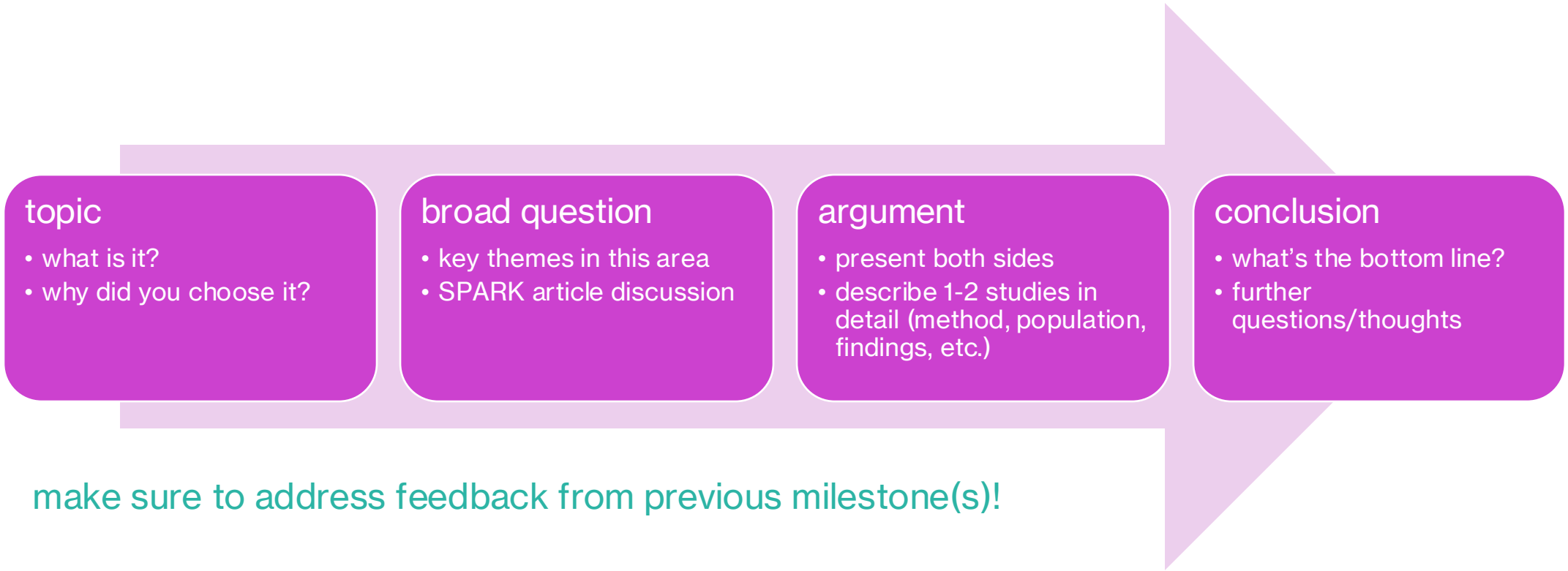
Cognition

PSYC 2040

W14: Intelligence

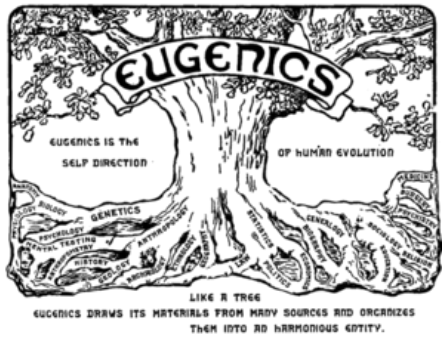
presentation guidelines / roadmap



make sure to address feedback from previous milestone(s)!

