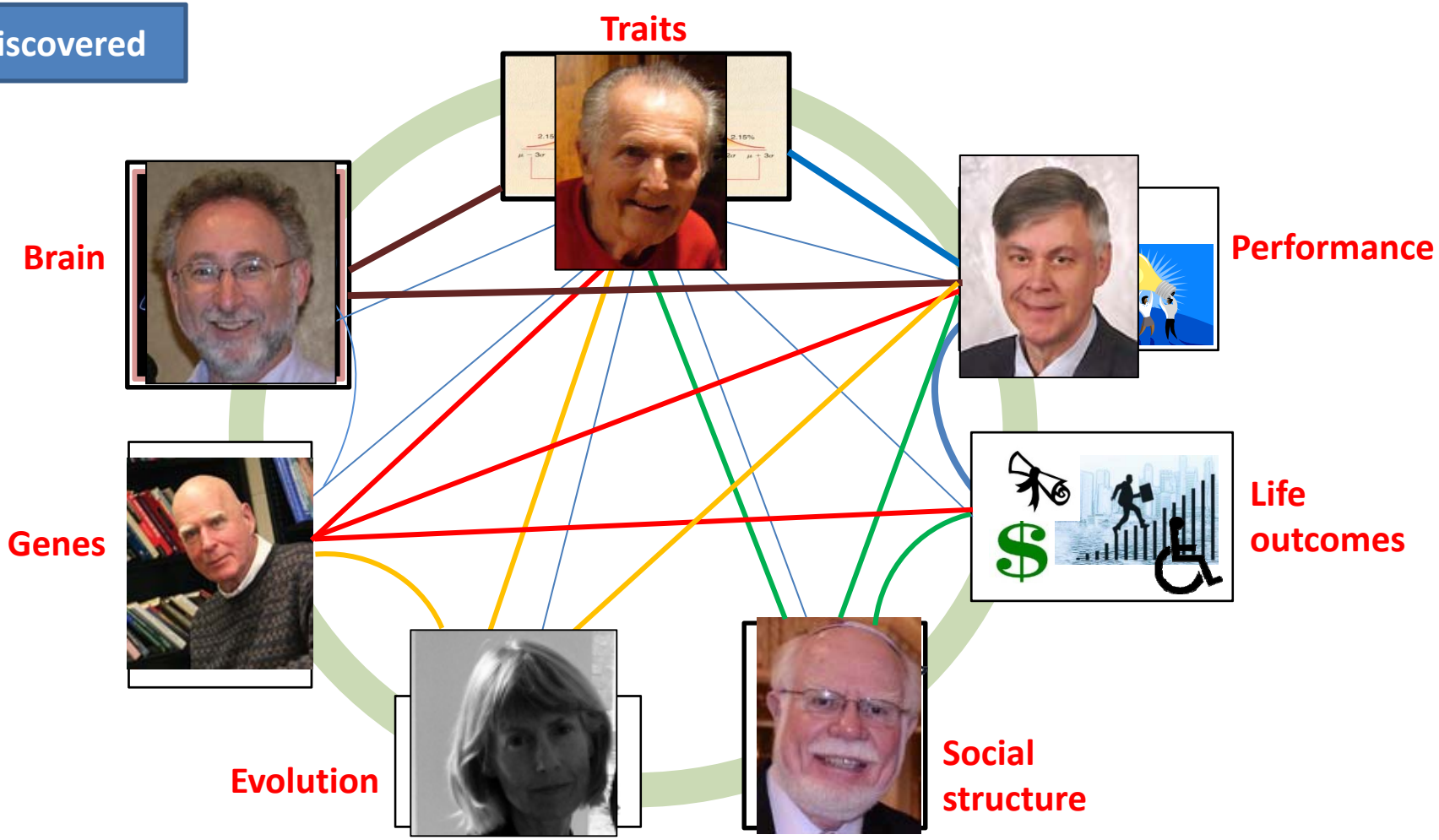

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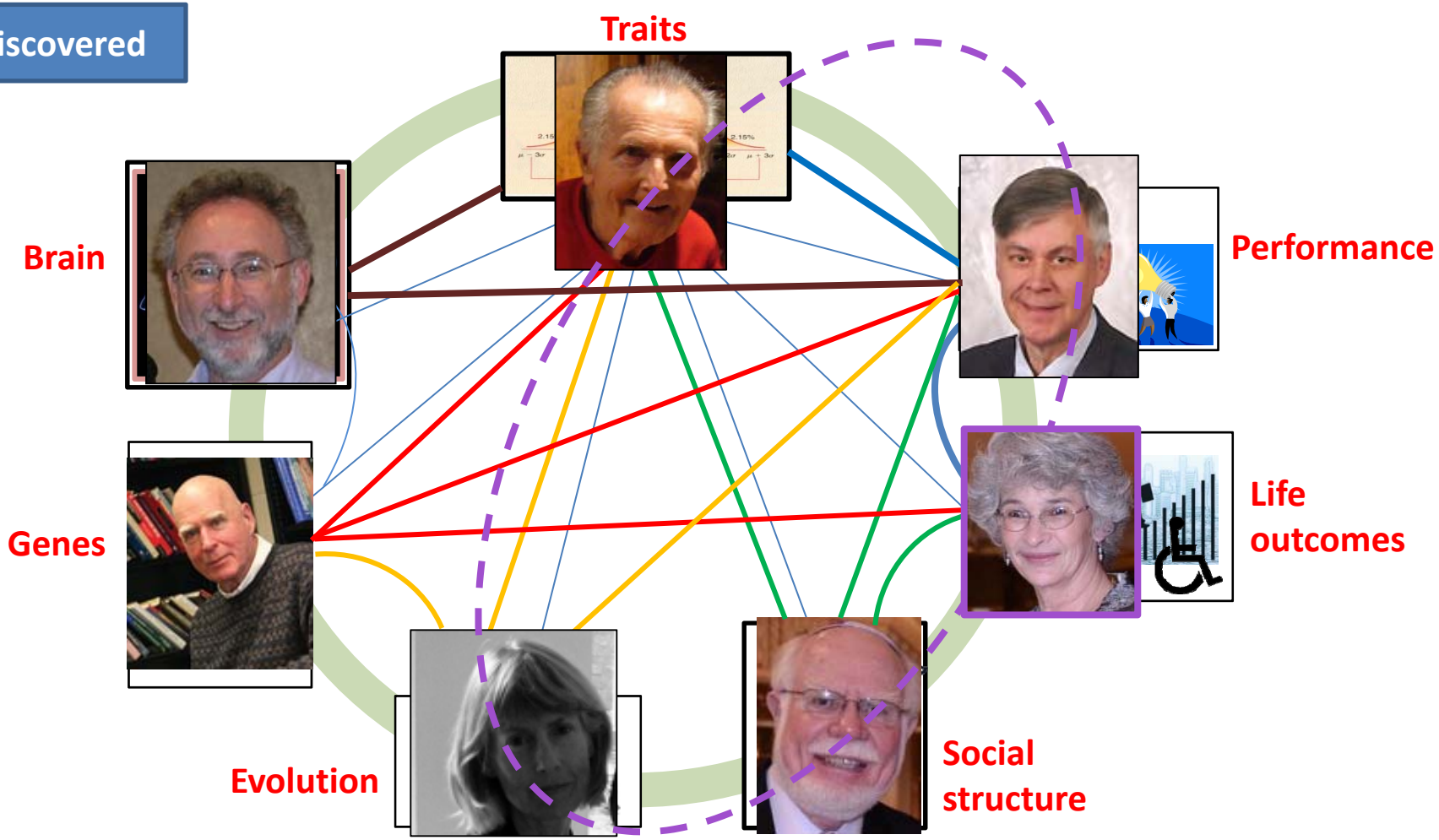

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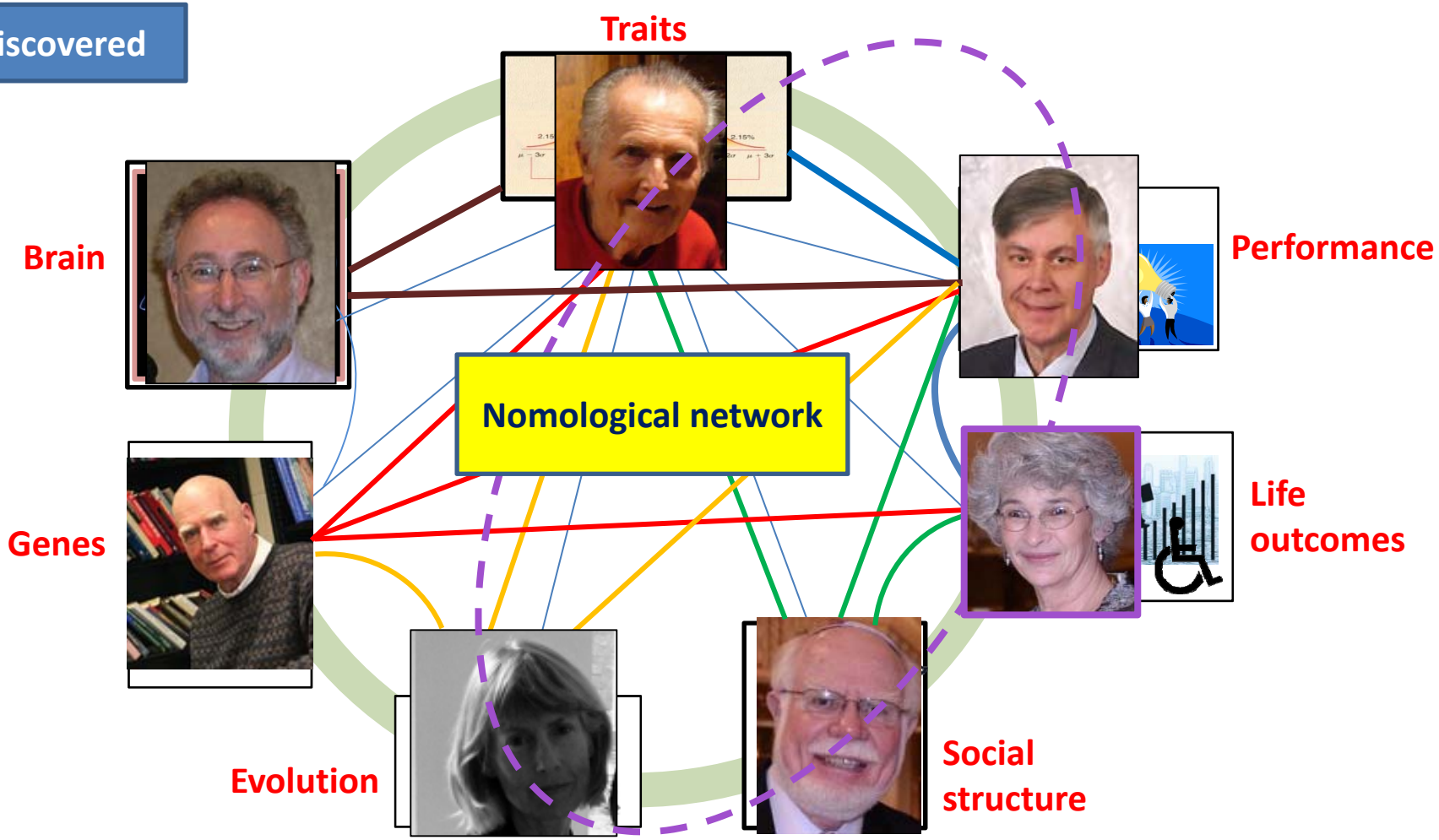
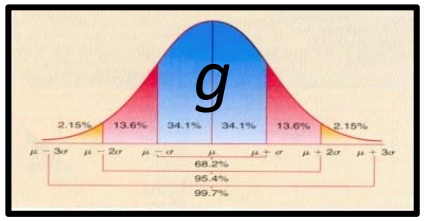


