



**PSYCHOPATHY AND HUMAN JUDGEMENT:
A PERSONALITY VIEW OF CRIMINAL DECISION-MAKING**

João Cardoso da Silva Próspero Luís

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Abstract

On the present thesis, criminal decision-making was explored through the view of specific personality traits (i.e. psychopathic traits and low self-control). After performing an historical and empirical analysis of the concept of self-control and psychopathy, an in-depth examination of some of the different components that constitute the human decision-making process (i.e. rational choice, expectation-value approach, heuristics and associative learning) was conducted. Furthermore, a theoretical link was established between all the included decision-making components and psychopathy; this conceptual integration allowed the analysis of the impact of relevant psychopathy-related mechanisms (i.e. learning deficits, emotional impairments, sensation-seeking tendencies, hypersensitivity to rewards) on criminal decision-making, which works as a base to explain psychopathy's increased criminal propensity. The studies that integrate the present work focus on the different components of said process. Study 1 focuses on the relationship between psychopathic traits and attitudes, particularly attitudinal beliefs that act in favor of criminal behavior, more specifically, theft. Using a Theory of Planned Behavior (Ajzen, 1991) inspired methodology, this study explores the dynamics underlying criminal attitudes and intention formation in a sample of male recidivist inmates. Study 2 acts as an extension of Study 1; using similar methodology and hypotheses, Study 2 also analyzes attitudinal and intention elements of the decision-making process, however, in a non-forensic context and with different research behaviors (i.e. academic cheating and shoplifting). This study also involves the inclusion of female participants and an antisocial behavioral history measure. Study 3 delves into psychopathy's psychophysiology through the use of heart-rate measures and laboratorial tasks that focus on passive-avoidance learning and motor impulsivity. Study 4 investigates psychopathy's use of heuristic-based thinking. In this last study, the relationship between psychopathic traits and loss aversion is explored in a non-forensic setting. These studies aim at painting a general image of psychopathy's antisocial decision-making process, each focusing in a unique element (i.e. attitudes, intention, learning deficits, heuristics and judgement biases). Afterwards, a general discussion integrates the reported data into a more conceptual view of the significant phenomena. The concept of psychopathy is further dissected, along with the notion of *criminal optimism*. A brief thought is also devoted to the relation between psychopathic traits and moral emotions (i.e. shame and guilt). An overview of other concepts that could contribute to the existing research on human decision-making is presented in the final chapter.

Resumo

A presente tese tem como objetivo explorar a tomada de decisão criminal, com especial ênfase na influência de traços de personalidade específicos (i.e. psicopatia e baixo auto-controlo). A dissertação inicia-se com uma extensiva análise teórica e empírica dos conceitos de auto-controlo e psicopatia, seguido de um levantamento e posterior discussão de diferentes elementos que fazem parte integrante do processo de tomada de decisão (i.e. escolha racional, abordagem do tipo expectativa-valor, heurísticas e aprendizagem). As diferentes componentes desse processo são analisadas em interação com os traços psicopáticos de modo a permitir explorar em detalhe o impacto que os diversos mecanismos subjacentes à psicopatia (i.e. défices de aprendizagem, perturbações emocionais, tendências para a procura de adrenalina, hipersensibilidade à recompensa) têm sobre a decisão criminal. Os estudos que integram a present tese centram-se nas componentes distintas desse mesmo processo. O Estudo 1 foca-se na relação entre traços psicopáticos e atitudes; em especial crenças atitudinais que contribuem para o envolvimento criminal em comportamentos de furto. Este estudo, através de uma abordagem baseada na Teoria do Comportamento Planeado (Ajzen, 1991), explora as dinâmicas subjacentes à formação de atitudes e intenção criminal numa amostra constituída por reclusos reincidentes. O Estudo 2 tem como objetivo a extensão dos resultados obtidos no Estudo 1; através de uma abordagem metodológica semelhante, este estudo analisa os mesmos elementos (i.e. intenção e atitudes) do processo de tomada de decisão, agora num contexto não-forense e com diferentes comportamentos (i.e. Fraude académica e *shoplifting*). O estudo 2 integra participantes do sexo feminino e novas medidas de histórico criminal. O Estudo 3 centra-se na componente psicofisiológica da psicopatia através da inclusão de medidas de ritmo cardíaco e tarefas laboratoriais com foco na aprendizagem por evitamento-passivo e impulsividade motora. O Estudo 4 foca-se no uso de heurísticas na psicopatia, analisando-se a relação entre traços psicopáticos e a aversão à perda num contexto não-forense. Este conjunto de estudos pretende definir detalhadamente o processo de decisão criminal na psicopatia; cada um destes estudos se centra num elemento particular desse mesmo processo (i.e. atitudes, intenção, défices de aprendizagem, heurísticas). Posteriormente, os resultados obtidos são discutidos numa abordagem mais conceptual dos fenómenos em estudo, onde o conceito de psicopatia é dissecado em conjunto com o conceito de *otimismo criminal* e de emoções morais (i.e. culpa e vergonha). Por último, procede-se à integração de novos conceitos de relevo para o estudo do processo da tomada de decisão criminal.

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List of acronyms and abbreviations

ADHD – Attention Deficit Hyperactivity Disorder
ADMC - Adult Decision-making Competence
ASPD – Antisocial Personality Disorder
BAS - Behavioral Activation System
BFI - Big Five Inventory
CAPP - Comprehensive Assessment of Psychopathic Personality
CFI- Comparative Fit Index
CPS - Childhood Psychopathy Scale
CR – Conditioned Response
CS – Conditioned Stimulus
CU - Callous-Unemotional Trait
DSM – Diagnostic and Statistical Manual of Mental Disorders
DT – Dark Triad
ECG – Electrocardiogram
EPPF - Estabelecimento Prisional de Paços de Ferreira
EPSCB - Estabelecimento Prisional de Santa Cruz do Bispo
ESC - Electric Skin Conductance
FFM – Five Factor Model
fMRI - Functional Magnetic Resonance Imaging
GESS - Generalized Expectancy for Success Scale
GTC – General Theory of Crime
HR - Heart Rate
HRV – Heart Rate Variability

ICU - Inventory of Callous-Unemotional Traits
ID/ED - Intradimensional/Extradimensional Shift Task
IES - Integrated Emotion Systems
IRI - interpersonal Reactivity Index
LOT - Life Orientation Test
LSRP - Levenson Self-Report Psychopathy Scale
MACH-IV – Machiavellianism Test
MI – Modification Indices
MPQ-35 - Multidimensional Personality Questionnaire
NEO PI-R - NEO Personality Inventory
NEO-FFI – NEO Five Factor Inventory
NPI - Narcissistic Personality Inventory
PA – Passive-Avoidance
PBC - Perceived Behavioral Control
PCL:SV - Psychopathy Check-List: Screening Version
PCL:YV - Psychopathy Check-List: Youth Version
PCL-R – Psychopathy Check-list – Revised
PD - Personality Disorders
PEBL - Psychology Experimental Building Language
PPI - Psychopathic Personality Inventory
PPI-SF - Psychopathic Personality Inventory – Short Form
PRI - NEO PI-R Psychopathy Resemblance Index
RMSEA – Root Mean Square Approximation
SEM – Structural Equation Model
SRP-III - Self-Report Psychopathy Scale–III
TMAS – The Manifest Anxiety Scale
TONI-II - Test of Nonverbal Intelligence
TPB - Theory of Planned Behavior

TRA - Theory of Reason Action

TriPM – Triarchic Psychopathy Measure

US – Unconditioned Stimulus

vmPFC – Ventromedial Pre-Frontal Cortex

WAI-SF - Weinberger Adjustment Inventory Short Form

WCST – Wisconsin Card Sorting Task

YDMC - Youth Decision-making Competence

YPI – Youth Psychopathic Traits Inventory

Introduction

I - Introduction and objectives

Decision-making is regarded as a rational process that results in the selection of a specific course of action among various different alternatives. This phenomenon has been studied for centuries by philosophers, mathematicians, economists, and statisticians, however, it has a relatively short history within experimental psychology (Slovic, Lichtenstein & Fischhoff, 1983). The first major work in the field of human judgement (Edwards, 1954) presented an elaborate and complex literature, heavily economic-based, on risky *versus* safe choices, utility as well as game theory, reviewing a plethora of relevant experimental studies on the topic. According to Ajzen (1996), the field of human judgement and decision-making, in spite of its multidisciplinary character, has been developing an independent identity throughout the years, acquiring its own problem definitions, concepts and traditions in research.

Since Edward's review, numerous theories and controlled experiments regarding choice and decision-making flooded the field. The origin of the research on human decision follows two main streams: the theory of riskless choice, originated by the notions of utility maximization postulated by Jeremy Bentham and James Mill and; the theory of riskless choice (Slovic, et al., 1983). Theories that were based on the first stream (e.g. Thurstone, 1927; Luce, 1959; Restle, 1961) perceived the decision-maker as informed about the possible courses of action and inherent consequences, sensitive to differences in the various alternatives and able to perform rational choices (i.e. they can organize the possible courses of action and make choices in order to maximize something - *utility*). Authors such as Thurstone, introduced alterations to these frameworks to capture the inconsistent nature of human judgement. Regarding the second research stream; this theory deals with decisions made in the face of uncertainty about events that will determine the outcomes of one's actions (Slovic, et al., 1983). The role of maximization is also central to these theories, however, the quantity to be maximized becomes *expected utility* due to the uncertainty it involves. Simon (1956) contested the idea of maximization, arguing that a rational decision-maker attempts to attain some satisfactory level of achievement, rather than maximal level, highlighting the importance of perception, learning and cognition to the research surrounding the decision-making process. The work of Simon (1956) rose attention to the inherent psychological processes of human judgement.

The decision environment presents the individual with an overabundance of potential challenges: awareness of the problem that requires a decision, enumerating possible courses of action, amassing data about the different alternatives, identifying possible future circumstances that might be relevant to the decision and considering the possible outcomes contingent on the chosen action and the prevailing circumstances (Albert, Aschenbrenner & Schmalhofer, 1989). Following this decision structuring, the decision-maker needs to estimate the probability of the outcomes associated with the different alternatives, as well as, appraising their subjective values (Ajzen, 1996). These judgements then need to be integrated in order to choose a preferred course of action, leading to the implementation of the decision at the appropriate opportunity. Another important element pointed out by Ajzen (1996) is the importance of using the feedback from the behavioral decision as future reference for upcoming decisions. The degree of satisfaction towards the selected choice can lead to further restructuring of the issue, reassessment of the subjective expectations and values attributed to the outcomes and opinion shift regarding the preferred course of action. According to Ajzen (1996), the starting point of the majority of research done on human decision-making is the rational model of choice behavior, heavily rooted in the field of economics and statistics. Within this framework, the individual is compared to an intuitive statistician who carefully considers the different alternatives, making full use of the available information in accordance with normative, statistical principles of probability and logic (Peterson & Beach, 1967).

The processes underlying human judgement are vast and complex in nature, encompassing elements from several distinct research fields such as the rational pondering of behavior outcomes (e.g. Becker, 1976; Cornish & Clarke, 1987), the attribution of subjective probabilities and values to each consequence (e.g. Ajzen & Fishbein, 1975), the influence of group norm and peer pressure (e.g. Ajzen, 1991), the importance of actual control *versus* perceived control over the behavior (e.g. Ajzen, 1991), the influence of personality characteristics (i.e. low self-control, psychopathic traits) and the irrational effect of judgement heuristics (e.g. Tversky & Kahneman, 1974). The study of the decision-making process demands the use of a multidisciplinary lens in order to capture its full essence. The present work focusses on a very specific type of decision process; the criminal decision-making process. Special attention will be dedicated to the impact of psychopathy and psychopathy-related mechanisms over this type of human judgement.

Psychopathy is viewed as a syndrome encompassing a constellation of affective, interpersonal and behavioral attributes, such as indifference towards the rights of others, manipulation and tendency to lie, impulsivity and irresponsibility, thrill-seeking behavior, shallow affect, low levels of self-control, lack of empathy and remorse, promiscuity and propensity to engage in antisocial conducts (Hare, 2007). Several of these characteristics make the psychopath a particularly criminally-prone individual, frequently adopting and relapsing in violent and risky behavior (Woodworth & Porter, 2002). Research on the construct of psychopathy has been vast and riddled with conflict (Skeem, Polaschek, Patrick & Lilienfeld, 2011). In part, the interest in psychopathic traits is due to the fact that these provide a natural experiment for the research on the interaction of emotional, cognitive and behavioral-control elements. Also, psychopathic individuals exhibit a higher risk of offending, sometimes up to three times more likely to relapse after prison release and four times more likely to reoffend violently (Grann, Långström, Tengström, & Kullgren, 1999; Hemphill, Hare, & Wong, 1998).

Research has shown that various specific mechanisms that underlie psychopathy have also a significant impact on the way these individuals make decisions, especially in a criminal context. One of such mechanisms is related to learning impairments. In fact, several studies have shown that psychopathic individuals exhibit deficits regarding stimulus-reinforcement learning (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005). Authors, such as Blair (2005), argue that these deficiencies are related to amygdala impairments that compromise the establishment of associations between behavior and its consequences. This failure to establish a behavior-outcome link is particularly relevant in the case of criminal conduct (i.e. failing to learn with the consequence of one's actions will lead into behavior repetition). Furthermore, these learning problems are also related to unresponsiveness to emotional expressions and other social reinforcers indispensable to human judgment and decision-making (Blair, 2013).

Another of psychopathy's influence over the decision-making process has to do with their innate tendency towards sensation-seeking. Psychopathic individuals, often considered naturally hypo-activated (Lykken, 1995), will pursue adrenaline-inducing activities and frequently opt for the risky alternative in order to restore their levels of arousal (Eysenck & Gudjonsson, 1989; Gatzke-Kopp, Raine, Loeber, Stouthamer-Loeber, & Steinhauer, 2002; Quay, 1965; Zuckerman, 1994). Since crime is a highly arousing activity, individuals with this type of tendency will exhibit

higher inclination towards it. This way, this sensation-seeking tendency can heavily influence the individual's decision-making process, especially concerning criminal activities. Also related with the hypo-activation is hyper-sensitivity to rewards. In fact, neuro-imagiological studies have shown that these individuals exhibit a type of sensitivity towards outcome rewards that might also significantly impact their decision-making process (e.g. Bjork, Chen, & Hommer, 2012; Buckholz et al., 2010). Modulations in the attraction of specific rewards will turn antisocial behavior into a more alluring alternative.

Some of these elements are also present in the case of individuals with low levels of self-control (e.g. reward sensitivity, sensation-seeking, learning deficits). Throughout the development of the construct of psychopathy a heavy accent has been set on the importance of self-control. In fact, several working models of psychopathy have entered impulsivity as a main element of the construct (e.g. McCord & McCord, 1964; Robins, 1966; Hare, 1991; Cooke, Hart, Logan, & Michie, 2012). Moreover, studies highlight the importance of a conjunct approach in the study of severe delinquency, especially in regard to psychopathy and low self-control (e.g. Wiebe, 2003; Vaughn, DeLisi, Beaver, Wright & Howar, 2007; Jonason & Tost, 2010; Flexon & Meldrum, 2013; Flexon, Meldrum, Young & Lehmann, 2016). Despite this close relationship, low self-control is also closely associated with criminal conduct and, therefore, it configures an essential element in understanding criminality and the criminal decision-making process.

The link between self-control and criminal behavior is one of the most studied associations in the field of Criminology (Akers, 1991). The theory developed by Gottfredson and Hirschi (1990), the general theory of crime, understands self-control as the single, most important predictor of criminal conduct. This assumption, as well as the theory itself, has been thoroughly researched over the years and the concept has been soundly established as one of the most important predictors of crime (e.g. Polakowski, 1991; Keane, Maxim & Teevan, 1993; Wood, Pfefferbaum & Arneklev, 1993; Grasmick, Tittle, Bursik & Arneklev, 1993; Evans, Cullen, Burton, Dunaway & Benson, 1997; Longshore, 1998; LaGrange & Silverman, 1999; Pratt & Cullen, 2000; De Ridder, Lensvelt-Mulders, Finkenauer, Stok & Baumeister, 2018).

As every other psychological phenomenon, the concept of self-control is not without criticism. Authors, such as Akers (1991), point out several weaknesses to the concept itself and to the way the framework is structured and tested. Simultaneously, the link between self-control and

psychopathy is also not foolproof, with some authors rejecting a possible connection between both constructs (e.g. Gottfredson & Hirschi, 1990; Harris, Rice & Cormier, 1994). At the same time, both psychopathy and self-control characterize the offender as lacking self-regulation, being indifferent to others and difficult in terms of temperament, possessing deficits in regard to emotional and behavioral regulation, descending into hedonistic and short-sighted quests (Wiebe, 2003; DeLisi, Tostlebe, Burgason, Heirigs & Vaughn, 2018). Even though not every individual integrates all of these traits, each of them individually increases the individuals' predisposition towards crime (Wiebe, 2003). The research points out the importance of a conjunct approach to the study of criminal behavior and decision-making. In spite of the overlapping characteristics of psychopathy and self-control, it is still unclear how these two concepts relate to each other and, therefore, the mutual inclusion of these constructs is essential.

Individual differences and personality traits seem to carry a strong influence over the process of decision making, however, they are not exclusive. Tversky and Kahneman's research (1974) brought to light another gravitating influence to the study of human decision, the effect of heuristics. In the field of psychology, heuristics are considered basic, and sometimes efficient rules that are used in human decision-making as shortcuts to solve complex problems. These shortcuts often ignore important aspects of the issue, leading to systematic errors that diverge from logical and rational thinking (Lewis, 2008). The research on heuristics started with Kahneman and Tversky in the 1970s, in an era where rational choice led the study on human decision (Gilovich, Griffin & Kahneman, 2002). Their work aimed at proving that, although being fundamentally rational-based, human cognition still bears its flaws (Herrnstein, 1990). Tversky and Kahneman's initial work (1974) described three types of heuristics (i.e. availability, representativeness, anchoring and adjustment) that work as guides in case of intuitive judgment in the face of uncertainty (Gilovich et al., 2002). According to the authors, several decisions are based on beliefs concerning the likelihood of uncertain events; people rely on heuristics in order to reduce problematic tasks to easier judgmental processes. One of Tversky and Kahneman's (1974) main point about the use of heuristics is related to one major flaw: cognitive biases. According to the authors, subjective evaluation of likelihoods are based on information of questionable validity that can lead to grave, systematic errors. The wide spreading of Kahneman and Tversky's work led to a vast research pool on heuristic-based thinking from where several new heuristics arose (e.g. framing effect, sunk costs, loss aversion).

Even though the effect of heuristics is perceived as being a general influence on human judgement, there are several elements underlying psychopathy that might have an impact on the way these cognitive biases work. Heuristics can be sorted into different groups, from more cognitive-based heuristics (e.g. anchoring and framing), to more affect-based (e.g. availability). As previously mentioned, psychopathic individuals exhibit deep impairments regarding emotional processing (e.g. Patrick, Fowles & Krueger, 2009; Hastings, Tangney & Stuewig, 2008; Marsh, et al., 2008) and cognitive resource allocation (e.g. Patterson & Newman, 1993; Baskin-Sommers, Curtin & Newman, 2011) which can have a significant effect in the way heuristics influence decision-making in psychopathy.

The present work, as a thesis on the area of Criminology, constitutes a contribution to the literature concerning the criminal and antisocial decision-making process and its interaction with psychopathic traits and low self-control. The main structure of this dissertation is divided into three sections. In Section A, a theoretical approach will be used, compiling literature and empirical remarks about the elements in study. In order to carry out this work, Section A will be segmented into two parts. Part 1 will focus on the conceptual definition and delimitation of the individual differences in study (i.e. psychopathic traits and self-control). Regarding both psychopathy and self-control, an in-depth historical analysis will be developed and complemented with a review of the major theoretical frameworks, conducted research and critiques. Throughout the development of Part 1, an effort will be made towards connecting both personality elements under study. In Part 2, the decision-making process will be closely dissected. This second part will include literature review concerning different models of human decision-making as well as other elements that have a major influence over human judgement, such as the influence of heuristics and the importance of learning. The elements discussed over in Part 2 will be consistently linked to the personality characteristics elicited in Part 1, with a special focus on the impact of psychopathic traits. Each part will be deeply focused on criminal and antisocial behavior.

Section B will consist of an exhaustive description of the conducted studies constructed around the research on antisocial decision-making. This section includes an introductory chapter where the objectives and specific research hypothesis will be described and enumerated. In section B four distinct studies will be described. In Study 1 the relationship between psychopathic traits and criminal attitudes as well as criminal intention formation is explored in a forensic setting

(recidivist inmates). Study 2 works as an extension of the results obtained in the first study. This study analyses the psychopathy - attitude formation – behavioral intention link in a non-forensic sample and for other types of antisocial behavior (i.e. Shoplifting and Academic Cheating), it includes female participants, and it considers past behavior as a predictor of behavioral intentions. Study 3 takes an extra step in complementing the second study by integrating three experimental tasks regarding stimulus-reinforcement learning and self-control (i.e. passive-avoidance task - Blair, Mitchell, Leonard, Budhani, Peschardt, & Newman, 2004; Wisconsin card-sorting task - Berg, 1948; Go/No-go task - Bezdjian, Baker, Lozano & Raine, 2009). In addition to the experimental tasks, a heart-rate measure was also included in the protocol. Finally, Study 4 inspects the relationship between psychopathic traits, self-control and other personality components (Machiavellianism and Narcissism) and the loss aversion heuristic. Each study chapter includes specific sections regarding the used sample and procedures, the utilized scales and measuring instruments (as well as a description of each), the obtained results and relevant statistical analysis as well as a comprehensive discussion of those same results.

Section C focus on reporting a holistic view of the thesis. In this last section, a general discussion is presented; this discussion delves deeply into the more relevant and extrapolative results. With a more theoretical view in mind, this section unfolds into three different topics. First, an alternative psychopathy framework is presented. This framework is based on the collected data and assumptions based on previously discussed issues. Secondly, a different view is offered concerning the concept of *criminal optimism* (this concept is explained further). Lastly, the link between psychopathy and morality is discussed. Section C ends with a brief section where finalizing remarks are made and a few new concepts relevant to the study of human decision are introduced.

In summary, the overall goal of this work is to deeply inspect the influence of psychopathic traits, low self-control and heuristics in the antisocial decision-making process.

SECTION A

Theoretical Framework

Part 1

Individual Differences

1.1. General Theory of Crime

In 1990, Gottfredson and Hirschi developed the General Theory of Crime, a control theory advertised as being able to explain all types of criminality (and other analogous acts) regardless of its context. The core of this framework is the assumption that low self-control is the most important predictor of criminal behavior. The authors use the “self-control” concept as a pivot in which every known fact about crime can be organized around (Akers, 1991). This framework marked a relevant period for criminology as a science with major methodological and theoretical impact due to its spectrum of application as well as overall strength of its main argument (Akers, 1991). According to Cohn and Farrington (2011), Hirschi and Gottfredson’s book ranks number two in citations within criminological literature (in the 1990s). In the origin of the GTC lies another theory developed by the Hirschi named social bonding theory (Hirschi, 1969). This had a severe impact on following theories of delinquency, spawning a plethora of studies in that regard (Ozbay & Ozcan, 2006) and was inspired by Jackson Toby’s research on gang socialization, in special, the concept of *investment in conventionality*, also known as, *stake in conformity* (Toby, 1957). In general lines, Hirschi draws attention to the rationality in the decision to engage in criminal behavior, also arguing that people are less likely to get involved in criminal activities if they have strong social bonds (Hirschi, 1969). From that point onward, the authors have progressively researched and formulating the GTC, including the bonding element as an influence on the development of self-control (Gottfredson & Hirschi, 1990, pp. 95).

The conception of this theory included a very thorough definition of two main concepts that are perceived as distinct from one another: “Crime” and “Criminality”. The authors conceive “crime” as “...acts of force or fraud undertaken in pursuit of self-interest” (Gottfredson & Hirschi, 1990). This conceptualization is made in order to enable the authors to define the nature of the crime by themselves (freeing them from any political grasp). Contrary to a juridical definition, the authors’ definition is malleable. Whether a specific act is illicit or not can change when the same action is carried out in different contexts. This type of conceptualization makes “crime” as the central element of the theory (Gottfredson & Hirschi, 1990).

Criminal acts are conceived as trivial and with little to no need of prior planning. This point of view gives these acts a feel of effortlessness and immediacy. According to the authors, crimes

are interchangeable and, therefore, distinctions regarding seriousness, type or function are pointless and often misleading (Siegmunt, 2016). “Criminality” is defined as the pull of an individual towards crime. This propensity takes the shape of the aforementioned defining features of criminal acts: promise of immediate and easy profit, thrill-seeking, lack of long-term benefits, low skill requirements, absence of need to plan and potential damage to the victims. These characteristics are perceived as having an early onset and as being consistent throughout the individual’s life (Gottfredson & Hirschi, 1990, pp. 90-91).

For the authors, self-control is the same as “criminality” and is generally defined as a tendency to avoid acts in which long-term costs exceed short-term benefits. Self-control acts as a unidimensional trait, consisting of thrill-seeking, a preference for simple task (as opposed to tougher ones), a self-centered orientation, a preference for physical tasks (as opposed to more mental activities), a search for immediate gratification and an unstable temper (Grasmick, et al., 1993).

According to Gottfredson and Hirschi (1990), the origin of low self-control is, primarily, family socialization. The framework postulates that children do not differ in self-control levels; self-control develops throughout life until the age of ten. Low levels of self-control originate from excessive punishment and care negligence. Overt disapproval of parental unities acts as the most important sanction. The authors also describe the ideal parental practices for children to naturally develop normal self-control levels; the steps comprise of behavior observation, recognition of deviant practices and punishment of such behaviors. Careful parental rearing and supervision is also perceived as a deterrent of future antisocial behavior. Even though socialization occurs throughout life, once established, self-control remains relatively unchanged over-time. The importance of socialization for the development of self-control has been extensively validated (e.g. Feldman & Weinberger, 1994; Polakowski, 1994; Gibbs, Giever & Martin, 1998; Hay, 2001; Gibbs, Giever, & Higgins, 2003; Burt, Simons & Simons, 2006). Despite this idea of socialization being in the genesis of self-control having solid research support (e.g. Gottfredson & Hirschi, 1990; Hay, 2001; Pratt, Turner, & Piquero, 2004; Turner, Piquero, & Pratt, 2005; Burt, Simons, & Simons, 2006), more recent studies have attributed some of this responsibility to other biogenetic elements (e.g. Barkley, 1997; Unnever, Cullen, & Pratt, 2003; Walsh, 2002; Wright & Beaver, 2005; Beaver & Wright, 2005; Cauffman, Steinberg, & Piquero, 2005; DeLisi, 2005).

One of such cases is the importance of specific brain regions on the modulation of self-control (i.e. prefrontal cortex). The prefrontal cortex is responsible for several executive functions like behavioral inhibition, emotion control and self-regulation, all of those closely associated with self-control (e.g. Goldberg, 2001; Ishikawa & Raine, 2003; Raine, 2002). The concept of executive functions is referent to a group of higher order cognitive processes that encompass starting, planning, cognitive flexibility, abstraction and decision-making. The interaction of all these processes allow the execution of contextually appropriate behavior (Ishikawa & Raine, 2003). By comparing these executive functions with Gottfredson and Hirschi's conceptualization of self-control it is evident that both point towards the importance of regulating impulsive tendencies as well as the ability to control emotions and attention (Beaver, Wright & DeLisi, 2007). Other common elements include the importance of cognitive function to anticipate expected consequences of behavior, the ability of control temper and inhibit improper conduct, as well as the narrow link between working concepts and criminal/antisocial behavior. The deficits that arise in regard to these executive functions are a result of brain deficiencies that can be originated in the gestation period of the fetus, though contact with tobacco, lead, alcohol and other relevant elemental agents (e.g. Bellinger, Leviton, Allred, & Rabinowitz, 1994; Chen, Maier, Parnell, & West, 2003; Sadowski & Parish, 2005) or can have a genetic origin (e.g. Pfefferbaum, Sullivan, Swan, & Carmelli, 2000; Thompson et al., 2001; Toga & Thompson, 2005).

Despite the major impact the self-control theory had in criminological research, it falls short in some very important aspects. Akers (1991) points the following shortfalls in regard to the GTC. On one hand, the theory (as it was conceived) offers no specific nor general empirical tests, having its foundation supported only by official and unofficial distribution and correlates of crime which are then interpreted as consistent with the social control concept.

Furthermore, Akers (1991) points out that the nature of the general theory of crime is prone to tautology. In fact, the concept of self-control is defined in parallelism with propensity towards crime in a manner which low and high control is the same as low and high crime propensity. Since Gottfredson and Hirschi give no operational definition of self-control, one cannot label someone as having low self-control (or high propensity towards crime) unless they commit a criminal act. Therefore, the statement that low self-control is the cause of crime is tautological. The authors fail to give an effective measure of control that is independent of criminality or crime propensity.

Gottfredson and Hirschi (1993) however disagree with the tautology statement. According to the authors, theories whose starting point is the causes of crime “eventually define crime as a response to the causes they invoke”. The origin of the “tautology argument” lies in the firmly established established logical connection between their conception of actor and act. In response to Akers (1991), Gottfredson and Hirschi say that they do not recognize the existence of criminal propensity nor do they perceive self-control as the main motivational element for criminal behavior. To the authors, self-control is no more than an obstacle between the actor and the monetary benefits of crime, defining the link between crime and self-control as probabilistic rather than deterministic.

The authors also contradict themselves at times arguing that high self-control leads to lower rates of anti-social behaviors “under all circumstances” but also acknowledging that certain, non-specified, individual characteristics and situational circumstances might have a degree of influence on the total impact of self-control over crime (Grasmick et al., 1993).

When conceiving the framework, the authors focused a lot of effort criticizing other models instead of using some of their assertions to complement their theory. This led to a downplay of the relevance of important elements such as, peer influence (Pratt & Cullen, 2000), biological influences (Grasmick et al., 1993) and social learning (Akers, 1991).

A grand amount of studies regarding Gottfredson and Hirschi’s theory have been conducted since its conception. In Pratt and Cullen’s meta-analysis (2000), 21 empirical studies have been integrated (with a total of 49,727 participants) and self-control emerged as a strong predictor of criminal behavior with effect sizes consistently above .20 (superior to almost every other correlate of crime to date).

The effect size remained stable through different studies that included control over other theoretical frameworks and was not affected by the type of self-control measure used (whether it was an attitudinal or behavioral measure, Grasmick et al. scale (1993) or others) which suggests that the effects are robust enough to be impervious to changes caused by different types of operationalization. Furthermore, according to this analysis, the effects of self-control seem general across crimes and analogous behaviors, forensic vs. non-forensic sample, race, gender and age, which is consistent with Gottfredson and Hirschi’s view of self-control.

Pratt and Cullen (2000) also found loss of effect size when comparing longitudinal with cross-sectional studies. This confronts Gottfredson and Hirschi's claim about self-control being a constant tendency that does not work through other variables over the course of an individual's life (Pratt & Cullen, 2000). Furthermore, this study also revealed a strong and consistent effect of other variables (social learning) even when self-control is included in the analysis. These other variables also contributed to a significant increase in the models' explained variance. This result lent evidence to the importance of formation of antisocial attitudes through peer interaction and their impact on criminal propensity, which also contradicts some Gottfredson and Hirschi's claim (Pratt & Cullen, 2000).

De Ridder and colleagues (2018) also developed a meta-analytic research on self-control. In their study, self-control was tested in regard to several different behaviors, other than deviant, and using other scales besides the Grasmick. The tested behaviors were organized into categories: *school and work performance, eating and weight-related behavior, sexual behavior, addictive behavior, interpersonal functioning, affect regulation, well-being and adjustment, deviant behavior, and planning and decision*. In this analysis, 102 studies were compiled (with a total of 32,648 participants). In summary and regarding the deviant behavior category, the study found significant correlations between these types of behavior and self-control. Also, the correlations between self-control and behavior were stronger for automatic (*vs.* controlled) and imagined (*vs.* actual) behavior.

Grasmick and colleagues (1993) also conducted a study focused in the empirical testing of the General Theory of Crime. Using a sample of 395 participants Grasmick et al., (1993) managed to, generally, support the different elements that constitute self-control according to Gottfredson and Hirschi. Furthermore, self-control, in interaction with criminal opportunity, significantly predicted self-reported fraud and force. The effect of self-control on criminal behavior occurred (primarily) in interaction with opportunity. Criminal opportunity, however, also significantly predicted crime, independently of its interaction with self-control (with this effect being, at times, stronger than the interaction between opportunity and control). These findings point out the importance of social environment variables in the creation of criminal opportunities. Furthermore, the inclusion of only the theory-related variables in the model left a considerable amount of variance left unexplained. Even though the authors attribute some of this variance to

methodological and conceptual errors these findings show the self-imposed limitations of the self-control theory of crime.

The scale used by Grasmick and colleagues was conceived using the six self-control elements proposed by Gottfredson and Hirschi in the GTC: *impulsivity, reference for simple tasks, Risk seeking, preference for physical activities (in contrast to more cerebral-based ones), self-centered orientation and low frustration tolerance*. The first component is perceived as the tendency to immediately act on a stimulus and reject delayed gratification. The following takes into account the individual's lack of tenacity and persistence, which leads him into choosing the simplest path towards its objectives. *Risk seeking* is defined as the pursue of adventure, danger, as well as relying on risky decision-making in detriment of safety. The *preference for physical activities* element is directed towards the frequent rejection of more cognitive-based activities such as reading. The *self-centered orientation* component characterizes an individual that is mainly focused on himself, often disregarding others. The last element refers to a low level of tolerance and to a difficulty to inhibit violent responses when faced with conflict.