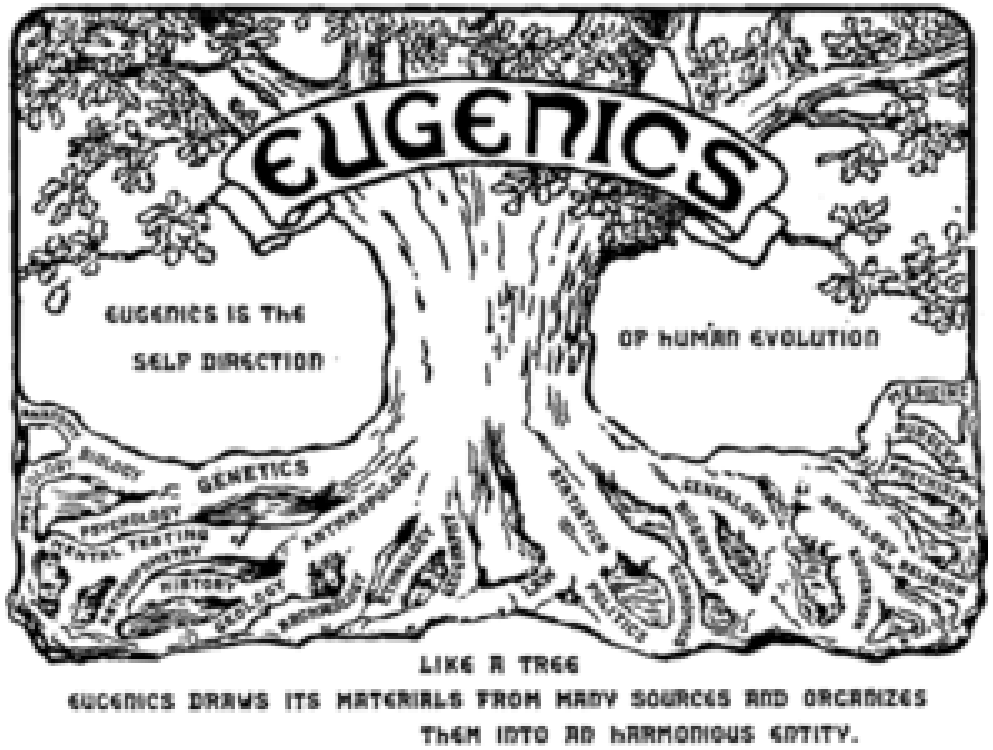
today’s agenda

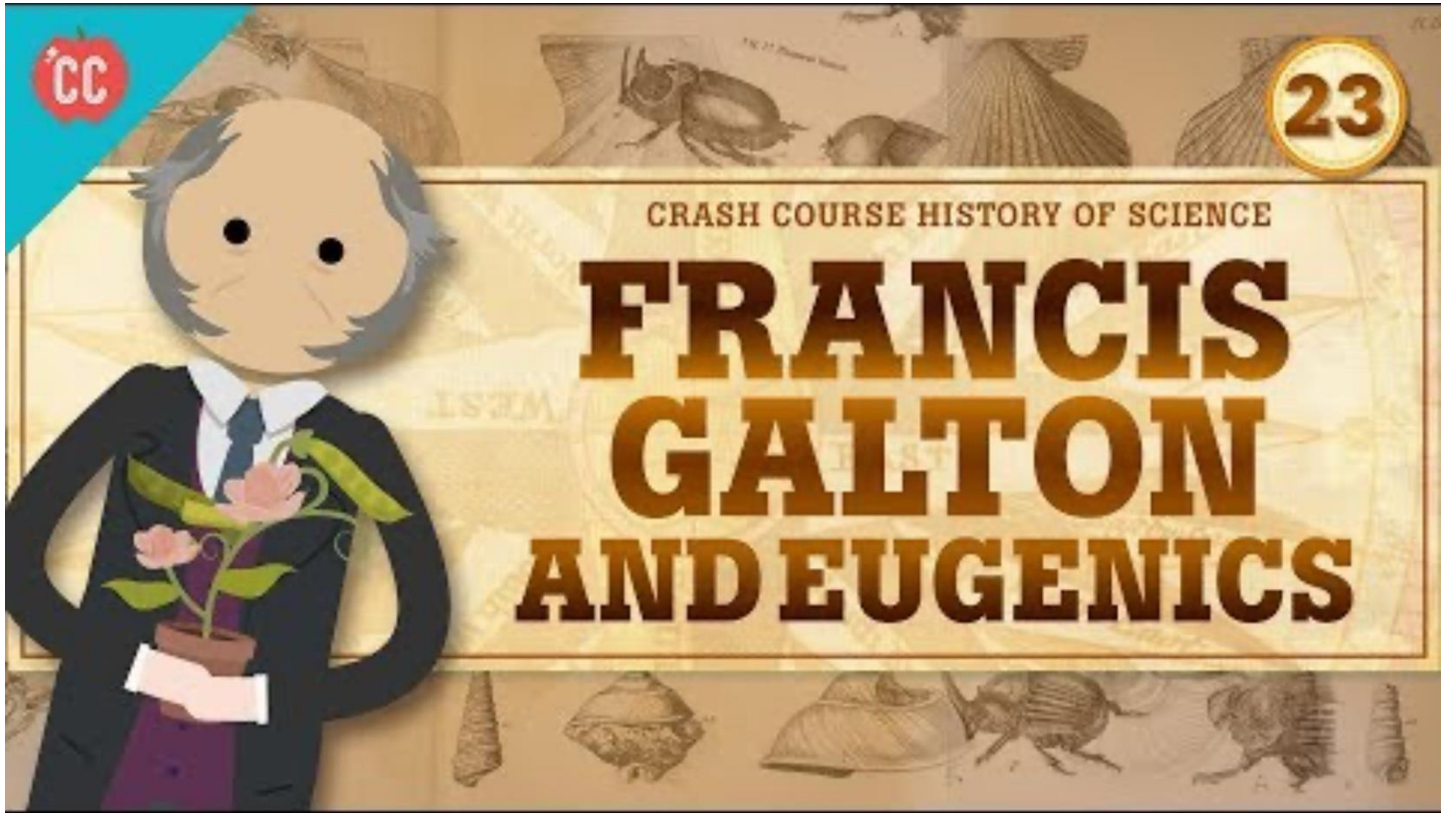
- psychology and eugenics
- defining intelligence
- testing intelligence



what is eugenics?

- an idea to “improve” society through the selective breeding of humans
- a widespread, worldwide movement that perpetuated and institutionalized racism and white supremacy
- led to many human rights violations





https://youtu.be/JeCKftkNKJ

eugenics: broader negative consequences

- Nazi propaganda and war crimes
- forced sterilization and institutionalization
- racial segregation and anti-miscegenation
- IQ/standardized testing, gifted school programs
- employment selection procedures

eugenics and psychology

- The American Psychological Association (APA) and other prominent psychological organizations (e.g., APS) had several prominent eugenicists on their boards, as members, and even had/have awards that are named after them
  - E.L. Thorndike Career Achievement Award (renamed)
  - Granville Stanley Hall Award (renamed)
- APA recently issued an apology for its complicity in perpetuating racism (also see a historical chronology here)
- psychology as a field legitimized eugenicist ideas by developing tests, tools, methods that were published in scientific journals

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ARTICLE

WILEY

Eugenics and its evolution in the history of western psychology: A critical archival review

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Abstract

Since its inception Western academic psychology has been influenced by and closely affiliated with eugenics, defined by its originators as the "science of racial betterment." The role of eugenics has been minimally acknowledged in historical accounts of Western psychology, although it was fundamental to the establishment of empirical psychology methods as well as its applied theories, specifically behaviorism. The continued influence of eugenics in Western psychology, noted in this article, is traced to biologizing human differences while minimizing the role of social context as well as to dividing individuals into groups according to their supposedly innate fitness levels (such as intelligence and optimism). The impact of eugenics on the practice of psychotherapy is highlighted.

many researchers, many definitions

Researcher	Quotation
Alfred Binet	Judgment, otherwise called "good sense", "practical sense", "initiative", the faculty of adapting one's self to circumstances ... auto-critique.[11]
David Wechsler	The aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment.[12]
Lloyd Humphreys	"...the resultant of the process of acquiring, storing in memory, retrieving, combining, comparing, and using in new contexts information and conceptual skills".[13]
Howard Gardner	To my mind, a human intellectual competence must entail a set of skills of problem solving — enabling the individual to resolve genuine problems or difficulties that he or she encounters and, when appropriate, to create an effective product — and must also entail the potential for finding or creating problems — and thereby laying the groundwork for the acquisition of new knowledge.[14]
Linda Gottfredson	The ability to deal with cognitive complexity.[15]
Robert Sternberg & William Salter	Goal-directed adaptive behavior.[16]
Scott Barry Kaufman	"The dynamic interplay of ability and engagement in pursuit of personal goals."[17]
Reuven Feuerstein	The theory of Structural Cognitive Modifiability describes intelligence as "the unique propensity of human beings to change or modify the structure of their cognitive functioning to adapt to the changing demands of a life situation".[18]
Shane Legg & Marcus Hutter	A synthesis of 70+ definitions from psychology, philosophy, and AI researchers: "Intelligence measures an agent's ability to achieve goals in a wide range of environments",[7] which has been mathematically formalized.[19]
Alexander Wissner-Gross	$F = T \nabla S_{\tau}$[20] "Intelligence is a force, F, that acts so as to maximize future freedom of action. It acts to maximize future freedom of action, or keep options open, with some strength T, with the diversity of possible accessible futures, S, up to some future time horizon, τ. In short, intelligence doesn't like to get trapped".

https://en.wikipedia.org/wiki/Intelligence

many researchers, many definitions

- Coane et al. (2023) asked 425 participants what does...
  - "remembering mean to you?"
  - "knowing mean to you?"
  - "being intelligent mean to you?"

Dimension	Definition	Example Participant Response
DIMENSIONS SPECIFIC TO "REMEMBERING" AND "KNOWING"		
Recollection	Response includes reference to Recollection of specific details or uses word recollect	Being able to reflect on a time in your past and feel the specific emotions or senses associated with that moment
Familiarity	Response notes "feels familiar" or response indicates a lack of detail combined with a sense of prior experience/mention of "awareness"	Having a memory that is accompanied by feelings of familiarity, but lacks specific details
Episodic	Response indicates retrieval of specific event from the past	Recalling facts, images, scenarios and being able to picture these things in your mind
Accuracy	Response includes reference to perceived accuracy of retrieved information (includes statements such as "true", "factual", "evidence-based")	Being able to accurately recall information.
Confidence	Response includes reference to confidence or certainty of answer	To be certain of a fact, thought, or idea.
Fluency	Response includes statements that reflect the ease of retrieval, the speed/automaticity with which information comes to mind	To have information in your head intuitively. It is there, you do not need to do anything to recall and use it
Mastery	Response indicates depth of understanding or mastery of material	Knowing means that you have internalized and understand the material. When talking about a subject that you know it means you can expand upon the subject and go into detail about it.
Experience	Response includes a reference to the fact that the information was acquired through learning or prior experience	Knowing is the result of successful learning.
DIMENSIONS SPECIFIC TO "BEING INTELLIGENT"		
Multi-Faceted	Response refers to multiple types/forms/facets/aspects of the construct, from many sources	Having a knowledge of events, books, life events. Having wisdom. Being emotionally intelligent.
Application	Response refers to using or applying information or knowledge	Knowing many things without reference and using them in ways that are beneficial to you
Problem-Solving	Response indicates importance of construct for solving problems	Being capable of using the knowledge you have in a critical and interpretive manner
Acquisition	Response indicates its importance for learning/acquiring new information	Being intelligent means being able to pick up concepts and ideas quickly and having the ability to apply them.
Mindset	Response refers to fixed or growth mindset/innate/genetic	Having the genetic ability to learn fast.
Creativity	Response refers to thinking outside the box, using information in new/unusual ways	Applying one's knowledge in untraditional ways
Comparison	Response includes some form of comparative judgment relative to others	Knowing more information than those around you.

