

Problem Gambling: The Impact of Personality on Gambling

by

Chad Graves

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

DOCTORATE OF PHILOSOPHY

Department of Psychology

University of Manitoba

Winnipeg

Copyright © 2017 by Chad Graves

## Table of Contents

Abstract .....	iii
Acknowledgements .....	iv
List of Tables .....	v
List of Figures .....	vi
Introduction .....	1
Study One: Do Personality Factors Influence Game Preferences? .....	22
Method .....	25
Results .....	30
Discussion .....	41
Study Two: Do Personality Factors Mediate the Relationship Between Gambling Behaviours and Gambling Severity? .....	50
Method .....	54
Results .....	61
Discussion .....	77
General Discussion and Conclusions .....	86
References .....	94
Appendix .....	118

## **Abstract**

Gambling is a form of entertainment that for some individuals can lead to harmful physical, mental, and financial outcomes. The current study examined two research questions: 1) the effects of personality on gambling preferences and 2) whether personality mediates the relationship between gambling severity and electronic gambling machine (EGM) play. In Study 1, I used a gambling dataset from the Quinte Longitudinal Study to explore the influence of Torgersen's eight personality types on the gambling frequency and money spent of 1,315 gamblers on 8 different gambling activities. Torgersen's personality types were created using combinations of high or low neuroticism, extraversion, and conscientiousness. Results suggest that Torgersen's impulsive and insecure personality types presented with more severe gambling classifications. The impulsive and hedonist personality types demonstrated a preference for strategic gambling. Additionally, men were found to prefer strategic gambling, while women preferred non-strategic. In Study 2, I examined the effects of the personality on gambling severity and EGM play behaviours among 159 gamblers. EGM play was behaviourally measured in a laboratory using a simulated gaming program that recorded the participants' choices. Contrary to my expectations, only neuroticism significantly mediated the relationship between gambling severity and EGM play. The results of both studies provide further evidence that problem gamblers are heterogeneous in nature and supports the notion of subtyping gamblers.

## Acknowledgements

This thesis would not have been possible without the support from several important people and organizations whom I would like to thank here.

Dr. Harold Walbridge has been instrumental in the designing and completion of this thesis. From its conception to its final revisions, Dr. Walbridge has provided his support and expertise which greatly facilitated the process. I am very grateful for his support during these past years and wish to recognize that the completion of this dissertation would not have been possible without his involvement.

I also want to recognize the support I received from my committee members, whose comments and recommendations served to greatly strengthen the design of this study.

I want to thank my family and friends for their support and encouragement over these past years. Throughout my undergraduate and graduate studies, they have always been a reliable and dependable source of support.

Finally, I want to acknowledge the generous financial support I have received while completing this dissertation by studentships from the Manitoba Gambling Research Program and the Liquor and Gaming Authority of Manitoba.

## List of Tables

Table 1: Composition of Vollrath and Torgersen's personality types .....	9
Table 2: Personality types descriptions.....	9
Table 3: Measures assessed in Study 1 .....	27
Table 4: Personality dimensions by gender .....	31
Table 5: Personality types by gender .....	32
Table 6: Means (and SDs) for the Demographic Variables as Functions of Personality Type ....	33
Table 7: PGSI classification by personality type .....	34
Table 8: Gambling frequency by activity as a function of personality type using Kruskal-Wallis tests .....	37
Table 9: Money lost by activity as a function of personality type using Kruskal-Wallis tests.....	38
Table 10: Gambling frequency by activity as a function of gender using Kruskal-Wallis tests ..	40
Table 11: Money lost by activity as a function of gender using Kruskal-Wallis test .....	41
Table 12: Measures assessed in Study 2 .....	57
Table 13: Means (and SDs) for the Demographic Variables as Functions of PGSI Category .....	63
Table 14: Means (and SDs) for the Gambling Frequency Variables as a Function of PGSI Category .....	64
Table 15: Variable Correlations.....	66
Table 16: Means (and SDs) for the EGM variables as functions of PGSI category .....	67
Table 17: Means (and SDs) for the personality variables as functions of PGSI category .....	68
Table 18: Parallel Mediation Analyses (Neuroticism).....	72
Table 19: Parallel Mediation Analyses (Agreeableness) .....	72
Table 20. Parallel Mediation Analyses (Conscientiousness) .....	72
Table 21. Simple Moderation Analysis of Agreeableness on Gambling Variables x PGSI Score	76
Table 22. Simple Moderation Analysis of Conscientiousness on Gambling Variables x PGSI Score .....	76
Table 23. Simple Moderation Analysis of Neuroticism on Gambling Variables x PGSI Score ..	77
Table 24. Mediated Moderation of Agreeableness on Neuroticism .....	77
Table 25. Mediated Moderation of Conscientiousness on Neuroticism .....	77

## List of Figures

Figure 1. Flow chart of sample identification .....	27
Figure 2. Visual box plot of strategic gambling frequency across personality type .....	118
Figure 3. Visual box plot of bingo frequency across personality type .....	119
Figure 4. Visual box plot of casino table game frequency across personality type .....	120
Figure 5. Visual box plot of skill gambling frequency across personality type .....	121
Figure 6. Visual box plot of money spent on scratch tickets across personality type .....	122
Figure 7. Visual box plot of money spent on casino table games across personality type .....	123
Figure 8. Visual box plot of scratch ticket frequency across personality type .....	124
Figure 9. Visual box plot of bingo frequency across personality type .....	125
Figure 10. Visual box plot of casino table games frequency across personality type .....	126
Figure 11. Visual box plot of skill gambling frequency across personality type .....	127
Figure 12. Visual box plot of sports betting frequency across personality type .....	128
Figure 13. Visual box plot of animal race betting frequency across personality type .....	129
Figure 14. Visual box plot of money spent on scratch tickets across personality type .....	130
Figure 15. Visual box plot of money spent on bingo across personality type .....	131
Figure 16. Visual box plot of money spent on sports betting across personality type .....	132
Figure 17. Flow chart of sampling process .....	55
Figure 18. EMG simulation program .....	56
Figure 19. Path model for PGSI classification as a predictor of average bet magnitude, including paths to represent parallel mediation by neuroticism, agreeableness, openness, extraversion, and conscientiousness .....	70
Figure 20. Path model for PGSI classification as a predictor of average bet magnitude, including paths to represent parallel mediation by neuroticism, extraversion, and conscientiousness .....	71
Figure 21. Path model for PGSI classification as a predictor of time played, including paths to	

represent parallel mediation by neuroticism, agreeableness, and conscientiousness ..... 73

Figure 22. Path model for PGSI classification as a predictor of games played, including paths to represent parallel mediation by neuroticism, agreeableness, and conscientiousness ..... 74

Figure 23. Path model for PGSI classification as a predictor of games played, including paths to represent parallel mediation by neuroticism, agreeableness, and conscientiousness ..... 75

## Problem Gambling: The Impact of Personality on Gambling

Gambling is a commonly enjoyed form of entertainment, played by millions of people around the world. In studies of Canadian gambling participation, 75% of adults reported gambling in the past year (Cox et al., 2005). These rates are similar to those reported in Great Britain (73%, BGPS, 2010), Australia (70%, Productivity Commission, 2010), and Finland (78%, Salonen, Alho, & Castren, 2015). Its popularity draws from the arousal of risk and the excitement generated from a big win, as well as the sheer variety of experiences gambling encapsulates. This variety includes different forms of gambling (e.g. lottery, sports betting, electronic gambling machines), the assorted venues in which to gamble (e.g. casino, bars, the internet), and the option to pursue legal or illegal gambling. What all forms of gambling share in common is the decision to place a wager on an uncertain outcome that provides the potential for a larger prize. While gambling represents a harmless form of entertainment for most, it also has the capacity to become dysfunctional and impairing for a minority of people. Those individuals who go on to develop gambling disorder (GD), will struggle with excessive gambling behaviour that is associated with severe physical and mental health outcomes, as well as financial and legal consequences (Gerstein et al., 1999; National Research Council, 1999; Petry, 2005). These financial consequences are evident in the proportion of gambling revenues derived from problem gamblers. For example, in Canada the prevalence of problem gamblers is 4.2%, yet 23.1% of gambling revenues are generated from this group (Williams & Wood, 2004). These rates are similar to those reported in Australia (33%, Productivity Commission, 1999), New Zealand (30%, Abbott & Volberg, 2000) and the United States (15%, Gerstein et al., 1999). Unfortunately, the harm caused by these negative consequences is not limited to the gambler in question but has ramifications for their family, friends, and the wider community (Ferris &

Wynne, 2001).

Gambling disorder is defined by the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) as a maladaptive gambling behaviour, persistent and recurrent, which alters the course of one's personal, family or professional life (APA, 2013). Results from different epidemiological studies around the world (Baken et al., 2007; Bondolfi et al., 2008; Faregh & Derevenski, 2013; Petry, Stinson, & Grant, 2005) have estimated the prevalence rates for GD range between 0.5% and 2.5% in the general population, with higher estimated rates for young adults (Barnes, Welte, Hoffman & Tidwell, 2010). Given that most people who engage in gambling can do so responsibly and without functional impairment, the study of disordered gambling focuses on why other individuals with similar levels of exposure to gambling develop a gambling problem. Likewise, why do other individuals with similar personal characteristics, but who differ in the forms of gambling they prefer, go on to develop a gambling problem? Research efforts to explore these questions examine the interaction between "vulnerable individuals" and the addictive features of gambling. Understanding how a multitude of variables within these two factors influence the development of gambling problems has important implications for both the prevention and treatment of GD. Through this study, my aim is to examine the role of personality and its role in both gambling preferences and disordered gambling behaviour. The findings of this study add to the growing literature of how individual differences account for "vulnerable individuals" who develop gambling problems and complements the body of research that examines the other side of the equation, the potentially addictive features of the gambling activities themselves. In the forthcoming sections, the research literature of both personality and gambling will be reviewed, providing the context for my efforts to further elucidate the relationship between the two. Specifically, the chief aim of this study is to

tackle two questions:

- 1) Do personality factors influence game preferences?
- 2) Do personality factors mediate the relationship between gambling severity and in-session gambling behaviours?

### **Personality Psychology: History & Current Developments**

The study of human personality, personality psychology, involves the exploration of interindividual differences in behavioural tendencies, commonly known today as personality traits. Behavioural tendencies are defined in a broad sense, incorporating not only action but also thoughts and feelings. In assessing personality traits, personality researchers typically explore an individual's behavioural tendencies through reports from informants (observer reports) or direct ratings from the individual themselves (self-report). These tendencies together form the whole person and their specific collection of traits, in combination with their life experiences, ensures that each individual has a unique personality. When these individual ratings are taken together, with hundreds or thousands of additional individual data, broad personality factors can be explored.

While hundreds of personality traits can be identified, most of these traits are positively or negative correlated with each other. As such, a central aim of personality psychology is the identification of broad, independent factors that can summarize the variance found amongst personality traits. Through repeated experimentation exploring the differences in personality traits between individuals, the field of personality psychology has found that these traits appear to be captured by five broad factors (Briggs, 1992; Digman, 1990; Goldberg, 1990; Hofstee, de Raad, & Goldberg, 1992; McCrae & John, 1992). The discovery of these five factors (Openness,

Extraversion, Conscientiousness, Agreeableness, Neuroticism) was achieved through the combination of the lexical approach and factor analysis. The lexical approach involves the accumulation of trait-descriptive adjectives and individuals engaging in self-report measures to rate their personality on these assorted traits. Factor analysis, developed by Charles Spearman (1927) is a form of statistical analysis that eliminates the redundancy in variance among a set of correlated variables through the creation of a lower number of unobserved, broad variables called factors.

The development of personality psychology dates back to the work of Francis Galton and his assessment of physical and perceptual abilities. His techniques were later adopted by American psychologists who were interested in measuring intellect through the collection of vast amounts of data from large groups of individuals. Over time, these efforts were expanded in scope and began measuring nonintellectual dimensions. The proliferation of these traits (e.g. character, temperament) led to the creation of a subdiscipline (Danziger, 1997) separate from both intellectual assessment and abnormal psychology. The pioneering work in this subfield, personality psychology, can be traced to the accumulation of trait-descriptive adjectives by Allport (1927, 1937) and his book *Personality: A Psychological Interpretation*. These terms later served as the raw data for the trait analyses later performed by Ramond Cattell (1945, 1947) and eventually resulted in his 16 Personality Factors theory of personality. Using a more conservative approach of Cattell's methodology, Fiske (1949) was the first to identify five factors (Confident Self-Expression, Social Adaptability, Conformity, Emotional Control, and Inquiring Intellect). While Fiske's five factors were never picked up by the personality theorists, Tupes and Christal (1961) would later bring the five-factor model to the forefront of personality research.

While personality theory was making significant progress in the early to mid-1900's, a

series of critiques from various researchers stalled the field's development. Walter Mischel was the most prominent critic of trait assessment and published his criticisms in his book *Personality and Assessment* (1968). Amongst his various criticisms, there were three key issues he put forth: 1) traits have limited utility to predict behaviour because the correlations between the two were rarely are above .3 (known as the personality coefficient), 2) any stability found in traits is due to the situation, and 3) behaviour is not cross-situationally consistent. Overall, he claimed that personality traits had limited predictive validity and the situation must be responsible for the unaccounted variance not explained by traits. Mischel's criticisms created a paradigm crisis in personality psychology with many psychologists reiterating Mischel's criticism that traits have weak predictive validity (Bandura, 1999; Lewis, 2001; Paul, 2004).

Over time, many of Mischel's criticisms have been refuted (Block & Block, 2006; Craik, 1969; Funder & Ozer, 1983; McAdams & Pals, 2006; Roberts et al., 2007). Specifically, Meyer et al. (2001) were able to demonstrate that the modal effect size on a correlational scale for psychology as a whole is between .10 and .40. Additionally, research has demonstrated that the effects of personality traits are generally as strong as the effects of situations (Funder & Ozer, 1983; Sarason, Smith, & Diener, 1975). These findings demonstrate the necessity of studying both personality and the situation. Moreover, even when an association between two variables is statistically low (e.g. the association between taking aspirin and reducing heart attacks is .03), they still may have important practical significance (the effect of taking aspirin resulted in 85 fewer hearts among 10,845 patients (Rosenthal, 1990)). Likewise, despite criticisms of low predictive validity, a review of the social and health benefits of personality found that personality predicted mortality, divorce, and achievement (Roberts et al., 2007). As suggested by these results, incorporating personality into predictive models of human behaviour should result in a

better understanding of this behaviour, including behaviour that is targeted for clinical intervention.

Despite the criticisms brought forth by Mischel (1968) and his peers (Block, 1995), work to explore the five factors of personality has continued and has been reinforced with supportive data from behaviour genetics (Yamagata et al., 2006), developmental psychology (Kohnstamm, Halverson, Mervielde, & Havill, 1998), psychopathology (Clark & Livesley, 2002), as well as replications with samples from around the world (Schmitt et al., 2007; Terracciano et al., 2005). Some personality psychologists have argued the existence of a sixth factor (honesty/humility, Ashton et al., 2004; interpersonal relatedness, Cheung et al., 2001; spirituality, Piedmont, 1999) and others have criticised the five factors for not exhaustively accounting for the variance in personality measures. Disputing these claims, a personality study by Lanning (1994) found that five of the 15 personality factors (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism) they examined accounted for 64% of the total variance with only 16% accounted for by the remaining factors.

Of the theories and models put forth to study the five factors of personality, Costa and McCrae's (1985) five-factor model of personality (FFM) is the most widely used and accepted model of personality. The five factors in this model were derived from factor analysis and consist of neuroticism, extraversion, openness, agreeableness, and conscientiousness. Neuroticism is defined as a person's emotional stability or instability. Extraversion examines whether an individual prefers solitary versus social interactions. Openness examines whether people are open-minded to experiences or closed-minded. Agreeableness examines whether a person is good-natured and trusting or antagonistic. Finally, conscientiousness examines whether people are careful and knowledgeable or careless and ignorant.

Based on the five-factor model (FFM) and the NEO Personality Inventory-Revised (NEO-PI-R), the International Personality Item Pool – NEO inventory was developed to assess an individual's personality. The questionnaire consists of six subscales for each of the five factors (30 subscales in all), and each subscale consists of ten items, scored on a five-point Likert scale. The five-factor model has been used extensively across the world and has shown to be applicable across a range of cultures. Digman (1990) found support for the model in Israel, Germany, and Japan. Using different languages, McCrae and Costa (1997) found similar clusters of personality factors in six nations (Germany, Portugal, Israel, China, Korea, and Japan). This research supports the claim by McCrae and Costa (1997) that the five factors are universal across culture and language.

Despite the success of the FFM, the model does have limitations. For instance, the FFM adopts a variable-centered approach, which examines personality factors in isolation. Ultimately, this approach can only partially predict the behaviour of participants as it does not account for any interaction between personality factors. This limitation is problematic as an individual is not solely extraverted, neurotic, or non-conscientious. Instead, these characteristics are simultaneously present within the individual and interact to influence that individual's behaviour. This interaction, in turn, could intensify, weaken, or even cancel out single personality factors. The limited predictive effect of the FFM could explain the presence of mixed results in the personality research literature. One alternative to a variable-centered approach is adopting a personality typology that allows for the combinations of trait factors. With that thought in mind, Torgersen (1995) created a personality typology with the intention to explore the complex interactions of personality factors and their impact on variables of interest. Vollrath and Torgersen (2000, 2002) have lauded the utility of this approach against the use of interactions of

personality dimensions, which only allows for linear relationships and three-way interactions are too conceptually difficult to comprehend.

Building off Eysenck's three-factor theory of personality (1990), Torgersen's (1995) typology posits three main personality factors: extraversion, neuroticism, and psychoticism (inversely related to conscientiousness). Each personality factor has the potential to drive individuals to pursue risky health behaviours like gambling. Extroverts are highly sociable, impulsive, individuals who pursue risky behaviours to elicit arousal. Individuals high in neuroticism are emotionally unstable and pursue risky behaviours to regulate distress. Individuals high in psychoticism are cold and unconventional. Their pursuit of risky behaviour lies in their lack of socialization and the unconventional nature of their behaviour. Separating each of three personality factors at their median results in the formation of high and low groups. Each of these groups is combined to form Torgersen's eight personality types: spectator, insecure, skeptic, brooder, hedonist, impulsive, entrepreneur, and complicated (see Tables 1 and 2 for a breakdown and description of each personality type). Torgersen's typology has been used in many studies, exploring various topics including coping (Vollrath, & Torgersen, 2000), risky health behaviours (Vollrath, M. & Torgersen, 2002; Vollrath, M. & Torgersen, 2008), police service (Lau, Hem, Berg, Ekeberg, & Torgersen, 2006), high-risk sports (Castanier, Le Scanff, & Woodman, 2013), and stress in med school (Tyssen, et al., 2007). Overall, these studies have found more favorable outcomes and better coping skills amongst the personality types that combined low neuroticism with high conscientiousness (skeptic, entrepreneur). In contrast, personality types combining high neuroticism with low conscientiousness (insecure, impulsive) were associated with poorer outcomes and less adaptive coping. These findings suggest that unhealthy, maladaptive coping behaviours, like gambling, should be associated with personality

types combining high neuroticism and low conscientiousness, a suggestion which will be tested in the current study.

Table 1

*Composition of Vollrath and Torgersen's personality types*

Type	Neuroticism	Conscientiousness	Extraversion
<b>Spectator</b>	Low	Low	Low
<b>Skeptic</b>	Low	High	Low
<b>Hedonist</b>	Low	Low	High
<b>Entrepreneur</b>	Low	High	High
<b>Insecure</b>	High	Low	Low
<b>Brooder</b>	High	High	Low
<b>Impulsive</b>	High	Low	High
<b>Complicated</b>	High	High	High

Table 2

*Personality types descriptions*

Type	Description
<b>Spectator</b>	Emotionally flat, low ambition, little interest in social norms
<b>Skeptic</b>	Self-secure, emotionally stable, holds close relationships, rigid
<b>Hedonist</b>	Pleasure-oriented, socially skilled, undependable
<b>Entrepreneur</b>	Independent thinking, socially secure, goal-oriented, domineering
<b>Insecure</b>	Overly sensitive and reflective, self-conscious, external locus of control
<b>Brooder</b>	Shy, withdrawn, insecure, ambivalent, low frustration tolerance
<b>Impulsive</b>	Pleasure-oriented, attention seeking, chaotic, lacks emotional control
<b>Complicated</b>	Emotionally intense, sensitive, overly dependent, conscientious

*Note.* Adapted from Vollrath & Torgersen (2000)

### Early Personality Theories and Gambling

Much of the earliest work on exploring the role of personality in gambling disorders originated from psychoanalytic theorists attempting to explain deviant gambling (Aasved, 2002, Bolen & Boyd, 1987; Rosenthal, 1987). Common across these theories are a set of assumptions inherent in psychoanalytic theory. For example, many psychoanalytic theories assume that a significant portion of human activity is subliminal, occurring at the unconscious level. This assumption leads to the conclusion that the motivations behind human behaviour are unconscious and inaccessible. Further, psychoanalytic theory sees much of this behaviour as instinctive and

largely biologically determined. In the context of a psychoanalytic theory of gambling, this assumption holds that the motivation for why a pathological gambler continues to gamble, despite its many repercussions, is unknown to the gambler. This psychoanalytic perspective argues that only intensive psychoanalytic psychotherapy can uncover the deeply held beliefs or psychological trauma that is responsible for pathological gambling.

Early psychoanalytic theories also assumed that all human beings pass through Freud's psychosexual stages of development (Aasved, 2002). Each of these five stages is characterized by an erogenous zone that is the source of sexual drive. Proponents of the psychosexual stage theory argued that children could become fixated in one stage, a fixation that could result in long-standing maladaptive personality characteristics. With this tenet in place, many psychoanalytic theories on gambling argue that fixation at a specific psychosexual developmental stage is the root of pathological gambling. A final assumption found in psychoanalytic theory holds that human beings use a process called sublimation in order to substitute more acceptable behaviours for unconscious desires that are socially and morally unacceptable. Taken as a whole and applied to the context of gambling, early psychoanalytic theorists would argue that pathological gambling begins with a fixation at a psychosexual developmental stage (e.g., oral) which later in adulthood and through the process of sublimation, presents as pathological gambling. With these assumptions in mind, a brief overview of the work of several psychoanalytic theorists on gambling will now be explored.

Hattinberg (1914) developed the first psychoanalytic treatment for pathological gambling (PG) (as cited in Aasved, 2002; Bolen & Boyd, 1968; Rosenthal, 1987). From his writings, gambling was explained as a quest for parental love that began with a fixation at the anal stage. In contrast, Stekel (1929) viewed gambling as a love of play and a regressive escape from

adulthood (as cited in Aasved, 2002; Bolen & Boyd, 1968). He differentiated "real gamblers" from "professional gamblers," suggesting that professionals gamble for the potential financial benefits while real gamblers play simply for fun. He was one of the first theorists to discuss how gambling, like alcohol, releases hidden qualities in individuals through a process known as disinhibition, a process where an individual has a reduced capacity to manage their immediate response. These hidden qualities are linked to the different emotional states elicited through gambling and are intrinsically rewarding for gamblers, including excitement, as well as cycles of tension and release. Stekel also noted the numerous erroneous cognitions gamblers hold about gambling, namely identifying their strong belief in superstition and the use of ritualistic behaviours to improve their luck.

The father of psychoanalysis, Sigmund Freud (1950), created his own theory on pathological gambling, which argued that the root cause was a fixation at the phallic stage. Due to this fixation, gambling in adulthood represents an acceptable substitution for masturbation and allows individuals to punish themselves for their guilt over the Oedipal complex. Like Freud, Belger (1943, 1957) developed his gambling theory primarily based on clinical observation. He identified many of the symptoms listed in the current diagnosis of pathological gambling, and he viewed gambling as a fixation at both the oral and anal stages of psychosexual development. Compulsive gambling represented an attempt to recapture infantile omnipotence as well as self-punishment for the rage directed towards parents during the weaning and toilet training processes (Olmstead, 1962). Belger also created his own classification system for gambling and was one of the first psychoanalysts to focus on women's gambling (Belger, 1943, 1957). Finally, the later work of Bolen and Boyd (1970) broke from the tradition of early psychoanalysts by focusing on the effects of gambling on intimate relationships and incorporating the gambler's spouse into

treatment. They noted that gambling fulfills both a social and a psychological need, and these needs often present an emotional defense for deeper emotional problems.

Psychoanalytic theories on gambling began to fall out of favor due to the many shortcomings pointed out by its critics (Aasved, 2002). The biggest criticisms concerned psychoanalytic theory's focus on the unconscious, which was viewed as an untestable construct and therefore not subject to scientific study. From this criticism, it follows that psychoanalytic theorists were not able to provide the scientific evidence to the broader psychological community to prove that gambling behaviour was the product of sexual substitution or of the psychosexual developmental stages. Not only are psychoanalytic theories untestable, but they are also criticized for stemming from a limited number of case studies. This small sample size greatly diminishes any claims of generalizability and raises the question of whether the insights gleaned from the case studies merely represent the idiosyncrasies of particular clients. The strong focus on internal psychodynamic processes has also led critics to argue that psychoanalytic theories neglected social and environmental factors. These factors were largely unaccounted for by early psychoanalytic theory.

Clinically, psychoanalytic treatment for pathological gambling has also waned in popularity as it has been deemed too time intensive, expensive, and ineffective. Time-limited psychotherapy has prospered in its place, especially cognitive behavioural therapy, which has its roots in the behavioural and cognitive psychology movements.

Like psychoanalytic theories on gambling, other personality theories also began with a focus on pathological rather than normal gambling. However, over time this oversight was rectified and modern researchers have accomplished much in studying the entire gambling continuum, not just the severe end. Beginning in the 1940s, personality theorists argued that all

disordered behaviours could be explained by personality traits common to the disordered group. They viewed addictive behaviour as the symptomatic expression of a personality disorder that predisposes individuals towards addictive behaviours. This argument has some merit due to the fact that when many gamblers successfully abstain from gambling, they often become addicted to something else (Blume, 1994). This pattern suggests that a deeper underlying issue is the cause for the presenting gambling symptoms (Aasved, 2002).

Other early personality theories within the broader psychodynamic tradition have also been applied to gambling behaviour, specifically: power theory and dependency conflict theory (Aasved, 2002). Both theories explain addiction as a symptom of feelings of low self-esteem. These theories were developed from the male-oriented framework proposed by psychoanalytic theory but justify this focus by the high percentage of men who seek treatment for pathological gambling. These early theories argue that gambling is male dominant due to different gender needs. This argument holds that women find personal contentment through being a wife and mother, while men find contentment through achievement in the role of the provider. In this view, those men who are unsuccessful at meeting the provider role through legitimate means may turn to gambling (Fink, 1961). In gambling, the tangible rewards are considered less important than the emotional rewards it provides. These theories argue that for gamblers, gambling provides the feelings of self-importance, power, and control that are lacking from their lives. These emotional rewards are at their most apparent when a player is winning, and these sensations are so great that gamblers want to immediately return to gambling. In contrast, losses induce feelings of unimportance and low self-esteem. These feelings stimulate further gambling to regain losses (e.g., gambling to recuperate previous losses, a gambling concept known as chasing) in an effort to regain their positive self-image. Neither winning nor losing can provide

gamblers the escape from the drive to gamble that originates in poor self-image.

Power theory evolved from Adler's individual psychology and proposes that human behaviour is motivated by unconscious needs for self-esteem, achievement, and power (Adler, 1969). When these needs are not met, individuals struggle with feelings of inferiority, dependence, and weakness. According to this perspective, this state of being is intolerable and, as a result, persistent attempts are made by the individual to meet this need by any means available. For gamblers, the act of gambling allows them to gain control over their lives. Through gambling, they can demonstrate their virility to themselves and others by being bold and aggressive. The intermittent success of gambling makes gamblers feel as if they are masters of their own fate.

In contrast, dependency conflict theory proposes that gambling is a result of psychological distress from dependence and unresolved needs for parental support (Whiting & Child, 1953). When these childhood needs are unmet they persist into adulthood and through the psychological defense of sublimation (whereby a socially unacceptable impulse is transformed into a socially acceptable behaviour), these unmet needs are satisfied through gambling. This theory, like most psychoanalytic theories, solely focuses on gambling in men. The theory posits that men, in order to meet the instinctual need for independence, have a neurotic need to fight against dependence, which causes distress (Haustein & Schurgers, 1992). If these power or dependency needs are unresolved, individuals feel inadequate and struggle with low self-esteem. Gambling provides an opportunity for temporary relief by artificially meeting these needs through the illusion of self-control, independence, and power. Over time, this pairing between gambling and psychological relief can produce a strong, learned behaviour.

### **Modern Personality Theories and Gambling**

Most modern personality theories of gambling behaviour come from the trait or dispositional perspective. Many personality traits are found in the gambling population; however, they are not present in all pathological gamblers. This finding is due to the considerable heterogeneity of the gambling population; there is a lack of common etiology in gamblers' personality traits and many of these traits are associated with each other. This is a problem because pathological gamblers are often studied as a single homogeneous group. Blaszczynski (1999) has noted that one single conceptual model is inadequate for accounting for the heterogeneity seen in pathological gamblers. For this reason, modern personality theorists have focused on identifying a constellation of traits responsible for pathological gambling. This shift in focus has resulted in attempts to classify gamblers into subtypes to better account for their variability. This movement seeks to base these subtypes on the etiological, psychopathological, personality, and motivational factors of pathological gamblers.