However, Gottfredson and Hirschi (1993) disagree with the approach used by Grasmick and colleagues. The authors organize their criticism in the lights of four main arguments: *measure of self-control, sampling approach, self-control as a propensity and causal order*. In regard to the first topic, the authors argue that the best approach to measure the phenomenon would be the use of behavioral measures rather than self-reports since they consider that the degree of self-control might influence the survey responses. Furthermore, they claim that the merge of this type of measurement constraint with the general unwillingness of these individuals to participate in the survey leads to significantly attenuated correlations by restricting the ranges of both dependent and independent variables. Concerning the sampling approach, the authors refer the importance of a stratified disproportionate sampling to ensure a sufficient number of individuals low in self-control. Gottfredson and Hirschi claim that a sample such as the one use by Grasmick (1993) would fail to produce adequate variation on the dependent variable. The use of longitudinal samples was also criticized through the argument that sample mortality is also dependent of self-control. In regard to the third argument, the authors point out that the translation of a control concept, such as self-control, into a personality concept is something to avoid. Even though the GTC implies an enduring predisposition to consider the (long-term) consequences of one's acts

there is no personality traits that predisposes individuals towards crime. The absence of criminal predisposition is a fundamental assumption of control theories. According to Gottfredson and Hirschi, Grasmick uses a psychological positivist approach rather than a control theory logic. The last argument revolves around the flaws of the longitudinal solution used by Grasmick and colleagues.

The conceptualization of self-control as a personality trait has been target of a lengthy and fruitful debate over the years. According to Wright and colleagues (Wright, Morgan, Almeida, Almosaed, Moghrabi & Bashatah, 2016) “there is a good reason to view self-control as an important personality trait”. This view generates a link between criminology and more advanced fields of cognitive psychology and neuroscience. The concept postulated by Gottfredson and Hirschi (1990) is not orthogonal to psychology’s view on the same phenomenon (e.g. effortful control; Eisenberg, Smith & Spinrad, 2011). The research holding self-control as an element of personality led to a broader recognition of the role of individual factors in criminal behavior (Wright, et al., 2016).

Keane, Maxim and Teevan (1993), using the self-control theory framework, conducted an in-depth analysis of drunk driving behavior. Using a sample of 12,777 participants from both genders, the authors found a positive correlation between lower levels of self-control and higher blood alcohol levels. They described drunk drivers as risky, hedonistic, short-term oriented and impulsive, once again contributing to the validation of Gottfredson and Hirschi’s model.

LaGrange and Silverman (1999) tested the gender differences in self-control with Gottfredson and Hirschi’s model, using a sample of 2,000 secondary school students. The authors found significant gender differences in the expression of the self-control trait; male students were more likely to express behaviors that reflect low self-control, with risk-taking working as the most important trait. Furthermore, both opportunity and self-control account for a considerable amount of explained variance of the gender differences. However, even though self-control and opportunity variables reduced the impact of gender, it did not eliminate gender effects completely. In fact, gender still acts as a significant predictor of general delinquency, property offenses and violent behavior.

Longshore (1998) also tested this framework using self-control and opportunity as predictors of property and personal crimes among drug-using offenders (N=619). The authors

found that both types of crimes are positively related to lower scores of self-control and higher scores of criminal opportunities. Also, an interactive effect was found between self-control and opportunity, showing a partial dependability between the first and the latter.

Polakowski (1994) also looked into the concept of self-control and tested the general theory's relation with minor conduct problems, as well as other personality disorders (hyperactivity, impulsivity and attention deficits). This study used a longitudinal approach and included a sample of 411 participants. Once again, Polakowski's data lent support to Gottfredson and Hirschi's thesis, concluding that low self-control incorporates several personality disorders as well as early behavior indicators of violence and aggression. Furthermore, self-control was moderately stable over a short period of time and was also a significant predictor of criminal convictions. However, the author was not able to lend support to other relevant components of the model, such as, the commonness of its occurrence or its holistic nature capable of explaining all forms of criminal behavior.

Wood, Pfefferbaum and Arneklev (1993) also test the self-control theory in its ability to explain criminal behavior. Using a sample of 975 juveniles the authors concluded that the composite predictive power of Gottfredson and Hirschi's self-control is substantial. However, their multivariate analysis outlined the need to disaggregate the six dimensions of self-control. According to this study, all the dimensions should be treated individually when trying to explain different types of antisocial behavior. This segregation, besides increasing the model's explained variance, allows for a more detailed view on which self-control elements influences a specific delinquent act. Within this analysis, the authors concluded that the risk-taking component is the most influential element across different criminal behaviors.

Evans, Cullen, Burton, Dunaway and Benson (1997) examined the General Theory of Crime using two different measures of self-control (attitudinal and behavioral). Furthermore, they extended the research to include possible effects of self-control on other elements such as life chances, life quality and other social consequences. Through their analysis, the authors concluded that both measures of self-control had significant impact on crime, even when controlling for several social factors. Furthermore, the data also supported the impact of self-control over quality of life and life outcomes (social consequences). Self-control was related to reduced quality of interpersonal relationships and involvement in church activities, as well as, lower levels of

occupational and educational achievement and higher propensity to criminal associations and internalization of antisocial attitudes.

Wright and colleagues (2016) also tested the impact of self-control on criminal behavior, with the added element of three interrelated personality characteristics, psychopathy, Machiavellianism and narcissism (Dark Triad - DT). As a self-control measure the authors used a compilation of items from the Grasmick self-control scale with 9 items adapted from the Project on Human Development in Chicago Neighborhoods (PHDCN), regarding temperament and perseverance at schools. In summary, the authors concluded that the scores of the DT were predictive of delinquency, independently of the variation in self-control. The DT also accounted for the effects of self-control on serious and violent offending. The interaction between the two measures was statistically significant and stronger than either main effect. Furthermore, there was no significant effect of the DT over drug use, however, the interaction between the DT and self-control remained significant. The authors state that, according to their data, individuals with low self-control have a propensity to engage in impulsive and dangerous behaviors, however, when self-control is paired up with a dark core they are significantly more likely to engage in crime and to engage more often in significantly more serious behaviors.

It is evident that the General Theory of Crime has been thoroughly tested since its creation with the majority of the research validating some of Gottfredson and Hirschi's claims (e.g. Pratt & Cullen, 2000; De Ridder, et al., 2018). Low self-control has been linked to a vast array of antisocial behaviors in a variety of different contexts, for instance, inmates (Malouf, Schaefer, Witt, Moore, Stuewig & Tangney, 2013; Ward, Nobles, & Fox, 2014), individuals in parole and probation (DeLisi, Hochstetler, & Murphy, 2003; Taylor, Hiller, & Taylor, 2013), institutionalized delinquents (DeLisi & Vaughn, 2008; Piquero, MacDonald, Dobrin, Daigle, & Cullen, 2005) and sex offenders (Ha & Beauregard, 2016), children (Coyne & Wright, 2014; Houts, Caspi, Pianta, Arseneault, & Moffitt, 2010), adolescents (Beaver, DeLisi, Mears, & Stewart, 2009; Nedelec & Beaver, 2014) and even elderly adults (Wolfe, Reisig, & Holtfreter, 2016). Even though it is arguable that low self-control is the single, most important predictor of criminal behavior it would be naïve to discard the importance and power of such construct in both the explanation and interpretation of crime.

1.2. Psychopathy

Even though the link between self-control and crime has been soundly established in criminological literature, there are other important personality characteristics that have also been thoroughly linked to this type of behavior. One of such characteristics is psychopathy. Individuals with psychopathic traits have been shown to have higher propensity to get involved in criminal activities due to a very specific set of characteristics such as emotional and empathy-related deficits, low fear susceptibility, self-centeredness and others. Also, and as postulated by Wright and colleagues (2016), when psychopathic traits converge with low self-control the severity of the individual's criminal involvement is severely increased.

Since the beginning of the study of psychopathy, authors have been focusing in understanding the elements that constitute the phenomenon and its implications in regard to both emotional intelligence and behavior (Patrick, et al., 2009). Research in psychopathy acts as an important referent for the study of both affective and control processes. It seems important to sketch a brief history of the concept before entering the more practical aspects and implications to our specific research.

In its genesis, the conceptualization of psychopathy had a strong emphasis on behavior, more specifically, violent and antisocial behavior (Patrick, et al., 2009). The origin of the modern western conceptualization of psychopathy dates back to the early 18th century with works such as Pinel's, with his conception of "mania without delirium" (*manie sans delire* – Pinel, 1962) and Pritchard's moral insanity (1835). Yet, the *term* psychopathy only came to light in the end of the 19th century from the works of Koch (1891) and as heritage of the German tradition. Koch's psychopathy was far distinct from nowadays conceptualization, referring to a diverse array of chronic conditions like mental retardations, neuroses and numerous character disorders (Skeem, Polaschek, Patrick & Lilienfeld, 2011). Pichot (1978) also highlights a third influence in the development of the concept of psychopathy: the doctrine of moral degeneracy, advanced by Morel (1857), in which certain peculiar personalities, prone to psychotic states, were described. According to Skeem and colleagues, the early sketches of the psychopathic personality worked around a combination of intact mental faculties with characteristics like irresponsible and explosive behavior (Pritchard, 1835), charm, self-assurance, social dominance, attention seeking,

persuasiveness and shallow affect (Kraepelin, 1904; Schneider, 1958), brutality, cold-heartedness and exploitation of others (Pinel, 1962; Schneider, 1958).

Pritchard's (1835) definition of moral insanity was described as dark distortion of feelings, inclinations, habits, affects, and moral dispositions that surface from an individual lacking any relevant mental disorder or intellectual deficits. The origin of these distortions was attributed to reactions to the stressors of civilized life. Moral insanity was to be distinguished from other intellectual insanities; monomanias, manias and incoherence. The works of Pritchard on the different moral insanities share similar characteristics to Cleckley's later conceptualization, like the seeming rational persona that beneath hides some kind of mental condition. It is important to highlight that Pritchard's use of the term *moral* is not related to actual morality in the ethical sense, but it is rather a reference to the affect component, representing affectivity-related mental conditions in which a seemingly sane individual demonstrates a degenerative process (Whitlock, 1982). Morel's (1857) conceptualization of psychopathy rests on terms of human imperfection; these imperfections are a direct result from the original sin and have a hereditary origin. The works of Morel list distinct kinds of *hereditary insanities*, and both Pinel's and Pritchard's concepts are prescribed among these.

The term *psychopathy* was actually coined by Koch, in his work "Elements of Psychiatry" (Koch, 1888). The author uses this terminology as reference to an extensive range of chronic early-emerging psychic anomalies that have an underlying genetic basis, including mental retardation, as well as character disorders (Skeem, et al., 2011). Koch's sketch emphasized psychic frailty rather than behavioral. His work greatly influenced the development of German psychiatry and authors such as Kraepelin (1904), in whose treatise was included a chapter, named *psychopathic personalities*, which describes several features of antisocial behavior. Within the German psychiatric heritage, Schneider's work entitled *Psychopathic Personalities* (1958) advanced several fundamental arguments to his own conception of psychopathy. Firstly, antisocial behavior was completely excluded from the formulation since, according to the author, the inclusion of such would characterize psychopathy as a socio-political concept. In cases which antisocial conduct was present the behavior component was perceived as secondary rather than defining. The abnormal character of psychopathic personalities was a cause of suffering for both the self and to others and was perceived as a derivation of the normal personality. In his research, Schneider

(1958) listed and identified ten distinct types of psychopathic personalities in which some shared common characteristics with Pritchard's moral insanity, however, a common underlying factor between these conditions was never advanced.

In regard to the modern conceptualization of psychopathy one could say that the most influential work was the research developed by Harvey Cleckley, *The Mask of Sanity* (1976). Cleckley's contribution to the development of the study psychopathy was crucial; drawing from extensive experience with psychiatric patients, Cleckley was able to clarify and circumscribe the phenomenon of psychopathy as a condition in which individuals, while not overtly showing external symptoms of mental illness, suffered from an ailment which manifested itself through impaired patterns of both personal and social functioning (Skeem, et al., 2011). Through his work, the author managed to better clarify a concept which was classically associated with a heterogeneous group of individuals impossible to classify according to other taxa. The title of his book, *The Mask of Sanity*, works in reference to a tendency of psychopathic individuals to articulate confidence, friendship and normal social adjustment, but only at a superficial level. Underneath this "mask" of wellness, lies a severe pathology expressed over time through actions and attitudes (Skeem, et al., 2011). Cleckley's sketch of the psychopathic individual includes a listing of 16 criteria that characterizes the disorder and helps in operationalization:

1. Superficial charm and good intelligence;
2. Absence of delusions and other signs of irrational thinking;
3. Absence of nervousness or psychoneurotic manifestations;
4. Unreliability;
5. Untruthfulness and insincerity;
6. Lack of remorse or shame;
7. Inadequately motivated antisocial behavior;
8. Poor judgment and failure to learn by experience;
9. Pathologic egocentricity and incapacity for love;
10. General poverty in major affective reactions;
11. Specific loss of insight;
12. Unresponsiveness in general interpersonal relations;
13. Fantastic and uninviting behavior with drink and sometimes without;

14. Suicide rarely carried out;
15. Sex life impersonal, trivial, and poorly integrated;
16. Failure to follow any life plan.

This conceptualization allowed Cleckley to distinguish psychopathy from other conditions (e.g. psychoses, mental deficiencies, etc.). The author's view excludes antisocial and transgressive instrumental acts for personal gains from the concept since psychopathic individual's actions are perceived as irrational and self-destructive. This way, Cleckley is not concerned with the display of criminal behavior, since he argues that it is not an integral part of the condition. Likewise, these individuals do not commit brutal acts that might condemn them to hard penalties, which works accordingly with Cleckley's argument that criminals are distinct from psychopaths; psychopathic tendencies are not the same as antisocial ones. These individuals are not seen as violent, cruel, predatory or dangerous, instead, the harm they caused emerges as a consequence of their shallow and hopeless nature (Skeem, et al., 2011). In a brief manner, the Cleckley psychopath is a self-destructive and harmful individual who is oblivious to the damage he brings and lacks the capacity to perceive himself as others perceive him. These individuals lack emotional contact with reality, disabling their ability to notice the emotional consequences of their acts, hindering their ability to learn from experience. Even though these individuals are able to describe and reproduce feelings, they lack the ability to experience them. Despite his impaired social functioning the psychopath masks himself with an appearance of normality and charm. The psychopath is virtually able to imitate and respond to social situations, yet he falters in regard to rudimentary patterns of social functioning and decision.

Whilst Cleckley's work completely shuns away from psychopathy's relation to antisocial behavior, other contemporary authors who researched with offender-based samples, such as McCord and McCord (1964) or Robins (1966), establish a close connection between these two elements. The work of McCord and McCord (1964) conceptualizes psychopaths as more troubled, maladjusted individuals, with salient features of hostile disaffection from others. According to this conceptualization, psychopathy is more closely related to aggressive and impulsive behavior, callousness and active exploitation of others. Nevertheless, this conception also includes Cleckley's superficial emotionality along with characteristic lack of apparent behavior motivation. Robin's (1966) research on the development of objective behavioral indicators also threaded an

important path for the development of psychopathy. In fact, his work served as foundation for the DSM-III conception of antisocial personality disorder (ASPD), with certain traits even being represented later on in DSM-IV (e.g. antisocial behavior in childhood that persists into adulthood). Yet, some authors (e.g. Lykken, 1995; Hare, 1985) argue that the reliability obtained through the establishment of specific behavioral criteria in the DSM-III and onwards came at the cost of validity since what was then regarded as a group of specific dispositional features was now sketched as chronic criminal behavior.

1.2.1. Hare's Psychopathy Check-List and the modern view on psychopathy

The modern view on psychopathic traits has its origins on the work developed by Robert Hare. Hare's description and operationalization (the Psychopathy Check-List - PCL; Hare, 1980) of the phenomenon was (and still is) the gold standard for research in psychopathy (Storey, Hart, Cooke & Michie, 2016). The PCL has seen several modifications across the years with its revised version (PCL-R; Hare 1991), and different derivations (Psychopathy Check-List: Screening Version – PCL:SV; Psychopathy Check-List: Youth Version – PCL:YV). The PCL-R is a 20-item rating scale, used in a semi-structure interview setting with added case history data. The measure is comprised of three-point scaled items (0-1-2) which are rated in regard to the degree to which they describe the individual. The final score, calculated by summing the individual score of each item, reflects the degree to which the individual matches the prototypical psychopath.

The items included in the PCL-R match some of Cleckley's clinical characteristics of psychopathy and are separated into two dimensions. In fact, the PCL-R assumes the existence of two underlying oblique factors. The first (Factor 1) accounts for interpersonal and affective elements and includes characteristics such as glibness and/or superficial charm, grandiose sense of worth, pathological lying, conning and/or manipulative, lack of remorse or guilt, shallow affect, callous and/or lack of empathy, parasitic lifestyle and failure to accept responsibility for own actions. The second factor (Factor 2) relates to behavioral characteristics such as lack of self-control and antisocial behavior and includes the following features: need for stimulation and/or proneness to boredom, poor behavioral control, promiscuous sexual behavior, early behavior problems, lack of realistic, long-term goals, impulsivity, irresponsibility, (many) short-term

marital relationships, juvenile delinquency, revocation of conditional release and criminal versatility.

The PCL-R has been proven across several studies to be a reliable measure in order to identify an individual's likelihood of committing crimes (e.g. Hart, Kropp & Hare, 1988; Serin, 1991, 1992; Hart & Hare, 1992). Furthermore, this psychopathy scale has also been used extensively in predictions of recidivism (e.g. Hart, et al., 1988; Serin, Peters & Barnaree, 1990), future violent behavior (e.g. Harris, Rice & Quinsey, 1993) and type of crime (e.g. Williamson, Hare & Wong, 1987) in offender samples. The PCL has also a very high interrater reliability (e.g. Schroeder, Schroeder & Hare, 1983; Hare 1991; Hare, Harpur, Hakstian, Forth, Hart & Newman, 1990) as well as high test-retest reliability (e.g. Alterman, Cacciola & Rutherford, 1993). Initial research showed that the PCL factor structure was stable, with studies consistently identifying the existence of two factors (e.g. Hare, et al., 1990; Harpur, Hakstian & Hare, 1988). However, later on, Cooke and Michie (2001) through confirmatory factor analysis, found the two-factor model to be untenable, suggesting a three-factor hierarchical model. This model included 13 items grouped within three correlated factors: *arrogant and deceitful interpersonal style*, *deficient affective experience* and *impulsive and irresponsible behavioral style*. The three-factor model of the PCL-R was shown to have a good fit (e.g. Cooke, Michie & Hart, 2006; Jackson, Rodgers, Neumann & Lambert, 2002; Skeem, Mulvey & Grisso, 2003; Weaver, Meyer, Van Nort & Tristan, 2006). Following Cooke and Michie's factor model, Hare (2003; Hare & Neumann, 2008) proposed a new, four facet model, inspired in the latter. The four correlated facets included were *interpersonal*, *affective*, *behavioral* and *antisocial*. This model has been extensively validated and received heavy support across different samples, youth offenders (Neumann, Kosson, Forth & Hare, 2006; Selekin, Brannen, Zalot, Leistico & Newman, 2006), both male and female offenders (Hare & Neumann, 2006; Neumann, Hare & Newman, 2007), community samples (Neumann & Hare, 2008) and psychiatric patients (Vitacco, Neumann, Caldwell, Leistico, VanRybroek, 2006). The four facets may still be converted into a two-factor structure (without loss of model fit) in which factors can be explained by a single super-ordinate factor (Neumann, Hare, Newman, 2007). This super-ordinate factor indicates that the total factor scores of the measures reflect a central aspect of personality underlying the lower order factors. This factor analytic research also suggests that psychopathy scores are distributed in a continuous manner across the population (Marcus, Lilienfeld, Edens & Poythress, 2006; Hare & Neumann, 2008).

All these characteristics make the PCL-R an attractive instrument to both researchers and clinicians in the study of psychopathy. Despite its strength, the PCL-R model is not without criticism. First of all, according to Salekin and colleagues (Salekin, Rogers, Sewell, 1996), the PCL, despite following Cleckley's conceptualization of psychopathy, deviates from its theoretical foundations. In fact, only four of the 16 characteristics elicited by Cleckley are closely paralleled by the PCL and only three other share nuclear characteristics with Hare's measure. Further, according to Lilienfeld (1994), it is unclear if factor 1 items represent core psychopathy traits, while factor 2 describes concomitant behaviors that some psychopaths are prone to. In fact, the author also stated that high scoring in factor 1-related items together with low scoring in factor 2 would still describe psychopathy as defined by Cleckley. This issue could lead to false positives in psychopathy assessment (Salekin, et al., 1996). Some issues regarding clinical evaluation of psychopathy also arise, including problems regarding the selection of an appropriate cutoff score and ambivalence in regard to which items weight the most when predicting dangerousness (Salekin, et al., 1996).

One of the most salient flaws pointed out to the PCL model is the weak empirical link between low negative emotionality and psychopathy. Negative emotionality is described as the tendency to experience unpleasant emotional states (e.g. fear, anger, nervous tension; Hicks & Patrick, 2006). According to the authors, even though concepts such as fearlessness and low anxiety have surfaced frequently with theories regarding psychopathy, empirical research has faltered when trying to test them, frequently yielding unsatisfactory results, contributing to the existing confusion around the subject (c.f. Hare, 2003). Hicks and Patrick (2006) point out that these difficulties are originated by the multifaceted nature of both constructs, as well as, by the presence of suppressor effects between the PCL-R scores in relation to the negative emotionality criterions. Suppression occurs when the inclusion of two correlated predictor variables in the same regression model increases one (or both) validities (Paulhus, Robins, Trzesniewski & Tracy, 2004). In their research, Hicks and Patrick (2016) concluded that both PCL-R factors show mutually repulsive effects when predicting facets of negative emotionality. Factor 1 appears to be negatively associated with emotional distress and fearfulness, while being unrelated to anger-hostility, whilst Factor 2 is positively related with every negative emotionality facet. Other studies have also lent support to these results (e.g. Hale, Goldstein, Abramowitz, Calamari & Kosson, 2004; Harpur, Hare & Hakstian, 1989; Verona, Patrick & Joiner, 2001; Vitale, Smith, Brinkley &

Newman, 2002). These findings have important implications. From an empirical perspective, Hicks and Patrick (2006) point out the importance of using both PCL-R factors in prediction of criterion measures in the subject of negative emotionality. This is important since negative emotionality is such a central factor, especially in the case of criminal offenders. From a theoretical standpoint, the detection of suppressor effects is essential to reconcile discrepancies between theory and empirical observations collected from assessment measures, in this case, between the PCL-R and Cleckley's stress on absence of nervousness in psychopathy (Paulhus et al., 2004). The problem of negative suppression between psychopathy and negative emotionality worked as a doorway towards new conceptualizations of psychopathy (e.g. dual-process models such as the Triarchic Psychopathy Model; Patrick, et al., 2009).

1.2.2. The Triarchic Model of Psychopathy and the dual-process conceptualization of psychopathy

The triarchic model of psychopathy is a dual-process conceptualization of psychopathy developed by Patrick and colleagues with a strong accent on psychological and neurobiological elements (Patrick, et al., 2009). In its dual-process characterization, the triarchic model conceptualizes psychopathy as reflecting the influence of two main etiological factors of orthogonal origin: trait fearlessness and externalizing vulnerability. The first factor reflects low fear reactivity, and the latter reflects elevated levels of impulsivity, risk seeking behavior, violent behavior and other externalization-related elements (Krueger, Hicks, Patrick, Carlson, Iacono & McGue, 2002). These two factors have also different neurological origins, with fearlessness linked to impairments on the limbic and emotional systems and externalization related to abnormalities in prefrontal functioning (Rogers, 2006).

The triarchic model was assembled through an extensive analysis of psychopathic characteristics proposed in previous frameworks which were then clustered into three main phenotypical constituents: boldness, meanness and disinhibition. With different phenotypical identities, the different components are susceptible to segregated analysis as well as conceptualization, even though all three are intertwined (Patrick, et al, 2009).

Patrick and colleagues describe boldness as an ability to stand ground and remain calm and composed under threat or pressure situations and also recover swiftly from these types of circumstances. The boldness component is connected to high self-assurance, social efficacy and tolerance of unfamiliarity. From a personality point of view, this component can be understood as a node of social dominance, linked to low stress reactivity and sensation seeking (Benning, Patrick, Hicks, Blonigen, 2003). The behavioral representation of boldness comprises of social poise, imperturbability, persuasiveness and assertiveness (Patrick, et al., 2009). According to the authors, this component is associated with the trait fearlessness etiological factor. In fact, boldness is one of two ways in which trait fearlessness (genotypic) can be expressed phenotypically, the other being meanness. It seems important to highlight that the role of fearless dominance in the conceptualization of psychopathy has been the center of much scientific debate (Drislane, Patrick & Arsal, 2014). In fact, to some authors (ie. Lynam & Miller, 2012), boldness such not be included as a core constituent of the conceptualization of psychopathy due to its degree of association with indices of adaptive functioning, while others argue that adaptive functioning are nothing but consistent with Cleckley's view of the psychopath (cf. Lillienfeld et al., 2012). Besides, the boldness-related emotional stability, according to Drislane and her colleagues (2014), seems to be the most distinguishing feature between psychopathy and antisocial personality disorder.

The meanness constituent of psychopathy is described as a collection of antagonistic characteristics such as absence of close relations, lack of empathy, risk seeking, malice, manipulation, cold-heartedness, defiance of authority, arrogance, etc (Patrick, et al., 2009). This phenotypical attribute contains elements that are essential to the conceptualization of psychopathy in regard to criminal groups. Even though meanness also configures a phenotypical representation of trait fearlessness, unlike boldness, it expresses a more malignant side (Patrick, et al., 2009). Finally, the disinhibition component is used to describe a phenotypical tendency towards impulsivity (Patrick, et al., 2009). Disinhibition included characteristics such as deficient regulation of urges, lack of foresight, absence of future planning, search for immediate gratification, scarce behavioral restraint, and others. In regard to personality traits, disinhibition can be perceived as a nexus of impulsivity and negative affect (Krueger et al., 2002). In terms of behavior representations, this constituent includes impatience, recklessness, suspicion, impulsive actions with negative consequences, proneness to drug addiction, engagement in antisocial behavior, etc. (Krueger, Markon, Patrick, Benning & Kramer, 2007).

The triarchic model of psychopathy has been extensively used and tested in several and distinct research contexts through the use of its specifically designed measure, the Triarchic Psychopathy Measure (Patrick, 2010). For instance, Stanley, Wygant and Sellbom (2013) examined the model's construct validity with a sample of 141 adult inmates in regard to both its normal range (i.e. Five-factor model) and pathological range (i.e. deficient empathy and narcissism) personality traits. Within this study the TriPM results were compared with data from the PPI-SF (Psychopathic Personality inventory – Short form), NPI (Narcissistic Personality Inventory), IRI (interpersonal reactivity index), and the BFI (Big Five Inventory). Overall, all three phenotypical subscales of the TriPM exhibited convergent and discriminant validity with other conceptually relevant measures of the underlying constructs. Boldness was significantly correlated with extraversion, stress resistance and fearlessness, low levels of neuroticism, narcissistic exploitativeness, feelings of authority and superiority and social potency. Furthermore, this constituent was the only to be associated with the fearless dominance factor of PPI. Meanness was correlated to low levels of conscientiousness and agreeableness, which is consistent with findings from other researches (e.g. Singh, Arteché & Holder, 2011). Also, this component was also associated with low levels of empathic response to others, deficiencies in perspective taking, narcissistic feelings of entitlement, egocentricity and also impulsivity, negative affect, aggressiveness and tendency to blame others (these last four behavioral tendencies also correlate to disinhibition). Lastly, disinhibition was related to low levels of self-discipline and dependability, and high levels of emotional instability. The authors conclude on the efficacy of this model as an effective measure of psychopathy.

Poy, Segarra, Esteller, López and Moltó (2013) also examined the three phenotypical components of the TriPM under the lights of the five-factor model (N=349) and with special attention attributed to possible gender differences. The test battery included the revised NEO personality inventory (NEO PI-R) and the NEO PI-R Psychopathy Resemblance Index (PRI). In general, all three components of the triarchic model were representative of distinctive configurations of normal personality traits across gender. Also, each TriPM facet captured unique variance in facet-level FFM description of psychopathy. According to the authors, this last result highlights the relevance of the boldness features in full account of psychopathy as represented in terms of the five-factor model. The disinhibition was associated to low conscientiousness, low agreeableness, high neuroticism, high sensation-seeking and low warmth (from extraversion),

which is consistent with previous empirical findings on FFM descriptions of the externalizing component (i.e. Derefinko & Lynam, 2006). Meanness scores were related to low agreeableness and conscientiousness, low interpersonal connectedness, low affiliation (in men) and low openness to feelings and to values. According to the authors, the results emergent from meanness are consistent with Cleckley's conceptualization of psychopathy (1976) and PCL-R's affective facet.

Drislane and colleagues (2014) also developed research in regard to the validation of the triarchic model of psychopathy by testing its relation to other personality and psychopathy inventories (NEO-PI-R; MPQ-35; PPI; SRP-III; LSRP; YPI; CPS; APSD; ICU). In their work, disinhibition is highly associated with several indices of the deviant facet of psychopathy. Traits related to TriPM's disinhibition include impulsivity, irresponsibility, carelessness, thrill seeking and antisocial behavior. Furthermore, this phenotypical component, along with meanness, contribute, in equivalent fashion, to the unique variance in the total psychopathy score. According to the authors, this last conclusion shows that the disinhibition-related elements are not sufficient by themselves to an effective diagnosis of psychopathy. Moreover, in the younger samples, the weight expressed by disinhibition was larger than meanness'. This might mean that the assessment tools used in this study operationalize psychopathy differently across life span, with a clear over-emphasis of disinhibition early-on. For instance, boldness was not represented in most child-oriented measures, which, according to Drislane, Patrick and Arsal (2014) could be explained by two different hypotheses. On one hand, the boldness facet might not be as important in a childhood diagnostic of psychopathy as in adult samples, with emotional deficits representing the more prototypic expression of psychopathy in youngsters. On the other hand, boldness might not be evenly represented in psychopathy measures directed to younger samples, possibly due to research's main focus on the conduct issues side of psychopathy. In regard to meanness, much like the previous facet, it is strongly represented in every psychopathy measure researched. Additionally, this TriPM constituent was heavily related to measures indexing cold-heartedness, callous affect, unemotionality, manipulation, Machiavellianism and lack of remorse. Meanness was also a unique contributor to prediction of scores in almost all of the used sub-scales as well as the strongest predictor of specific personality traits vital to the definition of psychopathy (i.e. Antagonism – NEO-PI-R; callous-unemotional traits - ICU), lending evidence to the relevance of antagonism as a central component of psychopathy. Lastly, boldness was related to both several indices of maladjustment and measures of adaptive function. Indices of maladjustment include

guiltlessness, lack of modesty, dishonesty, callous affect, manipulativeness, erratic lifestyle whilst adaptive function include charm, stress immunity, social potency, achievement and well-being. Drislane and colleagues (2014) argue that these findings support the hypothesis that fearless dominance represents, to some extent, the interpersonal features of psychopathy.

Even though the TriPM is a relatively new measure, a lot of effort has been put into its testing and validation, with the majority of research backing-up the use of this measure as a consistent and powerful index of psychopathic traits.

1.3. Psychopathy *versus* Self-control

Both psychopathy and self-control represent very serious contenders in regard to the understanding of criminality. Not many studies have been conducted where these two components are studied in conjunction, even though they both often present a very similar type of individual (Wiebe, 2003; DeLisi, et al., 2018; Wright et al, 2016). Either one of these elements are characterized as general theories of antisociality, where a specific constellation of traits is responsible for explaining involvement in various forms of antisocial acts. These types of theories share three important features: detection of the fundamental causes of crime at an individual level (i.e. specific characteristics of symptoms are theorized to cause behavioral problems); the fundamental concepts are perceived as all-encompassing, robust and general and; they are parsimonious (DeLisi, et al., 2018). Even though psychopathy and self-control are distinct theories are some authors reject a possible connection between the two (Gottfredson & Hirschi, 1990; Harris, et al., 1994), they similarly characterize the offender as lacking self-regulation, being indifferent to others and difficult in terms of temperament, possessing deficits in regard to emotional and behavioral regulation, descending into hedonistic and short-sighted quests (Wiebe, 2003; DeLisi, et al., 2018). Not every individual integrates each of these traits, however, each of these traits, individually increases the likelihood of offending (Wiebe, 2003).

Despite their independent genesis, some attempts have been made at integrating both concepts. Such is the case of the Comprehensive Assessment of Psychopathic Personality (CAPP; Cooke, et al., 2012). The CAPP's six main domains (attachment, constraint, cognition, dominance, emotion and self) entirely overlap with low self-control traits commonly found in attitudinal

measures of self-control, showing that some psychopathy measures are also measures of low self-control (DeLisi, et al., 2018).

Other empirical studies have also focused in this conceptual integration. Wiebe (2003), through the use of structural equation models, inspected the underlying PCL-R and multiple self-control measures factors in an undergraduate sample. From this analysis, twelve factors arose, including anger, low attachment, antisocial cognitions, guiltlessness, low diligence, low commitment, impulsive sociability, low respect, manipulativeness, short-sightedness, sullenness and risk seeking. Within the best fitted model, a two-factor structure emerged that linked self-control to psychopathy; factor one, described as antisociality, included risk seeking, antisocial cognitions, manipulativeness, anger, low commitments and delinquency; and factor two, self-direction, defined by short-sightedness and low diligence. Jonason and Tost (2010) researched the interaction of the Dark Triad with the Life History Theory through a correlation of three distinct measures of self-control (N=358; undergraduates). Within their data, both psychopathy and Machiavellianism, were correlated with low self-control, as well as, tendency to discount future consequences and high rates of attention deficit disorder. Vaughn and colleagues (2007) also test the interaction between self-control and narcissistic traits. In their study, narcissism explained the majority of the variance between psychopathy and low self-control; furthermore, the authors also suggested that low self-control was possibly incorporated in constituent elements of psychopathic personality.

In another study, Flexon and Meldrum (2013) also discovered a link between psychopathy and low self-control where both were correlated with violent delinquency among youth. Flexon, Meldrum, Young and Lehmann (2016), also found associations between self-control and the Dark triad. In their data, an attitudinal measure of self-control was correlated with all three components of the triad. Moreover, low self-control was found to be correlated with offending and substance abuse but not with victimization while the Dark Triad was significantly associated with offending and victimization but not with substance abuse. Both scales were also correlated with each other. In Wright and colleagues (2016) research, self-control acted as predictor of delinquency by itself and when combined with the Dark Triad in a compound model (and even when including and interaction term between the Dark Triad and self-control). In Connolly, Al-Ghamdi, Kobeisy, Alqurashi, Schwartz, and Beaver (2016) a latent class analysis in a sample with a small sub-group

characterized as high in aggression, psychopathic traits and low in self-control showed that for the most violent youth, low-self control and psychopathy are central components of their personality. Finally, DeLisi and colleagues (2018), also found that low self-control and psychopathy were related to several forms of delinquency as measured by the 90th percentile on the distribution. However, self-control levels were associated with more forms of delinquency and victimization. Also, youths with lower levels of self-control had increased risk for pathological delinquency, relative to those with most severe forms of psychopathy.