https://www.mdpi.com/2079-3200/11/5/84

many researchers, many definitions

- Coane et al. (2023) asked 425 participants what does…
  - "remembering mean to you?"
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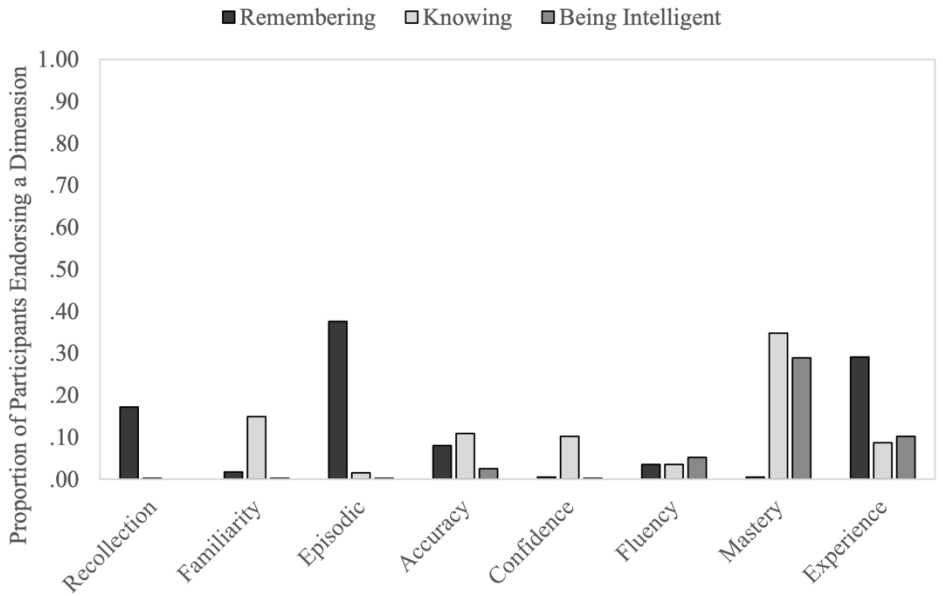

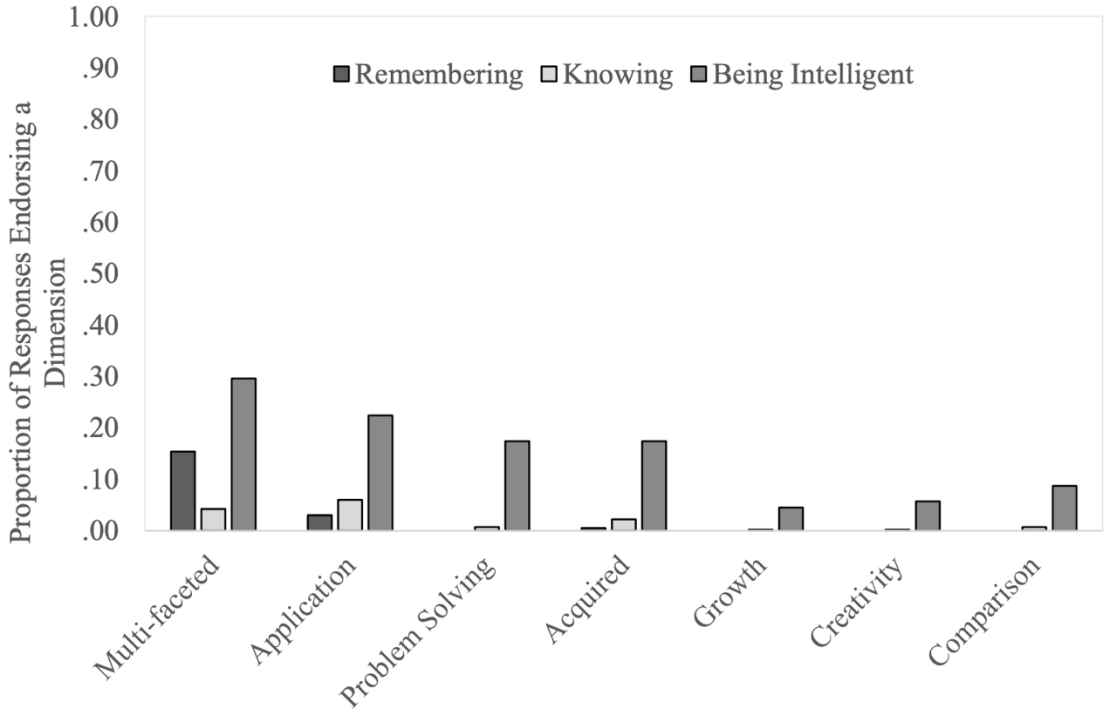

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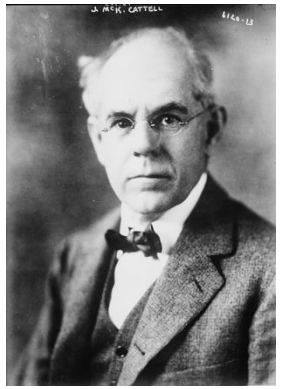
Galton to Cattell

- James Cattell published “Mental tests and measurements” in 1890
- influenced by Galton’s ideas and the eugenics movement
- proposed obtaining a variety of measurements from individuals
- several of these were *physical* measurements that Cattell thought reflected some aspect of intelligence

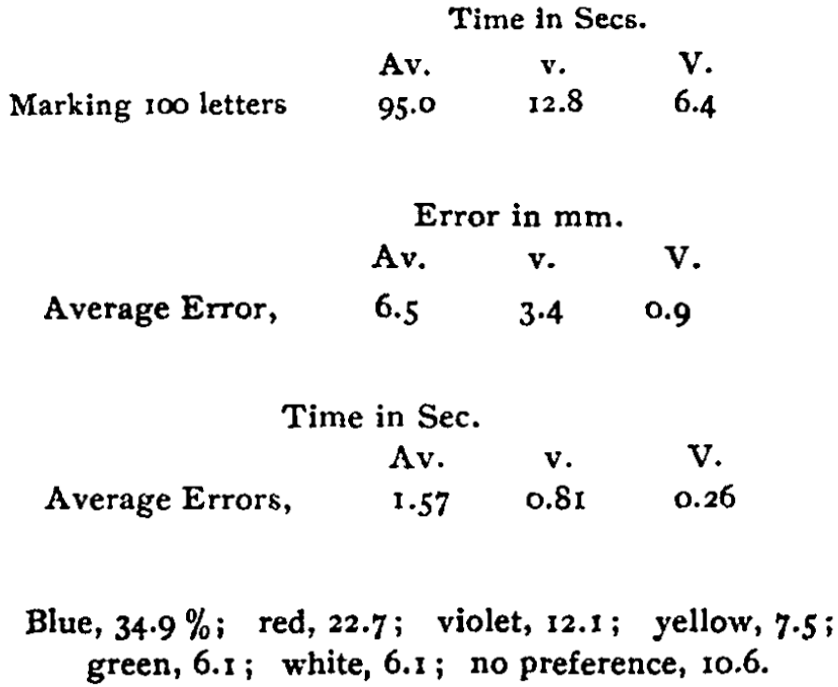


The following ten tests are proposed :

I. Dynamometer Pressure.
II. Rate of Movement.
III. Sensation-areas.
IV. Pressure causing Pain.
V. Least noticeable difference in Weight.
VI. Reaction-time for Sound.
VII. Time for naming Colours.
VIII. Bi-section of a 50 cm. line.
IX. Judgment of 10 seconds time.
X. Number of Letters remembered on once Hearing.

