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### Psychology 371: Personality Research Introversion-Extraversion

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#### Outline

Descriptive versus casual models Descriptions of Introversion-Extravesion

A personal digression Eysenck's world wide influence Eysenck's influence on personality theory

Eysenck, the development of theory Original work Eysenck's arousal theory as a theory of performance

Theory comparison and development

References

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#### I/E

- 1. Simple descriptive basis
  - Self reports
  - Sociabile
  - Active
  - Impulsive
  - Spontaneous
- 2. Peer ratings
- 3. People who describe themselves as outgoing are more known to others.

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#### American Taxonomists – European Theorists

1. While most US researchers were studying the dimensionality of self reports, Europeans were developing casual models.

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#### Where I first learned about personality theory (and Hans Eysenck)



Figure: Nanga Medamit, ulu Limbang, Sarawak, Malaysia, 1965-1967

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#### My first exposure to Hans Eysenck



# The only psychology books in the Brunei bookstore (100 Km or 10 hours by boat downriver) were by Hans Eysenck



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#### Who was this man?



#### published by Penguin Books

Psychology occupies a somewhat ambiguous place in the world today. Its findings are being widely applied in critical of the alleged laws of human behaviour disanalysts, and doubtful about the applicability of scientific to indicate to what extent the claims made for his science are justified, and to what extent they fail to have any carried out in this country and abroad. Topics dealt with are the testing of intelligence, selection procedures in occupational selection, psychotherapy and its effects, national differences, racial intolerance, Gallup surveys, psychological findings are submitted to a searching criticism, and a clear distinction made between those uses of psychology where enough is known to support social action, and those abuses where personal opinions



#### published by Penguin Books

Eysenck's Pelican trilogy: Uses and Abuses of Psychology, Sense and Nonsense in Psychology - and now Fact and Fiction in Psychology.

ever, while the range of subjects that he deals with is. as always, provocatively wide. Of special interest in this volume is his application of behavioural therapy to the to the severe clinical problem of the alcoholic, Also Professor Eysenck's most recent views on the criminal personality are set out with challenging authority.

Further chapters on the psychology of road traffic offenders and a hard look at the more exclusive claims of depth psychology complete a fascinating volume.

Cover design by Germano Facetti



#### The influence of Eysenck on personality and individual differences

- 1. Popular books
  - Uses and abuses of psychology (1953)
  - Sense and nonsense in psychology (1957)
  - Fact and fiction in psychology (1965)
- 2. Scholarly books (a small selection)
  - Dimensions of personality (1947)
  - The scientific study of personality (1952)
  - The structure of human personality (1953)
  - The dynamics of anxiety and hysteria (1957)
  - The biological basis of personality (1967)
  - Eysenck of extraversion (1973) (Edited reprints)
  - The measurement of personality (1976) (Ed.)
  - A model for intelligence (1982) (Ed.)
  - Personality and Individual differences (1985) (H.J. and M.W.)
  - A new look at intelligence (1998)

### European personality research was a beacon of light in the "Dark Ages of personality"

- While personality was under attack in the US (Mischel, 1968; Endler & Magnusson, 1976) it was alive and well and living in Europe (Eysenck, 1967), Gray (1970, 1982, 1991), Strelau & Angleitner (1991)
  - It is hard to remember now in the second decade of the 21st century the attacks of the 60s-80s on the study of stable, biologically based, important personality traits.
  - These attacks had a perverse and long lasting influence on American personality research.
  - The scars of these debates persist in that a generation of American researchers avoided the field.
  - However, it is because of the contributions of (mainly) European personality researchers that we have such a vibrant field today.
- Whether we agree or disagree with Hans Eysenck's theoretical program, we all owe a great debt to his contribution in advancing the field.

### Eysenck's theories as integration of individual differences with general laws

Eysenck always tried to integrate his taxometric study of individual differences with the best general psychological theories available at the time. That meant that the theory changed. (Although sometimes without comment.) Thus, to read Eysenck & Himmelweit (1947) or Eysenck (1952) is to read a completely different theoretical integration than proposed in Eysenck (1967) or Eysenck & Eysenck (1985) or finally, that of Eysenck (1997).