These empirical findings elevate the importance of a conjunct approach in the study of severe delinquency, especially in regard to psychopathy and low self-control. However, despite their clear overlapping, it is unclear how these two concepts relate to each other. They could work as a single unified construct, or, they could function as two distinct constructs that work in a way similar to Levenson, Kiehl and Fitzpatrick (1995) description. According to this conception, primary psychopathy is characterized by traits like self-centeredness and manipulateness, whilst secondary psychopathy encompasses traits that mirror Gottfredson and Hirschi's (i.e. sensation seeking, impulsivity and low diligence). According to Wiebe (2003) a third conception including a distinction between traits, interpersonal style and behaviors derived from Cooke and Michie's (2001) data. In his article, Wiebe (2003) proposes a fourth possibility where there is the inclusion of interpersonal correlates of behavior that are perceived as facilitator of conventional success, instead of focusing exclusively in antisocial behavior correlates (i.e. low levels of antisocial traits and other traits that might enable the individual to work in their own, long-term, best interest).

Part 2

Decision-Making

2.1. An introduction to the Rational Choice framework

The inherent personality characteristics previously described have a significant impact on the way individuals make decisions. Traits such as low self-control and psychopathy modulate the decision-making process, leading these individuals into taking rash and unpondered decisions that might lead into antisocial behavior (e.g. Hughes, Dolan & Stout, 2015; Glenn, Raine, Schug, 2009; Koenigs, Kruepke & Newman, 2010; Bechara, Dolan, Denburg, Hindes, Anderson & Nathan, 2001; Boureau, Sokol-Hessner & Daw, 2015; Hare, Camerer & Rangel, 2009). When specific personality traits are present, the elements that encompass the decision are distinct and, therefore, an in-depth analysis of these distinctions is essential in order to better understand the criminal decision-making process. Throughout the history of criminological research several approaches have been taken to better understand criminal decision. One of the major theories in this regard is Becker's rational choice theory (1976).

The rational choice theory is a, economical-based, framework created with the objective of understanding social and economic behavior (Blume & Easley, 2008). This framework has a large spectrum of applicability and its versatility allows for its application in a myriad of different sciences (Herrnstein, 1990), such as criminology (Cornish & Clarke, 1987), political sciences (Lohmann, 2008), sociology (Hedström & Stern, 2008). Even though the theory's conceptual origin dates back to William Stanley Jevons (1866), the model's widespread use was, in its majority, due to Gary Becker's work (1987).

The rational choice theory argues that a decision is made with the objective of maximizing total utility. When making a decision, the individual will ponder on a series of calculations of possible costs and benefits that might result from the action in mind (Scott, 2000). In this case, utility takes the form of behavioral psychology's reinforcement. Since reinforcement is not directly observable, one can only infer it from behavior. Therefore, this framework is used as a mean to understand if a certain behavior is being successful in obtaining its specified goals (in an optimal fashion) and, how to adapt said behavior in order to obtain maximum efficiency (Herrnstein, 1990). According to Herrnstein (1990), the rational choice theory is held by its supporters as a law that human behavior would obey if not for other exogenous influences. This framework also denies the

existence of any kind of action that is not purely rational, postulating that every social action is instrumental and rationally motivated (Scott, 2000).

A structural assumption present in every rational choice model is the concept of methodological individualism. This concept tells us that every social phenomenon can be explained in relation to the individual actions from which the phenomenon is generated (Scott, 2000). This type of theoretical framework follows the same kind of principles as economic theories, meaning that, like the production, distribution and consumption of goods and services, human behavior can also be explained by availability and use of resources. Instead of money and other market mechanisms, human action depends on time, information, approval prestige, etc (Scott, 2000).

According to rational choice framework, individual motivation is dependent of the certain goals that express the person's preferences. The individual acts according to the information he or she possess about the specific circumstances he or she is acting under (Scott, 2000). Since it is impossible to complete all wanted goals, the individual must make choices in relation to both their objectives and the necessary means to obtain them (Scott, 2000). The rational individual will try to predict the most expected outcomes from alternative courses of action and use these predictions to choose the ideal path, the one that gives the greatest amount of gratification (Heath & Heath, 1976).

Despite rational choice model's wide spectrum of applications, it is not without its flaws. Herrnstein (1990) argues that this framework fails when trying to explain behavior that is, apparently, against self-interest. Using smoking, overeating and excessive drinking as an example, the author draws attention to the model's inability to justify both unwise and altruistic behavior. Furthermore, Herrnstein (1990) also points out the model's openness to explain these types of behavior through forced rationalization. This means that, because utility (which is subjective) differs from objective value, often rational choice theorists will invoke some kind of source of utility in order to rationalize the behavior under analysis (Herrnstein, 1990). According to the author, since utility has no clear constraints so, theoretically, it is possible to infer utility in, for example, self-harming behaviors. Another critique forwarded by Herrnstein (1990) argues that the theory's view on probabilities is also riddle with subjectivity. In fact, people have a tendency to over-estimate low probability outcomes (such as winning the lottery) and to under-estimate high

probability ones (like running red lights in a crowded intersections). From a rational choice perspective these types of behavior are difficult to explain.

After the previous generalist view on the rational choice framework it matters to take a closer look into some of its most relevant applications to the subject in hands.

2.2. Cornish and Clarke's Rational Choice Theory

One of the most influential representations of Becker's rational choice approach as a mean to explain criminality is the theoretical framework developed by Cornish and Clarke (1987). The basic premise of this theoretical thinking lies in the idea of the offender as a decision maker. This means that the offender thinks rationally when choosing to commit a certain offense; he seeks and thinks about possible rewards, costs and opportunities as outcomes from his behavior (Cornish & Clarke, 1987). According to the authors, the offender's criminal decision is constrained by time, individual cognitive abilities and availability of relevant information and, therefore, the criminal decision-making process is hindered by limited rationality. Cornish and Clarke's version of the rational choice theory also proposes that it is very likely for the factors and decision processes to change at various stages of the decision and even across diverse types of crime. It is relevant to point out that this framework was conceived with deterrence and crime prevention in mind (Cornish & Clarke, 1987) and so it has a very practical rather than theoretical formulation.

Cornish and Clarke (1987) depart from a solidified view on situational crime prevention. This kind of prophylactic approach focus on the limitation of elements that may provoke criminal intentions. Examples of situation crime prevention include defensible space architecture, target-hardening and neighborhood watch (Clarke, 1983). These environmental changes are designed to reduce criminal opportunity by increasing the risk of negative outcomes (Clarke, 1983). On the other hand, several authors argue that this type of prevention causes a shift in the criminal tendencies, displacing crime to other less protected areas (Gabor, 1981) This kind of prevention works flawlessly with the idea of a rational offender that picks and chooses his crimes with costs and benefits in mind.

The rational choice approach was proposed by the authors as a more promising framework to study crime displacement (Cornish & Clarke, 1987). Cornish and Clarke's model, rather than assuming that offenders have a general predisposition to offend (which makes them indifferent to the nature of the crime), argues that every type of crime is selected and executed for a specific reason. The criminal decision-making process is affected by both the specific characteristics of the behavior and the individual and results from the interaction between the two (Cornish & Clarke, 1987). Therefore, the final decision is the result of a complex process in which the individual evaluates the pros and cons of a plethora of potential courses of action with a very specific objective in mind (Cornish & Clarke, 1987).

According to the framework, it is crucial to take into account the elements that constitute the offender's decision process. The offense characteristics, the ones that pull the individual towards antisocial behavior, the ones that represent the individual's motives and preferences are the key for selecting the most effective course of action and, therefore, understand the offender's choice. These specificities were labeled *choice-structuring properties* (Cornish & Clarke, 1987). According to the model, when a certain offender shifts from one type of crime to another it implies that certain relevant elements were present in both offenses.

Cornish and Clarke (1987), looking into previous work on rational choice (Becker, 1976), introduced a new view on criminal behavior. According to the authors, this kind of perspective might be capable of explaining changes and stability on criminal behavior. A clearer view over the natural evolution of criminal careers and tendencies is of great importance to the efficacy of prevention policies and practice.

2.3. Fishbein and Ajzen's Theory of Planned Behavior

Becker's approach to the study of the decision-making process is heavily inspired in the author's economic research, however there are other relevant models from different branches of science. Such is the case of the Theory of Planned Behavior; a social psychology framework developed by Ajzen and Fishbein (1975) within the research on attitudes and behavior prediction.

The theory of planned behavior (TPB) one of the most validated frameworks regarding human decision-making (Armitage & Conner, 2001). Even though this model is not integrated in the economist branch of research (this model is part of social psychology research), its basic arguments seem to share a common ground; the use of behavioral outcomes as the main motivator of human action (Ajzen, 1991). Furthermore, much like the previous model, the TPB's object of study is human voluntary, hence rational, behavior (Ajzen & Fishbein, 1975).

The theory of planned behavior is essentially an extension of its antecessor, the theory of reason action (TRA; Armitage & Conner, 2001). According to Ajzen and Fishbein (1975), the intention of an individual towards a specific behavior is composed of information (beliefs) about the likelihood that, performing a certain behavior will culminate in a certain outcome. This behavioral intention is modulated by three conceptually distinct sets of belief compounds: behavioral beliefs, normative beliefs and control beliefs (Ajzen, 1991). The behavioral beliefs influence the individual's attitude towards performing the behavior; the normative elements underlie the inherent subjective norm; lastly, the control beliefs (perceived behavioral control – PBC, which is TPB's main addition to the TRA) elicit the individual's perceived behavior control over the behavior (Ajzen, 1991). The main argument of the framework rests on the assumption that the individual beliefs affect the behavioral intention and subsequent analogous behavior either through attitudes, subjective norm or perceived behavioral control (Madden, Ellen & Ajzen, 1992). Any other exogenous variables influence behavior only through their influence over the three belief sets (Fishbein & Ajzen, 1975).

From a methodological perspective the TPB model assumes the effect of attitudes and subjective norm on behavior to be fully mediated by intentions whilst the effect of PBC expresses only a partial mediation. The effects of behavioral, normative and control beliefs over the intention (and behavior) are shown as being mediated by attitudes, subjective norm and PBC, respectively (Sniehotta, Pesseau & Araújo-Soares, 2014). Furthermore, the effects of other exogenous influences (p.ex. biological, environmental, cultural, etc.) are perceived as also being mediated by the TPB, according to the sufficiency assumption (Ajzen, 1985; Sniehotta, et al., 2014).

The authors (Fishbein & Ajzen, 1975) discriminate three different conditions that are capable of influencing the extent of the relation between intentions and behavior. First of all, the level of specificity of the correspondence between the measure of intention and the behavioral

criterion. Secondly, the steadiness of behavioral intention between time of measurement and actual performance of the behavior. Lastly, the volitional aspect of the behavior; “the degree to which carrying out the intention is under the volitional control of the individual” (Madden, et al., 1992).

The TRA separates two distinct belief groups which are responsible for the modulation of the behavioral intention: attitudes and subjective norm (Fishbein & Ajzen, 1975). Attitudes include beliefs related to the individual’s evaluation of the behavior (Trafimow, 2009). According to Fishbein and Ajzen (1975) attitudes “(...) refer solely to a person’s location on a bipolar evaluative or affective dimension with respect to some object, action or event.”. In accordance with the authors (Fishbein & Ajzen, 1975), the attitudinal component expresses the individual’s degree of favorableness (or unfavorableness) towards certain behavior. When beliefs about an object are created, the individual, automatically, acquires an attitude toward that object. The created beliefs will link the object to specific attributes and the person will conceive a valuation of these attributes. This is the definition of attitudes. This concept is easily understood within Cornish and Clarke’s (1987) conception. The rational offender will approach the decision by valuating the expected rewards and costs, which will create a more or less clear image of the behavior itself. The recalling of relevant attitudes will be dependent of the individual experience as well as his cognitive ability. This will make the criminal decision highly dependent on the individual’s rationality (Cornish & Clarke, 1987). These same elements are also present in Gary Becker’s formulation of the rational-choice theory.

The attitudes towards a behavior can be either positive or negative, more or less important and, can vary greatly from one person to another (Fishbein & Ajzen, 1975). According to Fishbein and Ajzen (1975), in order to understand the relevance of a certain attitude to the decision-making process one has to dissect its nuclear beliefs. In fact, each belief can be perceived from two different perspectives; these, when calculated together, express the total favorableness of that attitude. On one hand, we have the belief *value*. This component illustrates whether the specific attribute is positive (p.ex *A certain brand of coffee is known for its bitterness; if a person enjoys a bitter flavor, this belief would express a positive attribute*) or negative according to the person. On the other hand, we have the belief *expectancy*. In this case, the component looks to evaluate the perceived likelihood of a certain attribute (e.g. *How likely is someone to get injured in a mountain climbing accident?*). Following the previous example, the *injury* expectancy will vary according

to different people; this likelihood evaluation, when combined with the belief value, will produce either a positive or a negative attitude regarding *mountain climbing*. According to Fishbein and Ajzen (1975) when thinking about a certain behavior, the individual will ponder the different attitudes, culminating in either a favorable or unfavorable decision.

Contrary to attitudes, the subjective norm looks into one's evaluation of what is important to others (Trafimow, 2009). This component is modulated by the individual's perception of the beliefs of the ones around him. Logically, only the opinion of peers that are considered important to the individual will be taken into account (Madden, et al., 1992). General examples of relevant peers include family, close friends, partners, etc. According to the TRA (Fishbein & Ajzen, 1975), people conceive beliefs regarding whether these groups (or individuals) would approve or disapprove of the behavior in mind. Furthermore, the model also takes into account the individual's own motivation to comply with the opinion of the relevant others. When merging both components, the significant impact of subjective norm over the decision-making process arises. This TRA element introduces environmental clues in its conception of decision. According to several studies, the subjective norm is the weakest element of the TPB, having the least predictive power over intentions (Sparks, Shepherd, Wieringa & Zimmermanns, 1995; Armitage & Conner, 2001; Sheppard, Hartwick & Warshaw. 1988; Van den Putte, 1991). Due to this limitation, some studies have opted for leaving the component out of the analysis (Sparks et al., 1995).

The last inclusion to Ajzen and Fishbein's model was the perceived behavioral control (PBC) variable (Ajzen, 1991). This component expands the boundary condition of pure volitional control specified by the TRA (Madden, et al., 1992). The PBC includes beliefs that are directed to the possession of necessary resources and opportunities in order to execute the behavior (Ajzen, 1991). The greater the individual's resource perception is, the greater the perceived control over the behavior will be. Much like attitudes and subjective norm, it is possible to individually separate the beliefs and treat them as independent determinants of the behavior (Madden, et al., 1992). The concept of PBC appears to be soundly linked to some elements integrated in the literature regarding situational crime prevention (Cloward & Ohlin, 1960; Clarke, 1983; Rosenbaum, Lurigio & Davis, 1998; Felson, 2007). This approach emphasizes the use of physical elements in order to prevent criminal activity such as alarms, bolted doors, CCTV, etc.

As already mentioned and according to Ajzen's (1991) formulation, the PBC has both direct and indirect (through behavioral intentions) effects over the behavior. The origin of the indirect effect lies on the assumption that perceived control has motivational implications over behavioral intentions (Madden, et al., 1992). In fact, when people believe they have greater control over the behavior itself their intentions will be higher, as opposed to, a situation where people's perception of control is low. Even though resources might be limited, this perception of control will greatly influence the outcome of their behavior (Ajzen, 1991). This idea that self-confidence can influence behavior outcomes has already been empirically tested (e.g. Bandura, Adams, Hardy & Howells, 1980). The aforementioned direct effect is related to the effective control of the individual over the behavior (Madden, et al., 1992).

Several other authors suggested the inclusion of other variables as effective predictors of behavior. Gorsuch and Ortberg (1983) argued that moral values could also have relevant implications on intentions. Within this research, the authors concluded that, when in a moral-heavy context, a distinction should be made between attitudes and moral responsibility. In fact, in certain situations, participants seemed to follow what they think as morally correct, even when it boycotts their preferences. Zuckerman and Reis (1978) brought up the relevance of establishing a direct link between attitudes and behavior in a study regarding altruistic behavior. This frame of thought had already been previously explored by Pomazal and Jaccard (1976).

One central aspect of the TPB is the fact that the relevance of each of the three factors is dependent of the intention under study (Ajzen, 1985). For certain behaviors, the attitudinal considerations might be of greater importance than the subjective norm or *vice versa*. These possible shifts in predictor variable weights give the model a wide spectrum of applicability.

Despite all its deserved praise, the TPB is not without criticism. Several groups of critiques have been pointed to Ajzen and Fishbein's model (Sniehotta, et al., 2014). The first major flaw rests on its over-simplification of the human decision-making process. In fact, the TPB tries to sum up all volitional behavior with only four different explanatory variables (Sniehotta, et al., 2014). McEachan, Conner, Taylor, & Lawton (2011) also talk about the frailties of the TPB in regard to the effects of human action on cognition and future behavior. Other authors (Sheeran, Gollwitzer & Bargh, 2013) argue that the theory is also excessively focused on rational reasoning. The TPB purposefully ignores all unconscious influences on behavior, as well as, the importance

of emotional thinking (outside expected affective consequences - Conner, Gaston, Sheeran, & Germain, 2013). Sniehotta, Presseau & Araújo-Soares (2014) also criticize the model's predictive validity and its utility.

As previously mentioned, the TPB is one of the most solidified and validated frameworks from social psychology (Armitage & Conner, 2001). Armitage and Conner (2001) developed a meta-analytic review of 161 TPB-related journal articles aiming at testing the efficacy of the model. Overall, their findings support the effectiveness of the TPB in regard to behavior and intention predictions; self-report-based studies expressed superior predictive capabilities than observation-based ones. The meta-analysis reported an $R = .52$ for multiple correlation of intention and PBC with behavior. This last construct was also proven to distinctively contribute to the prediction of behavior. Both direct and indirect relations of PBC over behavior were found, with a 6% increased prediction of intentions, solidifying the PBC as an important variable in decision-making research and also justifying the implementations done over the TRA. Furthermore, the nuclear link between intention and behavior was also established (Armitage & Conner, 2001). Armitage and Conner's meta-analysis (2001) also supported the argument of subjective norm's low predictive ability as it was the component least related with behavioral intentions. However this characteristic was linked to measurement problems, suggesting the need to devote closer attention when trying to tap into this concept (Armitage & Conner, 2001).

Several other meta-analysis regarding the TPB applicability were also developed, validating the efficacy of Ajzen and Fishbein's model (e.g. Randall & Wolff, 1994; Sheeran & Orbell, 1998; Sheppard, et al., 1988; Van den Putte, 1991; McEachan, et al., 2011).

After reviewing the most validated theories on human rational decision-making it seems relevant to also explore the opposing side. According to Herrnstein (1990), one of the main adversaries to the rational choice framework is the models explored by Tversky and Kahneman (Kahneman, Slovic & Tversky, 1974) in which certain choice phenomena are, at the same time, consistent with certain principles of cognitive psychology but inconsistent with rationally as it is formally designed.

2.4. Heuristics

The previous theories allowed for an orderly structuring of the elements that are implicated in the human decision-making process. Besides attitudes, groups influence, perceived control, rational thinking and weighting of behavior outcomes there are other elements that might have a great impact in the decision process, be it positive or negative. Such is the case of heuristics and decision biases.

According to Merriam-Webster dictionary (2011), a heuristic can be defined as a problem-solving approach that makes use of practical methods that, despite not being optimal, are considered sufficient to attain certain immediate goals. This definition is not far from its scientific use. In fact, in psychology, heuristics are considered basic (and efficient) rules that are used in human decision-making as shortcuts to solve complex problems. However, these shortcuts often ignore important aspects of the issue, which leads to systematic errors that diverge from logical and rational thinking (Lewis, 2008).

The study of the influence of heuristics in the decision-making process was pioneered by Kahneman and Tversky in the 1970s and 80s (Gilovich, et al., 2002). Kahneman and Tversky's approach surfaced from an era where rational choice led the study on human decision and tried to prove that, despite all its rationality, human cognition still has its flaws (Herrnstein, 1990). This model also offered a cognitive alternative which explained human error without invoking motivated irrationality (Gilovich, et al., 2002). The author's research on heuristics was inspired by works on biased real-world judgements conducted by Meehl (1954), Edwards (1968) and Simon (1983).

Kahneman and Tversky describe three different, general-purpose heuristics: availability, representativeness, anchoring and adjustment (Tversky & Kahneman, 1974). These heuristics work as guidance in case of intuitive judgment in the face of uncertainty (Gilovich, et al., 2002). Based on the fact that many decisions are based on beliefs concerning the probability of uncertain events, the authors show people's reliability on heuristics to reduce difficult tasks to easier judgmental processes, also pointing out the flawed side of this type of cognitive shortcuts; grave systematic errors (cognitive biases - Tversky & Kahneman, 1974). According to Tversky and

Kahneman (1974), subjective evaluation of likelihoods are based on information of questionable validity, which is managed with different heuristic rules.

The first heuristic advanced by the authors was named representativeness (Tversky & Kahneman, 1974). Representativeness, according to Tversky and Kahneman (1974), works with problems regarding the likelihood of A being the origin of B. This heuristic assesses probabilities by the degree to which A is representative of B (How much does A resemble B?). In fact, when A is highly similar to B, the probability of A causing B is estimated as being high and vice-versa (Tversky & Kahneman, 1974). As an example (see Tversky & Kahneman, 1974), “Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.” When people are asked to assess the likelihood of Steve being engaged in an occupation from a list of possible choices, the representativeness heuristic tells them that there is a higher chance of Steve being a librarian rather than a farmer. This type of thinking leads to grave errors because there are several important elements that are left out of this process such as, general income, actual field of activity, skills and expertise, etc.

The representativeness heuristic is also immune to probability history of the outcomes. In fact, even though the base-rate frequency is very relevant to probability estimates, when we lock in this type of heuristics, our calculations became impervious to prior probabilities. Recalling Kahneman and Tversky’s (1974) example, even though there are plenty more farmers than librarians in the general population, people still respond according to the stereotypes, ignoring the importance of other, more relevant considerations. This is, according to the authors, because probability history does not influence the resemblance of Steve’s characteristics to a farmer.

In their 1974 study (Tversky & Kahneman, 1974), the authors verified this hypothesis by manipulating the base-rate frequency in an experimental setting. In this experiment, participants had to read several personality descriptions of engineers and lawyers and assess which descriptions belong to each group. On the experimental group, however, participants were also told that, in the general description pool, there were 70 engineers and only 30 lawyers. According to this last parameter, the odds that a particular description would fit an engineer should be higher in the experimental sample, due to the added knowledge of majority of engineer. However, the results between samples were identical. This means that the participants favored the stereotypes rather

than the objective probability. Furthermore, when personality descriptions were absent, the participants correctly judged this probability at 30% for lawyers and 70% for engineers.

Another characteristic of the representativeness heuristic is the insensitivity to sample size. This bias expresses itself when an individual evaluates the likelihood of obtaining a specific result in a sample drawn from a specific population (Tversky & Kahneman, 1974). In fact, if the probability of a certain result is X in the population, this heuristic will tell us that the probability is also X for a small sample, removed from that population, downright ignoring the influence of the sample size.

Tversky and Kahneman (1974) conducted an experiment to assess this hypothesis in which participant had to answer a specific scenario. In this scenario, people had to choose, from two hospitals (a small one where 15 babies were born each day, and a bigger one where 45 babies were born), the one with higher probability of reporting a day with more than 60% baby-boys. Since male/female ratio is 50/50, the majority of the participants responded that both hospitals had the same probability of reporting such a day. However, sampling theory tells us that the smaller sample is more likely, since a larger one is less likely to stray from 50% (Tversky & Kahneman, 1974). According to the authors, “this fundamental notion of statistics is (...) not part of people’s repertoire of intuitions”.

Another type of sample size insensitivity is also reported in a different scenario. This error is related to the likelihood of a sample being drawn from one population instead of another (Tversky & Kahneman, 1974). In this scenario, two individuals draw balls from an urn. The first one, draws 4 red balls and a white one and the second one draws 12 red ones and 8 white. The problem also states that the urn carries $2/3$ of one color and $1/3$ of the other. The participant is then asked which of the individuals should feel more confident that the urn has the previously mentioned distribution, as well as, what odds should each individual report. The correct odds are 8 to 1 in the 4:1 sample and 16 to 1 in the other, assuming equal prior probabilities. Nevertheless, the majority of the participants chose the first, and this is due to the proportion of red balls being higher. Once again, participants ignore the sample sizes within their intuitive judgement, focusing, exclusively, on sample proportions.

Further into the representativeness heuristics, there is a tendency to expect that a sequence of random events (even a short one), is representative of the fundamental characteristic of the

process (Tversky & Kahneman, 1974). In a coin toss sequence, individuals regard random sequences as more likely than organized ones (T-H-H-T-H T vs. T-T-T-H-H-H) or sequences that seem to misrepresent the randomness of the coin toss (such as T-T-T-T-H-T). The same happens to, not only in regard to the full sequence, but also to its individual parts. The gambler's fallacy is also a clear example of this kind of bias (Tversky & Kahneman, 1974).

The representativeness heuristic is also responsible for systematic errors in some types of numerical predictions. In fact, when asked to predict the future profit of some company, people will often base their predictions on the favorableness or unfavorableness of the company's description, in spite of that description's reliability. Therefore, their predictions will be impervious to the reliability of the evidence and to the expected accuracy of the prediction itself. In this type of decision-making, the range of the prediction is controlled by considerations of predictability (Tversky & Kahneman, 1974).

In Tversky and Kahneman (1974), the authors proceed to enunciate a few more heuristic-related biases which result from representativeness, for example, illusion of validity and misconceptions of regression. The first one represents the confidence that results from a good fit between predicted outcome and input information, whilst the second represents the "regression towards the mean" phenomenon.

The representativeness heuristic is one of the most studied heuristics in the decision-making literature (Bhatia, 2015). Grether (1980) conducted a series of experiments on undergraduates from different schools (N=341) in order to test this heuristic. The experiment consisted of three bingo cages filled with balls (Cage X contained balls numbered from 1 to 6; cage A contained four balls marked with the letter N and two balls with the letter G; cage B contained three balls marked with an N and three with the letter G). A rule to determine a cage was then announced; the rule followed a specific format ("if one of the numbers one through k is drawn from cage X, we shall choose cage A; otherwise we shall choose cage B." – k varied between 2 and 4). A ball was then drawn from cage X, which determined which cage was to be drawn from (six balls were then drawn, with replacement). The drawn letters were written in a blackboard and the participants were asked to report from which cage they thought the draws were from. Through this protocol Grether (1980) concluded that the subjects did use the

representativeness heuristic as a source of probability assessment, showing that sometimes, individual reasoning processes do not follow the rules of statistics.

Grether (1992) also tested this heuristic through a series of three different experiments in another population of undergraduates. The first two protocols were similar to the one used in Grether (1980) (balls were drawn from bingo cages after the announcement of different rules regarding which cage the next draw would be from). The participants would then state the cage from which the balls were drawn from. In the first experiment, subjects also had to choose the most likely from two compound events. In the second one, instead of compound events, a choice was substituted in order to elicit actual subjective probabilities. The third experiment included a few other alterations. The author concluded that participants used the representativeness heuristics when it was available, and that the use of this heuristic lead to extreme judgements. Furthermore, the use of representativeness seems to depend on various details of the decision problem and context. The use of this heuristic can be influenced by different variables, such as the accuracy of the source information, motivations and the order in which problems are presented (Grether, 1992).

Gigerenzer, Hell and Blank (1988) tested the impact of the representativeness heuristic in regard to base rate negligence. In this study, the authors used the previously mentioned engineer-lawyer experiment used by Tversky and Kahneman (1974) and an analogous problem in which participant's everyday experience was represented as a probability revision problem. The authors concluded that the representativeness heuristic was inadequate to explain the data and that these types of likelihood judgement errors are rather explained by internal problem representation. Gigerenzer and colleagues (1988) suggest that an analogy between perceptual and probability judgement should be preferred over an all-purpose heuristic.

Triplet (1992) conducted a study concerning the representativeness (and availability) heuristic as the cause of fear and prejudice towards HIV patients. In this research, participants, after reading case descriptions of patients (the descriptions varied in gender, sexual orientation and displayed symptoms of two distinct diseases), had to indicate which disease the though the patient had, as well as, rate the patient's accountability and interactional desirability. Overall, the cognitive biases were proven robust. In regard to the representativeness heuristic, homosexuals were perceived more frequently as HIV patients, in spite of the displayed symptoms. Heterosexuals, on the other hand, were perceived as having other diseases.

Davidson (1995) also validated the use of the representativeness heuristic in children (N=60) from the second, fourth and sixth grade. The participants assessed eight problems regarding the heuristic; the test included stereotypical and non-stereotypical domain problems. The authors concluded that representativeness-based responses were more frequent in non-stereotypical problems. Furthermore, older children were more prone to the use of the heuristic.

Agnoli (1991) also tested the effect of this heuristic in children. The author constructed four experimental protocols designed for children. In the first experiment, participants were to assess relative frequencies of pairs of alternatives, each pair including a class and its sub-class; in experiment 2, alternative explanations (ex. children misunderstand the problem) were controlled; experiment 3 focused on the ability to train children to rely on logical thinking, suppressing the use of heuristics; experiment 4 was designed to control for memorization of the previous experimental sessions in order to verify the training effect. The author concluded that, the representativeness caused participants to misjudge the frequency of a typical subclass as more frequent than an inclusive class. Furthermore, the children's explanations on the different problems also established that they did not interpret all questions as requiring comparison between subclasses, further validating the heuristic use. The author also concluded that, the existence of rational training effectively influenced the participant's problem-solving ability, reducing the use of the representativeness heuristic.

The second heuristic was named availability. According to Tversky and Kahneman (1974), the availability heuristic acts when individuals evaluate the frequency of a certain event. In fact, in their estimations, people will often guess this type of frequency regarding the ease with which previous similar occurrences come to mind. For example, people will estimate the likelihood of a car crash by recalling comparable events across the individual's acquaintances. Availability is very useful clue when frequency assessment is required, since occurrences of large classes are, normally, recalled easier than instances of smaller ones (Tversky & Kahneman, 1974). Of course, this heuristic suffers the influence of several factors other than mere frequency and probability, leading the judgment into predictable biases.

Yet again, Tversky and Kahneman (1974) reported all possible biases that may result from the use of this heuristic, opening the subject with the errors that might occur from the instance retrievability process. In fact, when certain instances are easily recalled, the analogous class will

appear far more plentiful than a class which instances are harder to retrieve. To test this hypothesis, the authors showed a list of well-known personalities (both female and male) and asked the participants to judge whether this list had more male than female names. There were different lists presented, in some of them, the male names were significantly more famous than the female, while in the others, the women were more famous than the men. In every list, the sex with the most famous individuals was the one chosen. The salience of the event also plays an important role in the process of recalling (Tversky & Kahneman, 1974). In fact, witnessing a car crash is more impactful than reading about it on the newspaper and, therefore, more easily recallable. Also, events that occurred recently will be thought of more easily than distant ones.

People tend to recall events more easily if they require less effort. In fact, following Tversky and Kahneman's (1974) example, people will have less trouble recalling words that start with the letter r than when they try to recall words with r as the third letter. This will cause them to report words that start with r as more frequent than words which r is the third letter. The authors call this error bias due to the effectiveness of the search set. Another of the availability bias described by Tversky and Kahneman (1974) is the illusory correlation. This bias happens when some event co-occurs frequently with a different one. The strength of the association between events will define the individual's assessment of the frequency of both events, even if the predictive validity of one of the events is nil (Tversky & Kahneman, 1974).

When people have to assess the frequency of a certain class whose instances are not dependent of memory functions they will try to generate each possible outcome. Take, for instance, the risks involved in an expedition; the individual will assess these risks by conceiving different situations with which the expedition is not equipped to deal with. If the individual recalls several of these situations, the expedition will be judged as very dangerous even if the ease with which dangers are recalled does not replicate their real probability. This is called the error of imaginability (Tversky & Kahneman, 1974).

Schwarz, Bless, Strack, Klumpp, Rittenauer-Schatka, and Simons (1991) tested the use of the availability heuristic in a sample of college students. In their first test, participants had to describe 6 or 12 situations in which they behaved assertively and felt at ease and situations in which they acted unassertively and felt insecure. In their second experiment, participants had to report 6 or 12 examples of assertive and unassertive behavior. Participants were also told that,

most of the previous respondents found it easy/hard to fulfill the task (this manipulation served the purpose of increasing the perceived diagnosticity of difficulty of retrieval under conditions in which subject's own experience deviates from the (alleged) experience of others). The third experiment, followed the previously mentioned protocol with the adding of an extra component (subjects had to answer the question while listening to meditation music). Overall, all three experiments validate the use availability in a setting where events have to be recalled. The emerging results could be explained by biased recall of events (accessibility bias) or greater ease of retrieval, consolidating the availability heuristic as an important component of human cognition.

Manis, Shedler, Jonides, and Nelson (1993) also designed three experiments in order to assess availability use in judgements of category size and frequency of occurrence. Experiment 1 consisted of a variation of Tversky and Kahneman's (1974) "list of famous people" experiment. From this first experiment the authors reported the presence of the availability heuristic. Furthermore, the same results surfaced from path analysis with the heuristic operationalized as free recall, spew order and recognition. Experiment 2 followed a similar approach as the previous, with an added delay element in order to test the over-time stability of the heuristic (the tested retention interval was 5-7 minutes). This test reported similar results to the first one, however, the weight of the direct path in regard to the delay condition was not fully verified. Finally, experiment 3 was designed in order to acquire further information on two distinct patterns: assessments frequently influenced by errors in the participant's recollection protocols and the lack of support from frequency-of-occurrence estimates on the heuristic. Overall, assessments of presentation frequency are independent of recall and its direct effects are unreliable. According to the authors, all three protocols support a common ground and set further experimental evidence on the use of the availability heuristic.

