Raymond Cattell: Mapping the Blueprint of Human Personality

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Raymond Bernard Cattell

Raymond Bernard Cattell (20 March 1905 - 2 February 1998) was a British and American psychologist, known for his exploration of many areas in psychology. These areas included: the basic dimensions of personality and temperament, a range of cognitive abilities, the dynamic dimensions of motivation and emotion, the clinical dimensions of personality, patterns of group and social behavior, applications of personality research to psychotherapy and learning theory, predictors of creativity and achievement, and many scientific research methods for exploring and measuring these areas. Cattell was famously productive throughout his 92 years, authoring and co-authoring over 50 books and 500 articles, and over 30 standardized tests. According to a widely cited ranking, he was the 16th most influential and eminent psychologist of the 20th century.

As a psychologist, Cattell was rigorously devoted to the scientific method. He was an early proponent of using factor analytical methods instead of what he called "verbal theorizing" to explore the basic dimensions of personality, motivation, and cognitive abilities. One of the most important results of Cattell's application of factor analysis was his discovery of 16 factors underlying human personality. He called these factors "source traits" because he believed they provide the underlying source for the surface behaviors we think of as personality. This theory of personality factors and the instrument used to measure them are known respectively as the 16 personality factor model and the 16PF Questionnaire.

Although Cattell is best known for identifying the dimensions of personality, he also studied basic dimensions of other domains: intelligence, motivation, and vocational interests. Cattell theorized the existence of fluid and crystallized intelligences to explain human cognitive ability, and authored the Culture Fair Intelligence Test to minimize the bias of written language and cultural background in intelligence testing.

Innovations and accomplishments

Cattell's principal accomplishments were in personality, intelligence, and statistics. In personality, he is best remembered for his 16-factor model of personality, arguing for this over Eysenck's simpler 3-factor model, and developing tests to measure his primary factors in the form of the 16PF Questionnaire. He was the first to propose a hierarchical, multi-level model of personality with basic primary factors at the first level and the broader, "second-order," or global traits of personality at a higher level of personality organization (Cattell, 1943). These five global traits are now identified with the widely used Big Five model of personality. His research lead to additional conceptual advances - for instance distinguishing state versus trait measurement of personality: immediate, transitory states versus long-term, enduring trait levels on traits such as anxiety. In intelligence, Cattell is best identified with the distinction of fluid and crystallized intelligence: current, abstract, adaptive intellectual abilities versus applied or crystallized knowledge. As a

theoretical underpinning for this distinction, Cattell developed the investment-model of ability, arguing that crystallized ability emerged out of investment of fluid ability in a topic of knowledge. He thus contributed to cognitive epidemiology, arguing that crystallized knowledge, while initially lagging fluid ability, could be maintained or even increase after fluid ability began to decline, a concept embodied in the National Adult Reading Test (NART). Cattell developed his own ability test, the Culture Fair Intelligence Scales, designed to minimize the effect of cultural or educational background and provide a completely non-verbal measure of intelligence such as that now seen in the Raven's.

In statistics, he founded the Society of Multivariate Experimental Psychology (1960) and its journal Multivariate Behavioral Research. He was a early and frequent user of factor analysis, and developed improvements for this process, such as the Scree Test which used the curve of latent roots to judge the best number of factors to result from a factor analysis. He also developed a new factor analysis rotation, the "Procrustes" rotation, designed to test the fit of data to a prior-hypothesized factor structure. Additional contributions include the Coefficient of Profile Similarity (taking account of shape, scatter, and level of two score profiles),the Dynamic Calculus for assessing interests and motivation, P-technique factor analysis for an occasion-by-variable matrix, the Taxonome program for ascertaining the number and contents of clusters in a data set, the Basic Data Relations Box (assessing the dimensions of experimental designs), sampling of variables, as opposed to or in conjunction with sampling of persons; the group syntality construct: the "personality" of a group; factoring or repeated measures on single individuals to study fluctuating personality states, and Multiple Abstract Variance Analysis (MAVA) with "specification equations" embodying genetic and environmental variables and their interactions.