Cattell's mental tests

- several of Cattell's tests were about physical attributes (vision, touch, etc.)
- the ones you did today (mostly mental):
  - read aloud paragraph (memory testing, RBANS, Wechsler Memory Scales)
  - color preference
- other tests:
  - reaction time (processing speed: intelligence)
  - spatial perception (judgment of line orientation: neuropsychological testing)
  - time perception
  - read aloud numerals (working memory, also tested backwards)



	Time in Secs.		
	Av.	v.	V.
Marking 100 letters	95.0	12.8	6.4

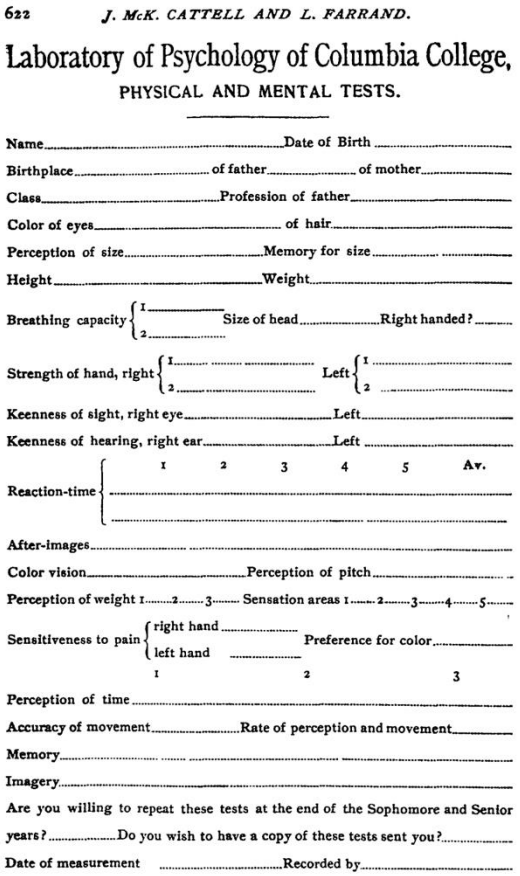
	Error in mm.		
	Av.	v.	V.
Average Error,	6.5	3.4	0.9

	Time in Sec.		
	Av.	v.	V.
Average Errors,	1.57	0.81	0.26

Blue, 34.9 %; red, 22.7; violet, 12.1; yellow, 7.5; green, 6.1; white, 6.1; no preference, 10.6.

Cattell's mental tests at Columbia

- Cattell tested 100 students at Columbia university and published the results in 1896 on a whole host of measures
- Although the hope was these measurements would correlate with grades, there was no consistent relationship between test performance and student grades



622 J. McK. CATTELL AND L. FARRAND.

Laboratory of Psychology of Columbia College,

PHYSICAL AND MENTAL TESTS.

Name..... Date of Birth .....

Birthplace..... of father..... of mother.....

Class..... Profession of father.....

Color of eyes..... of hair.....

Perception of size..... Memory for size.....

Height..... Weight.....

Breathing capacity { 1 ..... 2 ..... } Size of head..... Right handed?.....

Strength of hand, right { 1 ..... 2 ..... } Left { 1 ..... 2 ..... }

Keenness of sight, right eye..... Left.....

Keenness of hearing, right ear..... Left.....

Reaction-time { 1 2 3 4 5 Av. .... }

After-images.....

Color vision..... Perception of pitch.....

Perception of weight 1.....2.....3..... Sensation areas 1.....2.....3.....4.....5.....

Sensitiveness to pain { right hand ..... left hand ..... } Preference for color.....

1 2 3

Perception of time.....

Accuracy of movement..... Rate of perception and movement.....

Memory.....

Imagery.....

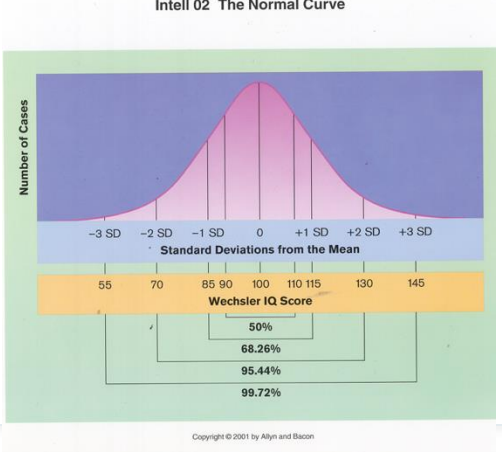
Are you willing to repeat these tests at the end of the Sophomore and Senior years?..... Do you wish to have a copy of these tests sent you?.....

Date of measurement ..... Recorded by.....

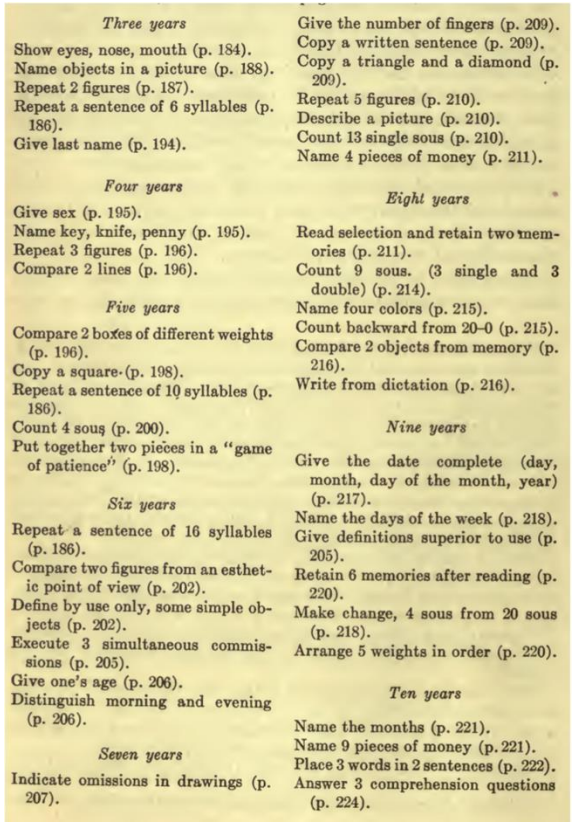
Alfred Binet

- Binet was a French psychologist also interested in developing intelligence tests
- he criticized Cattell's tests on face-validity and came up with his own set of tests that were arguably more challenging
- was motivated by the unfair institutionalization practices of the French government for children

Binet-Simon test



- the tests measured a whole host of abilities across different ages
- Binet equated mental ability with age and assumed that intelligence grew with age linearly
- came up with an algorithm to compute "mental age" based on number of tests passed for that age



Three years

Show eyes, nose, mouth (p. 184).
Name objects in a picture (p. 188).
Repeat 2 figures (p. 187).
Repeat a sentence of 6 syllables (p. 186).
Give last name (p. 194).

Four years

Give sex (p. 195).
Name key, knife, penny (p. 195).
Repeat 3 figures (p. 196).
Compare 2 lines (p. 196).

