

Lecture 12 – Intelligence and Intelligence Testing

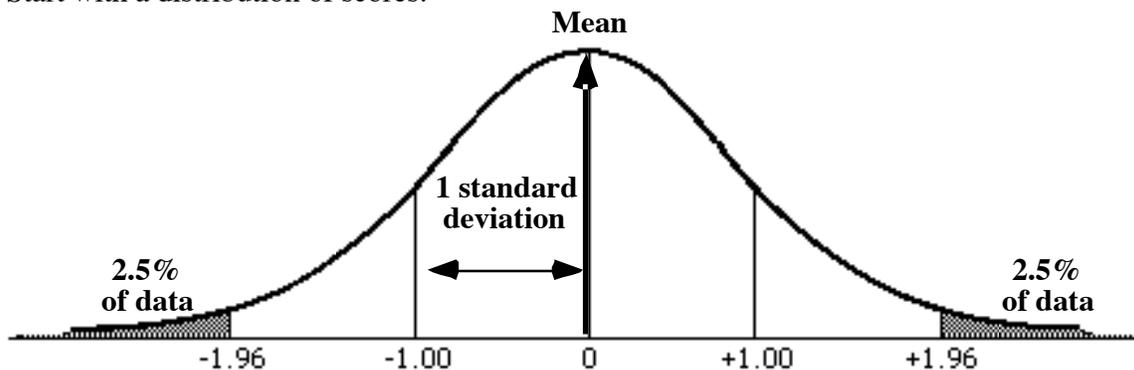
The Abstract: With this lecture, we switch gears. In discussing individual differences are fundamentally important in ways that they were not when we were talking about memory or perception. The first task is to discuss some of the statistical tools that are used to talk about differences (notably correlation and analysis of variance). Next we will consider some of the sources of variance. Is there a genetic component? (yes) How important is it? (Well, that depends who you ask, but IQ sure isn't eye color). In the next part of the lecture, we will look at the history of the study of group differences in intelligence. It is amusing, but that is not the point. The point is that what we think is Science might look pretty amusing in 100 years, too. Finally, we will turn to the question of changing IQ in individuals and groups.

Lecture Notes:

The interesting questions in intelligence are questions of individual difference.

How you look at variability in data?

Start with a distribution of scores:



A normal curve (or bell curve)

N data points have a

A **mean** = $\sum(\text{dataPoint})/N$

A **variance** = $(\sum(\text{Mean}-\text{dataPoint})^2)/N$

A **Standard deviation** = $\text{sqrt}(\text{variance})$

What is intelligence?

Fluid intelligence is the set of abilities that let you reason

Crystallized intelligence is the application of knowledge to specific situations

Is it just mental processing speed?

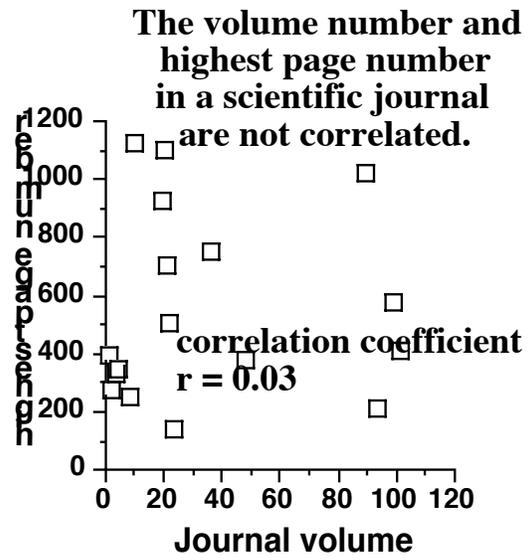
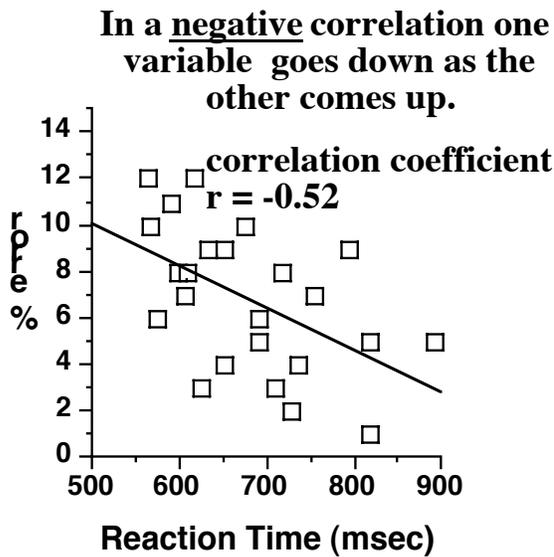
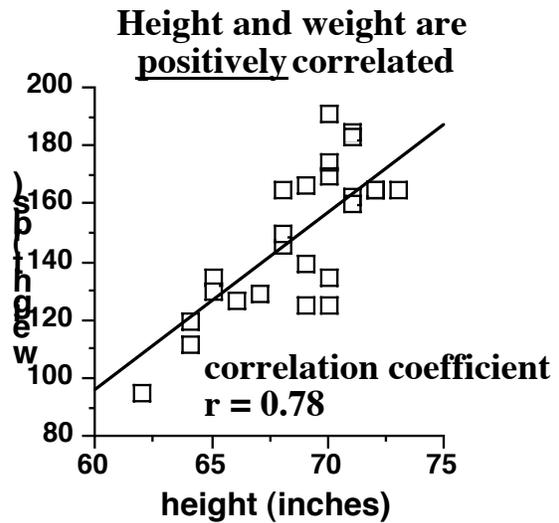
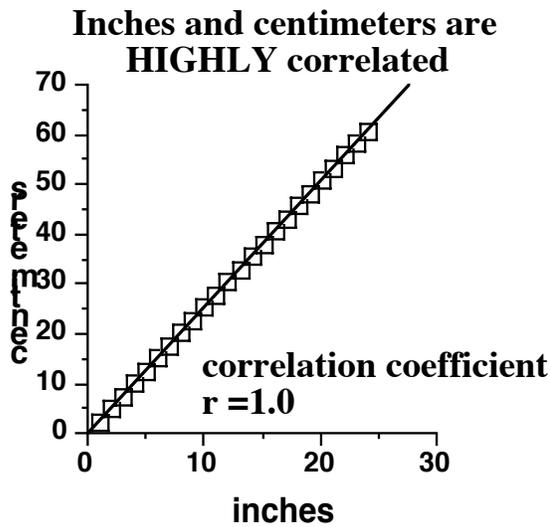
How about working memory capacity?