Hayibor and Wasieleski (2008) also tested the use of the availability heuristic in ethical decision-making, more specifically, on perceptions of moral intensity. This study used self-reported measures of ability to recall and free recall and also integrated an experimental protocol that allowed manipulation of the heuristic. Overall, this heuristic had effect on the perception of the moral intensity of the issue and on the magnitude of the consequences of an act. Furthermore, the availability heuristic of those who believe that a particular act is morally acceptable was related (positively) to perceptions of social consensus (about the correctness of the act).

Slovic, Finucane, Peters and MacGregor (2004) suggest that the availability heuristic might also have a close connection to affect. In fact, the authors argue that part of the reason people recall certain events has to do with the relation between the image and affect (Keller, Siegrist & Gutscher, 2006). Slovic et al, (2004) define affect as the specific quality (positive or negative) experienced as a feeling state (either conscious or unconscious), that delineates a quality of a stimulus. According to the authors, people recall events that are tagged with a specific emotionality and, therefore, availability and affect are closely related. This close link between the availability heuristic and affect could represent a relevant element in the study of psychopathy. As previously mentioned, psychopathic individuals exhibit amygdala deficiencies that hinders their emotional capabilities (e.g. Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008; Jones, Laurens, Herba, Barker & Viding., 2009; White et al., 2012; Viding, et al., 2012; Lozier, Cardinale, VanMeter & Marsh, 2014). Since, according to Slovic and colleagues (2004), affect plays an important role in the process of recalling specific events, one might argue that psychopathic individuals might experience difficulties in the recalling process, as a result of their characteristic emotional deficits. This can imply some type of resistance to the availability heuristic, however, it may also reflect a tendency to ignore negative consequences of past behavior.

Keller, Siegrist and Gutscher (2006) studied the impact of the availability and affect heuristic in risk perception. In their experimental protocol, participants were asked to imagine they were buying a house and that they were warned of a possible flood. The flood risk was described in four different ways (each version presented a different probability of flood). The three different studies followed the same protocol with a few added extras (study 2 also contained graphical displays and study 3 included photographs). Through study 1 and 2 the authors concluded that when participants received risk information regarding long time periods (e.g. 30 years) the perceived risk was higher than on shorter ones (e.g, within one year). Also, risk information was affected by individual experience with flooding. Finally, when presented with flood-related pictures, participants' perceived risk was also higher. Overall, evidence has been lent to the importance of affect (and availability) heuristic in human perception of danger.

In the same path, Pachur, Hertwig and Steinmann (2012) also studies the impact of both these heuristics on risk assessment. Using a sample of students, the author measured risk with measures of frequency, value of statistical life and perceived risk. Also, the author used both

homogeneous and heterogeneous causes of death. In general, the availability heuristic conformed to participant's responses. Past experience, once again, also carried a high degree of ecological validity, surpassing affective information. Though, the impact of affect was more evident in judgements related to perceived-risks and value-of-a-statistical life than in judgements related to risk-frequency. Furthermore, the author also found evidence for mechanisms that combine both availability and affect.

Even though Tversky and Kahneman (1973) emphasize the role of experiential information (phenomenal experience of ease/difficulty to recall) in the operative definition of the availability heuristic, a different research program, with a large body of research in social cognition has also demonstrated that judgements are grounded on declarative information that is most accessible at the time of the judgement (e.g. Bodenhausen & Wyer, 1985; Higgins, 1996; Schwarz, 1998; Srull & Wyer, 1989). According to this research path, when forming a judgement, people seldom retrieve all the information that constitutes the task. Normally, individuals truncate the search process as soon as sufficient information has come to mind in order to create a judgement with satisfactory subjective certainty (Schwarz & Vaughn, 2002).

The final original heuristic assessment described in Tversky & Kahneman (1974) was named adjustment and anchoring. The anchoring heuristic occurs in situations where people have to make an estimate starting from an initial value or starting point. This initial value may have different origins (be it in the formulation of the problem or a consequence of a partial computation) and is, usually, adjusted in order to reach a final answer. However, this mechanism is flawed because different starting point result in different estimates which are always biased in the direction of the starting value (Tversky & Kahneman, 1974). The first error mentioned in regard to the anchoring process occurs when the adjustment made is insufficient. In Tversky and Kahneman's (1974) experiment, participants were asked to estimate a certain percentage of an event occurrence. Before judging that percentage, a number was determined from a spinning-wheel and the participants were asked if the guessed percentage would be inferior or superior to the presented number. The participants were then asked to guess the event's percentage by moving up or down the spinning-wheel number. As a result, participants' estimates were, in fact, influenced by the randomly selected number, even though all participants knew the number had no real relation to the event. This kind of bias also appears as a result from incomplete computations, for example,

when people have to estimate the result of a complex mathematical calculation with limited time to answer (Tversky & Kahneman, 1974).

The anchoring heuristic is also responsible for errors related to the assessment of conjunctive and disjunctive events (Tversky & Kahneman, 1974). In fact, in an experiment conducted by Bar-Hillel (1973), the majority of the participants, from three different probabilistic events, chose the conjunctive event in detriment of the simple one, which had higher probability. Much in the same manner, the participants chose to bet in the simple event instead of the disjunctive that also had higher probability. According to Tversky and Kahneman (1974), the tendency to overestimate conjunctive events and also under-estimate disjunctive ones is frequent and could be explained by the anchoring effect. This type of bias can have severe implications in everyday decision-making. The planning of a task is conjunctive in its nature; for it to come to fruition, a series of events have to occur. The success rate of the plan can be severely decreased with the increase in number of events (Tversky & Kahneman, 1974). The same happens for disjunctive events, especially evident in risk-evaluations. A system that is dependent on multiple components will fail if any of these critical components fail; again, the more the components, the higher the probability of failure. In both these situations, people will tend to be optimistic due to the calculation error issued by the anchoring heuristic (Tversky & Kahneman, 1974).

Wright and Anderson (1989) tested the influence of familiarity and financial incentives on the use of the anchoring heuristic in a probability assessment context. Using a sample of 336 business school students, the authors conducted two different experimental tasks. In the first one, participants had to choose between two alternatives inspired on a preliminary judgement of a relatively likely (and unlikely) event. Then, the participants were to generate their final probability judgement. Experiment 2 consisted of a no-choice control protocol. Overall, the reported anchoring effects were very strong, disabling any eventual effect that could origin from the situation familiarity. However, monetary incentives did lessen the effect of the heuristic.

Cervone and Peake (1986) researched the use of the anchoring heuristic within judgements of performance capability (self-efficacy). Furthermore, they also focused on the succeeding impact of these judgements on behavior. In their first task, participants had to assess their capabilities for performance over a problem-solving task after being exposed to random anchor values which displayed extremely high and extremely low performance levels. In this first protocol, there was a

robust influence of the anchor values over the judgements of self-efficacy (high anchors led to high performance results and *vice-versa*). Furthermore, task persistence was also modulated by the anchor values (higher anchors elicited higher persistence). The second protocol was a replication of the first one in a different sample (high school students) and yielded similar results.

Epley and Gilovich (2006) research focused on the anchoring heuristic and, mainly, in the reason behind insufficient adjustment. In their first experiment, the authors asked the participants to respond to a series of questions known to elicit true adjustment. Afterwards, participants were to provide a range of possible values for the previous items. The authors also added a control protocol in order to guarantee that the effects resulted from underlying processes. In experiment 2, the authors focused on the extent to which estimates were affected by three different variables: Need for cognition, alcohol consumption and cognitive load. In general, Epley and Gilovich's results (2006) were consistent with previous research, showing that individuals adjust insufficiently because their adjustment process halts as soon as they reach an implicit range of plausible values. According to the authors, estimates have a tendency to reside near the anchor side of the implicit range, however, the true value usually lies nearer to the center of that range. At the same time, the authors found adjustment to be effortful, which implies that increasing the person's willingness to seek more accurate values will also decrease the dimension of the adjustment-based anchoring bias. Furthermore, the psychological mechanisms underlying the anchoring effects seem to differ. For instance, past research frequently reported that anchoring is not influenced by the manipulation of people's willingness (or ability) to devote effort to the task, which is contrary to what is postulated by this study. According to the authors, the effects observed in the anchoring paradigm result from an enhanced accessibility of anchor-consistent information and not insufficient adjustment (Strack & Mussweiler, 1997).

McElroy and Dowd (2007) tested the interactions between the anchoring heuristic and the Big-Five personality traits. More precisely, the authors investigate how openness to experience can influence previously anchored participants' judgement. In their first task, participants, after completing the personality inventory were asked about the exact length of the Mississippi river; the task included anchor values of 200 and 20,000 miles. The second task followed the same protocol but with a different scenario (participants had to estimate the percentage of African nations in the United Nations). Through these experimental tasks, the authors concluded that

participants with higher values of openness to experience were more influenced by anchoring (both high and low in the first scenario and only for high anchoring in the second one).

As one can conclude, there has been an extensive series of research regarding the Tversky and Kahneman's heuristics (1974). In fact, these heuristics seem to have an extremely large amplitude of applications and are generally perceived as robust, due to the vast validation they have received over the years. However, several more heuristics have been researched to the same degree of detail.

In their continuous work on decision-making and human judgement, Kahneman and Tversky (1984) came across different representations of these type of heuristics other than representativeness, availability and anchoring. Loss aversion is one of such examples. Human aversion to risk had already been reported in science in works such as the ones from Bernoulli in 1738. Bernoulli's (1738) work had already targeted the reasons behind people's general dislike in regard to risk taking and developed further work towards the reduction of this aversion with the increase of personal wealth. Tversky and Kahneman (1984) give a sound example of people's tendency to avoid risk. According to the authors, the majority of people would prefer to win 800€ than to gamble on a 1000€ prize with a win likelihood of 85%, even though the mathematical expectation of the gamble exceeds the expectation of the 800€. Following this example, one can conclude that a preference for a sure outcome is an important characteristic of loss aversion. In this regard, loss aversion configures a tendency to prioritize avoiding losses over acquiring equivalent gains. The loss aversion heuristic takes shape as a nuclear component of the prospect theory (Kahneman & Tversky, 1979)

The prospect theory was developed by Kahneman and Tversky (1979) as a replacement for the expected utility theory. This model offered a more precise description of decision-making. According to the authors, prospect theory describes human decision in two phases. The first stage includes the organization of possible outcomes following a heuristic. In this stage, people will decide which of the possible outcomes they consider equivalent to each other and use them to set a point of reference. Then, all outcomes that are considered of lesser/higher importance will be conceived as losses/gains. This first phase is called editing phase. The second stage, the evaluation phase, consists of a value attribution to the listed outcomes, considering the individual likelihood

of each. The final decision is the alternative with higher attributed value. According to the model's formula, losses have a greater impact than gains, which is due to the loss aversion heuristic.

Hochman and Yechiam (2010) developed a study in which they centered their attention in the role of losses in human decision. In this research, the authors looked into the behavioral responses and physiological correlated elicited by loss in decisions under uncertainty. The researchers assessed the effects of both gains and losses on pupil diameter and heart rate through a series of decision tasks that involved absolute or relative monetary losses. Overall, losses led to heightened autonomic response in relation to equivalent gains. These results were indicated by an increase in heart-rate and in pupil diameter, even in contexts where the average person exhibits no signs of loss aversion. Furthermore, these autonomous nervous system responses were not correlated to risk taking inclinations. These psychophysiological results seem to be related to an affective base (Appelhans & Luecken, 2006; Choi, Schuetz, Stewart, & Sun, 2016; Wei, Chen & Wu, 2018). Once again, the established link between psychopathic traits and emotional deficits could have an important implication in the way psychopathic individuals experience loss aversion (Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008; Jones, et al., 2009; White et al., 2012; Viding, et al., 2012; Lozier, et al., 2014). The results described by Hochman and Yechiam (2011) could imply a possible resistance to the loss aversion heuristic in the case of psychopathic individuals.

Schimdt and Traub (2002) investigated the loss aversion heuristic in an experimental context using a four-part protocol. Overall, the authors found mixed evidence towards loss aversion. While a considerable number of participants exhibited clear loss averse choices, the results did not report an actual lower percentage of loss seeking participants. The authors suggest that the conclusion that, loss aversion is a good description of general behavior should be taken with caution, since it appears to be the large extent of the phenomenon that makes it so protuberant, rather than its general occurrence.

Masiero and Hensher (2010) researched the loss aversion heuristic through asymmetric preferences, and also looked into its implication on measures of willingness to pay and willingness to accept in a freight transport choice experiment. To test their hypothesis, the authors used a stated choice experimental protocol with three different alternative choices; the participants were presented with 15 randomly generated situations. Loss aversion was reaffirmed within the three

choice experiment attributes with the asymmetry producing a steeper utility function for losses (rather than gains). Furthermore, the heuristic had a significant effect on both willingness to pay and willingness to accept, with a symmetrical model showing a tendency to over-estimate both.

The loss aversion heuristic has been thoroughly researched and validated through several studies (e.g. Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001; Vaish, Grossmann, & Woodward, 2008; Fiske, 1980; Rook, 1984; Costantini & Hoving, 1973; Ganzach & Karsahi, 1995).

One of the most documented cognitive bias commonly associated with loss aversion is the framing effect (Tversky & Kahneman, 1981). The framing effect is a judgement bias in which individuals react in a different manner to a particular judgement, depending on how the choices are presented (Plous, 1993). In Tversky and Kahneman (1981) the authors present a series of experiments where seemingly insignificant variations in formulation of choice problems cause relevant preference change in the participants.

The following experimental problems, cited from Tversky and Kahneman's (1981) work, illustrate clearly the framing effect.

Problem 1: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows: If Program A is adopted, 200 people will be saved (72 %). If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved (28 %). Which of the two programs would you favor?

In this first choice-problem the sample was reported as being risk averse. In fact, according to the authors, for the participants, the prospect of saving 200 lives was far more attractive than two-in-three chance that 600 would be saved.

Problem 2: If Program C is adopted 400 people will die (22%). If Program D is adopted there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die (78%) Which of the two programs would you favor?

In the case of the second problem, the sample was reported as being risk seeker; the certain death of 400 people is less acceptable than the second alternative of equal value. According to the authors, the different preferences reported in both judgements demonstrate a relevant pattern, in which, choices that result in gains lead to risk averse responses, while choices involving losses lead to risk taking ones, even though the problems are identical. In fact, the only major difference is the way they are described. While in problem 1 choices are reported in regard to saving lives, in problem 2 choices are formulated in regard to losing lives. This minor change is followed by a massive shift from risk aversion to risk taking.

The authors (Tversky & Kahneman, 1981) concluded that this bias is caused by the interaction of two sets of factors. The first factor being variations in the framing of acts, contingencies and outcomes, and the second being the non-linearity of values and decision weights. The reported effects happen when the choice problems concern both loss of human lives and money, are impervious to monetary incentives and are not restricted to hypothetical problems.

Mayhorn, Fisk and Whittle (2002) conducted a study where they compared new framing-related data with previous data collected by Tversky and Kahneman (1981). This research aimed at verifying behavior consistency across time. The authors used a sample of 58 young men and 58 older men to which 16 decision scenarios were administered. The used scenarios were borrowed from Tversky and Kahneman's work (1986). In these scenarios participants had to make a risky choice by choosing one out of two available options with stated probabilities of occurrence. The topics displayed in the used scenarios include both subjects of health and finance. The decision options included three types framing: Positive, negative and mixed. Much like the Tversky and Kahneman (1981), positive-frame options were described in terms of gains, whilst negative-frame ones were described as losses, relative to a neutral reference outcome. Overall, the obtained results were consistent with the ones reported by Tversky and Kahneman (1981) with the main differences resulting from finance-related decisions. The vulnerability to framing effects seems to rely on changes in society that influence the way people value money and even health. Furthermore, there seems to be no effect of age in regard to the framing effect, which shows that all ages are equally susceptible. Mikels and Reed (2009) also reported the same results in regard to age difference and the impact of framing effects, however, in their research, only the younger sample reported risk seeking in the loss frame. The authors speculate that these results might be explained by the way

older individuals (as more loss experient and more motivated by hedonistic factors) perceive losses as smaller than gains, resulting in less weight attributed to losses *vs.* gains (Harinck, Van-Dijk, Van-Beest, & Mersmann, 2007). As an alternative, the authors point out to the importance of motivational changes as result of aging, proposing that older adults may be more focused on promotion rather than prevention, resulting on a greater focus on the pleasure gains over the pain of losses (Idson, Liberman, & Higgins, 2000)

Gonzalez, Dana, Koshino and Just (2005), led a research that aimed at understanding the reason behind people falling for cognitive bias such as the framing effect. The authors offer an explanation of this effect based on the underlying neural processes involved in decision-making in response to negatively and positively framed problems. Gonzalez and colleagues (2005) used fMRI data collection and 10 decision scenarios with risky/riskless alternatives framed as gains and losses (also inspired by Tversky and Kahneman, 1981). In general, a clear preference for sure gains *versus* risky ones and risky losses *versus* sure ones emerged from the data. Negatively-framed decisions were also more time consuming than positive ones. Furthermore, fMRI data shows that less cognitive effort is needed when choosing a sure gain than when choosing a risky gain. However, the cognitive effort used when opting for a guaranteed loss is equally high when choosing a risky loss. This difference is due to the difficult tradeoff between minimizing cognitive effort and feelings of displeasure present in negatively-framed problems, since both the sure and risky option involve losses. This point seems to be relevant when taking into account the close link between psychopathy and specific attention deficits. According to the modulation hypothesis, these difficulties relate to a problem of relocating attention to secondary information when the individual is engaged in goal-oriented behaviors (Patterson & Newman, 1993). According to Blair (2013), this impairment in balancing the demands of goal-oriented processing with secondary information processing generates a specific bias characterized by lower responsiveness to affective information, unless it is a central aspect of their goal-oriented focus of attention. Baskin-Sommers, Curtin and Newman (pp. 227; 2011) argue that psychopathic individuals initially perceive and recognize both primary and secondary information, however, they are proficient in regard to using higher order processes to solve the struggle between goal-relevant and secondary demands on attention. The higher-order processes limit the processing abilities in regard to secondary information. This cognitive impairment appears to be important in risk *vs.* safe choices. Since psychopathic individuals attribute more cognitive resources to goal-oriented processes, this might

mean that the effort needed to make the *risk vs. safe* choice will not be sufficient, leading them to ignore important choice components and opt for the choice that seems closer to their goal. This uneven tradeoff will make the risk less relevant to the decision due to the individual's lower responsiveness to affective information, making psychopathic individuals more resistant to effects like framing.

The impacts of framing effect have been extensively studied and verified (e.g. Schepanski & Kelsey, 1990; Rolfe, Bennett & Louviere, 2002; Kuhberger, A., 1997, 1998) and seem to be a relevant element of human decision-making.

Another example of decision heuristics is the *Sunk cost* effect. According to Arkes and Blumer (1985), this heuristic is manifested by an irrational tendency to persist in an endeavor once a prior investment (money, effort, time, etc.) has been made. This persistence is the result of a desire not to appear wasteful. In this effect, the prior investment that has been made acts as the motivator of the decision to continue even though, objectively, that should have no impact on the decision (Arkes & Blumer, 1985).

Arkes and Blumer (1985) provide the following example of the sunk cost effect. *A man wins a contest sponsored by a local radio station. He is given a free ticket to a football game. Since he does not want to go alone, he persuades a friend to buy a ticket and go with him. As they prepare to go to the game, a terrible blizzard begins. The contest winner peers out his window over the arctic scene and announces that he is not going, because the pain of enduring the snowstorm would be greater than the enjoyment he would derive from watching the game. However, his friend protests, "I don't want to waste the twelve dollars I paid for the ticket! I want to go!"*. From a reasonable decision-making standpoint, the individual who bought the ticket is not behaving in a rational manner. In fact, if the suffering of standing in a violent snowstorm is superior to the satisfaction achieved from attending the game the individual should not feel motivated to go. The value of the ticket has already been paid, independently of going or not going to the game; decision-making should not be influenced by sunk costs, only incremental ones (Arkes & Blumer, 1985). The sunk cost effect is clearly represented in Kahneman and Tversky's *prospect theory* (1979).

Arkes and Blumer's research (1985) demonstrates how the sunk cost effect clouds human decision. In the first experiment, participants were presented with the following problem: *Assume*

that you have spent \$100 on a ticket for a weekend ski trip to Michigan. Several weeks later you buy a \$50 ticket for a weekend ski trip to Wisconsin. You think you will enjoy the Wisconsin ski trip more than the Michigan ski trip. As you are putting your just-purchased Wisconsin ski trip ticket in your wallet, you notice that the Michigan ski trip and the Wisconsin ski trip are for the same weekend! It's too late to sell either ticket, and you cannot return either one. You must use one ticket and not the other. Which ski trip will you go on? - \$100 ski trip to Michigan (33); \$50 ski trip to Wisconsin (28). According to traditional economic theory, decisions should be based on the perceived costs and benefits of each available option. It would be anticipated that every participant would choose the most enjoyable trip (Wisconsin), however, some of the subjects, were affected by the sunk cost effect, which led them to choose the more expensive Michigan trip. In the second experiment, the authors explore this effect in a real-life scenario implementing a task with real money (Arkes & Blumer, 1985). In this experiment, the authors provided discounts to a theater series, expecting that individuals who paid less for the series would choose to see fewer plays than individuals that paid the full ticket price. In fact, this proved itself to be true; people who purchased the ticket at full price attended more plays than the others. Furthermore, the sunk cost effect persevered for up to six months following the ticket purchase. Three other scenarios were also tested, all of them supporting the impact of this effect (see Arkes & Blumer, 1985).

Kahneman and Tversky's prospect theory (1979) presents two key features that can be used to analyze the sunk cost effect, the first being its value function and the second being the certainty effect. In regard to the function (fig. 1), which represents the existing relation between objectively defined gains and losses and the subjective value a person attributed to such outcomes. When considering an initial investment, the individual is at point A (the center of the axis). Following several unsuccessful investments, the investor proceeds to point B; losses that lead further than B will not result in large value decrease, yet equivalent gains will lead to large increases in value. This statement means that someone standing at point B will risk small losses in order to obtain eventual large gains; point B could be seen as the place of someone that has paid a sunk cost. When compared to someone at point A, the individual at B will be more inclined to make risky investments. Thaler (1980) makes use of this function to explain Arkes and Blumer's snowstorm scenario (Arkes & Blumer, 1985). Consider the following: The value of going to the game is $v(g)$. The value of losing 12\$ is $v'(-12)$; v' being the value function for losses. The cost of enduring the storm is c . The enjoyment that derives from the game is equaled to the cost of enduring storm. The

person who obtained the free tickets will be indifferent about attending the game during a snowstorm; $v(g) = -v'(-c)$. On the other hand, someone who paid the full price (12\$) will still want to go; $v(g) + v'(-(c + 12)) > v'(-12)$. The first group of terms denotes the net gain/loss when deciding towards attending the game; the second group represents the lost of 12\$, the outcome of missing the game. Take p as the price of the ticket. The convexity of v' will cause the second term in the equation ($v'(-(c + p))$) to always be smaller than ($v'(-c) + v'(-p)$) for $p > 0$. Therefore, the person who paid for the ticket will want to go (Thaler, 1980).

In regard to the certainty effect, it can be expressed in two distinct ways (Arkes & Blumer, 1985). On one hand, gains that are absolutely certain are overvalued. According to the authors, “(...) the value of certain gains is higher than what would be expected given an analysis of a person’s values of gains having a likelihood less than 1.0.” On the other hand, certain losses are undervalued; “(...) the value is more negative than what would be expected given an analysis of a person’s values of losses having a probability less than 1.0.” This means that certainty enhances both positive and negative values. This argument is also supported by another of Arkes and Blumer’s scenarios (see Arkes & Blumer, 1985); when a sunk cost problem involves a decision between a certain loss and a very unlikely outcome, the certainty effect favors the last.

According to Arkes and Blumer (1985), the prospect theory lacks a psychological basis that justifies why sure losses are so aversive and why sunk costs are so difficult to ignore. One reason that would explain why people continue to invest after losing money lies in the fact that stopping the investments would mean that the previously spent money was wasted, which is an aversive event. This aversive event can be evaded by persisting with the investments, acting as if the previous spending was sensible. Staw’s research (1976) supported this exact claim. It seems that, contrary to the postulated by commonsense, negative outcomes will not always lead to a change in behavior; instead negative consequences lead to a further commitment to the selected alternative. Even though the effect of sunk costs seems to have a general grasp, this heuristic could have a different influence in the case of psychopathic individuals. As previously mentioned, the main mechanism underlying the sunk cost heuristic is loss aversion (Arkes & Blumer, 1985). When inspecting the link between psychopathic traits and risk, research shows an evident preference towards risk-seeking (e.g. Benning et al., 2003; Benning, Patrick, Blonigen, Hicks & Iacono, 2005; Patrick et al., 2009). Psychopathy’s characteristic sub-activation (Fowles, 1980;

Lykken, 1995) leads these individuals into procuring thrilling activities and risky choices in detriment of the safer alternatives. Risk-seeking and loss aversion are in the opposite end of the spectrum, therefore, it is expected that individuals with psychopathic traits express some type of immunity towards the effects of loss aversion and, consequently, to the sunk cost bias.

Even though the long-term heuristic research shows that people's decision-making is often affected by elements other than the knowledge over the behavior, there are some authors that express a more optimistic view of these cognitive shortcuts, the most famous being Gerd Gigerenzer (Vranas, 2000).

Gigerenzer and his colleagues have raised three main critiques to Tversky and Kahneman's view on heuristics (Vranas, 2000). First of all, at a more empirical level, Gigerenzer states that a few of the cognitive biases advanced by Kahneman are unstable. According to the author, the scale of the effect of these biases could be reduced significantly by re-formulating questions in terms of frequencies rather than probabilities (Gigerenzer, 1991a, 1991b). The second critique advanced by Gigerenzer rests at a more methodological level. Kahneman and Tversky's heuristics seem to be formulated in a very vague and atheoretical manner (Gigerenzer, 1996). Terms like "representativeness" and "availability" reduce the appeal of these heuristics as generators of biases, limiting their explanatory power. Lastly, perhaps the most relevant critique emerges at a normative level. Gigerenzer reckons that defining some of the cognitive biases described by Kahneman as errors is, somewhat, inappropriate (Gigerenzer & Todd, 1999). There are three main reasons behind this argument (Vranas, 2000). On one hand, there are no appropriate norms for single-case judgements, since, according to frequentists, single-case probabilities are meaningless. Furthermore, single-case probabilities do not need to be overseen by statistical norms because these norms are indifferent to content and, often conflict with conversational norms. Finally, Gigerenzer also argues that sometimes statistical norms are inconsistent; conflicting statistical norms (Vranas, 2000).

One of the main characteristics of behavioral economics is their inherent *behaviorist* approach. This leads to a consistent lack of explanation concerning the underlying mechanisms to the reported effects. Nonetheless, it is important to organize the previously reported heuristic effects in a partially structured model so that these become integrated with the personality traits under study. The reported heuristic effects interact with three different characteristics of the

psychopathic personality: *affect impairments, allocation of cognitive resources and sub-activation*. These three characteristics affect the way in which judgement bias influence the decision-making process in psychopathic individuals. The effect of emotional processing deficits (e.g. Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008; Jones, et al., 2009; White et al., 2012; Viding, et al., 2012; Lozier, et al., 2014) appears to be a grand influence on heuristics that carry a heavy affective component, such is the case of availability (Slovic, et al., 2004). The close link between these heuristics and emotion, paired up with difficulties in emotion processing exhibited by psychopathic individuals could lead to a greater resistance to affect-based judgement bias. Secondly, the way psychopathic individuals prioritize their cognitive resources might also sport an impact in more cognitive-based heuristics, for example, anchoring (e.g. Epley & Gilovich, 2006) and the framing effect (e.g. Gonzalez, et al., 2005). According to the modulation hypothesis (Patterson & Newman, 1993; Baskin-Sommers, et al., 2011), psychopathic individuals experience difficulties in relocating attention to secondary information when engaged in goal-oriented behaviors. Heuristics such as the ones mentioned require a specific level of attention and allocation of cognitive resources (Gonzalez, et al., 2005) in order to be effective. Pairing these cognitive requirements with difficulties in the distribution of resources, might lead to a bypass of the heuristic, generating some type of immunity to its bias in psychopathic individuals. At last, the hypo-arousal often included in the description of the psychopath (e.g. Fowles, 1980; Lykken, 1995) might also have an evident impact on heuristic-based thinking (e.g. Sunk costs). Psychopathic individuals, due to their sub-activated state, are often described as thrill-seekers (e.g. Benning et al., 2003; Benning, et al., 2005; Patrick et al., 2009). Heuristics, such as sunk costs, are dependent of the loss aversion bias, which is characterized by the avoidance of losses and risk-prone behaviors. Taking into consideration psychopathy's sensation-seeking nature, one might hypothesize that these individuals might have a natural tendency to be immune to such heuristic effects. The general nature of the reported heuristics imply that they are a common element in human decision-making. Psychopathic individuals appear to have major deficits in most of the mechanisms that are responsible for these heuristics, which implicates that their decision-making process is fundamentally different from non-psychopath's.

2.5. Associative learning - Classical origins

Despite the intrinsic influence of heuristics and rational choice in the decision-making process there is another important element that underlies an effective, pondered decision; *learning*. When individuals go through a specific behavior they learn the consequences that emerge from them, which will allow them to ponder more accurately in decisions that follow.

The study of human learning has a very vast and rich history, with influences from several different scientific fields, from philosophy with Plato and John Locke (Phillips & Soltis, 2009) to physiology, working even through Darwin's theory of evolution (Delamater & Lattal, 2014). In the end of the 18th century, behaviorism was starting to dominate experimental psychology and research was pursuing simple and mechanical explanations to dissolve unscientific forms of thought. It was from this setting that Ivan Pavlov's research on conditioning began emerging. Perhaps one of the most famous psychology experimental protocol, Pavlov's experiments with dogs cleared a path to understand human learning with the concept of *conditioned reflex* (Kalat, 2008).

Pavlov's work argued that animals were born with specific *unconditioned reflexes* (UC) between a stimulus (e.g. food) and a response (e.g. digestive juices) and that they could develop new reflexes by relocating a certain response from stimulus to another. In the case of one of his most well-known experiments, dogs learned to associate the sound of a bell (an otherwise neutral stimulus) to food in a manner in which, each time the bell would ring, the animal would begin to salivate (the typical response elicited from presenting food). The conditioned response is usually similar to the unconditioned one, however, the first is only acquired through experience and is relatively impermanent. This process in which a powerful biological stimulus is associated to a previously neutral stimulus would later be named classical conditioning (or Pavlovian conditioning) (Olson & Hergenhahn, 2015).

The work developed by Pavlov originated a series of works and changes to the original protocol from other scientists aiming at fully understanding this type of conditioning effect. Soon, other important concepts emerged. For instance, in *forward conditioning*, the learning process is quicker; the onset of the conditioned stimulus precedes the unconditioned stimulus', signaling that the unconditioned stimulus will follow (Chang, Stout, & Miller, 2004). *Delay* (the *conditioned*

stimulus - CS is presented and overlapped by the UC) and *trace* (in this form the first stimulus ends before the onset of the second; there is no overlapping) *conditioning* are two forms of this kind of conditioning (Olson & Hergenhahn, 2015). In *simultaneous conditioning*, both the CS and the US co-occur simultaneously (both start and terminate at the same time). In *second-order conditioning*, the protocol acquires a second level; in this case, a first CS1 signals the US and then, a second CS2 is associated with CS1, in a manner in which the CS2 also elicits the expected conditioned response. *Backward conditioning* is a form of conditioning in which the CS immediately follows the UC (Chang, et al., 2004). In this type of conditioning, the CS has an inhibitory nature, since it signals the US off-set. In *temporal conditioning* procedures, the US is presented in regular intervals. After the conditioning occurs, the conditioned response will ensue shortly before each US; this type of conditioning suggests the existence of a biological clock which acts as a CS. In the *zero-contingency procedure*, besides the normal pairing CS-US, the US also occurs randomly, which leads to the absence of actual conditioning (this protocol had a great influence over future conditioning research). One last protocol associated with classical conditioning is called *extinction*. In this protocol, after the conditioning has been established, the CS occurs without any US, leading to the reduced conditioned response (it is important to note that the effects of previous conditioning are not fully eliminated). In fact, *extinction* is merely the inhibition of the previously learned association (Olson & Hergenhahn, 2015). Associated with *extinction* is also *spontaneous recovery*, which is a temporary return of an extinguished response after a time delay. This type of recovery does not need additional conditioning.

Pavlov's work also refers to *stimulus generalization*. This concept circles around the hypothesis that new stimulus that are similar to the original CS might also elicit the same response from the subject. The closer the similarities between stimulus, the stronger the response and *vice-versa* (Shettleworth, 2010). However, learning theorists find it problematic to specify what "similar" means (Pearce, 1994). Individuals can also learn to discriminate between similar stimulus (*stimulus discrimination*). This happens when a CS1 elicits a certain CR, while a similar CS elicits a different CR (or even no CR). Pavlov and other researchers inspired by his work further developed the study of classical conditioning, including other various important concepts, such as *latent inhibition*, *external inhibition*, *conditioned suppression*, *conditioned inhibition*, *blocking*, etc. (Shettleworth, 2010).

Shortly before Pavlov's work, Edward Thorndike was already researching several aspects of the learning process. Through his experiments with cats and puzzle boxes, in which the animals would figure out a way, through levers and other assorted elements, to escape the boxes, Thorndike managed to shed some early light on conditioning (Kalat, 2008). Through trial and error, these cats would learn how to exit the puzzle boxes sometimes even without the need of food as an external stimulus. The cat's performance would even increase through experiment, reducing, however inconsistently, the speed of its escape. Even though the subjects learned how to work the boxes, Thorndike argues that the cats do not gain insights or any type of understanding regarding the puzzles, hence the gradual, inconsistent improvements (Gray, 2010). In fact, the learning exhibited has to do with reinforcement of specific behaviors at the expense of others. When the cat is closed inside the box, it has a certain repertoire of actions, for example scratching the wall, that it starts to use, starting with the most probable response. If nothing happens, the cat will attempt other behaviors, ultimately reaching the one that opens the door; when this happens, the opening of the door will act as a reinforcement, that will reinforce that specific action.

