THE EFFECTS OF EMOTION-ATTENTIONAL BIAS AND MORAL IDENTITY ON NEURAL SUBSTRATE IN SMOKING BEHAVIOR AMONG YOUTH

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by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADHD	Attention Deficit Hyperactivity Disorder
ASD	Autism Spectrum Disorder
BCIs	Brain-Computer Interfaces
CFA	Confirmatory Factor Analysis
CNS	Central Nervous System
CO	Carbon Monoxide
EEG	Electroencephalogram
EPN	Early Posterior Negativity
ERP	Event-Related Potential
fMRI	Functional Magnetic Resonance Imaging
HR	Heart Rate
ICC	Internal Consistency Coefficeint
I-CVI	Individual Content Validity Index (I-CVI)
LPP	Late Positive Potential
MEG	Magnetoencephalography
MNI	Montreal Neurologic Institute
MRI	Magnetic Resonance Imaging
M-MIS	Malays version of Moral Identity Scale
PD	Photic Driving
PNS	Peripheral Nervous System
VEP	Visual Evoked Potentials

LIST OF APPENDICES

KESAN BIAS EMOSI-PERHATIAN DAN IDENTITI MORAL TERHADAP SUBSTRAT NEURAL DALAM TINGKAH LAKU MEROKOK DAN TIDAK MEROKOK DI KALANGAN BELIA.

ABSTRAK

Penjelasan neurosains mengenai hubungan antara identiti moral dan tingkah laku merokok melibatkan pemahaman bagaimana mekanisme otak mempengaruhi pertimbangan moral seseorang individu dan tindakan seterusnya mengenai merokok. Kajian ini bertujuan untuk membuktikan pengaruh elektrofisiologi terhadap kecenderungan perhatian emosi terhadap rangsangan merokok dan tidak merokok dikalangan kategori identity moral yang berbeza. Kajian ini mempunyai dua fasa. Fasa 1 iaitu ketentusahan skala Skala Identiti Moral(388 belia julat umur 18 hingga 24) berserta dengan versi terjemahan melayu berserta ketentusahan rakaman Elecroencephalogram (EEG), (N=78) . Imej merokok dan tidak merokok digunakan sebagai rangsangan visual untuk membangkitkan kognisi emosi peserta yang mempengaruhi kecenderungan perhatian mereka terhadap kategori imej yang berbeza. Ujian selang dua minggu-ujian semula menggunakan Intraclass Correlation Coefficient (ICC) telah dijalankan. Bagi rangsangan afektif (imej merokok dan tidak merokok), ketentusahan kandungan telah diluluskan oleh ketiga-tiga pakar tersebut. Kaedah Split-Half dijalankan keatas valence dan arousal. Ujian selang dua minggu ujian semula Intraclass Correlation Coefficient (ICC) juga dijalankan keatasnya. *Convergent Validity* digunakan untuk melihat korelasi antara valence dan arousal. Neurosains menyediakan asas untuk memahami interaksi kompleks antara mekanisme otak, identiti moral, dan tingkah laku seperti merokok.

THE EFFECT OF EMOTION-ATTENTIONAL BIAS AND MORAL IDENTITY ON NEUTRAL SUBSTRATE IN SMOKING BEHAVIOR AMONG YOUTH

ABSTRACT

This study aims to provide electrophysiological evidence that could explain how the various categories of moral identity influences the emotion-attentional bias towards smoking and non-smoking stimuli. This study has two phases. In phase 1, the Moral Identity Scale and the visual affective stimuli were validated in 388 youths (age range from 18 to 24) recruited from Kota Bharu, Kelantan. In phase 2, participants (N=78) underwent the Elecroencephalogram -EEG recording (ERP session) at the Neuroscience Laboratory. The validated images of smoking and non-smoking images were used as visual stimulus to evoke the participants' emotional cognition that influence their attentional bias towards the different categories of images. Discriminant validity and the construct reliability of the two factors were looked into. Two-weeks interval test-retest Intraclass Correlation Coefficient (ICC) and the Split-half analysis was used. Convergent validity revealed that the valence and arousal and the visual affective stimuli has a high correlation. The ERP recording data indicates the early ERP components (P100, N100, P200, N200), showed significant interaction effect between the emotion-attentional bias of the visual affective stimuli with the moral identity categories in the latency of the P100, N100, N200 and P200 ERP component and only in the P200 among the amplitude early ERP components in the frontal and temporal brain region. Neuroscience provides a foundation for understanding the complex interplay between brain mechanisms, moral identity, and behaviours like smoking.