The idea of separating pathological gamblers into subtypes dates back to Moran's (1970) classification of gamblers into five subtypes based on individual characteristics and social influences. These subtypes include subcultural (PGs who gamble due to family and peer pressure), neurotic (PGs who gamble due to emotional difficulties or life stressors), impulsive (PGs who lost control and succumb to gambling cravings), psychopathic (PGs who gamble due to a personality disorder or psychopathy), and symptomatic (PGs who gamble due to another psychological disorder).

Recently, Blaszczynski and Nower's (2002) pathways model of PG has gained acclaim and has been increasingly prominent in gambling research. Their model integrates biological, personality, developmental, and etiological factors into a cohesive theoretical framework. This

model suggests there are three major pathways to PG, each of which is associated with a specific vulnerability, demographic feature, and etiological process. The model proposes that all gamblers gamble because of environmental determinants. Operant and classical conditioning, as well as cognitive processes, lead to the development of faulty beliefs concerning skill and chance. Overall, Blaszczynski and Nower (2002) described three pathways: behaviourally conditioned, emotionally vulnerable, and antisocial impulsivist. Behaviourally conditioned subtypes present with little psychopathology and no maladaptive personality traits. They gamble based on social influences and faulty cognitive processes. For this subtype, gambling is not an emotional process. The emotionally vulnerable subtype present with elevated depression and/or anxiety. They are low in impulsivity and/or sensation seeking and gamble in an effort to regulate dysphoric feelings. Finally, the antisocial impulsivist presents with elevated antisocial traits, high impulsivity, and gambles to enhance positive feelings. The pathways model of PG has incited further research into the relationship between personality and gambling, however, no formal, standardized measure or methodology has been developed to classified problem gamblers into the pathways specified by the model. This current limitation demonstrates that there is a gap between theory and application within the model and emphasizes that need for research to develop a means to bridge that gap. While Blaszczynski and Nower's various pathways have not been formally linked to specific factors of the FFM, the pathways do share similarities with some of Torgersen's personality types. Specifically, the description provided for antisocial impulsivists fits well with Torgersen's hedonist personality type, while emotionally vulnerable gamblers appear qualitatively similar to the Torgersen's insecure personality type. These similarities suggest that Torgersen's personality typology could potentially be used as a means to identify and study two of the three pathways described in Blaszczynski and Nower's model.

The application of modern dispositional models of personality functioning and gambling behaviour will be discussed further in the next section. Specifically, the Five Factor Model will be employed as a framework for understanding both pathological and non-pathological gambling.

### **Gambling Research and the FFM**

Although gambling research is in a nascent stage compared to the study of other addictive behaviours (Petry, 2005), some studies have examined the relationship between problem gambling and the five-factor model of personality. Neuroticism is frequently associated with problem gambling (Miller et al., 2013, Myrseth et al., 2009; Bagby et al., 2007, Roy, Custer, & Lorenz, 1989; Slutske et al., 2005; Kaare et al., 2009; MacLaren, Ellery, & Knoll, 2015), although some studies have failed to demonstrate this relationship (Hwang et al., 2013; Tackett, Rodriguez, Rinker, & Neighbors, 2014). The higher scores on neuroticism seen in pathological gamblers could explain the high co-morbidity problem gambling has with other mental disorders, as a vast majority of studies have linked neuroticism with a wide range of psychopathology (e.g., Malouff, Thorsteinsson, & Shutte, 2005). Myrseth et al. (2009) found that neuroticism was significantly associated with problem gambling — specifically, higher scores on neuroticism were generally associated with impulsivity and emotional vulnerability, which suggests that neuroticism may make individuals vulnerable to developing a gambling problem. An alternative explanation relates to the finding that many gamblers engage in gambling activities to escape from feelings of anxiety or depression (Blaszczynski & Nower, 2002). A recent study offers a possible model for explaining how neuroticism and escape motivation are linked with problem gambling (MacLaren, Ellery, & Knoll, 2015). The study explored whether personality indirectly influences gambling severity through motivational or cognitive mechanisms. Neuroticism,

through its facets, volatility, and withdrawal, was associated with gambling severity through its effects on cognitive distortions. This finding suggests that individuals with high scores on neuroticism, in an effort to escape negative emotions, develop distorted gambling cognitions, which could lead to disordered gambling over time.

In multiple studies examining the relationship between problem gambling and the FFM, openness has been found to be a significant predictor of problem gambling (Miller et al., 2013; Myrseth et al., 2009). Lower scores on openness suggest that problem gamblers are more conventional, less artistic, and less analytic than healthy controls (Myrseth et al., 2009). With gambling often used as an escape from reality (Blaszczynski & Nower, 2002), lower scores on openness could be indicative of an inability to escape negative moods in more adaptive ways. Further, Myrseth et al. (2009) suggested that lower scores on openness could also reflect the attentional biases and cognitive distortions gamblers hold about gambling (Petry, 2005). This inability to identify unrealistic expectations and to accurately judge probabilistic outcomes may be reflected in lower scores on openness. Despite these findings, some studies have found no significant relationship between openness and problem gambling (Bagby et al., 2007; Kaare et al., 2009).

Of the five personality traits in the FFM, conscientiousness is the trait with the strongest conceptual links to impulsivity because it captures the capacity to resist impulses, manage desires, and apply guiding principles to actively control behaviour (Costa & McCrae, 1992). This conceptual link to impulsivity may explain why conscientiousness is frequently found to be associated with pathological gambling (Bagby et al., 2007; Roy et al., 1989; Slutske et al., 2005; Kaare et al., 2009). Bagby et al. (2007) found that pathological gamblers scored lower than non-pathological gamblers on four of the six facets of this trait. Specifically, three of four

impulsivity-related traits (impulsiveness, self-discipline, and deliberation) distinguished pathological gamblers from non-pathological gamblers. Additionally, conscientiousness has been found to be associated with gambling severity through its effect on distorted gambling cognitions (MacLaren, Ellery, & Knoll, 2015). Specifically, low scores on industriousness (a facet of conscientiousness) are associated with increases in distorted gambling cognitions, which in turn, increased gambling severity.

MacLaren et al. (2011) used a meta-analysis to examine personality and problem gambling. They found that traits from the neuroticism, agreeableness, and conscientiousness personality factors were among the most consistent personality traits associated with problem gambling. The strong effects found for agreeableness and conscientiousness are consistent with the theory that pathological gamblers have difficulties with impulse control; this fits with problem gambling being classified as a behavioural addiction, as impulsive traits are common to substance abuse as well. Overall, they concluded that the personality traits of pathological gamblers are similar to those in people with substance use disorders and borderline personality features. Individuals with higher scores on neuroticism have been found to experience difficulty inhibiting urges or cravings, particularly when experiencing negative affect. It is possible that higher scores on measures of neuroticism with pathological gamblers are a consequence of problem gambling itself, (e.g., the financial and interpersonal costs of problem gambling lead to increases in negative affect). This personality profile is consistent with that found for substance use and other externalizing disorders. Despite differences, most of the summarized studies found some correlation between problem gambling and some combination of neuroticism, conscientiousness, and agreeableness. Specifically, problem gamblers seem to present with a personality profile of high neuroticism, low conscientiousness, and low agreeableness.

A recent study examining the associations between the FFM model and gambling severity suggests this gambling specific personality might differ by age group (Tackett, Rodriguez, Rinker, & Neighbors, 2014). Tackett et al. found that this gambling personality profile was only partially supported in college-aged gamblers. Specifically, associations were found between low agreeableness and low conscientiousness, but not high neuroticism. It is possible that the differences found in personality profiles between college and adult gamblers may be developmental, whereby college gamblers who continue to gamble will develop the profile typically seen in adult gamblers over time (high neuroticism, low agreeableness, and low conscientiousness). These mixed findings at the college age level suggest more research is needed to explore any differences between college and adult gamblers.

### **Limitations in the Research Literature**

The current research literature examining the relationship between personality and gambling is not without its limitations. As previously discussed, these limitations include the mixed findings seen in the FFM literature, as well as the gap between theory and application in the predominant gambling-personality models (e.g. pathways model of PG). Additionally, many gambling studies rely heavily on the use of self-report data and the gambling literature tends to focus on the influence of environmental factors (e.g. schedules of reinforcement, availability) rather than individual factors (e.g. personality, cognitive bias) on problem gambling. This heavy focus on environmental factors has led to a deficit of research exploring individual factors, like the relationship between personality and gambling preferences, which will be examined in the current study. While some of these individual factors require more exploration, previous research on the influence of individual factors has been successful in identifying some demographic risk factors for problem gambling, such as low socio-economic status (Shepherd et al., 1998; Volberg

& Steadman, 1988), lack of employment (Volberg & Steadman, 1988), and low education (Shepherd et al., 1998). However, research into personality models in gambling has found mixed results in identifying a relationship between personality types and PG (Breen & Zuckerman, 1999; Langewisch & Frisch, 1999). For instance, both of the aforementioned referenced studies examined the relationship between problem gambling and the five-factor model developed by Zuckerman, Kuhlman, Thornquist, and Kiers (1991). While Breen & Zuckerman (1999) found impulsive sensation-seeking predicted chasing following losses, Langewisch and Frisch (1998) found no evidence that this model could predict the severity of PG symptoms. These results suggest that more work is needed to better understand the relationship between personality differences, gambling behaviour, and gambling severity.

A common limitation in many personality studies is the reliance on self-reported measures that do not include behavioural measures of gambling play to validate these self-reported variables. For instance, Blascynski and Nower's (2002) pathways model of PG is a prominent theory in the gambling literature, yet no study has examined whether these theoretical pathways have a behavioural link with actual gambling play. The exclusion of these behavioural measures may neglect unique variances not captured by the self-report measures the research literature relies on. Further, behavioural measures also have the benefit of assessing temporary fluctuations where self-report measures depend on accurate recall, insight, and honesty (Funetes, Tavares, Artes, & Gorenstein, 2006). Self-report measures also tend to be broad in their time range, making them suitable only for the more stable concepts. For these reasons, both self-report and behavioural measures will be used in this study. Through the inclusion of a behavioural measure of gambling, this study can explore whether there are possible behavioural links with prominent theoretical models like Blascynski and Nower's (2002) pathways model.

**Study 1: Do personality factors influence game preferences?**

The research literature, for the most part, is conclusive that neuroticism, conscientiousness, and agreeableness are related to problem gambling. These findings come from numerous gambling studies exploring the relationship between gambling and personality through the five factor model of personality. While the FFM model is the dominant personality model in personality research, Blascynski and Nower's pathways model of PG is the prominent personality-gambling models in the gambling research. Unfortunately, there have been few studies linking the FFM and the pathways model. Fortunately, Torgersen's personality typology approach provides a means to connect the research findings of these two model. Specifically, Torgersen's personality types are created from the personality factors found in the FFM and the personality types appear to be qualitatively similar to two of three pathways described by Blascynski and Nower. While the gambling literature has some sense of the relationship between problem gambling and personality, it is unknown whether having certain personality characteristics lead individuals to prefer certain gambling activities. While all forms of gambling have an inherent sense of risk, a preference for some forms of gambling has been found to be particularly problematic. For instance, a preference for EGMs is associated with faster rates of developing gambling problems than table games, horse racing, and sports betting. (Breen & Zimmerman, 2002).

The gambling literature has provided several different ways to classify and categorize gambling activities, which could offer some insights into understanding the relationship between personality and gambling preference. Existing classification schemes have predominately grouped gambling activities as either games of skill or games of luck. For example, the classification of gambling activities as strategic versus non-strategic (Odlaug, Marsh, Won Kim,

Grant, 2011) or active versus passive (Bonnaire, Lejoyeux, & Dardennes, 2004) fundamentally comes down to skill vs. chance. Active gambling involves forms of gambling that have some element of skill and planning. Betting during these activities is generally less continuous, with a longer time period between placing a bet and the outcome (Dickerson, 1993). Additionally, excitement is a key motivating factor in pursuing these activities, which appeals to high sensation seekers (Bonnaire et al., 2004). Many of these activities are more social and involve interaction with other individuals (Holtgraves, 2009). Examples of active gambling activities include poker, sports betting, and blackjack. In contrast, passive gambling has more of a chance element, with low involvement by the gambler (Bonnaire et al., 2004). Betting is more automatic and continuous, with a short time period between placing a bet and the outcome (Dickerson, 1993). While active gambling often produces excitement, passive gambling is only mildly arousing and typically attracts low sensation seekers (Bonnaire et al., 2004). With many passive games offering solitary play, they draw gamblers looking to gamble without social involvement from others (Holtgraves, 2009). Examples of these activities include EGMs, VLTs, and scratch tickets.

Based on the characteristics of each gambling activity, gambling has also been classified as predominantly strategic or non-strategic. Non-strategic games involve little decision-making or skill and are predominately chance based, such as machine gambling. In contrast, strategic gambling incorporates skill and knowledge of the game, which influences outcomes (e.g., poker). Studies using this classification scheme have found that men tend to prefer strategic forms of gambling for their higher rates of arousal, whereas women tend to prefer non-strategic forms of gambling as an escape (Potenza, Steinberg, McLaughlin, et al., 2001; Vitaro, Arsenault, & Tremblay, 1997; Ledgerwood & Petry, 2006).

The purpose of this study is to observe the effects of personality, following the FFM based personality type model proposed by Vollrath and Torgersen (2002), to determine whether it influences an individual's gambling preference. While the gambling literature has linked neuroticism, conscientiousness, and agreeableness to problem gambling, the Vollrath and Torgersen model does not include agreeableness. Instead, the various personality types in the model are constructed from neuroticism, conscientiousness, and extraversion. While not including agreeableness is limiting, the Vollrath and Torgersen model has been applied to other risk taking behaviours (Castanier, Le Scanff, & Woodman, 2013) and hypotheses can be drawn from that literature. The effects of eight distinct personality types were examined across eight forms of popular gambling activities. A quasi-experimental, between-subjects design was used to test a number of hypotheses. It was predicted that individuals with either the impulsive or insecure personality types would demonstrate a preference for non-strategic, chance games (e.g. EGMs, bingo). This hypothesis is based on the finding that individuals with high neuroticism and low conscientiousness (which corresponds with both the impulsive and insecure personality types) typically have difficulties with impulse control (Bagby et al., 2007), a trait which is often associated with more continuous, non-strategic forms of gambling. It was also predicted that individuals with either the hedonist or entrepreneur personality types would prefer strategic, skill games (e.g. poker, sports betting). Based on the finding that arousal is a key motive to playing strategic, skill-based games (Bonnaire et al., 2004; Ledgerwood & Petry, 2006), it is expected that individuals higher in extraversion (hedonists, entrepreneur) would prefer more strategic forms of gambling. A gender difference in gambling preferences was predicted, whereby men would prefer strategic gambling, while women would prefer non-strategic gambling. This hypothesis is drawn from previous studies' findings demonstrating women's preference for

lottery and slots while men were found to prefer cards, blackjack, and sports betting (Potenza et al., 2006).

## **Method**

### **Participants**

To explore my hypotheses, I used the dataset from the Quinte Longitudinal Study (QLS) (a study of problem gambling conducted in the Quinte region of Ontario, Canada). This dataset was selected due to its large, representative sample. The dataset consists of 4,121 adults (17 and older) recruited via random digit telephone dialing and assessed annually over five years (from 2006-2011). To ensure an adequate number of problem gamblers, 26% of the sample was over selected for higher levels of gambling involvement. The sample was roughly representative of the demographic profile of the Canadian adult population. The annual assessments were digital and self-administered and completed either online or at the QLS office. The assessments consisted of a variety of measures that were used to collect information on demographics, gambling behaviour, physical health, mental health, substance use and abuse, stressors, personal values, social functioning, personality, leisure activity, and intelligence. Overall, dropout rates in the study were low with a retention rate of 93.9% after five years. In the present study, the data from phase one was selected for data analysis due to its inclusion of all variables of interest.

### **Personality Typology**

To explore personality in the current study I adopted Vollrath and Torgersen's personality typology (2002), with some modifications. The typology comprises of eight different personality types, which are combinations of three personality domains: extroversion (E), neuroticism (N) and conscientiousness (C). Using the 60-item version of the NEO (NEO Five-Factor Inventory, NEO-FFI), domain scores were calculated for each domain, with each

consisting of 12 items (scored on a five-point rating scale). According to the original typology, total scores of the three dimensions were then divided at the median into two groups, creating a high (those above the median) and low (those below the median) group. These high and low dichotomies are then combined in eight different ways to create different personality types. In the current study, the three personality domains were each partitioned into three groups using the percentiles of the scores within the sample, creating low (1-33% percentile), moderate (33-66% percentile), and high (67-99% percentile) groups. This method was selected because it provided an objective, valid and commonly applied statistical procedure to divide groups into roughly equally sized subgroups. The high and low groups were then combined to form the eight different personality types, with the moderate group excluded ( $N = 2,806$ ). In other words, participants scoring in the moderate range on extraversion ( $N = 1,358$ ), conscientiousness ( $N = 1,497$ ), or neuroticism ( $N = 1,447$ ) were excluded. Note that the sum of the three moderate personality groups is larger than the total moderate group due to the incomplete overlap among those scoring in the moderate range on more than one scale. Additionally, this process resulted in unequal groups sizes in the personality types, as any participant scoring any combination involving a moderate score was excluded, which included a variety of combinations. This modification was performed to create purer forms of the personality types. Through this process, the original sample size was reduced from 4,121 to 1,315 (see figure 1).

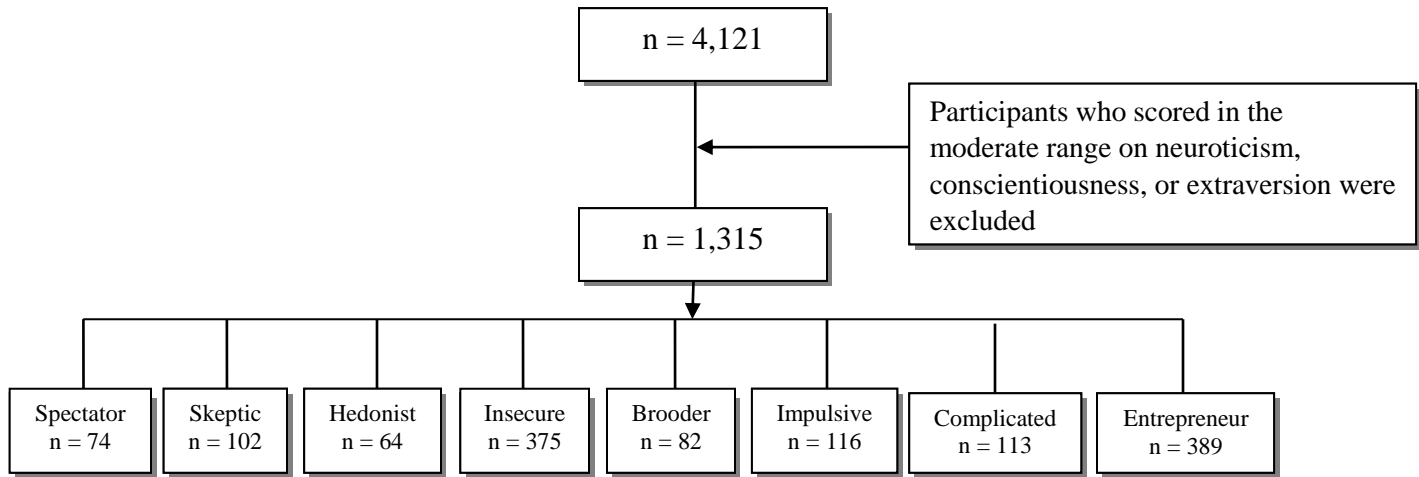


Figure 1. Flow chart of sample identification

## Measures

The research team of Quinte Longitudinal Study administered a series of questionnaires to gather information on demographics, personality, problem gambling, and gambling behaviour. Table 3 provides a summary of the variables assessed and the instruments used to measure each variable. A brief description of each measure is included here.

Table 3

### *Measures assessed in Study 1*

Domain	Variables of Interest	Instrument
<b>Demographics</b>	Age, Gender, Marital Status, Education	Quinte - Demographics
<b>Personality</b>	Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism	NEO Five Factor Inventory
<b>Gambling</b>	Gambling Risk Classification	Problem Gambling Severity Index
	Type, Monthly frequency, and spending	Quinte - Past Year Gambling

**NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992).** The NEO-FFI is a 60 item self-report personality inventory. It was developed as a shortened version of the 240 question NEO Personality Inventory - Revised (NEO PI-R) (Costa & McCrae, 1992). The NEO assesses personality traits in line with the big five model of personality. These five major personality domains include Introversion versus Extraversion; Neuroticism versus Emotional Stability; Agreeableness versus Coldness; Openness versus Close-Mindedness; and Conscientiousness versus Impulsiveness. Of the 60 items in the FFI, each domain is allotted 12 items. Each item is rated on a five-point scale (strongly agree to strongly disagree) with each scale having a range between 0 - 60. The Quinte Dataset also included additional questions from the NEO-PI-R in order to measure the facets of Depression, Vulnerability, Impulsivity, and Excitement-Seeking. Internal consistency estimates of the NEO-FFI range from 0.68 for Agreeableness to 0.86 for Neuroticism (Costa & McCrae, 1992). The current study found the following Cronbach's alpha coefficients: Agreeableness = 0.76, Extraversion = .74, Neuroticism = 0.91, Openness = 0.73, and Conscientiousness = 0.84. The concurrent and discriminant validity of the NEO has been established in both normal and clinical populations (Costa & McCrae, 1992).

**Problem Gambling Severity Index (PGSI; Wynne, 2003).** Wynne (2003) designed the PGSI to classify gamblers into four categories: non-problem, low risk, moderate risk, and problem gamblers. Its nine items are based on the DSM-IV criteria for pathological gambling, and scores have been shown to be correlated with the diagnosis (American Psychiatric Association, 1994). When scores are calculated, the PGSI assigns the recipient to one of the four classes based on their total score. Scores of zero represent non-problem; between one and two represent low risk; three to seven, moderate risk; above eight, problem gambling. Concerning the

reliability of the PGSI, Ferris and Wyne (2001) found a Cronbach's alpha coefficient of 0.84.

The current study found a Cronbach's alpha coefficient of 0.73, thus the PGSI scale had a high level of internal consistency. Research has also found the PGSI to be both sensitive and specific. Using a cutoff score of 8 or greater, the instrument detected 83% of the individuals in a validation study who met DSM-IV (APA, 2000) criteria for pathological gambling, and did not falsely identify any individuals as problem gamblers who did not meet DSM-IV (APA, 2000) criteria for pathological gambling (Wynne, 2003).

**Demographics.** This questionnaire consisted of a series of demographic questions, such as age, gender, country of birth, ethnic origins, marital status, education, employment and household income.

**Gambling Frequency.** Within the Quinte dataset, a subset of questions was included on past year gambling behaviour. These questions were used to inquire about the type of gambling engaged in, the frequency of monthly play, and the frequency of monthly spending. Specifically, the types of gambling assessed included lottery, scratch tickets, bingo, electronic gambling machines (e.g. VLTs, slots), casino table games (e.g. poker, blackjack), games of skill (e.g. poker, pool, bowling), sports betting, and horse/dog racing.

**Statistical Analysis.** I conducted the analyses in this study using the Statistical Package for Social Sciences (SPSS) Software Version 23. I used ANOVAs and Chi-square to examine the relationship between personality with various demographic variables, as well as with PGSI classifications. To indicate effect sizes, I report partial eta squared ( $\eta^2$ ) values with small, medium, and large effect sizes associated with  $\eta^2$  values of 0.01, 0.06, and 0.14 (Olejnik & Algina, 2000). Due to significantly skewed distributions of the dependent variables (e.g. gambling frequency variables), I used non-parametric tests to carry out the analyses.

Specifically, the relationships between personality and the eight gambling frequency variables were studied through a series of Kruskal-Wallis tests. The Kruskal-Wallis test, a rank-based nonparametric test, was selected in order to determine if there are statically significant differences between the personality types on the eight gambling variables. The test is commonly used as a nonparametric alternative to the one-way ANOVA. A significance level of  $p < 0.05$  was selected and Bonferroni corrections were used to adjust for multiple comparisons.

## **Results**

### **Assumptions**

I examined the distributions of variables using a series of ANOVAs, to determine if these variables had skew and kurtosis values that were within acceptable limits (e.g. values less or greater than  $\pm 3$ ). The eight gambling frequency variables were significantly skewed and kurtotic, hence the assumption of normality was violated. Kruskal-Wallis tests were selected and run to address this violation through non-parametric testing. Unfortunately, the change to Kruskal-Wallis tests led to the inability to include age and gender as covariates as originally intended. In the remaining ANOVA analyses, Levene's tests of Homogeneity of Variance were run to assess for homogeneity of variances with most analyses meeting the assumption. In cases where the Levene's test was significant, Welsh ANOVA values are presented with posthoc Games-Howell tests run instead of Tukey tests. For the pair of chi-square tests, the expected cell frequencies were greater than five for gender and marital status.

### **Demographics**

A breakdown of both personality dimensions and types by gender is shown in Tables 4 and 5, respectively. Note that although all five personality factors were included, only conscientiousness, extraversion, and neuroticism were used to create the personality types

defined by Vollrath and Torgersen's typology. ANOVAs revealed a gender difference in personality, with women presenting with significantly higher levels of conscientiousness  $F(1, 1313) = 14.97, p < .001$ , partial  $\eta^2 = .011$ ), agreeableness (Welch's  $F(1, 1204.31) = 70.616, p < .001$ ), and neuroticism ( $F(1, 1313) = 22.45, p < .001$ , partial  $\eta^2 = .017$ ) than men (Table 4). The eight personality types were distributed relatively unevenly (Table 5), with a large portion of the sample categorized as either the entrepreneur or the insecure type. The three most common personality types were the entrepreneur (389, 29.6 %), insecure (375, 28.5%), and impulsive (116, 8.8 %) types. To examine the relationship between gender and personality type, a series of chi-square analyses were performed. Men significantly outnumbered women among the spectator ( $\chi^2(1) = 31.05, p < .001$ ) and hedonist types ( $\chi^2(1) = 28.17, p < .001$ ), whereas the opposite held true for the brooder ( $\chi^2(1) = 6.87, p < .05$ ) and complicated types ( $\chi^2(1) = 6.82, p < .05$ ).

Table 4

*Personality dimensions by gender*

	All (N=1315)	Men (n=584)	Women (n=731)	F	P-value
Personality Trait	M (SD)	M (SD)	M (SD)		
Conscientiousness	33.48 (6.78)	32.67 (6.67)	34.12 (6.81)	14.97	0.00***
Extraversion	27.53 (6.21)	27.32 (6.30)	27.70 (6.14)	1.24	0.27
Neuroticism	17.86 (9.67)	16.46 (9.38)	18.98 (9.76)	22.45	0.00***
Openness	28.07 (6.12)	27.80 (6.08)	28.28 (6.08)	2.01	0.16
Agreeableness	33.10 (6.04)	31.56 (6.13)	34.33 (5.68)	70.61	0.00***

*Note.* Only conscientiousness, extraversion, and neuroticism are used in Vollrath and Torgersen's typology; \*\*\* $p < .001$

Table 5

*Personality types by gender*

Type	Composition	Men n (%)	Women n (%)	Total n (%)	$\chi^2$	P-value
Spectator	E-, N-, C-	56(75.7)	18(24.3)	74(5.6)	31.05	0.00***
Skeptic	E-, N-, C+	51(50.0)	51(50.0)	102(7.8)	1.40	0.25
Hedonist	E+, N-, C-	49(76.6)	15(23.4)	64(4.9)	28.17	0.00***
Entrepreneur	E+, N-, C+	158(40.6)	231(59.4)	389(29.6)	3.22	0.08
Insecure	E-, N+, C-	161(42.9)	214(57.1)	375(28.5)	0.46	0.50
Brooder	E-, N+, C+	25(30.5)	57(69.5)	82(6.2)	6.87	0.01*
Impulsive	E+, N+, C-	47(40.5)	69(59.5)	116(8.8)	3.22	0.08
Complicated	E+, N+, C+	37(32.7)	76(67.3)	113(8.6)	6.82	0.01*
Total		584(44)	731(56)	1315(100)		

Note. \* $p < 0.05$ , \*\*\* $p < 0.001$

Table 6 displays the means (and SDs) for the demographic variables as a function of personality type. I analysed the demographic variables (i.e., age, total years of education, and income) through a set of ANOVAs (with continuous demographic variables) or chi-square analysis (with the two dichotomous demographic variables gender and marital status, which was coded as either living with a partner or not living with a partner). For the ANOVAs on the continuous demographic variables, there were significant main effects of personality type on income (Welch's  $F(7, 332.08) = 13.13, p < .001$ ), education ( $F(7, 1307) = 5.74, p < .001$ , partial  $\eta^2 = .030$ ), and age ( $F(7, 1307) = 10.36, p < .001$ , partial  $\eta^2 = .053$ ). Those with skeptic personality types tended to be older, whereas those with impulsive personality types were younger. Individuals with a hedonist personality type tended to have higher education and higher incomes. For the dichotomous demographic variables, there were significant differences among in terms of marital status ( $\chi^2(7) = 33.21, p < .001$ ) and gender ( $\chi^2(7) = 73.37, p < .001$ ). Those with spectator personality types tended to be single, while those with brooder personality types tended to be married. These results suggest that personality types were significantly different in their demographics, which could possibly influence the study's findings. While these variables

would typically be included as covariates in further analyses, this was not possible for the Kruskal-Wallis tests performed in this study.

