

Interpretation of NP Test Results

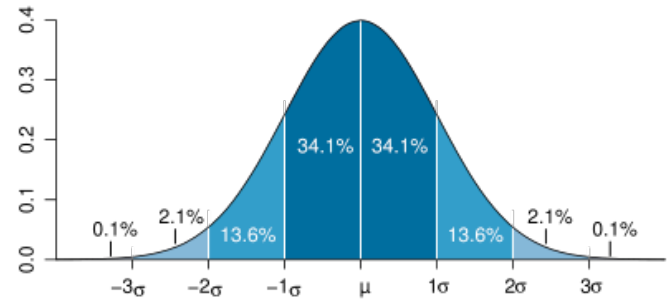
- Standard Scores
- Normative Scores
- Demographic Corrections
 - Age, Education, Gender and Race/Ethnicity
 - Race
 - is it real?
 - Demographic Norms Example
 - Example paper (Diehr et al 1998)
- Premorbid Functioning
 - Qualitative Estimates
 - Quantitative Estimates
- Psychometric Issues

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Normal Distribution



Many measures show a normal distribution

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Raw vs. Standard Scores

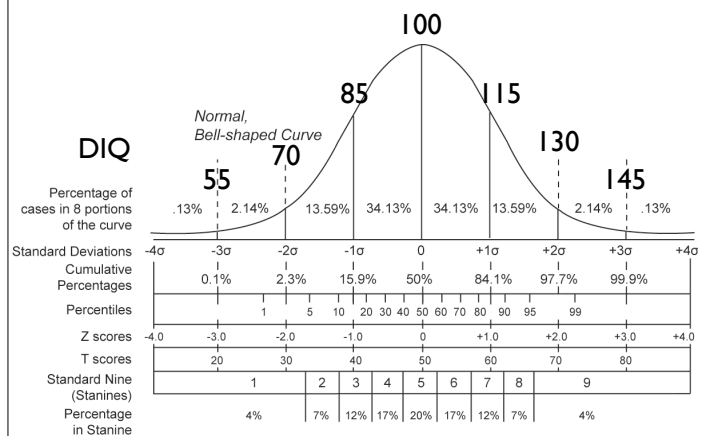
- Raw score - the # or percent correct
 - range : depends on test
 - mean : depends on test
 - standard deviation : depends on test
- Standardizing scores
 - put all tests on same metric
 - allows comparisons across tests
 - method
 - Describe scores as distance from Mean, with distance measured against the SD
- Problem:
 - too many “standard” standard scores!

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Standard Scores



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Standard Scores

	Z scores	IQ scores	T scores
Mean	0.0	100	50
SD	1.0	15	10

top 3% is 97 percentile, a Z score of approximately 1.9, IQ score of 128.5 T score of 19, and scaled score of 15.7

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Normative Data

- Normative Group
 - For each test, give test to a group of “normal” people and measure scores.
 - group should match society (age, education, SES, gender, ethnicity...)
 - Determine Mean (SD), call this “normal”
- For an individual under assessment...
 - compare observed score to normative data
 - data tables
 - formulas
 - computer programs

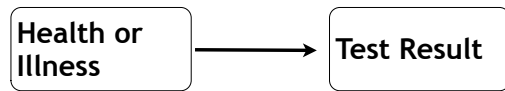
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Demographic Corrections

- Normative Data would be simple if there was one definition of “normal”
- Simple model



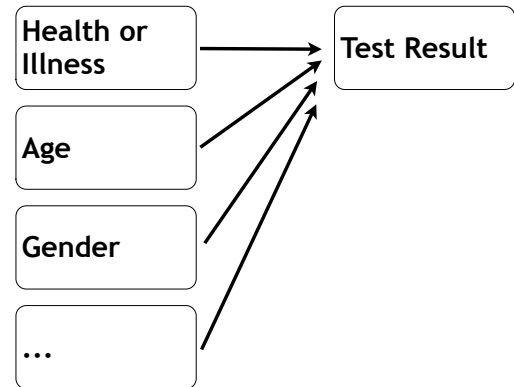
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Demographic Model