Active Span tasks

Variances are additive so: $V = V_{\text{gen}} + V_{\text{env}}$

Heritability: $H = V_{\text{gen}} / V_{\text{gen}} + V_{\text{env}}$

Correlations positive, negative, and otherwise



The most important thing to remember about correlation is.....

Correlation does not imply causality.

Where does variability in IQ come from?

- Genetic variation
- Environmental variation

Something that is often overlooked. Is the **interaction term**

Interaction Example: How anxious are you at test time? (Can you explain this example?)

Some correlations in IQ

Correl of child and parent is about 0.5

Siblings

identical twins	~.9
fraternal	~.6
siblings	~.5
adopted siblings	~.2

Identical Twins Reared Apart (monozyg. apart = MZA) ~0.7

Bouchard, T. J., Lykken, D. T., McGue, M., Segal, N. L., & Tellegen, A. (1990). Sources of human Psychological differences: The Minnesota study of twins reared apart. *Science*, 250, 223-228. issue of 10/12/90

Pitfalls in the analysis of heritability

Pitfall 1: Does high heritability mean that environment is unimportant?

Pitfall 2: Ignoring that interaction term

Turkheimer E, Haley A, Waldron M, D'Onofrio B, Gottesman, II. 2003. Socioeconomic status modifies heritability of IQ in young children. *Psychol Sci* 14: 623-8

Pitfall 3: Thinking that high H means unmodifiable.

The instructive case of PKU (=phenylketonuria). (It is in the book)

A little history (see Gould SJ. 1981. *The Mismeasure of Man*. New York: Norton)

Who has higher IQ men or women?

In the 19th, scientists asked the same questions about brain size.

Remember Paul Broca?

What is the point of these amusing stories?

Is IQ fixed or modifiable?

The Flynn effect

Flynn, J. R. (1987). Massive IQ gains in 14 nations: What IQ tests really measure. Psych. Bull., 101, p171-191.

Can we move the intelligence of individuals?

Head Start and Enriched Rats

Diamond, M., Krech, D., & Rosenzweig, M. R. (1964). The effects of an enriched environment on the histology of the rat cerebral cortex. *J. Comparative Neurology*, 123, 111-119.

What is the rat experiment?

What are the Head Start data

What happens when you are adopted from a low SES to a higher SES family?

What does it all mean?

Reading Notes for Chapter 14 (Intelligence)

NOTE: I will try to provide notes for other Gleitman chapters as we go along. My original plan was to do all of them over the summer but.....well, you know how it is.

P551 The starting questions in intelligence testing are "Who wants to know? And why?" Is there a difference between using an SAT test to influence college admissions and using an IQ test to study differences between populations? Why?

P552 This is the first point in the course where we really begin to care about individual differences. We were asking "What is the average/typical behavior of people on this task." Now we are asking, what are the differences between people on this task and what are the causes of those differences?"

P553 You want to understand the "normal curve" and, even more, correlation and correlation coefficients.

P556 What do the terms "reliability" and "validity" mean in the context of psychological testing?

P558 Some knowledge of the mechanics of intelligence testing is helpful but it is not as important as gaining an understanding of

P560 The Psychometric Approach.

P562 Be sure you are clear on the problems in inferring causality from correlational data.

P563 The sea serpents are a useful introduction to the effort to distinguish between the idea of "general intelligence" ("g") and the notion of multiple components to intelligence (see p571)

P565 What is the distinction between fluid and crystallized intelligence?

P567 The next couple of pages give a summary of some candidates for cognitive operations that underlie "g". Me? I rather like the working memory (active span) accounts. At least these seem more plausible than the reaction time story.

P573 The controversial stuff begins when you start talking about group differences in IQ and when you start making claims about what is inherited and what might be learned.

P575 What is the distinction between genotype and phenotype?

P576 I think that the book is a bit too heavy on the genetic influences on IQ and a bit too light on environment. I will cover some similar material with a somewhat different balance,

P581 "Heritability" is a somewhat problematic concept. It shows up a lot in the popular press so you should know what it means AND what it does not mean.

P582 Why doesn't heritability within a group tell you about heritability between groups?

P584 The conclusions work for me. See what you think.