Human variation in *g:* Extraordinary phenomenon

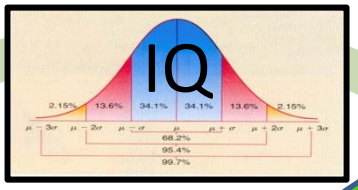


- Recurring
- Species-wide
- General-use capacity
- Shapes human institutions
- Drives its own evolution

Dark Ages Before Rediscovery

g lost by 1970s

Traits



Performance

Life outcomes

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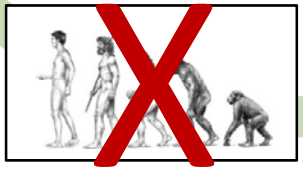
Evolution



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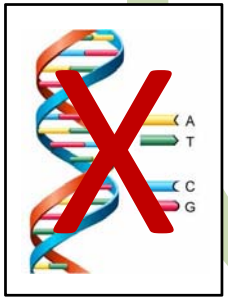
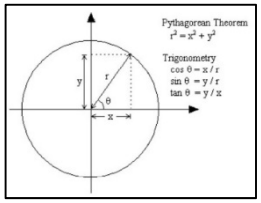


Brain

when I entered grad school

My 30 years, pre-PhD



Themes

Explore, collect & classify

Chase puzzles

Feet on the ground

Man from Mars

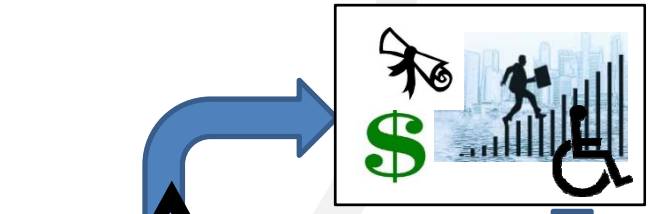
Penang
Malaysia

1947 **1977**

1970s

Sociology

- Difference= inequality
- Inequality is neither natural nor moral



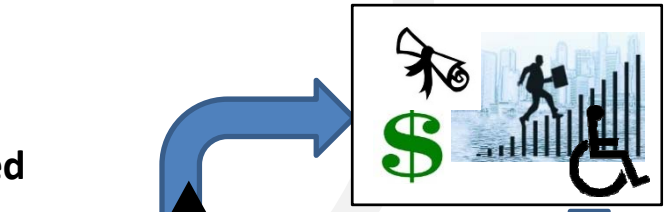
Social inequality

Social class hierarchy

1970s

Social privilege is…

…socially reproduced



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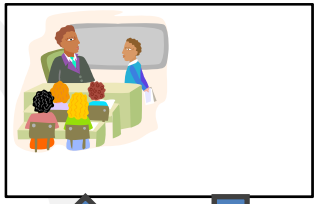


Performance

Social inequality

Social class hierarchy

1970s

Social privilege is…

Manufactured differences

aspirations
IQ

…disguised as "merit"

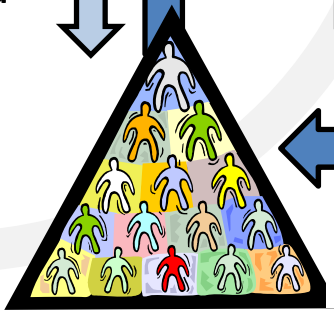
Performance

…socially inherited

"everyone can do any job"
"doctors should work up from orderly"

…socially reproduced

Social inequality



Social class hierarchy

Sound eerily familiar?

In USA:

- Law—“No Child Left Behind”
- Too-good-to-be-true science—“several weeks of N-back training raised intelligence”

Needed: Shift in Focus

Knowing *g* by what brings it forth—
task complexity

My alternative explanation:*
Higher intelligence has *functional* value

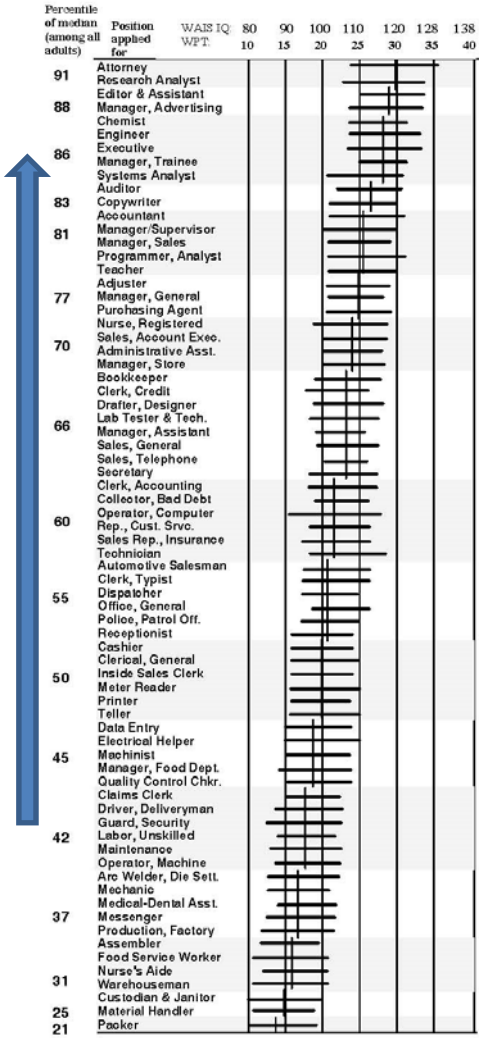
Required me to study attributes
of *jobs and tasks*, not just people.

Specifically--
What in a job requires the exercise of *g*?
What makes some more "*g* loaded" than others?

*Alternative to social privilege theory

Key finding #1:
Occupational hierarchy is cognitive

- Same worldwide
- Mean worker IQs track jobs' cognitive complexity
- Job complexity hierarchy evolved as work tasks clustered (into occupations) by g loading to fit human variation in *g*

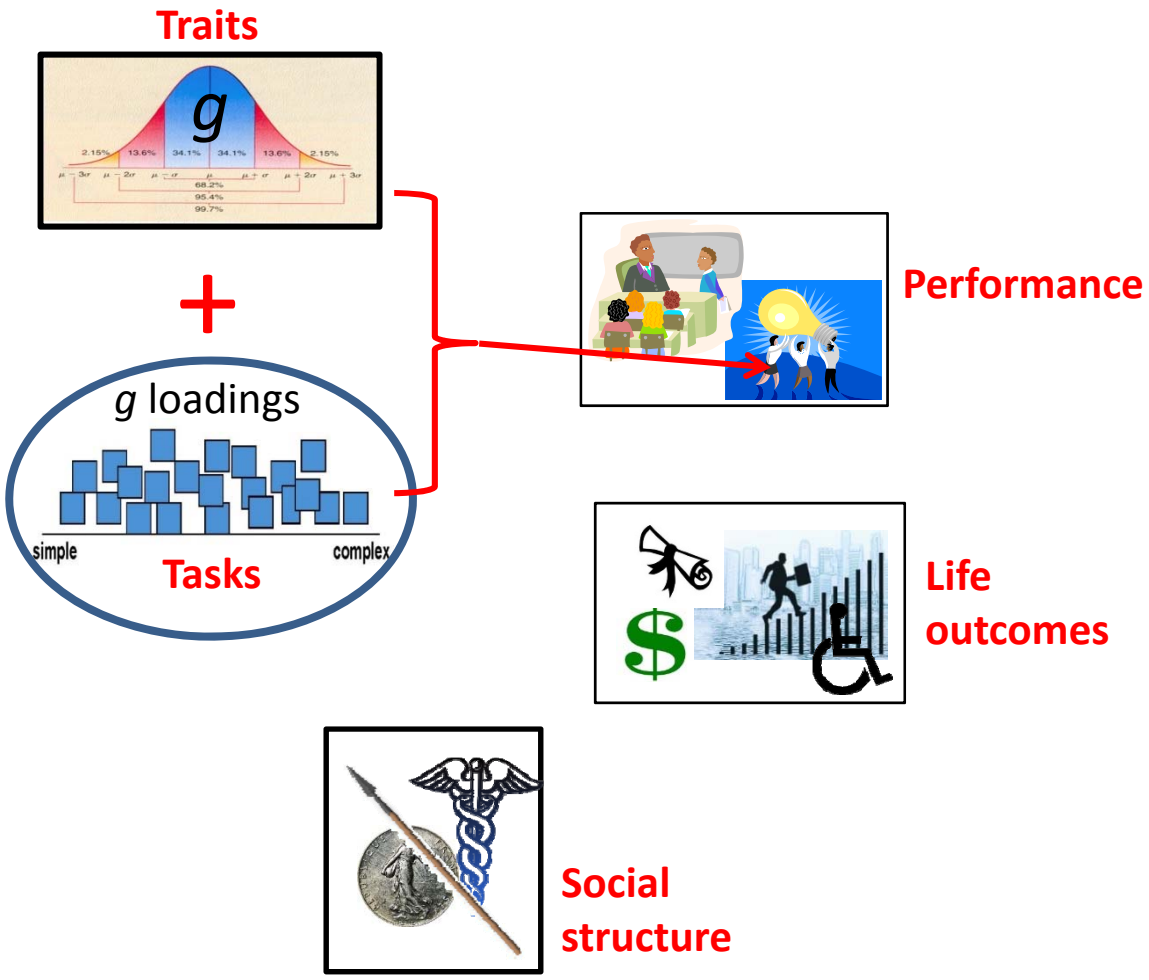


Key finding #2: "Judgment & Reasoning Factor" among jobs*
Complexity factor among jobs is mirror image of *g* factor among people