- More realistic model



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Common Demographic Covariates

- Age
- Sex
- Race/Ethnicity
- Education
- Language

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Age

- Once you hit 35 years old, it's all downhill!
- Gets significantly worse
 - fluid reasoning
 - speed of processing
 - working memory
 - long term memory
- Gets a little worse or stays same
 - Crystallized information
 - semantic memory
- May get better
 - reasoning
 - vocabulary
 - emotion
 - metacognition

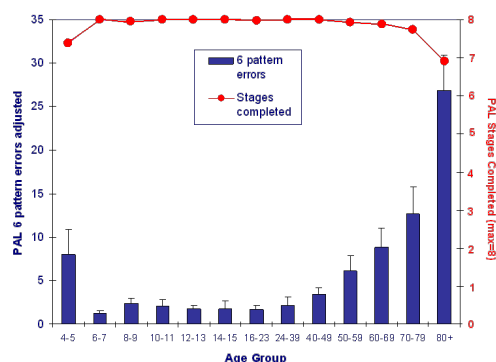
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CANTAB Paired Associate Learning

Paired Associate Learning (errors)– Computerized Task (n=1444)



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Gender

- Historical conceptions
- Modern data

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Gender and IQ

- It was commonly accepted in the 1800s that men were intellectually superior to women
- Darwin, *Descent of Man* (1871) "The chief distinction in the intellectual powers of the two sexes is shewn by man's attaining to a higher eminence, in whatever he takes up, than can woman - whether requiring deep thought, reason, or imagination, or merely the use of the senses and hands"
- Book was edited by Darwin's daughter Henrietta and wife Emma.
- Darwin was in other ways socially liberal

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Gender and IQ

- Modern scientific consensus is that men and women, on average, have equal IQ scores.
- Differences are small and generally insignificant (1-3 IQ points when differences are found)
- Men's IQ scores tend to be slightly more variable (higher variance) so more men tend to fall at either end of the spectrum
- Some evidence that males are better at stereotypical "male" tasks (visuospatial skills) whereas women are better at "female" tasks (language). Evolutionary reasons? Testosterone?

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Race vs. Ethnicity

- Race - genetic heritage
- Ethnic group -- population whose members identify with each other
- "National, religious, geographic, linguistic and cultural groups do not necessarily coincide with racial groups: and the cultural traits of such groups have no demonstrated genetic connection with racial traits. Because serious errors of this kind are habitually committed when the term "race" is used in popular parlance, it would be better when speaking of human races to drop the term "race" altogether and speak of 'ethnic groups'.

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Pre-DNA views

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Gold, silver, brass, iron

"Citizens, we shall say to them in our tale, you are brothers, yet God has framed you differently. Some of you have the power of command, and in the composition of these he has mingled gold, wherefore also they have the greatest honor; others he has made of silver, to be auxiliaries; others again who are to be husbandmen and craftsmen he has composed of brass and iron; and the species will generally be preserved in the children. But as all are of the same original stock, a golden parent will sometimes have a silver son, or a silver parent a golden son."

-- Plato, *The Republic*, circa 380 BC

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Racial Attitudes of the 1800s

- "[...]There is a physical difference between the white and black races which I believe will for ever forbid the two races living together on terms of social and political equality. And inasmuch as they cannot so live, while they do remain together there must be the position of superior and inferior, and I as much as any other man am in favor of having the superior position assigned to the white race."

