

# PSYCHOMETRICS

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- ▶ Psychometrics can be defined as the branch of psychology concerned with the design and use of psychological tests and the application of statistical and mathematical techniques to psychological testing
- ▶ Psychometrics is the field of study concerned with the theory and technique of psychological measurement, which includes the measurement of knowledge, abilities, attitudes, and personality traits

- ▶ According to Robert J. Gregory(2004), a test refers to a standardized procedure for sampling behavior and describing it with categories of scores. In addition, most tests have norms or standards by which the result can be used to predict other more important behaviour.
- ▶ This branch of psychology is concerned with the construction and use of different tests and techniques meant for the measurement or assessment of the various types of human abilities and capacities, the processes and

products of human behavior and nature of the relationships and adjustment etc. in this way the task of construction and standardization of various intelligence tests, interest and aptitude tests, attitude scales, inventories and other techniques meant for the assessment of personality traits, behavioral characteristics and adjustment etc. is carried out through the study of this branch. Since statistical methods and techniques are very much needed in the construction, standardization and application of these measures, these are also included in the subject matter of the branch psychometrics.

# CHARACTERISTICS OF PSYCHOMETRIC TESTING

1. Standardized procedure- the procedure for administering a test is uniform from one examiner and setting to another.
2. Behavior sample- a test targets a well defined and finite behavior or domain.
3. Scores or categories.



# History of Psychometric Testing

The textbooks trace the origin of psychological testing to the Chinese civil services as early as around 4,000 years ago (DuBois 1970,1972). Every third year in china, oral examinations were given to help evaluate the work of the employees and make decisions about their promotions. However, according to Erford (2007) the Greeks may have been the first to use assessment for educational or military purpose.

The founding of psychometrics might well be thought to correspond with the founding of academic psychology, marked by the publication in 1860 of physicist-philosopher Gustav Fechner's *Elemente der psychophysik*.

Fechner defined psychophysics as an exact science of the fundamental relations of dependency between body and mind.

He experimentally established the lawful relationship between the measure of a physical stimulus( R) and the measure of an observer's sensation thereof(s) as

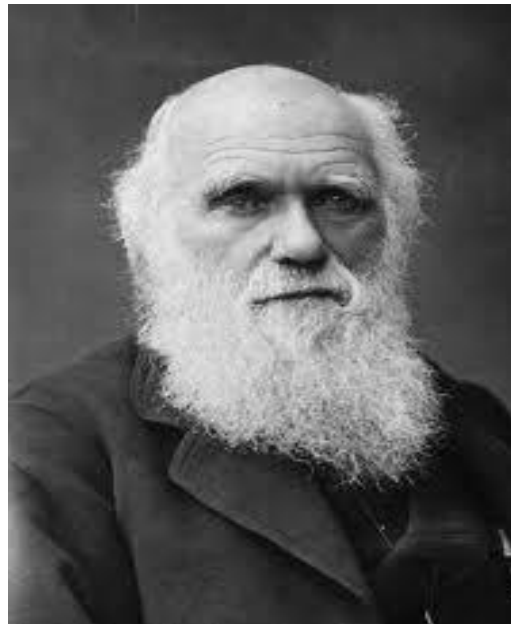
$$S = k \log R$$

This stimulated psychometric research not only in Europe especially in Germany and some what in US.

Herman Helmholtz, a physicist- physiologist accepted Fechner proposed logarithmic relation between sensation and stimulus and he adopted psychophysical methods to support his theories of vision, hearing and tactile sensation. His former assistant was wilhelm wundt whose Leipzig Laboratory in 1879 became the first psychology lab in the world, they involve psychophysical method as primary tools of experimental psychology.



On the other hand the publication of Charles Darwin's all time influential book *The Origin Of Species*(1859) influence psychometric testing. Darwin's ideas offered major impetus to work on the individual differences and it was Sir Francis Galton, a relative of Darwin, who soon began applying Darwin's ideas to the study of human abilities.



# Francis Galton

- ▶ Modern psychometrics dates to Sir Francis Galton (1822-1911),



- Interested in (in fact, obsessed with) individual differences and their distribution
- 1884-1890: Tested 17,000 individuals on height, weight, sizes of accessible body parts, + behavior: hand strength, visual acuity etc
- Demonstrated that objective tests could provide meaningful scores.

- ▶ In his book Heredity Genius(1869), he concluded that some people possess certain characteristics that made them more fit than others, he carried out a series of experimental studies to validate his observations.