CHAPTER 1

INTRODUCTION

1.1 Study Background

The human brain is a very complex part of the human body where it controls basically everything from the senses, responses, behaviours and reflexes, hormonial and biological accurance in the body and many more. The human mind concluding the brain, personality and emotion is a very complex phenomenon built on the physical scaffolding of the brain. (Nunez et al, 2010, Sporns, 2009, Gazzaniga, 2010). There is some research that goes on about the psychological categories. One solution to the emotion paradox suggests that anger, sadness, fear, and so on are observer-dependent psychological categories and that instances of these emotions live in the head of the perceiver (Barrett, 2006b).

Throughout our history, the link between the social (mind and behaviour) and the natural (brain) has felt less like a solid footbridge and more like a tightrope requiring lightness of foot and a really strong safety net. Mind–brain, and relatedly, behaviour–brain, correspondence continue to be central issues in psychology, and they remain the largest challenge in 21st century psychology (Barret L.F, 2009). The human mind is a complex phenomenon built on the physical scaffolding of the brain (Nunez, 2010, Sporns, 2010, Bullmore et al, 2009), which neuroscientific investigation continues to examine in great detail. However, the nature of the relationship between the mind and the brain is far from understood (Gazzaniga, 2010). There are many researches that studies the brain but yet comes to a total understanding towards the structure, development and functional values it has.

Many studies on the brain aligned with the human behaviour has been conducted in order to cover the loops and holes to further understand the relation. The topic of this study has been highlighted by the researcher due to the high rate of at risk(smoking) behaviours among youth. There are statistics according to the increase amount of smokers among the recent youth compared to the past generations. World Health Organisation (2021) Leading cause of death, illness and impoverishment. (Referenecs. According to the World Health Organisation (2021) and the Global Burden of Disease database (2017), the tobacco epidemic is one of the biggest public health threats the world has ever faced, killing more than 8 million people a year around the world. More than 7 million of those deaths are the result of direct tobacco use while around 1.2 million are the result of non-smokers being exposed to second-hand smoke.

Youth, as a transitional phase between childhood and adulthood, plays a pivotal role in shaping society's moral fabric. The moral development of young individuals is essential for the future of any community (Yadav, 2018). Morality, often defined as the principles that govern what is right and wrong, influences the choices and actions of youth. Youth experience a unique set of challenges in their quest to develop a strong moral compass. Peer pressure, societal expectations, and the allure of instant gratification can sometimes lead them astray. The struggle to find their own moral identity while facing external pressures can create ethical dilemmas.

Additionally, the digital age has introduced new ethical considerations, such as cyberbullying and online privacy, which demand a fresh perspective on morality. Education plays a pivotal role in shaping the moral values of youth. Schools and families are primary sources of moral education (Yadav, 2018; George et al., 2014). Teachers, parents, and mentors have the responsibility to impart moral principles and

guide young minds in understanding the consequences of their actions. Society at large exerts a profound influence on the moral development of youth. Media, culture, and role models all contribute to shaping their values and beliefs (George et al., 2014). In an increasingly globalized world, the exposure to diverse perspectives can be enriching, but it also poses the risk of moral relativism. The relationship between youth and morality is a dynamic and ever-evolving one. The challenges they face in a rapidly changing world are counterbalanced by the potential for positive moral development. Education, societal influences, and personal responsibility all play crucial roles in shaping the moral compass of the youth. Psychological research and theory suggests that by having students learn through the experience of solving problems, they can learn both content and thinking strategies. (Hmelo-Silver, Cindy E., 2004).

1.2 Justification of The Study

Despite extensive research on smoking behavior and its psychological and social influences, the role of moral identity in shaping attitudes and attentional biases toward smoking remains underexplored. Existing studies primarily focus on health risks, social influences, and addiction mechanisms, but there is a lack of research on how moral identity categories influence emotional and cognitive processing of smoking-related stimuli. Some of the key research gaps are limited neuroscientific evidence on moral identity and smoking, lack of studies on attentional bias and moral identity, unclear relationship between emotional arousal and moral identity and the lack of validated measures connecting moral identity, emotion, and attention.

Having to realise the danger of smoking and the changes that it has come into nowadays brings a very big responsibility to researcher in finding ways on how to reduce these addiction and toxic culture among the youth. The most basic concept in