Workers must:	Correlation with factor
▪ Learn and recall relevant information	**.75**
▪ Reason and make judgments	**.71**
▪ Deal with unexpected situations	**.69**
▪ Identify problem situations quickly	**.69**
▪ React swiftly when unexpected problems occur	**.67**
▪ Apply common sense to solve problems	**.66**
▪ Learn new procedures quickly	**.66**
▪ Be alert & quick to understand things	**.55**

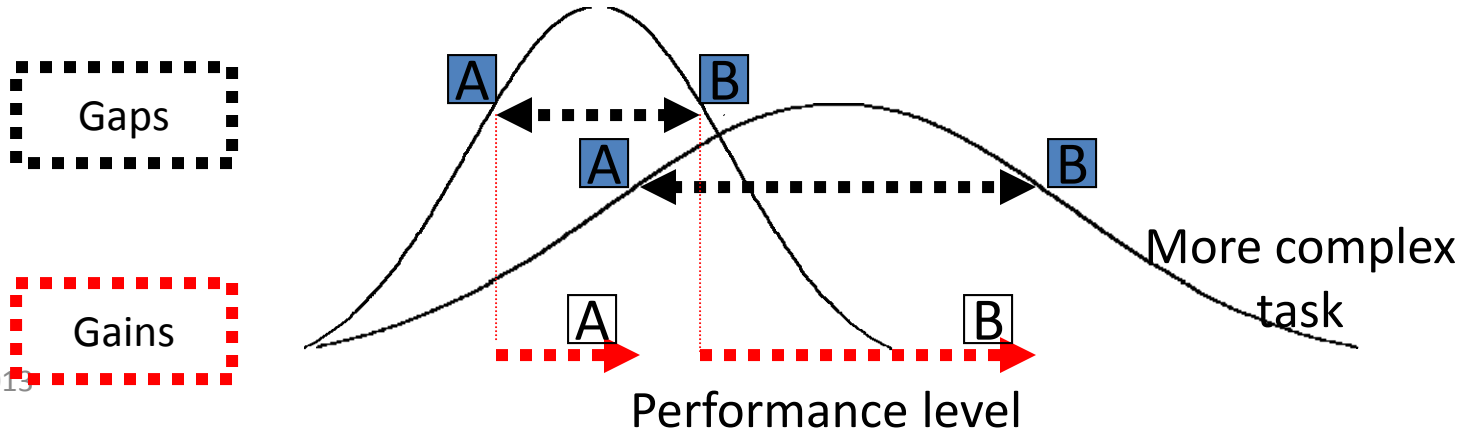
*Job analysis by Arvey (1986)

So, *g* loading is the flip side of *g*



Key finding #3: The Complexity Dynamic

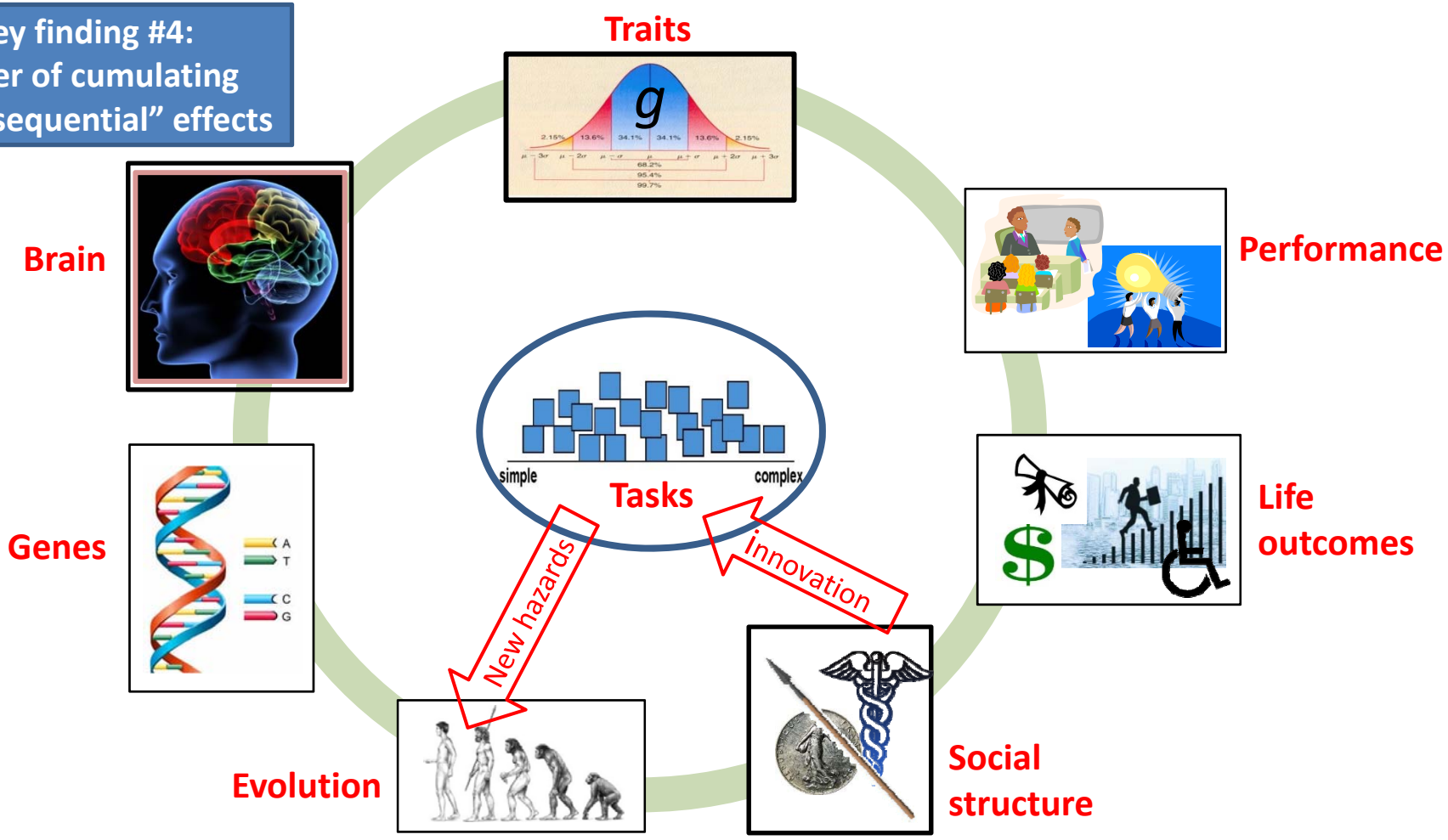
- Tasks that are more complex
  - put a bigger premium on learning-reasoning ability
  - lead to bigger differences in task performance



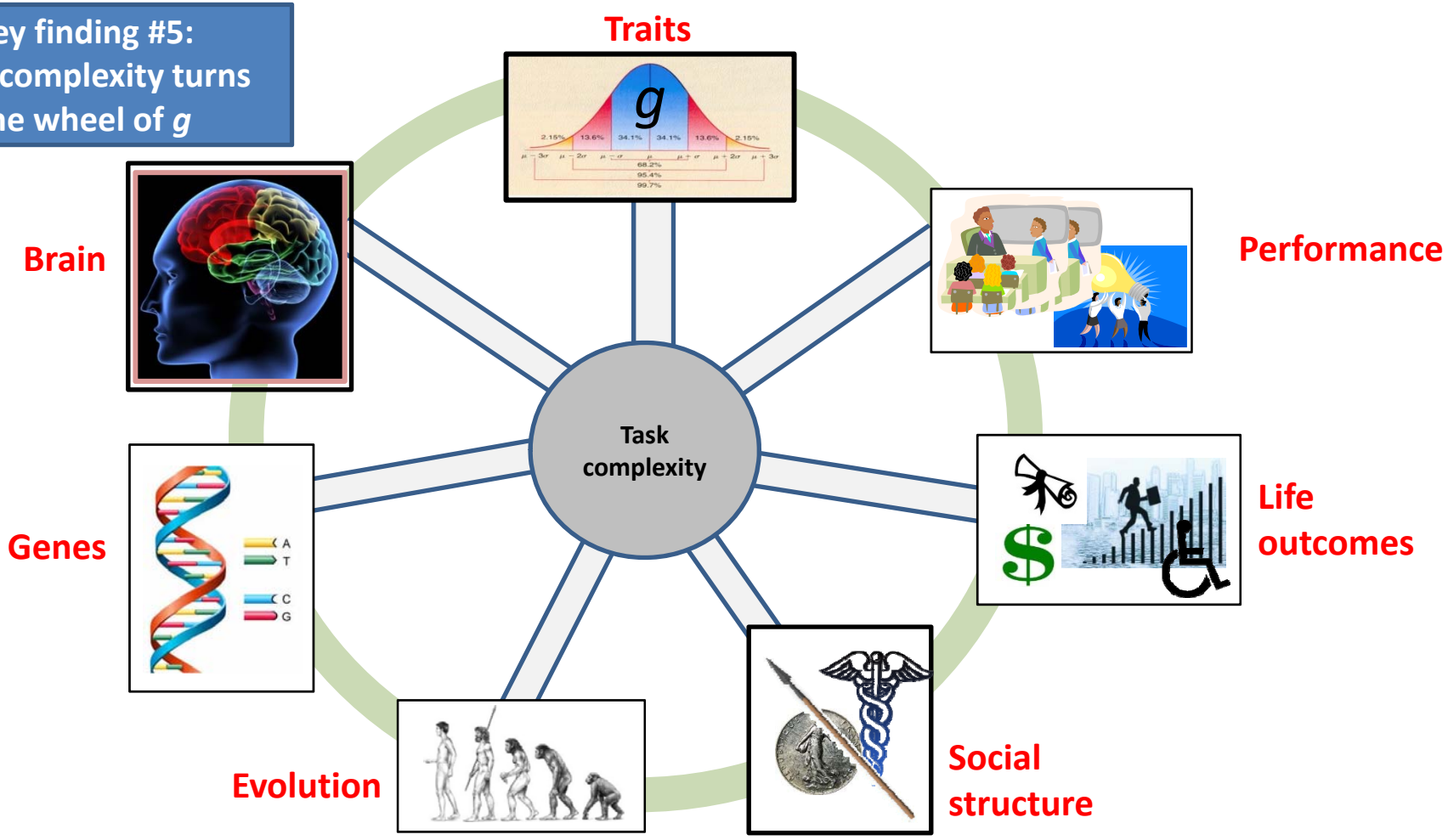
But how could a *general* intelligence ever evolve?