These experiments lead to the creation of Thorndike's Law of Effect (Thorndike, 1911/1970) which states that certain responses with a satisfying outcome in a particular situation are more likely to happen again, while actions with unpleasant effects become less likely to occur. Thorndike's law was one of the first principles associated with learning and behavior (Gray, 2010). Once the association between the stimulus and the response is established, the response is likely to occur without the actual presence of the stimulus. The author also highlights the importance of the setting in the elicitation of the response, arguing that the cats' behaviors inside the puzzle box would only make sense inside the box. Furthermore, the stimuli to which the subject is exposed to is also essential (e.g. the cat's desire for freedom). The notion applied by Thorndike in his law has a clear inspiration drawn from the evolutionary theory, in which characteristics which prove useful or advantageous tend to persevere (Schacter, Gilbert, Wegner, 2011). Terminology-wise, "satisfying" and "unpleasant" conditions, both terms present in the law of effect, are determined behaviorally and cannot be predicted with accuracy, since each animal has a different conception of both. Later, these terms were replaced respectively by *reinforcement* and *punishment* (Mazur, 2013, pp. 101–126).

This type of learning researched by Thorndike was named *operant conditioning*, since the subject operates on the environment in order to produce an outcome. This kind of conditioning is the process of changing behavior by providing reinforcement after a specific response and can be distinguished from the Pavlovian conditioning since, in the latter, the subject's behavior has no effect whatsoever on the outcome. These two types of conditioning affect distinct behaviors; while classical conditioning applies mainly to instinctual responses, operant conditioning applies to skeletal ones (this distinction is not absolute) (Kalat, 2008).

Almost half a century later, inspired by the research led by Thorndike, B.F. Skinner conducted his own work on operant conditioning, with an enormous impact on both our perception regarding law of effect in modern society and empirical elements regarding the study of learning. Skinner's work resolved issues present in conditioning experiments by generalizing the behaviors in study; the definition of behavior was defined by its outcome rather than by the muscle movement associated with it. This alteration in conceptualization allowed for more consistent results, which led to Skinner's protocol being considered standard across laboratories (Hergenhahn & Olson, 2015).

Skinner advanced a systematic description of the manner in which environmental variables control behavior. In his research, the author differentiates two types of behavior, controlled differently from one another: *respondent* and *operant* behavior (Skinner, 1938). While the first type of behaviors is caused by certain stimuli, susceptible of alteration through classical conditioning and measured by their latency, the latter is not initially induced by any particular stimulus, can be reinforced by operant conditioning and is measurable through their rate. While both these concepts had already been studied by Pavlov and Thorndike, Skinner managed to unite both under the same roof (Jenkins, 1979).

According to Skinner (1938), the origin of operant responses lies in its reinforcement. Since the individual's behavior fluctuates across time, when a certain behavioral variation is reinforced it increases in frequency within the subject's repertoire. The author coins the term "shaping" as a progressive behavioral change through the reinforcement of the desired behavioral variations. In his protocols, Skinner intended that animals executed specific tasks that, contrary to Thorndike's puzzle box, are not intuitive to the subject, such as pressing a button. In order to achieve this, the reinforcement process has to be gradual, implying the reinforcement of certain intuitive behaviors

individually until the final behavior is reached. For example, when training a rat to press a button, first the “standing” behavior has to be reinforced, followed by “standing on top of the button” and only then the desired final behavior (Kalat, 2008). This concept is also relevant in regard to human learning. Since a behavior is produced with no reference to any particular stimulus, the question of control arises. A certain stimulus can control an operant if it is present when the response is strengthened but also if it is absent when it is not. Skinner showed this with protocols that included discriminative stimulus (such as lights) needed to set the moment for the reinforcement of the behavior. For example, in order for the button produce food a certain light had to be on; in this setting, the rat will learn to only press the button if said light is tuned on (Jenkins, 1979). This is called a three-term contingency and is one of Skinner’s most important concepts.

Further into his work, Skinner also explains more complex human behavior within reinforcement framework. In fact, the majority of human behaviors are hard to describe in terms of simple individual responses reinforced one by one. The author argues that some types of more complex behaviors can be perceived as a sequence of smaller and simpler responses; he calls these sequences *behavioral chains* (Mazur, 2013). The *chaining* process assumes that a discriminative stimulus not only sets the situation for a follow-up behavior, but also strengthens the behavior that comes before, which means that a discriminative stimulus also functions as a conditioned reinforcer (Skinner, 1966). Usually, in these types of reinforcement, the sequence starts with the final desired behavior and is constructed backwards in a manner that each behavior is reinforced by the opportunity to perform the last one (Kalat, 2008). Despite the *chaining* process, Skinner (1966) also recognizes that the great majority of human behavior could not be easily explained by either *chaining* or *shaping*, as, most of the times, these behaviors happen suddenly and in their final form. In order to account for these types of behavior, the author presents the concept of rule-governed behavior; in these types of protocols, at first, simple behaviors come under the control of verbal stimuli, for example a child learns how to “wink”. Then, with time, a grand number of responses will come under such verbal control which will allow a sequence of verbal stimuli to evoke an unlimited variety of complex responses (Skinner, 1966).

Skinner argues about the importance of reinforcement as it is perceived as the primary process that shapes and controls behavior. The author (Skinner, 1953) advances two different types reinforcements in his work: positive and negative reinforcements. While in positive reinforcement

the behavior is strengthened by the occurrence of some type of satisfying event (e.g. a candy after a positive behavior) in negative reinforcement the strengthening comes from the removal of some type of aversive event (e.g. delayed bed-time in children). Negative reinforcement should not be confounded with punishment, since the latter is the application of an aversive stimulus and is mostly used as a behavior suppressor. The author also argues that the effects of punishment are temporary and also include a myriad of negative side-effects.

Skinner's (and Fester) work also includes an extensive analysis of various forms in which reinforcements could be organized over time; the *schedules of reinforcement* (Ferster & Skinner, 1957). Skinner reports five different schedules: *continuous*, *fixed-ratio*, *variable-ratio*, *fixed interval* and *variable interval*. Continuous reinforcement assumes that a reinforcement is provided for every correct response; when the reinforcement happens sporadically (the last four types) it is called intermittent reinforcement. In the case of fixed-ratio schedules, the reinforcement happens only after a certain, previously fixed number of correct responses. This type of schedule usually produces steady and quick responses. Variable-ratio is similar to the previous, however the reinforcement occurs after a variable number of correct responses. In fixed-interval schedule the strengthening happens for the first response after a defined time interval while in variable-interval schedules the time interval is variable (Hergenhahn & Olson, 2015).

2.6. The implications of associative learning for psychopathy (and criminal behavior)

The work developed by Pavlov, Thorndike and Skinner cleared the field to a deeper understanding of the elements underlying human learning, clearing the way to later authors who applied these same principles (and more complex ones) to several other aspects of humanity, interlacing them with other research phenomena, in search of better understanding. Such is the case of James Blair and Joseph Newman whose work led important conclusions in regard to the learning and decision-making process of psychopathic individuals. The work of Blair (2013) sheds some light on the learning processes of psychopathic individuals and their specificities. In a generalist fashion, the author argues that individuals with psychopathic traits express deficits in regard to emotional learning and decision-making (Blair, 2013). These impairments cause unresponsiveness to emotional expressions and other social reinforcers and further reflects deficits

in processes underlying different types of learning (aversive conditioning, passive avoidance, operant extinction and reversal learning). These learning deficits have been reported in various neurophysiological studies (e.g. Birbaumer et al, 2005; Finger, et al., 2011; Blair, Colledge, Murray & Mitchell, 2001; Blair, 2013; Balleine & Doherty, 2010; Budhani, Marsh, Pine & Blair, 2007).

The link between these learning disabilities and psychopathy had already been researched by Lykken (1957) in a study where subjects had to resolve a 20 choice points mental maze; at each point, participants had to choose which of four response levers would lead them to the next step in the maze (subjects had 20 trials to learn the full correct sequence to navigate the maze). In Lykken's maze task the passive avoidance component was latent; subjects had to learn which of the three incorrect responses at each maze step would result in electric shock, in order to avoid it. Individuals with psychopathic traits, despite a successful performance in the maze, showed passive avoidance errors, exhibiting increased likelihood of selecting a "punishment lever". Schmauk's (1970) replication of Lykken's study further uncovered psychopathic learning *nuances*. Even though the same passive avoidance mistakes were committed, psychopathic subjects performed as well as controls when the punishment was loss of reward instead of and electric shock. Schmauk (1970) concluded that psychopathic individuals are not impaired when the consequence of avoidance errors is perceived as relevant to the individuals value system. Another contrasting view emerges from Chesno and Kilmann's (1975) work, in fact, the authors argue that the passive avoidance errors exhibited by psychopaths is a product of the laboratorial context. In fact, in monotonous tasks, psychopaths seem to perceive punishment as reinforcement instead of aversive. This is due to the increase of the individual's levels of arousal as a result of the punishment. An alternative perspective works in respect to the importance of the formation of dominant response sets in the expression of impaired passive avoidance learning in these individuals. According to Newman (Newman, Widom & Nathan, 1985), when a psychopathic individual focus on a specific objective, the attention he devotes on cues associated with his goal will distract him from other, unrelated cues.

Joseph Newman also developed research within the subject of conditioning deficits as a trademark characteristic of the psychopathic individual, especially in regard to passive avoidance learning (Newman & Kosson, 1986). Newman's work was inspired by previous studies on passive

avoidance learning (e.g. Lykken, 1957; Schmauk, 1970; Trasler, 1978) in psychopathy. In Newman and Gorenstein's model (1980) of psychopathy, the authors argue that psychopathic individuals exhibit passive avoidance learning deficits which are central to explanations regarding psychopathy's connection with antisocial behavior

In their 1985 study, Newman, Widom and Nathan conduct one experiment (N = 90) focused in psychopathy and extroversion's relation to passive avoidance deficits. In passive avoidance learning individuals have to suppress a certain response in order to avoid punishment (Newman, et al., 1985). In their protocol, the authors used both an avoidance contingency and a salient approach contingency; the subjects executed a successive go/no go task in which rewards and punishments were employed to correct/incorrect answers. A second go/no go task was used with the objective of understanding if psychopathic individuals were capable of suitable response inhibition in a context where response inhibition also involves reward; in this second task, participants received the same reward for correctly constraining from answering to a "no-go" cue. The study concluded that, individuals with psychopathic traits committed more passive avoidance errors when avoidance required inhibiting a rewarded response even if loss of reward was the penalty for these types of errors (Newman, et al., 1985). Moreover, the same tendency was not evident in the altered go/no go protocol. The authors argue that, individuals with psychopathic characteristics exhibit a type of impairment in conditioning related to the inhibition of goal-directed behavior when reward cues are present.

Newman and Kosson (1986) looked further into psychopathy learning impairments by conducting a replication of the previous research, now with an adult psychopathic sample (N=60), in a forensic context. This protocol involved two distinct tasks; the first included both punishment and reward contingencies whilst the second entailed two punishment contingencies. Overall, the later study agrees with the results obtained in the first, that is the increased number of passive avoidance errors by psychopathic individuals in contrast to control. However, this increase was only evident in the punishment/rewards task; in fact, in the task that involved only punishment cues, psychopaths fared as efficiently as the control group. Despite removing group differences in passive avoidance, the punishment-only task did not cause a decrease of passive avoidance errors (the performance of subjects from the punishment-only task was identical to the punishment/reward group). As advanced by the authors, psychopathic individuals participating in

the punishment-only protocol should have exhibited better performance than the participants in the reward-punishment protocol; this would be explained by the interference of psychopathy's reward-focused tendency in the passive-avoidance learning process. The authors justify this result, arguing that the difficulty in both conditions was not equal (the modification of the contingencies altered the degree of difficulty across both conditions). Overall, the study supported the existence of passive-avoidance deficits in psychopathy, as well as, the absence of performance differences (psychopaths vs. non-psychopaths) when experimental conditions involve only one motivationally significant goal.

Newman's work includes a plethora of studies that dissect how psychopathic individuals interact with punishment and rewards and how their characteristic passive avoidance learning impairments influence this interaction. In fact, Newman, Patterson and Kosson (1987) further developed the link between psychopathy and learning disabilities, specifically in regard to response preservation. In this study, participants had to complete a card-playing task that involved monetary rewards and punishments under three different conditions (in each condition the probability of punishment increased by 10% at each 10-card block). The number of cards played before ending the task measured participant's response preservation. According to the authors, psychopathic individuals played a higher number of cards, and lost more money in tasks with exclusively instant feedback, further consolidating the link between psychopathy and passive avoidance learning disabilities.

Newman, Patterson, Howland and Nichols (1990) designed another study with a forensic sample that aimed at testing psychopath's deficits on tasks that encompass monetary rewards and punishments. The authors advanced the hypothesis that the state of behavioral activation created by the availability of rewards hinders these individual's ability to modulate a dominant response set for reward. In the first experiment, participants had to learn through trial and error when to and not to respond to certain numbers, some of which wielded rewards and others were associated with punishments. Through this task, Newman and colleagues (1990) concluded that since psychopathic individuals were less hesitant and paused less time to process punishment feedback, which led to inferior passive avoidance learning (pausing to process punishment involves in interruption of a dominant response set for reward). "Psychopaths are less willing to suspend reward seeking behavior (...) to process cues for punishment" (Newman, et al., 1990).

The second experiment was designed in order to understand the manner in which monetary rewards impair psychopath's passive avoidance learning. The author's advance to possibilities, the first is that rewards establish a dominant response set which is resistant to disrupt, the second has to do with subject's level of motivation; the prospect of reward disrupts passive avoidance learning. In this second task, learning reward cues was independent of learning punishment cues; this way, the likelihood of a subject developing a dominant response set was reduced, maintaining the opportunity for the subject to win/lose money. With this task, the authors managed to measure subjects' aptitude to learn punishment cues in a reward-punishment context while lessening the requirement to constrain a dominant response set for reward. This time, the experiment was inconclusive in regard to the power of the individual's reaction to punishment as a disruptor of passive avoidance learning. Despite the findings being consistent with the prior hypothesis there still was no evidence supporting the hypothesis that excessive activation interferes with response modulation. Newman and colleagues (1990) developed a third protocol that also failed to test this hypothesis. This study lent support to the hypothesis that psychopathic individuals perseverate sets of responses that rewards, and to a possible link between response preservation and the processing of punishment cues.

Arnett, Howland, Smith and Newman (1993) conducted a study regarding autonomic responsivity of psychopathic individuals to punishment and rewards throughout passive avoidance. The authors used a heart rate and electric skin conductance (ESC) measures during the duration of the task (the task used was a successive go/no go task with four reward and four punishment stimuli). The analysis showed that low-anxious psychopathic individuals displayed superior heart rate (HR) after reward cues than in punishment cues; the response of the HR post reward feedback was very quick, however, facing punishment cues the HR developed slowly. Also, there was an increase in HR following punishment cues greater than after rewards. No relevant conclusions arose from the ESC measures. The authors report that psychopathic individuals show less reactivity to punishments, which is consistent with Hare (1978) hypothesis that psychopaths are resistant to aversive stimulus which results in difficulties in learning from punishment experience.

Newman's research further solidifies the link between psychopathy and learning deficits (e.g. Arnett, Smith & Newman, 1997; Newman & Schmitt, 1998; Blair et al., 2004). Overall, the

author has raised proof of the existence of passive avoidance impairments in psychopathic individuals, displayed by increased passive avoidance errors when inhibiting reward responses, showing that these individuals display difficulties when trying to interrupt reward-seeking behavior, disregarding relevant punishment cues.

The later studies regarding the link between learning disabilities and psychopathic traits have integrated a more neuroscience-based approach (e.g. Finger, et al., 2011; Blair, et al., 2001; Blair, 2013; Balleine & Doherty, 2010; Budhani, et al., 2007). For instance, Finger and colleagues (2011) tested the responsiveness of the amygdala and orbitofrontal cortex to early stimulus-reinforcement exposure and reward through the use of a passive-avoidance experimental task. Within this protocol, subjects had to select certain images, some of which attributed points and other that took points away. The study included a sample of 30 subjects (15 conduct disorder youths and 15 healthy ones) with data collected from fMRI scans while performing the task. The authors concluded that individuals with conduct disorder exhibited less orbitofrontal responsiveness to both elements (stimulus-reinforcement exposure and reward) as well as less caudate response to stimulus-reinforcement exposure. Furthermore, the amygdala response throughout the task was inferior in conduct disorder subjects. Finger et al. (2011) argue that these results might imply some type of dysfunction in the previously mentioned components, which seems to be related to a tendency to disadvantageous decision-making.

Blair, Colledge, Murray and Mitchell (2001) compared the performance of youth with psychopathic traits with healthy subjects on two tasks (a gambling task and a intradimensional/extradimensional shift task – ID/ED task) related to functioning of the amygdala and orbitofrontal cortex. The ID/ED is a learning task where the participant has to select one of two stimuli; the stimuli can involve up to two dimensions: object shape and line shape. Individuals with psychopathic traits exhibited impaired performance in the gambling task through a reduced avoidance of the risky packs, however there were no major differences in reversal errors to the second task. However, Mitchell and colleagues (Mitchell, Colledge, Leonard, & Blair, 2002) in a similar protocol with adults with psychopathic traits, despite results related with the gambling task remaining the same (participants displayed impaired learning abilities throughout the task), the data retrieved in the ID/ED task showed impairments related to response reversal (response reversal is a tendency often associated with psychopathy defined by the modification of an already

conditioned behavioral response to a previously rewarded stimulus as the result of a variation of reinforcement contingencies). Rothmund et al. (2012) also tested aversive conditioning in psychopaths using electric stimuli as unconditioned stimulus (several psychophysiological measures were also assessed). This research showed that these individuals exhibited, when compared with healthy subjects, an absence of a conditioned response in both startle potentiation and electrodermal response measures. This type of conditioning-based research within the study of psychopathic traits showed an important constituent of the pathology related with very specific learning impairments. According to Blair (2013) these impairments come afloat when making moral judgements and within the individual's decision-making process.

According to the author (Blair, 2013), psychopathic individuals display deficits in the ability to connect rewards (or punishments) with responses. These deficits result from dysfunctions within different brain structures: the amygdala, striatum and ventromedial prefrontal cortex (vmPFC). Further, the use of outcome data by structures such as the anterior insula, dorsomedial prefrontal cortex and inferior frontal cortex also seems to be disrupted (Blair, 2013). These disabilities may often manifest in violent, destructive behaviors such as starting a fight due to a minor provocation, in spite of previous negative consequences of similar actions. According to Blair (2013), the use of reinforcement outcome information when making a decision implies two distinct elements: a proper depiction of the active consequences (positive and negative) of the behavior and an appropriate representation of the expected value of each.

In regard to the first component, the importance of prediction error signaling is indispensable since these signals are responsible for stimulus reinforcement learning (through the amygdala and striatum). A prediction error happens when an individual receives more or less punishment/reward than expected; the greater the difference between prediction and reality, the greater the prediction error. Blair (2013) further develops this idea arguing that, since the vmPFC encodes the received rewards, the reduced activity exhibited by this structure in psychopaths reflects a reduced response to rewards which also entails disrupted prediction error signaling (Finger et al. 2011). When the rewards are larger than what was anticipated, the size of the positive prediction error has been proven to be associated with activity in the striatum (Balleine & Doherty, 2010). This effect is attenuated in case of psychopathic individuals which leads to reduced and slower conditioning of the reinforcements associated with behavior (Blair, 2013). A similar effect

appears in regard to prediction error signaling and the response to punishments. In fact, in psychopathic individuals a positive correlation emerges between prediction errors to (worse than expected) punishments and the activity in the striatum (White et al., 2013), as opposed to the expected negative association that appears in healthy subjects (Balleine & Doherty, 2010). The reason behind this difference remains uncertain but, according to Blair (2013), it has negative impact on decision. The second component of decision-making advanced by Blair (2013) is the representation of the expected value. Previous research has shown that this component is also impaired in individuals with psychopathic traits. In fact, while in healthy individuals a positive association emerges between the expected value associated with a stimulus and vmPFC activity, which implies that the higher the expected value the more likely the response, in psychopathic individuals the same effect is lessened and therefore, these are less effective at using expected value information, ultimately impacting decision-making (Blair, 2013). Furthermore, psychopathic individuals also exhibit lower activity within the anterior insula, inferior frontal cortex and dorsomedial prefrontal cortex in representation of expected value in a context of avoidance of stimuli that would be beneficial to approach (Blair, 2013). These last three brain structures have been proved to be relevant in leading an individual away from suboptimal choices (Budhani, et al., 2007). Blair (2013) argues that, despite these decision-making deficits being present in psychopathic individuals, these characteristics are not psychopathy exclusive, being also prevalent in other externalizing conditions, for example, ADHD.

Blair's approach to learning deficits in psychopathy is very distinct from the approach used by Newman. Newman's view on psychopathy involves an involuntary shift of attention from the effortful implementation of goal-oriented behavior (Newman, Schmitt & Voss, 1997). This modulation of attention allows individuals to use peripheral information (if relevant) to their dominant response set (Lorenz & Newman, 2002). In situations where non-psychopaths would automatically process information (e.g. consequences, feelings of shame, persistence when frustrated, awareness of commitments), psychopathic individuals need effort to become aware of such factors (Newman, 1998). According to Newman (Lorenz & Newman, 2002), psychopaths are capable of behavior regulation, however this self-regulation is more effortful because psychopathic individuals lack the previously mentioned automatic processes. Being an attention-based model, it explains the lack of self-control, learning difficulties and emotional processing deficits as originating from failure to process information that is peripheral to their main goal (Lorenz &

Newman, 2002). As previously stated, according to Newman (Newman & Kosson, 1986), passive-avoidance deficits in psychopathy are a result of a lack of ability to shift attention from the goal of responding to gain rewards to the peripheral punishment information. However, according to Blair (2005), Newman's approach falls short, due to inconsistencies in regard to the established literature on attention (e.g. Berger & Posner, 2000). As a model that, besides psychopathy, also accounts for the functioning on healthy individuals, it should be compatible with contemporary models of attention (Blair, 2005).

Blair's approach to the concept of psychopathy and its influence on learning difficulties rests on other elements. Blair's Integrated Emotion Systems' model (IES) was constructed as a heavily neuroscience-based framework and can be perceived as an integration of the fear dysfunction and violence inhibition mechanism position. The IES implies a primary amygdala dysfunction that disturbs the ability to form stimulus-reinforcement learning associations in psychopathic individuals. According to the author (Blair, 2005), even though stimulus-reward associations are affected, the model is mainly focused on stimulus-punishment associations. Since these deficits hinder socialization, it makes the individuals less likely to learn how to avoid the use of antisocial behavior as a mean to achieve his goals, leading the individual into including these behaviors as instrumental actions. The second central component to Blair's model is orbital/ventrolateral frontal cortex dysfunctions, responsible for disrupting the systems that allow for a quick alteration of responding following contingency change. These impairments are connected to increased risk for reactive aggression based on frustration. According to the author, this second element is not exclusive to psychopathy.

Even though both Blair and Newman's models integrate passive-avoidance learning deficits as fundamental to the etiology of psychopathy, their perception of how these impairments work differs dramatically. While Newman (Newman & Kosson, 1986) views these passive-avoidance deficits as the result of a lack of ability to shift attention from goal-oriented actions, Blair (2005) argues that the impairments lie in the ability to create stimulus-reinforcement learning associations. The newer dual-process models of psychopathy (e.g. Patrick, et al., 2009) make an effort at settling this discussion by segregating the phenomenon of psychopathy into two distinct processes, one that is responsible for the externalizing component, embracing Newman's attention deficits and a second process that includes amygdala-related impairments, such as the ones postulated by Blair.

Despite the confronting ideas, both authors highlight learning problems as an essential element in the conceptualization of the phenomenon of psychopathy.

2.7. Concluding remarks

Throughout the development of the previous chapters, the human decision-making process has been dissected along with personality components that are closely related to antisocial behavior. Furthermore, a strong emphasis has been laid in the influence of specific psychopathy components on criminal decision. Both the concept of psychopathy and low self-control have been inspected individually and in mutual interaction with each other through the lens of the multidisciplinary science that is Criminology.

As previously mentioned, there are several characteristics of the psychopathic individual that carry an important weight regarding their decision-making process. One of such examples is the learning deficits frequently linked to the phenomenon, especially impairments in stimulus-reinforcement learning (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005). These deficits are closely linked to amygdala impairments (Blair, 2005), and hinder the establishment of links between the behavior and its consequences. The failure to create this link is a great determinant of criminal involvement (especially in the case of relapse) since these individuals will fail to learn with the negative consequences of their actions, making them more prone to repeat them. These learning difficulties cause unresponsiveness to emotional expressions and other social reinforcers essential to the decision-making process (Blair, 2013). According to Blair (2005), the passive-avoidance learning deficits are more severe in the case of behavior penalties. This means that these individuals will experience difficulties in learning from their mistakes, even if they are punished, generating some type of *penalty immunity*. The failure to learn from past experience will affect the decision-making process, causing these individuals to forget important elements of the behavior, which could lead them to underestimate the importance and even the likelihood of certain outcome events.

From a different perspective, psychopathy's characteristic thrill-seeking behavior might also reflect a grand influence in the decision process. As previously mentioned, there is a narrow link between psychopathy and the pursue of adrenaline (e.g. Fowles, 1980; Lykken, 1995). According to Lykken (1995) psychopathic individuals are naturally sub-activated, which will lead

them into the pursue of risky choices and activities, in order to restore their levels of arousal back to an optimal state (Eysenck & Gudjonsson, 1989; Gatzke-Kopp, et al., 2002; Quay, 1965; Zuckerman, 1994). This propensity towards risk can modulate the decision-making process pulling these individuals towards the riskier option, even though it might not be the correct one. Since crime is a highly arousing activity, individuals with this type of tendency will exhibit higher inclination towards it. Sensation-seeking is also closely related to low self-control (e.g. Gottfredson & Hirschi, 1990; Patrick et al., 2009).

Another element of psychopathy that might have a significant impact on the decision-making process is the *hypersensitivity to rewards* often linked with to these individuals (e.g. Gorenstein & Newman, 1980; Lykken, 1995; Newman, MacCoon, Vaugh, & Sadeh, 2005). Studies with neuroimaging have further solidified this propensity (e.g. Bjork, et al., 2012; Buckholz et al., 2010), even though it is an element often focused in more impulsivity-related elements. A overinflated value attributed to the positive outcomes of a certain behavior will make the behavior more alluring, which will disturb the decision-making process. When the nature of the decision is criminal, this sensitivity, paired up with a preference for risky decisions, *punishment immunity*, failure to learn from experience and unrealistic likelihood estimates will generate a highly criminally predisposed individual.

The previously mentioned decision-making impairments have, as previously explained, a more rational base, however, psychopathy also seems to be connected to deficits regarding more automatic processes, such as some types of heuristics. The formerly proposed model regarding psychopathic traits and heuristic processing focus three distinct influences: *affect impairments*, *allocation of cognitive resources* and *sub-activation*. These elements, inherent to psychopathy, are perceived as having some degree of influence over different heuristics. For instance, the affect impairments seem to be connected to more emotion-based heuristics (e.g. availability); the effects psychopathy's emotional processing deficits (e.g. Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008) generate some type of resistance to affect-based heuristics. In the case of more cognitive heuristics, the modulation hypothesis (Patterson & Newman, 1993; Baskin-Sommer, et al., 2011) seems to imply that difficulties in attention-allocation could result in the dismissal of heuristics that have a heavier cognitive load (e.g. anchoring, framing effect). Lastly, psychopathy's hypo-arousal also seems to influence heuristics such as sunk costs. Since this heuristic is based on

the human tendency to avoid risk and risky decisions (loss aversion), an individual characterized as a sensation-seeker would appear to be somewhat resistant to its effects. It is important to note that these assumptions are essential, however, purely speculative.

The previously discussed elements highlight the importance of researching the decision differences in psychopathy, especially concerning the criminal decision-making process. Several psychopathy characteristics elicited previously seem to be responsible for alterations in the decision process, which leads to an increased criminal propensity. The previous chapters focused in the in-depth analysis of several research phenomena that are essential to the description of psychopathy, self-control and human decision. The following chapters, empirically in their nature, will dissect the hypothesis under research, as well as, the studies developed in order to test them.

SECTION B
EMPIRICAL RESEARCH

I. Introduction to experimental section

On the following section, the studies developed in order to test the main hypothesis will be described and the emergent results will be reported and further discussed. As previously stated, overwhelming evidence supported the existence of flaws in psychopathic individual's decision-making process (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005; Bjork, et al., 2012; Buckholtz et al., 2010). These flaws result from different elements that have already been reported; passive avoidance and aversive conditioning deficits (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005), emotional learning impairments (e.g. Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008; Jones, et al., 2009; White et al., 2012; Viding, et al., 2012; Lozier, et al., 2014), blind focus and over-sensitiveness to rewards and disregard for punishments (e.g. Bjork, et al., 2012; Buckholtz et al., 2010), as well as other disabilities (e.g. Patterson & Newman, 1993; Baskin-Sommers, et al., 2011) that hinder the individual's decision-making process. Based on this evidence, it is to be expected a robust association between psychopathic traits and the already mentioned passive-avoidance learning difficulties which will have an important impact on the way the individual acts and decides how to act. The inherent characteristics of the psychopathic individual are also expected to have some degree of impact on the way heuristics are processed and used. Since several heuristics have an emotional background (Slovic, et al., 2004), for example, the framing effect, psychopaths, classically described as having emotional processing deficits, should function differently or even become completely impervious to the effects of these cognitive biases. The loss aversion heuristic should also behave differently in these individuals. While the majority of people are reported to be loss averse and thus avoid risky behavior altogether, psychopathic individuals, often characterized as thrill seekers (e.g. Benning et al., 2003; Benning, et al., 2005; Patrick et al., 2009), should exhibit some degree of resistance to this heuristic. Furthermore, since psychopathic individuals process cues of punishment and rewards in a different manner (e.g. Bjork, Chen, & Hommer, 2012; Buckholtz et al., 2010; Blair, 2005), ponderations of expected outcomes from the individual's behavior should also exhibit specific distinct characteristics, especially in regard to the expected likelihood and perceived value of each consequence. Moreover, the already robust link between psychopathy and antisocial acts (e.g. Grann, et al., 1999; Hemphill et al., 1998) should imply that the attitudinal element of decision

could also be affected by psychopathy's idiosyncrasies, which will, once again, alter the individual's decision process.

As previously mentioned, the integrated model of psychopathy used in the present work is the Triarchic Psychopathy Model and its measure the TriPM. This scale is relatively recent and has a self-report nature unlike the PCL-R. This may raise several questions, ranging from the dimensional orientation of the scale to its construct validity, or even to the reliability of self-report methods for the assessment of psychopathy. Lilienfeld and Fowler (2005) elicit several advantages of the self-report format in the study of psychopathy. First of all, the authors argue that "the self is in a privileged position with respect to its own mental status". Based on this premise, the self-report questionnaire is considered very practical when assessing subjective emotional states and traits. Even though psychopaths often exhibit lack of such states, they may experience certain emotions more frequently than non-psychopaths. Also, there is strong convergence between personality self-reports and reports of others (i.e. self-reports of personality traits have a tendency to concur moderately with scorings of knowledgeable observers). The substantial amount of nonshared variance between observer assessments and self-ratings introduces the possibility that each information source possesses incremental validity (Sechrest, 1963) beyond the other when predicting relevant variables. The authors also highlight the more "economical" nature of self-reports (Lilienfeld & Fowler, 2005). In fact, self-report measures are typically brief and easy to administer and also require no additional training from the researcher. This element is highly contrasting with the PCL-R protocol (i.e. lengthy semi-structured interview with specific skill requirements). The demanding nature of the PCL-R has led to research difficulties, especially when concerning institutional settings (Lilienfeld, 1994). Self-reporting scales also allow for a systematic assessment of the response styles (Widiger & Frances, 1987) which is not possible when using interviews. Lastly, when dealing with self-reports, there is no issue regarding interrater reliability (Lilienfeld & Fowler, 2005).

The self-reporting approach is not without disadvantages though. The first major issue with this type of questionnaire is related to psychopathy's inherent pathological lying and dishonesty (Lilienfeld & Fowler, 2005). In fact, when psychopathic individuals find themselves in a situation where they find it desirable to make a positive impression they may attempt to make themselves look good and *vice versa*. This tendency can have a negative effect of the collected

data. Furthermore, psychopath's lack of self-awareness and insight into the nature and extent of their psychological issues (Cleckley, 1976) could also affect the validity of the data collected by self-report especially in response items that demand specific knowledge concerning the impact of their actions on others. Another appointed criticism to the use of self-report scales in the study of psychopathy had to do with semantic aphasia (Lilienfeld & Fowler, 2005). According to the authors, asking individuals who have never experienced emotion to account for its absence seems to be problematic and susceptible to produce inaccurate data. The last element of criticism presented by Lilienfeld and Fowler (2005) concerns the oversaturation of negative emotionality (NE) on measures of self-report. The over-representativeness of this trait is responsible for reducing the measure's discriminant validity due to its prevalence in a myriad of distinct psychiatric conditions (Watson & Clark, 1984). Psychopathy measures that integrate elements of impulsive behavior and antisocial lifestyle are particularly susceptible to NE (e.g. Harpur, Hare & Hakstian, 1989). It is important to mention that some of the reported disadvantages are, in fact, originated in deeply established misconceptions (i.e. requirement of veridical responding, propensity toward positive impression management, aptitude for malingering; Lilienfeld & Fowler, 2005) which has led to misunderstandings concerning the potential use of self-report measures.

Lilienfeld and Fowler (2005) review the strengths and weaknesses of three self-report psychopathy measures in contrast with the PCL-R. Even though the TriPM is recent enough not to be included into this comparison, the authors examine the effectiveness of the PPI which includes similar constructs (i.e. Machiavellian egocentricity, social potency, fearlessness, coldheartedness, impulsive nonconformity, etc; Lilienfeld, 1990; Lilienfeld & Widows, 2005). Furthermore, much like the TriPM, the PPI conforms to a two-factor structure that is conceptually related to that of the PCL-R (Benning, et al., 2003). The authors concluded that self-report scales such as the PPI display good convergent and discriminant validity with other self-report, interview and observer-rated measures of psychopathy; also, the PPI was found to be moderately to highly correlated with both Factor 1 and 2 from PCL-R. The authors conclude that the use of self-report measures of psychopathy, despite its flaws, is potentially useful in the study of the phenomenon of psychopathy.

