# Factor Analytic Theories

## Chapter 11

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### Raymond Cattell

- 1905-1998
- Born Staffordshire, England
- Happy childhood
- Lived through WW I
- Admitted he was heavily influenced by the war
- Chemistry & Physics background before pursuing PhD in Psychology
- Studied under Spearman, noted quantitative psychologist
- Spearman developed factor analysis
Definition of Personality

• “Personality is that which permits a prediction of what a person will do in a given situation”
  – Personality as a way to predict future events
• Expressed as a formula
  – \( R = f(P, S) \)
  – A response \( R \) is a function of the person \( P \) and the stimuli \( S \)

Surface Traits versus Source Traits

• For a trait theory to be useful, it must go beyond overt behaviors
• Examples:
  – Bad: Dale is lazy because of underlying laziness (tautological/circular)
  – Good: Pat is honest because of underlying ego strength
• Surface traits refer to overt behaviors
• Source traits refer to underlying variables

More on Source Traits

• Source traits are critical to Cattell’s theory of personality
  – Source traits are few: a simple economy of human description
  – Source traits have influence on personality and, in turn, the ways we behave
• Source traits reflect both hereditary and environmental influences
• Building blocks of personality
  – 16 basic temperament and ability traits \( \rightarrow 16 \) Personality Factor Questionnaire (16PF)
Basic Temperament Source
Traits

Outgoing ↔ Reserved
More Intelligent ↔ Less Intelligent
Assertive ↔ Humble
Happy-go-lucky ↔ Sober

Basic Temperament Source
Traits

Strong Conscience ↔ Lack of Internal Standards
Adventurous ↔ Shy
Tough-Minded ↔ Tender-Minded
Trusting ↔ Suspicious

Basic Temperament Source
Traits

Imaginative ↔ Practical
Shrewd ↔ Forthright
Apprehsiive ↔ Self-Assured
Experimental ↔ Conservativ
Basic Temperament Source Traits

- High Ego ⇐⇒ Low Ego
- High Strength ⇐⇒ Low Strength
- Group-Dependent ⇐⇒ Self-Sufficient
- Casual ⇐⇒ Controlled
- Relaxed ⇐⇒ Tense

Derivation of the Basic Temperament Source Traits: Factor Analysis

- Cattell used factor analysis to derive the Sixteen Personality Factor Questionnaire or 16PF
- Factor analysis is a statistical technique to find patterns in a larger subset of data
  - Patterns of correlations among items
  - Grouped into "factors" or highly correlated items
  - Extremely time consuming without computers

What is Factor Analysis?

Hypothetical Correlation Matrix

<table>
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<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
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<tr>
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<td>5. Subtract</td>
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Creation of the 16PF

- Administered items to participants
  - Hundreds of surface personality traits
- Factor analysis of these surface traits
- Clusters of surface traits grouped into a common source trait
  - Source trait then named and identified...
Prediction with the 16PF

- Cattell hoped to predict future responses by knowing where a person stood on the 16 traits.
- Cattell used specification equations to make predictions in various situations:
  \[ R = s_1T_1 + s_2T_2 + \ldots + s_nT_n \]
  - Read: An individual's response is equal to the sum of that individual's traits as weighted by the influence of situational factors.
  - A limited formula: a more complete version would also consider individuals' state of mind and role within a group or society.

Contemporary Successors to Cattell: The Big 5

- Cattell influenced considerable efforts to advance and refine his 16PF.
- Cattell's 16 factors distilled into 5 core personality traits:
  - Openness
  - Conscientiousness
  - Extraversion
  - Agreeableness
  - Neuroticism
- Not complete consensus on Big Five.

The Big Five (Costa & McCrae, 1992)

- Conscientiousness: Trustworthy, dependable, productive, purposeful.
- Neuroticism: Anxious, insecure, guilt-prone, self-conscious.
- Openness: Curious, imaginative, broad interests, imaginative.
- Extrapversion: Sociable, active, fun-loving, spontaneous.
- Agreeableness: Sympathetic, warm, trusting, cooperative.
Approaches of Big Five Theorists

- Big Five theorists study language and words humans use to describe personality
  - English language has almost 18,000 words that can characterize personality • Allport
  - This was the list Cattell initially used in his Factor Analysis
  - Factor analysis of ratings of these words can derive factors that characterize personality
- Big Five theorists construct questionnaires that purport to measure the five factors.
  - NEO-PI-R

Applying the Big Five

- In the Workplace
  - To predict job performance
  - To match employees to certain jobs or tasks
  - To predict job satisfaction
- Diagnosing personality disorders, planning treatments
  - Group therapy for extraverts
- DSM-V
- Can you think of any problems in using measures in this way?
- Cross cultural support for Big Five
  - Not completely universal support
  - Best support from languages/cultures originating in Europe

Cattell’s Other Contributions: Behavioral Genetics

- Emphasized role of genetics and heredity on personality
  - Genotype or the genetic makeup of a person
  - Phenotype or a person’s outward appearance
- Twin studies that attempt to assess the habitability of certain traits
  - Multiple Abstract Variance Analysis (MAVA) with twins and siblings reared either together or apart
    - Adoption studies
    - MZ twins vs. DZ twins vs. Family vs. Strangers
Behavioral Genetics (cont’d)

- Genetic influence on IQ scores
- Heritability refers to a statistical estimate of the phenotypic variation that may be caused by genetic variation
- Some physical characteristics, such as height, may be as much as 90% heritable
- Estimates of heritability for most personality traits range from 33% (habits & attitudes) to 50% (temperament) …

Genes and Personality

- [Graph showing comparison of MZ Twins vs. DZ Twins]

Eugenics

- Eugenics is the practice of selective breeding in animals or humans
  - Cultivate “desirable” qualities in humans
- In the extreme, forced sterilization of humans because of “defects”
  - Occurred in USA in 20th Century—WW II
    - Cattell vs. the idea of a master race—sought to maximize evolutionary progress through variability
    - Some suggest this practice should be applied to the mentally ill
- Softer eugenics = Restricting birthrate
  - Population control