- 1. Personality and Learning Theory
  - Hull (1943, 1952)
  - Eysenck & Himmelweit (1947); Eysenck (1952)
- 2. Personality and Arousal Theory
  - Hebb (1955); Berlyne (1960); Berlyne & Madsen (1973); Broadbent (1971)
  - Eysenck (1967); Eysenck & Eysenck (1985)
- 3. Personality, genetics, structures, and neurotransmitters

#### The original Eysenck factors (of behavior

#### Table: The original Eysenck matrix

The original Eysenck factor output

Variable	1	2	3	4
Age above 30	0.08	0.14	-0.27	-0.22
Unskilled	0.22	-0.45	0.12	-0.48
Unemployment	0.55	-0.23	-0.12	-0.36
Degraded work-history	0.16	-0.29	0.16	-0.29
Abnormality in parents	0.47	0.21	0.35	0.31
Unsatisfactory home	0.43	0.06	0.45	0.00
Married	0.21	0.39	-0.12	-0.19
No group membership	0.46	-0.40	-0.16	-0.32
Narrow interests	0.55	-0.57	0.04	-0.10
Alcohol	0.07	0.00	0.17	-0.36
Abnormal before illness	0.61	-0.09	0.24	0.33
Badly organized personality	0.92	-0.12	0.35	0.15
Dependent	0.65	-0.22	0.06	0.24
Little energy	0.53	-0.69	0.06	-0.24
Cyclothymic	0.46	0.31	0.00	0.37
Schizoid	0.52	-0.07	0.26	0.29
Hypochondriacal personality	0.31	-0.22	-0.41	0.07
Obsessional	0.00	0.51	0.07	0.25
Somatic anxiety	0.05	0.25	-0.37	0.12
Effort intolerance	0.23	0.13	-0.63	0.26
Dyspepsia	0.54	0.17	-0.36	-0.01
Fainting, fits	0.23	-0.23	-0.42	0.23
Pain	0.12	0.00	-0.39	0.03
Tremor	0.30	0.34	0.17	0.10
Sex anomalies	0.14	-0.50	0.54	-0.01
Irritability	0.18	0.41	0.13	-0.10
Apathy	0.18	0.48	-0.02	-0.46

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#### The first two unrotated factors from the Eysenck correlation matrix





#### Learning theory

- 1. In the late 1940s to the late 1950's, theories of learning were the major theoretical approach
- 2. Eysenck (and Spence) tried to integrate individual differences into these approaches by examining differential rates of learning
- 3. To eysenck introverts condition more rapidly than extraverts
- 4. Thus, introverts learned to be rule followers, Extraverts not so much

State of the art theory in 1955–Hebb's Conceptual Nervous System

### Hebb Curve (1955)



Level of Arousal function (non specific cortical bombardment)

Predicting individual differences in performance under stress

### Eysenck (1967) + Hebb (1955)



Level of Arousal function (non specific cortical bombardment)

### Confirmation experiment $\neq$ theory testing: The example of caffeine by extraversion

- 1. Basic hypothesis
  - Introverts are more aroused than extraverts Eysenck (1967)
  - Caffeine or time stress will increase arousal
  - Performance is a curvilinear function of arousal (Yerkes & Dodson, 1908; Hebb, 1955; Easterbrook, 1959; Broadbent, 1971)
- 2. Revelle, Amaral & Turriff (1976)
  - I-E measured with Eysenck Personality Inventory
  - caffeine given as placebo or 200 mg in capsule
  - Performance on practice Graduate Record Exams (GRE), reported in standardized scores
- 3. Predictions
  - Introverts > extraverts in relaxed condition
  - Introverts < extraverts with time pressure and caffeine



#### Caffeine and time stress on complex performance

# Introversion, time pressure, and caffeine: effect on verbal performance



# Failures to replicate lead to theory improvement: The discovery of the imp/soc distinction

Failures to replicate can lead to better science for they show the limits of an effect.

- 1. Kirby Gilliland (1976) failed to replicate the Revelle et al. (1976) effect
  - A better study, caffeine was dosed by body weight and had 3 levels of caffeine
  - Used the Eysenck Personality Questionnaire (EPQ) instead of Eysenck Personality Inventory (EPI)
  - Failed to find the same results
- 2. Did replicate the results when using the EPI (Gilliland, 1980)
- 3. What was the difference?

#### Gilliland's dissertation results did not replicate Revelle et al. (1976)

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Gilliland (1980) replicated (Revelle et al., 1976) when using EPI.