Table 6

*Means (and SDs) for the Demographic Variables as Functions of Personality Type*

	Spectator n=74	Skeptic n=102	Hedonist n=64	Entrepreneur n=389	Insecure n=375	Brooder n=82	Impulsive n=116	Complicated n=113
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Gender***								
Men	56	51	49	158	161	25	47	37
Women	18	51	15	231	214	57	69	76
Marital status *** (% single)	3%	22%	28%	22%	35%	55%	43%	35%
Age*** (years)	49.89 (14.40)	50.77 (11.79)	43.25 (14.31)	46.15 (13.40)	45.47 (14.08)	47.76 (13.39)	37.97 (14.61)	41.51 (12.86)
Years of education *** (rated 0 to 8)	5.41 (1.63)	5.43 (1.64)	6.17 (1.24)	5.83 (1.48)	5.27 (1.59)	5.23 (1.58)	5.48 (1.51)	5.49 (1.57)
Household income*** (rated 1 to 12)	5.30 (2.87)	5.19 (2.98)	7.14 (3.34)	6.04 (3.18)	4.33 (2.80)	4.76 (2.97)	4.44 (2.96)	5.01 (2.92)

Note. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

A breakdown of participants' personality type by PGSI classification is shown in Table 7. As seen in the table, the insecure (46%) and impulsive (21%) personality types account for most of the moderate and problem gamblers in the sample. An ANOVA analysis on PGSI classification by personality type revealed a significant main effect (Welch's  $F(7, 329.22) = 10.80, p < .001$ ). Games-Howell posthoc tests demonstrated a significant difference between the insecure type with the entrepreneur ( $p < .001$ ) and skeptic types ( $p = .007$ ); the impulsive type with the entrepreneur ( $p < .001$ ) and skeptic types ( $p = .015$ ); the entrepreneur type and the complicated type ( $p < .001$ ). These classifications suggest that individuals with either the insecure or impulsive personality types tend to have difficulties controlling their gambling behaviour, while the skeptic and entrepreneur types have fewer problems with gambling.

Table 7

*PGSI classification by personality type*

Personality Type	PGSI Classification			
	No gambler problem (n=927)	Low risk gambler (n=255)	Moderate risk gambler (n=112)	Problem gambler (n=21)
Spectator	55	13	6	0
Skeptic	79	18	4	1
Hedonist	39	24	1	0
Entrepreneur	325	52	11	1
Insecure	234	80	51	10
Brooder	61	16	3	2
Impulsive	67	21	21	7
Complicated	67	31	15	0

*Note.* Numbers refer to the how many of participants are in a given category (personality type X

PGSI classification)

### Personality and Gambling

I conducted a pair of Kruskal-Wallis tests to determine whether there were differences in total gambling frequency (the average of all 8 gambling activities) and total money lost between the eight personality types. Through these analyses, I tested my two hypotheses: that individuals with either the impulsive or insecure personality types would demonstrate a tendency to gamble and spend more playing non-strategic, chance games, while individuals with either the hedonist or entrepreneur personality types would gamble and spend more playing strategic, skill games. Both tests revealed that neither total gambling frequency,  $\chi^2(7) = 3.473, p = .838$  nor total money lost,  $\chi^2(7) = 4.495, p = .721$  were significantly associated with personality type. Grouping each gambling activity into strategic (casino table, skill, sports, horses/dogs) and non-strategic (lottery, scratch, bingo, EGMs) gambling demonstrated significant results for strategic gambling. Specifically, median strategic gambling frequency,  $\chi^2(7) = 32.324, p < .001$ , was found to be statistically significant. The distributions of strategic gambling frequency were similar across the personality types, as assessed by visual inspection of a boxplot (see Figure 2, Appendix A). In

order to determine specific group differences between the personality types, I performed subsequent pairwise comparisons using Dunn's (1964) procedure. I used Bonferroni corrections for multiple comparisons and adjusted  $p$ -values are presented. Pairwise comparisons of strategic gambling revealed that those with hedonist personality types played more strategic forms of gambling than the skeptic ( $p < .001$ ), brooder ( $p = .001$ ), insecure ( $p = .001$ ), complicated ( $p = .012$ ), and entrepreneur types ( $p = .043$ ). Individuals with skeptic personality types were also found to play less strategic gambling than those with impulsive types ( $p = .04$ ).

I used further analyses to examine the relationship between personality type and each gambling activity in both frequency and money lost. Through a series of Kruskal-Wallis tests (see table 8) I explored whether there were differences in gambling between the eight personality types in terms of their specific gambling preferences. Median gambling frequency amongst the personality types was found to be statistically significant for bingo,  $\chi^2(7) = 15.302$ ,  $p = .032$ , and casino table games,  $\chi^2(7) = 27.503$ ,  $p < .001$ , while the distribution of skill games was statistically significantly ( $\chi^2(7) = 35.115$ ,  $p < .001$ ). The distributions of gambling frequency were similar for bingo and casino table games across the personality types, as assessed by visual inspection of a boxplot (see figures 3-4, Appendix). The distributions of gambling frequency in skill games were judged to be not similar across personality types, hence the distributions, rather than median scores, were compared (see figure 5, Appendix). In order to determine specific group differences between the personality types, I performed pairwise comparisons using Dunn's (1964) procedure. I used Bonferroni corrections for multiple comparisons and adjusted  $p$ -values are presented. In regards to bingo play, there were no significant group differences between the eight personality types. Pairwise comparisons of casino table games play revealed that the insecure type gambled less frequently on casino table games than the impulsive ( $p = .004$ ) and

hedonist ( $p = .012$ ) personality types. Individuals with the hedonist type, in turn, demonstrated a preference for skill games, with more frequent play than the brooder ( $p = .001$ ), skeptic ( $p = .030$ ), and insecure ( $p = .007$ ) personality types. In contrast, those with brooder types played less skill games than the entrepreneur ( $p = .021$ ) and impulsive ( $p = .002$ ) personality types. Likewise, the insecure type played less than the impulsive ( $p = .016$ ) personality type. No other combinations were found to be significant.

Table 8

*Gambling frequency by activity as a function of personality type using Kruskal-Wallis tests*

Gambling Activity		Spectator N-E-C- n=74	Skeptic N-E-C+ n=102	Hedonist N-E+C- n=64	Entrepreneur N-E+C+ n=389	Insecure N+E-C- n=375	Brooder N+E-C+ n=82	Impulsive N+E+C- n=116	Complicated N+E+C+ n=113
Lottery	M (SD)	1.77(1.37)	1.89(1.30)	1.72(1.40)	1.88(1.31)	1.86(1.32)	1.80(1.37)	1.71(1.31)	2.10(1.20)
Scratch	M (SD)	1.03(1.29)	0.98(1.01)	1.03(1.26)	1.07(1.09)	1.21(1.12)	1.13(1.184)	1.34(1.25)	1.11(1.03)
Bingo*	M (SD)	0.24(0.84)	0.27(0.81)	0.11(0.36)	0.23(0.62)	0.35(0.84)	0.26(0.66)	0.35(0.75)	0.32(0.77)
EGM	M (SD)	0.49(0.76)	0.56(0.78)	0.58(0.79)	0.49(0.60)	0.50(0.73)	0.44(0.57)	0.47(0.65)	0.57(0.69)
Casino***	M (SD)	0.09(0.21)	0.05(0.15)	0.22(0.53)	0.13(0.39)	0.07(0.28)	0.07(0.30)	0.19(0.47)	0.07(0.19)
Skill***	M (SD)	0.49(1.13)	0.25(0.75)	0.71(1.21)	0.38(0.88)	0.31(0.86)	0.15(0.53)	0.51(0.99)	0.36(0.81)
Sports	M (SD)	0.23(0.76)	0.22(0.77)	0.45(1.07)	0.24(0.76)	0.20(0.71)	0.21(0.75)	0.28(0.82)	0.22(0.77)
Horses	M (SD)	0.10(0.49)	0.06(0.20)	0.12(0.28)	0.08(0.34)	0.11(0.51)	0.10(0.44)	0.08(0.32)	0.08(0.38)

*Note.* Gambling frequency = In the past 12 months, how often have you gambled on the following activity; N+E+C-= high neuroticism + high extraversion + low conscientiousness; M = mean; SD = standard deviation.

\* $p < .05$ , \*\*\* $p < .001$

Table 9

*Money lost by activity as a function of personality type using Kruskal-Wallis tests*

Gambling Activity		Spectator N-E-C- n=74	Skeptic N-E-C+ n=102	Hedonist N-E+C- n=64	Entrepreneur N-E+C+ n=389	Insecure N+E-C- n=375	Brooder N+E-C+ n=82	Impulsive N+E+C- n=116	Complicated N+E+C+ n=113
Lottery	M (SD)	-21.42 (73.94)	-37.12 (209.17)	-11.78 (49.85)	-16.75 (109.04)	-18.97 (55.84)	11.88 (176.83)	-20.45 (60.58)	-16.05 (155.50)
Scratch*	M (SD)	-1.65 (31.35)	-5.39 (25.75)	-1.62 (17.15)	-10.44 (80.21)	-11.74 (55.59)	-1.00 (67.80)	-17.13 (42.63)	-4.59 (22.80)
Bingo	M (SD)	-14.39 (59.15)	-12.86 (55.33)	0.17 (13.99)	-3.06 (46.36)	-10.49 (62.26)	29.29 (392.89)	-12.09 (51.74)	-5.02 (26.80)
EGM	M (SD)	-30.93 (124.17)	-51.80 (280.45)	-13.18 (62.56)	-24.79 (95.81)	-26.74 (140.40)	-20.37 (53.30)	-27.74 (108.14)	-28.50 (147.70)
Casino**	M (SD)	-11.59 (65.21)	-4.07 (19.10)	-12.19 (137.80)	-5.05 (65.72)	-11.75 (134.25)	5.98 (90.82)	-28.91 (138.93)	-3.96 (51.52)
Skill	M (SD)	-139.15 (1162.20)	0.54 (32.33)	-2.27 (47.80)	0.53 (72.00)	-6.14 (41.63)	2.39 (33.94)	-9.95 (56.98)	9.12 (95.37)
Sports	M (SD)	-0.50 (43.06)	-1.54 (10.66)	-3.04 (53.94)	-1.28 (35.32)	-1.88 (13.12)	-3.17 (33.91)	-3.47 (11.50)	-2.01 (10.86)
Horses	M (SD)	-55.81 (464.86)	-2.01 (10.72)	-2.73 (14.28)	-2.71 (25.05)	-11.07 (116.21)	0.00 (8.05)	-3.01 (11.50)	0.12 (5.02)

*Note.* Money lost = roughly how much do you spend on a given gambling activity in atypical month; positive values represent money won, negative values represent money lost; N+E+C-= high neuroticism + high extraversion + low conscientiousness; M = mean; SD = standard deviation.

\*p< .05, \*\*p< .01

I also performed a series of Kruskal-Wallis to determine if there were differences in money lost across the different gambling activities as a function of personality type (see table 9). These analyses were run to further explore if endorsing a certain personality type leads to particular gambling preferences, as demonstrated by their spending habits. Median money lost amongst the personality types was found to be significantly different for two forms of gambling: scratch ( $\chi^2(7) = 19.690, p = .006$ ) and casino table games ( $\chi^2(7) = 18.284, p = .011$ ). The distributions of money lost across the scratch and casino table games were similar for all personality types, as assessed by visual inspection of a boxplot (see figures 6-7, Appendix). Again, pairwise comparisons were performed using Dunn's (1964) procedure, with adjusted  $p$ -values presented. In regards to scratch play, the impulsive type was found to lose more money than the entrepreneur ( $p = .031$ ), spectator ( $p = .041$ ), and hedonist ( $p = .013$ ) personality types. No other combinations were found to be significant. In regards to casino table game play, those with impulsive type were found to lose significantly more on casino table games than the insecure ( $p = .012$ ) and complicated ( $p = .025$ ) personality types. No other combinations were found to be significant.

### **Gender and Gambling**

I performed a pair of Mann-Whitney tests to determine if there were gender differences in total frequency played and total money lost across the different gambling activities. With these analyses, I tested my hypothesis that men would prefer strategic gambling, while women would prefer non-strategic gambling. Both tests revealed that neither total gambling frequency nor total money lost was significantly associated with gender.

I conducted further analyses to examine the relationship between gender and each gambling activity in both frequency and money lost. Through a series of Mann-Whitney tests, I

explored whether there were gender differences in frequency played and money lost across the different gambling activities (see tables 10 and 11). The distributions of frequency played and money lost across the different gambling activities were similar across gender, as assessed by visual inspection of a boxplot (see figures 8-16, Appendix). Median frequency of play was found to be significantly different, with women playing scratch ( $U = 247, 139.00, p < .001$ ) and bingo ( $U = 242, 0246.50, p < .001$ ) more than men. Men were found to play casino table games ( $U = 185, 855.50, p < .001$ ), skill ( $U = 178, 074.50, p < .001$ ), sports ( $U = 174, 844.00, p < .001$ ), and racing ( $U = 203, 496.50, p < .01$ ) more than women. Median money lost was found to be significantly different, with women losing more on scratch ( $U = 193, 360.00, p < .01$ ) and bingo ( $U = 199, 666.50, p > .01$ ) than men. Men were found to lose more on sports betting ( $U = 230, 638.50, p < .001$ ) than women.

Table 10

*Gambling frequency by activity as a function of gender using Kruskal-Wallis tests*

Gambling Activity		Gender	
		Men n = 584	Women n = 731
Lottery	M (SD)	1.91 (1.35)	1.82 (1.28)
Scratch***	M (SD)	0.98 (1.13)	1.25 (1.15)
Bingo***	M (SD)	0.15 (0.47)	0.39 (0.88)
EGM	M (SD)	0.49 (0.66)	0.52 (0.70)
Casino***	M (SD)	0.17 (0.45)	0.05 (0.21)
Skill***	M (SD)	0.53 (1.05)	0.24 (0.71)
Sports***	M (SD)	0.42 (1.02)	0.09 (0.43)
Dog/Horse Racing**	M (SD)	0.13 (0.51)	0.06 (0.29)

*Note.* Gambling frequency = In the past 12 months, how often have you gambled on the following activity; M = mean; SD = standard deviation.

\*\* $p < .01$ , \*\*\* $p < .001$

Table 11

*Money lost by activity as a function of gender using Kruskal-Wallis tests*

Gambling Activity		Gender	
		Men n = 584	Women n = 731
Lottery	M (SD)	-17.68 (98.97)	-14.75 (121.99)
Scratch**	M (SD)	-10.78 (78.41)	-7.57 (34.89)
Bingo**	M (SD)	2.25 (147.28)	-11.45 (65.95)
EGM	M (SD)	-26.87 (145.21)	-28.05 (128.50)
Casino	M (SD)	-13.98 (140.64)	-4.89 (47.77)
Skill	M (SD)	-17.71 (421.58)	-2.83 (30.04)
Sports***	M (SD)	-3.35 (40.35)	-0.71 (5.55)
Dog/Horse Racing	M (SD)	-15.73 (190.61)	-1.19 (9.97)

*Note.* Money lost = Roughly how much do you spend on a given gambling activity in a typical month; positive values represent money won, negative values represent money lost M = mean; SD = standard deviation.

\*\*p< .01, \*\*\*p<.001

### Discussion

The principal aim of this study was to explore the relationship between personality and gambling preferences through three hypotheses. The first hypothesis predicted that individuals with either the impulsive or insecure personality types would demonstrate a preference for non-strategic, chance games (e.g. EGMs, bingo). This hypothesis was partially supported in the results. Specifically, the impulsive personality type lost more money on scratch and casino table games than other subtypes, while the insecure personality type was among the lowest in frequency played on casino table games and skill games. Individuals with the insecure personality type were also found to lose less money on casino table games. Contrary to the study's initial hypothesis, the impulsive personality type demonstrated a preference for more strategic forms of gambling, as seen in their greater frequency played in casino table games and skill games. The second hypothesis, that individuals with either the hedonist or entrepreneur personality types would prefer strategic, skill games (e.g. poker, sports betting), was partially supported by the results. While individuals with the hedonist personality type demonstrated a

preference for more strategic forms of gambling, as seen in their greater frequency played in casino table games and skill games, the entrepreneur personality type was not found to be associated with strategic gambling. The final hypothesis predicted a gender difference in gambling preferences, whereby men would prefer strategic gambling, while women would prefer non-strategic gambling. This hypothesis was supported by the results, where men were found to prefer strategic games (casino table games, skill, sports, racing) and women were found to prefer non-strategic games (scratch, bingo). Likewise, men were found to lose more money on strategic games (sports betting), while women lost more on non-strategic games (scratch, bingo). Overall, the results partially supported the predicted hypothetical preferences.

As hypothesized, the results of the study appear to support the idea that the motive for playing strategic games is arousal based (Bonnaire et al., 2004; Ledgerwood & Petry, 2006), with those personality types high in extraversion showing a preference for strategic games. Specifically, the hedonist and impulsive subtypes (both involve high extraversion) were found to prefer strategic games, like casino table games and skill games. These personality types were found to gamble more frequently on these game types than the personality types low in extraversion, namely the skeptic, insecure, and brooder types. The purpose of gambling behaviour for these individuals might be to increase arousal and is consistent with multiple other studies (Bagby et al., 2007; Langewisch & Frisch, 1998) that have demonstrated a significant association between sensation seeking and general gambling behaviour. While the aforementioned studies found no association between sensation seeking and problem gambling, the results of the current study found that the impulsive subtype (high extraversion, high neuroticism, low conscientiousness) accounted for 46% of the moderate risk and problem gamblers in the study. There is some inconsistency in the gambling literature in regards to the

relationship between sensation seeking and problem gambling. While some studies have found a significant relationship with problem gambling (Blaszczynski, Wilson, & McConaghy, 1986; Mysreth et al., 2009), others have only found an association with gambling per se (Bagby et al., 2007; Langewisch & Frisch, 1998). For example, Myrseth et al. (2009) found problem gambling was associated with a high need for stimulus intensity. This finding is consistent with one of the criteria for gambling disorder, specifically the need for gamblers to gamble with increasing larger amounts of money in order to achieve their desired excitement (American Psychiatric Association, 2013). This need for stimulus intensity may reflect the abnormal arousal level (Zangeneh et al., 2008) and low baseline levels of endorphins (Blaszczynski, Wilson, & McConaghy, 1986) seen in gamblers.

Results also partially supported the hypothesis that personality types with high neuroticism and low conscientiousness (impulsive and insecure personality types) would prefer non-strategic gambling due to their difficulties with impulse control (Bagby et al., 2007). While there were no significant effects found for the individual non-strategic forms of gambling, the insecure type was consistently amongst the lowest in frequency played for strategic forms of gambling. Additionally, the impulsive type was found to lose significantly more on scratch tickets (a non-strategic form of gambling) than the entrepreneur, spectator, and hedonist subtypes. However, the impulsive type also demonstrated a preference for strategic forms of gambling as well, as seen in their high frequency of play on casino table games and skill games, as well as their losing more on casino table games than the insecure and complicated personality types. These unpredicted results are most likely associated with the role of extraversion, a personality factor not accounted for in the original hypothesis. As discussed earlier, the strength of the Torgersen's typology is the combinative effects of including multiple personality factors

under one type, thereby allowing these factors to interact. In the current study, extraversion was positively related to gambling severity in some gamblers (impulsive and hedonist types), yet negatively related to others (entrepreneur). Only the combination of neuroticism, conscientiousness, and extraversion was able to explain these seemingly conflicting results. These results suggest that conscientiousness regulates the effects of high neuroticism and extraversion (Clark & Watson, 1999). The higher risk typologies found in the study (impulsive, hedonists, insecure) were characterized by low conscientiousness. Overall, conscientiousness appears to be the most consistent personality predictor of problem gambling severity in the current study. Several characteristics of low conscientiousness could explain its positive relationship with problem gambling, including its focus on immediate needs over future consequences (West et al., 1993) and greater risk taking (Bermúdez, 1999; Clarke & Robertson, 2005; Vollrath et al., 1999; Vollrath & Torgersen, 2002). In contrast, high conscientiousness is associated with improved quality of life and goal-directed behaviour (Bermúdez, 1999).

The findings of the current study also bear similarities to previous studies that have adopted the Torgersen typology to examine risk taking and stress. (Grant & Langan- Fox, 2006; Lau, Hem, Ekeberg & Torgersen, 2006; Pittenger, 2004; Vollrath & Torgersen, 2000, 2002, 2008). In studies of stress and coping (Vollrath & Torgersen, 2000, 2002), the personality types that combined low neuroticism with high conscientiousness (skeptical, entrepreneur) reported a high stress tolerance and had adaptive coping, while personality types combining high neuroticism with low conscientiousness (insecure, impulsive) showed high vulnerability to stress and poor coping. The role of extraversion was more ambiguous as it seemed to depend on the specific combination of the other two personality traits (Vollrath & Torgersen, 2000). Similar results have been found in a replication of this study (Grant & Langan- Fox, 2006; Lau, Hem,

Ekeberg & Torgersen, 2006; Pittenger, 2004), as well as a study examining risky health behaviours (Vollrath & Torgersen, 2008). In the current study, similar results were found as personality types combining high neuroticism and low conscientiousness demonstrated greater risk taking (as seen in their problem gambling classifications). Likewise, a study exploring risk taking in high-risk sports (Castanier, Le Scanff, & Woodman, 2013) identified high, neutral, and low-risk typologies from Torgersen's personality typology. Specifically, the impulsive, hedonistic, and insecure types reported greater risk-taking behaviour, with impulsive types reporting the most accidents. In contrast, the skeptic, brooder, and entrepreneur types reported significantly fewer accidents. Finally, the result for the spectator and complicated types were non-significant (e.g. neither low nor high risk for accidents and risk taking). In the current study, through grouping the four PGSI classifications by personality type it was found that the insecure and impulsive types accounted for most of the moderate risk and problem gamblers in the study. Additionally, those with the hedonist type were found to gamble more frequently on skill games than the brooders and skeptics. Hence, Castanier, Le Scanff, and Woodman's (2013) low risk and high-risk typologies were supported in the current study.

The propensity to take risks and gamble in both the impulsive and hedonist personality types could be explained by their desire to enhance bodily sensation (Cooper et al., 2000). This strong arousal motivation, in turn, leads to a tendency to focus on satisfying immediate needs for stimulation, regardless of future consequences (West et al., 1993; Zuckerman, 1990). These personality types, particularly the impulsive types in the current study, are regular gamblers with identified gambling problems, as demonstrated by their PGSI classification. Despite their most likely knowledge that gambling has a negative expectancy, these individuals continue to engage in gambling activities, ignoring the negative future outcomes of their behaviour. While the high

endorsement of neuroticism in those with the impulsive type suggest these risk-taking behaviours may also be fulfilling the role of regulating negative affect (Cooper et al., 2000; Taylor & Hamilton, 1997), those with the hedonist type (who are low in neuroticism) are likely driven solely by their need to generate positive affect through risky behaviours like gambling (Zuckerman, 1990).

The gender differences in gambling preferences demonstrated in the current study support the findings in the gambling literature. It was found that men significantly preferred strategic gambling, while women were found to prefer non-strategic gambling (Ledgerwood & Petry, 2006; Nower & Blaszczynski, 2005; Potenza, et al., 2001; Vitaro, Arseneault, & Tremblay, 1997; Wilson & Ross, 2009, Young & Stevens, 2009). Specifically, in measuring gambling frequency across eight different forms of gambling, men were found to play casino table games, skill games, sports, and horse/dog racing (all strategic forms of gambling) more than women. In contrast, women played scratch tickets and bingo more than men. The results of the Mann-Whitney tests on gender differences in money lost on each gambling activities also supported the hypothesis. Specifically, women were found to lose more on scratch tickets and bingo than men, while men lost more on sports betting than women. The gender differences found in gambling preferences are in agreement with the qualitative and quantitative research in the gambling literature. In a qualitative study of gender differences in gambling preferences (Wilson & Ross, 2009), men noted a general preference for strategic forms of gambling (sports betting, dice), while women described a preference for non-strategic gambling (lottery, scratch). Additionally, women described little interest in the gambling activities that men were interested in (poker, sports betting) and found activities with larger risk aversive. Wilson & Ross also found gender differences in gambling motives, which may explain these differences in

preference. Specifically, men in the study described gambling as primarily a social experience, while women described it as a more of a solitary activity. These preferences suggest different motives to gamble based on one's gender, which has been confirmed in multiple gambling motive studies (Milosevic & Ledgerwood, 2010; Stewart & Zack, 2008). In quantitative studies exploring the gender differences in gambling preferences, multiple studies have found that women show a preference for low-skill forms of gambling (Nower & Blaszczynski, 2005; Young & Stevens, 2009; 20-22) such as slot machines, whereas men are more likely to engage in table games and sports betting (Grant & Kim 2002; Hing & Breen, 2001). A potential explanation for these differences might follow from considering the levels of arousal each form of gambling creates. For example, strategic gambling has been found to elicit higher levels of arousal than non-strategic gambling (Hing & Breen, 2001). This need for arousal is demonstrated by the tendency for men to score higher on sensation seeking measures than women (Coventry & Constable, 1999; Vitaro et al., 1997). In contrast, non-strategic forms of gambling have been found to be associated with lower sensation-seeking and arousal (Coventry & Constable, 1999). Alternatively, these gender differences in gambling preferences could also be explained by the social and cultural acceptability for men and women to engage in them. Some forms of gambling are linked to more male dominated environments (e.g. race track, poker tables at casinos), which may influence women's likelihood of engaging in these forms of gambling. For example, Volberg (2003) noted an increase in women's gambling in four states coinciding with the expansion of slot machines into less gendered environments (e.g. clubs and convenience stores).

The analyses I performed to explore gender effects on personality dimensions and types demonstrated that women were significantly higher on conscientiousness and neuroticism than men. These results were expected and fit with the establish gender differences detailed in the

personality literature. For example, Desai and Potenza (2008) found higher rates of depression and negative emotionality (anxiety, dysthymia) among women who are problem gamblers than men who are problem gamblers (Desai & Potenza 2008). The results of a series of chi-square analyses examining the eight personality types by gender replicated the patterns seen in the personality dimensions. Specifically, women were more likely to be categorized as the brooder and complicated personality types (both featuring high neuroticism and high conscientiousness), while men were more likely to be classified as the spectator and hedonist types (both feature low neuroticism and low conscientiousness).

### **Limitations**

Although results from the present study are promising, there are several limitations to consider. First, due to the cross-sectional design of the study, temporal relationships between personality type and gambling preference could not be assessed. In other words, the findings of the study cannot establish which whether personality type causes gambling preferences or vice versa. However, given that an individual's personality type develops at a young age, it is highly likely that personality type precedes gambling preferences and, as found in the current study, has some influence on gambling preferences. Second, while the use of a representative sample of the Canadian population allowed for greater generalization of this study's results, gamblers with more severe gambling problems accounted for only a small proportion of the sample. Overall, much of the sample engaged in very little gambling outside of buying lottery and scratch tickets. Replicating this study with a clinical sample would allow for greater generalization to individuals who are more frequent gamblers and for those who have gambling problems. Additionally, within the sample, there was high variance in money lost amongst the different forms of gambling. Given that Kruskal-Wallis tests do not assume normality and are a test of

ranks, they are robust to the presence of outliers and should reduce their influence on the data to some degree. Third, the Torgersen typology only includes three personality factors of the FFM model. In other words, Torgersen's typology does not account for the potential variance accounted for by openness to experience and agreeableness (Pittenger, 2004). Fourth, the use of a typological model over a dimensional model has been criticised for its reduction in power.

However, a study by Rovik et al. (2007), exploring the difference in results between the typological and dimensional approaches, found that the typology approach produced only a small loss of predictive power (3.7%). Based on Rovik et al.'s findings, the use of Torgersen's typology in this study likely resulted in a minimal loss of predictive power.

## **Study Two: Do Personality Factors Mediate the Relationship Between Gambling Behaviours and Gambling Severity?**

### **Personality, Gambling and Electronic Gambling Machines**

Gambling researchers have attempted to identify factors that influence a gambler's transition from non-pathological gambling to pathological gambling. These efforts have led to examining both individual and environmental factors, with an emphasis on the latter (Parke & Griffiths, 2006; Cox et al., 2010; Volberg, 2003; Ladouceur, 1991; Shepherd et al., 1998; Volberg & Steadman, 1988). As noted in the general introduction of this study, personality is one individual factor that has been examined in the gambling research literature. This research has, for the most part, concluded that neuroticism, conscientiousness, and agreeableness are related to problem gambling (MacClaren et al., 2011). While study 1 included various forms of gambling to explore the role of personality in influencing gambling preferences, the current study narrows the focus of gambling activity to Electronic Gambling Machines (EGMs). Given this particular focus on EGMs, the following section will summarize the key findings in the research literature examining EGMs and their unique characteristics. Just as the broader gambling research literature tends to examine environmental factors over individual factors, a similar focus can be seen in the research on gamblers who play EGMs. When studying EGM players, researchers have focused heavily on the features of the machines. For instance, Parke and Griffiths (2006) identified many factors that serve to either start or maintain EGM play. These include the use of advertisements, the placement of EGMs, and rapid play leading to immediate gratification. Two features prominently researched in EGMs are their intermittent reinforcement ratio schedules and the near miss. An intermittent reinforcement ratio schedule provides rewards for a behaviour randomly, which leads to a learned behaviour becoming increasingly entrenched. EGMs operate

on intermittent reinforcement ratio schedules by rewarding play unpredictably and regularly. This encourages a high and steady rate of responding, making EGM play a strongly learned behaviour. Near misses occur when the outcome of a spin is a loss but appears close to a win (e.g., a result where the winning symbols almost line up). Near misses encourage gambling, even though such a “close” loss has the same net monetary value as any other loss. Despite this fact, near misses are rated by gamblers as less pleasant than full misses and, when gamblers have the ability to manipulate the game in some way, increase gamblers motivation to continue gambling (Clark et al. 2009; Clark et al., 2012; Chase & Clark, 2010). Supporting these self report ratings, near misses have also been demonstrated to be associated with greater increases in electrodermal activity and heart rate acceleration compared to full misses (Clark et al., 2012). Further, functional neuroimaging of near misses has demonstrated activation in the reward-related regions of the brain (ventral striatum and anterior insula) that are also activated by monetary wins (Clark et al. 2009). In more severe problem gamblers, near misses are associated with enhancing dopamine transmission, which physiologically demonstrates how these gambling events increase the motivation to gamble. Over time, the physiological rewarding responses of near misses may result in an increase in both time spent gambling and bet size.