Five years

Compare 2 boxes of different weights (p. 196).
Copy a square (p. 198).
Repeat a sentence of 10 syllables (p. 186).
Count 4 sous (p. 200).
Put together two pieces in a "game of patience" (p. 198).

Six years

Repeat a sentence of 16 syllables (p. 186).
Compare two figures from an esthetic point of view (p. 202).
Define by use only, some simple objects (p. 202).
Execute 3 simultaneous commissions (p. 205).
Give one's age (p. 206).
Distinguish morning and evening (p. 206).

Seven years

Indicate omissions in drawings (p. 207).
Give the number of fingers (p. 209).
Copy a written sentence (p. 209).
Copy a triangle and a diamond (p. 209).
Repeat 5 figures (p. 210).
Describe a picture (p. 210).
Count 13 single sous (p. 210).
Name 4 pieces of money (p. 211).

Eight years

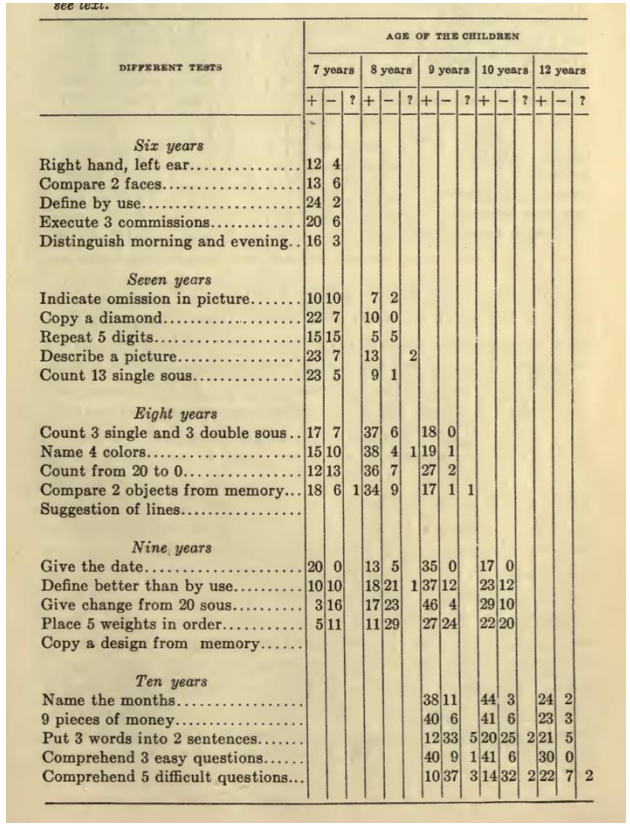
Read selection and retain two memories (p. 211).
Count 9 sous. (3 single and 3 double) (p. 214).
Name four colors (p. 215).
Count backward from 20–0 (p. 215).
Compare 2 objects from memory (p. 216).
Write from dictation (p. 216).

Nine years

Give the date complete (day, month, day of the month, year) (p. 217).
Name the days of the week (p. 218).
Give definitions superior to use (p. 205).
Retain 6 memories after reading (p. 220).
Make change, 4 sous from 20 sous (p. 218).
Arrange 5 weights in order (p. 220).

Ten years

Name the months (p. 221).
Name 9 pieces of money (p. 221).
Place 3 words in 2 sentences (p. 222).
Answer 3 comprehension questions (p. 224).



See text.

DIFFERENT TESTS	AGE OF THE CHILDREN														
	7 years			8 years			9 years			10 years			12 years		
	+	−	?	+	−	?	+	−	?	+	−	?	+	−	?
Six years															
Right hand, left ear	12	4													
Compare 2 faces	13	6													
Define by use	24	2													
Execute 3 commissions	20	6													
Distinguish morning and evening	16	3													
Seven years															
Indicate omission in picture	10	10		7	2										
Copy a diamond	22	7		10	0										
Repeat 5 digits	15	15		5	5										
Describe a picture	23	7		13		2									
Count 13 single sous	23	5		9	1										
Eight years															
Count 3 single and 3 double sous	17	7		37	6		18	0							
Name 4 colors	15	10		38	4	1	19	1							
Count from 20 to 0	12	13		36	7		27	2							
Compare 2 objects from memory	18	6	1	34	9		17	1	1						
Suggestion of lines															
Nine years															
Give the date	20	0		13	5		35	0		17	0				
Define better than by use	10	10		18	21	1	37	12		23	12				
Give change from 20 sous	3	16		17	23		46	4		29	10				
Place 5 weights in order	5	11		11	29		27	24		22	20				
Copy a design from memory															
Ten years															
Name the months							38	11		44	3		24	2	
9 pieces of money							40	6		41	6		23	3	
Put 3 words into 2 sentences							12	33	5	20	25	2	21	5	
Comprehend 3 easy questions							40	9	1	41	6		30	0	
Comprehend 5 difficult questions							10	37	3	14	32	2	22	7	2

Binet-Simon test correlations

- Binet recognized that a single test did not mean anything, but believed that the collection of them could represent something meaningful
- Binet also proposed the idea of norms/standardization, i.e., building a pattern from a large database and then comparing individuals on that pattern

TABLE IV

This table shows the relation between the intellectual level and the scholastic level

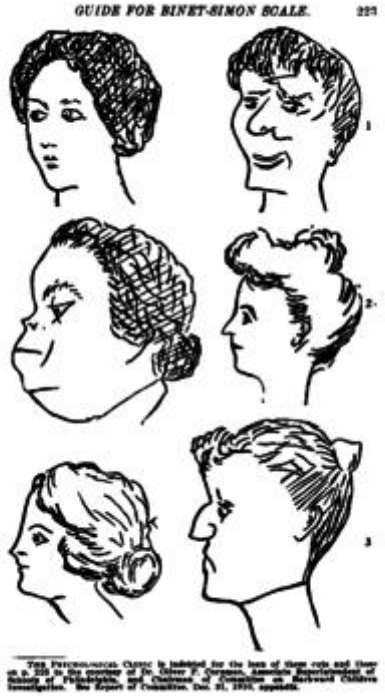
	CHILDREN BEHIND IN SCHOOL INSTRUCTION	CHILDREN REGULAR IN SCHOOL INSTRUCTION	CHILDREN ADVANCED IN SCHOOL INSTRUCTION
Intelligence above the average.....	1	16	7
Average intelligence.....	9	33	5
Intelligence below the average.....	14	16	0

One test signifies nothing, let us emphatically repeat, but five or six tests signify something. And that is so true that one might almost say, 'It matters very little what the tests are so long as they are numerous

modern IQ tests

- Binet's tests were linked to "mental age" based on a standardized scale
- modern "intelligence tests" also use a standardized scale called the intelligence quotient (IQ)
- Binet's tests were popularized by American psychologists to further the eugenics cause (e.g., Lewis Terman, Stanford-Binet test)
- criticisms: formation of Association of Black Psychologists (ABPsi) in 1978

22. Show the pretty and ugly faces in pairs. "Which of these two faces is the prettier (or uglier)?" Or: "Which is the good looking one?" 1 2 3 All three must be correct. Both are pretty = —.