# Extraversion, Caffeine



# Using psychometrics to explain experimental results: Rocklin & Revelle (1981)

- 1. Eysenck Personality Inventory
  - Extraversion
  - Neuroticism
- 2. The new and improved Eysenck Personality Questionnaire
  - Extraversion
  - Neuroticism
  - Psychoticism
- 3. Cross form correlations were high for E (.74) and N (.83)
- 4. Structure was completely different for the two Extraversion scales
  - Number of factors determined by the Very Simple Structure criterion (Revelle & Rocklin, 1979)
  - 2 primary factors of EPI E (sociability and impulsivity)
  - one factor for EPQ E
- This led to a small cottage industry of replications using EPI instead of EPQ (e.g., Campbell, 1983; Campbell & Heller, 1987).

#### Theory testing and rejecting by finding limiting cases

- 1. Over three years, we could replicate the Revelle et al. (1976) study about half the time.
  - We tested many different explanations, none worked.
  - Had varied time of day because we thought everyone would be more aroused later in the day. That is we hypothesized
    - *E* < *I*
    - *am* < *pm*
    - placebo < caffeine</li>
- 2. Eventually we found a consistent interaction of Imp x drug x Time if we assumed an inverted U relationship of arousal and performance and
  - E<sub>am</sub> < I<sub>am</sub>

placebo < caffeine</li>

Revelle, W., Humphreys, M. S., Simon, L., & Gilliland, K. (1980). Interactive effect of personality, time of day, and caffeine: A test of the arousal model. Journal of Experimental Psychology General, 109(1), 1–31.



### Theory testing by rejection: The example of time of day x caffeine Impulsivity, Caffeine, and Time of Day: the effect on complex cognitive performance





### Theory testing by rejection: The example of time of day x caffeine Impulsivity, Caffeine, and Time of Day: the effect on complex cognitive performance



#### Using experimental data for correlational analysis: body temperature and personality

- 1. Charmane Eastman had examined core body temperature over two weeks to study the effects of shift work.
  - Multiple, small experimental studies
  - Each study had included measures (MMPI-2) that could be interpreted as impulsivity.
  - Each study included measures of morningness-eveningness.
- 2. Erin Baehr synthesized these studies to examine individual differences in body temperature.
  - We also measured average bed time and average rise time for all subjects.
  - Acrophase of Body Temperature differed more than differences in behavior (biology meets society)
- Although we plot the data in terms of Morningness/Eveningness, somewhat weaker results were true for impulsivity (Baehr, Revelle & Eastman, 2000).

Baehr, E. K., Revelle, W., & Eastman, C. I. (2000). Individual differences in the phase and amplitude of the human circadian temperature rhythm: with an emphasis on morningness-eveningness. Journal of Sleep Research, 9(2), 117–127.



#### Biology meets society – time of day and morningness/eveningness



#### Theory development by integrating multiple alternative theories

Multiple theories about personality and efficient performance

- 1. H.J. Eysenck (1967) and arousal theory
  - Introverts more aroused than Extraverts
  - Arousal has an inverted U relationship to performance
- 2. J.W. Atkinson (1957, 1974) and achievement motivation theory
  - High need achievement and low test anxiety lead to high motivation (Atkinson, 1957)
  - Motivation has inverted U relationship to performance (Atkinson, 1974)
  - Motivation has inertial properties (Atkinson & Birch, 1970; Revelle & Michaels, 1976; Revelle, 1986)
- 3. Theories of anxiety and cognitive performance
  - Anxiety and task difficulty (Spence, Farber & McFann, 1956)
  - Anxiety and working memory (Eysenck & Mathews, 1987; Eysenck, Derakshan, Santos & Calvo, 2007; Eysenck, 2000)
  - Anxiety and resource allocation (Wine, 1971)
- 4. Easterbrook (1959) and the Yerkes & Dodson (1908) "law"

# Integrating multiple theories of performance: Humphreys & Revelle (1984)

- 1. Multiple dimensions of personality relating to efficient cognitive performance
  - Introversion/Extraversion Impulsivity
  - Anxiety (not just neuroticism)
  - Achievement motivation
- 2. Decomposing motivation
  - Arousal
  - Effort
- 3. Decomposing Performance
  - Attention tasks
  - Short term (working) memory tasks
  - Complex tasks that reflect some mixture of attention and memory