Despite these theoretical notes, there is also plenty empirical support for the use of the TriPM as an alternative to the PCL-R. In fact, at the conceptual level, both psychometric evidence (Marcus, et al., 2006; Marcus, John & Edens, 2004) and structural neuroimaging (Walters, Ermer, Knight, & Kiehl, 2015) evidence support the nature of psychopathy to be more accurately reflected by a latent dimension than by a taxonomic structure. This is consistent with the dimensional view of personality disorders (PD) that holds that PD are better conceptualized as reflecting configurations of extreme variants in dimensional traits, rather than discrete categories (Clark, 2007; Wright, Pincus, Thomas, Hopwood, Markon & Krueger, 2013). In addition, theoretically consistent findings have been found for psychopathy using dimensional approaches, both in community (Almeida, Ferreira-Santos, Vieira, Moreira, Barbosa, & Marques-Teixeira, 2014; Drislane, Patrick, & Arsal, 2014; Vieira & Marsh, 2013) and in forensic populations (Edens, Poythress, Lilienfeld, Patrick, & Test, 2008). Concerning the scale in particular, the TriPM has been shown to have good convergence with other measures of psychopathy such as the PPI or the PCL-R (Drislane et al., 2014; Sellbom & Phillips, 2013; Stanley et al., 2013) and to be reliably associated with externalizing symptoms and criminal behavior (Drislane et al., 2013). Lastly, the reported results were consistent with the described hypothesis for the effects of psychopathic traits and are theoretically sound.

The following studies focus on several specificities of the psychopathic decision-making process. Study 1 focuses on the relationship between psychopathic traits and attitudes, particularly attitudinal beliefs that act in favor of criminal behavior, more specifically, theft. Using a TPB (Ajzen, 1991) inspired methodology, this study explores the dynamics underlying criminal attitudes and intention formation in a sample of male recidivist inmates. It is significant to remark that the data collection undertaken in Study 1 was conducted within the development of the previous Master's thesis. Regardless, the data analysis was significantly deepened within the present work and led to later publication. Study 2 acts as an extension of Study 1; using similar methodology and hypotheses, Study 2 also analyzes attitudinal and intention elements of the decision-making process, however, in a non-forensic context and with different research behaviors (academic cheating and shoplifting). Study 2 also involves the inclusion of female participants and an antisocial behavioral history measure. By including female participants, it will be possible to inspect the effects of gender differences in the expression of psychopathy. Furthermore, a measure antisocial behavior will be important as a proxy for future deviance.

Study 3 delves into psychopathy's psychophysiological differences through the use of heart-rate measures. Measures of heart-rate (especially heart-rate variability) have been linked to activity in the behavioral activation system (BAS) (e.g. Fowles, 1980) as well as other elements essential to the study of psychopathy (e.g. Hansen, et al., 2007; Beauchaine & Thayer, 2015). For instance, Hansen and colleagues (2007) concluded that the PCL-R interpersonal facet explained most of the variance during HR baseline and the executed tasks (i.e. California Computerized Assessment Package and a working memory test). Beauchaine and Thayer (2015) also report HR to be as a transdiagnostic biomarker of self-regulation and cognitive control. In this study, attitude and intention formation, as well as psychopathic traits, are analyzed from a physiological perspective. Study 3 also focuses on passive avoidance learning impairments that are already a staple in the psychopathy framework (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005). Through the use of a go/no go task, a passive avoidance task and physiological correlates (HR), this study further inspects the associations between psychopathy and learning deficits. It is important to mention that the data included in studies 2 and 3 were collected in the same session.

Study 4 investigates psychopathy's use of heuristic-based thinking. As previously stated (refer to Heuristics), psychopathy encompasses a series of characteristics that seem to impart some type of influence over heuristic processing. In fact, elements such as *affect impairments*, *allocation of cognitive resources* and *sub-activation*, should exhibit some degree of influence over these judgement bias (e.g. Slovic, et al., 2004; Gonzalez, et al., 2005; Epley & Gilovich, 2006) In this study, the relationship between psychopathic traits and two heuristics (framing effect and loss aversion) is explored in a non-forensic setting. These four studies aim at painting a general image of psychopathy's antisocial decision-making process, each focusing in its unique element (i.e. attitudes, intention, learning deficits, heuristics and judgement biases).

STUDY 1 – Psychopathy, criminal intention and the abnormal appraisal of the expected outcomes of theft

1. Introduction

On the present study, the relationship between psychopathic traits and criminal attitudes as well as criminal intention formation was explored in a forensic setting (recidivist inmates). More specifically, it was hypothesized that psychopathic traits should be associated with more favorable attitudes towards theft, which result from atypical appraisal of the expected consequences of such behavior. In order to operationalize the attitudinal component, a TPB inspired framework was adopted (Ajzen, 1991). According to Fishbein and Ajzen (1975), attitudes are viewed as the degree of desirableness that a specific behavior has to the individual. This decision element acts as predictor of the individual's intention towards the behavior in question and, therefore, is vital in the decision-making process (Fishbein & Ajzen, 1975). Several studies have shown the predictive power of attitudinal beliefs over individual intention and actual performance of behaviors both prosocial (see Godin & Kok, 1996; Armitage & Conner, 2001, for meta-analytic reviews) and antisocial (Beck & Ajzen, 1991; Welsh & Gordon, 1991; Carpenter & Raimers, 2005; Lin & Chen, 2010). In their 1991 study, Beck and Ajzen showed the consistency of attitudes as significant predictors of the intention towards both shoplifting and cheating behaviors. Carpenter and Raimers (2005) research also accounted for the effectiveness of attitudes (in association with the other elements from the TPB) as a core element in the prediction of future unethical and fraudulent financial report. Several other studies have attested for the power of attitudinal beliefs as effective predictors of antisocial behavior, such as Lin and Chen (2010) that explores the predictive power of attitudes over dishonest workplace behaviors (i.e. private usage of company resources, taking credit for someone else's work, forging work data), and Welsh and Gordon (1991) whose research concluded that the operationalization of cognitive variables according to the TPB model mediated (partially) commitment of violent acts within a role-play scenario.

The TPB framework's versatility allowed for the operationalization of the model predictors (attitudes, subjective norm and perceived behavioral control) following an "expectancy X value" scheme. This approach allows for the separate study of each component, permitting a deeper analysis of the relation between psychopathic traits and the perceived value and likelihood of each belief. In the case of the operationalization of attitudes, this variable is computed as the perceived value of each potential outcome of the behavior (either positive or negative) weighted by the perceived likelihood of its occurrence. The product of this relation is the degree of favorability that

the behavior has to the individual. In regard to the subjective norm component (the perceived social pressure towards the behavior), the calculation reflects the weighting of the apparent opinion of relevant social groups by the projected individual motivation to comply with these groups. The last component, perceived behavioral control, varies as a function of the foreseen obstacles (or facilitators) of the behavior, weighted by their expected occurrence and represents the apparent difficulty or easiness of performing the behavior (Ajzen, 1985).

In the present study, the methodological framework provided by the TPB was used to explore the underlying dynamics existent in intention and attitude formation in psychopathy. Past meta-analysis (Glasman & Albarracín, 2006) have revealed that behavioral beliefs work as better predictors of the actual behavior when the individuals have previous experience with the behavior in study. Taking this into consideration, the constituted sample was composed of recidivist inmates convicted for theft. A TPB questionnaire was developed in order to assess the dimensions involved in the intention to reoffend in the crime of theft.

Considering the close association between psychopathy and antisocial behavior and the expected effect of psychopathic traits in criminal attitude formation, attitudes are expected to work as a mediator variable between the effect of fearlessness-related psychopathic traits and the intention to reoffend. Furthermore, these fearlessness-related traits should be associated with higher individual expectancy of rewards, together with lower expectation of penalties as probable outcomes of reoffending. This hypothesis would constitute supplementary support for the assumption of abnormalities in expectancy-value formation in psychopathy, illustrated through the use of a real-world scenario. No hypotheses were advanced in regard to the remain predictors of the TPB, nonetheless, these were included in the study for informative purposes.

The present study involved two different data collection phases. In the first one (elicitation study), a reduced sample was used in order to qualify the elements contributing to attitudinal belief formation regarding theft (the perceived potential rewards and penalties of theft), the social elements susceptible of exerting influence over the commitment/avoidance of theft, and the elements that influence perceived control over theft. The data obtained at this stage was used to construct a closed-response measure with the objective of estimating the intention to reoffend, along with the predictor variables from the TPB, which was used in the second stage of the study (main phase).

2. Method

2.1. Elicitation Study

2.1.1. *Participants and procedure*

Participants were 28 Caucasian adult male recidivist inmates convicted for theft, serving sentences in two medium-security prisons (mean age = 37.70, SD = 6.75; average years of education = 5.44, SD = 2.27). The correctional institutes included in this study were *Estabelecimento Prisional de Santa Cruz do Bispo* (EPSCB) and *Estabelecimento Prisional de Paços de Ferreira* (EPPF). Each subject had been convicted of, at least, two accounts of theft, aggravated theft and robbery. The great majority of participants had also committed multiple other crimes. Prior to the data collection, the project was submitted for administrative and ethical approval from the General Authority of Prison Services (*Direção-Geral de Reinserção e Serviços Prisionais*). The participants were randomly chosen from the pool of inmates incarcerated for theft. Each participant was interviewed individually in a room within the correctional facility. Both confidentiality and anonymity were assured to every participating inmate; all participants agreed to participate on a voluntary basis and signed a waiver of consent (see *appendix 1*). The interview was conducted following a structured questionnaire with three distinct question groups that focused in identifying salient behavioral, normative, and control beliefs with respect to committing a theft crime. Participants were required to identify (1) possible benefits (rewards) and penalties that may result from stealing, (2) friends, relatives, or groups of significant people who would approve/disapprove of this behavior, and (3) possible obstacles and facilitators of theft (see *appendix 2*).

Following the suggestions of Fishbein and Ajzen (2010), responses were analyzed and preliminarily coded simultaneously with the data collection. Furthermore, participants were added to the sample until the data became redundant (i.e., no new categories emerged). As no new categories emerged from participant 23 on, we closed the elicitation sample with 28 participants.

2.1.2. Coding procedure

The acquired data was categorized by two independent raters. The work developed by each rater was then compared and, with the participation of a third rater, the disagreements were resolved. The between-rater agreement rates were as follows: 100% for *rewards*, 94% for *penalties*, 85% for *significant others who would approve the behavior*, 92% for *significant others who would disapprove the behavior*, 60% for *facilitators*, and 82% for *obstacles*. The lower agreement rate for exhibited for *facilitators* was mainly due to differences in the range of the categories (e.g., carrying tool and carrying weapons to commit a crime were defined as two distinct categories by one rater while agglutinated in the same category by the other).

2.1.3. Resulting categories

The following table displays the categories that emerged from the elicitation study. During the construction of the TPB questionnaire, categories were selected so that 75% of the total identified salient beliefs for each component (attitude, normative, and control) were included in the final form. This rule (Fishbein & Ajzen, 2010) allows for a global representation of the salient beliefs in the final questionnaire, while further avoiding the encumbrance of the final scale with irrelevant, spurious categories. The belief '*disappoint/lose family*', although mentioned by 15.9% of the sample as a potential penalty, was left out of the questionnaire since it makes reference to the opinion of a virtually significant social group which had already been included in the subjective norm component. Beliefs used in the final questionnaire are signaled in Table 1.

Table 1 - Main Categories for Attitudes, Subjective Norm and Behavioral beliefs, Along With the Percentage of Participants that Mentioned the Category.

	Category	% of participants that mentioned category
Rewards	Easy money*	39.22
	Money for drugs*	31.37
	Adrenaline*	16.65
	Keep the stolen object*	7.84
	Others	3.92

Penalties	Go to prison*	40.58
	Disappoint/lose family	15.94
	Get injured*	15.94
	Social stigma*	5.80
	Harm others*	5.80
	Lose friends	2.90
	Feeling of regret	2.90
	Others	10.14
Groups that would approve behavior	Friends who steal*	54.54
	Buyers of stolen goods*	12.12
	Friends who use drugs*	12.12
	Family member	6.06
	Others	3.03
	Does not know	12.12
Groups that would disapprove the behavior	Family*	82.31
	Friends who do not steal*	13
	Neighbors*	3.08
	Others	3.08
	Does not know	1.54
Facilitators	Carrying tools*	14.71
	The object is accessible*	13.24
	Known area*	10.30
	Carrying weapons*	8.82
	Opportunity	8.82
	No people around	5.88
	Carrying gloves/mask*	5.88
	Easy access to the object	5.88
	Being stressed or nervous*	4.41
	Others	14.70
Does not know	7.35	
Obstacles	Presence of people *	30.88
	Surveillance*	23.53
	Presence of authority*	19.12
	Nothing to steal	4.41
	Physical obstacles	2.94
	Elderly victims	2.94
	Others	13.24
Does not know	2.94	

Note: Categories signaled with a * were included in the TBP questionnaire in Phase 2.

2.2. Main study

2.2.1. Sample and procedure

Participants were 91 Caucasian adult male recidivist inmates convicted for theft (Table 2), incarcerated in the same, previously mentioned, prisons. Subjects were randomly selected from the available pool of inmates incarcerated for theft (theft: 68%; aggravated theft: 70%; robbery: 71%).

Table 2 - Sociodemographics

	<i>N</i>	<i>Min.</i>	<i>Max.</i>	<i>X</i>	<i>SD</i>
Age	94	19	62	35.49	8.758
< 35	49				
35 - 45	30				
> 45	15				
Years of school	91	0	12	6.10	2.150
Prison infractions	96	0	9	1.48	2.229
Total crimes	97	3	100	15.49	11.808
Total thefts	97	0	10	1.82	2.097
Total aggravated thefts	97	0	37	3.66	5.746
Total robberies	97	0	27	2.88	3.940
Total other crimes	97	0	97	7.09	10.316
Boldness	97	31	66	45.74	7.25
Meanness	97	19	53	33.32	8.62
Disinhibition	97	29	74	55.15	10.62
TriPM Total Score	97	96	173	134.22	17.47

No elicitation study participant was included in this second data collection phase; there was no overlapping of participants. Much like the sample used in the belief elicitation phase, every participant had been an history of at least two accounts of theft, aggravated theft, or robbery. Seventy-two per cent of the participants reported past of drug addiction, and 96% had records for other types of offences other than theft. Demographic information was collected *via* prison data based (see *appendix 3*)

The test battery was administered in group (2-5 participants) with the assistance of a researcher. The researcher made himself available to answer every question that arose, but otherwise remained silent. Only a small number of issues were reported by the subjects, most of which were in respect to the meaning of words; the researcher provided the participants with the needed synonyms. The administration order of the TPB questionnaire and the psychopathy scale was altered across participants. Once again, participants were assured of the confidentiality and anonymity of their data. Moreover, all participants agreed to participate on a voluntary basis and signed an informed consent document (see *appendix 1*).

2.2.1.1. Predictors of the intention to reoffend

To comply with the distinct role attributed to approach and withdrawal motivational systems in the literature on psychopathy (e.g., Fowles, 1980; Fowles & Dindo, 2006), attitudes were separated into two subcomponents: perceived rewards (Keep the stolen object, Adrenaline, Easy money) and perceived penalties (Harm others, Get injured, Go to prison, Social stigma). These, along with subjective norm and behavioral control dimensions, were entered as predictors of the intention to reoffend in a multiple regression analysis. The dependent variable was imputed (Bayesian imputation with 10,000 observations) into a single output file.

The analysis shows that perceived rewards is the only significant predictor of the intention to reoffend (Table 3).

Table 3 - Regression Model: TPB Predictors of the Intention to Reoffend

Independent variables	<i>b</i>	SE <i>b</i>	Intention β	<i>p</i>
Attitude – Penalties	-.001	.073	-.030	.987
Attitude – Rewards	.023	.005	.441	.000
Subjective Norm	.003	.013	.023	.822
Perceived Control	-.003	.011	-.028	.782
Constant	-.001	.073		.987
R ²	.192			

2.2.2. Results

2.2.2.1. Instruments

All participants completed the TPB questionnaire, as well as the Triarchic Psychopathy Measure (TriPM; Patrick, 2010).

TPB questionnaire. The construction of the TPB questionnaire was based on the results of the elicitation phase. It consisted of 55 items, organized into four groups (see *appendix 4*). Attitudes were assessed using 18 items: For each of the nine behavioral beliefs included in the questionnaire, one item was designed to assess its value (on a scale ranging from 1 to 5 – e.g., *For me getting easy money is extremely undesirable/extremely desirable*) and another to assess the expectancy of its occurrence (on a scale ranging from 1 to 5; e.g., *If I commit a theft it is unlikely/likely that I get easy money*). Subjective norm components were assessed using 12 items: For each of the six relevant social groups that emerged from the elicitation phase, one item was designed to assess the perception of the members of the group concerning theft (on a scale ranging from 1 to 5 – e.g., *The elements of my family think that I should not/should commit theft*) and another to assess the individual's motivation to comply (on a scale ranging from 1 to 5 – e.g., *The opinion of my family is not important/important to me*). Perceived control was assessed using 22 items: For each of the 11 facilitators or obstacles that emerged from the elicitation study, one item assessed the impact of the obstacle/facilitator in committing theft (on a scale from 1 to 5 – e.g., *When I carry weapons it is less likely/more likely that I commit a theft*) and another assessed the probability of its occurrence (on a scale from 1 to 5 – e.g., *Me carrying weapons is very unlikely/very likely*). The individual score for each of these two components was computed as the sum of the expectancy X value of each belief. Lastly, criminal intention was assessed using three analogical-scaled items in which participants were requested to report their estimate of the likelihood of reoffending after release. To avoid floor effects resulting from social desirability, we anchored the items in such a way as to ensure that participants would not respond in the lowest end of the continuum (*'I am absolutely sure that I will never rob/steal again'* to *'I think I may rob/steal again'*; *'It is absolutely impossible for me to rob/steal again'* to *'I will maybe rob/steal again'*; *'I will never in my life rob/steal again'* to *'I might rob/steal again'*). This configuration (Certainty to Possibility) increased the variance of the items. Participants were requested to

provide their response signaling their position with an 'X' in the continuous line between the two anchors. The response was inserted in the database as millimeters departed from the lowest end of the continuum. The alpha coefficient for the intention to commit theft scale was .86.

Before use, the instrument was pilot-tested in a sample of five inmates who were required to read the questions out loud, reformulate them, and report any difficulties. The questionnaire was adjusted according to their feedback.

Psychopathy scale. The TriPM is a 58-item self-report instrument that assesses psychopathic traits according to the triarchic model of psychopathy (Patrick et al., 2009). The scale has been shown to have good construct validity and to tap efficiently the core constituents of psychopathy (Hall et al., 2014; Sellbom & Anderson, 2013). It yields three subscales that correspond to the triarchic model's phenotypical constituents. Disinhibition is defined as tendency towards the manifestation of impulse control problems, and its manifestations include lack of planfulness and foresight, impaired regulation of affects and urges, reliance on immediate gratification, and deficient behavioral restraint. Boldness is defined as a capacity to remain calm and focused under pressure or threat, an ability to recover from stressful situations, and high self-assurance and social efficacy. Meanness taps deficient empathy, lack of close attachments with others rebelliousness, excitement seeking, exploitativeness, and empowerment through cruelty (Patrick et al., 2009). Items are responded on a 4-point Likert scale. The TriPM assesses psychopathic traits in a dimensional fashion, which is consistent with the idea that psychopathy is more reliably characterized in a continuous, rather than in a categorical manner (Marcus, et al., 2004). The TriPM has been shown to display good construct validity and to successfully capture the nuclear psychopathic traits (Sellbom & Phillips, 2013; Stanley, Wygant, & Sellbom, 2013). We have chosen the TriPM in detriment of other instruments for a variety of reasons: In addition to its strong psychometric properties, including convergence with the PPI-R and the PCL-R (Drislane et al., 2014; Patrick, 2010; Sellbom & Phillips, 2013; Stanley et al., 2013), it is a short self-report instrument, which allows its expedite administration along with other instruments. Moreover, the instrument is conceptually based in the dual-process framework of psychopathy, which has been extensively supported by empirical data (for a review, see Fowles & Dindo, 2006).

The Portuguese version of the scale was produced by three independent translators, and a consensual version was back-translated. The final version was subjected to the original author's

approval. In our sample, alpha coefficients were as follows: $\alpha = .63$ for boldness, $\alpha = .81$ for meanness, and $\alpha = .80$ for disinhibition. The consistency of each scale, along with its mean and standard deviation, is within the range previously reported for offender samples (Stanley et al., 2013; Wall, Wygant, & Sellbom, 2014).

2.2.2.2. *Mediation analysis*

The impact of psychopathy in the intention to reoffend was estimated using a structural equation model (SEM) approach. Since, perceived Rewards was the only significant predictor of the intention to reoffend, this variable was entered as the single mediator of the association between psychopathic traits and intention to reoffend.

The model combined measurement sub models for *Intention* and *Rewards* and the structural sub model from *Rewards* to *Intention*, along with the TriPM scores as predictors of both latent variables. The SEM was fitted using maximum-likelihood estimation. Goodness-of-fit was evaluated using the chi-square statistic as well as the comparative fit index (CFI) and the root mean square error of approximation (*RMSEA*; Hu & Bentler, 1999; Schermelleh-Engel, Moosbrugger, & Muller, 2003). To determine the statistical significance for indirect effects, a bootstrap estimation (maximum likelihood, 200 samples, with a percentile confidence interval of 90%) was performed. No modification indices (*MI*) were obtained according to the $MI \geq 11$ criterion. The model revealed satisfactory fit, $\chi^2(20) = 28.39; p = .100$ | CFI = .957 | RMSEA (HI90) = .068 (.28).

In general, criminal intention was significantly predicted by the model ($R^2 = .530, p = .001$). As illustrated in Figure 1, boldness was a significant predictor and meanness was a marginally significant predictor of the perceived rewards of committing a theft ($B = .373, SE = 0.069, p = .027$, and $B = .315, SE = 0.057, p = .056$, respectively), and *Rewards* was a significant predictor of the intention to reoffend ($B = .668, SE = 0.026, p = .035$). The bootstrap approximation shows that boldness ($B = .255, SE = 0.285, p = .050$) and meanness ($B = .216, SE = 0.221, p = .027$) have a significant indirect effect on intention, thus suggesting that perceived rewards play a mediating role on the association between psychopathic traits and the intention to reoffend. In fact, the proportion of indirect effects on intention is 88.9% for meanness and 74.1% for boldness. On the other hand, considering both direct and indirect effects, disinhibition did not significantly predict either *Rewards* or *Intention*.

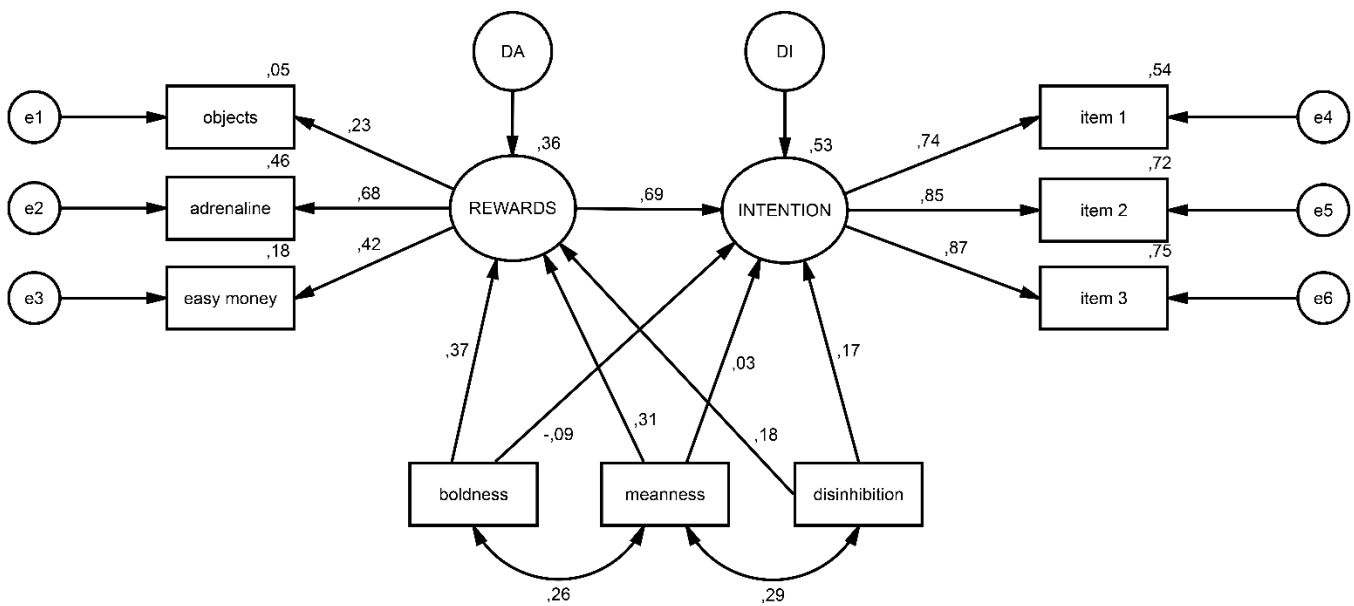


Figure 1 – Structural model with perceived rewards as mediator between psychopathic traits and the intention to reoffend

2.2.2.3. Psychopathy and the expectancy and value components of attitudes

The associations of psychopathy with the expectancy and value components of attitudinal beliefs were estimated using single Spearman correlations, given the non-normal distribution of the expectancy and value items.

Table 4 shows that boldness and meanness were negatively associated with the expectancy of harming others, going to jail, social stigma, and getting injured (boldness at trend level). In addition, meanness was positively associated both with the expectancy and value of feeling adrenaline and getting easy money and with the value of harming others and keeping the stolen object. Finally, boldness was also associated with the expectancy and value of feeling adrenaline as a consequence of reoffending.

Table 4 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs

Belief	Component	Boldness	Meanness	Disinhibition
<i>Harming others</i>	Expectancy	-.285**	-.304**	-.100
	Value	.121	.177*	.017
<i>Going to jail</i>	Expectancy	-.292**	-.268**	.034
	Value	.070	-.011	-.049
<i>Social stigma</i>	Expectancy	-.379***	-.228**	-.022
	Value	-.033	.031	.118
<i>Getting Injured</i>	Expectancy	-.150	-.197*	-.042
	Value	.012	.141	.098
<i>Keeping stolen object</i>	Expectancy	-.021	.084	.006
	Value	.072	.282**	.088
<i>Feeling adrenaline</i>	Expectancy	.238*	.270**	.085
	Value	.404***	.287**	.169
<i>Easy money</i>	Expectancy	-.029	.187*	.149
	Value	.019	.214*	.092

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

3. Discussion

In the present study, the mechanisms underlying psychopathic individual's higher likelihood of reoffending were dissected (Hemphill et al., 1998; Walters, 2003). Based on the already established laboratorial relation between psychopathic traits and deficits in emotional learning (e.g., Birbaumer et al., 2005; Lykken, 1957; Newman & Kosson, 1986), it was expected that psychopathic traits would be related to more favorable attitudes towards committing theft, which, consequently, would result in increased intention to reoffend. As predicted, boldness and meanness were associated with increased intention to reoffend; this effect was also mediated by the perceived benefits of reoffending. On a distinct analysis, related to the impact of psychopathy on the expectancy and value components of attitudinal beliefs, fearlessness-related traits were also associated with an underestimation of the probability of negative outcomes, and, in the case of meanness, increased expectation and increased clue attribution to the positive consequences of stealing.

It must be noted that although the used methodology was inspired by the TPB framework the study does not strictly follow this model. Specifically, given the interest in analyzing the formation and structure of attitudes towards criminal behavior, and the traditional distinction between approach and avoidance motivational systems in the literature on the etiology of psychopathy (Fowles, 1980), attitudes were divided into perceived rewards and penalties. Only the perceived rewards of theft were significant predictors of the intention to reoffend, and its inclusion, along with psychopathic traits, explained 53% of the variance of this outcome. This value is within the range reported by several studies on various other behaviors (e.g., Beck & Ajzen, 1991; Godin & Kok, 1996). According to Fishbein and Ajzen (1975), although the theoretical predictors are sufficient to explain the intention to perform a given behavior, they are not all necessary, and these are expected to differ across behaviors and even populations. For instance, in a study with a college population, attitudes and perceived behavioral control predicted cheating and shoplifting, and subjective norm and behavioral control predicted lying behavior (Beck & Ajzen, 1991).

The most significant finding of this study, however, was the relation between the fearlessness-related psychopathic traits and the underestimation of the probability of suffering negative effects and overestimation of the probability of attaining positive outcomes as a consequence of reoffending. This effect was consistent across different beliefs (e.g., getting

arrested, getting injured, harming others, adrenaline, easy money). As previously mentioned, this pattern may result from abnormal stimulus-reinforcement learning abilities, which have been shown to impair decision-making processes in psychopathic individuals (Blair, et al., 2006). These results lend support with increased ecological validity to the argument that psychopathic traits are associated with less ability to use reinforcement information to modify the representation of the outcomes associated with potential responses, and thus properly use this information in everyday decision-making (Blair, 2005, 2013). Notably, these results are restricted to the traits that, according to the triarchic model of psychopathy (Patrick et al., 2009), are etiologically associated with amygdala impairments. Hence, these results also seem to support the targeting of stimulus-reinforcement learning as a nuclear pathophysiological mechanism operating in psychopathy, suggesting that successful intervention in youth or adults with callous-unemotional psychopathic traits should aim at restoring the integrity of these processes (Finger et al., 2008).

In addition, inmates with higher meanness scores attributed higher importance to positive outcomes, with this effect being especially dramatic for 'feeling adrenaline' (which was also positively associated with boldness). Although this effect was not initially expected (no hypothesis were described) the increased value attributed to the search for sensations (risk-seeking) is consistent with stimulation-seeking theories of crime (e.g., Eysenck & Gudjonsson, 1989; Gatzke-Kopp, et al., 2002; Quay, 1965; Zuckerman, 1994). According to these models, antisocial behavior is a stimulating activity sought out by under aroused individuals in order to restore arousal back to optimal levels. Although this is a long-standing theory of criminal behavior, empirical evidence for its validity is not plentiful (Portnoy, Raine, Chen, Pardini, Loeber & Jennings, 2014). The reported data does not offer direct support for this hypothesis, since it is lacking an effective measure of participants' resting-state arousal. Nonetheless, this link is seen as worth to pursue in further studies. Furthermore, the increased importance attributed to rewards by individuals with higher psychopathy scores is also consistent with the already established link between psychopathy and increased reward sensitivity (Gorenstein & Newman, 1980; Lykken, 1995; Newman, et al., 2005). Supporting this notion, neuroimaging evidence shows that psychopathy is associated with increased reward sensitivity (Bjork, et al., 2012; Buckholtz et al., 2010). It should be mentioned, however, that studies associating psychopathic traits with increased reward sensitivity have focused on the impulsivity-related components of psychopathy. The reason behind the inexistence

of an expected significant association between the value of ‘feeling adrenaline’ and the disinhibition scores is further explored on Study 2.

It is also notable that the associations are limited to boldness and meanness scores. In fact, and as stated in the introductory section, stimulus-reinforcement deficits in psychopathy have been associated with dysfunction in the amygdala and related regions (Birbaumer et al., 2005; Blair, 2005, 2013). Disinhibition, on the other hand, seems to rely on distinct pathophysiological processes, such as impairments in brain structures involved in cognitive control (Nelson, Patrick & Bernat, 2011; Patrick et al., 2009). Various recent neuroimaging studies support the involvement of distinct pathophysiological processes in the etiology of fearlessness- and externalizing-related traits (Almeida et al., 2014; Carlson & Tháí, 2010; Carlson, Thai, & McLarnon, 2009; Nelson et al., 2011; Yoder, Porges, & Decety, 2014). Hence, the present study adds to mounting evidence on the importance of the two-process conceptions of psychopathy (Fowles & Dindo, 2006).

One limitation of the present study is the absence of a laboratorial measure of stimulus-reinforcement learning. In fact, showing that, not only individuals higher in psychopathy, but specifically those impaired in a laboratorial measure of stimulus-reinforcement learning underestimate the probability of penalties and overestimate the probability of rewards would add further evidence to the presented argument. This measure would be crucial to show that the effects of psychopathy in decision-making in ecological contexts are, in fact, the product of impaired stimulus-reinforcement learning. In order to further test this link, Study 3 includes specific experimental tasks (i.e. passive-avoidance learning task).

The TPB model assumes consistency between the intention of performing a given behavior and its manifestation (Ajzen, 1991). Focusing on criminal behavior, it would be expected that the intention to reoffend would be closely related with the displaying of criminal behaviors. However, due to logistic and data privacy issues, a behavioral measure of post-release offending was absent in the study. Furthermore, the analysis was limited to theft, which may reduce the scope of the findings. However, it should be noted the interest in analyzing the impact of psychopathic traits in the formation and structure of criminal beliefs and intentions using the Ajzen-Fishbein model. It is a clear guideline in the TPB framework that behaviors under study should be as specific as possible (Fishbein & Ajzen, 2010), so different behaviors should be analyzed independently. The crime of theft was selected due to the availability of large recidivist samples. Although it is possible

that any antisocial behavior could be used for this specific purpose, other studies should be undertaken to validate these findings and broaden their scope.

In summary, this study, built from laboratorial evidence of impaired stimulus- association learning and increased reward sensitivity in psychopathy, suggests that this may have an impact in the formation of attitudes and intentions. It has been shown that psychopathic traits are related to abnormal appraisal of the consequences of theft and to increased pro-criminal attitudes. Further implications of these results will be addressed in the general discussion.