standardized tests today

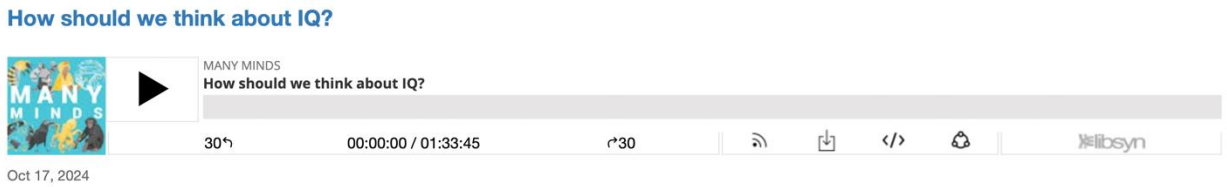
- Stanford-Binet IQ test (last update in 2003)
- more commonly used:
  - WPPSI (preschool and primary scale of intelligence; 2y6mo – 7y7mo)
  - Wechsler Intelligence Scale for Children (WISC, 6-16)
  - WAIS (16-90)
- have key properties: standardized, reliable, and valid
- used in schools to determine learning/intellectual disabilities or gifted students

video link

PODCASTS

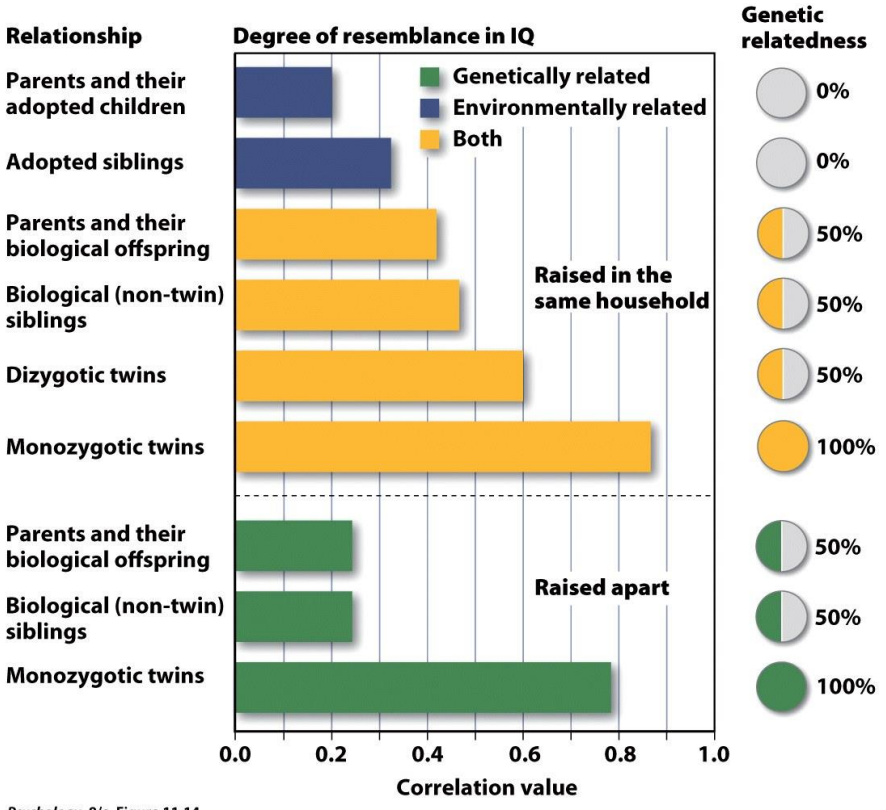
Nice White Parents

IQ correlations



podcast link

- positive
  - income (A. R. Jensen, 1998)
  - job prestige (Nyborg & Jensen, 2001)
  - life expectancy (Deary et al., 2004)
  - job performance (Schmidt & Hunter, 2004)
- negative
  - criminal behavior (Beaver et al., 2013)
  - long-term unemployment (Herrnstein & Murray, 1996)
  - dementia (Deary et al., 2004)
  - death by automobile accident (O'Toole & Stankov, 1992)



Psychology, 8/e Figure 11.14

What Do Undergraduates Learn About Human Intelligence? An Analysis of Introductory Psychology Textbooks

Russell T. Warne, Mayson C. Astle, and Jessica C. Hill
Utah Valley University

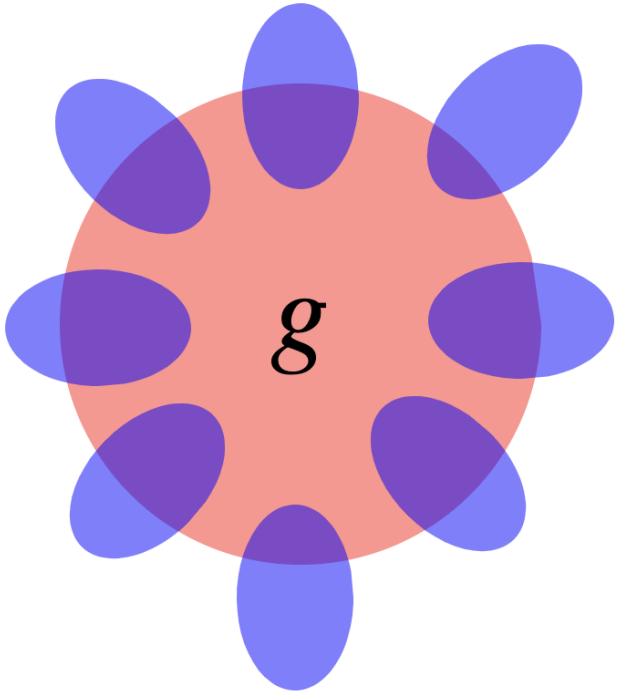
A B S T R A C T

Human intelligence is an important construct in psychology, with far-reaching implications, providing insights into fields as diverse as neurology, international development, and sociology. Additionally, IQ scores can predict life outcomes in health, education, work, and socioeconomic status. Yet, students of psychology are often exposed to human intelligence only in limited ways. To ascertain what psychology students typically learn about intelligence, we analyzed the content of 29 of the most popular introductory psychology textbooks to learn (a) the most frequently taught topics related to human intelligence, (b) the accuracy of information about human intelligence, and (c) the presence of logical fallacies about intelligence research. We found that 79.3% of textbooks contained inaccurate statements and 79.3% had logical fallacies in their sections about intelligence. The five most commonly taught topics were IQ (93.1% of books), Gardner's multiple intelligences (93.1%), Spearman's *g* (93.1%), Sternberg's triarchic theory (89.7%), and how intelligence is measured (82.8%). Conversely, modern models of intelligence were only discussed in 24.1% of books, with only one book discussing the Carroll three-stratum model by name and no book discussing bifactor models of intelligence. We conclude that most introductory psychology students are exposed to some inaccurate information and may have the mistaken impression that nonmainstream theories (e.g., Sternberg's or Gardner's theories) are as empirically supported as *g* theory. This has important implications for the undergraduate curriculum and textbook authors. Readers should be aware of the limitations of the study, including the choice of standards for accuracy for the study and the inherent subjectivity required for some of the data collection process.

paper

a general “*g*” factor

- Charles Spearman proposed the idea of “general intelligence”, after observing high correlations between unrelated tasks administered to children
- two factors: general (*g*) and specific abilities (s_i)
- *g* accounts for ~50% variance across many tasks, measures, cultures, and has also been applied to other species



Radiolab Presents: G

series link

factor-based theories

- Carroll (1993) three-stratum theory
  - specific, narrow tasks (e.g., vocabulary knowledge, arithmetic skills, visual memory)
  - broader cognitive ability, e.g., verbal ability, mathematical reasoning, short-term memory (STM)
  - general intelligence (g)
- bifactor models
  - observed variables are a combination of *g* are broad abilities