figuring out a problem is to identify what it is and how it works. As for what the researcher is studying in this topic, the researcher is focusing in identifying the moral identity trait that smokers and non-smokers are categorised as, as their neural substrates are monitored while being exposed towards smoking Visual Affective Stimuli and measured with the equipment of ERP and Net Station. There must be a significant reasoning that individuals who are implementing the smoking at risk behaviour. Logical reasoning is of great societal importance and, as stressed by the twenty-first century skills framework, also seen as a key aspect for the development of critical thinking. Reasoning is a cognitive process that occurs by the guidance of knowledge, peer influence, parental or guardian guidance and personal intellectual and emotional conditions. (Bronkhorst, et al., 2020). Having to understand the basic part of the at risk behaviour(smoking) may open doors towards better interventions in avoiding or even curing at risk (smoking) behaviour. The youth in this study indicates young adults aging from 18 to 24 years old as defined by the United Nations for statistical purposes. (Secretary-General's Report to the General Assembly, A/40/256, 1985). The advantage of this study is that it provides a much deeper and thorough understanding on the reasoning of tendency towards or against smoking among adolescences nowadays. Having to understand the moral identity trait helps identify the tendency towards smoking at risk behaviour for further research or rehabilitation. The disadvantage that this study has to agree to is that having to understand the study is that the study in this area is still very new and ripe. Therefore, there will be many loop holes that this study will uncover. However, identifying loop holes in a certain problem helps determine a much diverse objective for further studies.

It has been a common behaviour to see many people around the street puffing out smokes and firing cigarettes. According to Marquez, 2021, it is estimated to be that

25% of all heart disease deaths and 80% of lung cancer deaths are caused by smoking and many others are caused by exposure or second hand smoke. The author also mentioned that cigarette smoke kills at about 8 million people across the year. Based on the country evidence from China, Italy and other countries suggest that smokers have higher odds of progression in COVID-19 severity and death compared to non-smoker. China Report on the Health Hazards of Smoking" in 2012 indicated that China had 350 million smokers including 14 million young smokers and more than 1 million deaths each year due to smoking-related diseases. A national survey showed that young adults had the highest smoking rate than any age group in the United States. (Ling et al., 2009). Plus, according to Lantz, 2003, at least 20% of young smokers which had higher levels of nicotine dependence became regular smokers. The nicotine in the cigerrate may be the cause of addiction, however, the tar substance causes the illness and deaths among the smokers. In a study conducted by Chang Liu et al., 2019, the inhibitory cognitive ability of young smokers was measured by a Go/NoGo task whereby the participants responded quickly to "Go" stimuli without responding to "NoGo" stimuli, and the more they responded to "NoGo" stimuli, the more serious their inhibitory cognitive control deficits.

Throughout the study, it is found out that two major ERP components, N200 and P300, have been shown to be associated with smoker inhibition control in the Go/NoGo task (Bokura et al., 2001; Luijten et al., 2011; Cid-Fernández et al., 2014). During the preparation, the researcher required the participants to take no smoking activities, alcohol and drugs 12 hours prior to the experiment. The result showed that the latency of N200 was prolonged compared with that in the satiety sessions during the Go/NoGo task state in young smokers while the amplitude amplitude of N200 in 12-h smoking abstinence condition had an increasing trend compared with the

smoking satiety sessions in young smokers but the difference was not significant. For the P300, there was no significant difference between the smoking satiety group and the 12-h smoking abstinence session on amplitude. the correlation analysis showed that there was a significant correlation between N200 latency and NoGo errors and Go response time after 12 h of abstinence in young smokers. According to the author, the procedure of this study were approved by the Medical Ethical Committee of the First Affiliated Hospital of Baotou Medical College, Inner Mongolia University of Science and Technology, and were conducted in accordance with the Declaration of Helsinki. All participants and their legal guardians signed in an informed consent after understanding the purpose of our research.

Other research has also been done in order to understand the neural construct and the smoking behaviour such as the study conducted by Golding J, F, 1988, where he studied the effect of smoking versus sham smoking using EEG. visual evoked potentials (VEP), photic driving (PD) and heart rate (HR) in thirty young healthy male and female habitual cigarette smokers. The heart rate (HR) and the exhaled carbon monoxide (CO) level increased significantly by real as opposed to sham smoking. Real versus sham smoking significantly increased relative power in the beta bands, reduced alpha and theta activity to a small but significant extent, but had no effect on delta activity. (Golding, 1988). According to the study, Dominant EEG alpha frequency was significantly increased by real as opposed to sham smoking. Smoking produced no significant mean change in PD or VEP meanwhile correlational analysis indicated that variables such as basal CO level, residual butt filter nicotine, basal electrocortical response level and personality, predicted to varying degrees the magnitude and direction of the effect of smoking on VEP, PD and EEG.

The neural construct of the human brain is very complex yet very mysterious. Many researchers focus in studying these domains where it contains hints and notes regarding on any individuals' behaviour. Having the topic of the study to narrow towards smoking behaviour is because the smoking culture among the youth is evolving towards even more possibilities. Nicotine had been studied in the laboratory as a central and pharmacologically active ingredient in tobacco since the 19th century, and for almost as long anti-tobacco forces had denounced cigarettes for their dependence-producing effect. (Tate, 1999). Over the past decade, the ideology in reducing the harm of tobacco whereby reducing the morbidity and mortality from tobacco use without necessarily getting rid of the exposure to tobacco or nicotine—has increased the attention and discussion among tobacco control scientists and public health professionals (M. Zeller & Hatsukami, 2001).