Recent studies on machine gambling have examined the effect of different payback percentages in identical EGM games and how playing multiline versus single line slots change gambling outcomes (Harrigan & Dixon, 2009; Harrigan, Dixon, & Brown, 2014). Payback percentages are the percentage of wagers that on average the gambler gets back. For example, an EGM with a 94% payback percentage returns, on average, 94 cents for every dollar wagered. In some gambling districts, EGMs are permitted to have identical games with different payback percentages (Harrigan & Dixon, 2009). Although by law, payback percentages must be restricted

to a set range (85-98% in Canada), there are often no restrictions in setting different percentages for the same game. In other words, one EGM could have a payback rate of 85%, while another EGM with the same game has a payback rate of 98%. Harrigan & Dixon (2009) ran a simulation to explore any potential differences in the gambler's experience between these different payback rates. They found that the 98% payback group had more total spins, winning spins, shorter intervals between bonus mode entries, and higher winning peaks. Although these differences in outcomes would likely not be detected by casual gamblers who typically play for shorter periods, heavy gamblers would likely detect the differences. These differences in outcomes reinforce many common cognitive distortions (e.g. irrational thoughts) concerning EGMs, especially those beliefs concerning "hot" versus "cold" machines.

The pairing of multiline slot games and losses disguised as wins (LDWs) has also been associated with increased gambling (Harrigan, Dixon, & Brown, 2014). These two factors represent two different EGM game characteristics that are commonly present in various EGM games. Many EGMs provide celebratory cues in the form of sirens, lights, and music to winning wagers. However, not all celebratory cues are triggered by wins, as LDWs also trigger these cues. An LDW occurs when a wager results in credits less than the total wager (e.g. wagering \$5.00 and winning \$2.00). A multiline slot game functions similarly to one-line slot games, except it provides the player additional lines to wager on. While investigating the differences between playing 20-line versus one-line games, Harrigan, Dixon, and Brown found that 20-line games provide a much more reinforcing experience. Through their simulations, 20-line games were found to provide higher hit frequency rates, shorter times between bonuses, more unique prizes, and LDWs. Of all the wagers that result in celebratory cues (sirens, lights, etc.), 60% were LDWs. Despite the losses in credit, LDWs are often physiologically experienced as small wins

by gamblers (Dixon et al., 2010) with increases in gambler's heart rate and skin conductance response. This reaction contributes to a cognitive error that misclassifies LDWs as wins. When gamblers are asked to recall how many wins occurred in a gambling session, gamblers playing single-line games were significantly more accurate (within 2) than those playing 20-line games (who tended to overestimate by approximately 15). This misclassification distorts the gambler's experience, creating the impression for the player of shorter losing streaks (Dixon et al., 2010). In single-line games, a win occurred on average once every 5.6 spins. In contrast, if players erroneously classify LDWs as wins in 20-line games, a win would occur every 2.08 spins. These differences in reinforcement rates have been shown to influence gamblers preferences, with players preferring multiline games because these games are characterized by shorter losing streaks and the player has the perception of a higher frequency of wins (Templeton, Dixon, & Harrigan, 2014). Additionally, LDWs have been hypothesized as a contributor to cognitive distortions, like the illusion of control, by fostering the belief of skill and mastery over gambling outcomes (Clark, 2010).

As demonstrated by the extensive research of EGM machine characteristics (e.g. intermittent reinforcement schedules, near misses, payback percentages, LDWs), there is a strong basis of research suggesting that EGMs have additive characteristics that may lead some individuals to develop a gambling problem. However, the current research literature on EGMs has neglected the role of individual factors and by doing so fails to account for the fact that the majority of individuals who play EGMs do not develop a gambling problem. Through this study, I aim to address this limitation by exploring the role of individual factors on gambling severity and EGM play. The chief aim of this study will examine whether personality factors influence the relationship between within-session gambling behaviours (time played, average bet

magnitude, number of bets, max bet use, money spent) and gambling severity. Specifically, in study 2 I performed a series of parallel mediation analyses to explore this relationship. I employed a quasi-experimental, between-subjects design to test my hypothesis. Given that problem gamblers seem to present with a personality profile of high neuroticism, low conscientiousness, and low agreeableness (MacClaren et al., 2011), I predicted that neuroticism, conscientiousness, and agreeableness will mediate the relationship between gambling severity and EGM play (e.g. time played, average bet magnitude, number of bets, max bet use, money spent).

## **Method**

### **Participants**

The sample consisted of 159 first year intro psychology students from the University of Manitoba (see Figure 17 for a flowchart of sampling process). As part of the consent process, I asked participants their age to ensure all participants were of legal age to gamble in Manitoba (eighteen years or older). Participants were also required to have played EGMs at least twice in the last month to ensure that participants were regular EGM players. To ensure problem gamblers were adequately represented in the study, they were actively recruited through a pre-study screen, which involved participants completing the PGSI to identify those who scored eight or above. A total of 1,973 students completed the pre-study screen. Students who met the criteria for problem gambling ( $n = 66$ ) were sent emails inviting them to participate in the study. Participants from the university's intro psychology classes were also invited to participate in the study through the university's website. Those interested in the study, completed the first part of the study online (e.g. completing a series of questionnaires) and scheduled a session in the lab to complete the final part of the study. The inclusion criterion, requiring participants to have played

EGMs at least twice in the last month, was assessed during the completion of the questionnaires. Overall, 533 students participated in the study, however, many students failed to meet the regular EGM criteria. This led to a final sample size of 159.

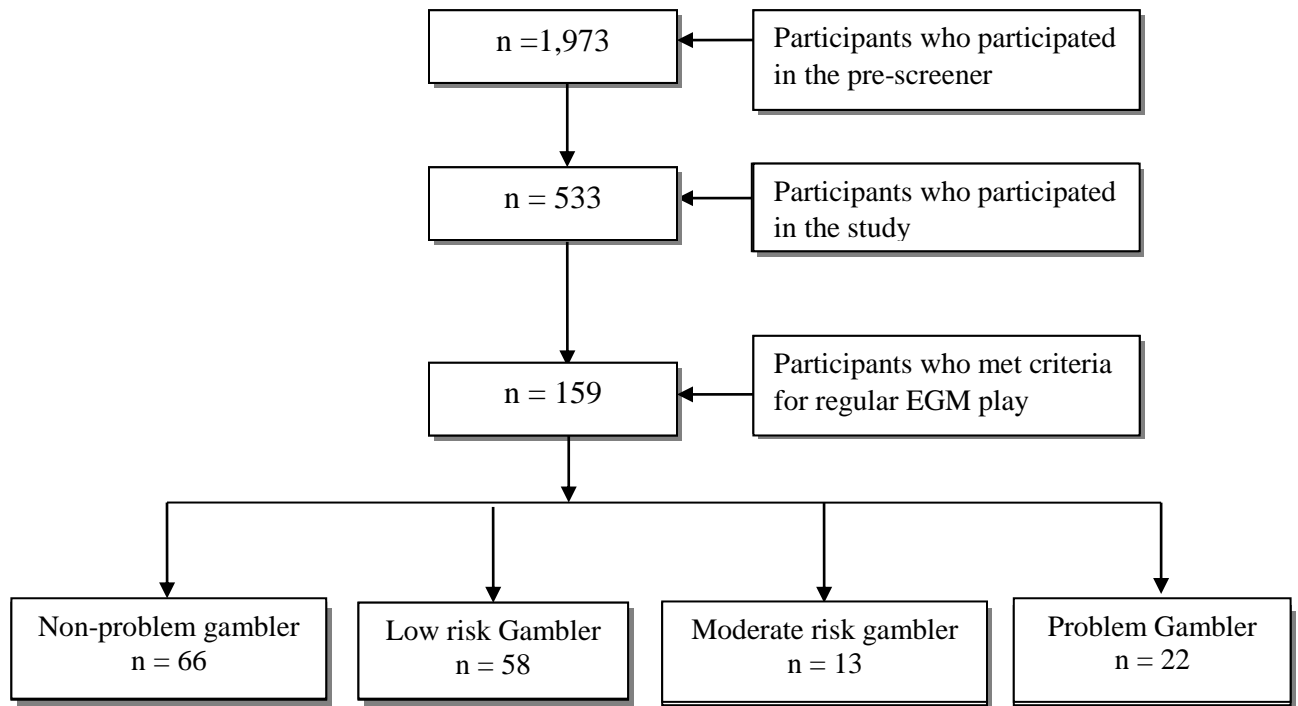
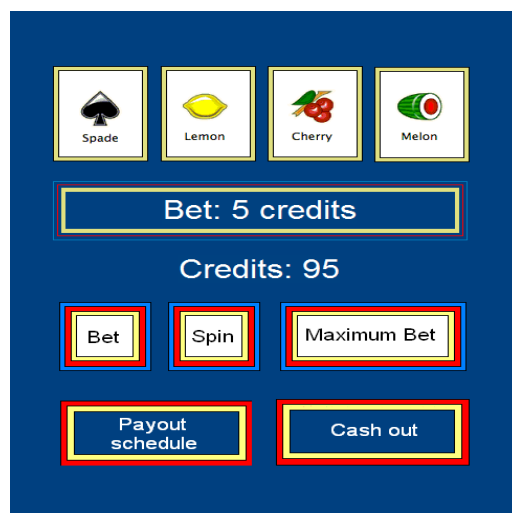


Figure 17. Flow chart of the sampling process.

## Materials

EGM play was simulated and recorded using a computer program simulation of an EGM slots game (see Figure 18 (Hurley, Ellery, & Jamieson, 2010)). The program monitors each participant's play and records multiple variables (e.g. time played, money lost/won, max bet use). The layout of the EGM slots game consisted of four digital reels, a spin button, and an adjustable bet button with the options of one to ten (max bet) per "spin". Inside the digital reel were numerous animations including fruits, numbers, and other gambling related symbols. After bet magnitude was set through the bet button, players clicked the spin button to activate the four

digital reels. The outcome of each wager depended on the final symbols displayed in the digital reels and whether they match one of the winning patterns seen in the payout schedule, accessed via the payout schedule button. The program displayed the number of credits won/lost for a given outcome and the number of credits bet. When the program began, the player was presented with instructions on how to play and the worth of each credit. The program began with 100 credits with each credit worth ten cents; hence they began with the equivalent of \$10.00. These credits were used to play the EGM simulation only and were not exchanged for actual money. Play came to an end after the allotted time for the experiment ran out (60 minutes) or when participants decide to terminate, whichever came earlier. Players could terminate the game, using the cash out button, at any time during the simulation. Based on a previous study using this program (Graves & Ellery, 2014), participants (on average) play the program for eight minutes and five seconds.



*Figure 18.* EMG simulation program.

## Measures

I used a series of questionnaires in study 2 to gather information on demographics, personality, gambling severity, gambling behaviour, and EGM play. Table 12 provides a

summary of the variables assessed and the instruments used to measure each variable. A brief description of each measure is included here.

Table 12

*Measures assessed in Study 2*

Domain	Variables of Interest	Instrument
<b>Demographics</b>	Age, Gender, Marital Status, Education	Demographics Questionnaire
<b>Personality</b>	Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism	International Personality Item Pool – NEO inventory
<b>Gambling</b>	Gambling Severity	Problem Gambling Severity Index
	Type, Monthly Frequency, and Spending	Gambling Activities Questionnaire
<b>EGM Play</b>	Money Spent, Time Played, Average Bet Magnitude, Games Played, Max Bet Use	EGM Simulation Program

**Gambling Severity.** As in the first study, I assessed gambling severity in study 2 by administering the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2003). However, in contrast to study 1 where I entered the PGSI as a categorical variable, I entered the PGSI as a continuous measure in study 2. To ensure a sufficient number of gamblers with greater gambling severity (e.g. higher PGSI scores), I attempted to recruit additional problem gamblers (PGSI scores >8). The PGSI scale had a high level of internal consistency in the current study; as determined by a Cronbach's alpha of 0.92.

**Gambling Activities Questionnaire.** This questionnaire consisted of a series of questions asking how often the participants plays sports betting, lottery/scratch tickets, charity lotteries, bingo, EGMs, table games, horse racing, poker, and internet gambling (scales ranging

from (1) never to (7) daily). The questionnaire also included questions on how many hours and how much money they spent per week on gambling.

**Demographics Questionnaire.** This questionnaire consisted of a series of demographic questions, such as age, gender, and family income.

**International Personality Item Pool – NEO Inventory (IPIP-NEO; Goldman, 1999).**

The IPIP-NEO was developed by Goldman (1999) to measure the same facets of the Big Five that are assessed by the NEO-PI-R (Costa & McCrae, 1992), including extraversion (E), neuroticism (N), openness (O), agreeableness (A) and conscientiousness (C). Along with the five major traits, the IPIP-NEO also measures the six facets that define each trait. Participants are asked to answer 120 questions using a five-point Likert scale (*strongly disagree to strongly agree*). The decision to use the IPIP-NEO instead of the NEO-PI-R was based on cost, however, the IPIP-NEO has been shown to be similar in content to the NEO-PI-R. The IPIP NEO scales correlated on average  $r = .66$  ( $r = .91$  when corrected for attenuation due to scale unreliability) with the NEO PI-R scales on which they were based. The current study found the following Cronbach's alphas: Neuroticism = 0.87, Extraversion = 0.83, Openness = 0.76, Agreeableness = 0.81, and Conscientiousness = 0.85.

**Post-Study Questionnaire** – To identify possible contamination effects, a post-study questionnaire was administered to assess a number of variables. The questionnaire included five statements and participants were asked to indicate how much they agreed with each one (scales ranging from (1) Strongly Disagree to (5) Strongly Agree). Specifically, these variables were included to examine for possible effects due to ecological validity (e.g. "The slots game in the study was an accurate and realistic simulation of a Video Lottery Terminal (VLT)"), influence on play by fellow participants (e.g. "My play on the slots machine was influenced by the other

participants in the room”), motivation (e.g. “I was highly motivated to have the high cash out and win the gift card”), and the effect of winning versus losing (e.g. “How frustrated or successful did you feel while playing the simulation”).

### **Procedure**

Students were invited to sign up for the pre-screener portion of the study during their intro psychology course and those interested completed the pre-screener in class. Those who scored 8 or above on the PGSI in were emailed to invite them to participate in the study. Students were also invited to participate in the study using the University of Manitoba website. All participants were presented with an informed consent form in which they had to agree to in order to participate in the study. Next, participants were administered a series of online self-report questionnaires, including the Gambling Activities Questionnaire (Dechant & Ellery, 2011), the IPIP-NEO (Goldman, 1999), the Demographics and Information Questionnaire (Ellery & Stewart, 2014), and the PGSI (Wynne, 2003), with the order of these questionnaires randomized across participants. These self-report questionnaires were administered online using Qualtrics, a web-based application that supplies tools to create online questionnaires and produces data in a useable form for statistic packages.

Following the completion of the questionnaires, participants booked an appointment for the in lab portion of the study. These appointments were scheduled to be run in groups, with 6 in each group. Arriving participants were directed to a computer desk where the informed consent form was re-reviewed. Participants then were invited to play the slots program for “as long as they wish”. The game was pre-loaded with \$10.00 and the participants were instructed that they could play as much or as little of the \$10.00 as they wish. Once participants either ran out of virtual money or indicated they wish to end their session, they were debriefed, completed a post-

study questionnaire, given a feedback statement, thanked for their participation and reimbursed with two credits towards their introductory psychology course.

**Statistical Analysis.** I performed my analyses using the Statistical Package for Social Sciences (SPSS) Software Version 23. I report effect sizes as partial eta squared ( $\eta^2$ ) with small, medium, and large effect sizes associated with  $\eta^2$  values of 0.01, 0.06, and 0.14 (Olejnik & Algina, 2000). I ran a series of ANOVAs and Chi-square analyses to examine various demographic variables by PGSI classification. Through a MANOVA, with follow-up univariate ANOVAs, I examined various gambling frequency variables, as well as the post study variables. I conducted a set of correlations to examine the relationship between the demographics, personality, and EGM variables. Next, I ran MANOVAs, with follow-up univariate ANOVAs, to examine the relationship between PGSI classifications with the EGM variables, as well as with the personality variables.

I performed a series of parallel mediation models to test whether personality mediates the relationship between PGSI defined gambling risk classifications and EGM play. These models were tested using a statistical mediation and moderation program, PROCESS, which tests for both direct and indirect effects (Hayes, 2012). Specifically, three models were tested: an overall model (including all personality factors), a model corresponding to Eysenck's personality model (neuroticism, conscientiousness, extraversion), and a model corresponding to the personality profile identified in the gambling literature (neuroticism, conscientiousness, agreeableness). Significance tests for each of the mediated effects of gambling group on EGM play were obtained using the estimation methods described by Preacher and Hayes (2004, 2008) including bootstrapped estimates for confidence intervals (for bootstrapping,  $z = 5,000$  samples were requested). Age and gender were included as covariates. Direct and indirect effects were

estimated for the effects of PGSI classification on the five EGM measures, with the personality factors as parallel mediating variables.

Finally, I ran post hoc moderation and mediation analyses to examine if agreeableness or conscientiousness could possibly be influencing the relation between gambler status and EGM play act as a moderator or mediated moderator. These analyses were tested using the procedure as described by Preacher and Hayes (2003) via the statistical mediation program, PROCESS.

## **Results**

### **Assumptions**

I examined the distributions of variables using a series of ANOVAs, which had skew and kurtosis values that were within acceptable limits (e.g. values less or greater than  $\pm 3$ ). One exception was PGSI score, which showed marked positive skew. This variable was therefore transformed using a log transformation. After transformation, skew values fell within acceptable limits. To assess for homogeneity of variances, Levene's tests of Homogeneity of Variance were run with most analyses meeting the assumptions. In cases where the Levene's test was significant, Welch ANOVAs are reported with posthoc Games-Howell tests instead of Tukey tests. For the pair of chi-square tests, the expected cell frequencies were greater than five for gender, but less than five for marital status. To address this violation of expected cell frequencies, a Fisher's exact test was performed.

In the MANOVA analyses, the assumption of the equality of variance-covariance matrices was assessed using the Box's M test. All the MANOVA analyses were not significant, indicating the assumption was met and there was homogeneity of variance-covariance matrices. To assess for the possibility of multicollinearity in the predictor variables, variance inflation factor (VIF) values for each predictor were assessed. Through several analyses regressing each

predictor variable on the remaining predictor variables, no VIF values were found to be greater than 10, thus significant multicollinearity was not present in the predictor variables. Finally, multivariate outliers were identified using mahalanobis distance. Some multivariate outliers were found in the gambling and personality variables. Analyses were run including and removing these outliers to determine how much influence they exercised. Including the analyses appeared to have little effect on the overall multivariate effect and the follow-up univariate effects, hence the decision was made to include the outliers in the final analyses.

### **Demographics**

Table 13 displays the means (and SDs) for the demographic variables as a function of PGSI category. I analysed the demographic variables (i.e., age, total years of education, and income) through a set of ANOVAs or Chi-square analysis in the case of the two dichotomous demographic variables (i.e., gender and marital status, which was coded as either living with a partner or not living with a partner), in order to ensure comparability of the two groups. For the ANOVAs on the continuous demographic variables, there were no significant main effects of PGSI category on income, educational, and employment status, indicating that the conditions were balanced in terms of these demographic variables. The ANOVA on PGSI classification x age revealed a significant main effect ( $F(3, 155) = 3.137, p < .05$ , partial  $\eta^2 = .057$ ). Tukey posthoc tests demonstrated a significant difference between problem gamblers and low-risk gamblers ( $p = .014$ ), with problem gamblers tending to be older. For the dichotomous demographic variables, no differences existed among the four groups in terms of marital status ( $p = 0.485$ ) and gender ( $\chi^2(3) = 0.604, p > .05$ ).

Table 13

*Means (and SDs) for the Demographic Variables as Functions of PGSI Category*

	Non-problem gambler n=66	Low risk gamblers n=58	Moderate risk gamblers n=13	Problem gamblers n=22
	M (SD)	M (SD)	M (SD)	M (SD)
Gender				
Men	38	30	8	12
Women	28	28	5	10
Marital status (% single)	94%	88%	92%	86%
Age (years)*	20.38(4.52)	19.57 (2.28)	20.15 (3.21)	22.86 (7.31)
Years of education (rated 1 to 4)	2.56 (0.66)	2.59 (.053)	2.38 (0.51)	2.50 (0.67)
Household income (rated 1 to 11)	7.47 (4.45)	7.17 (4.63)	5.77 (5.05)	5.32 (4.67)

Note. \* $<.05$

**Self-Reported Gambling Frequencies**

I examined the self-reported gambling behaviour variables through an MANOVA (e.g. hours and money spent gambling per week), as well as the frequency of assorted gambling behaviours (e.g. sports betting, poker, etc.). This analysis was performed in order gain some understanding of the typical gambling characteristics and patterns of the sample. The MANOVA revealed a significant overall multivariate effect of PGSI category on the set of gambling behaviour variables ( $F(27, 430) = 2.24, p < .001$ , partial  $\eta^2 = .120$ ). Follow-up univariate ANOVAs showed that the overall effect was reflective of the significant effect of PGSI category on bingo ( $F(3,155) = 9.38, p < .001$ , partial  $\eta^2 = .154$ ), slots play ( $F(3,155) = 3.67, p < .05$ , partial  $\eta^2 = .066$ ), VLT ( $F(3,155) = 3.57, p < .05$ , partial  $\eta^2 = .065$ ), hours per week spent gambling ( $F(3,155) = 5.20, p < .01$ , partial  $\eta^2 = .091$ ), and money per week spent gambling ( $F(3,155) = 6.73, p < .001$ , partial  $\eta^2 = .115$ ). Games-Howell posthoc tests largely demonstrated a difference between non-problem and low risk compared to moderate risk and problem gamblers, (see Table

14). Specifically, those classified with a more severe gambling risk classification gambled significantly more on bingo, slots, and VLTs than those classifications on the lower end. Table 14 displays the means (and SDs) for the gambling frequency variables as a function of PGSI category.

Table 14

*Means (and SDs) for the Gambling Frequency Variables as a Function of PGSI Category*

Gambling activities (rated 1 to 9)	<u>Non-</u> <u>problem</u> <u>gamblers</u> n = 66	<u>Low-risk</u> <u>gamblers</u> n = 58	<u>Moderate</u> <u>risk</u> <u>gamblers</u> n = 13	<u>Problem</u> <u>gamblers</u> n = 22	<i>F</i>	<i>p</i>
	M (SD)	M (SD)	M (SD)	M (SD)		
Sports betting	2.92 (2.06)	3.47 (2.31)	3.46 (2.03)	3.41 (2.34)	0.75	.524
Lottery tickets	4.18 (1.81)	3.95 (1.74)	4.77 (1.83)	4.41 (1.82)	0.91	.436
Bingo***	1.80 (1.34)	1.95 (1.41)	3.46 (2.22)	3.36 (1.79)	9.38	.000
Slots play*	3.89 (1.51)	4.14 (1.44)	5.08 (1.19)	4.82 (1.76)	3.67	.014
VLT*	4.47 (1.48)	4.07 (1.51)	5.54 (1.05)	4.36 (1.62)	3.57	.015
Table games	2.88 (1.78)	3.28 (1.90)	4.23 (1.69)	3.36 (1.92)	2.13	.098
Card/Skill games	2.83 (2.01)	2.79 (1.71)	3.46 (1.85)	3.82 (2.06)	2.01	.115
Hours per week gambling**	1.46 (2.15)	2.53 (3.06)	3.23 (2.20)	4.11 (4.51)	5.20	.002
Money spent per week gambling*** (in dollars)	34.74 (63.86)	57.34 (69.69)	80.77 (67.76)	126.86 (158.49)	6.73	.000

*Note.* \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

### Post-Study Questionnaire Results

A total of five variables were identified and assessed for possible contamination effects. The five variables post-study questions asked participants whether the program accurately simulated a VLT slot game, if they played the program differently than they would typically play an actual VLT, how motivated they were to obtain a high cash out, whether their play was influenced by the presence of other participants, and whether their experience of frustration or success with the game influenced their play. These variables were examined through a series MANOVAs to determine if they influenced any of the five EGM play variables. Across the five

separate MANOVA analyses, there was only one significant overall multivariate effect of these variables on the set of gambling behaviour variables: frustration/success experienced while playing ( $F(15, 417) = 3.02, p < .001$ , partial  $\eta^2 = .090$ ). Follow-up univariate ANOVAs, with posthoc Games-Howell tests, demonstrated that players felt more successful with greater money won ( $F(3, 155) = 12.23, p < .001$ , partial  $\eta^2 = .191$ ), less time spent played ( $F(3, 155) = 5.72, p < .01$ , partial  $\eta^2 = .1$ ), and less games played ( $F(3, 155) = 6.72, p < .001$ , partial  $\eta^2 = .115$ ). Additionally, follow-up univariate ANOVAs revealed a significant effect of play being influenced by the presence of others on average bet magnitude ( $F(4, 152) = 2.85, p < .05$ , partial  $\eta^2 = .070$ ), however, there were no significant pairwise comparisons. The general trend demonstrated that players who believed their play was not influenced by other players tended to have higher average bet sizes.

### **Effects of PGSI score on Gambling Behaviours and Personality**

Table 15 displays the correlations between the age, gender, PGSI score, personality, and the EGM variables. As can be seen in the table, age and all three personality variables were significantly correlated with PGSI score. Only two of the five EGM variables (e.g. money won/lost, games played) were found to significantly correlate with PGSI score.

A series of MANOVAs were run as a means to preliminary explore for possible relationships between gambling severity, personality, and the EGM play variables. A MANOVA revealed a non-significant overall multivariate effect of PGSI category on the set of the EGM play variables ( $F(5, 412) = 0.896, p = .567$ , partial  $\eta^2 = .029$ ). Follow-up (PGSI category x EGM play variables) univariate ANOVAs also were non-significant. In other words, the five EGM variables did not significantly differ between the PGSI classifications. However, these

Table 15

*Variable Correlations*

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age		-.03	.23**	.05	-.02	-.04	-.02	.11	.06	-.06	-.11
2. Sex	-.03		-.01	.15	.30**	.00	-.23**	.04	-.32**	.13	.08
3. PGSI Score	.23**	-.01		.20*	-.32**	-.30**	-.10	.22**	.06	-.13	-.23**
4. Neuroticism	.05	.15	.20*		-.32**	-.53**	-.22**	-.01	-.21**	.13	.10
5. Agreeableness	-.02	.30**	-.32**	-.32**		.53**	.02	-.15	-.10	.10	.14
6. Conscientiousness	-.04	.00	-.30**	-.53**	.53**		.09	-.11	.03	.02	.08
7. Max bet	-.02	-.23**	-.10	-.22**	.02	.09		-.23**	.71**	-.07	.09
8. Money won/lost	.11	.04	.22**	-.01	-.15	-.11	-.23**		-.03	-.60**	-.79**
9. Average bet	.06	-.32**	.06	-.21**	-.10	.03	.71**	-.03		-.38**	-.27**
10. Time played	-.06	.13	-.13	.13	.10	.02	-.07	-.60**	-.38**		.84**
11. Games played	-.11	.08	-.23**	.10	.14	.08	.09	-.79**	-.27**	.84**	

*Note.* \* Correlation is significant at the 0.05 level, \*\* Correlation is significant at the 0.01 level

non-significant findings do not rule out the possibility of these variables being significant in a mediation analysis. Fortunately, a significant relationship between independent and dependent variables is not necessary to test mediation; only the indirect effect is required to be significant to establish mediation (Zhao, Lynch, & Chen, 2010). Means (and SDs) for the variables are presented in Table 16.