## James Cattell

Galton did important work on individual differences which was later extended by James Cattell (studied with Wundt & Galton) he first time used the term 'mental test 'in 1890.



- Founded 'Psychological Review'(1897)
- His work was based on Galton's work on individual differences in reaction time. Their work offered the stage for the development and growth in the modern testing and led to its present status as we see today.

# Clark Wissler

- ▶ Clark Wissler (Cattell's student) did the first basic validation research, examining the relation between the old 'mental test' scores and academic achievement



- His results were largely discouraging
- He had only bright college students in his sample

# Alfred Binet

- ▶ Good enough (1949): The Galtonian approach was like “inferring the nature of genius from the the nature of stupidity or the qualities of water from those of....hydrogen and oxygen”.

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- ▶ Alfred Binet (1905) introduced the first modern intelligence test, which directly tested higher psychological processes (real abilities & practical judgments)
  - ▶ i.e. picture naming, rhyme production, weight ordering, question answering, word definition.
- ▶ Also motivated IQ (Stern, 1914): mental ‘age’ divided by chronological age.

# TYPES OF PSYCHOMETRIC TEST

- ▶ According to mode of administration
- ▶ According to rate of performance
- ▶ According to behavioral attribute measured
- ▶ According to the medium used
- ▶ According to the nature of test items
- ▶ Based on the mode of interpretation
- ▶ According to the scope/applicability



# TEST CONSTRUCTION

The process of choosing the most appropriate items or questions that are to be included in a test. Generally all test follow the below given steps.

- ▶ Planning the test
- ▶ Preparing the preliminary draft of the test
- ▶ Trying out the preliminary draft of the test
- ▶ Evaluating the test
- ▶ Constructing of the final draft of the test.

# ITEM ANALYSIS

The effective and usefulness of test depends upon the qualities of the items that are included in it. The score of the test is obtained as a result of its validity, reliability and the intercorrelation between two items. Therefore to make the test more effective, the test constructor should study one by one all the items which are to be included in it. This process is known as item analysis

- ▶ Two technical aspects - **item validity** and **item difficulty** are usually considered for the value assessment of the items