There is a huge research gap in understanding the cause of the brain towards smoking behaviour and also the behaviour itself towards the brain. Many studies have been focusing on the smoking behaviour yet fails to understand the innate reasoning for individuals to smoke. Past studies used survey methods and experimental methods in understanding the structure, effect and causes of smoking. However, there have not yet to be a research tht looks into this issue in the perspective of the brain and the neural construct itself. There has been research that evaluated the relation between smoking and the emotions of people who smokes and found out that smoking gives a positive effect towards the smoker's emotions. Therefore, there has not been a research that looked up into this issue in a innate perspective. This study focusing on the deepest reasoning which is influenced by an individual's own belief and decision making. The moral identity is the base for an individual's way of thinking and way of implementing value towards a certain situation, object or condition. Having to see the interaction

between the moral identities and smoking behaviour fullfills the research gap that currently exist.

Across studies on the brain, many have been focusing on including many tasks such as visual, auditory and gestures while using the event-related programme, EEG, EOG and many more platforms such as the study done by Donchin, et al, 1987, which uses both EEG and EOG to measure the P300 construct of participants from both visual and auditory senses. The data was filtered online with a 35Hz and a 100Hz. Various studies use various ways and alternative to bring up to an even more specific conclusion on the human brain. The ERP session done by Polish, J, Howard, L, and Star, A, 1985, presented the data in a sequence of 2000Hz tone occurring 20% of the time while 1000Hz tone occurring 80% of the time. The authors recorded and filtered the data using EEG with a bandpass of 1 to 30Hz. Despite many studies that is focusing on analysing and researching the values of P300 and its' potential, the researcher of this particular study measures and analyse the neural construct of P300, N200 solely on visual senses among youth ranging from 18 to 24 years old around Kota Bharu, Kelantan. By investigating how moral identity shapes attentional bias and emotional responses to smoking-related stimuli, this study bridges the gap between moral psychology, neuroscience, and smoking behavior research. The findings could lead to better public health strategies, tailored anti-smoking campaigns, and improved smoking cessation interventions based on moral and cognitive factors.

1.2.1 Problem Statement

The relationship between smoking as a health behaviour and morality is a complex and controversial one. Smoking is often seen as a moral issue because it involves personal choices that can impact not only an individual's health but also the

well-being of those around them. Morality, in this context, pertains to values such as responsibility and empathy. Smoking can be viewed as morally questionable when it negatively affects the smoker's health and exposes others to secondhand smoke. However, it's important to recognize that morality can be subjective, and judgments about smoking may vary. While some may see it as a moral failing, others emphasize the importance of autonomy and personal choice in making health decisions. Ultimately, the relationship between smoking as a health behaviour and morality highlights the interplay between individual choices, societal norms, and ethical considerations. Past research has focused on the issue of smoking behaviour among the society. However, the conclusion of most research correlates the relationship of smoking behaviour and the effect it has towards emotions, cognitive, academic performance, well being and health. There has not yet to be an understanding on what actually causes an individual to start or initiate smoking behaviour. Researchers yet fail to understand the reason on why people tend to smoke thus knowing the effects that it brings not only to the health but also to the whole well-being of living as a proper individual.

1.3 Research Question

1. How is the emotion-attentional bias tendency towards smoking and non-smoking visual affective stimuli in different domain of moral identity (internalisation and symbolisation) is reflected in the early neural substrate component (P100, N100, P200 and N200)?

2. How is the emotion-attentional bias tendency to smoking and non-smoking in different domain of moral identity (symbolisation and internalisation) is reflected in the late neural substrate component (P300, LPP)?

3. What is the brain localization characteristics in relation to the emotion-attentional bias towards smoking and non-smoking behaviour in early neural substrate component, as based on moral identity classification?

4. What is the brain localization characteristics in relation to the emotion-attentional bias towards smoking and non-smoking behaviour in late neural substrate component, as based on moral identity classification?

1.4 Objectives

1.4.1 General Objective

To investigate the neural substrate associated with the emotion-attentional bias to smoking behaviour and non-smoking behaviour in different domains of moral identity (internalization versus symbolization)

1.4.2 Specific Objectives

1. To examine the early neural substrate components (P100, N100, P200, N200) associated with the emotion-attentional bias to smoking and non-smoking in different domain of moral identity (symbolisation and internalisation)

2. To examine the late neural substrate components (P300, LPP) associated with the emotion-attentional bias to smoking and non-smoking in different domain of moral identity (symbolisation and internalisation)

3. To identify the source of localization of emotion-attentional bias towards smoking and non-smoking behaviour in early neural substrate as based on moral identity classification

4. To identify the source of localization of emotion-attentional bias towards smoking and non-smoking behaviour in late neural substrate (P300, LPP) as based on moral identity classification

1.5 Hypothesis

1.5.1 Alternative Hypotheses

1. The emotion-attentional bias to smoking is greater among those with high internalization moral identity than those with high symbolization moral identity, as reflected

in early neural components (P100, N100, P200, N200)

2. The emotion-attentional bias to smoking is greater among those with high internalization moral identity than those with high symbolization moral identity, as reflected

in late neural components (P300 LPP)

3. The emotion-attentional bias in the early ERP component to smoking and non-smoking, across different type of moral identity shows different brain localization characteristics.