#### A "simple" model of personality and performance



Adapted from Humphreys & Revelle, 1984; Revelle, 1989

#### Personality, Motivation, and Cognitive Performance



Adapted from Humphreys & Revelle, 1984; Revelle, 1989

#### Theory testing by critical comparisons

- 1. Theories differ in breadth and depth
  - Many theories are silent for some phenomenon
  - Some sets of theories are mutually compatible, but with different range

Phenomenon	Theory 1	Theory 2	Theory 3	Theory 4
A	+	+	+	+
В	+	+		+
С	+		+	+
D		+	+	
E	+	-	0	
F	0	+		

- 2. We test alternative theories by looking for where they make different predictions.
- 3. It is not enough to disconfirm a theory, we must show better alternatives.

#### Testing four models of conditioning: Zinbarg & Revelle (1989)

- 1. Drive Theory (Hull, 1943; Spence, 1964)
  - Anxiety and performance (Spence et al., 1956) but see Weiner & Schneider (1971)
- 2. Eysenck (1967); Eysenck & Eysenck (1985) specify the variables that affect conditioning:
  - Partial reinforcement
  - weak conditioned stimuli
  - discrimination learning
- 3. Impulsivity and cues for reward, anxiety and cues for punishment Gray (1981)
- Extravert's focus on reward blinds them to punishment Newman, Widom & Nathan (1985); Patterson, Kosson & Newman (1987)



#### Zinbarg & Revelle (1989) used a go-nogo discrimination task



Reliable anxiety x impulsivity x Cue type interactions across four studies. Results not directly supportive of any of the four theories but suggested a revision of the Gray model. From Zinbarg, R. E. & Revelle, W. (1989). Personality and conditioning: A test of four models. Journal of Personality and Social Psychology, 57(2), 301-314.

#### Tests of competing theories of anxiety and information processing Leon & Revelle (1985)

How does anxiety affect performance?

- 1. Anxiety interacts with task difficulty Spence et al. (1956)
  - But see Weiner & Schneider (1971)
- 2. Anxiety limits working memory capacity Eysenck & Mathews (1987); Eysenck et al. (2007); Eysenck (2000)
- 3. Anxiety narrows the breadth of attention Easterbrook (1959)
- 4. Anxiety leads to off task thoughts Wine (1971)

Leon, M. R. & Revelle, W. (1985). Effects of anxiety on analogical reasoning: A test of three theoretical models. Journal of Personality and Social Psychology, 49(5), 1302-1315.

### Geometric analogies differing in memory load (transformations) and complexity (number of elements)



Memory load, stress and anxiety Leon & Revelle (1985)



Figure: default

#### Integrating cognitive theory with personality theory: Impulsivity, arousal and breadth of processing

1. Strong theories make testable predictions and theory develops by testing these predictions. Who is better able to test one's theories than oneself?

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- 2. Anderson & Revelle (1994) examined sustained performance on a recognition memory task to test the hypothesis that high trait impulsives were consistently faster to suffer from a decay in arousal than low trait impulsives.
- 3. We examined this effect at two times of day and unexpectedly found a time of day by impulsivity interaction.

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- 3. We examined this effect at two times of day and unexpectedly found a time of day by impulsivity interaction.
- 4. But science advances by disconfirmation as well:
  - "Two particular models deserve attention here. First, these data obviously contradict our own previous arguments (e.g., Revelle et al., 1987; Revelle & Anderson, 1992) that impulsivity is linked to stable differences in rate of change in arousal states." (Anderson & Revelle, 1994)

#### Integrating experimental and correlational data: Aggregating data across experimental studies for psychometric analysis

- 1. For about 10 years, we collected mood and arousal data as part of every experimental study we did.
  - Typical design was a mood pretest
  - Some arousal or motivation manipulation (e.g., caffeine, time stress, movies)
  - Then some post test
- Motivational State Questionnaire (MSQ) was formed from items taken from Thayer's AD-ACL Thayer (1978), the PANAS (Watson, Clark & Tellegen, 1988) and various circumplex measures of emotion (?)
- Factor structure of the 72 items for 3896 subjects and their correlations with basic personality scales from the EPI is reported by Rafaeli & Revelle (2006)
- 4. The actual data are available as the msq data set in the *psych* package (Revelle, 2018) in R.

#### **Dimensions of the Motivational State Questionnaire**

#### **Dimensions of affect**



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