Module 5: Psychobiology

Lecture 31: Psychobiology of personality

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Psychobiology of personality

Several personality traits have been examined for their psychobiological relationships. For example, neuroticism is one of the well studies personality traits. A person high on neuroticism is susceptible to anxiety, depression, stress, and so forth. Benzodiazepine potentiates the effect of gama-aminobutyric acid (GABA) which has inhibitory effect on brain nuclei. Decreased amount of benzodiazepine in amygdala is related to high neuroticism. Similarly sensation seeking behaviour is another personality trait that has high social relevance. Those who are high on sensation seeking be likely to be under-aroused. Their Ascending Reticular Activation System (ARAS) is below the optimum level of arousal.

Studies examining autonomic nervous system (ANS) function differences introverts and extroverts have used skin conductance, heart rate and EEG measures. Studies have explored difference between introversion-extraversion and skin conductance level. Skin conductance level has been used to measure tonic arousal in the baseline resting condition or the period prior to stimulation in an experiment. Studies have found that simple sensory stimulation do not elicit any difference between introverts and extraverts in terms of tonic levels of electrodermal activity. However, when challenged by task demands, the s kin conductance level has been found to be higher for extraverts at higher stress levels. Contrarily the skin conductance level was higher in introverts for lower stress levels.

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Cardiovascular measures are an important component of ANS function changes. Deceleration of the phasic heart rate is the cardiac depiction of orienting responses whereas phasic acceleration is the cardiac representation of the defensive responses. Studies examining difference between introverts and extraverts in terms of cardiovascular measures did not find any variation in the baseline or tonic heart rate. However, in vigilance conditions introverts show higher heart rate as compared to extraverts. Researchers studying sensation seeking behaviour have found heart rate deceleration when moderately intense novel stimuli are presented to high sensation seekers. The low sensation seekers display acceleration of heart rate.

The relationship between personality and electrical activities of the brain has also been studied. The introverts and extroverts have been found to be different with respect to alpha recording from the posterior regions of the skull. The amplitude and frequency of the alpha waves indicate the level of cortical activation. High arousal level is represented by low amplitude and high frequency ranging between 8-13 Hz.

Although the usage of imaging technique in personality studies is not new, there are still not many studies in this domain. Mathew *et al.* (1984) administered Eysenck Personality Inventory (Eysenck & Eysenck 1964) on 51 normal female volunteers and used the xenon inhalation technique to correlate regional blood flow with personality dimensions. They found inverse correlations between blood flow and extraversion. The correlation between blood flow and neuroticism was not significant. The findings suggest inverse relationship between extraversion and general cortical arousal. Couples of studies have correlated PET-glucose metabolic rate (GMR) and scores of Eysenck Personality Questionnaire. The findings show positive correlation between extraversion and GMR in frontal and temporal areas of the brain. Caudate and putamen areas were also correlated with extraversion.

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Canli *et al.* (2001) used fMRI to study response to emotional stimuli and correlated them with personality. They found positive correlation between extraversion and increased activation to positive stimuli in the frontal and temporal lobes, and parts of the caudate, putamen, and amygdala. Similar results were found by Canli *et al.* (2002) where the degree of activation in the amygdala during presentation of happy stimuli correlated with extraversion.

Let us look at the boarder picture. Behaviour of an individual is under the control of executive functions. Our reaction to any stimuli involves planning, spatiotemporal segmentation and execution. It also entails self-regulation. Any given situation demands certain degree of attention, regulation of emotion and behaviour, and performance of psychomotor activity. All this are linked to the prefrontal cortex. Hence, it can be inferred that our executive functions are controlled by the prefrontal cortex. The amount of dopamine in the prefrontal cortex increases in response to stress. This, in turn, intensifies our attention towards the stressor. It is important to note that chronic stress might lead to extra amount of dopamine in the prefrontal cortex than what is functionally needed. This increase might impair the functions of the prefrontal cortex, thus leading to decreased attention, hypervigilance, and certain psychotic symptoms.

Deprivation and its psychological consequences has been a topic of interest for many psychologists. Studies of baby rats and monkeys confirm impaired executive function in those experiencing maternal deprivation. Now that we know the outcome of executive functions, we can infer the social and behavioural cost of maternal deprivation.

Adjustment of an individual is also appraised by their ability to understand and interpret behaviours of others in terms of deciphering other person's intentions and thoughts. The brain structures supposed to constitute the neural basis of this ability are amygdala and its projections to the superior temporal gyrus, thalamus, and prefrontal cortex. fMRI studies show that the superior temporal gyrus, amygdala and prefrontal cortex are involved in processing social information. Thus, they can be considered to constitute the neural basis of social intelligence.

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