Multivariate research

Rather than pursue a "univariate" research approach to psychology, studying the effect that a single variable (such as "dominance") might have on one other variable (such as "decision-making"), Cattell pioneered the use of a multivariate approach to psychology. He believed that behavioral dimensions were too complex and interactive to fully understand one dimension in isolation. The classical univariate approach required bringing the individual into an artificial laboratory situation and measuring the effect of one particular variable on another, while the multivariate approach allowed psychologists to study the whole person and their unique combination of traits in a natural environment. Multivariate analyses allowed for the study of real-world situations (e.g. depression, divorce, loss) that could not be manipulated in a laboratory.

Cattell applied multivariate research to three domains: the traits of personality or temperament, the motivational or dynamic traits, and the diverse dimensions of abilities. In each of these areas, he thought there must be a finite number of basic, unitary elements that could be identified. He drew a comparison between these fundamental, underlying traits to the basic elements of the physical

world that were discovered and presented in the periodic table of the elements.

In 1960, he organized an international meeting of research-oriented psychologists, resulting in the founding of the Society for Multivariate Experimental Psychology, and its journal, Multivariate Behavioral Research. He brought many researchers from Europe, Asia, Africa, Australia, and South America to work at his lab at the University of Illinois. Many of his books were written in collaboration with others.

Factor analysis

Cattell noted that in sciences such as chemistry, physics, astronomy, and medicine, unsubstantiated theories were historically widespread until new instruments were developed to improve scientific observation and measurement. In the 1920s, Cattell studied under Charles Spearman who was developing the new psychometric technique of factor analysis in his effort to understand the basic dimensions and structure of human abilities. Factor analysis became a powerful tool to help uncover the basic dimensions behind a confusing array of surface variables in a particular domain.

Factor analysis was built upon the earlier development of the correlation coefficient, which measures the degree to which two variables are related or tend to go together. For example, if "frequency of exercise" and "blood pressure level" were measured on a large group of people, then inter-correlating these two variables would indicate the degree to which "exercise" and "blood pressure" are directly related to each other. Factor analysis performs complex calculations on the correlation coefficients among a multitude of variables in a particular domain (such as abilities or personality) to determine the basic, unitary factors at work behind the superficial variables of behavior found in that domain.

While working at the University of London with Spearman exploring the number and nature of human abilities, Cattell postulated that factor analysis could be applied to other areas beyond the domain of abilities. In particular, Cattell was interested in exploring the basic dimensions and structure of human personality. For example, he thought that if factor analysis were applied to a wide range of measures of interpersonal functioning, the basic dimensions within the domain of social behavior could be identified. Thus, factor analysis could be used to discover the fundamental dimensions behind the large number of apparent surface behaviors and then facilitate more effective research in this area.

Personality theory

In order to apply factor analysis to personality, Cattell believed it necessary to sample the widest possible range of variables. He specified three kinds of data for comprehensive sampling, to

capture the full range of personality dimensions:

Life data (or L-data), which involves collecting data from the individual's natural, everyday life behaviors, measuring their characteristic behavior patterns in the real world. This could range from number of traffic accidents or number of parties attended each month, to grade point average in school or number of illnesses or divorces.
Experimental data (or T-data) which involves reactions to standardized experimental situations created in a lab where a subject's behavior can be objectively observed and measured.
Questionnaire data (or Q-data), which involves responses based on introspection by the individual about their own behavior and feelings. He found that this kind of direct questioning often measured subtle internal states and viewpoints that might be hard to see or measure in external behavior.

In order for a personality dimension to be called "fundamental and unitary," Cattell believed that it needed to be found in factor analyses of data from all three of these domains. Thus, Cattell constructed personality measures of a wide range of traits in each medium. He then repeatedly performed factor analyses on the data.

With the help of many colleagues, Cattell's factor-analytic studies continued over several decades, eventually producing the 16 fundamental factors underlying human personality. He decided to name these traits with letters (A, B, C, D, E...) in order to avoid misnaming these newly discovered dimensions, or inviting confusion with existing vocabulary and concepts. Factor-analytic studies by many researchers in diverse cultures around the world have re-validated the number and meaning of these traits.

Cattell set about developing tests to measure these traits across different age ranges, such as The 16 Personality Factor Questionnaire for adults, the Adolescent Personality Questionnaire, and the Children's Personality Questionnaire.