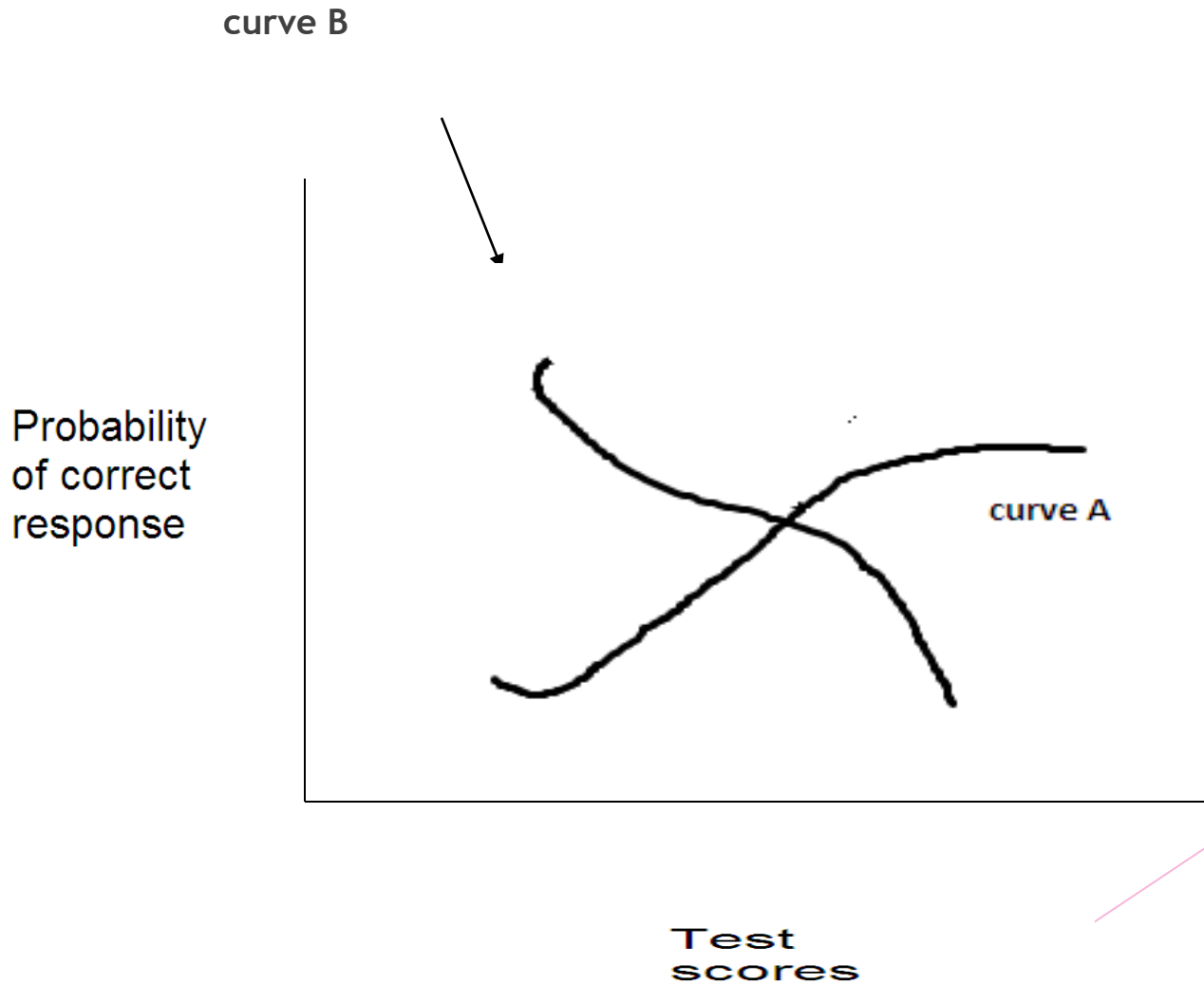
# Item difficulty

- ▶ According to Tate(1955)  
item difficulty= 1/proportion of students that have answered the item correctly





## Item validity

When each item of the test effectively discriminates on the basis of a particular quality or ability between high and low or strong and weak persons of a group, then only it can be called valid. therefore each item has to be discriminative besides being fully valid.

# Item Characteristic Curve



The above mentioned curve depicts the probability that a person with a given ability level will answer the item correctly. Persons with lower ability have lesser chances of answering a problem correctly, while persons with high ability are more likely to answer the item correctly; simply stating that a person possessing higher intelligence will score higher, and a person possessing lower intelligence (ability) will score lower. The steepness or the slope of the ICC shows the discriminating power of an item. Item discriminating power is given by a relationship between the slope of the ICC and the inter-item correlation.

- ▶ Scoring of tests and problems of scoring 
- ▶ Reliability 
- ▶ Validity 
- ▶ Norms 

# Applications of Psychometric Tests

## ▶ In schools

1. Career interest inventory
2. Standard progressive matrices (SPM)

## ▶ In counseling and guidance

1. Quality of life assessment
2. The MC Master Health Profile (McEwen 1992)

## ▶ In clinical settings

1. 16 PF
2. TAT

Clinical assessment has a long history in the field of mental health. The use of psychological tests in clinical setting is guided by basically three modals of mental health: the information gathering model, the therapeutic model and the differential treatment model (Finn and Tonsager 1997).

### ▶ In organizational settings

1. 16PF
2. Emotional quotient (EQ) test

In organiztional setting they are broadly used mainly at two stages: first in the pre-employment phase and , second, in the form of various performance appraisal tools done after the employment.



Assessment of psychometric test helps to identify the personality traits, cognitive skills ethical values and social and interpersonal skills.

Apart from this, psychological tests can be used in a more positive sense for management development programme, leadership development training and other areas of training and development.

# Ethical issues in psychological testing

- ▶ Responsibility
- ▶ Moral and legal codes
- ▶ Competence
- ▶ Confidentiality
- ▶ Client welfare
- ▶ Client relationship
- ▶ Test security
- ▶ Test publication
- ▶ Responsibility towards the organization

# REFERNCES

- ▶ Chadha N.K., (2009). *Applied Psychology*. New Delhi: SAGA publication india private limited, pp-(71-285).
- ▶ Cripps, B., & Spry, D., (2008). *Psychometric Testing Pocketbook*. United kingdom: Management Pocketbooks Ltd, pp-9.
- ▶ Rao, C.R., & Sinharay, S., (2007). *Handbook of Statistics 26, Psychometrics*. Netherland: Elsevier, pp-(2-5).
- ▶ Ward, W.A., Stoker, H.W., & Ward, M.M., (1996). *Educational Measurement*. USA: University press of America, pp-72.