4. The emotion-attentional bias in the late ERP component to smoking and non-smoking, across different type of moral identity shows different brain localization characteristics.

1.5.2 Null Hypotheses

1. The emotion-attentional bias tendency to smoking is similar among those with high internalization moral identity and those with high symbolization moral identity, as reflected in early neural components (P100, N100, P200, N200)

2. The emotion-attentional bias tendency to smoking is similar among those with high internalization moral identity than those with high symbolization moral identity, as reflected in late neural components (P300 LPP)

3. The emotion-attentional bias tendency in the early ERP component to smoking and non-smoking, across different type of moral identity shows similar characteristic of brain localization.

4. The emotion-attentional bias tendency in the late ERP component to smoking and non-smoking, across different type of moral identity shows similar characteristic of brain localization.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Smoking is an activity that has become a social norm among the youth and adults to the extent that is has become a problem to the community and the individuals themselves so far. According to the Disease Control Division from the Ministry of Health Clinical Practice Guidelines, 2016 and the Institute of Public Health, 2004 and 2011, Malaysia is not spared from this smoking scourge, where 10 000 deaths attributed to smoking are reported each year and smoking-related diseases have been identified as the major contributor to disability-adjusted life years and lost years of life among the Malaysian population. Having to realise the danger of smoking and the changes that it has come into nowadays brings a very big responsibility for researcher in finding ways on how to reduce these addiction and toxic culture among the youth. The most basic concept in figuring out a problem is to identify what it is and how it works. As for what the researcher is studying in this topic, the researcher is focusing in identifying the neural construct according to the domains among non-smoker regarding smoking behaviour in order to clear up the borderline of habits and mental pathways. Psychological research and theory suggests that by having students learn through the experience of solving problems, they can learn both content and thinking strategies. (Hmelo-Silver, Cindy, 2004).

2.2 Risk Taking Behaviour

Risk taking behaviour are known as behaviours that creates or expose harm towards a certain individual intentionally or unintentionally. Risk taking behaviour are behaviours that are habits org actions that individuals do that may bring harm and danger to him or herself and others around them According to Azmawati et al., 2015, : Risk taking behaviour refers to the tendency to engage in behaviours that have the potential to be harmful or dangerous, which has become a major concern and is rated as one of the public health issues that need special attention. The term risk-taking behaviour has been used to link, conceptually, a number of potentially health-damaging behaviours including, among others, substance use, precocious or risky sexual behaviour, reckless vehicle use, homicidal and suicidal behaviour, eating disorders, and delinquency (Igra & Irwin, 1996). The word "risk" is defined as a chance or opening towards danger in various ways regarding on the context that an individual or a subject is facing. risk has been defined as in various ways, with frequent themes including the balance of potential rewards and losses, and the value of the link between short-term gain and long-term consequences. It could also be understood as a chance to lose a certain value, risky behaviours have been known as those behaviours that entails the possibility to subjective loss. (Leather, 2009, Furby & Beyth-Maron, 1990). 7People may be influenced by risks not focusing on its reality but on what to gain across the risk that is taken. Moore and Gullone (1996) described risk-taking behaviour as a behaviour that involves in moderate to high term gains followed by a potential to experience loss in many ranges. In other words, as described by Moore and Gullone, 2000, the definition of risk-taking behaviour is 'the participation in behaviour which involves potential negative consequences (or loss) balanced in some way by perceived positive consequences or gain).

Problematic behaviours can be seen as means of accomplishing age-typical goals of peer-group identity and adult status (Jessor, 1977). These behaviours have been a big topic among educators and guardians across the globe whereby it has a really close connection with violence. The behaviour of youths, especially in relation to violence, alcohol and drug misuse, has been the subject of numerous headlines in the UK over the past year. (Leather N.C, 2009). Risk-taking behaviours are also aligned with the culture or lifestyle of a certain background. Meaning that there are activities according to a certain life pattern that brings harm to an individual and also to their surroundings. According to another article by Jessor, 1991, risk-taking is synonymous with lifestyle, with risk having both positive and negative aspects. risk-taking behaviour may be described as 'those behaviours, undertaken volitionally, whose outcomes remain uncertain with the possibility of an identifiable negative health outcome' (Igra and Irwin, 1996). The period of adolescence is characterized by multiple transitions (puberty, relationships, school, abilities), and by an increase in risk-taking behaviours (Michael and Ben-Zur, 2007). Having to know the age range and the phases that youths go through emotionally, mentally and culturally helps encourage researchers to develop predictions and expectation on how and why do they take interest in various activities whereby some may be involved with violence and self-harm.