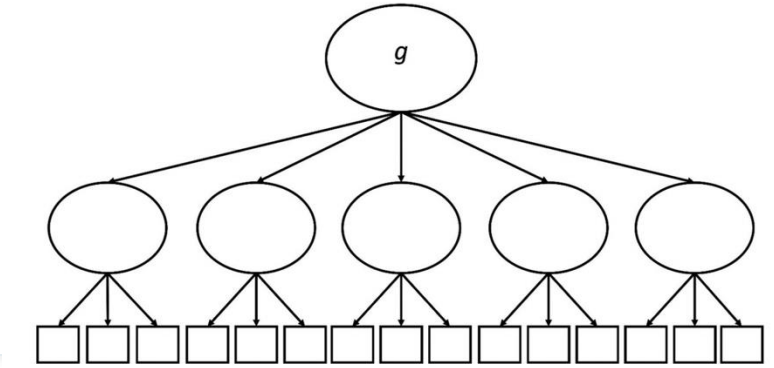


Figure 1. A representation of a hierarchical model of intelligence. The model depicts a hierarchy of cognitive abilities. At the bottom are specific, narrow abilities. Highly correlated groups of these specific abilities (represented as rectangles) coalesce into a small number of abilities that have broader impact and are represented in the middle row of ovals. These broad abilities, in turn, are all related via the general intelligence factor (labeled *g*) at the top of the hierarchy. Although many intelligence researchers subscribe to this model, the exact number of abilities in the middle and lower levels is a subject of much debate (McGrew, 2009).

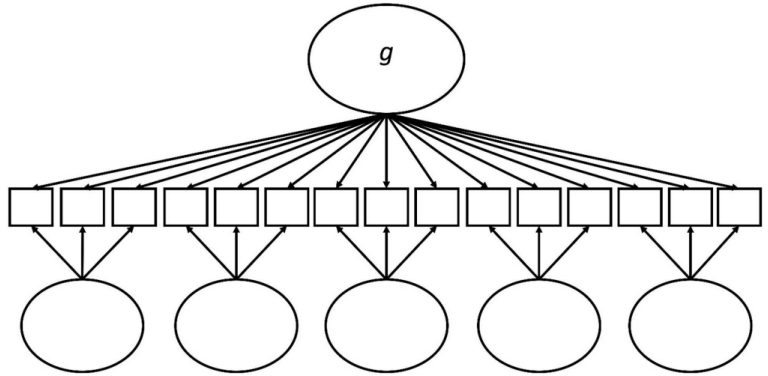
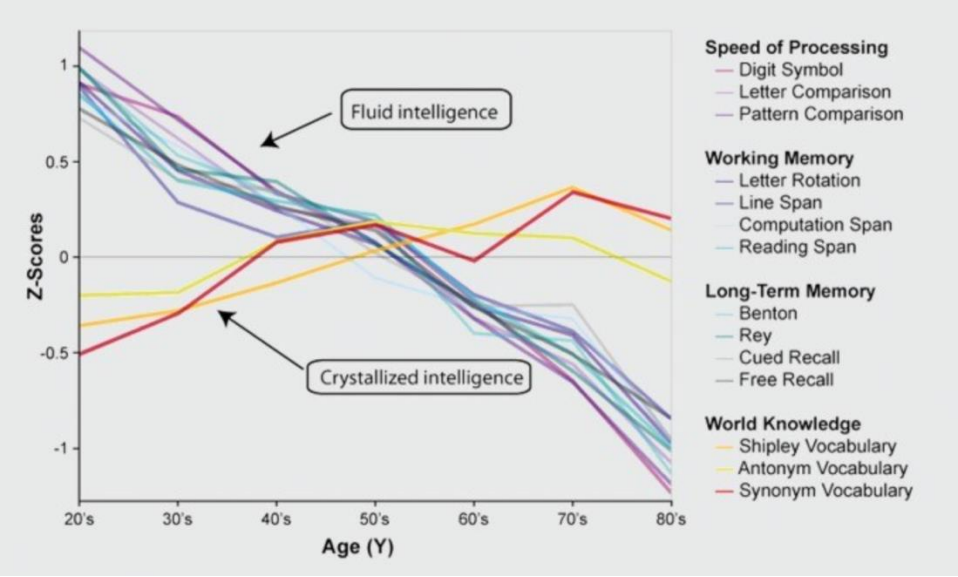


Figure 2. A representation of the bifactor model of intelligence. The model depicts each specific ability (represented as rectangles) are the product of general intelligence (labeled *g*) and the broad abilities (shown at the bottom of the figure). Like the hierarchical model shown in Figure 1, the exact number of specific and broad abilities is the subject of debate. When compared with hierarchical models, the bifactor model tends to fit the data better (Cucina & Byle, 2017).

fluid and crystallized intelligence

- Raymond Cattell proposed dividing *g* into two independent constructs: crystallized and fluid intelligence
- fluid: basic reasoning, less reliant on prior knowledge
- crystallized: learned knowledge



Park and Bischof (2022)

idea of genius/brilliance/smartness

WOMEN IN SCIENCE

Expectations of brilliance underlie gender distributions across academic disciplines

Sarah-Jane Leslie,[1*†] Andrei Cimpian,[2*†] Meredith Meyer,[3] Edward Freeland[4]

The gender imbalance in STEM subjects dominates current debates about women's underrepresentation in academia. However, women are well represented at the Ph.D. level in some sciences and poorly represented in some humanities (e.g., in 2011, 54% of U.S. Ph.D.'s in molecular biology were women versus only 31% in philosophy). We hypothesize that, across the academic spectrum, women are underrepresented in fields whose practitioners believe that raw, innate talent is the main requirement for success, because women are stereotyped as not possessing such talent. This hypothesis extends to African Americans' underrepresentation as well, as this group is subject to similar stereotypes. Results from a nationwide survey of academics support our hypothesis (termed the field-specific ability beliefs hypothesis) over three competing hypotheses.

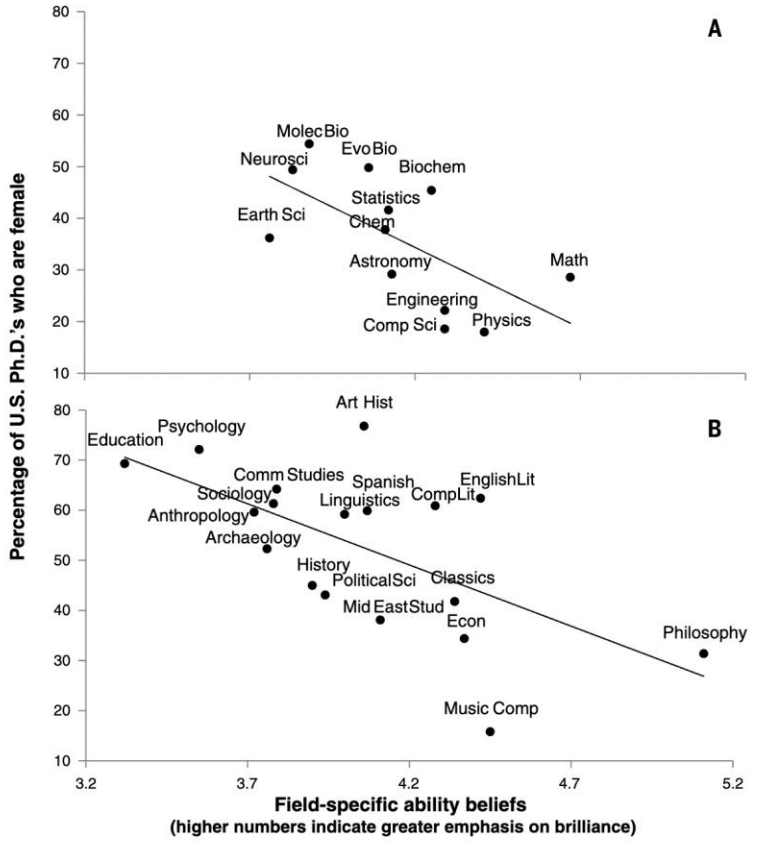


Fig. 1. Field-specific ability beliefs and the percentage of female 2011 U.S. Ph.D.'s in (A) STEM and (B) Social Science and Humanities.

paper

idea of genius/brilliance/smartness

Gender stereotypes about intellectual ability emerge early and influence children's interests

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Common stereotypes associate high-level intellectual ability (brilliance, genius, etc.) with men more than women. These stereotypes discourage women's pursuit of many prestigious careers; that is, women are underrepresented in fields whose members cherish brilliance (such as physics and philosophy). Here we show that these stereotypes are endorsed by, and influence the interests of, children as young as 6. Specifically, 6-year-old girls are less likely than boys to believe that members of their gender are "really, really smart." Also at age 6, girls begin to avoid activities said to be for children who are "really, really smart." These findings suggest that gendered notions of brilliance are acquired early and have an immediate effect on children's interests.