What adaptive challenges could possibly have been so *general*, so non-specific, to evolve such a content-free, domain-general ability??

Key finding #4:
Power of cumulating "inconsequential" effects

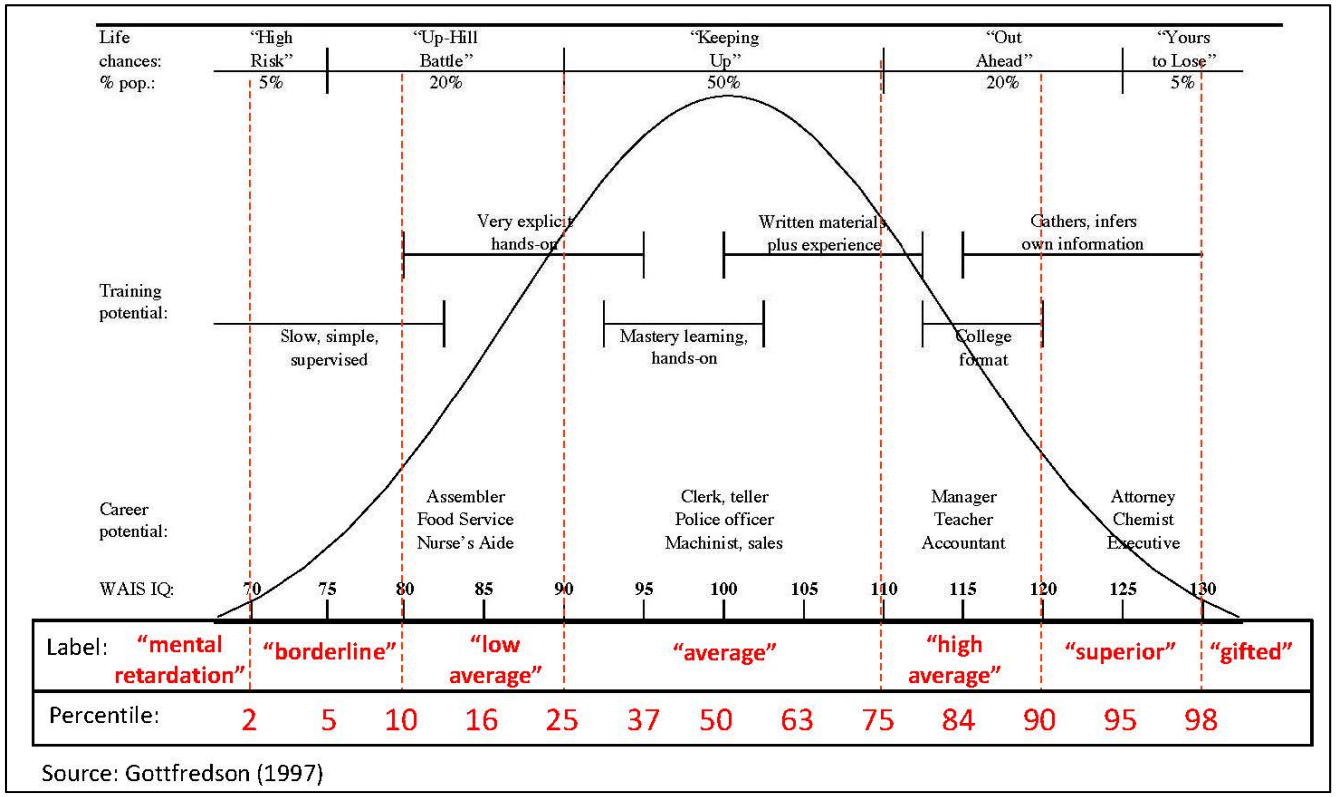


Key finding #5:
Life's complexity turns the wheel of *g*



Complexity of everyday life, today

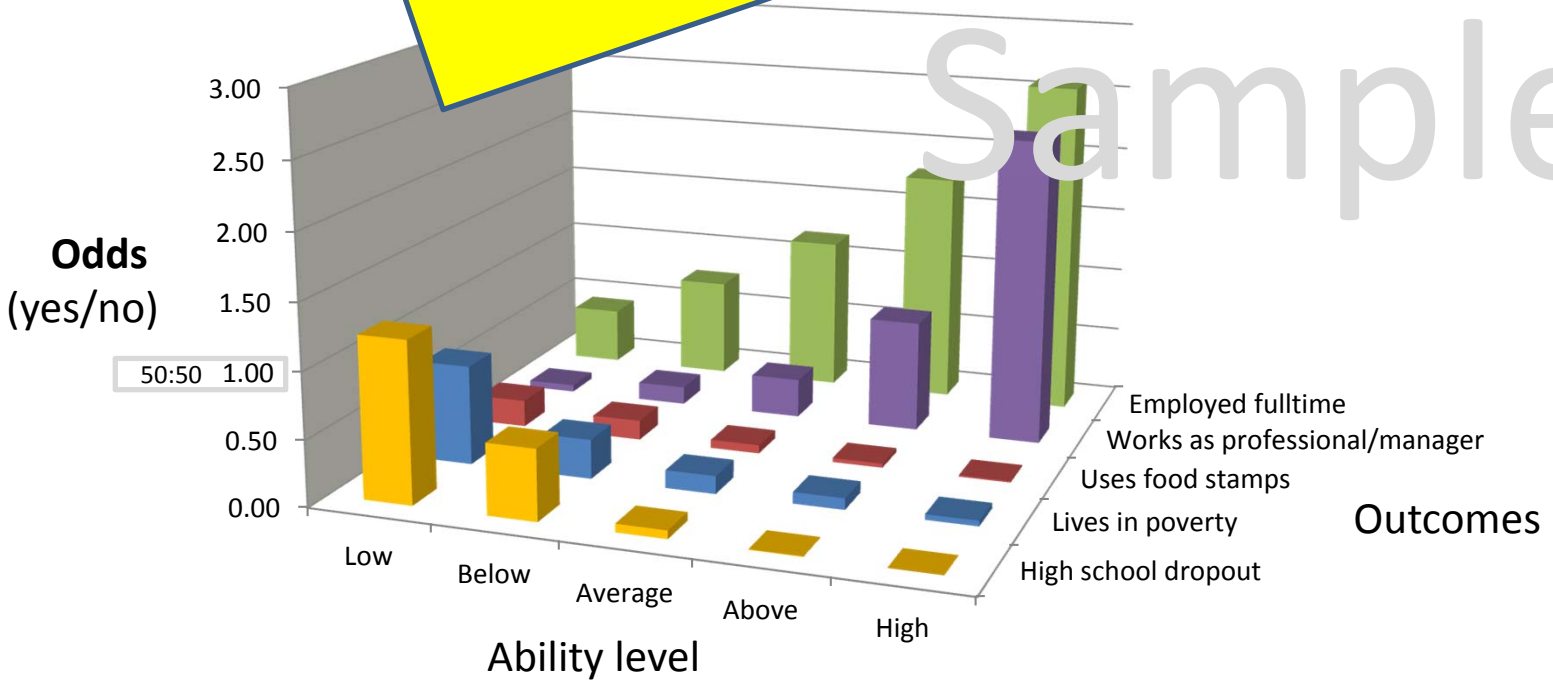
Typical life outcomes along IQ continuum



Source: Gottfredson (1997)

Landscape of cognitive error on everyday tasks*

Recall this

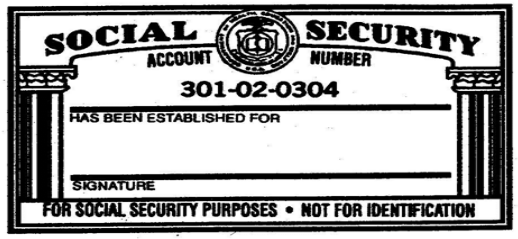


* Source of data: Gottfredson, 1997, p.118 (young adults) and p.116 (all adults)

Examples of everyday tasks*

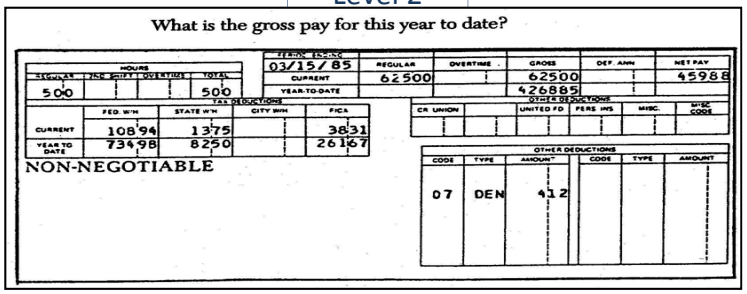
Level 1

Here is a Social Security card. Sign your name on the line that reads "signature."