Table 16

*Means (and SDs) for the EGM variables as functions of PGSI category*

EGM variables	<u>Non-problem</u> <u>gamblers</u> n = 66	<u>Low risk</u> <u>gamblers</u> n = 58	<u>Moderate risk</u> <u>gamblers</u> n = 13	<u>Problem</u> <u>gamblers</u> n = 22	<i>F</i>	<i>p</i>
	M (SD)	M (SD)	M (SD)	M (SD)		
Average bet size (in credits)	6.20 (2.28)	6.10 (2.38)	6.67 (2.29)	6.50 (1.91)	1.04	.881
Max bet use (total use)	29.47 (33.80)	23.12 (26.73)	33.85 (34.20)	19.77 (22.25)	0.92	.433
Time played (in minutes)	11.82 (3.48)	11.53 (3.66)	11.51 (3.47)	10.32 (4.64)	0.81	.490
Money spent (in dollars)	6.50 (5.18)	6.38 (5.34)	6.48 (5.15)	3.05 (6.80)	2.00	.117
Gaming events (total spins)	96.91 (26.70)	96.83 (30.85)	93.38 (24.77)	77.95 (37.23)	2.08	.106

In order to establish the theoretically expected (albeit statistically unnecessary to establish mediation; Zhao et al, 2010) differences in personality, I conducted an MANOVA to probe for significant differences between the PGSI classifications. The MANOVA revealed a significant overall multivariate effect of PGSI category on the set of personality variables ( $F(15, 412) = 1.926, p = .019, \text{partial } \eta^2 = .060$ ). Follow-up (PGSI category x personality variables) univariate ANOVAs showed that the overall effect was reflective of the significant effect of PGSI category on agreeableness ( $F(3, 153) = 510.195, p = .001, \text{partial } \eta^2 = .096$ ) and conscientiousness ( $F(3, 153) = 630.029, p = .002, \text{partial } \eta^2 = .093$ ). Tukey posthoc tests revealed that problem gamblers are lower in agreeableness ( $p = .003$ ) and conscientiousness ( $p = .009$ ) than

non-problem gamblers. Additionally, low-risk gamblers were found to be significantly lower in conscientiousness than non-problem gamblers ( $p=.017$ ). Means (and SDs) for the variables are presented in Table 17.

Table 17

*Means (and SDs) for the personality variables as functions of PGSI category*

EGM variables	<u>Non-problem</u> <u>gamblers</u> n = 66	<u>Low risk</u> <u>gamblers</u> n = 58	<u>Moderate risk</u> <u>gamblers</u> n = 13	<u>Problem</u> <u>gamblers</u> n = 22	<i>F</i>	<i>p</i>
	M (SD)	M (SD)	M (SD)	M (SD)		
Neuroticism	70.06 (12.75)	72.47 (11.63)	75.69 (15.01)	75.36 (16.03)	1.26	.290
Agreeableness	84.50 (9.63)	81.48 (10.09)	76.85 (12.16)	76.18 (10.83)	5.40	.001
Conscientiousness	87.18 (10.40)	81.22 (10.00)	80.62 (11.90)	78.18 (13.71)	5.25	.002
Extraversion	82.29 (10.12)	84.05 (11.55)	83.31 (9.72)	77.73 (11.11)	1.17	.322
Openness	74.18 (9.07)	75.50 (11.00)	76.38 (9.31)	76.45 (9.47)	0.36	.784

### **Mediation of the Effects of PGSI Category on Gambling Behaviours**

A series of parallel mediation analyses were run to test my hypothesis that personality variables mediate the relationship between the degree of problem gambling and betting behaviours. Specifically, higher neuroticism, lower conscientiousness, and lower agreeableness were hypothesized to mediate the relationship between gambling severity and EGM play. Before investigating this particular model (problem gambler model), I explored two models: an overall model in order to assess the overall influence of the FFM on gambling severity and EGM play, and a model built according to Eysenck's theory of personality (used in study 1; consists of neuroticism, conscientiousness, extraversion) in order to make possible connections between the findings of study 1 and study 2.

**Model #1 (Overall Model)**

Direct and indirect effects were estimated for the effects of PGSI classification on the five EGM measures, with all five personality factors as parallel mediating variables. Age and gender were included as covariates. No statistically significant results were found for agreeableness, openness, extraversion, or conscientiousness, indicating that none of these personality factors mediated the relationship between PGSI classification and EGM play behaviours. However, neuroticism was found to mediate the effect of PGSI category on average bet magnitude. The total  $R^2$  for prediction of EGM play from PGSI classification and personality ranged from 0.073 to 0.144.

The mediated effect of gambling group on average bet magnitude through neuroticism was significant,  $a_1 \times b_1 = (0.56 \times -0.04) = -.02$ ,  $p < .05$  (see Figure 19). These results support the hypothesis that the effect of PGSI classification on average bet magnitude is mediated by neuroticism. In other words, PGSI score (i.e., level of self-reported gambling problems) was primarily related to wager size via the indirect effect of the person's level of neuroticism. Interestingly, higher levels of neuroticism were associated with slightly smaller bet sizes, perhaps reflective of the effects of higher levels of anxiety or uncertainty about betting.

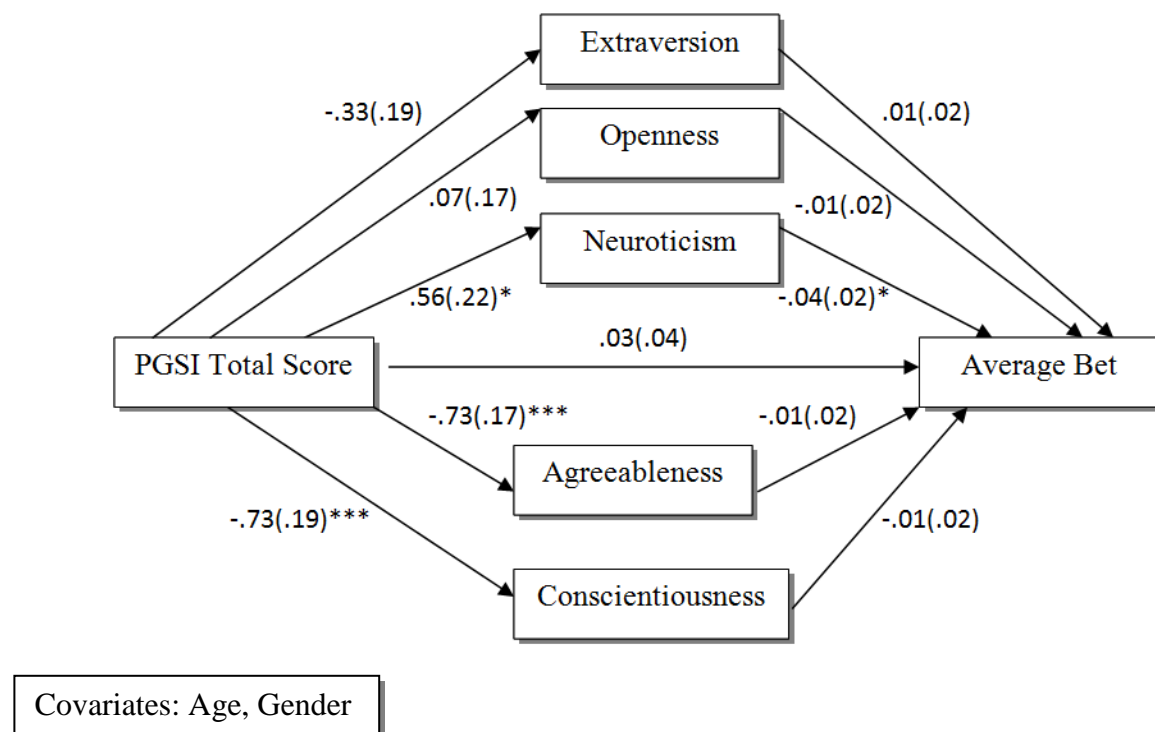


Figure 19. Path model for PGSI classification as a predictor of average bet magnitude, including paths to represent parallel mediation by neuroticism, agreeableness, openness, extraversion, and conscientiousness.

### Model #2 (Eysenck's Model)

Direct and indirect effects were estimated for the effects of PGSI classification on the five EGM measures, with the three personality factors (neuroticism, conscientiousness, extraversion) described in Eysenck's model of personality entered as parallel mediating variables. Age and gender were included as covariates. No statistically significant results were found for extraversion or conscientiousness, indicating that neither personality factor mediated the relationship between PGSI classification and EGM play behaviours. However, like the results from the first model, neuroticism was found to mediate the effect of PGSI category on average bet magnitude. This finding The total  $R^2$  for prediction of EGM play from PGSI classification and personality ranged from 0.064 to 0.141.

The mediated effect of gambling group on average bet magnitude through neuroticism was significant,  $a_1 \times b_1 = (0.56 \times -.03) = -.02$ ,  $p < .05$  (see Figure 20). These results support the hypothesis that the effect of PGSI classification on average bet magnitude is mediated by neuroticism. In other words, the relationship between self-reported gambling problems (PGSI score) and bet size was mediated by neuroticism, with greater neuroticism associated with smaller bets. Essentially the same result as with the full FFM analysis.

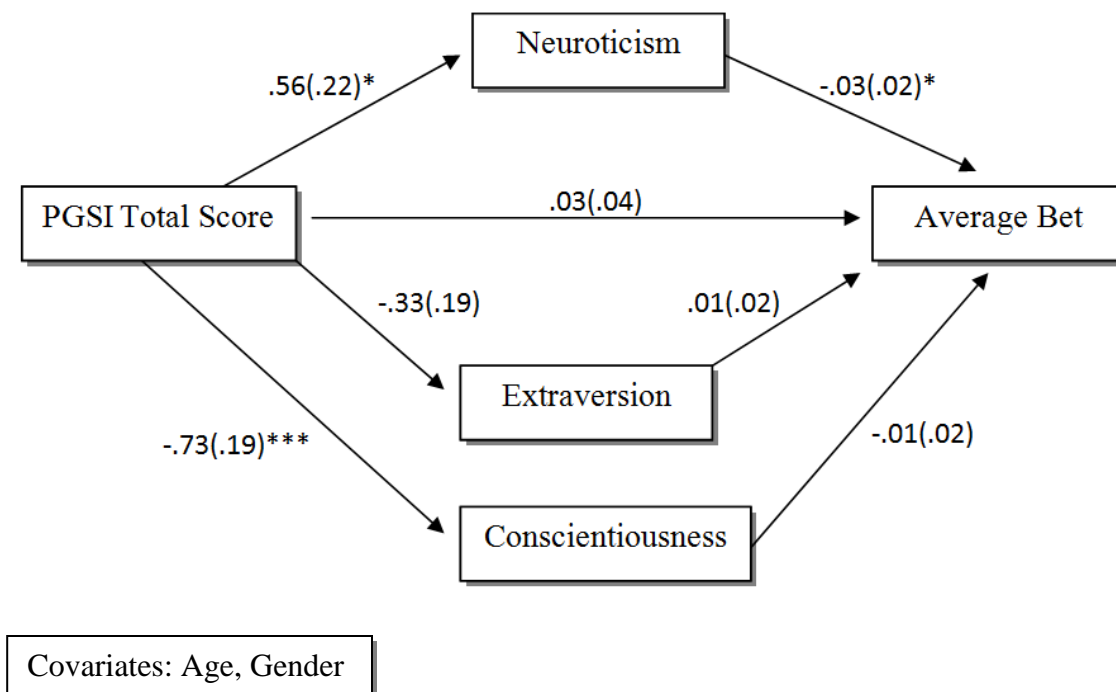


Figure 20. Path model for PGSI classification as a predictor of average bet magnitude, including paths to represent parallel mediation by neuroticism, extraversion, and conscientiousness.

### Model #3 (Problem Gambler Model)

Direct and indirect effects were estimated for the effects of PGSI classification on the five EGM measures, with the personality factors (neuroticism, conscientiousness, agreeableness) as parallel mediating variables. Age and gender were included as covariates. Raw score (unstandardized) coefficients for the significant paths in this model appear in Tables 18, 19, and 20. No statistically significant results were found for agreeableness or conscientiousness,

indicating that neither personality factor mediated the relationship between PGSI classification and EGM play behaviours. However, neuroticism was found to mediate the effect of PGSI category on three of the five gambling behaviours. The total  $R^2$  for prediction of EGM play from PGSI classification and personality ranged from 0.063 to 0.143.

Table 18

*Parallel Mediation Analyses (Neuroticism)*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	0.03	0.02	[0.0005, 0.07]
Games Played	PGSI Score	0.28	0.19	[0.001, 0.71]
Average Bet	PGSI Score	-0.02	0.01	[-0.07, -0.01]

Note. \* $<.05$

Table 19

*Parallel Mediation Analyses (Agreeableness)*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	-0.02	0.03	[-0.09, 0.03]
Games Played	PGSI Score	-0.20	0.24	[-0.74, 0.24]
Average Bet	PGSI Score	-0.01	0.02	[-0.05, 0.03]

Table 20

*Parallel Mediation Analyses (Conscientiousness)*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	-0.01	0.03	[-0.06, 0.04]
Games Played	PGSI Score	-0.17	0.23	[-0.61, 0.33]
Average Bet	PGSI Score	-0.01	0.02	[-0.05, 0.03]

Note. \* $<.05$

The mediated effect of gambling group on time spent playing through neuroticism was significant,  $a1 \times b1 = (0.56 \times 0.06) = 0.03$ ,  $p < .05$  (see Figure 21). These results support the hypothesis that the effect of PGSI classification on time spent playing is mediated by neuroticism. In other words, neuroticism mediated the relationship between self-reported level of problem gambling and time spent gambling: problem gamblers spend more time gambling when they scored higher in neuroticism.

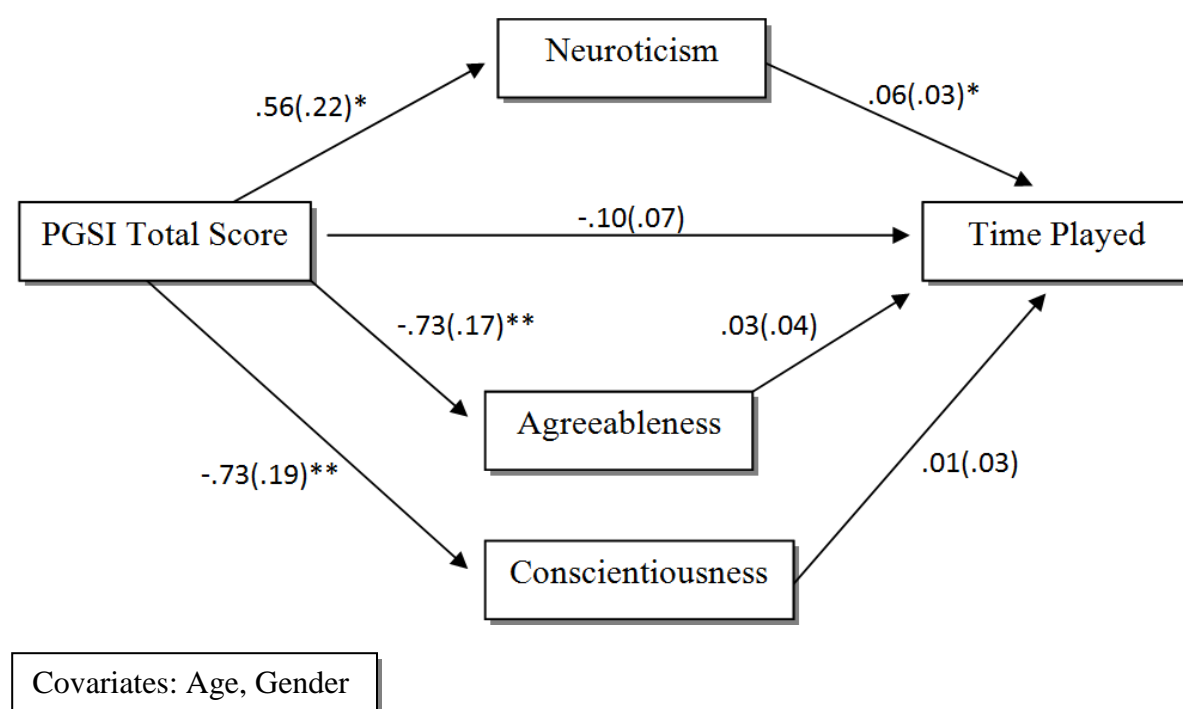


Figure 21. Path model for PGSI classification as a predictor of time played, including paths to represent parallel mediation by neuroticism, agreeableness, and conscientiousness.

The mediated effect of gambling group on number of games played through neuroticism was significant,  $a1 \times b1 = (0.56 \times 0.51) = 0.28$ ,  $p < .05$  (see Figure 22). These results support the hypothesis that the effect of PGSI classification on games played is mediated by neuroticism. In other words, problem gamblers who were higher in neuroticism played more games, which is

probably a result similar to time played.

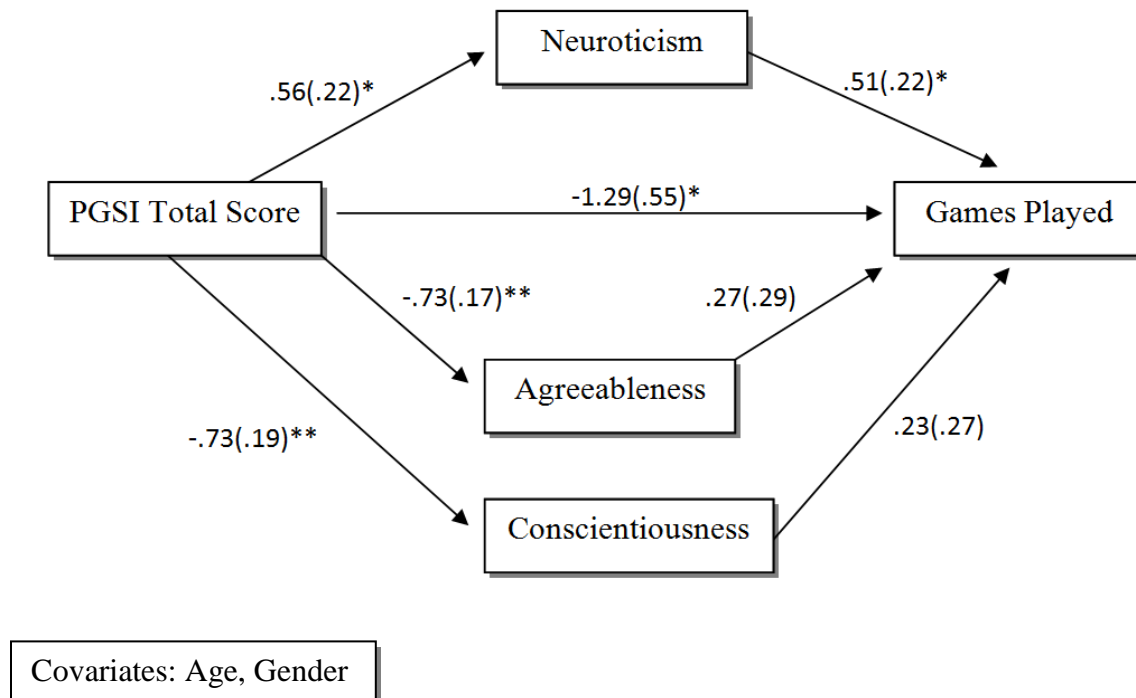


Figure 22. Path model for PGSI classification as a predictor of games played, including paths to represent parallel mediation by neuroticism, agreeableness, and conscientiousness.

The mediated effect of gambling group on average bet magnitude through neuroticism was significant,  $a_1 \times b_1 = (0.56 \times -0.04) = -0.04$ ,  $p < .05$  (see Figure 23). These results support the hypothesis that the effect of PGSI classification on average bet size is mediated by neuroticism, however, neuroticism was expected to be associated with larger bet sizes. Again, this mediation analysis found that gamblers higher in neuroticism had a tendency to make lower wagers while playing the EGM simulation.

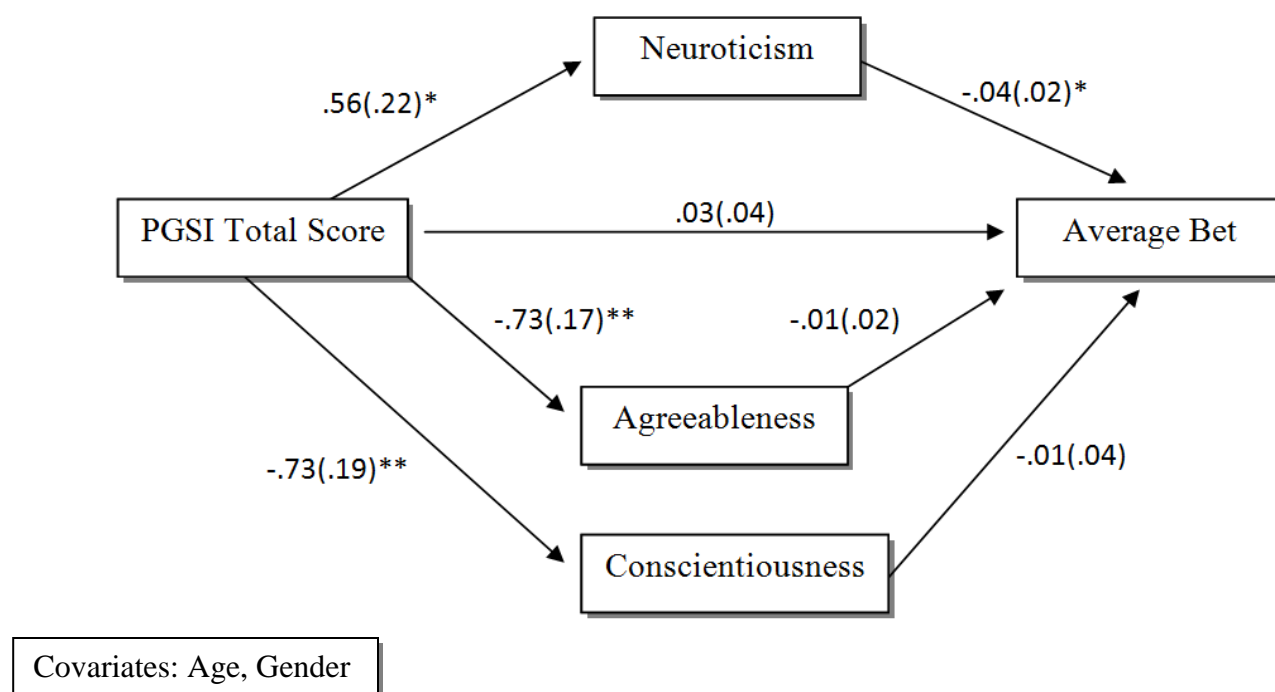


Figure 23. Path model for PGSI classification as a predictor of games played, including paths to represent parallel mediation by neuroticism, agreeableness, and conscientiousness.

### Post hoc Moderation Analyses

Given the association between agreeableness, conscientiousness, and gambling severity in the gambling literature, it was unexpected to find no mediating effect. Rather than ruling out the influence of these personality factors completely, it is possible these factors may act as a moderator, whereby different levels of each factor could influence the relationship between gambler status and EGM play. To investigate this hypothesis, I performed a series of moderation analyses (see Tables 21-25), with age and gender included as covariates. These analyses revealed that neither agreeableness, conscientiousness, nor neuroticism moderated this relationship and therefore simple moderation and mediated moderation could be ruled out. Another possible mechanism was that agreeableness and conscientiousness could have an influence is whether

they moderate the mediating variable (neuroticism), otherwise known as moderated mediation. In this case, different levels of agreeableness or conscientiousness would influence the strength of the mediating effect of neuroticism on gamblers risk status and EGM play. Using the procedure as described by Preacher and Hayes (2003), I performed a bootstrapping analysis to test this hypothesis. Results from the bootstrapping analysis were non-significant for agreeableness ( $b=.0048$ ,  $SE=.0146$ ,  $CI= -.0241, .0337$ ) and conscientiousness ( $b=.0175$ ,  $SE=.0123$ ,  $CI= -.0068, .0418$ ).

Table 21

*Simple Moderation Analysis of Agreeableness on Gambling Variables x PGSI Score*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	.007	.005	[-0.00, 0.02]
Games Played	PGSI Score	.058	.036	[-0.01, 0.13]
Average Bet	PGSI Score	.002	.003	[-0.00, 0.01]
Money Spent	PGSI Score	-.009	.007	[-0.02, 0.00]
Max Bet Use	PGSI Score	.030	.036	[-0.04, 0.10]

Table 22

*Simple Moderation Analysis of Conscientiousness on Gambling Variables x PGSI Score*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	.007	.004	[-0.00, 0.02]
Games Played	PGSI Score	.060	.033	[-0.01, 0.13]
Average Bet	PGSI Score	.002	.002	[-0.00, 0.01]
Money Spent	PGSI Score	-.010	.102	[-0.02, 0.00]
Max Bet Use	PGSI Score	.008	.033	[-0.06, 0.07]

Table 23

*Simple Moderation Analysis of Neuroticism on Gambling Variables x PGSI Score*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	-.001	.004	[-0.01, 0.01]
Games Played	PGSI Score	.024	.034	[-0.04, 0.09]
Average Bet	PGSI Score	.003	.003	[-0.00, 0.01]
Money Spent	PGSI Score	-.005	.006	[-0.03, 0.01]
Max Bet Use	PGSI Score	.034	.034	[-0.06, 0.07]

Table 24

*Mediated Moderation of Agreeableness on Neuroticism*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	.0002	.0015	[-.0043, .0017]
Games Played	PGSI Score	.0020	.0130	[-.0379, .0152]
Average Bet	PGSI Score	-.0002	.0010	[-.0012, .0029]

Table 25

*Mediated Moderation of Conscientiousness on Neuroticism*

Dependent variables	Independent Variable	Indirect effect		95% CI
		a1 x b1		
		b	SE	
Time Played	PGSI Score	.0008	.0010	[-.0016, .0026]
Games Played	PGSI Score	.0078	.0095	[-.0151, .0247]
Average Bet	PGSI Score	-.0007	.0008	[-.0019, .0014]

## Discussion

The principal aim of this study was to test whether personality mediates the relationship between gambling risk status and EGM play. Specifically, it was predicted that neuroticism, agreeableness, conscientiousness would mediate the relationship. The results of this study partially support this hypothesis. The results demonstrated that neuroticism mediated the effect

of gambling severity on three of the five EGM play variables measured, with increased neuroticism associated with increased number of gaming events played and time spent playing. Neuroticism was also associated with lower average bet magnitude. Surprisingly, neither agreeableness nor conscientiousness was found to mediate the relationship between gambling severity and any of the EGM play variables. Subsequent posthoc analyses to explore possible moderation effects through agreeableness and conscientiousness also were non-significant. Overall, only neuroticism was found to influence the relationship between gambling severity and EGM play.

As hypothesized, the results of the study revealed that agreeableness and conscientiousness were lower as gambling severity increased. Surprisingly, neuroticism was not found to be associated with gambling severity despite mediational analyses demonstrating its influence on the relationship between gambling severity and EGM play. Although unexpected, this result parallels the findings of Tacket et al. (2014) who found problem gambling was associated with low agreeableness and conscientiousness, but not high neuroticism. Openness and extraversion were also non-significant, however, that finding was expected and in line with the research literature's findings that problem gambling is associated more with neuroticism, agreeableness, and conscientiousness (MacLaren et al., 2011). While openness has been found to be associated with problem gambling in some studies (Myrseth et al., 2009), this relationship has been inconsistent (e.g., Bagby et al., 2007). One potential explanation offered in the gambling literature is that openness relates to an individual's intelligence (Ackerman & Heggestad, 1997). Supporting this finding, a study by Miller et al. (2013) found that controlling for IQ rendered a previously significant relationship between openness and problem gambling non-significant. Finally, all five of EGM play variables were not associated with severity of gambling problems

(PGSI scores). This finding was not unexpected as a previous study examining EGM play variables found all the variables, except for max bet use, were not associated with gambling severity (Graves & Ellery, 2014). Fortunately, a significant relationship between independent and dependent variables does not rule out a possible mediation effect (Zhao, Lynch, & Chen, 2010), as demonstrated by the finding that neuroticism mediated three of the five EGM variables in the current study.

Neuroticism affected some, but not all, of the EGM play variables, with increased neuroticism associated with a riskier style of play. Overall, neuroticism was associated with more gaming events played and time played, yet also reduced average bet sizes among gamblers with greater gambling severity. Betting may be smaller, but more playing time could expose players to greater opportunity for losses and more significant social consequences. Based on these findings, regular EGM players, with greater gambling severity, might be adopting a playing strategy to maximize playing time by betting lower wagers, with this effect explained by increased endorsement of neuroticism. This playing strategy would result in longer, uninterrupted gambling sessions, potentially leading to a greater risk of developing or further worsening a gambling problem (Wanner, Vitaro, Carbonneau, & Tremblay, 2009). Electronic gambling machines have a negative expectancy (i.e., a “house edge”) (Turner, 2011), whereby individuals who play longer will lose more money. Over time, these financial losses would accumulate and could result in the negative social (e.g. alienation from peers, divorce) and personal (e.g. financial debt, deterioration in mental health) ramifications typically seen in problem gamblers. The findings of the current study support the relationship between problem gambling and personality found in the gambling literature (King, Abrams, Wilkinson, 2010; MacLaren et al., 2011; Roy, Custer, & Lorenz, 1989; Slutske et al. 2005), particularly the

positive relationship between neuroticism and gambling severity. Neuroticism has been shown to be a significant predictor of gambling behaviours over and above a familial history of gambling, substance use problems, and gender (King, Abrams, Wilkinson, 2010). High scores on neuroticism are generally associated with two facets, impulsivity, and emotional vulnerability. These two facets most likely interact, as individuals high in neuroticism often have a significant difficulty inhibiting urges or cravings, particularly when experiencing negative affect (MacLaren et al., 2011; Whiteside & Lynam, 2001). In reference to gambling, the development of problem gambling could be, in part, the result of maladaptive efforts to regulate negative affect and maintained through individual deficits in executive control. Related to the emotional vulnerability side of neuroticism, one prominent motive for gambling could be as a form of escape, whereby distraction is used to alleviate negative affect. In a study exploring the gambling motives of 149 problem gamblers, a principal component analysis found escape and distraction were significant and related motives (Stewart & Zack, 2008). Further, research on gambling expectancies has demonstrated that gamblers who expect gambling will alleviate negative mood report more severe gambling problems than those who gamble for rewards or excitement (Shead, Callan, Hodgins, 2009). Additionally, when primed with relief expectancies, gamblers respond with a linear increase in gambling activity. Supporting this line of expectancy and motivation research, three quarters of problem gamblers manifest symptoms of depression at some point in their lives (Blaszczynski & McConaghy, 1988; Linden, Pope, & Jonas, 1986), while several studies have linked anxiety disorders with problem gambling (Black et al., 2003; Blanco et al., 2006; Boughton & Falenchuk, 2007; Dannon, et al., 2006; Desai & Potenza, 2008; Potenza et al., 2005).