2.3 Sociodemographic

Adolescence is a transformative phase marked by rapid physical and emotional development. During this time, individuals experience significant hormonal changes, leading to the development of secondary sexual characteristics such as breast development in girls and facial hair growth in boys. Cognitive abilities also undergo

significant growth during adolescence, allowing for more complex thinking and problem-solving. Social relationships become increasingly important, and teenagers often seek independence and autonomy from their parents. It's a time of self-discovery and identity formation, as youths grapple with their values, beliefs, and aspirations.

The act of love and care that parents provide towards their child plays a very huge role in bringing up the basic belief and perspective of their child. According to Harlow, there are five types of love that evolves accordingly. The first type of love is a love that These types of love are the development of the care and nurture that parents bring in the family household. It is one of the most necessities that holds up a great up building of an individual moral values and personality. The first type of love is a love that an infant shows for its' mother. Going on, is the love known as "peer love" where affection of young organisms for other youngsters their own age.

Moving on to the third stage is the heterosexual love that is developed from peer love where this type of love is only possible if the organism has learned certain behaviour pattern while playing with its' peers. The forth stage is only applicable by female – where it is a love that a mother shows to her infant while the last type of love is only applicable to males who meets the right condition known as paternal love. (Vicedo & Marga, 2010). Parenting has a huge role in developing safety measures towards harmful activities and habits. Parenting also has a significant part in developing the risk-taking behaviour itself among youths. Parents and guardians are occasionally accused for the risk taking behaviour of their children. In some courts of other countries, parents are even given penalty for the false social value conduct of their child. (Machteld, Judith, Wilma, et al. 2009). Every individual that develops certain behaviour is heavily guided by the family background and culture they go

through throughout their life. Family has to bring great value towards the social understanding of an individual.

The family, which is the smallest unit in the society, needs to be charged with positive values to ensure family members grow up in a conducive environment, so that they can face the outside world problems appropriately. (Mohd Nawi Azmawati et al., 2015). Many researchers agree that the foundation of the youth risk behaviour is rooted in the kind of home that the youth has been brought up in. (Okorodudu G, 2010). , family characteristics, namely family conflict, had a strong influence on children's development and their outcome. However, this needs not only the parents, but also other parties to work in hand to protect the youths from deviant behaviour, such as a policy-maker in improving of inadequate bedrooms for youths per house. (Mohd Nawi Azmawati, 2015). Risk taking behaviour in Malaysia also has its' intensity and investigation.

According to some studies, smoking has been occurring in an individual's life activities from a very early age. It has been proven that smoking has been a norm in the average age range of 14-17 years old. (Koenig et al. 1998). This is mostly due to the influence if the minority of the smokers that do not agree with the rules and regulation of the health, religious and social perspective. According to a study in 2016, It was observed that a large number of smokers were aware of the fatwa for forbidding smoking practice, yet a low proportion of the smokers supported it. The likely reason of this finding could be due to their beliefs that smoking is not harmful and should not be considered forbidden in Islam. (Elkalmi et al., 2016).

2.4 The Neural System

The human brain, a complex and intricate organ, is often regarded as the epicenter of our consciousness, thoughts, emotions, and actions. Understanding how it functions has been a subject of fascination and research for centuries. One indispensable tool in this quest to decode the mind's mysteries is the Electroencephalogram (EEG). This essay delves into the neural system, its components, and the remarkable insights EEG provides into the workings of the human brain. The neural system, often referred to as the nervous system, is a vast network of specialized cells, neurons, and supporting structures that transmits information throughout the body. As it is widely known that the neural system is divided into two areas known as the CNS or also called the Central Neural System while the other is called Peripheral Nervous System where parasympathetic and sympathetic nerve responses occurs. Many intense research across the decade has been done to provide the society with grand information and input that describes the necessity of the CNS and PNS in our neural system.

Central Nervous System (CNS): The CNS comprises the brain and the spinal cord. The brain, with its 86 billion neurons, is the command center of the entire system. It processes sensory information, coordinates responses, and stores memories. The spinal cord serves as a communication highway, transmitting signals between the brain and the rest of the body. Peripheral Nervous System (PNS): The PNS connects the CNS to the body's extremities. It includes sensory and motor neurons that relay information from the senses to the CNS and convey motor commands to muscles and glands, enabling voluntary and involuntary actions. During embryonic development, neurons of vertebrate animals arise from the epithelial structures called neurogenic placodes and neuroectoderm of the neural tube and neural crest. (Harland R, 2000).