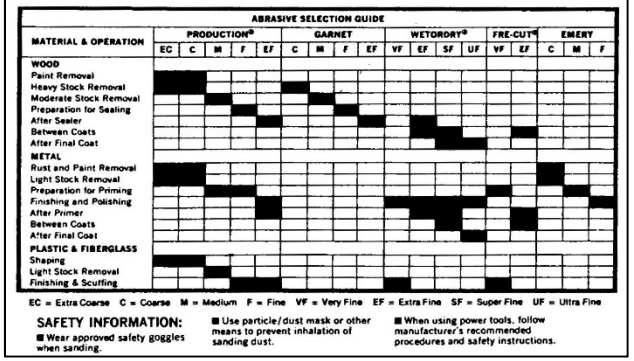
Level 2

What is the gross pay for this year to date?



Level 3

You need to smooth wood in preparation for sealing and plan to buy garnet sandpaper. What type of sandpaper should you buy?



Level 4

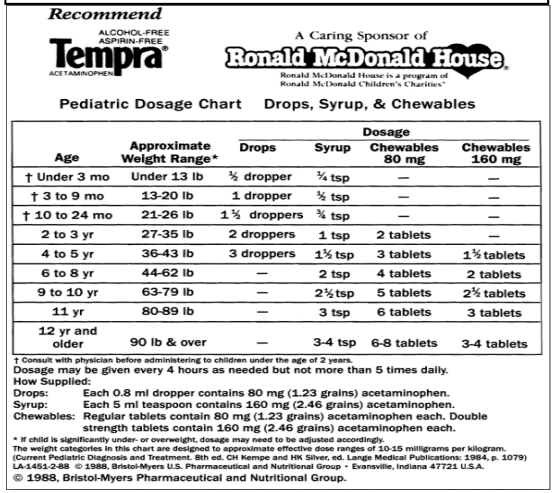
Estimate the cost per ounce of the creamy peanut butter. Write your estimate on the line provided.

Unit price	You pay
11.8¢ per oz.	1.89
rich chnky pnt bt	
10693	16 oz.

Unit price	You pay
1.59 per lb.	1.99
creamy pnt butter	
10732	20 oz.

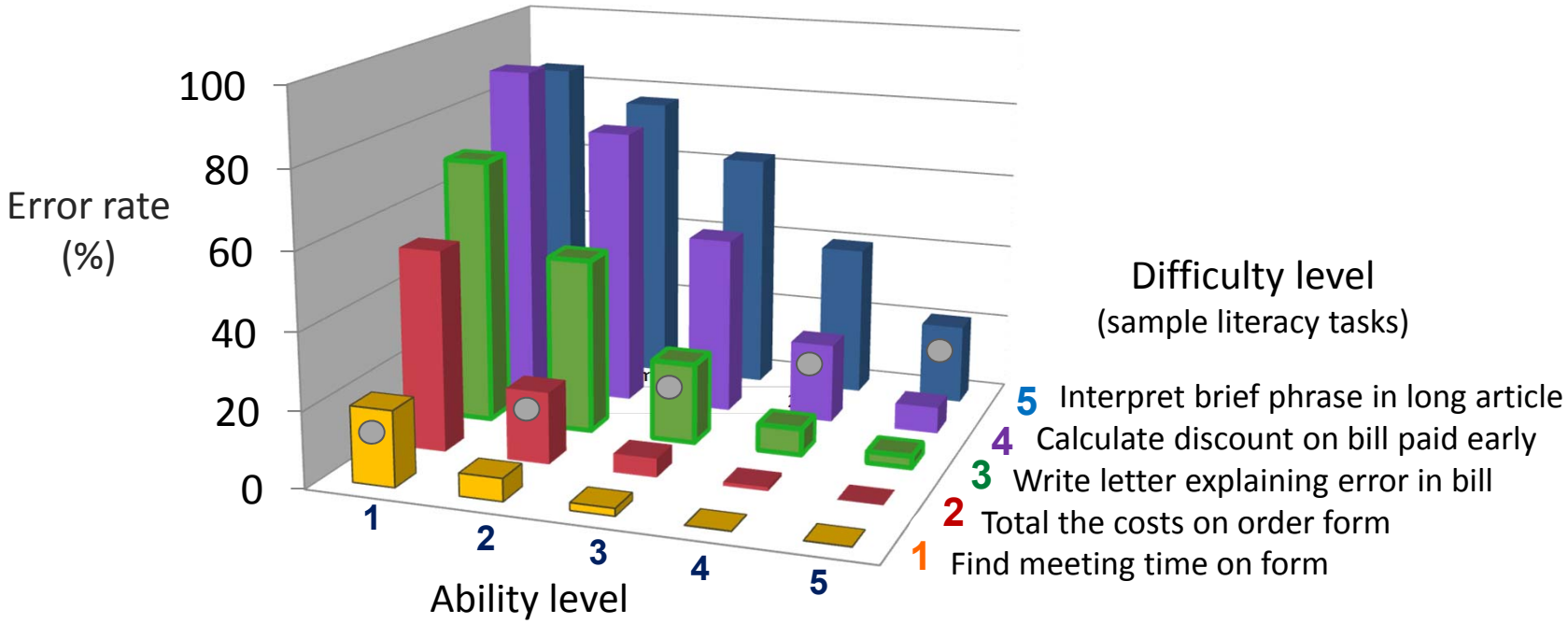
Level 5

Your child is 11 years old and weighs 85 pounds. How many 80 mg tablets can you give in 24-hr period?



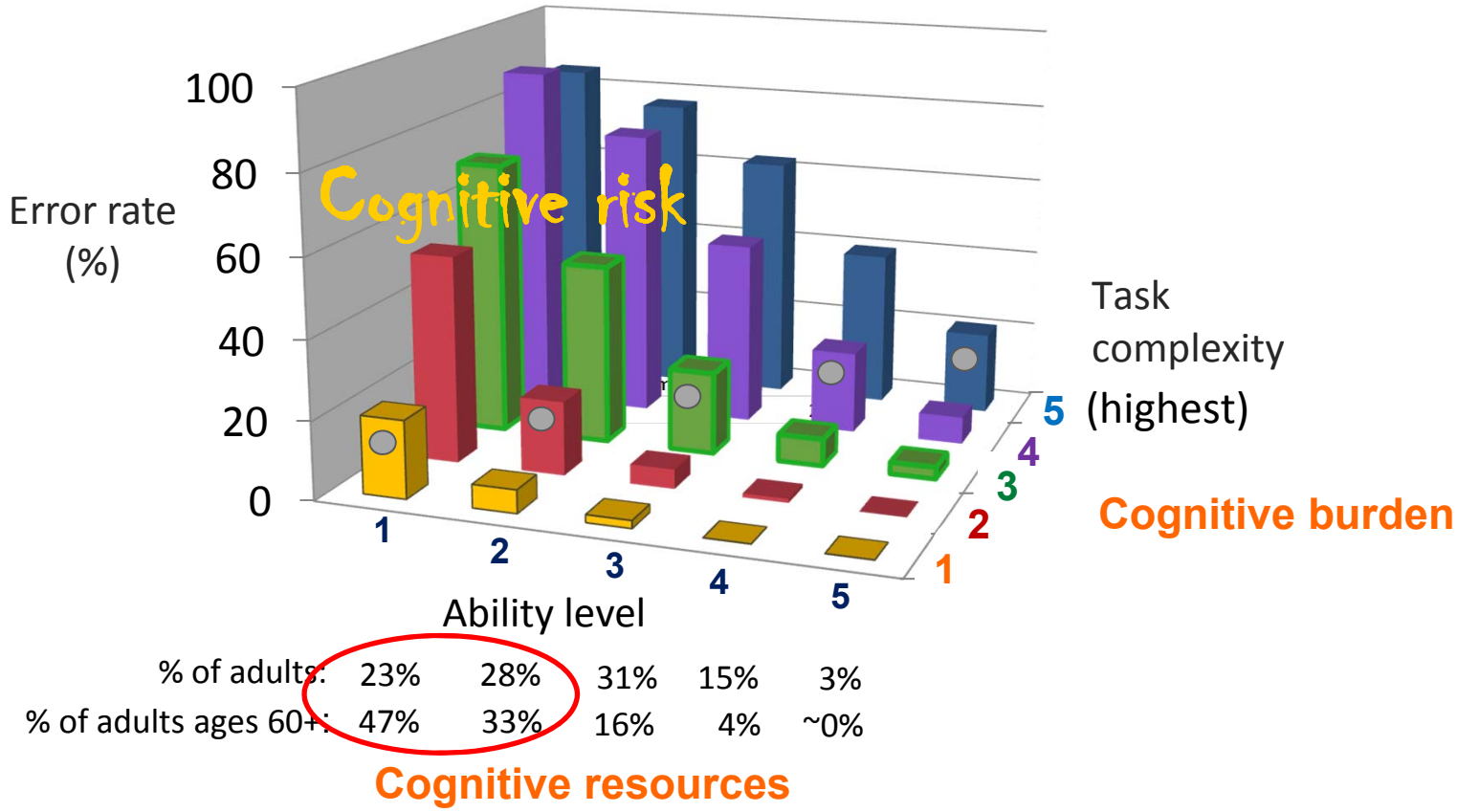
*Items on 1993 National Adult Literacy Survey (NALS)

Landscape of cognitive error on everyday tasks*



*Source of data: National Adult Literacy Survey (NALS), ages 16-65., Kirsch et al. (1993)

Landscape of cognitive error on everyday tasks*



*Source of data: National Adult Literacy Survey (NALS), ages 16-65., Kirsch et al. (1993)

Opportunities—An Example

Current (*g*-blind) "solutions" to challenges in health care

- Political: race-class disparities in health
  - Equalize access to care [it actually *increases* disparities]
  - Teach health providers to be more culturally sensitive
  - Redistribute wealth to keep social disadvantage from "getting under the skin"

- Practical: patient non-adherence to treatment
  - Give patients more information