-- 1858, in a debate with Stephen Douglas
Abraham Lincoln

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Genetics

- Human genome contains about 4 billion pairs of deoxyribonucleic acid (DNA)
- DNA is Transcribed into RNA
- RNA is Translated into Proteins
- Proteins
 - serve as structural components
 - function as enzymes to catalyze biochemical reactions
- Human DNA is grouped into 46 chromosomes
 - 23 pairs, one of each pair comes from each parent
 - 22 pairs in both males and females (autosomes)
 - 1 pair determines sex: either "XX" (females) or "XY" (males)

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Nonconcordant traits

- Naive view : Race = Genetics or heritage
- Biochemical view : traits & genes are spread out among groups. Group difference occur, but often the differences have fuzzy edges
- Non concordance : visible traits (skin color, eye shape, hair texture, etc.) don't go together
- Visible vs. Invisible differences: differences on the genetic level often don't track what is seen in surface differences (such as skin color)

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Post-DNA views

- Variance
 - variation between individuals
 - variation within groups
 - variation between groups
- Variance
 - variation between individuals : 3mbp / person
 - variation within groups : 85%
 - variation between groups: 15%
 - about 5% - within "races"
 - about 10% - between races

Psychology 402 - Fall 2010 - Dr. Michael Diab

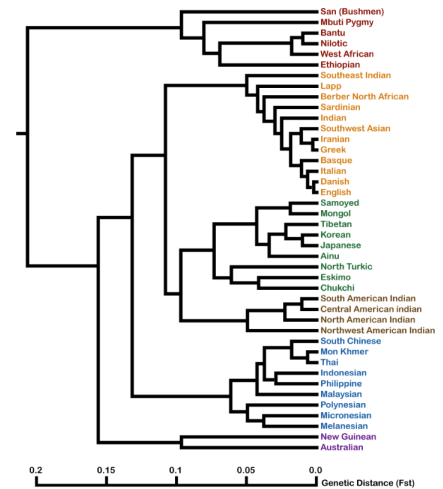
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Genetic Differences

- Sub-Saharan African
- Indo-European
- East Asian
- Native American
- South Asian
- Aboriginal

Fst = % of subpopulation variance



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Effects of Race & Ethnicity on NP Scores

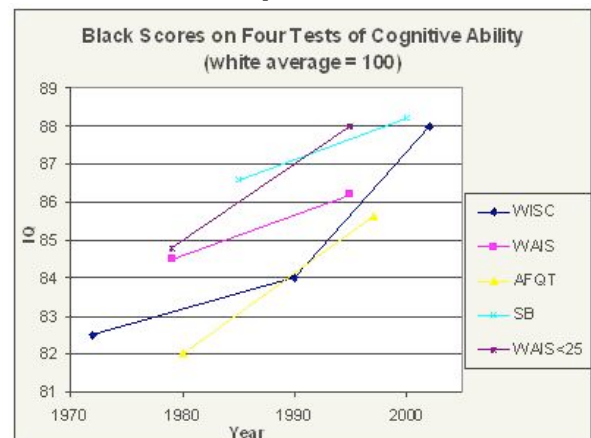
- Many NP tests show effects of Race
 - widespread agreement
- Reasons for these differences?
 - great disagreement
 - Proxy for other variables (nutrition, education, social & environmental opportunities & rewards, money...)
 - Genetics?

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The Flynn Effect



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Diehr et al (2003)

- Paced Auditory Serial Addition Test
- Demographic variables:
 - ethnicity : self-identified as either White / Black
 - age
 - gender
 - education

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Diehr et al (2003) Results

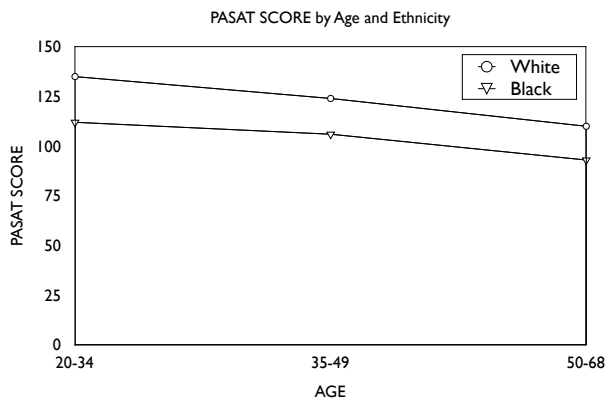
- Statistically and Clinically-significant differences in PASAT test result found for
 - Age
 - Education
 - Ethnicity
- Results not statistically significant:
 - Gender

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Diehr et al (2003) Results



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Education

- Is education a demographic variable?
- Can educational level be a result, not a cause, of brain development?