**STUDY 2 – Psychopathy and abnormal estimation of the risk to reoffend:
extending the data to non-forensic context**

1. Introduction

The present study works as an extension of the results obtained in Study 1. As an extension, the present study analyses the psychopathy - attitude formation – behavioral intention link in a non-forensic sample and for other types of antisocial behavior, it includes female participants, and it considers past behavior as a predictor of behavioral intentions. In respect to the first point, the results of the previous work are thought to represent general features related to the impact of psychopathic traits in criminal decision making, not being specific to forensic samples or specific behaviors. In fact, psychopathy is increasingly regarded as a set of personality traits distributed in a *continuum* (Marcus et al., 2006, Almeida et al., 2014) and increasing evidence has shown similar effects of psychopathy in both forensic and non-forensic samples (e.g. Williams & Paulhus, 2004; Rogers, Salekin, Sewell, Goldstein & Leonard, 1998). If indeed the heightened expectation of rewards and lower expectation of penalties for criminal behaviors is a general consequence of the presence of high levels of psychopathy, then the effect should be pervasive across samples and behaviors. Concerning the second aspect, gender differences are the single most important individual factor in the prediction of antisocial behavior (Raine, Yang, Narr, & Toga, 2009; Bennett, Farrington & Huesmann, 2005). Furthermore, several studies regarding psychopathic traits have come across significant gender differences in regard to different elements, such as, physical and relational aggression (e.g. Stickel, Marini & Thomas, 2011), facet scorings (e.g. De Vogel & Lancel, 2016), emotional processing (e.g. Rogstad & Rogers, 2008), deceitfulness and low self-control (e.g. Strand & Belfrage, 2005) as well as other elements (e.g. Weizmann-Henelius, Grönroos, Putkonen, Eronen, Lindberg & Häkkänen -Nyholm, 2010) Hence, the impact of gender in the model should be accounted for. Finally, the relevance of past behavior in the prediction of intention is strongly mentioned by Ajzen (1991) as it is thought to be an integrant part of the individual's perceived control towards the behavior. The same is proclaimed by Bandura (1986).

2. Method

As in Study 1, the present study was composed of two stages. Stage one (elicitation study) consisted of a qualitative phase in which participants were inquired concerning the potential benefits and penalties of committing cheating and shoplifting. This is a common component in

studies structures under the Theory of Planned Behavior framework (see Ajzen, 1991). Stage two (Main study) consisted of a quantitative phase, in which the impact of psychopathic traits, along with the perceived benefits and penalties was estimated in the intention to commit each of the behaviors.

2.1. Elicitation Study

2.1.1. Participants and procedure

Participants were 28 university students (14 male and 14 female) from Portugal (Mean age = 24.666, SD = 9.26). The belief elicitation scale was administered in *online* format and was distributed via social media websites. In spite of being a new approach to research and data collection, the use of *online* surveys has been increasing throughout the years (e.g. Flaherty, Pearce, & Rubin, 1998; Matheson, 1991; Nonnecke, Preece, Andrews, & Voutour, 2004; Preece, 1999; Preece & Ghozati, 2001; Walther, 1996; Walther & Boyd, 2002; Wood & Smith, 2001; Wright, 2000a, 2002a, 2002b, 2004). Wright (2017) elicits the various advantages and disadvantages of this type of format. According to the author, this kind of approach is less demanding concerning resource use (i.e. less time, less money invested in paper questionnaires, less people needed to apply the questionnaires) and allows access to populations otherwise very difficult to reach (e.g. Furlong, 1989). Furthermore, the use of *online* methods also lets the researcher divide his/her attention between several tasks, making work more efficient (Wright, 2017). Rhodes, Bowie and Hergenrather (2003) also argue that this approach allows for more respondent openness and full participation. However, this methodology also brings in some associated disadvantages, the most severe being related to sampling issues (i.e. less and less reliable information about the participants - Dillman, 2000; Stanton, 1998; difficulties in accurately sizing the population - Couper, 2000; sampling representativeness – Rhodes, et al., 2003). Despite its characteristics, the online survey approach seems to be comparable with the physical version in terms of closed item non-response rate (Denscombe, 2008) and in terms of the scale's psychometric properties (Riva, Teruzzi & Anolli, 2003), making it a viable alternative to traditional paper surveys.

The belief elicitation scale (see *appendix 5*) was comprised of three groups of questions, two of them aimed at identifying the salient behavioral beliefs regarding the antisocial behaviors in study, and the last one was a brief compilation of sociodemographic information (gender, age and current job). Participants were required to identify: a) possible benefits (rewards) and penalties that may result from shoplifting; b) possible benefits (rewards) and penalties that may result from cheating in an exam. Participants were assured of the confidentiality and anonymity of their data. The present protocol was submitted and approved by the faculty's ethics committee.

Once again, as suggested by Fishbein and Ajzen (2010), the data was analyzed and coded simultaneously with the data collection, and participants were added to the sample until the data became redundant (i.e., no new categories emerged). Since no new categories emerged from participant 23 on, we closed the elicitation sample with 27 participants.

2.1.2. Coding procedure

Similar to the previous study, the resulting responses were categorized by two independent raters. Results were compared and disagreements were solved by a third rater. The between rater agreement rates were: 80% for rewards regarding shoplifting, 87.5% for penalties regarding shoplifting, 80.5% for rewards regarding academic cheating, and 87.5% for penalties regarding academic cheating.

2.1.3. Resulting categories

Table 5 shows the results of the elicitation study. As previously, in the construction of the attitude-intention questionnaire, categories were selected so that 75% of the total identified salient beliefs for the attitudinal component were included in the final form, as suggested by Fishbein and Ajzen (2010). Once again, this ensures that the general salient beliefs are represented in the final questionnaire and avoids cluttering caused by spurious categories. Despite having a high percentage of mentions, the *morally incorrect* category (in cheating) was not included in the final form because it was seen as not being a penalty *per se*.

Table 5 - Main Categories for Attitudinal beliefs related to Shoplifting and Academic cheating Along with the Percentage of Participants that Mentioned the Category.

Behavior	Category	% of participants that mentioned category	
Shoplifting	Rewards	<i>Save money*</i>	59
		<i>Adrenaline*</i>	8.8
		<i>Earn money*</i>	8.8
		<i>Feeling good*</i>	5.9
		<i>Peer acceptance</i>	2.9
	Penalties	<i>Others</i>	15
		<i>Morally incorrect*</i>	21
		<i>Being punished*</i>	19
		<i>Feeling ashamed/guilty*</i>	17
		<i>Hurting the owner*</i>	17
Academic cheating	Rewards	<i>Others</i>	27.3
		<i>Better grade*</i>	51
		<i>Less effort*</i>	14
		<i>Correct answer*</i>	11
		<i>Avoiding blank questions*</i>	2.9
		<i>Avoiding wrong answers*</i>	2.9
		<i>Pass the exam*</i>	2.9
	Penalties	<i>Others</i>	14.3
		<i>Being caught*</i>	22.4
		<i>Morally incorrect</i>	16.3
		<i>Copying wrong answers*</i>	12.2
		<i>Acquiring less knowledge*</i>	12.2
		<i>Wrong perception of knowledge*</i>	10.2
Others	<i>Null exam*</i>	6.12	
	<i>Feeling ashamed/guilty*</i>	4.08	
	<i>Others</i>	16.32	

*Note: Categories signaled with a * were included in the TBP questionnaire in Phase 2.*

2.2. Main Study

2.2.1. Participants and procedure

Participants were 260 University students or former students (130 male and 130 female) from the city of Porto, Portugal (Mean age = 24.40, SD = 7.532). This test battery was compiled

in online format and distributed via email using the university contact database. The questionnaires were assembled in Google survey.

The scale compilation was arranged like the following: sociodemographic data (gender, age, current job, education), shoplifting-related items (advantages and penalties intention), academic cheating-related items (advantages and penalties intention), self-reported items, and the psychopathy scale.

Table 6 - Descriptive statistics of the male-only sample.

Variables	<i>N</i>	Min.	Max.	<i>X</i>	<i>SD</i>
Age	130	17	51	25.13	6.804
Boldness	130	31	70	49	8.17
Meanness	130	23	66	34.42	8.724
Disinhibition	130	23	64	37.923	8.639
TriPM Total Score	130	91	182	121.35	19.30

Table 7 - Descriptive statistics of the female-only sample.

Variables	<i>N</i>	Min.	Max.	<i>X</i>	<i>SD</i>
Age	130	17	57	23.68	8.158
Boldness	130	21	65	45.23	8.64
Meanness	130	22	60	30.42	6.601
Disinhibition	130	22	62	34.76	7.602
TriPM Total Score	130	78	160	110.42	14.99

2.2.2. Instruments

All participants completed the scale battery (i.e. attitude-intention scale, TriPM and self-reported delinquency scale).

The Attitude-Intention scale. The construction of the attitude-intention scale was based on the results of the elicitation phase. It consisted of 48 items, organized into three groups: attitudes

facing shoplifting, attitudes facing academic cheating, and antisocial intention (see *appendix 6*). Attitudes (regarding both behaviors) were assessed using 42 items: for each of the 21 behavioral beliefs included in the questionnaire one item was designed to assess its value (on a scale ranging from 1 to 7 – e.g., *For me getting saving money is extremely undesirable/extremely desirable*) and another to assess the expectancy of its occurrence (on a scale ranging from 1 to 7; e.g., *If I commit shoplifting it is unlikely/likely that I save money*). The individual score for each of these two components was computed as the sum of the expectancy x value of each belief. Lastly, intention was assessed using three items (for each behavior) in which participants were requested to report their estimate of the likelihood of committing each of the signaled.

In our sample alpha coefficients were $\alpha = .707$ for attitudes towards cheating, $\alpha = .611$ for attitudes towards shoplifting, $\alpha = .876$ for intentions towards cheating, $\alpha = .759$ for intentions towards shoplifting.

Psychopathy scale. This study also included the TriPM scale as psychopathy measure (refer to Study 1). In the present sample alpha coefficients were $\alpha = .825$ for Boldness, $\alpha = .846$ for Meanness, and $\alpha = .821$ for Disinhibition.

Self-reported delinquency scale. The self-reported delinquency was comprised of 2 items, one regarding shoplifting and the other academic cheating. These items questioned the participants about the number of times they had committed each of the behaviors in the previous year. Answer criteria went from *never* to *more than five times*.

3. Results

3.1. Structural models

Focusing in replicating the findings of Study 1, the presented study estimated the impact of psychopathic traits in antisocial intention using a SEM approach, entering the perceived rewards and penalties as mediators of the association between psychopathy and intention, as well as estimating the impact of gender in these associations. In order to test the effects of gender in the

SEMs, different models were computed for both male and female participants, along with a main model for the total sample.

Six different models were estimated which combined measurement sub-models for *Intention, Rewards and Penalties*, and the structural sub-model from *Reward and Penalties to Intention to Behavior* along with the TriPM scores and self-reported delinquency as predictors of the latent variables. The SEM was fitted using maximum-likelihood estimation. Goodness-of-fit was evaluated using the chi-square statistic as well as the comparative fit index (CFI) and the root mean square error of approximation (RMSEA; Hu & Bentler, 1999; Schermelleh-Engel, Moosbrugger, & Muller, 2003). To determine the statistical significance for indirect effects, a bootstrap estimation (maximum likelihood, 200 samples, with a percentile confidence interval of 90%) was performed.

3.2. The impact of psychopathy on the intention to shoplift

The first model regarding shoplifting (total sample) revealed satisfactory fit, $\chi^2/df (76) = 2.28; p < .001$ | CFI = .921 | RMSEA = 0.07 ($p = 0.009$).

For the total sample, *Intention* was significantly predicted by the model ($R^2 = .77$). As displayed in fig. 3, meanness and disinhibition were both significant predictors of the *perceived penalties* of committing shoplifting ($B = .56, SE = .042, p < .001$, and $B = .17, SE = .038, p = .018$, respectively). Meanness was also a significant predictor of the *perceived rewards* ($B = .36, SE = .022, p = .003$). Disinhibition and boldness were significant predictors of *self-reported shoplifting behavior* ($B = .29, SE = .006, p < .001$; $B = .18, SE = .005, p = .003$, respectively). Boldness was also a significant predictor of *Intention* ($B = -.22, SE = .011, p = .002$). The *rewards and penalties* also acted as significant predictors of the *antisocial intention* ($B = .49, SE = .143, p = .001$; $B = .62, SE = .028, p < .001$, respectively). Both the meanness and the disinhibition component had also a significant indirect effect on *intention*. This finding suggests that the perception of penalties has a mediating role (total mediation) on the association between psychopathy (meanness and disinhibition) and intention. The proportion of indirect effects on intention is .536 for meanness and .225 for disinhibition.

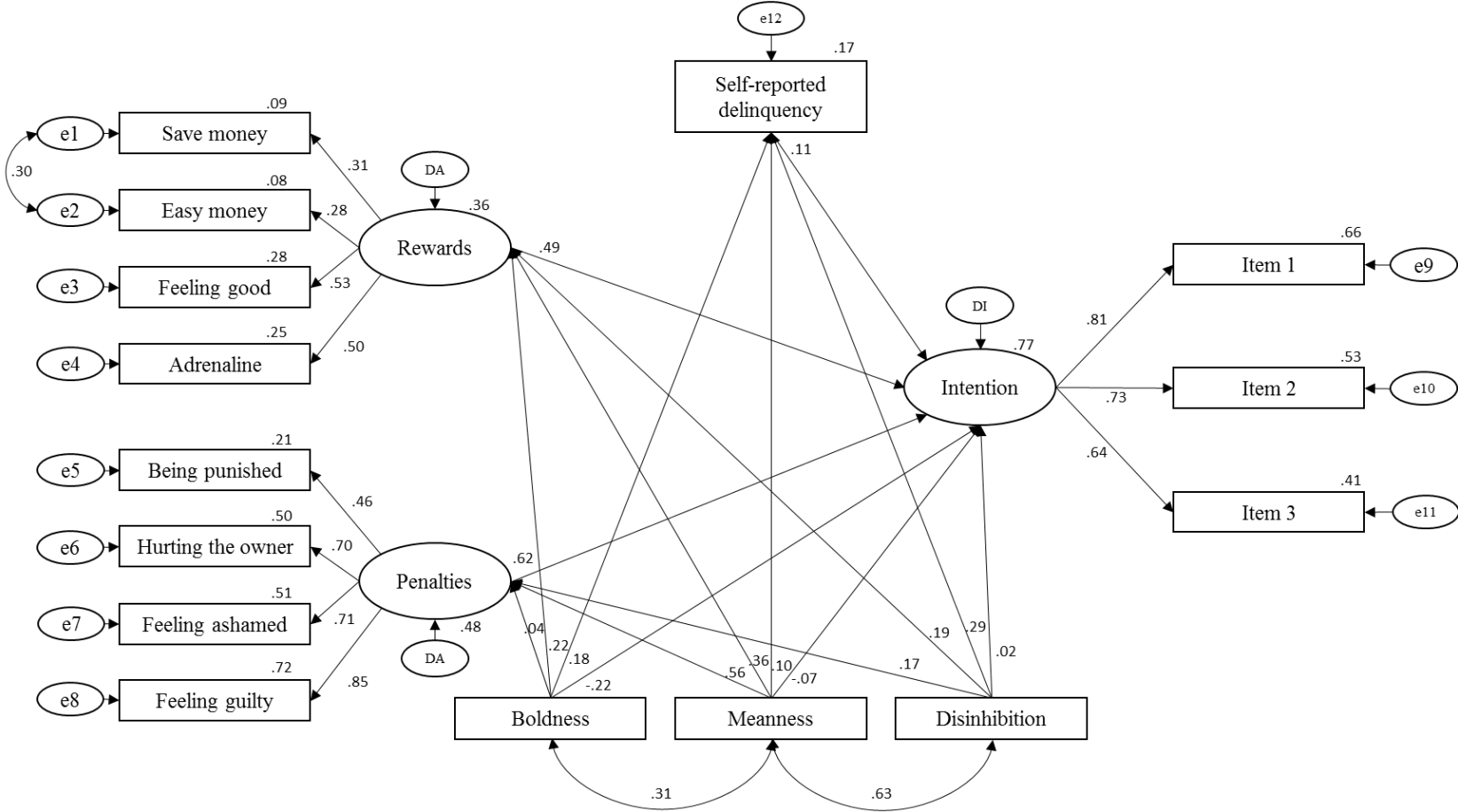


Figure 2 – Structural model of Intention to shoplift (total sample).

A) *Male sample*

The male only model¹ revealed satisfactory fit, $\chi^2/df (76) = 1.51$; $p = .003$ | CFI = .941 | RMSEA = .063 ($p = .184$).

Intention was significantly predicted by the model ($R^2 = .93$). Meanness was a significant predictor of both the perceived penalties and the perceived rewards of committing shoplifting ($B = .53$, $SE = .064$, $p < .001$; $B = .41$, $SE = .033$, $p = .028$, respectively). Both disinhibition and boldness were significant predictors of self-reported shoplifting behavior ($B = .34$, $SE = .009$, $p < .001$; $B = .30$, $SE = .008$, $p < .001$, respectively). Boldness was also a significant predictor of the Intention ($B = -.24$, $SE = .020$, $p = .023$). The perceived rewards and penalties are also significant predictors of the intention ($B = .66$, $SE = .258$, $p = .011$; $B = .67$, $SE = .037$, $p < .001$, respectively). Meanness had a significant indirect towards the intention. This suggests that the penalties of shoplifting have a mediating role (total mediation) on the association between meanness and intention. The proportion of indirect effects on intention is .630 for meanness.

B) *Female sample*

The female only model² revealed satisfactory fit, $\chi^2/df (76) = 1.73$; $p < .001$ | CFI = .884 | RMSEA = .075 ($p = .032$).

Intention was significantly predicted by the model ($R^2 = .64$). Meanness was a significant predictor of *penalties* in regard to shoplifting ($B = .57$, $SE = .051$, $p < .001$). Disinhibition acted as predictor of the *rewards* ($B = .27$, $SE = .029$, $p = .035$). Both *perceived penalties* and *self-reported shoplifting* predicted the intention ($B = .54$, $SE = .046$, $p < .001$); $B = .17$, $SE = .157$, $p = .033$; respectively). There were no reportable indirect effects within this model.

¹ See Figure 3.

² See Figure 4.

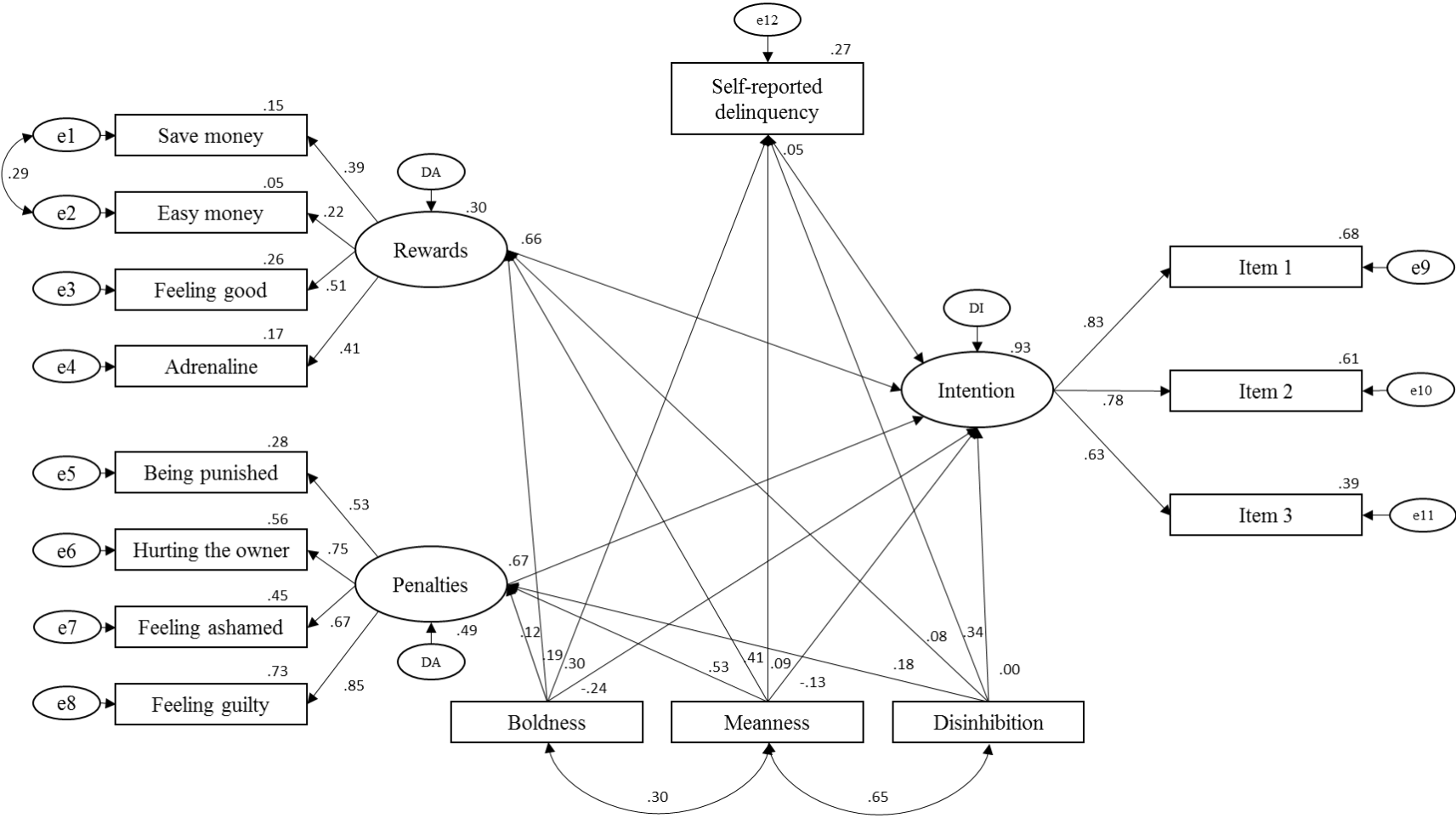


Figure 3 – Structural model of Intention to shoplift (male sample).

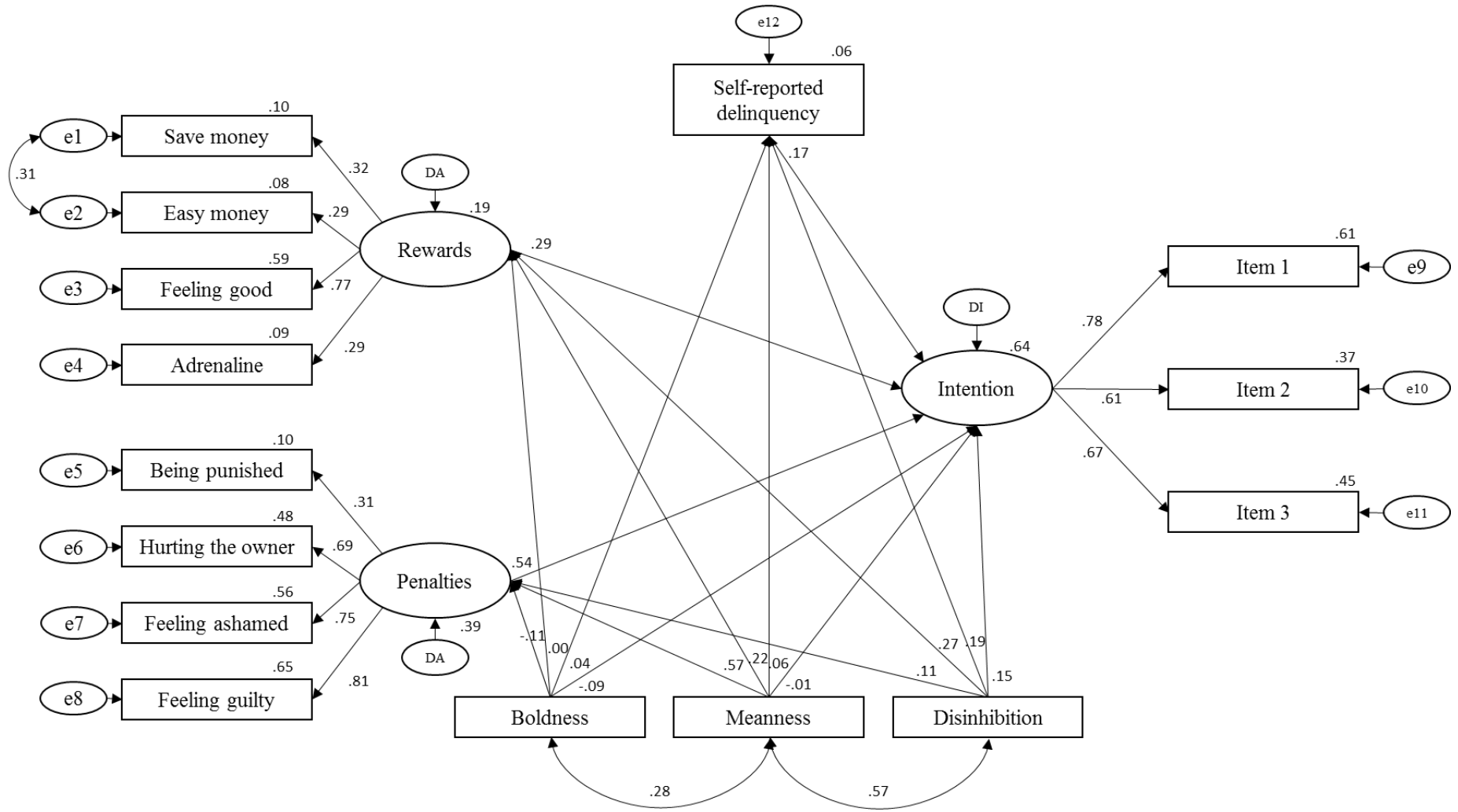


Figure 4 – Structural model of Intention to shoplift (female sample).

3.3. The impact of psychopathy on the intention to cheat

A) Total sample

The model³ revealed good fit, $\chi^2/df(119) = 1.96$; $p < .001$ | CFI = .941 | RMSEA = .061 ($p = 0.061$). *Intention* was significantly predicted by the model ($R^2 = .59$). Meanness was a significant predictor of the *perceived penalties* of cheating ($B = .46$, $SE = .032$, $p < .001$). The *perceived penalties*, *rewards* and the *self-reported* behavior all acted as predictors of the intentions towards academic cheating ($B = .66$, $SE = .060$, $p < .001$; $B = .27$, $SE = .023$, $p < .001$; $B = .25$, $SE = .061$, $p < .001$, respectively). Meanness had a significant indirect effect towards the intention. This suggests that *perceived penalties* had a mediating role (total mediation) on the association between meanness and intention. The proportion of indirect effects on intention is .354 for meanness.

B) Male sample

The model revealed⁴ satisfactory fit, $\chi^2/df(119) = 1.67$; $p < .001$ | CFI = .922 | RMSEA = .072 ($p = .025$).

Intention was significantly predicted by the model ($R^2 = .651$). Meanness acted as a significant predictor of the *penalties* of cheating ($B = .52$, $SE = .043$, $p < .001$). The *perceived penalties*, *rewards* and the *self-reported* behavior all acted as predictors of the intentions towards academic cheating ($B = .69$, $SE = .097$, $p < .001$; $B = .25$, $SE = .032$, $p < .001$; $B = .23$, $SE = .069$, $p < .001$, respectively). Meanness had a significant indirect effect towards the intention. This finding indicates that *perceived penalties* has a mediating role (total mediation) on the association between meanness and intention. The proportion of indirect effects on intention is .422 for meanness.

³ See Figure 5.

⁴ See Figure 6.

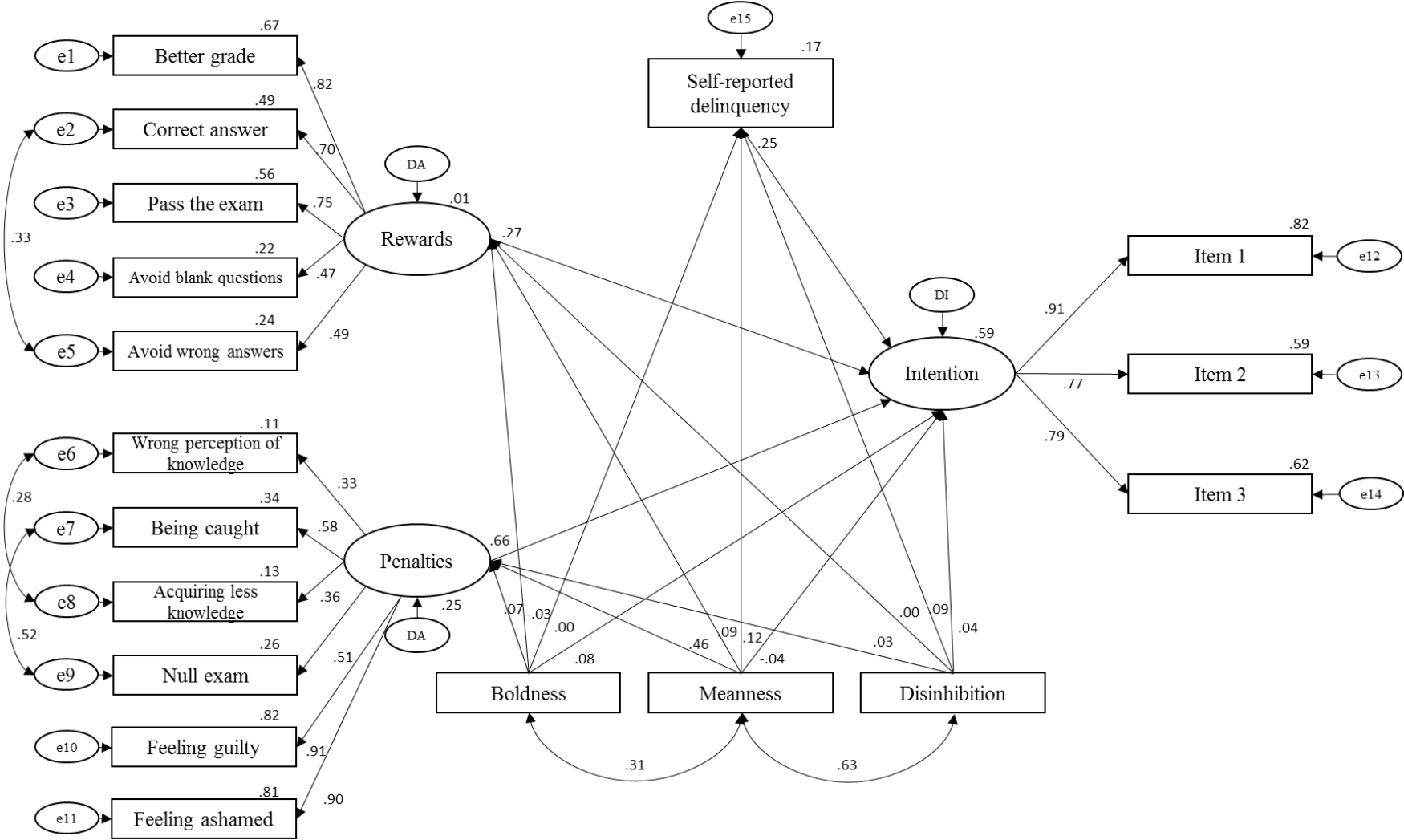


Figure 5 – Structural model of Intention to cheat (total sample).

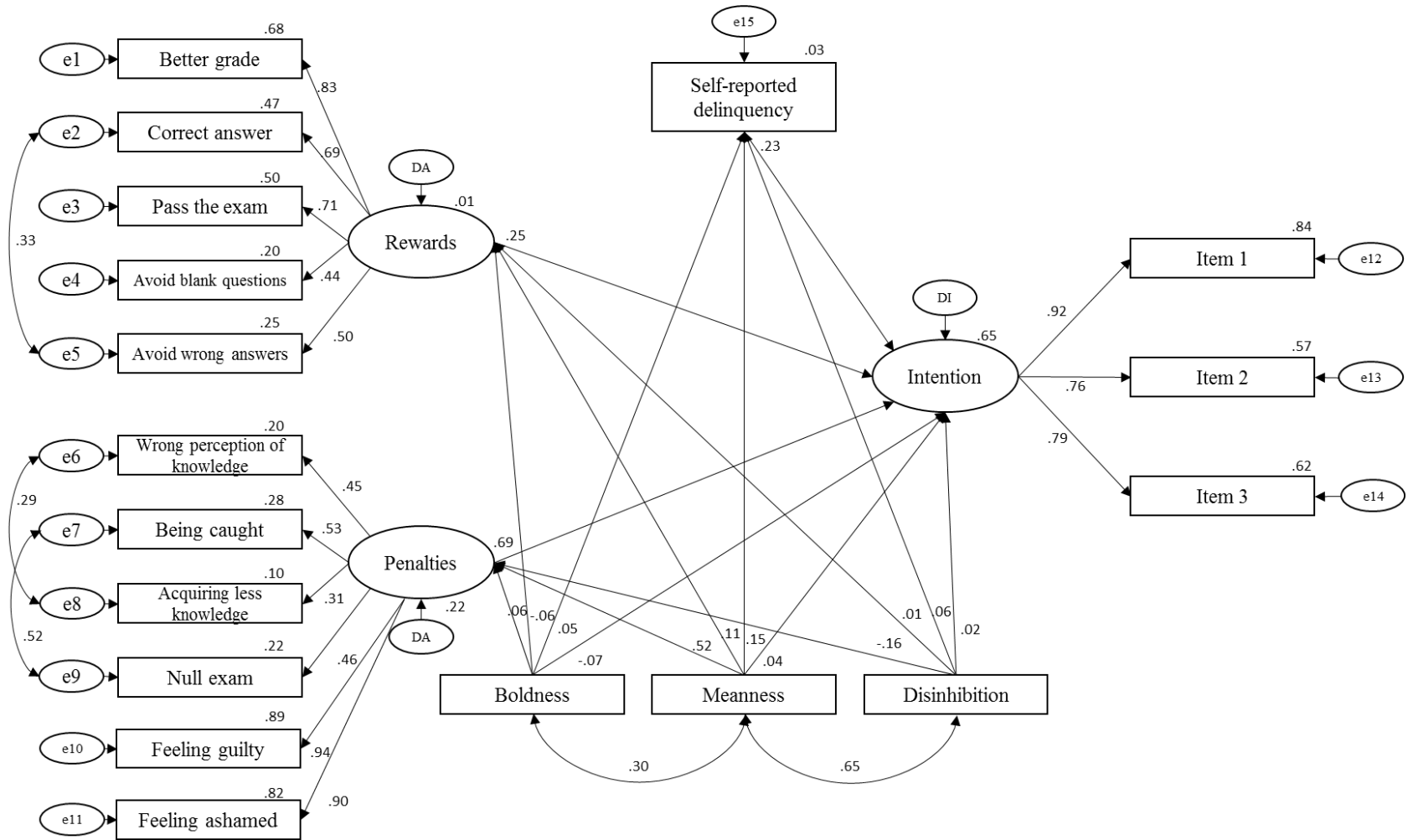


Figure 6 – Structural model of Intention to cheat (male sample).