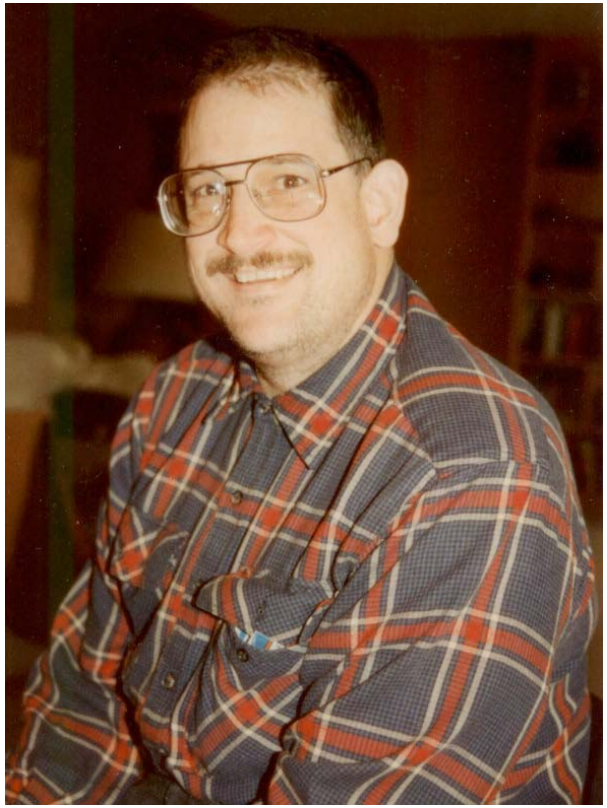
"Déjà vu all over again"

Current project
Increase cognitive accessibility of DSM*

- Analyze the “job” of diabetes
- Focus on most critical tasks
- Target instruction to ability level
- Feedback & follow-up

*DSM = diabetes self-management

Human face of diabetes self-management



Job analyst's view: The patient's job description

- **Learn about diabetes in general (At "entry')**
  - Physiological process
  - Interdependence of diet, exercise, meds
  - Symptoms & corrective action
  - Consequences of poor control
- **Apply knowledge to own case (Daily, Hourly)**
  - Implement appropriate regimen
  - Continuously monitor physical signs
  - Diagnose problems in timely manner
  - Adjust food, exercise, meds in timely and appropriate manner
- **Coordinate with relevant parties (Frequently)**
  - Negotiate changes in activities with family, friends, job
  - Enlist/capitalize on social support
  - Communicate status and needs to practitioners
- **Update knowledge & adjust regimen (Occasionally)**
  - When other chronic conditions or disabilities develop
  - When new treatments are ordered
  - When life circumstances change
- **Conditions of work—24/7, no days off, no retirement**

Training

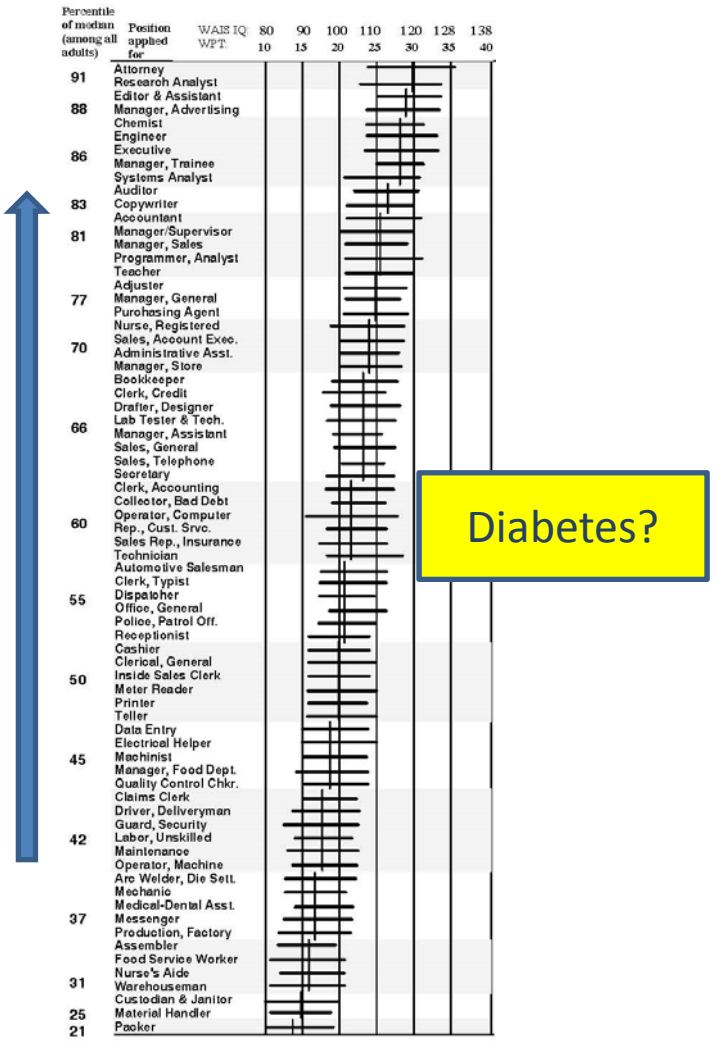
Self-management

Good performance requires good judgment

- **IT IS NOT** mechanically following a recipe
- **IT IS** keeping a complex system under control in often unpredictable circumstances (like accident prevention process)
  - Coordinate a regimen having multiple interacting elements
  - Adjust parts as needed to maintain good control of system buffeted by many other factors
  - Anticipate lag time between (in)action and system response
  - Monitor advance "hidden" indicators (blood glucose) to prevent system veering badly out of control
  - Decide appropriate type and timing of corrective action if system veering off-track
  - Monitor/control other shocks to system (infection, emotional stress)
  - Coordinate regimen with other daily activities
  - Plan ahead (meals, meds, etc.)
    - For the expected
    - For the unexpected and unpredictable
  - Prioritize conflicting demands on time and behavior

Occupational hierarchy

- Cognitive complexity



Sample guidance today

"Adjust insulin dose for number of carbohydrates in meal"

Knowledge & mental calculations required??

Sample health literacy item—how simple?

Task #1—Underline sentence saying how often to give medicine

- One piece of info
- Simple match
- But lots of irrelevant info

Pediatric Dosage Chart

Recommend

ALCOHOL-FREE
ASPIRIN-FREE
Tempra®
ACETAMINOPHEN

A Caring Sponsor of
Ronald McDonald House®
Ronald McDonald House is a program of
Ronald McDonald Children's Charities®

Pediatric Dosage Chart Drops, Syrup, & Chewables

Age	Approximate Weight Range*	Dosage			
		Drops	Syrup	Chewables 80 mg	Chewables 160 mg
† Under 3 mo	Under 13 lb	½ dropper	¼ tsp	—	—
† 3 to 9 mo	13-20 lb	1 dropper	½ tsp	—	—
† 10 to 24 mo	21-26 lb	1½ droppers	¾ tsp	—	—
2 to 3 yr	27-35 lb	2 droppers	1 tsp	2 tablets	—
4 to 5 yr	36-43 lb	3 droppers	1½ tsp	3 tablets	1½ tablets
6 to 8 yr	44-62 lb	—	2 tsp	4 tablets	2 tablets
9 to 10 yr	63-79 lb	—	2½ tsp	5 tablets	2½ tablets
11 yr	80-89 lb	—	3 tsp	6 tablets	3 tablets
12 yr and older	90 lb & over	—	3-4 tsp	6-8 tablets	3-4 tablets

† Consult with physician before administering to children under the age of 2 years.

Dosage may be given every 4 hours as needed but not more than 5 times daily.

How Supplied:
Drops: Each 0.8 ml dropper contains 80 mg (1.23 grains) acetaminophen.
Syrup: Each 5 ml teaspoon contains 160 mg (2.46 grains) acetaminophen.
Chewables: Regular tablets contain 80 mg (1.23 grains) acetaminophen each. Double strength tablets contain 160 mg (2.46 grains) acetaminophen each.

* If child is significantly under- or overweight, dosage may need to be adjusted accordingly.
The weight categories in this chart are designed to approximate effective dose ranges of 10-15 milligrams per kilogram.
(Current Pediatric Diagnosis and Treatment. 8th ed. CH Kempe and HK Silver, ed. Lange Medical Publications: 1984, p. 1079)
LA-1451-2-88 © 1988, Bristol-Myers U.S. Pharmaceutical and Nutritional Group · Evansville, Indiana 47721 U.S.A.

Caution!
Can train people to do this task, but not all possible tasks like it

Not so simple for many people…

Task #1—Underline sentence saying how often to give medicine

- One piece of info
- Simple match
- But lots of irrelevant info

Pediatric Dosage Chart

Recommend

ALCOHOL-FREE ASPIRIN-FREE Tempra® ACETAMINOPHEN

A Caring Sponsor of Ronald McDonald House®

Ronald McDonald House is a program of Ronald McDonald Children's Charities®

Pediatric Dosage Chart Drops, Syrup, & Chewables

Age	Approximate Weight Range*	Dosage: Drops	Syrup	Chewables 80 mg	Chewables 160 mg
† Under 3 mo	Under 13 lb	½ dropper	¼ tsp	—	—
† 3 to 9 mo	13-20 lb	1 dropper	½ tsp	—	—
† 10 to 24 mo	21-26 lb	1½ droppers	¾ tsp	—	—
2 to 3 yr	27-35 lb	2 droppers	1 tsp	2 tablets	—
4 to 5 yr	36-43 lb	3 droppers	1½ tsp	3 tablets	1½ tablets
6 to 8 yr	44-62 lb	—	2 tsp	4 tablets	2 tablets
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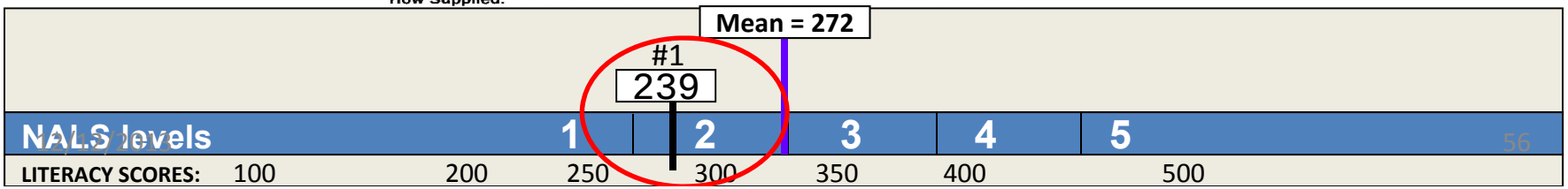
11 yr	80-89 lb	—	3 tsp	6 tablets	3 tablets
12 yr and older	90 lb & over	—	3-4 tsp	6-8 tablets	3-4 tablets