From the beginning of his research, Cattell reasoned that, as in other scientific domains like intelligence, there might be an additional, higher level of organization within personality which would provide a structure for the many primary traits. When he factor analyzed the 16 primary traits themselves, he found five "second-order" or global factors, now commonly known as the Big Five. These second-order or global traits were broad, over-arching domains of behavior, which provided meaning and structure for the primary traits. For example, the global trait Extraversion emerged from factor-analytic results made up of the five primary traits that were interpersonal in focus.

Thus, global Extraversion is fundamentally related to the primary traits that came together in the factor analysis to define Extraversion, and, moving in the opposite direction, the domain of Extraversion gave conceptual meaning and structure to these primary traits, identifying their focus and function in personality. These two levels of personality structure can be used to provide an integrated understanding of the whole person, with the global traits giving an overview of the

individual's functioning in a broad-brush way, and the more-specific primary trait scores providing an in-depth, detailed picture of the individual's unique trait combinations.

Research on the basic 16 traits has shown them to be useful in understanding and predicting a wide range of real life behaviors. For example, the traits have been used in educational settings to study and predict such things as achievement motivation, learning style or cognitive style, creativity, and compatible career choices; in work or employment settings to predict such things as leadership style, interpersonal skills, creativity, conscientiousness, stress-management, and accident-proneness; in medical settings to predict heart attack proneness, pain management variables, likely compliance with medical instructions, or recovery pattern from burns or organ transplants; in clinical settings to predict self-esteem, interpersonal needs, frustration tolerance, and openness to change; and, in research settings to predict a wide range of dimensions such as aggression, conformity, and authoritarianism.

Cattell's program of personality research in the 1940s, 50's, and 60's resulted in five books that have been widely recognized as identifying fundamental dimensions of personality and their organizing principles:

The Description and Measurement of Personality (1946)
Personality: A Systematic, Theoretical, and Factual Study (1950)
Personality and Motivation Structure and Measurement (1957)
The Scientific Analysis of Personality (1965)
Personality and Mood by Questionnaire (1973)

These books detailed a program of research that was based on personality data from objective behavioral studies, from self-report or questionnaire data, and from observer ratings. They presented a theory of personality development over the human life span, including effects on the individual's behavior from family, social, cultural, biological, and genetic influences, as well as influences from the domains of motivation and ability.

Criticism and the APA Lifetime Achievement Award

William H. Tucker and Barry Mehler, have taken issue with Cattell based on his interests in eugenics, evolution and political systems. They argue that throughout his life Cattell adhered to a mixture of eugenics and theology, which he eventually named Beyondism and proposed as "a new morality from science". Beyondism is based on the premise that groups, like individuals, evolve based on survival of the fittest. Cattell argues that a diversity of "racio-cultural" groups is necessary to allow that evolution. He makes controversial arguments to support natural group selection by encouraging not only the separation of groups but also the prevention of any "external" assistance to "failing" groups from "successful" ones, and by calling for a process of "genthanasia," in which the former would be "phased out" by the latter through "educational and birth control measures"-

that is, by segregating them and preventing their reproduction. However, Cattell's former colleagues and other supporters assert that, although some of Cattell's views are controversial, Tucker and Mehler have exaggerated and misrepresented him by using quotes out of context and from outdated writings.

In 1997, Cattell, at 92, was chosen by the American Psychological Association (APA) for its "Gold Medal Award for Lifetime Achievement in the Science of Psychology." Before the medal was presented, Mehler launched a publicity campaign against Cattell through his nonprofit foundation ISAR accusing Cattell of being sympathetic to racist and fascist ideas and claiming that "it is unconscionable to honor this man whose work helps to dignify the most destructive political ideas of the twentieth century". A blue-ribbon committee was convened by the APA to investigate the legitimacy of the charges. However, before the committee reached a decision, Cattell issued an open letter to the committee saying "I abhor racism and discrimination based on race. Any other belief would be antithetical to my life's work" and saying that "it is unfortunate that the APA announcement ... has brought misguided critics' statements a great deal of publicity." He refused the award, withdrawing his name from consideration. The blue ribbon committee was therefore disbanded and Cattell, in failing health, died months later.

In 1994, Cattell was one of 52 signatories on "Mainstream Science on Intelligence," an editorial written by Linda Gottfredson and published in the Wall Street Journal, which declared the consensus of the signing scholars on issues related to race and intelligence following the publication of the book The Bell Curve.