The brain is very complex. Not counting the skull, the brain weighs at about 3 pounds (1.3 kilograms) where it is made up of 10 billion (10,000,000,000) nerve cells whose activities determine what you think and feel and learn and do. (McConnell, 1977). There are many changes and reaction that happens within the neural system in every individual regarding on their preferences and experiences on smoking behaviour. The neural construct of the human brain is very complex yet very mysterious. Many researchers focus in studying these domains where it contains hints and notes regarding on any individuals behaviour. If the brain- the power house for the neural system- is damaged, there will be a few cognitive problems.

According to McConnell, 1977, if the input neurons were damaged or drugged, an individual might suffer from various kinds of hallucinations such as hearing voices in their head org failing to detect important changes in an individual sensory environment. Having the topic of the study to narrow towards smoking behaviour is because the smoking culture among the youth is evolving towards even more possibilities. Nicotine had been studied in the laboratory as a central and pharmacologically active ingredient in tobacco since the 19th century, and for almost as long anti-tobacco forces had denounced cigarettes for their dependence-producing effect (C. Tate, 1999). Over the past decade, the ideology in reducing the harm of tobacco whereby reducing the morbidity and mortality from tobacco use without necessarily getting rid of the exposure to tobacco or nicotine—has increased the attention and discussion among tobacco control scientists and public health professionals (M. Zeller & D. Hatsukami, 2009).

Having technology at its' prime provides an enormous opportunity in describing and analysizng the neural construct and system whilst understanding the outcome that comes within. Novel technological advancements stimulated the

transition from conceptual scheme of neuronal differentiation into precise maps of molecular events leading to the diversity of specific neuronal subtypes in relation to their locations and microenvironment. (Kameneva & Adameyko, 2019). Across studies on the brain, many have been focusing on including many tasks such as visual, auditory and gestures while using the event-related programme, EEG, EOG and many more platforms such as the study done by Donchin, et al, 1987, which uses both EEG and EOG to measure the P300 construct of participants from both visual and auditory senses. The data was filtered online with a 35Hz and a 100Hz. Various studies use various ways and alternative to bring up to an even more specific conclusion on the human brain. The ERP session done by Polish, Howard, and Star, 1985, presented the data in a sequence of 2000Hz tone occurring 20% of the time while 1000Hz tone occurring 80% of the time. The authors recorded and filtered the data using EEG with a bandpass of 1 to 30Hz.

Electroencephalography (EEG) is a non-invasive neuroimaging technique that records the electrical activity of the brain over time using electrodes placed on the scalp. Hans Berger, a German psychiatrist, pioneered this revolutionary technology in the early 20th century, forever changing the landscape of neuroscience. According to Bell & Cuevas, 2012, EEG has since become an invaluable tool for studying brain function and disorders. Recording Brainwaves: EEG measures brainwaves, which are rhythmic patterns of electrical activity produced by large groups of neurons working together. These brainwaves are categorized into several frequency bands, each associated with specific mental states. For example, delta waves (0.5-4 Hz) are prominent during deep sleep, while beta waves (12-30 Hz) are associated with alertness and cognitive tasks.

Clinical Applications: EEG plays a crucial role in diagnosing and monitoring various neurological conditions, including epilepsy, Alzheimer's disease, and sleep disorders (Bell & Cuevas, 2012). Abnormal patterns in EEG recordings can provide valuable insights into the underlying pathology of these conditions. Cognitive Research: EEG is widely used in cognitive neuroscience to investigate brain processes associated with attention, memory, language, and emotion. Researchers use EEG to identify the neural signatures of specific cognitive tasks, shedding light on the neural mechanisms underlying human cognition. Brain-Computer Interfaces (BCIs): EEG-based BCIs enable individuals to control external devices, such as computers or prosthetic limbs, using their brain activity. This technology has transformative potential for individuals with paralysis or communication disorders. hile EEG has been instrumental in advancing our understanding of the neural system, it has its limitations. The technique provides relatively low spatial resolution, making it challenging to pinpoint the exact source of electrical activity within the brain. Moreover, EEG is sensitive to external artifacts, such as muscle activity and environmental noise, which can obscure the neural signal. To address these limitations, researchers are exploring advanced EEG techniques, such as high-density EEG and source localization methods, to improve spatial accuracy. Additionally, combining EEG with other neuroimaging modalities, like functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG), offers a more comprehensive view of brain function. The neural system, a marvel of evolution, underlies the complexity of human consciousness and behaviour. Electroencephalography (EEG) serves as a window into this intricate world, capturing the brain's electrical symphony. From clinical diagnosis to cognitive research and brain-computer interfaces, EEG continues to revolutionize our understanding of the mind. As technology advances, we can anticipate even greater

insights into the neural system, unraveling its mysteries one electrical impulse at a time.