These findings demonstrate a clear relationship between negative affect and problem

gambling, however, it is unclear if negative affect leads to problem gambling or if problem gambling leads to negative affect. For example, one potential explanation is that the higher rates of depression and anxiety present in problem gamblers is not a precipitating factor of problem gambling, but rather a consequence of the financial, emotional, and social crises brought about by excessive gambling (Lorenz & Yaffee, 1988; Trevorrow & Moore, 1998). Over time, negative affect gradually builds from these severe consequences resulting in higher scores on neuroticism measures. Alternatively, individuals who are experiencing depression and anxiety could turn to gambling as a way to escape this negative affect, which over time leads to the development of a gambling problem. Given the prolonged play strategy found in the current study, gambling as a means of emotional regulation puts an individual at greater risk of developing a gambling problem. A final, and probably more likely explanation, is that neuroticism and problem gambling could be bidirectional in nature, such that neuroticism increases the likelihood of problem gambling and problem gambling increases neuroticism over time. For example, Zangeneh, Grunfeld, and Koenig (2008) listed anxiety as a risk factor for gambling, but also a consequence of gambling. In other words, high scores on neuroticism may cause some individuals to become more vulnerable to developing a gambling problem, or having a gambling problem may contribute to the higher scores on this personality domain.

Neuroticism did not mediate all gambling behaviours, as it was unrelated to max bet use and the money spent in the gambling session. As previously suggested, gamblers with more severe gambling problems adopted a playing strategy that appeared to increase time played as a function of higher scores on neuroticism. This playing strategy could be indicative of a coping mechanism aimed at reducing, escaping, or managing negative affect. If managing negative affect was the goal of play, it follows that gamblers would manipulate their playing strategy to

maximize time rather than focusing on another motive, like winning money or sensation seeking. Increased max bet use would work counter to that goal, as increased bet sizes, in combination with the negative expectancy built into EGMs, would result in shorter gambling sessions. By lowering their average bet magnitude and max bet use, the gamblers in the current study were able to increase their gambling sessions, thereby maximizing the maladaptive coping function of gambling. Given that emotional regulation was the goal, it was unsurprising that these gamblers were not focused on the idea of winning money, and their final cash outs were statistically no different than gamblers with lower gambling severity scores. This finding suggests that a gambler's specific motivation to gamble influences their playing strategy and this finding is supported in the research literature (Shead, Callan, & Hodgins, 2008; Shead & Hodgins, 2009; Stewart & Jack, 2008). For example, Shead, Callan, & Hodgins (2008) demonstrated this relationship in their study of gambling expectancies. By examining the gambling activity of gamblers by their expectancies of gambling (e.g. gamblers who expect gambling to increase positive mood, those who expect gambling to alleviate negative mood and those who expect gambling to have no affect on mood) different patterns of activity emerged. While relief focused gamblers reported the most severe gambling problems, they did not demonstrate a tendency towards riskier choices as expected. Instead, gamblers looking to enhance their mood through gambling were associated with greater risk taking. Likewise, in the current study greater risk taking, through the use of the max bet button, was not linked to neuroticism, as the gamblers in the current study endorsed a strategy of play that focuses on relief rather than excitement. Together these findings suggest that personality and motivation play a role in how gambler's play.

Contrary to hypothesis, neither agreeableness nor conscientiousness mediated the

relationship between gambling severity and EGM play. These results were unexpected given the multitude of studies demonstrating an association between these personality factors and gambling severity (Blaszczynski, Steel, & McConaghy, 1997; Dougherty et al, 2009; Fuentes et al., 2006; Petry, 2001a, 2001b; Slutske et al., 2005; Steel & Blaszczynski, 1998). The non-mediating effect of conscientiousness was particularly surprising given this personality domain captures one's ability to resist impulses and manage desires. However, the MANOVA results revealed that conscientiousness, as well as agreeableness, were significantly lower among individuals with greater gambling problems. Given the association between these personality factors and gambling severity in the gambling literature, further analysis for possible moderation effects was performed. These post hoc analyses were non-significant, further ruling out the influence of these personality factors on the relationship between gambling severity and EGM play, at least as simulated with this procedure. One potential explanation is that agreeableness and conscientiousness are significant predictors of gambling severity, but do not influence within-session gambling behaviour. Their effects could be more indirect (e.g. influencing gambling preferences, the number of times a gambler withdraws from an ATM, or act to alienate gamblers from healthier peers, etc.), rather than the direct influence of in-game play. For example, a recent study (MacLaren, Ellery, Knoll, 2015) found that industriousness, a personality facet of conscientiousness, was associated with a negative effect on cognitive distortions, but not gambling behaviours. Likewise, a study by King et al. (2010) found that high negative emotionality (e.g., neuroticism) was associated with gambling behaviours and beliefs, but low constraint (e.g. conscientiousness) was only associated with gambling beliefs (King et al. 2010). These studies demonstrate that although conscientiousness may not have a direct effect on gambling behaviour, its effect could be acting indirectly through other variables, like gambling

beliefs. Another possible explanation for this finding could be due to the fact that EGM play and no other forms of gambling were assessed in the current study. It is possible that agreeableness and conscientiousness mediate other forms of gambling behaviour. As discussed previously, gamblers can hold different motives that drive their behaviour and give purpose to their actions. These motives could affect which forms of gambling a gambler may gravitate towards at a given time. For example, individuals high in neuroticism have been found to prefer non-strategic forms of gambling, like EGMs, as a way to emotionally regulate and escape negative affect (Blaszczynski & Nower, 2002; Bonnaire, Bungener, & Varescon, 2009; King et al. 2010). In contrast, individuals low in agreeableness have been found to prefer more strategic forms of gambling, like poker, where they can engage in more high-risk gambling in a socially competitive environment (Blaszczynski & Nower, 2002; Bonnaire, Bungener, & Varescon, 2009). Given these preferences, it is possible that replicating this study with EGM play substituted with poker may find that conscientiousness and agreeableness are significant mediators. According to the FFM (Costa & McCrae, 1992) individuals low in agreeableness tend to be more aggressive, competitive, manipulative, self-aggrandizing, dishonest, and demonstrate anti-social tendencies. These characteristics are primarily social in nature and suggest that individuals low in agreeableness might prefer a more competitive environment to gamble in as a means to manipulate others and demonstrate their perceived superiority over other gamblers. Hence, although agreeableness did neither mediate nor moderate EGM play, it is possible that it could have an effect on a more strategic form of gambling, like poker.

### **Further Limitations**

Some further limitations of the current study involve issues of generalizability, ecological validity, and the EGM simulation program. First, ecological validity is reduced due to practical

considerations, as an exact replication of playing an EGM in its usual settings (i.e., bars and casinos) is challenging and lacks experimental control. Studies that have conducted research directly in these settings were restricted to conducting interviews for data and suffered from attrition (Baron & Dickerson, 1999). Due to the fact that EGM play was simulated via a computer program instead of an actual EGM machine, and was played in an artificial office-like setting, ecological validity is reduced. Second, generalizability is limited due to the study's sole reliance on a university based sample. While university students are an appropriate group to study due to their frequent engagement in gambling and the greater prevalence of PG in this group relative to the general population (Shaffer, Hall, & Vander Bilt, 1999; Williams, Connolly, Wood, & Nowatzki, 2006), the fact remains that not all of the current findings should be generalized to other populations such as community-recruited gamblers. That said, the finding that problem gamblers are more likely to engage in risky play is consistent with studies of community-recruited gamblers (Ellery et al., 2005; Ellery & Stewart, 2014). Finally, the computer program responsible for simulating an EGM slots game does function in precisely the same way as a real world EGM. One difference is a delay that takes place between certain gaming events in the EGM simulation. This delay is present whenever a win occurs, as players must wait until the winning tone to finish before placing another bet. Real world EGMs do not have this limitation, as they allow its player to commence a new bet as soon as the results from the previous bet are revealed. The delay may explain the absence of difference in the amount of time spent and the number of gaming events played. Problem gamblers may play faster than non-pathological gamblers in real life settings, but the simulation may have created a ceiling effect by slowing play to the point where any real differences were undetectable.

### **General Discussion and Conclusions**

The results of both studies demonstrate that problem gamblers are not a homogenous group, but rather heterogeneous in nature. Of the various models presented in the current gambling literature, Blaszczynski and Nower's (2002) pathway model of problem gambling is one of the more prominent and empirically supported. In the model, three separate pathways (behavioural conditioned, emotionally vulnerable, and antisocial impulsivist) are pathways that could lead a gambler to develop a gambling problem. The differentiating characteristic of these pathways is their underlying pathology. While some experience neurological deficits leading to general impulsiveness (antisocial impulsivist; Chambers & Potenza, 2003), others develop gambling problems through behavioural conditioning without any prior predisposing vulnerabilities (behaviourally conditioned, Blaszczynski & Nower, 2002). The final subgroup of gamblers is thought to develop a pathological need to gamble out of a need to cope with painful emotional experiences, such as depression, anxiety, or trauma (emotionally vulnerable, Getty et al., 2000). Of the three pathways, the results of the current study offer empirical support for both the emotionally vulnerable and antisocial impulsivist pathways. The results from study 1 demonstrated a significant relationship between extraversion, conscientiousness, and strategic gambling. The personality types endorsing high extraversion and low conscientiousness (e.g. hedonist, impulsive) demonstrated a preference for strategic gambling over non-strategic gambling. Strategic forms of gambling provided greater risk, arousal, social competitiveness, and feature more elements of skill, which seemed to appeal to the more extroverted individuals. The characteristics of these personality types and their preference for strategic gambling seem to parallel the description of the antisocial impulsivist provided by Blaszczynski and Nower's (2002) pathways model. Antisocial impulsivist have been found to choose high skill games, like

poker, to combat states of dysphoria and boredom (Blaszczynski, McConaghy, & Frankova 1990; Blaszczynski & Nower, 2002). Gambling, when engaged in a riskier fashion, provides the necessary stimulation to alleviate boredom and other aversive states exhibited by antisocial impulsivists. The competitive, high-risk nature of strategic gambling is more suited to fulfilling these needs than the more repetitive, low arousal forms of gambling seen in non-strategic gambling. Strategic gambling has been associated with greater sensation seeking and greater gambling severity than non-strategic gambling (Bonnaire et al., 2004; Coventry & Brown, 1993; Stevens & Young, 2009). The greater gambling severity seen in strategic gamblers is most likely related to their tendency to engage in more than one specific type of problematic gambling and to bet higher amounts of money. Greater sensation seeking and psychopathology are also both characteristics of antisocial impulsivists. Antisocial impulsivists suffer from severe psychopathology (Blaszczynski & Nower, 2002), possessing both psychosocial and biological vulnerabilities to developing a gambling problem. This group is defined by its heightened impulsivity and antisocial personality disordered features (Blaszczynski et al., 1997; Steel & Blaszczynski, 1996). Likewise, those with hedonist and impulsive personality types both have marked difficulties in impulse control as demonstrated by their higher scores on neuroticism and lower scores on conscientiousness (both personality factors contain facets of impulsivity).

The results of study 2 demonstrated that neuroticism mediated the relationship between gambling severity and EGM play, whereby players seemed to adopt a strategy to prolong play. This finding demonstrates the escape motive often found in gambling through self-report measures and fits with the emotionally vulnerable pathway described in the Blaszczynski & Nower (2002) model. For the emotionally vulnerable gambler, gambling provides an escape from the otherwise harsh realities of life, with gamblers often reporting greater feelings of safety

and belonging while gambling (Brown & Coventry, 1997). This group is characterized by a history of poor coping and problem-solving skills, as well as negative life histories. These deficits over time result in a high prevalence of mood disorders, particularly anxiety and depression, found in problem gamblers (Beaudoin & Cox, 1999; Black & Moyer, 1998; Vitaro, Arsenault, & Tremblay, 1999). Presumably, emotionally vulnerable gamblers have a preference for low skill activities, like EGMs, in order to narrow their focus of attention and create a state of distraction to escape internal feelings of negative affect (Anderson & Brown, 1984; Jacobs, 1986). Greater distraction, often referred to as dissociation in the gambling literature, has been associated with increases in gambling severity (Gupta & Derevensky, 1998). Distraction, when combined with the playing strategy found in study 2, could lead to long, continuous gambling sessions and the increased likelihood of developing a gambling problem. Emotionally vulnerable gamblers, particularly women, are also most likely to choose forms of gambling that are socially isolating, repetitive, or monotonous in their efforts to regulate their mood state (Rosenthal & Lesieur, 1992; McCormick, 1994). Additionally, women who gamble have demonstrated a tendency to maximize their time spent playing EGMs by selecting machines with lower minimum bets available (Hing & Breen, 2001). This strategy bears some similarity with the strategy adopted by the more neurotic, problem gamblers in study 2.

While the results of the current study provided support for the pathways of the emotionally vulnerable and antisocial impulsivist, none of the results appeared to map onto the behavioural conditioned pathway. It is quite possible that the reason the behaviourally conditioned pathway was not represented in the study is because variables associated with this pathway were not included. For example, a study by Turner, Jain, Spence, and Zangeneh (2008) examined the extent to which Blaszczynski and Nower's (2002) model could be validated using

questionnaires that assessed impulsivity, depression, anxiety, erroneous beliefs, and early gambling wins. The behaviourally conditioned pathway was found to be related to both erroneous beliefs and the experiences of wins' components. Neither of these variables was included in the present study.

### **Implications**

Differences in gambling preference and play through personality variables have important implications in regards to treatment interventions. Blaszczynski and Nower's (2002) pathways model specified that each of the three subgroups has distinct clinical presentations with differences in their onset, course, and severity. Together these differences have implications for their prognosis and treatment of each subgroup. Without addressing the specific treatment needs of these different gambler subgroups, there is a risk that the gambler will simply fill the void created by the removal of their gambling with another maladaptive strategy to cope with their negative affect or to satisfy their need for arousal. These substituted maladaptive behaviours could manifest in many different forms, but would likely be addictive in nature (e.g. chemical or behavioural addictions). For antisocial impulsivists, substitution of another activity that serves the same function as gambling, but is less self-destructive, could be a part of their treatment plan. In contrast, emotionally vulnerable gamblers would need the introduction of specific coping skills to replace the function of gambling in order for them to effectively manage negative affect.

In regards to course and treatment plan, antisocial impulsivists, highlighted in this study by the hedonist and impulsive personality types, present with more severe, long-term gambling related problems than the other subgroups. The severity of their gambling problem suggests a more intensive and prolonged treatment plan is needed. Complicating their treatment, antisocial impulsivists engage in a wide range of dysfunctional behaviours, including substance abuse and

criminal behaviour (Steel & Blaszczynski, 1996). This subgroup of gamblers would require tailored treatment for their co-morbid disorders (e.g. antisocial personality disorder, attention deficit hyperactivity disorder) and their executive functioning deficits (e.g. poor problem solving, coping skills, stress intolerance, etc.). High impulsivity, in particular, has been related to high drop-out rates in problem gamblers receiving treatment (Leblond et al., 2003). This finding suggests that treatment of this group should probably involve an emphasis on a motivational enhancement to prevent treatment drop-outs and impulse control to manage their dysfunctional behaviour. In contrast, the emotionally vulnerable gambler, highlighted in study 2 (neuroticism associated with prolonged EGM play), requires a different treatment approach to address their difficulties with anxiety and depression. This group would benefit more from treatments designed to improve coping and emotional regulation strategies. Additionally, the fact that social support is a protective factor for emotionally vulnerable gamblers (Moragas et al., 2015) suggests that interpersonal psychotherapy could be promising with this population.

One study has examined the effect of Blaszczynski and Nower's (2002) subgroups on treatment outcomes. In a study of 229 problem gamblers, Ledgerwood and Petry (2010) divided gamblers into Blaszczynski and Nower's (2002) three subgroups using their scores on measures of impulsivity, depression, and anxiety. Behaviourally conditioned gamblers began treatment with less severe gambling problems and were the most likely of the subtypes to be symptom-free at post treatment and 12-month follow-up. The antisocial impulsivist and emotionally vulnerable subgroups demonstrated similar treatment courses, with an initial improvement rate similar to behaviourally conditioned gamblers, however, these improvements were not present at posttreatment or 12-month follow-up. These results demonstrated a difference in prognosis and treatment need based on gambling subgroups, with both the antisocial impulsivist and

emotionally vulnerable gamblers needing more extensive treatment approaches.

Other potential implications and uses of this study's findings are the possible inclusion of personality measures in screening procedures for treatment. These screening measures could aid in the conceptualization and treatment planning for problem gamblers. Identification of the specific maladaptive coping skills employed by each client could guide and inform treatment efforts. Additionally, there are possible implications for prevention in the form of media campaigns and screening mechanisms, the identification of the potential risks associated with certain forms of gambling or personality types, and recommendations for advertising regulations.

### **Strengths of this study**

Although this study does have limitations, it also boasts various strengths. As a whole, the results of the current study add to gambling literature exploring its connection to personality, a burgeoning area of research still in its early stages compared to other addictive behaviours (Petry, Stinson, & Grant 2005). Few studies have explored the relationship between the FFM and gambling (Bagby et al., 2007; Myrseth et al., 2009), while no previous study has employed Torgersen's typology to gamblers. While some studies have explored the relationship between gambling preference and personality, most of these studies have grouped various forms of gambling together instead of examining each separately (Coventry & Brown, 1993; Dickerson, 1993; Zuckerman, 2005). Some researchers have suggested that this common practice of lumping together various forms of gambling may be contributing to the contradictory findings found in the literature (Griffiths, 2013). While the different forms of gambling do share some similarities (as described in the various categorization models presented in the literature), there are considerable differences. Some of these differences include the diversity of settings in which they are played, the differences in rewarding and reinforcing properties, and the time between bet

and outcome. Both of the current studies examined gambling activities separately, instead of lumping them all together as “gambling”. While study 1 involved the examination of gambling preferences for eight separate forms of gambling, study 2 examined gambling behaviour, severity, and personality with a sole focus on EGM play. By exploring the influence of these various forms of gambling separately, these studies were able to make inferences individually, while also having the flexibility of drawing conclusions based on theoretical groupings (strategic vs. non-strategic). Studies that do not take account of personality and the effect of different forms of gambling are likely to continue to find the non-replicable and inconsistent findings currently found in the gambling literature. Likewise, studies of personality would be wise to examine the joint effect of personality traits, as personality traits do not exist or operate in isolation, but are simultaneously present and interacting. While adopting a typological over a dimensional approach does have its drawbacks, a typological approach does boast the advantage of offering an intuitively simple method to combine personality traits and comment on their interaction. For example, study 1 demonstrated conflicting results for high extraversion, however, its combination with conscientiousness provided a rationale for these seemingly conflicting findings.

The inclusion of gambling behaviour over self-report data in the study is another strength. To the best of my knowledge, this is the first study that has examined the relationship between personality and gambling severity using a behavioural measure of gambling play. Much of the gambling literature relies on self-report data for their convenience and ease of administration. However, self-report measures have various limitations as they depend on accurate recall, insight, and honest responding. The findings of study 2 represent the first behaviourally demonstrated relationship between personality, gambling severity, and gambling play. This

finding also is the first to behaviourally demonstrate the specific playing strategy Blaszczynski and Nower's (2002) emotionally vulnerable gambler would employ in their use of gambling as a coping strategy for negative affect.

**References**

- Aasved, M. (2002). *The Psychodynamics and Psychology of Gambling*. Springfield, IL: Charles C. Thomas Publisher LTD.
- Abbott, M., & Volberg, R. (1996). The New Zealand National Survey of problem and pathological gambling, *Journal of Gambling Studies*, 12, 143–160.
- Ackerman, P., & Heggestad, E. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychological Bulletin*, 121, 219–245.
- Adler, A. (1969). *The Science of Living*. Garden City, NY: Anchor Books.
- Allport, G. (1927). Concepts of trait and personality. *Psychological Bulletin*, 24, 284–293.
- Allport, G. (1937). *Personality: A psychological interpretation*. New York: Holt.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (fourth edition): DSM-IV*. Washington, D.C.
- American Psychiatric Association (APA). (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th revised edition). Washington D.C: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Anderson, G., & Brown, R. (1984). Real and laboratory gambling, sensation-seeking and arousal. *British Journal of Psychology*, 75, 401–410.
- Ashton, M., Lee, K., Perugini, M., Szarota, P., De Vries, R., Di Blass, L., et al. (2004). A six-factor structure of personality descriptive adjectives: Solutions from psycholexical studies in seven languages. *Journal of Personality and Social Psychology*, 86, 356–366.
- Bagby, R., Vachon, D., Bulmash, D., Toneatto, T., Quilty, L., & Costa, P. (2007). Pathological

- gambling and the five-factor model of personality. *Personality and Individual Differences*, 43, 873–880.
- Bakken, I., Gotestam, K., Grawe, R., Wenzel, H., & Oren, A. (2007). Gambling behavior and gambling problems in Norway 2007. *Scandinavian Journal of Psychology*, 50, 333–339.
- Bandura, A. (1999). *Social cognitive theory of personality*. In L.A. Pervin & O.P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 154–196). New York: Guilford Press.
- Barnes, G., Welte, J., Hoffman, J., & Tidwell, M. (2010). Comparisons of gambling and alcohol use among college students and non-college young people in the united states. *Journal of American College Health*, 58, 443-452.
- Baron, E., & Dickerson, M. (1999). Alcohol consumption and self-control of gambling behaviour. *Journal of Gambling Studies*, 15, 3-15.
- Baron, R., & Kenny, K. (1986). Moderator-Mediator Variables Distinction in Social Psychological Research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-82.
- Barrick, M., & Mount, M. (1991). The big five personality dimensions and job performance: a meta-analysis, *Personality Psychology*, 44, 1-26.
- Beaudoin, C., & Cox, B. (1999) Characteristics of problem gambling in a Canadian context: a preliminary study using a DSM-IV-based questionnaire. *Canadian Journal of Psychiatry*, 44, 483–487.
- Belger, E. (1943). The gambler: A misunderstood neurotic. *Journal of Criminal Psychopathology*, 4, 370-393.
- Bergler, E. (1957). *The psychology of gambling*. New York: Hill and Wang.

- Bermúdez, J. (1999). Personality and health-protective behavior. *European Journal of Personality*, 13, 83–103.
- Black, D., & Moyer, T. (1998) Clinical features and psychiatric co-morbidity of subjects with pathological gambling behaviour. *Psychiatric Services*, 49, 1434–1439.
- Black, D. W., Moyer, T., & Schlosser, S. (2003). Quality of life and family history in pathological gambling. *Journal of Nervous and Mental Disease*, 191, 124–126.
- Blanco, C., Hasin, D. S., Petry, N., Stinson, F. S., & Grant, B. F. (2006). Sex differences in subclinical and DSM-IV pathological gambling: Results from the national epidemiologic survey on alcohol and related conditions. *Psychological Medicine*, 36, 943–953.
- Blaszczynski, A. (1999) Pathological gambling: an impulse control, addictive or obsessive-compulsive disorder? *Anuario de Psicología*, 30, 93–109.
- Blaszczynski, A. & McConaghy, N. (1988) SCL-90 assessed psychopathology in pathological gamblers. *Psychological Reports*, 62, 547–552.
- Blaszczynski, A., & McConaghy, N. (1989). The medical model of pathological gambling: Current shortcomings. *Journal of Gambling Behaviour*, 5, 42–52.
- Blaszczynski, A., McConaghy, N., & Frankova, A. (1990). Boredom proneness in pathological gambling. *Psychological Reports*, 67, 35–42.
- Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, 97(5), 487–499.
- Blaszczynski A., Wilson A., & McConaghy N. (1986). Sensation seeking and pathological gambling. *British Journal of Addiction*, 81, 113–117.
- Block, J. (1995). A contrarian view of the five-factor approach to personality description. *Psychological Bulletin*, 117, 187–215.

- Block, J., & Block, J. (2006). Venturing a 30-Year longitudinal study. *American Psychologist*, 61, 315–327.
- Blume, S. (1994). Pathological gambling and switching addictions: Report of a case. *Journal of Gambling Studies*, 10, 87-96.
- Bolen, D., & Boyd, W. (1968). Gambling and the gambler: A review and preliminary findings. *Archives of General Psychiatry*, 18, 617-630.
- Bolen, D., & Boyd, W. (1970). The compulsive gambler and spouse in group psychotherapy. *The Intentional Journal of Group Psychotherapy*, 20, 77-90.
- Bondolfi, G., Jermann, F., Ferrero, F., Zullino, D., & Osiek, C. (2008). Prevalence of pathological gambling in Switzerland after the opening of casinos and the introduction of new preventive legislation. *Acta Psychiatrica Scandinavica*, 117, 236–239.
- Bonnaire, C., Bungener, C., & Varescon, I. (2009). Subtypes of French pathological gamblers: Comparison of sensation seeking, alexithymia and depression scores. *Journal of Gambling Studies*, 25, 455–471.
- Bonnaire, C., Lejoyeux, M., & Dardennes, R. (2004). Sensation seeking in a French population of pathological gamblers: Comparison with regular and nongamblers. *Psychological Reports*, 94, 1361-1371.
- Boughton, R., & Falenchuk, O. (2007). Vulnerability and comorbidity factors of female problem gambling. *Journal of Gambling Studies*, 23, 323–334.
- Boyd, W. & Bolen, D. (1970). The compulsive gambler and spouse in group psychotherapy. *International Journal of Group Psychotherapy*, 20, 77-90.
- Breen, R., & Zimmerman, M. (2002). Rapid onset of pathological gambling in machine gamblers. *Journal of Gambling Studies*, 18, 31-43.

- Breen, R., & Zuckerman, M. (1999). Chasing in gambling behaviour: personality and cognitive determinants. *Personality and Individual Differences*, 27, 1097–1111.
- Briggs, S. (1992). Assessing the five-factor model of personality description. *Journal of Personality*, 60, 253-293.
- British Gambling Prevalence Survey (BGPS). (2010). Retrieved from <http://www.gamblingcommission.gov.uk/PDF/British%20Gambling%20Prevalence%20Survey%202010.pdf>
- Brown, S., & Coventry, L. (1997). Queen of Hearts: The Needs of Women with Gambling Problems. Financial and Consumer Rights Council, Melbourne, Australia.
- Brown, S., & Mitchell, L. (2011). An observational investigation of poker style and the five-factor personality model. *Journal of Gambling Studies*, 26, 229-234.
- Caspi, A. (2000). The child is father of the man: Personality continuities from childhood to adulthood. *Journal of Personality & Social Psychology*, 78, 158-172.
- Castanier, C., Le Scanff, C., & Woodman, T. (2013). Who takes risks in high-risk sports? A typological personality approach. *Research Quarterly for Exercise and Sport*, 81, 478-484.
- Cattell, R. (1945). The description of personality: Principles and findings in a factor analysis. *American Journal of Psychology*, 58, 69-90.
- Cattell, R. (1947). Confirmation and clarification of primary personality factors. *Psychometrika*, 12, 197-220.
- Chambers, R., & Potenza, M. (2003). Neurodevelopment, impulsivity, and adolescent gambling. *Journal of Gambling Studies*, 19, 53–84.
- Chase, H., & Clark, L. (2010). Gambling severity predicts midbrain response to near-miss

- outcomes. *Journal of Neuroscience*, 30, 6180–6187.
- Cheung, F., Leung, K., Zhang, J., Sun, H., Gan, Y., Song, W., et al. (2001). Indigenous Chinese personality constructs: Is the Five-Factor Model complete? *Journal of Cross-Cultural Psychology*, 32, 407–433.
- Clark, L., Crooks, B., Clarke, R., Aitken, M., & Dunn, B. (2012). Physiological responses to near-miss outcomes and personal control during simulated gambling. *Journal of Gambling Studies*, 28, 123–137.
- Clark, L., Lawrence, A., Astley-Jones, F., & Gray, N. (2009). Gambling near-misses enhance motivation to gamble and recruit win-related brain circuitry. *Neuron*, 61, 481–490.
- Clark, L., & Livesley, W. (2002). Two approaches to identifying dimensions of personality disorder: Convergence on the Five-Factor Model. In P. T. Costa, Jr. & T. A. Widiger (Eds.), *Personality disorders and the Five-Factor Model of personality* (2nd ed., pp. 161–176). Washington, DC: American Psychological Association.
- Clark, L., & Watson, D. (1999). Temperament: A new paradigm for trait psychology. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality* (2<sup>nd</sup> ed., pp. 399–423). New York: Guilford Press.
- Clarke, S., & Robertson, I. (2005). A meta-analytic review of the big five personality factors and accident involvement in occupational and non-occupational settings. *Journal of Occupational and Organizational Psychology*, 78, 355–376.
- Cooper, M., Agocha, V., & Sheldon, M. (2000). A motivational perspective on risky behaviors: The role of personality and affect regulatory processes. *Journal of Personality*, 68, 1059–1088.
- Costa, P. & McCrae, R. (1985). *The NEO Personality Inventory*. Odessa, FL:

Psychological Assessment Resources.