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Demographic Variables: Conclusions

- Age difference : Large
- Gender differences on IQ tests are small (less than .2 SD) but still controversial
- Ethnic differences are fairly large (1.0 SD)
 - Explanations:
 - Test bias? some found, but doesn't explain most of difference
 - Genetic differences? yes, but recent results suggest this % has been vastly over-estimated.
 - Environmental differences? yes, explains a great deal, and explains recent reductions (e.g. Flynn effect)
- Education differences : Large
 - probably a proxy for other factors, but works well

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Estimating Premorbid Functioning

- Interpretation of NP test results is most accurate when comparing pre- and post- test results
- Rarely have premorbid tests
- What to do?
 - Estimates from demographic variables
 - age, education, gender, ethnicity
 - Estimates from vocation/skills
 - nature of work done
- Ideal: a test which is highly correlated with IQ but not affected by most forms of brain damage

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Premorbid Functioning : the NAART

- North American Adult Reading Test
- Pronunciation of 61 word reading list
- Correlates highly with IQ
- Correlates very weakly with many forms of brain damage
- Automatic Process
- Not timed

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Premorbid Functioning : the NAART

Debt	Placebo	Detente	Sidereal
Debris	Procreate	Impugn	Abstemious
Aisle	Psalm	Capon	Beatify
Reign	Banal	Radix	Gaoled
Depot	Rarefy	Aeon	Demesne
Smile	Gist	Epitome	Syncope
Lingerie	Corps	Equivocal	Ennui
Recipe	Hor d'oeuvre	Reify	Drachm
Gouge	Sieve	Indices	Cidevant
Heir	Hiatus	Assignate	Epergne
Subtle	Gauche	Topiary	Vivace
Catacomb	Zealot	Caveat	Talipes
Bouquet	Paradigm	Superfluous	Synecdoche
Gauge	Facade	Leviathan	
Colonel	Cellist	Prelate	
Subpoena	Indict	Quadruped	

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Psychometric Issues

- Standardization
- Reliability
- Validity
- Type I and II errors - Prevalence & Hit Rates

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Standardization

- Tests must be standardized in methodology
- Issues
 - feedback, encouragement
 - motivation

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Reliability

- Reliability
 - whether a test gives a consistent result in the same situation
 - how much statistical noise is present
 - Example:
 - We believe IQ is relatively fixed
 - IQ test should give same results when administered
 - over time
 - by different examiners

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Validity

- Validity
 - whether a test result “means what it says”
 - is the conclusion (or prediction) made using the test accurate
 - Example:
 - We believe IQ is related to employment success
 - Someone with low IQ
 - Prediction: “They will not win Jeopardy”
 - Result : ???

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Types Of Errors

		The patient actually is...	
		Sick	Healthy
You decide patient is...	Sick	True Positive $1-\beta$ "Hit"	False Positive Type I Error α "False Alarm"
	Healthy	False Negative Type II Error β "Miss"	True Negative $1-\alpha$ "Hit"

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Hit Rates

- Hit Rate
 - % of people correctly classified
- Sensitivity
 - probability of detecting illness
- Specificity
 - probability of detecting health
- Positive Predictive Value
 - probability of being ill when you test ill
- Negative Predictive Value
 - probability of being healthy when you test healthy

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Base Rates (Prevalence) and Hit Rates

- If the disease is very rare (has a low Base Rate or Prevalence)
 - most of the diagnoses are false positives
- SPIN / SNOUT:
 - SPIN : When Specificity is high, Positive result rules **IN** the condition
 - SNOUT : When Sensitivity is high, Negative result rules **OUT** the condition.

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Low Prevalence Example

- Imagine a disease that's only found in 1/1000 patients.
- You have a test with 95% specificity, 95% sensitivity (in other words, a good test).
- In a group of 1000 patients,
 - you will diagnose 50 of them as having the disease
 - but only 1 actually does

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