Table S1

The Gender-Neutral Stories Used to Assess Children's Stereotypes in Studies 1 and 2

	Story about an Adult (Study 1)	Story about a Child (Studies 1 and 2)
Trait: Smart	There are lots of people at the place where I work. But there is one person who is really special. This person is really, really smart. This person figures out how to do things quickly and comes up with answers much faster and better than anyone else. This person is really, really smart.	When I was your age, there were lots of children at the kindergarten where I went. But there was one child who was really special. This child was really, really smart. This child learned things very quickly and could answer even the hardest questions from the teacher. This child was really, really smart.
Trait: Nice	There are lots of people at the place where I work. But there is one person who is really special. This person is really, really nice. This person likes to help others with their problems and is friendly to everyone at the office. This person is really, really nice.	When I was your age, there were lots of children at the kindergarten where I went. But there was one child who was really special. This child was really, really nice. This child shared their toys with everyone else, and really cared about the other kids. This child was really, really nice.

"After telling the story, the experimenter laid out 4 pictures in a line (2 females and 2 males, randomly interspersed) and asked the child to guess which one of the 4 people might be the person in the story. If children chose a person of the same gender as themselves (e.g., if a girl picked a woman), they were assigned a score of 1 for that trial; otherwise, they received a 0."

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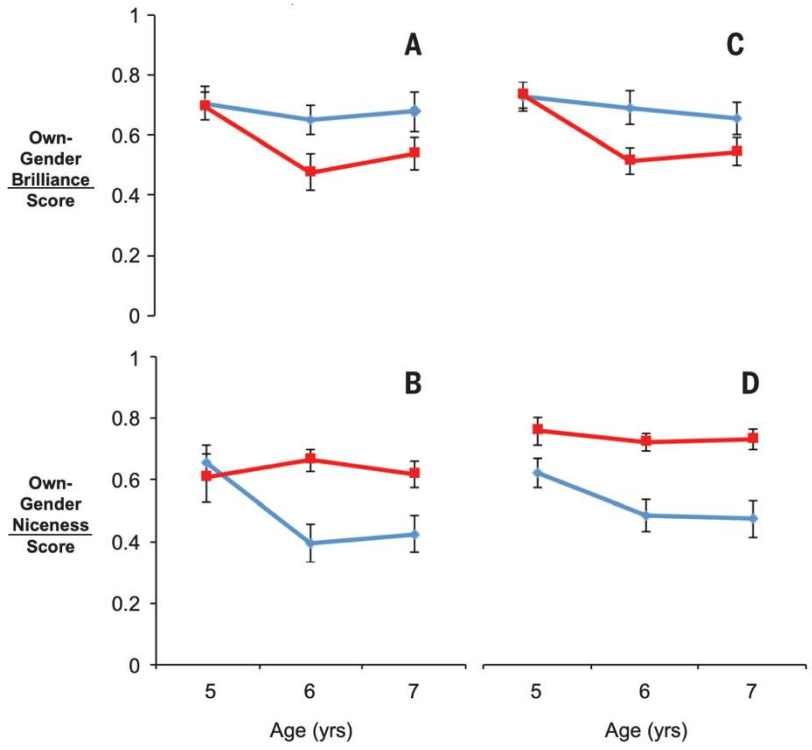

Fig. 1. Results of studies one and two. Boys' (blue) and girls' (red) stereotype scores in study one (**A** and **B**) and study two (**C** and **D**), by age group (5- versus 6- versus 7-year-olds). Error bars represent ± 1 SE.

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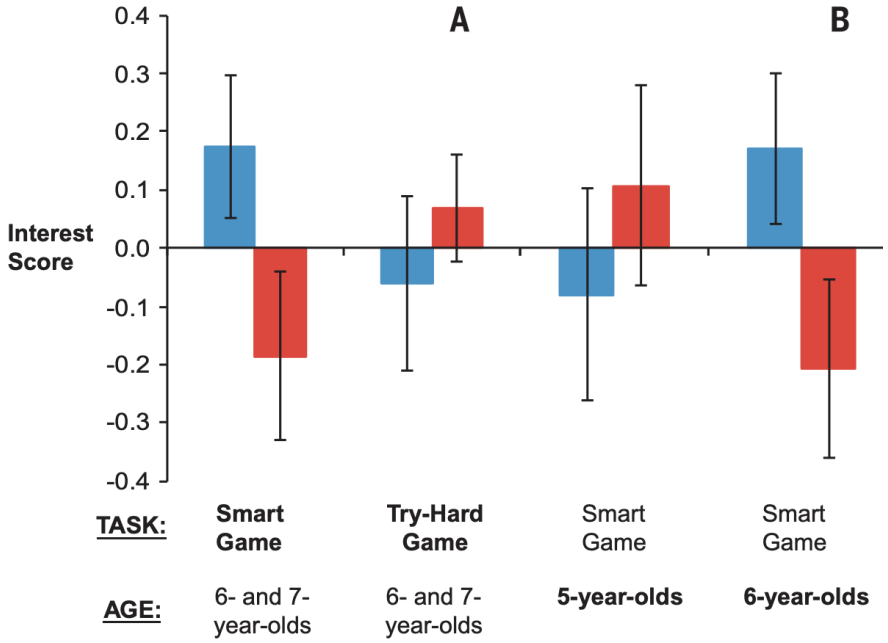

Fig. 2. Results of studies three and four. Boys' (blue) and girls' (red) interest (average of standardized responses to four questions) in novel games in study three (**A**) and study four (**B**). The main independent variable for each study (task in study three, age in study four) is shown in bold. Error bars represent ± 1 SE.

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paper

modern conversations on intelligence

- intelligence continues to remain a popular and scientifically important topic in the field but the goals have evolved over time
- intelligence is thought to be multifaceted, and the study of intelligence has many different motivations and goals
  - what makes humans different/unique?
  - how can we build artificial intelligence?

Building machines that learn and think like people

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bonus summary: intelligence video

https://www.youtube.com/watch?v=9xTz3Qjclol

next class

- are we really the most intelligent, the most unique?

Before Tuesday

- Complete W14 Activity 1

Before Thursday

- Complete W14 Activity 2

After Thursday

- See the Apply section

Here are the to-do's for the week:

- Week 14 Exit Ticket (due Thursday)
- Week 14 Quiz (due Sunday)
- Post any lingering questions here
- Extra credit opportunities:
  - Submit Exra Credit Questions (1 point for 8 submissions)
  - Submit Optional Meme Submission (1 point for winners!)