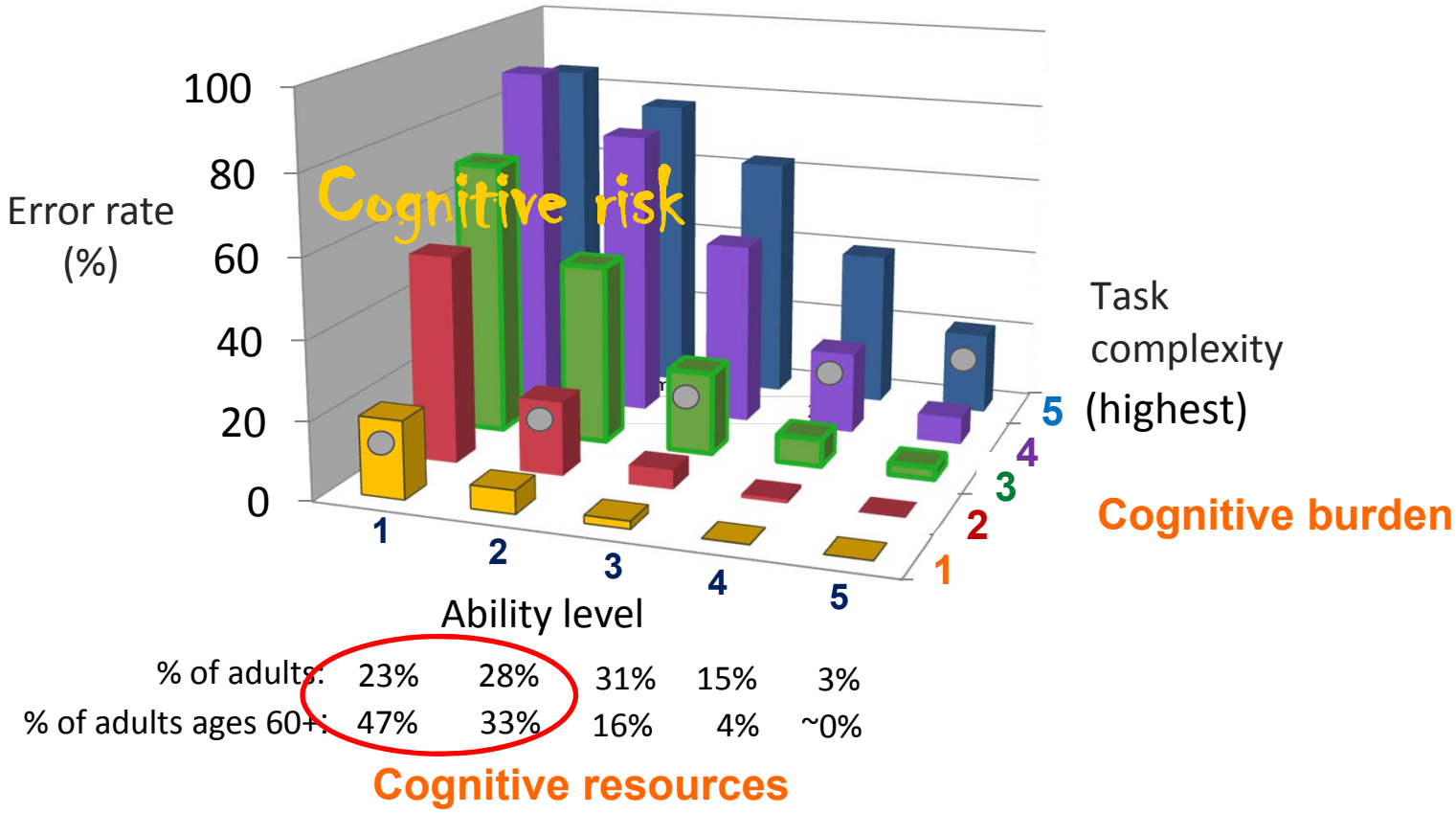
† Consult with physician before administering to children under the age of 2 years.

Dosage may be given every 4 hours as needed but not more than 5 times daily.

How Supplied:

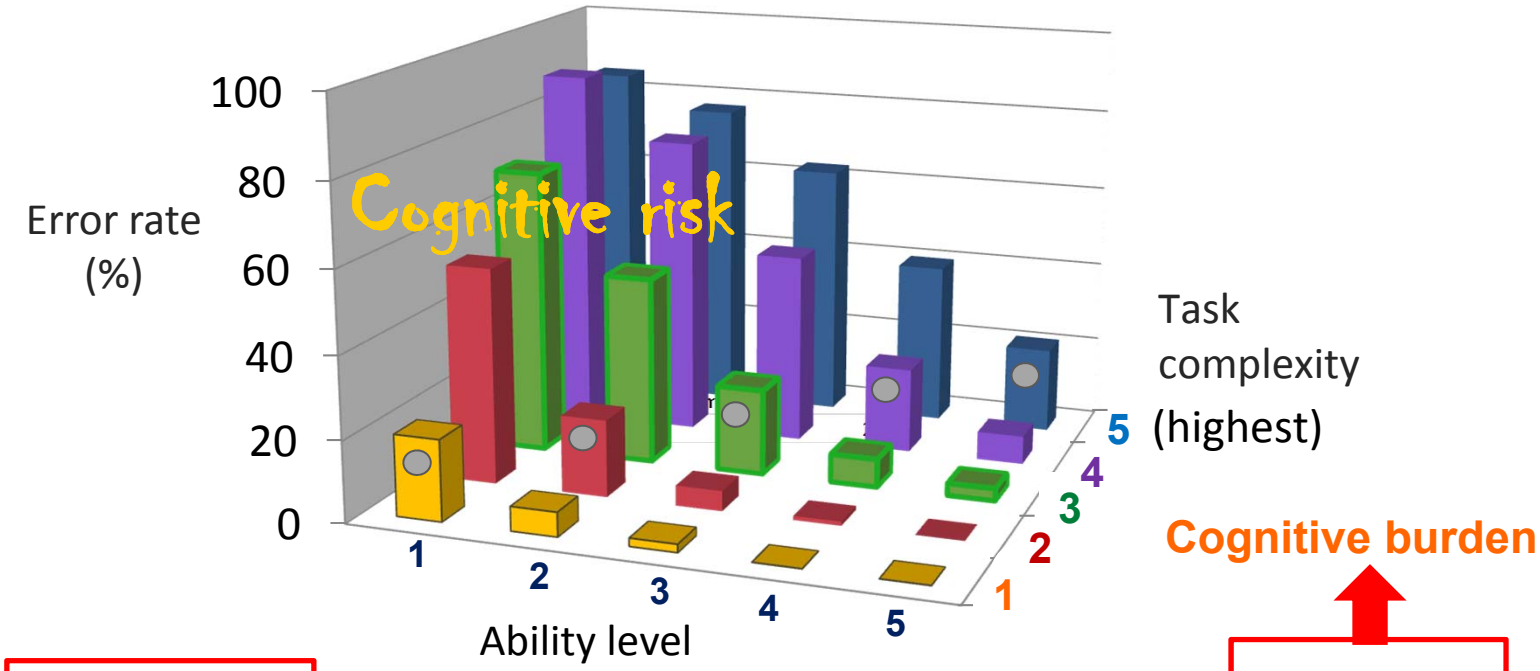


Need an epidemiology of patient error



*Source of data: National Adult Literacy Survey (NALS), ages 16-65., Kirsch et al. (1993)

Change the job (not person) strategies



Cognitive burden

Reduce/limit

Supplement when critical tasks complex

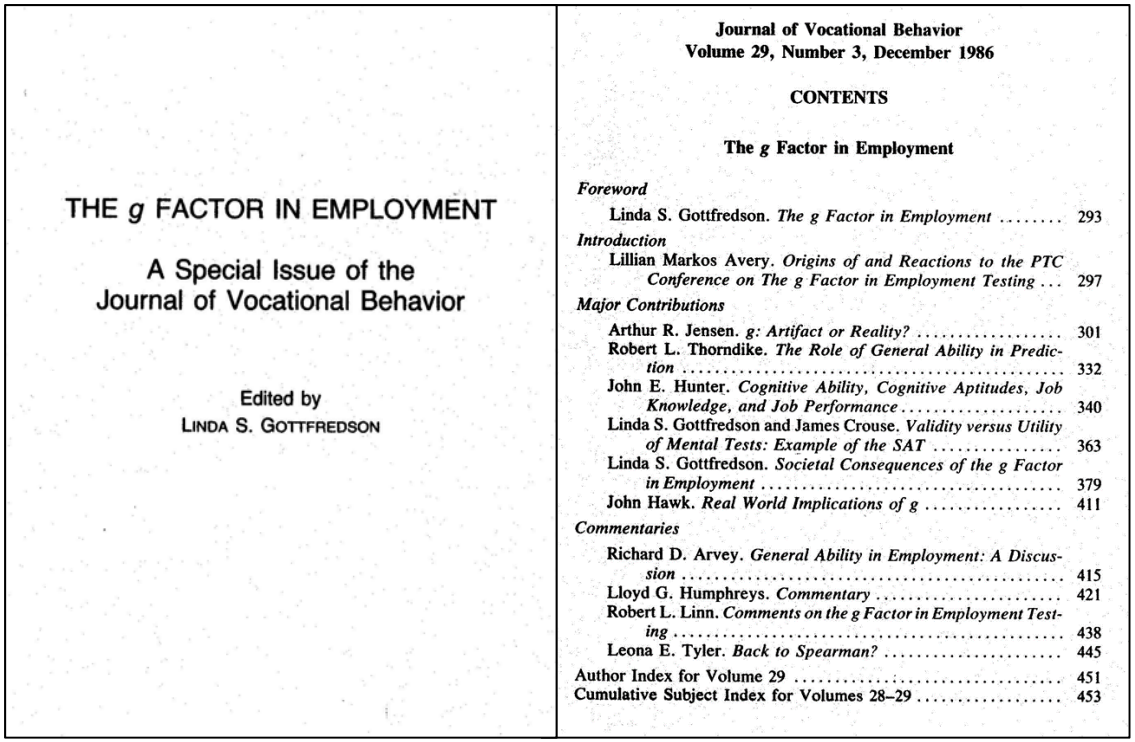
Cognitive resources

*Source of data: National Adult Literacy Survey (NALS), ages 16-65., Kirsch et al. (1993)

Stories of Synergy in Research on *g*

Synergy –
Interaction of parts has bigger effect than the sum of parts

Example: 1986



THE *g* FACTOR IN EMPLOYMENT

A Special Issue of the
Journal of Vocational Behavior

Edited by
LINDA S. GOTTFREDSON

Journal of Vocational Behavior
Volume 29, Number 3, December 1986

CONTENTS

The *g* Factor in Employment

Created synergy

- Panel of illustrious authors
- Peer-reviewed journal
- Mailed 6000 copies to top researchers

Instant impact

Example: 1997

EDITORIAL

Mainstream Science on Intelligence: An Editorial With 52 Signatories, History, and Bibliography

LINDA S. GOTTFREDSON
University of Delaware

The following statement was first published in the *Wall Street Journal*, December 13, 1994.