Costa, P. & McCrae, R. (1992). Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory professional manual. Odessa, FL: Psychological Assessment Resources.

Costa, P., & McCrae, R. (1992). Normal personality assessment in clinical practice: The NEO Personality Inventory. *Journal of Consulting and Clinical Psychology*, 4, 5-13.

Costa, P., & Widiger, T. (2001). Personality disorders and the five factor model of personality. Washington, DC: American Psychological Association.

Coventry, K., & Brown, I. (1993). Sensation seeking, gambling and gambling addiction. *Addiction*, 88, 541–554.

Coventry, K., & Constable, B. (1999). Physiological arousal and sensation seeking in female fruit machine gamblers. *Addiction*, 94, 425–430.

Cox, B., Yu, N., Afifi, T., & Ladouceur, R. (2005). A national survey of gambling problems in Canada. *Canadian Journal of Psychiatry*, 50, 213-217.

Craik, K. (1969). Personality unvanquished. *Contemporary Psychology*, 14, 147–148.

Dannon, P. N., Lowengrob, K., Shalgi, B., Sasson, M., Tuson, L., Saphir, Y., et al. (2006). Dual psychiatric diagnosis and substance abuse in pathological gamblers: A preliminary gender comparison study. *Journal of Addictive Diseases*, 25, 49–54.

Danziger, K. (1997). *Naming the mind: How psychology found its language*. London: Sage.

Dechant, K. & Ellery, M. (2011). The effect of including a monetary motive item on the Gambling Motives Questionnaire in a sample of moderate gamblers. *Journal of Gambling Studies*, 27, 331-344.

- Desai, R., & Potenza, M. (2008). Gender differences in the associations between past-year gambling problems and psychiatric disorders. *Social Psychiatry and Psychiatric Epidemiology*, 43, 173–183.
- Dickerson, M. G. (1993). Internal and external determinants of persistent gambling: Problems in generalising from one form of gambling to another. *Journal of Gambling Studies*, 9, 225–245.
- Digman, J. (1989). Five robust trait dimensions: Development, stability, and utility. *Journal of Personality*, 57, 195–214.
- Digman, J. (1990). Personality structure: emergence of the five factor model. In M.R. Rozenwieg and L.W. Porter (Ed.), *Annual Review of Psychology*, 41, 417–440. Palo Alto, CA: Annual Reviews Inc.
- Dixon, M., Harrigan, K., Sandhu, R., Collins, K., & Fugelsang, J. (2010). Losses disguised as wins in modern multi-line video slot machines. *Addiction*, 105, 1819–1824.
- Dougherty, D., Mathias, C., Marsh-Richard, D., Furr, M., Nouvion, S., & Dawes, M. (2009). Distinctions in behavioral impulsivity: Implications for substance abuse research. *Addiction Disorders and Their Treatment*, 8, 61–73.
- Dunn, O. (1964). Multiple comparisons using rank sums. *Technometrics*, 6, 241–252.
- Ellery, M. & Stewart, S. (2014). Alcohol affects video lottery terminal (VLT) gambling behaviours and cognitions differently. *Psychology of Addictive Behaviours*, 28, 206–216.
- Ellery, M., Stewart, S., & Loba, P. (2005). Alcohol's effects on Video Lottery Terminal (VLT) play among probable pathological and non-pathological gamblers. *Journal of Gambling Studies*, 21, 299–324.
- Eysenck, H. (1990). Biological dimensions of personality. In L. A. Pervin (Ed.), *Handbook of*

- personality: Theory and research (pp. 244–270). New York: Guilford.
- Faregh, N., & Derevenski, J. (2013). Epidemiology of problem gambling in a Canadian community. *Community Mental Health Journal*, 49, 230–235.
- Ferris, J. & Wynne, H. (2001). *The Canadian problem gambling index: Final report*. Ottawa, ON: Canadian Centre on Substance Abuse.
- Fink, H. (1961). Compulsive Gambling. *Acta Psychotheraputica*, 9, 251-261.
- Fisher, S. (1993). Gambling and pathological gambling in adolescents. *Journal of Gambling Studies*, 9, 277– 288.
- Fiske, D. (1949). Consistency of the factorial structures of personality ratings from different sources. *Journal of Abnormal and Social Psychology*, 44, 329-344.
- Freud, S. (1950). Dostoevsky and parricide. In Strachey, J. (Ed.) *Collected Papers, Vol. 5: Miscellaneous papers 1888-1938* (pp. 222-242). London: Hogarth Press and The Institute of Psychoanalysis.
- Fuentes, D., Tavares, H., Artes, R., & Gorenstein, C. (2006). Self-reported and neuropsychological measures of impulsivity in pathological gambling. *Journal of the International Neuropsychological Society*, 12, 907–912.
- Funder, D. (2004). *The Personality puzzle (3rd ed.)*. New York: W. W. Norton.
- Funder, D., & Ozer, D. (1983). Behavior as a function of the situation. *Journal of Personality and Social Psychology*, 44, 107–112.
- Funder, D., & Sneed, C. (1993). Behavioural manifestations of personality: an ecological approach to judgemental accuracy. *Journal of Personality and Social Psychology*, 64, 479-490.

- Gerstein, D., Hoffman, J., Larison, C., Engelman, L., Murphy, S., Palmer, A., Chuchro, L., Toce, M., Johnson, R., Buie, T., & Hill, M. (1999). *Gambling Impact and Behavior Study*. National Opinion Research Center, University of Chicago Press; Chicago.
- Getty, H., Watson, J., & Frisch, G. (2000). A comparison of depression and styles of coping in men and female GA members and controls. *Journal of Gambling Studies*, 16, 377–391.
- Goldberg, L. (1990). An alternative "description of personality": The Big Five factor structure. *Journal of Personality and Social Psychology*, 59, 1216–1229.
- Goldberg, L. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality Psychology in Europe*, Vol. 7 (pp. 7–28). Tilburg, The Netherlands: Tilburg University Press.
- Gonzalez-Ibanez, A., Aymani, M., Jimenez, S., Domenech, J., Granero, R., & Lourido-Ferreira, M. (2003). *Psychological Reports*, 93, 707–716.
- Grant, J., & Kim, S. (2002). Gender differences in pathological gamblers seeking medication treatment. *Comprehensive Psychiatry*, 43, 56–62.
- Grant, S., & Langan-Fox, J. (2006). Occupational stress, coping and strain: The combined/interactive effect of the big five traits. *Personality and Individual Differences*, 41, 719–732.
- Graves, G., & Ellery, M. (2014). Problem gambling: The mediating role of impulsivity and cognitive bias (Unpublished master's thesis). University of Manitoba, Manitoba.
- Griffiths, M. (2013). *Trait expectations: Is there a “gambling personality?”* Retrieved from <http://www.psychologytoday.com/blog/in-excess/201302/trait-expectations-0>

- Gupta, R., & Derevensky, J. (1998). Adolescent gambling behavior: A prevalence study and examination of the correlates associated with problem gambling. *Journal of Gambling Studies, 14*, 319–345.
- Harrigan, K., Dixon, M., & Brown, D. (2014). Modern multi-line slot machine games: The effect of lines wagered on winners, losers, bonuses, and losses disguised as wins. *Journal of Gambling Studies*.
- Harrigan, K., & Dixon, M. (2009). Government sanctioned “tight” and “loose” slot machines: How having multiple versions of the same slot machine game may impact problem gambling. *Journal of Gambling Studies, 26*, 159–174.
- Haustein, J. & Schurgers, G. (1992). Therapy and male pathological gamblers: Between self help and group therapy-report on developmental process. *Journal of Gambling Studies, 8*, 131-142.
- Hing, N., & Breen, H. (2001). Profiling lady luck: An empirical study of gambling and problem gambling amongst female club members. *Journal of Gambling Studies, 17*, 47–69.
- Hofstee, W., de Raad, B., & Goldberg, L. (1992). Integration of the Big Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology, 63*, 146-16
- Hogan, R., & Hogan, J. (1995). Human Personality Inventory Manual. (2<sup>nd</sup> ed). Tulsa, OK: Hogan Assessment Systems.
- Holtgraves, T. (2009). Gambling, gambling activities, and problem gambling. *Psychology of Addictive Behaviours, 23*, 295-302.
- Hwang, J., Shin, Y., Lim, S., Park, H., Shin, N., Jang, J., ... & Kwon, J. (2012). Multidimensional comparison of personality characteristics of the big five model,

- impulsiveness, and affect in pathological gambling and obsessive-compulsive disorder. *Journal of Gambling Studies*, 28, 351-362
- Hurley, J., Ellery, M., & Jamieson, R. (2010). The effect of near-misses on gambling behaviour during a simulated video lottery terminal (VLT) task. Presented at Discovery, the Annual Meeting of the Responsible Gambling Council of Ontario, Toronto, Canada, April.
- Jacobs, D. (1986). A general theory of addictions: A new theoretical model. *Journal of Gambling Behavior*, 2, 15-31.
- Johnson, J. (2014). Measuring thirty facets of the Five Factor Model with a 120-item public domain inventory: Development of the IPIP-NEO-120. *Journal of Research in Personality*, 51, 78-89.
- Kaare, P., Mottus, R., & Konstabel, K. (2009). Pathological gambling in Estonia: Relationships with personality, self-esteem, emotional states and cognitive ability. *Journal of Gambling Studies*, 25, 377-390.
- Kessler, R., Hwang, I., LaBrie, R., Petukhova, M., Sampson, N., Winters, K., & Shaffer, H. (2008). DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychological Medicine*, 38, 1351-1360.
- King, S., Abrams, K., & Wilkinson, T. (2010). Personality, gender, and family history in the prediction of college gambling. *Journal of Gambling Studies*, 26, 347-359.
- Kohnstamm, G. A., Halverson, C. F., Jr., Mervielde, I., & Havill, V. L. (Eds.). (1998). *Parental descriptions of child personality: Developmental antecedents of the Big Five?* Mahwah, NJ: Erlbaum.
- LaBrie, R., Shaffer, H., LaPlante, D., & Wechsler, H. (2003). Correlates of college student gambling in the United States. *Journal of American College Health*, 52, 53-62.

- Langewisch, M., & Frisch, G. (1998). Gambling behaviour and pathology in relation to impulsivity, sensation seeking, and risky behaviour in male college students. *Journal of Gambling Studies*, 14, 245–262.
- Lanning, K. (1994). Dimensionality of observer ratings on the California Adult Q-Set. *Journal of Personality and Social Psychology*, 67, 151–160.
- Larsen, R., & Buss, D. (2005). *Personality psychology: Domains of knowledge about human nature (2nd Ed.)*. New York: McGraw Hill.
- Lau, B., Hem, E., Berg, A. M., Ekeberg, Ø., & Torgersen, S. (2006). Personality types, coping, and stress in the Norwegian police service. *Personality and Individual Differences*, 41, 971–982.
- Laursen B., Pulkkinen L., Adams R. (2002). The antecedents and correlates of agreeableness in adulthood. *Journal of Developmental Psychology*, 38, 591–603.
- Leblond, J., Ladouceur, R., & Blaszczynski, A. (2003). Which pathological gamblers will complete treatment? *British Journal of Clinical Psychology*, 42, 205–209.
- Ledgerwood, D., & Petry, N. (2006). Psychological experience of gambling and subtypes of pathological gamblers. *Psychiatry Research*, 144, 17-27.
- Ledgerwood, D., & Petry, N. (2010). Subtyping pathological gamblers based on impulsivity, depression and anxiety. *Psychology of Addictive Behaviors*, 24, 680-688.
- Lemaire, J., MacKay, T., & Patton, D. (2008). *Manitoba gambling and problem gambling 2006*. Winnipeg: Addictions Foundation of Manitoba.
- Lesieur, H., Cross, J., Frank, M., Welch, M., White, C., Rubenstein, G., et al. (1991). Gambling and pathological gambling among college students. *Addictive Behaviours*, 16, 517–527.

- Linden, R., Pope, H., & Jonas, J. (1986). Pathological gambling and major affective disorder: Preliminary findings. *The Journal of Clinical Psychiatry*, 47, 201–203.
- Lorenz, V., & Yaffee, R. (1988). Pathological gambling: Psychosomatic, emotional, and marital difficulties as reported by the spouse. *Journal of Gambling Behavior* 4, 13–26.
- Lewis, M. (2001). Issues in the study of personality development. *Psychological Inquiry*, 12, 67–83.
- MacLaren, V., Ellery, M., Knoll, T. (2015). Personality, gambling motives and cognitive distortions in electronic gambling machine players. *Personality and Individual Differences*, 73, 24–28.
- MacLaren, V., Fugelsang, J., Harrigan, K., & Dixon, M. (2011). The personality of pathological gamblers: A meta-analysis. *Clinical Psychology Review*, 31, 1057–1067.
- Malouff, J., Thorsteinsson, E., & Schutte, N. (2005). The relationship between the five-factor model of personality and clinical disorders: a meta-analysis. *Journal of Psychopathology and Behavioural Assessment*, 27, 101–114.
- Mayer, J. D. (2007). *Personality: A systems approach*. Boston: Allyn & Bacon.
- McAdams, D. P. (2006). *The Person: A new introduction to personality psychology*. Hoboken, NJ: John Wiley & Sons.
- McAdams, D., & Pals, J. (2006). A new big five: Fundamental principles for an integrative science of personality. *American Psychologist*, 61, 204–217.
- McCormick, R. A. (1987). Pathological gambling: A parsimonious need state model. *Journal of Gambling Behavior*, 3, 257–263.
- McCormick, R. A. (1994) The importance of coping skill enhancement in the treatment of the pathological gambler. *Journal of Gambling Studies*, 10, 77–86.

- McCrae, R., & Costa, P. (1997) Personality trait structure as a human universal. *American Psychologist*, 52, 509-516.
- McCrae, R., & John, O. (1992). An introduction to the five-factor model and its applications. *Journal of Personality*, 60, 175-215.
- Miller, J., MacKillop, J., Fortune, E., Maples, J., & Lance, C. (2013). Personality correlates of pathological gambling derived from Big Three and Big Five personality models. *Psychiatry Research*, 206, 50-55.
- Milosevic, A., & Ledgerwood, D. (2010). The subtyping of pathological gambling: A comprehensive review. *Clinical Psychology Review*, 30, 988–998.
- Moagas, L., et al. (2015). Comparative analysis of distinct phenotypes in gambling disorder based on gambling preferences. *BioMed Central Psychiatry*, 15, 1-11.
- Mischel, W. (1968). Personality and assessment. New York: Wiley.
- Moran, E. (1970) Varieties of pathological gambling. *British Journal of Psychiatry*, 116, 593–597.
- Myrseth, H., Pallesen, S., Molde, H., Johnsen, B., & Lorvik, I. (2009). Personality factors as predictors of pathological gambling. *Personality and Individual Differences*, 47, 933-937.
- National Research Council. (1999). Pathological Gambling: A Critical Review. National Academy Press; Washington, DC.
- Nower, L., & Blaszczynski, A. (2005). Characteristics and gender differences among self-excluded casino problem gamblers: Missouri data. *Journal of Gambling Studies*, 22, 81-99.

- Odlaug, B., Marsh, P., Kim, S., & Grant, J. (2011). Strategic vs nonstrategic gambling: Characteristics of pathological gamblers based on gambling preference. *Annals of Clinical Psychiatry*, 23, 105-112.
- Olmstead, C. (1962). *Heads I win-tails you lose*. New York: McMillan.
- Parke, J., & Griffiths, M. (2006). The psychology of the fruit machine: The role of structural characteristics (revisited). *International Journal of Mental Health and Addiction*, 4, 151-179.
- Paul, A. (2004). *The cult of personality*. New York: Free Press.
- Pennington, D. (2003). *Essential Personality*. New York, NY: Oxford University Press.
- McCrae, R. & Costa, P. (1997). Personality trait structure as a human universal, *American Psychologist*, 52, 509-516.
- Petry, N. (2001). Pathological gamblers with and without substance use disorders, discount delayed rewards at high rates. *Journal of Abnormal Psychology*, 110, 482-487.
- Petry, N. (2005). *Problem gambling: Etiology, comorbidity and treatment*. Washington, DC: American Psychological Association.
- Petry, N., Stinson, F., & Grant, B. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of Clinical Psychiatry*, 66, 564-574.
- Piedmont, R. (1999). Does spirituality represent the sixth factor of personality? Spiritual transcendence and the Five-Factor Model. *Journal of Personality*, 67, 985-1013.
- Pittenger, D. (2004). The limitations of extracting typologies from trait measures of personality. *Personality and Individual Differences*, 37, 779-787.
- Potenza, M., Steinberg, M., McLaughlin, S., et al. (2001). Gender-related differences in the

- characteristics of problem gamblers using a gambling helpline. *American Journal of Psychiatry*, 158, 1500-1505.
- Potenza, M., Kosten, T., & Rounsaville, B. (2001). Pathological gambling. *Journal of the American Medical Association*, 286, 141–144
- Potenza, M., Steinberg, M., Ran, W., Rounsaville, B., O'Malley, S. (2006). Characteristics of Older Adult Problem Gamblers Calling a Gambling Helpline. *Journal of Gambling Studies*, 22, 241-254.
- Potenza, M., Xian, H., Shah, K., Scherrer, J., & Eisen, S. (2005). Shared genetic contributions to pathological gambling and major depression in men. *Archives of General Psychiatry*, 62, 1015–1021.
- Preacher, K., & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behaviour Research Methods, Instruments, & Computers*, 36, 717-73
- Productivity Commission. (1999). *Australia's gambling industries, Report No. 10*. Canberra, Australia: AusInfo.
- Productivity Commission. (2010). Gambling, Report. Retrieved from <http://www.pc.gov.au/inquiries/completed/gambling-2009/report/gambling-report-volume1.pdf>
- Qualtrics. (2014). Security statement. Retrieved from <http://www.qualtrics.com/security-statement/>
- Roberts, B., & DelVecchio, W. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin*, 126, 3–25.

- Roberts, B., & DelVecchio, W. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin*, 126, 3–25.
- Roberts, B., Kuncel, N., Shiner, R., Caspi, A., Goldberg, L. (2007). The Power of Personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives of Psychological Science*, 2, 313–345.
- Rosenthal, R. (1987). The psychodynamics of pathological gambling: A review of the literature. In T. Galski (Ed.), *The handbook of pathological gambling* (pp. 41–79). Springfield: Charles C, Thomas.
- Rosenthal, R. (1990). How are I doing in soft psychology. *American Psychologist*, 45, 775–777.
- Rosenthal, R. & Lesieur, H. (1992) Self-reported withdrawal symptoms and pathological gambling. *American Journal of Addictions*, 1, 150–154.
- Rothbart, M., & Bates, J. (1998). *Temperament*. In W. Damon & N. Eisenberg (Ed.), *Handbook of child psychology*, (pp. 105–176). New York: Wiley.
- Røvi, J., Tyssen, R., Gude, T., Moum, T., Ekeberg, O., & Vaglum, P. (2007). Exploring the interplay between personality dimensions: A comparison of the typological and the dimensional approach in stress research. *Personality and Individual Differences*, 42, 1255–1266.
- Roy, A., Custer, R., & Lorenz, V. (1989). Personality factors and pathological gambling. *Acta Psychiatrica Scandinavica*, 80, 37–39.

- Salonen, A., Alho, H., & Castrén S. (2015). Gambling frequency, gambling problems and concerned significant others of problem gamblers in Finland: Cross-sectional population studies in 2007 and 2011. *Scandinavian Journal of Public Health*, 43, 229–235.
- Sarason I., Smith, R., & Diener, E. (1975). Personality Research: Components of variance attributable to the persons and the situation. *Journal of Personality and Social Psychology*, 32, 199-204.
- Schmitt, D. P., Allik, J., McCrae, R. R., Benet-Martínez, V., Alcalay, L., Ault, L., et al. (2007). The geographic distribution of Big Five personality traits: Patterns and profiles of human self-description across 56 nations. *Journal of Cross-Cultural Psychology*, 38, 173–212.
- Shaffer, H., Hall, M., & Vander-Bilt, J. (1999). Estimating the prevalence of disordered gambling behaviour in the United States and Canada: A research synthesis. *American Journal of Public Health*, 89, 1369–1376.
- Shead, W., Callan, M., & Hodgins, D. (2008). Probability discounting among gamblers: Differences across problem gambling severity and affect-regulation expectancies. *Personality and Individual Differences*, 45, 536–541.
- Shead, W., & Hodgins, D. (2009). Affect-regulation expectancies among gamblers. *Journal of Gambling Studies*, 25, 357-375.
- Shepherd, R., Ghodse, H., & London, M. (1998). A pilot study examining gambling behaviour before and after the launch of the national lottery and scratch cards in the UK. *Addiction Research*, 6, 5–12.
- Shiner, R., & Caspi, A. (2003). Personality differences in childhood and adolescence: Measurement, development, and consequences. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 44, 1-31.

- Shiner, R., Masten, A., & Roberts, J. (2003). Childhood personality foreshadows adult personality and life outcomes two decades later. *Journal of Personality*, 71, 1145-1170.
- Slutske, W., Caspi, A., Moffitt, T., & Poulton, R. (2005). Personality and problem gambling: A prospective study of a birth cohort of young adults. *Archives of General Psychiatry*, 62, 769-775.
- Spearman, C. (1927). *The abilities of man*. London: MacMillan.
- Steel, Z., & Blaszczynski, A. (1996). The factorial structure of pathological gambling. *Journal of Gambling Studies*, 12, 3-20.
- Steel, Z., & Blaszczynski, A. (1998). Impulsivity, personality disorders and pathological gambling severity. *Addiction*, 93, 895-905.
- Stevens, M., & Young, M. (2010). Who plays what? Participation profiles in chance versus skill-based gambling. *Journal of Gambling Studies*, 26, 89-103.
- Stewart, S., & Zack, M. (2008). Development and psychometric evaluation of a three-dimensional gambling motives questionnaire. *Addiction*, 103, 1110-1117.
- Tackett, J., Rodriguez, L., Rinker, D., Neighbors, C. (2014). A personality-based latent class analysis of emerging adult gamblers. *Journal of Gambling Studies*.
- Taylor, R., & Hamilton, J. (1997). Preliminary evidence for the role of self-regulatory processes in sensation seeking. *Anxiety, Stress, and Coping*, 10, 351-375.
- Templeton, J., Dixon, M., Harrigan, K., & Fugelsang, J. (2014). Upping the reinforcement rate by playing the maximum lines in multi-line slot machine play. *Journal of Gambling Studies* DOI: 10.1007/s10899-014-9446-5.

- Terracciano, A., Abdel-Khalak, A., A´ da´m, N., Adamovoa´, L., Ahn, C.-k., Ahn, H.-n., et al. (2005). National character does not reflect mean personality trait levels in 49 cultures. *Science*, 310, 96–100.
- Torgersen, S. (1995). Personlighet og personlighetsforstyrrelser [Personality and personality disorders]. Oslo: Universitetsforlaget AS (in Norwegian).
- Trevorrow, K., & Moore, S. (1998). The association between loneliness, social isolation and women’s electronic gaming machine gambling. *Journal of Gambling Studies*, 14, 263–284.
- Trill, J., & Sher, K. (1994). Relationship between the five factor model of personality and Axis I disorders in a non-clinical sample, *Journal of Abnormal Psychology*, 103, 350-360.
- Turner, N., Jain, U., Spence, W., & Zangeneh, M. (2008). Pathways to pathological gambling: Component analysis of variables related to pathological gambling. *International Gambling Studies*, 8, 281–298.
- Tupes, E., & Christal, R. (1992). Recurrent personality factors based on trait ratings. *Journal of Personality*, 60, 225-251.
- Tyssen, R., Dolatowski, F., Røvik, J., Thorkildsen, R., Ekeberg, O., Hem, E., Gude, T., Grønvold, N., & Vaglum, P. (2007). Personality traits and types predict medical school stress: A six-year longitudinal and nationwide study. *Medical Education*, 41, 781–787.
- Vitaro, F., Arseneault, L., & Tremblay, R. (1997). Dispositional predictors of problem gambling in male adolescents. *American Journal of Psychiatry*, 154, 1769-1770.
- Volberg, R. (2003). Has there been a “feminization” of gambling and problem gambling in the United States? *Electronic Journal of Gambling Issues*, 8, 1–32.
- Volberg, R., & Steadman, H. (1988). Refining prevalence estimates of pathological gambling.

- American Journal of Psychiatry*, 145, 502–505.
- Vollrath, M., Knoch, D., & Cassano, L. (1999). Personality, risky health behavior, and perceived susceptibility to health risks. *European Journal of Personality*, 13, 39–50.
- Vollrath, M. & Torgersen, S. (2000). Personality types and coping. *Personality and Individual Differences*, 29, 367–378.
- Vollrath, M. & Torgersen, S. (2002). Who takes health risks? A probe into eight personality types. *Personality and Individual Differences*, 32, 1185–1198.
- Vollrath, M. & Torgersen, S. (2008). Personality types and risky health behaviors in Norwegian students. *Scandinavian Journal of Psychology*, 49, 287–292.
- Wanner, B., Vitaro, F., Carbonneau, R., & Tremblay, R. (2009). Cross-lagged links among gambling, substance use, and delinquency from midadolescence to young adulthood: Additive and moderating effects of common risk factors. *Psychology of Addictive Behaviors*, 23, 91-104.
- West, R., Elander, J., & French, D. (1993). Mild social deviance, type A behavior pattern and decision-making style as predictors of self-reported driving style and traffic accident risk. *British Journal of Psychology*, 84, 207–219.
- Williams, R., Connolly, D., Wood, R., & Nowatzki, N. (2006). Gambling and problem gambling in a sample of university students. *Journal of Gambling Issues*, 16, 1-14.
- Williams, R., Hann, R., McLaughlin, P., White, N., King, K., Schopflocher, D., West, B., Flexhaug, T. (2014). The Quinte longitudinal study of gambling and problem gambling 2006-2011, Bay of Quinte region, Ontario [Canada]. Retrieved from <http://hdl.handle.net/10864/10580> UNF:5:tORVFBP02Ly23HdyeHABdA== Gambling Research Exchange Ontario [Distributor] V23 [Version]

- Williams, R., & Wood, R. (2007). The proportion of Ontario gambling revenue derived from problem gamblers. *Canadian Public Policy*, 33, 367-388.
- Wilson, D., & Ross, N. (2009). Place, gender and the appeal of video lottery terminal gambling: Unpacking a focus group study of Montreal youth. *Geojournal*, 76, 123-138.
- Whiteside, S. & Lynam, D. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, 30, 669-689.
- Whiting, J. & Child, I. (1953). *Child Training and Personality: A cross cultural study*. New Haven, CT: Yale University Press.
- Winters, K., Bengston, P., Door, D., & Stinchfield, R. (1998). Prevalence and risk factor of problem gambling among college students. *Psychology of Addictive Behaviours*, 12, 127-135.
- Winters, K., Stinchfield, R., & Kim, L. (1995). Monitoring adolescent gambling in Minnesota. *Journal of Gambling Studies*, 11, 165-183.
- Wynne, H. (2003). Introducing the Canadian Problem Gambling Index. Edmonton, Alberta: Wynne Resources.
- Yamagata, S., Suzuki, A., Ando, J., Ono, Y., Kijima, N., Yoshimura, K., et al. (2006). Is the genetic structure of human personality universal? A cross-cultural twin study from North America, Europe, and Asia. *Journal of Personality and Social Psychology*, 90, 987-998.
- Young, M., & Stevens, M. (2009). Player preferences and social harm: An analysis of the relationships between player characteristics, gambling modes, and problem gambling. *International Journal of Mental Health and Addiction*, 7, 262-279.

- Zangeneh, M., Grunfeld, A., & Koenig, S. (2008). Individual factors in the development and maintenance of problem gambling. In M. Zangeneh, A. Blaszczynski, & N. E. Turner (Eds.), *In the pursuit of winning. Problem gambling theory, research and treatment* (pp. 83–94). New York: Springer.
- Zhao, X., Lynch, J., & Chen, Q. (2010). Reconsidering Baron and Kenny: myths and truths about mediation analysis. *Journal of Consumer Research*, 37, 197-206.
- Zuckerman, M., Kuhlman, D. M., Thornquist, M., & Kiers, H. (1991). Five (or three) robust questionnaire scale factors of personality without culture. *Personality and Individual Differences*, 12, 929–941.
- Zuckerman, M. (2005). Faites vos jeux anouveau: Still another look at sensation seeking and pathological gambling. *Personality and Individual Differences*, 39, 361–365.

