

Factor Analytic Theories

Chapter 11

Chapter 11 Big Ideas

- Raymond Cattell**
- Cattell's Definition of Personality
- Surface Traits versus Source Traits
- Personality Factor Questionnaire (16PF)
- What is Factor Analysis?
- Specification Equations
- Contemporary Successors to Cattell: The Big 5
 - Openness
 - Conscientiousness
 - Extraversion
 - Agreeableness
 - Neuroticism
- NEO-PI-R
- Applying the Big Five
 - In the Workplace
 - Diagnosing personality disorders
 - DSM-V
 - Cross-cultural support?
- Cattell's Other Contributions:
 - Behavioral Genetics
 - Twin studies that attempt to
 - Assess the heritability of certain traits
 - Multiple Abstract Variance Analysis (MAVA)
 - Eugenics

2

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

3

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)

4

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

5

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 → 16 Personality Factor Questionnaire (16PF)

6

Basic Temperament Source Traits

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

7

Basic Temperament Source Traits

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

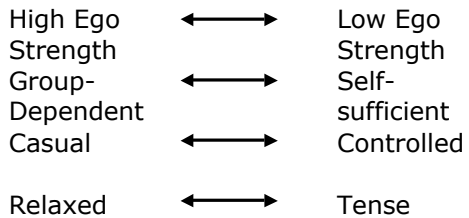
8

Basic Temperament Source Traits

Imaginative ↔ Practical
Shrewd ↔ Forthright
Apprehensive ↔ Self-Assured
Experimental ↔ Conservative

9

Basic Temperament Source Traits



10

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

11

What is Factor Analysis?

Hypothetical Correlation Matrix

Variable	1.	2.	3.	4.	5.	6.
1. Reading	1.0	.60	.50	.15	.20	.10
2. Vocab.		1.0	.50	.15	.10	.10
3. Spelling			1.0	.10	.20	.15
4. Addition				1.0	.60	.60
5. Subtact.					1.0	.60
6. Mult.						1.0

12

What is Factor Analysis?

Hypothetical Correlation Matrix

Variable	1.	2.	3.	4.	5.	6.
1. Reading	1.0	.60	.50	.15	.20	.10
2. Vocab.		1.0	.50	.15	.10	.10
3. Spelling			1.0	.10	.20	.15
4. Addition				1.0	.60	.60
5. Subtact.					1.0	.60
6. Mult.						1.0

13

What is Factor Analysis?

Factor Matrix

Variable	Factor 1	Factor 2
1. Reading	.70	.15
2. Vocabulary	.60	.15
3. Spelling	.60	.10
4. Addition	.10	.70
5. Subtraction	.10	.65
6. Multiplication	.05	.60

14

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...

15

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

$$R = s_1T_1 + s_2T_2 + \dots + s_nT_n$$

- 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

16

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

17

The Big Five (Costa & McCrae, 1992)

- Conscientiousness**
Ethical, dependable, productive, purposeful
- Neuroticism**
Anxious, insecure, guilt-prone, self-conscious
- Openness**
Daring, nonconforming, showing unusually broad interests, imaginative
- Extraversion**
Talkative, sociable, fun-loving, affectionate
- Agreeableness**
Sympathetic, warm, trusting, cooperative

18

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

19

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

20

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

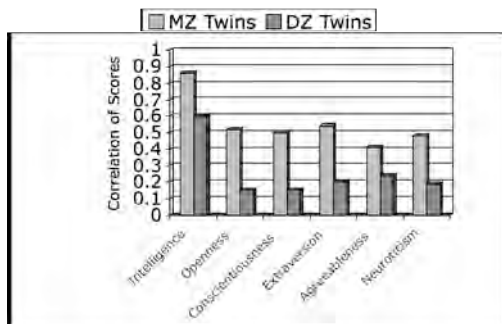
21

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) ...

22

Genes and Personality



23

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

24