2.5 Early ERP Components

P100 is an electrode that is located in the 50-150ms time period of the ERP recording. It is known as the most positive output of a neural impulse in an individual neural system. The P100 ERP component is a positive deflection in the electrical brain activity recorded using electroencephalography (EEG) or magnetoencephalography (MEG). It is typically observed over the occipital region of the brain, at approximately 100 milliseconds after the presentation of a visual stimulus, which is why it is named the P100 ("P" for positive and "100" for the time in milliseconds). According to Kocarski, K., et al., 2019, P100 was defined as the greatest positive deflection in the 70–140 ms time window. The time window varies in certain scholars however has been agreed that it is in the time window of 50-150ms. There are studies that focuses on P100 to identify a mental condition of a certain group of people. Autism spectrum disorder is one of the many mental condition that P100 has been used to identify the trajectory of the mental process. It is mainly done among ASD children. The result of the mentioned study has shown that having a reduced P100 amplitude among young children can be concluded to that it is a early typical sign of autism. In terms of youths and young adults, having a decreased P100 indicates that the young adult as mentioned before has overcome some progressive modification of sensory processing during childhood as a consequence of the difficulty to deal with sensory information everyday in life. (Kocarski, et al., 2019).

The characteristics of the P100 Component are based on latency and timing, scalp distribution and polarity. Baes on the latency and timing; As mentioned, the P100

component occurs around 100 milliseconds after stimulus onset, making it an early ERP component. The precise timing can vary slightly depending on factors such as the nature of the stimulus and individual differences. The scalp distribution of P100 is most prominent over the occipital scalp region, which is at the back of the head. This distribution reflects the involvement of the visual processing areas of the brain. The polarity of the P100 is a positive deflection, meaning that the voltage recorded at the scalp is higher compared to the baseline (pre-stimulus) period.

The P100 ERP component serves as an important marker of early sensory processing and perceptual awareness in the visual domain. Several key functions and interpretations of the P100 are, visual perception, sensory gating and bottom-up processing. Visual perception - the P100 reflects the brain's initial response to visual stimuli, indicating the early stages of visual perception. It is particularly sensitive to changes in basic visual features such as brightness, contrast, and spatial orientation. For the sensory gating, the P100 is also associated with sensory gating, which involves the brain's ability to filter out irrelevant or redundant sensory information. It plays a role in directing attention toward novel or salient stimuli while filtering out less important information. Finally, the bottom-up rrocessing: the P100 is thought to represent "bottom-up" processing, where sensory information is processed in a data-driven manner, primarily based on the physical characteristics of the stimulus rather than higher-level cognitive factors.

The P100 ERP component, occurring early in the visual processing stream, offers a glimpse into the fundamental mechanisms of visual perception and sensory processing. Its characteristics, timing, and functional significance make it a valuable tool in cognitive research, providing insights into how our brain perceives and responds to the visual world. As technology and methodologies continue to advance,

the study of the P100 component is likely to yield even greater insights into the intricacies of human cognition and sensory perception.

On the other hand, the component that indicates the brainwave low peaks is known as the N100. The N100 component, the negative downward peak around 100 ms after the exposure of stimulus, can be gained through many if not all tasks among all sensory reactions. In example, N100 has been found in auditory (van Elk et al. 2014), visual (Mangun and Hillyard 1991), olfactory (Pause et al. 1996), pain (Greffrath et al. 2007), balance (Quant et al. 2005), respiration blocking (Chan and Davenport 2008) and somatosensory paradigms (Wang et al. 2008). Like the P100 component, the N100 component in occurs approximately 100 milliseconds after the presentation of a stimulus. It is a key marker of early sensory processing in the brain and is typically recorded using electroencephalography (EEG) (Du, et al., 2016). The N100 waveform is characterized by a negative deflection in the EEG signal, often observed in response to visual, auditory, or somatosensory stimuli. This component reflects the initial detection and processing of sensory information, playing a fundamental role in our perception and cognitive functions. Researchers use the N100 to study sensory discrimination, attention, and even cognitive disorders, as abnormalities in this ERP can provide insights into various neurological conditions. Understanding the N100 component is vital for unraveling the intricacies of brain function and enhancing our comprehension of human cognition.

Cognitive neuroscience relies on a range of techniques to understand the intricacies of human perception, attention, and information processing. One such technique, Event-Related Potentials (ERPs), provides a unique window into the temporal dynamics of cognitive functions. Among the various ERP components, the P200 stands out as a critical marker of early information processing in the brain.