## Independent-Samples Kruskal-Wallis Test



Figure 2. Visual box plot of strategic gambling frequency across personality type

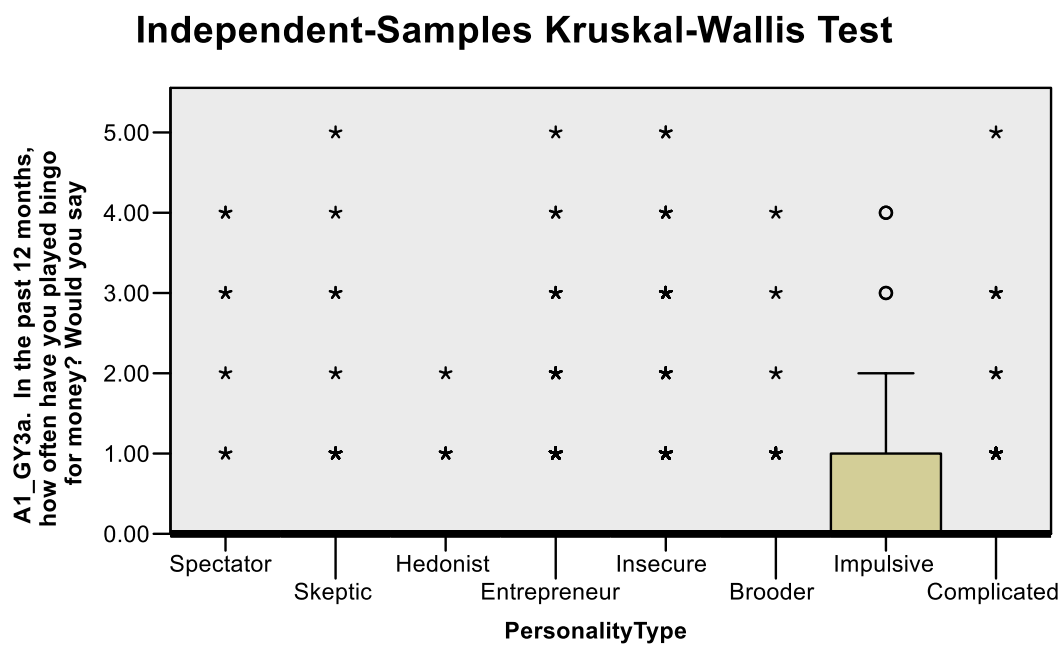


Figure 3. Visual box plot of bingo frequency across personality type

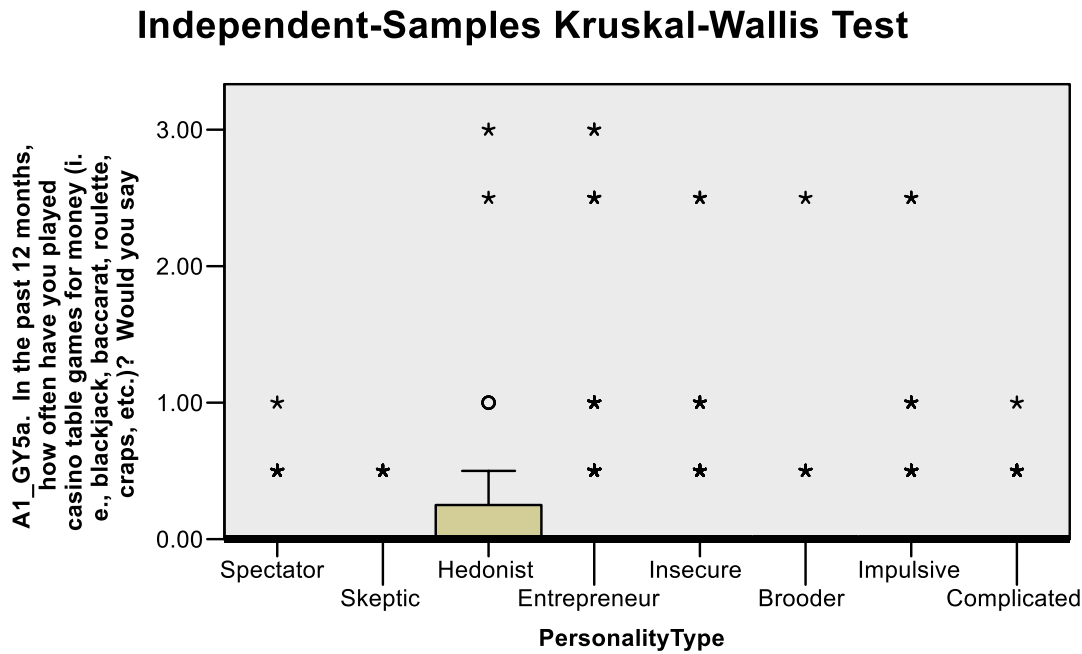


Figure 4. Visual box plot of casino table game frequency across personality type

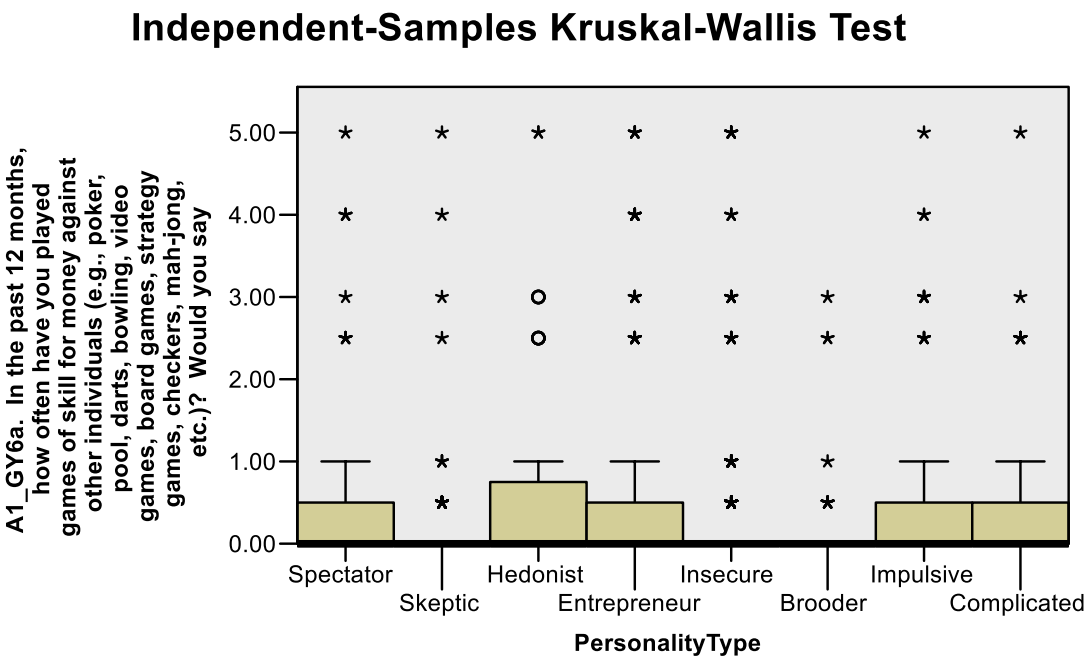


Figure 5. Visual box plot of skill gambling frequency across personality type

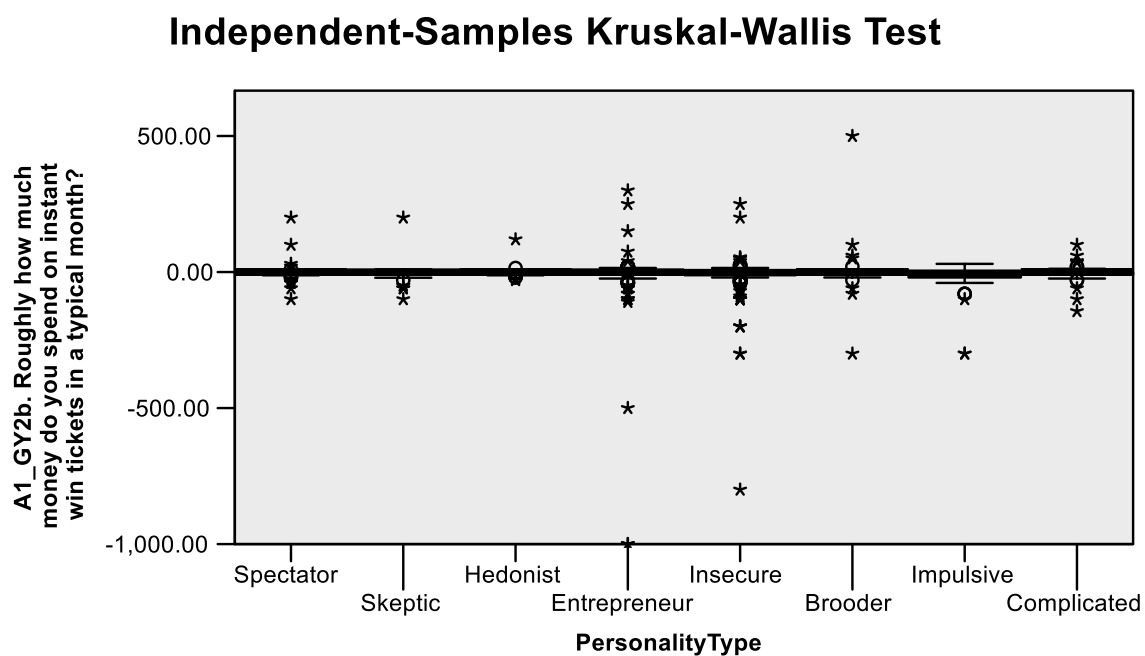


Figure 6. Visual box plot of money spent on scratch tickets across personality type

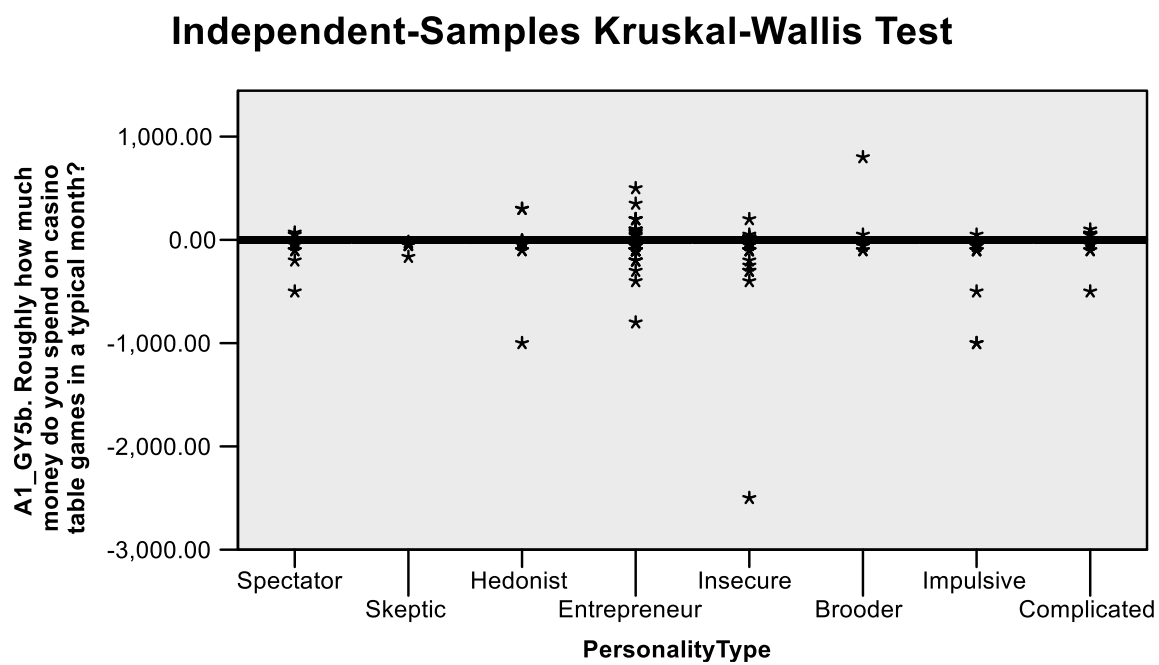


Figure 7. Visual box plot of money spent on casino table games across personality type

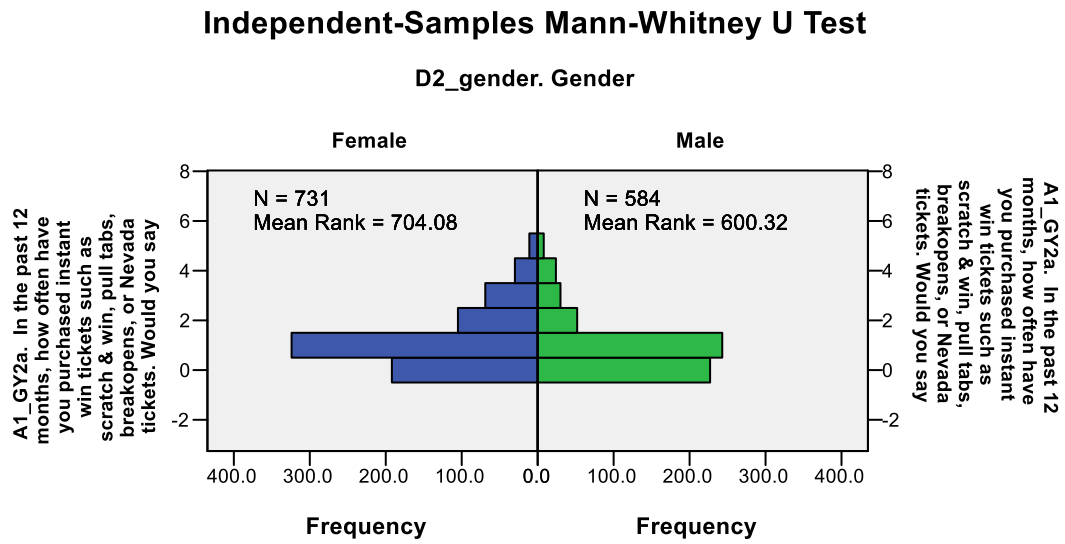


Figure 8. Visual box plot of scratch ticket frequency across personality type

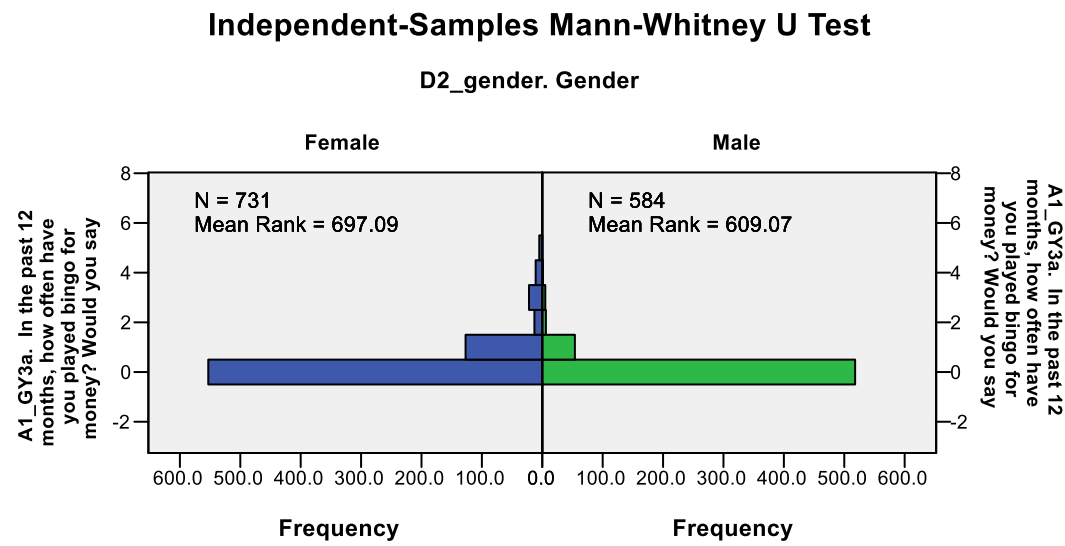


Figure 9. Visual box plot of bingo frequency across personality type

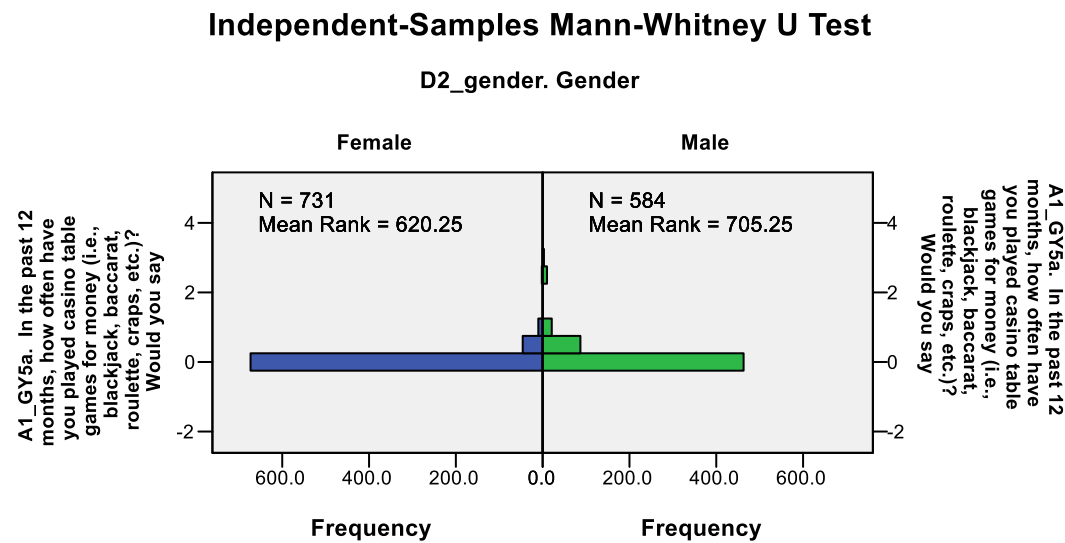


Figure 10. Visual box plot of casino table games frequency across personality type

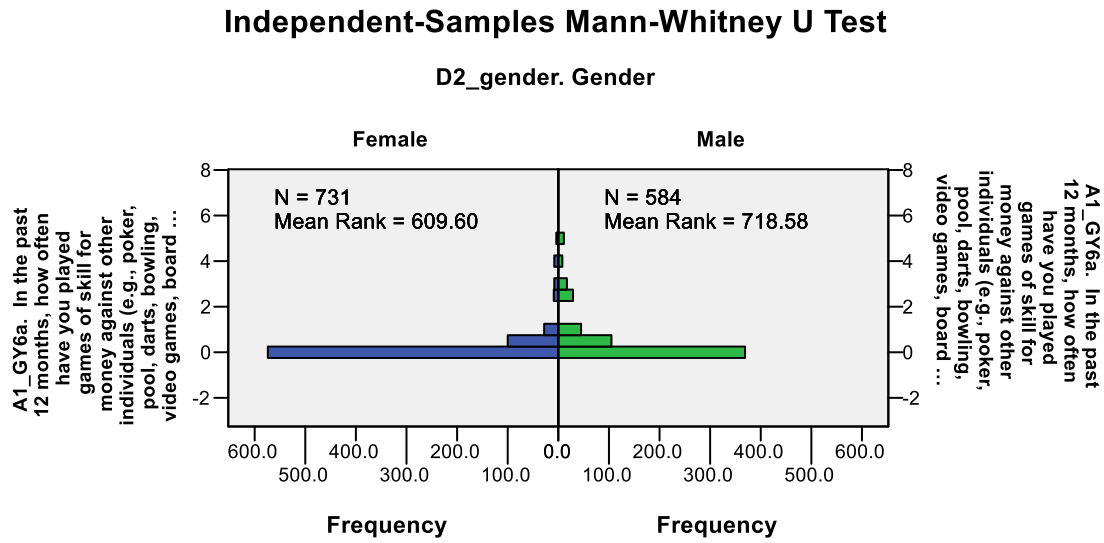


Figure 11. Visual box plot of skill gambling frequency across personality type

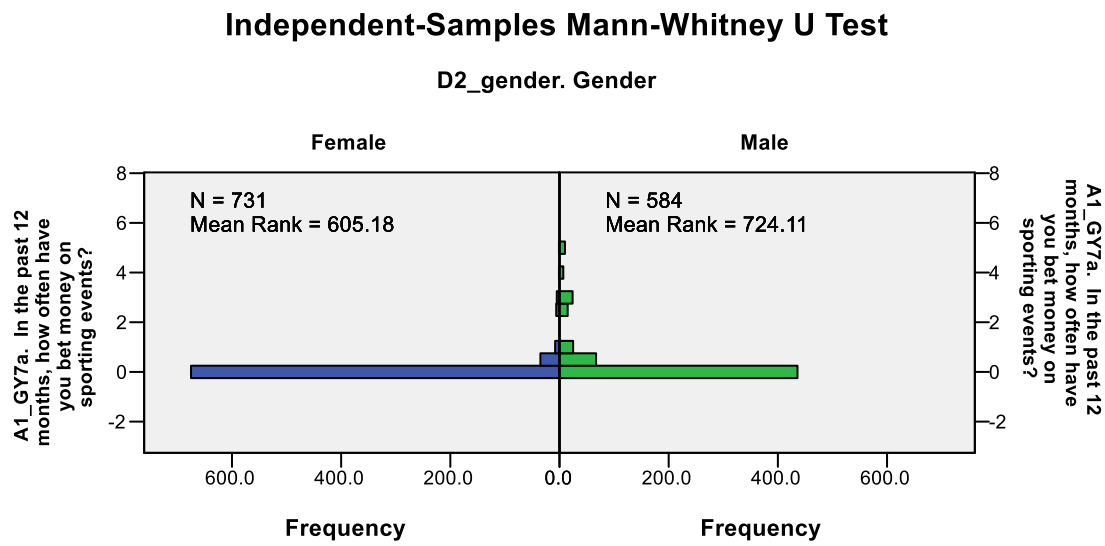


Figure 12. Visual box plot of sports betting frequency across personality type

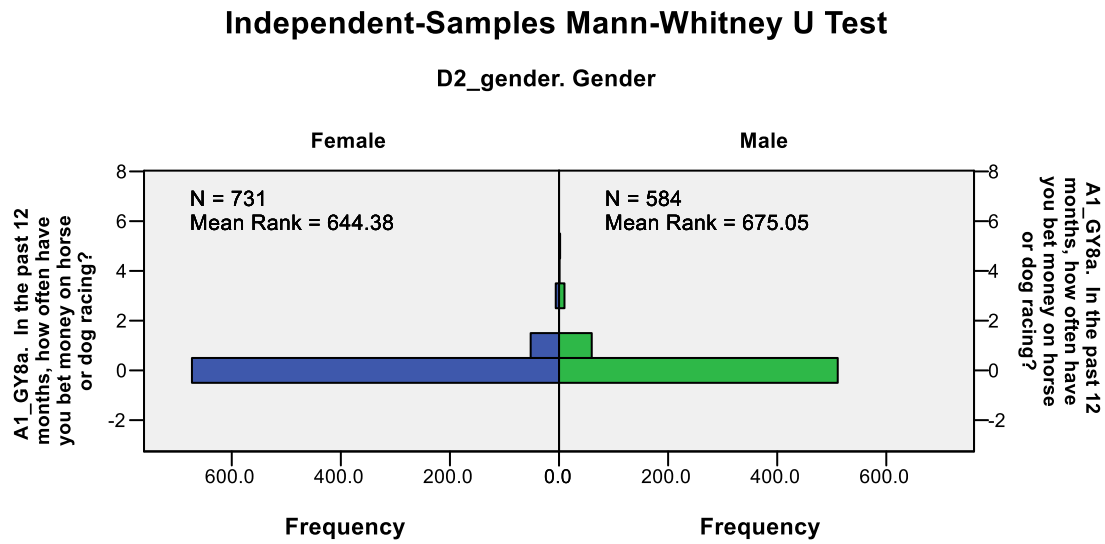


Figure 13. Visual box plot of animal race betting frequency across personality type

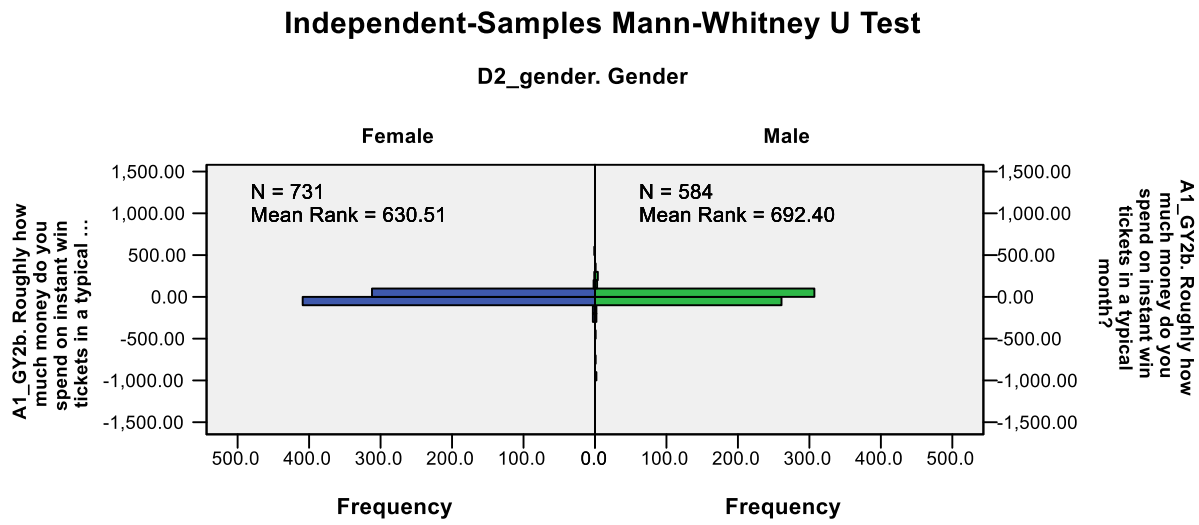


Figure 14. Visual box plot of money spent on scratch tickets across personality type

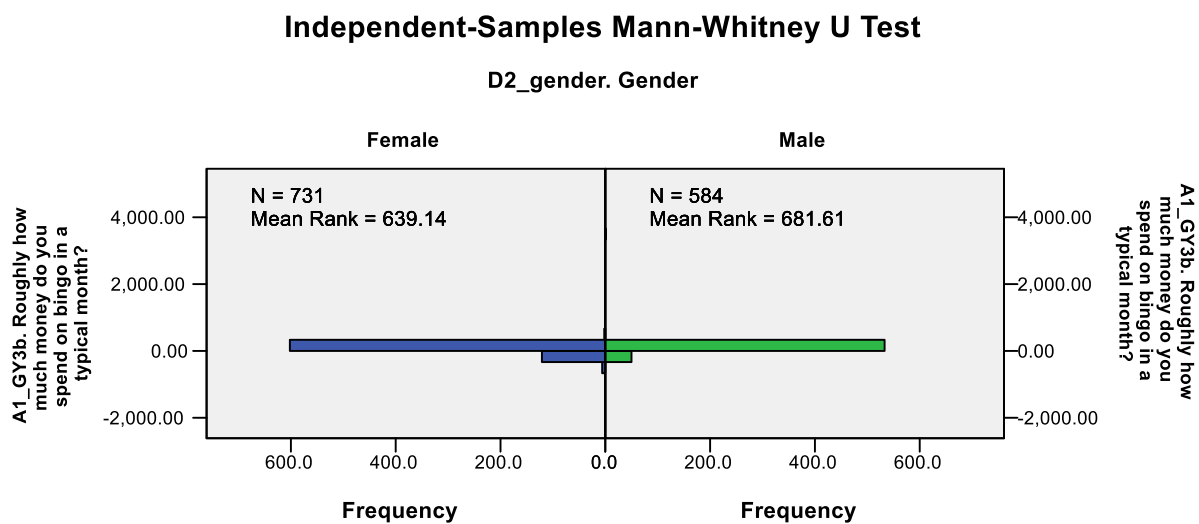


Figure 15. Visual box plot of money spent on bingo across personality type

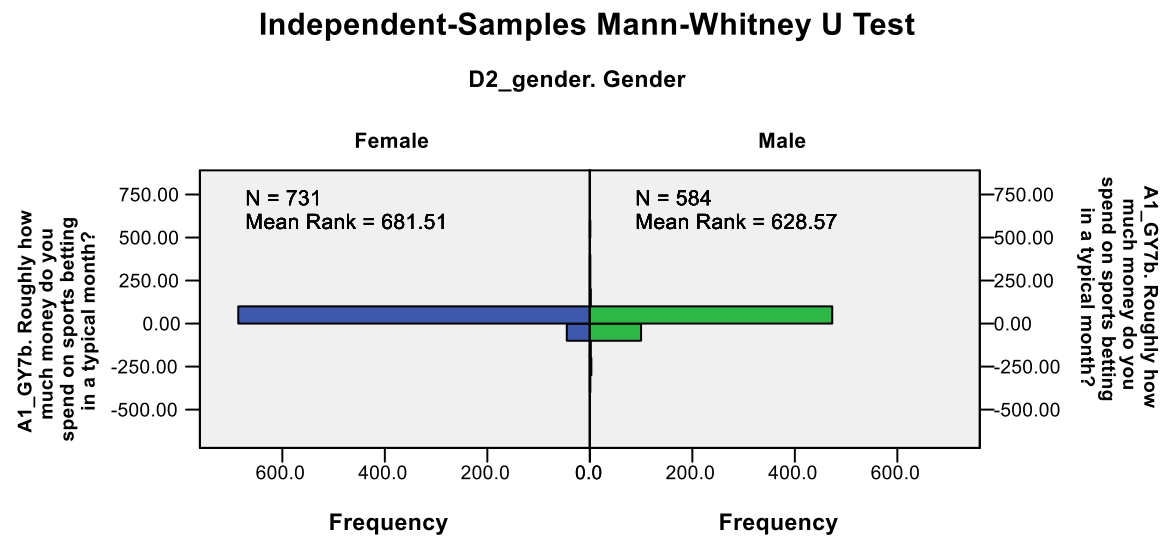


Figure 16. Visual box plot of money spent on sports betting across personality type