Mainstream Science on Intelligence

Since the publication of "The Bell Curve," many commentators have offered opinions about human intelligence that misstate current scientific evidence. Some conclusions dismissed in the media as discredited are actually firmly supported.

This statement outlines conclusions regarded as mainstream among researchers on intelligence, in particular, on the nature, origins, and practical consequences of individual and group differences in intelligence. Its aim is to promote more reasoned discussion of the vexing phenomenon that the research has revealed in recent decades. The following conclusions are fully described in the major textbooks, professional journals and encyclopedias in intelligence.

The Meaning and Measurement of Intelligence

1. Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—"catching on," "making sense" of things, or "figuring out" what to do.

2. Intelligence, so defined, can be measured, and intelligence tests measure it well. They are among the most accurate (in technical terms, reliable and valid) of all psychological tests and assessments. They do not measure creativity, character, personality, or other important differences among individuals, nor are they intended to.

3. While there are different types of intelligence tests, they all measure the same intelligence. Some use words or numbers and require specific cultural knowledge (like vocabulary). Other do not, and instead use shapes or designs and require knowledge of only simple, universal concepts (many/few, open/closed, up/down).

4. The spread of people along the IQ continuum, from low to high, can be represented well by the bell curve (in statistical jargon, the "normal curve"). Most people cluster around the average (IQ 100). Few are either very bright or very dull: About 3% of Americans score above IQ 130 (often considered the threshold for "giftedness"), with about

INTELLIGENCE **24(1)** 13-23
ISSN: 0160-2896

The following professors-all experts in intelligence and allied fields-have signed this statement:

Richard D. Arvey, University of Minnesota
Thomas J. Bouchard, Jr., University of Minnesota
John B. Carroll, Un. of North Carolina at Chapel Hill
Raymond B. Cattell, University of Hawaii
David B. Cohen, University of Texas at Austin
Rene V. Dawis, University of Minnesota
Douglas K. Detterman, Case Western Reserve Un.
Marvin Dunnette, University of Minnesota
Hans Eysenck, University of London
Jack Feldman, Georgia Institute of Technology
Edwin A. Fleishman, George Mason University
Grover C. Gilmore, Case Western Reserve University
Robert A. Gordon, Johns Hopkins University
Linda S. Gottfredson, University of Delaware
Robert L. Greene, Case Western Reserve University
Richard J. Haier, University of California at Irvine
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Joseph M. Horn, University of Texas at Austin
Lloyd G. Humphreys, University of Illinois at Urbana-Champaign
John E. Hunter, Michigan State University
Seymour W. Itzkoff, Smith College
Douglas N. Jackson, Un. of Western Ontario
James J. Jenkins, University of South Florida
Arthur R. Jensen, University of California at Berkeley
Alan S. Kaufman, University of Alabama
Nadeen L. Kaufman, California School of Professional Psychology at San Diego
Timothy Z. Keith, Alfred University
Nadine Lambert, University of California at Berkeley
John C. Loehlin, University of Texas at Austin
David Lubinski, Iowa State University
David T. Lykken, University of Minnesota
Richard Lynn, University of Ulster at Coleraine
Paul E. Meehl, University of Minnesota
R. Travis Osborne, University of Georgia
Robert Perloff, University of Pittsburgh
Robert Plomin, Institute of Psychiatry, London
Cecil R. Reynolds, Texas A & M University
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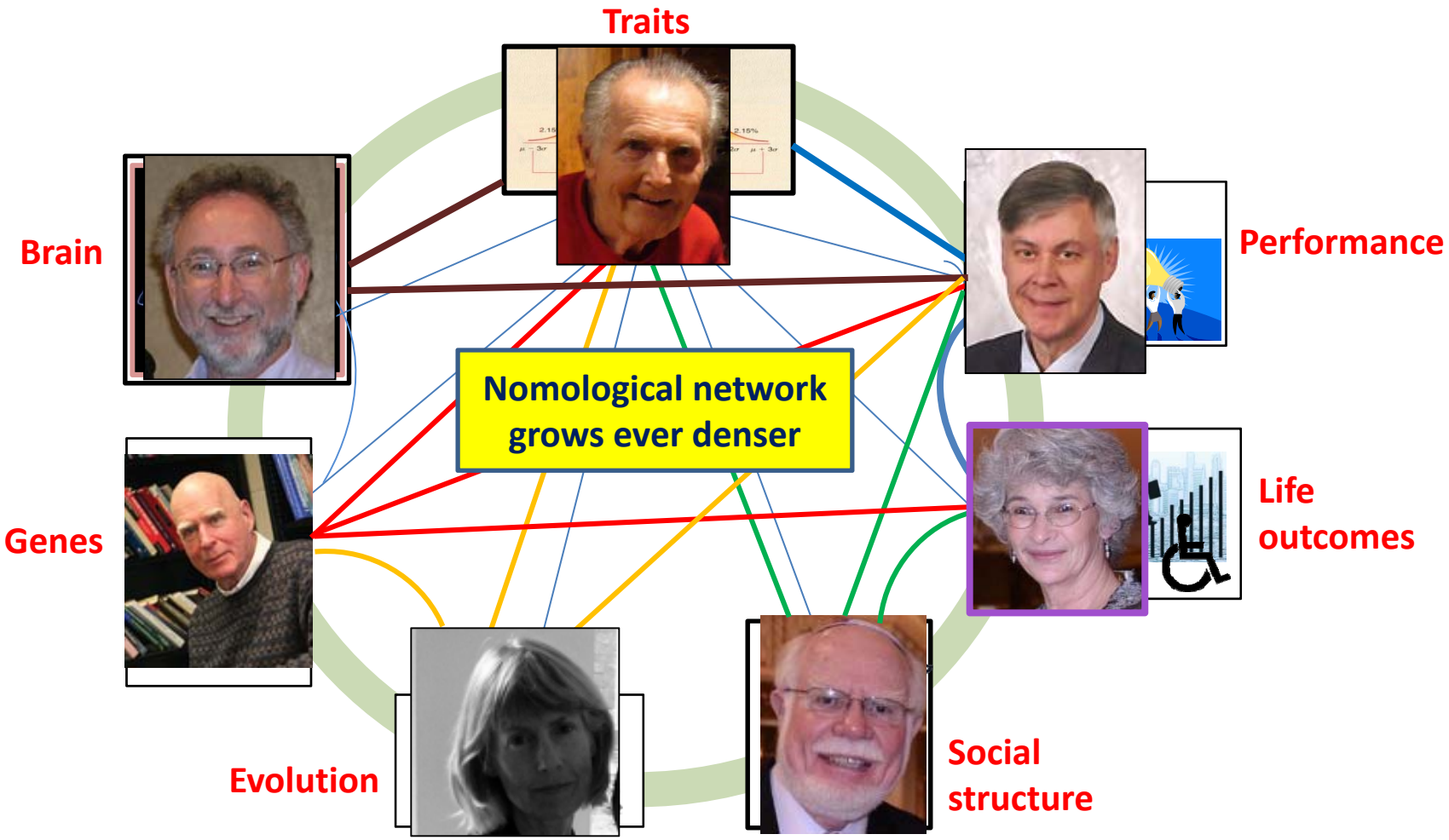
Herman Spitz, former director of research E.R. Johnstone Training and Research Center, Bordentown, N.J.
Julian C. Stanley, Johns Hopkins University
Del Thiessen, University of Texas at Austin
Lee A. Thompson, Case Western Reserve University
Robert M. Thorndike, Western Washington Un.
Philip Anthony Vernon, Un. of Western Ontario
Lee Willerman, University of Texas at Austin

AAIDD* Manual, 11th ed., 2010

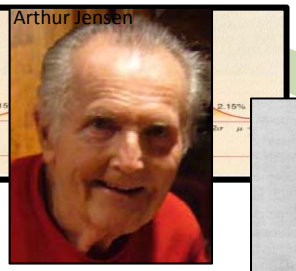
"It is the position of AAIDD that intellectual functioning (as defined [by *Mainstream Science on Intelligence,* 1997]) is best conceptualized and captured by a general factor of intelligence, *g*" (p. 34).

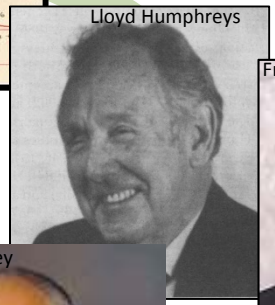
*AAIDD = Amer. Assoc. of Intellectual & Developmental Disabilities


Traits
Brain
Performance
Nomological network grows ever denser
Genes
Life outcomes
Evolution
Social structure

Shoulders I've stood on

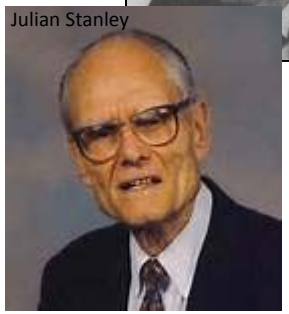
Traits

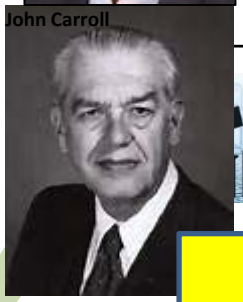




ISIR

Performance

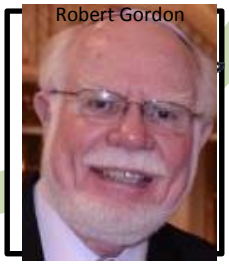




Genes

Life outcomes

Evolution



Social structure

Many others

To our young members

Go find some good shoulders to stand on!

Thank you.