C) *Female sample*

The model⁵ revealed satisfactory fit, $\chi^2/df (119) = 1.63; p < .001 | CFI = .916 | RMSEA = .070 (p = .040)$.

Intention was significantly predicted by the model ($R^2 = .49$). As displayed in fig. 8, meanness and disinhibition were both significant predictors of the *perceived penalties* of committing academic cheating ($B = .36, SE = .043, p = .003$, and $B = .21, SE = .034, p = .044$, respectively). The *perceived penalties, rewards* and the *self-reported* behavior all acted as predictors of the intentions towards academic cheating ($B = .59, SE = .090, p < .001; B = .27, SE = .033, p = .001; B = .29, SE = .117, p < .001$, respectively). Meanness had a significant indirect effect towards the *intention*. This finding indicates that *perceived penalties* has a mediating role (total mediation) on the association between meanness and intention. The proportion of indirect effects on intention is .226 for meanness.

⁵ See Figure 7.

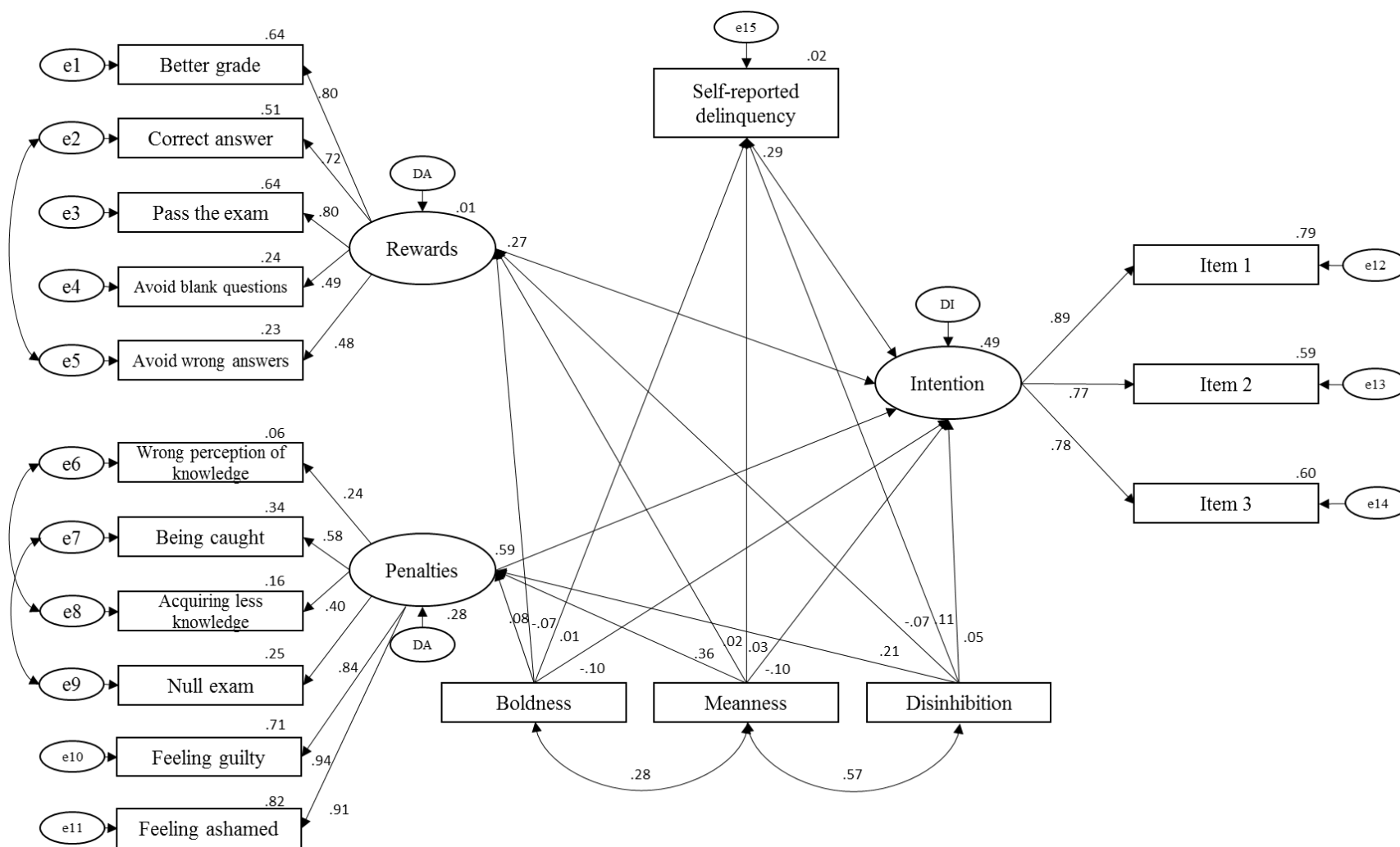


Figure 7 – Structural model of Intention to cheat (female sample).

3.4. Psychopathy and the expectancy and value components of attitudes

The associations of psychopathy with the expectancy and value components of attitudinal beliefs were assessed using Spearman correlations, considering the non-normal distribution of the expectancy and value items.

A) *Shoplifting*

Table 8 shows the correlations regarding shoplifting for the overall sample. Meanness and disinhibition were positively associated with the expectancy of saving money, earning money and feeling good (also with boldness) as a result of stealing. The expectancy of feeling adrenaline from a theft was solely associated with disinhibition. In addition, all three of the subscales were inversely correlated to the expectancy of getting arrested, feeling ashamed, feeling guilty and harming others (with boldness left out for this later item). In regard to the value component, meanness and disinhibition were negatively associated with feeling good, and positively associated with getting arrested, harming other, feeling guilty, feeling ashamed and feeling adrenaline (also with boldness).

Table 8 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Shoplifting (total sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Save money</i>	Expectancy	.015	.228***	.154**
	Value	-.074	.026	-.025
<i>Adrenaline</i>	Expectancy	-.060	.167***	.146**
	Value	.351***	.322***	.139**
<i>Earn money</i>	Expectancy	.015	.144**	.080
	Value	.043	.088	-.001
<i>Feeling good</i>	Expectancy	.143**	.512***	.394***
	Value	-.035	-.262***	-.201***

<i>Being punished</i>	Expectancy	-.138**	-.223***	-.224***
	Value	.094*	.215***	.173***
<i>Hurting the owner</i>	Expectancy	-.020	-.251***	-.249***
	Value	-.016	.362***	.251***
<i>Feeling ashamed</i>	Expectancy	-.160***	-.513***	-.404***
	Value	.030	.169***	.074
<i>Feeling guilty</i>	Expectancy	-.152**	-.474***	-.408***
	Value	.066	.263***	.159***

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 9 shows the correlations regarding shoplifting in a male-only sample group. Meanness was positively related to the expectation of earning money in a shoplifting context. All three psychopathy subscales were positively correlated to the expectancy of feeling good, and inversely correlated to the expectancy of harming others, feeling ashamed, feeling guilty and getting arrested (the last one with disinhibition out). In addition, Meanness and Disinhibition were positively related to the value of getting arrested, harming others, feeling guilty and, negatively related to the value of feeling good. All three components were positively related to the importance of feeling adrenaline. Meanness was the only subscale positively associated with the value of feeling ashamed.

Table 9 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Shoplifting (male sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Save money</i>	Expectancy	-.008	.161	.076
	Value	.004	.097	.038
<i>Adrenaline</i>	Expectancy	-.010	.069	.105
	Value	.264**	.341***	.231**
<i>Earn money</i>	Expectancy	.128	.205*	.109
	Value	.048	.151	.016

<i>Feeling good</i>	Expectancy	.249**	.596***	.430***
	Value	-.105	-.439***	-.348***
<i>Being punished</i>	Expectancy	-.280**	-.302***	-.151
	Value	.093	.278**	.253**
<i>Hurting the owner</i>	Expectancy	-.173*	-.242**	-.204
	Value	.015	.475***	.328***
<i>Feeling ashamed</i>	Expectancy	-.281**	-.604***	-.430***
	Value	.161	.222*	.165
<i>Feeling guilty</i>	Expectancy	-.274**	-.570***	-.485***
	Value	.158	.374***	.308***

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 10 shows the correlations regarding shoplifting in a female-only sample group. Meanness and disinhibition were positively correlated with the expectancy of feeling good as a consequence of stealing, and negatively correlated with the expectancy of harming others, feeling ashamed and feeling guilty. Meanness was positively correlated with the value of feeling ashamed negatively with the value of feeling good. Boldness and meanness were positively correlated with the value of feeling adrenaline while committing theft. And lastly, disinhibition and meanness were positively related with the importance of harming others as a consequence of stealing.

Table 10 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Shoplifting (female sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Save money</i>	Expectancy	-.017	.208***	.153**
	Value	-.090	.024	-.039
<i>Adrenaline</i>	Expectancy	-.104	.185**	.143**
	Value	.352***	.259***	.064
<i>Earn money</i>	Expectancy	-.060	.062	.042
	Value	.050	.077	-.002

<i>Feeling good</i>	Expectancy	.048	.403***	.347***
	Value	.018	-.124*	-.110*
<i>Being punished</i>	Expectancy	-.067	-.157**	-.240***
	Value	.072	.052	.068
<i>Hurting the owner</i>	Expectancy	.059	-.250***	-.263***
	Value	-.047	.290***	.202***
<i>Feeling ashamed</i>	Expectancy	-.043	-.372***	-.358***
	Value	-.047	.108*	.011
<i>Feeling guilty</i>	Expectancy	-.053	-.358***	-.339***
	Value	-.020	.116*	.039

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

B) Cheating

Table 11 shows the correlations regarding academic cheating. Meanness and disinhibition were positively associated with the expectancy of getting better grades, taking less effort while studying and avoiding wrong answers. The expectancy of passing the exam, of having an incorrect perception on one's knowledge and avoiding blank answers were solely correlated (positively) to meanness. Meanness was negatively correlated to the expectancy of acquiring less knowledge from studying to the exam. Meanness and boldness were negatively associated with the expectancy of getting caught cheating, getting the exam annulled as a result of cheating, feeling guilty and feeling ashamed (these last two also with the adding of disinhibition). Meanness and disinhibition were also positively associated with the value attributed to taking less effort studying, being less knowledgeable, having a wrong perception of one's knowledge, feeling guilty and getting caught cheating (this last one also with boldness). Disinhibition was also negatively associated with the value of avoiding wrong answers and passing the exam. Lastly, all three components were negatively associated with the value of feeling ashamed.

Table 11 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating (total sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Better grades</i>	Expectancy	-.023	.120***	.180***
	Value	.005	-.053	-.058
<i>Less effort</i>	Expectancy	.057	.180***	.139**
	Value	-.110*	.257***	.251***
<i>Correct answer</i>	Expectancy	-.042	.051	.030
	Value	.010	-.051	-.090*
<i>Avoid blank questions</i>	Expectancy	.012	.152**	.131**
	Value	-.009	-.035	-.014
<i>Avoid wrong answers</i>	Expectancy	.024	.088	.124**
	Value	.049	-.030	-.096*
<i>Pass the exam</i>	Expectancy	-.051	.087	.109*
	Value	.002	-.055	-.119*
<i>Being caught</i>	Expectancy	-.206***	-.241***	-.149**
	Value	.088	.210***	.141**
<i>Copying wrong answers</i>	Expectancy	-.017	.028	.011
	Value	-.038	-.010	-.059
<i>Acquiring less knowledge</i>	Expectancy	-.060	-.092*	-.086
	Value	-.032	.198***	.171***
<i>Wrong perception of knowledge</i>	Expectancy	.001	-.157**	-.131**
	Value	-.030	.155**	.158**
<i>Null exam</i>	Expectancy	-.145**	-.179***	-.155**
	Value	.006	.067	.040
<i>Feeling ashamed</i>	Expectancy	-.081	-.403***	-.270***
	Value	.003	.179***	.123**
<i>Feeling guilty</i>	Expectancy	-.167***	-.386***	-.270***
	Value	.001	.206***	.127**

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 12 shows the correlations regarding academic cheating in a separated male-only subsample. Meanness and boldness were positively correlated with the expectancy of taking less effort studying for the exam, and negatively correlated with the expectancy of getting caught cheating and feeling guilty. Disinhibition and meanness were positively with the expectancy of avoiding blank questions. Disinhibition was positively related with the expectancy of getting better grades and avoiding wrong answers. Boldness was the only component negatively associated with getting the exam annulled. Meanness was negatively associated with the expectancy of feeling ashamed in a context of academic cheating. Meanness and disinhibition were positively related to the value of taking less effort in the study for an exam, of having a wrong perception of one's knowledge and feeling guilty. All three subscales were positively related to the value of getting caught cheating.

Table 12 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating (male sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Better grades</i>	Expectancy	.052	.160	.175*
	Value	-.054	-.060	-.081
<i>Less effort</i>	Expectancy	.179*	.185*	.072
	Value	-.050	.267**	.243**
<i>Correct answer</i>	Expectancy	-.005	.088	.052
	Value	.033	-.018	-.106
<i>Avoid blank questions</i>	Expectancy	.042	.175*	.171
	Value	.014	.039	-.036
<i>Avoid wrong answers</i>	Expectancy	.113	.127	.221*
	Value	-.131	-.093	-.041
<i>Pass the exam</i>	Expectancy	-.025	.111	.084
	Value	-.051	-.028	-.005
<i>Being caught</i>	Expectancy	-.422***	-.259**	.011
	Value	.234**	.269**	.213*

<i>Copying wrong answers</i>	Expectancy	-.045	.111	.122
	Value	.009	.010	-.047
<i>Acquiring less knowledge</i>	Expectancy	-.046	-.050	-.042
	Value	.025	.157	.093
<i>Wrong perception of knowledge</i>	Expectancy	.022	-.169	-.066
	Value	.129	.185*	.187*
<i>Null exam</i>	Expectancy	-.193*	-.171	-.006
	Value	.047	.046	-.002
<i>Feeling ashamed</i>	Expectancy	-.144	-.371***	-.102
	Value	.011	.112	.053
<i>Feeling guilty</i>	Expectancy	-.260**	-.397***	-.171
	Value	-.027	.292**	.242**

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 13 shows the correlations regarding academic cheating in a separated female-only sub-sample. Meanness and disinhibition were negatively related with the expectancy of feeling guilty and ashamed as a consequence of cheating. Meanness was also negatively correlated with the expectancy of getting caught cheating. Meanness and disinhibition were positively related with the value of taking less effort studying, having less knowledge and feeling ashamed. Disinhibition was negatively correlated with the value of passing the exam. Boldness was also positively associated with the value of avoiding wrong answers. Meanness was positively related to the value attributed to feeling guilty.

Table 13 - Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating (female sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Better grades</i>	Expectancy	-.087	.038	.155**
	Value	.043	-.023	-.035

<i>Less effort</i>	Expectancy	-.032	.110*	.136*
	Value	-.149**	.250***	.247***
<i>Correct answer</i>	Expectancy	-.077	-.009	.000
	Value	.011	-.055	-.074
<i>Avoid blank questions</i>	Expectancy	-.043	.067	.079
	Value	.005	-.034	.021
<i>Avoid wrong answers</i>	Expectancy	-.025	.040	.069
	Value	.109*	-.008	-.124*
<i>Pass the exam</i>	Expectancy	-.094	.018	.093
	Value	.027	-.066	-.165**
<i>Being caught</i>	Expectancy	-.108*	-.198***	-.190***
	Value	-.041	.089	.058
<i>Copying wrong answers</i>	Expectancy	.002	.009	-.024
	Value	-.079	-.062	-.083
<i>Acquiring less knowledge</i>	Expectancy	-.045	-.077	-.087
	Value	-.071	.209***	.196***
<i>Wrong perception of knowledge</i>	Expectancy	.025	-.093	-.137*
	Value	-.094	.139*	.142**
<i>Null exam</i>	Expectancy	-.097	-.133*	-.194***
	Value	-.019	.068	.051
<i>Feeling ashamed</i>	Expectancy	-.025	-.395***	-.320***
	Value	-.025	.194***	.144**
<i>Feeling guilty</i>	Expectancy	-.099	-.344***	-.290***
	Value	.000	.150**	.066

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

4. Discussion

The present study focused on developing ideas explored in the previous study, regarding the association of psychopathic traits and heightened pro-criminal attitudes (Próspero-Luis, et al., 2017). Study 1 showed that the link between psychopathy and enhanced criminal intention relationship was mediated by increased attitude towards criminal behavior and related to abnormal appraisal of the consequences (both positive and negative) of criminal acts such as “being arrested” or “earning easy money”. It was suggested that this could be the result of impaired stimulus-reinforcement learning abilities, which have repeatedly been associated with psychopathy (Birbaumer et al., 2005; Lykken, 1957; Newman & Kosson, 1986). The study also lent evidence to the argument that individuals with higher psychopathic traits are less able to use reinforcement information to alter the representation of the outcomes associated with potential responses, and properly use this information in their decision-making (Blair, 2005, 2013). Building on previous results, the present study tested the hypothesis that psychopathic traits are associated with more favorable attitudes towards antisocial acts (shoplifting and academic cheating), which result from abnormal appraisal of the consequences of such behaviors. It was expected that psychopathic individual would have more positive attitudes towards both behaviors, which, in turn, would lead to stronger intentions towards recidivism.

Overall, the research showed that psychopathy impacts the intention to perform mildly and non-serious antisocial behavior, and that this effect is mediated by the perceived consequences of the behaviors. In fact, the *perceived penalties* of behaviors consistently appear as a mediator of the relationship between meanness and antisocial intention (for both cheating and shoplifting and in most of our sub-samples). There is also a particular case of this same mediation but with both *perceived penalties* and *perceived rewards* as mediator variables (the SEM including the male sample on shoplifting behavior). In contrast, the link was consistently mediated by *perceived rewards* in Study 1.

On one hand, shoplifting might be cognitively processed much in the same way as theft (the behavior studied previously). This may explain the resurgence of *perceived rewards* as a mediator variable in the models regarding shoplifting. Shoplifting is, fundamentally, a type of theft, and so these behaviors might work similarly. When considering the criteria established by the Portuguese penal code in regard to crimes against property, there is no clear distinction between

both theft and shoplifting. The severity of these types of crime are dependent on the value of the stolen object, as well as other related circumstantial elements (i.e. use of violence, breaking and entering, recurrence of the behavior, *etc.*). In this case, the distinction made between theft and shoplifting, is used in reference to the nature of the samples. The term *theft* was used in a context where the participants had already been prosecuted and arrested for the crime whilst, in the case of *shoplifting*, the terminology was integrated in a context where the crime was not prosecuted (non-forensic context). In any case, the term *shoplifting* was never openly used in any survey (it was replaced by *taking an object from a store without paying for it*) so there was no related exogenous influence on the data. The gap between both terms is purely conceptual and, in a practical context, distinction is redundant. The important distinction happens between *cheating* and shoplifting, since *academic cheating* is not an offense against property and, therefore, the severity and prevalence in a non-forensic setting is different. *Academic cheating* is a fundamentally different behavior and thus, one could not expect the mediators to work in the same fashion, hence the disappearance of the *reward* as a mediator.

On the other hand, the samples' idiosyncrasies may be foundational to the change in the mediator variable (rewards to penalties). In fact, in a forensic context, the mediator being *perceived rewards* may reveal that forensic individuals' main motivator towards theft is the positive consequences of the behavior. In regard to the non-forensic sample, the opposite is quite clear. Whilst they do not care as much for the rewards of their antisocial behavior (rewards still act as a mediator in one of the cases), it is the *perceived penalties* that pull against the commitment of criminal acts. For the non-forensic, penalties are the true (de)motivator. One possible explanation for this distinction might be related to the difference in disinhibition scores in both samples. In fact, the mean scores of TriPM disinhibition is much more severe in the forensic sample. One major characteristics of impulsive individuals is sensation seeking (e.g. Gottfredson & Hirschi, 1990; Patrick, et al, 2009; Zuckerman, 1994; Gatzke-Kopp et al., 2002; Quay, 1965). The penalties that might generate from a criminal act represent some type of risk to the individual, configuring the act as an arousing and thrilling activity. It could be argued that the forensic sample perceives the negative outcomes almost as positive ones, since the thrill of "being caught" is arousing. When inspecting the non-forensic sample, it is evident a much lower representativeness of the disinhibition facet which, by itself, might imply the lack of a sensation-seeking tendency. Non-forensic individuals seem to be much more risk averse as opposed to risk seekers and, therefore,

the expectancy of being punished is not an arousing element, causing penalties to acquire a heavier importance in the deconstruction of criminal intentions. This hypothesis has a speculative nature and requires further research however, it seems to accurately depict the presented data. Another possible explanation could rest on the existence of different crime deterrent elements in forensic *versus* community populations, however, no research has been raised on this topic. Nevertheless, it is a path worth of further investigation.

Once again, despite some minor differences, a mediation effect from personality characteristics (psychopathy traits) to attitudes to antisocial behavior arose. This is also theoretically supported by Fishbein and Ajzen's (1975) claim that, across different samples and behaviors, the predictors of a given behavior are not necessarily the same

In addition, an association between psychopathic traits and the perceived probabilities of the expected outcomes of antisocial acts has also emerged from this data. In fact, much alike to Study 1, psychopathic traits were found to be related to an overestimation of possible rewards and, at the same time, to an underestimation of the probability of penalties, in shoplifting and cheating. This tendency was evident in the majority of the reported attitudinal beliefs (eg. Shoplifting – *Saving Money, Earning Money, Feeling Adrenaline*, etc; Cheating - *Getting a better grade, taking less effort, passing the exam*, etc.) and even across gender-segregated sub-samples. According to Piquero and Tibbetts (1996) the same conclusion arises from the impact of self-control on positive and negative consequences of perceived sanctions and shame. The authors argue that short-sighted individuals will fail to perceive negative consequences because these have a long-term essence. Much in the same manner, positive consequences are over-estimated due to their short-term nature. Consistent with previous research, this reinforces the idea that psychopathy is related to abnormal appraisal of the consequences of criminal acts, even when probed at sub-clinical levels. Yet again, this data supports the premise that psychopathic individuals seem to have less ability to use reinforcement information to alter the representation of the consequences related to potential responses, impairing their ability to use this information in their decision-making process (Blair, 2005, 2013; Blair, et al., 2006).

However, it is relevant to note that, within this sample, and in comparison to forensic individuals, it is much more difficult to segregate the different psychopathic sub-scales. In fact, previous data clearly showed that these effects were driven by the meanness component, which

also aggregates with boldness, both fearlessness-related components. In the present study, however, the associations are not as clear since, for certain beliefs, meanness actually aggregates with disinhibition. The reason behind this may lay in the different nature of both samples. According to Vieira, Ferreira-Santos, Almeida, Barbosa, Marques-Teixeira and Marsh (2015) some of the variance expressed by disinhibition in non-forensic samples may reflect characteristics related to abnormal amygdala structure. In their study, Vieira and colleagues (2015) found a negative association between both meanness and disinhibition and the volume of the amygdala, implying the existence of a physiological association between these two components. This may explain the similar relation that emerges from this data.

Moreover, higher levels of psychopathy also correlate with the different valuations attributed to the consequences of both shoplifting and cheating behaviors in a very consistent fashion. In Study 1 only a few consequences of theft presented this kind of effects (*adrenaline*, *earning easy money* and *harming other people*). In the current data, however, the *value*-related correlations are much more consistent. In fact, in the present study, higher levels of psychopathy correlate with a lower importance attributed to negative and, sometimes even positive consequences of both behaviors. Blair (2005) argues that salient passive-avoidance learning deficits in psychopathy are especially noticeable in the case of stimulus-punishment associations, even though the same also happen in the formation of stimulus-reward. This effect may be explained by these type of learning impairments in psychopathy; difficulties in learning from punishments may results in *punishment desensitivity* leading psychopathic individuals into not caring the consequences of their actions.

In addition, a link has also been established between higher levels of psychopathy and a high valuation attributed to adrenaline. This result is also consistent with Study 1 and with well-established sensation-seeking theories of crime (e.g., Eysenck & Gudjonsson, 1989; Gatzke-Kopp, Raine, Loeber, Stouthamer-Loeber, & Steinhauer, 2002; Quay, 1965; Zuckerman, 1994). As previously stated, these theories' main premise rests on the fact that antisocial behavior configures an arousing activity that is often pursued by under-stimulated individuals with the intent of balancing their level of arousal. In spite of these results, a direct link cannot be established between these two elements since there was no effective measure for resting-state arousal for the present study.

One limitation of the present study is the use of a sample strictly composed of university students. On one hand, since one of the behaviors in the study was academic cheating, this sample would be adequate. However, the same does not apply to shoplifting. On the other hand, one could argue that an academic sample is on the opposing side of a forensic one. In fact, when inspecting the disinhibition levels on both the forensic and the undergraduate sample it is evident a heavy discrepancy. The forensic sample exhibits a much higher disinhibition score than its non-forensic counterpart (especially in comparison with the other TriPM subscales). Also, the forensic sample is composed of recidivist inmates with significant criminal careers whilst the non-forensic sample's criminal reporting is sparse. Since the same overall pattern of results emerged from the sample in Study 2, this could mean that the phenomenon under study operates universally across individuals.

The lack of an experimental measure regarding both stimulus-reinforcement learning and resting-state arousal also hinders our research. These two measures would be crucial to show if the effects of psychopathy in the decision-making are the result of impaired stimulus-reinforcement learning and if there is, in fact, a direct link between psychopathy and risk-seeking. Such protocols will be added in the following studies.

It is also important to mention that the surveys were administered in *online* format. While this kind of survey administration method has its flaws, it also allows for a quick and vast collection of data otherwise impossible with the resources at disposal (Wright, 2006; Rhodes et al., 2003). Furthermore, the type of scales in use are simple and the self-report response items are thoroughly described, explained and, therefore, completely independent of the researchers. The collected data makes sense from both theoretical and empirical points of view, and the results follow in the same footsteps of previous research.

Finally, and alike previous research, it is relevant to mention that the used psychopathy scale (TriPM – Patrick, 2010) is relatively recent, however, several studies have already attested for the scale's validity (refer to Study 1 - Discussion).

In conclusion, the present research complements previous work on the complementarity of rational choice and personality-based theories for the explanation of antisocial behavior (Piquero Tibbetts, 1996; Nagin & Paternoster, 1993; Próspero-Luis et al, 2017). The results illustrate a dramatic effect of a personality variable typically related to an increased predisposition to offend

on the processes involved in the formation of attitudes towards offences. Looking at personality traits from the perspective of such a rich and studied variable as psychopathy allows advancing in the specification of the theoretical mechanisms through which personality exerts influence over (anti-social) attitude formation and decision-making. Once again, further implications of these results will be addressed in the general discussion.

**STUDY 3 – Psychopathy, passive-avoidance learning and impulsivity: A
laboratorial study of decision-making**

1. Introduction

The following study was conducted alongside the previous one. As mentioned in the limitations section of Study 1, it was considered important to introduce laboratorial measures of stimulus-reinforcement learning. This measure would allow analysis that could show that not only individuals higher in psychopathy, but specifically those impaired in a laboratorial measure of stimulus-reinforcement learning, underestimate the probability of penalties and overestimate the probability of rewards. This measure would be crucial to test whether the effects of psychopathy in decision-making in ecological contexts result from a stimulus-reinforcement learning disability. Taking that into consideration, a passive-avoidance task was constructed (inspired by Blair, et al., 2004) and integrated along with the Wisconsin card-sorting task (Berg, 1948) within a laboratorial protocol. The WCST is a neuropsychological task of “set-shifting”, conceived in order to test the subject’s ability to display flexibility in the face of changing schedules of reinforcement (Monchi, et al., 2001). Through the use of the WCST it will be possible to inspect whether psychopathic individual’s lack of ability to shift attention from specific goal-oriented actions influences their learning and adaptative abilities (Newman & Kosson, 1986). Furthermore, in order to investigate possible relations with self-control problems, a Go/No-Go task was also included (Bezdjian et al., 2009). The task will produce a laboratorial measure of self-control which will be used to test the relation between psychopathic traits and impulsivity. The data extracted from this test will be used to try to segregate the TriPM externalization components from trait fearlessness (Pasion, Cruz, & Barbosa, 2016; Pasion, 2016). A second limitation was the lack of a resting state arousal measure that would allow for deeper analysis within the speculated relation between psychopathy and sensation seeking. As previously mentioned (in both study 1 and 2), the “feeling adrenaline” category was highly valued by higher meanness-scoring individuals, which seemed to imply some degree of under-arousal (Eysenck & Gudjonsson, 1989; Gatzke-Kopp, et al., 2002; Quay, 1965; Zuckerman, 1994). In order to further inspect this interaction, heart rate measures were recorded both at rest and while participants were undergoing the laboratorial tasks. All these tasks were administered to some of the participants from the Study 2 sample who were contacted via email (the selection criterion was psychopathy scores).

2. Method

Within Study 2 test battery, participants were asked whether they were willing to take part in a follow-up study that included a laboratorial component. If so, participants could write down their *email* address in a dedicated slot, so they could be contacted in the future.

After the programming of the protocol (see Instruments), the different tasks, along with the ECG recording equipment were tested for functionality (the whole protocol was applied to a pilot subject in order to guarantee that every aspect of the protocol was working as intended). Following these tests, the interested participants were contacted via email and the data collection sessions were scheduled according to the participant's availability. In a first phase, subjects were prioritized according to their *meanness* score (both higher and lower meanness-scoring participants were summoned). However, due to the lack of responses, all participants were, later on, contacted indiscriminately. Even with this last solution, the ideal number of participants was not reached, so a new participant collection stage was started.

2.1. Participants and procedure

Participants were 73 University students or former students (31 male and 42 female) from the city of Porto, Portugal (Mean age = 24.03, SD = 6.287) collected *via* email (see *appendix 7*) from the sample on Study 2. The physiological component of this study reported a high sample mortality (from 73 to 32 participants) that will be explained further on. As previously mentioned, the full experimental protocol included a Go/No-Go task (Bezdjian, et al., 2009), a Passive-avoidance task (Blair, et al., 2004) and a Wisconsin Card-sorting task (Berg, 1948), with simultaneous ECG recording. After the three tasks were completed the participants were also administered the *Test of Nonverbal Intelligence* (TONI-II; Brown, Sherbenou & Johnsen, 2010), to be used as a QI proxy (control variable). The order in which the tasks were executed was altered from one participant to next, with the exception of the TONI-II. The full protocol took about 2 hours. Before every task, a researcher would explain the following task and respond to every doubt expressed by the participants. It is also worth noting that, participants were told to interrupt the task if any new doubts arouse with no penalty whatsoever, in order to ensure that the tasks were

successfully carried through. When recording both *baselines*, participants were told to close their eyes, without falling asleep, and remain still and quiet in a comfortable position until told otherwise. The data collected from the laboratory stage was aggregated with the data collected from the test batteries from study 2 so both could be integrated in the analysis. Before the tasks, every participant signed a waiver of consent (see *appendix 8*) and filled in a form with questions concerning social-demographics, relevant physical characteristics, alcohol and drug consumption, use of prescription drugs, sight-related illnesses, sleep-related information, history of cardiac and breathing problems as well as other relevant data (see *appendix 9*). Participants were monitored through a window throughout all tasks.

2.2. Instruments

All participants completed the task sequence.

Passive-avoidance task. The used passive-avoidance task was constructed according to Blair, et al. (2004), using the *Psychopy* open-source software (Peirce, 2007). In this task, individual S+/S- stimuli were associated with different levels of point reward/punishment. Within this task, participants were presented with 8, two-digit numbers 12 times in a random order on a *Asus* 20-inch monitor (i.e., there were 8 trials in each of the 12 blocks). Responding to four of the numbers elicited reward (S+) and responding to the other four elicited punishment (S-). Two versions of this task were made in which the numbers corresponding to S+ in the first one corresponded to the S- in the second. Half of the participants resolved version one and, the other half, version two. The used reinforcement values were plus and minus 1, 1400, 1700 and 2000 points for the four different S+/S-. In this task, participants had to learn by trial and error to press the spacebar key in response to the S+ and avoid responding to the S-. After each trial, participants received visual feedback about the number of points earned/lost.

The numbers were 5 cm in height, presented in white on a black screen and each remained visible for 3 seconds if no response was made. The sets of numbers were balanced (i.e. both S+/S- had the same even to odd number ratio as well as >50 and <50). When a response was made, a prompt message appeared reporting the number of points that had been won/loss in that trial. All participants started with 10,000 points and a running point total was visible on the task screen

throughout. At the beginning of the task, the participant could read the detailed instructions to the task. The duration of this task was about 20 minutes. The output file from the task included both errors and omissions (total scores and by trial block), as well as reaction time.

Go/No-Go task. The used Go/No-Go was programmed in PEBL (Psychology Experimental Building Language, Mueller & Piper, 2014), based on the template version of Bezdjian et al., (2009). This task is described as a response inhibition task where a motor response must either be executed or inhibited. Within this task, participants are required to watch a sequential presentation of letters and respond to a target letter by pressing the shift-key. The screen shows a 2 x 2 array with a blue star in each cell. When the task starts, a single star (in random fashion) will shift into a letter P or R for the duration of 500 milliseconds, with an inter-stimulus interval of 1,500 milliseconds. This task is comprised of two parts. In part 1 (P-Go), participants are asked to press the key as response to the letter P and restrain from responding to the non-target letter R. The target to non-target was of 80:20. The first staged included 160 trials. In the second part (R-Go), participants were asked to respond to the target letter R while refraining from responding to non-target P. The ratio of targets to non-targets and the number of trails remained the same in part 2. In the beginning of each part, participants were administered a brief practice session to ensure the full comprehension of the task at hand. The instructions to each of the parts were also displayed and well as thoroughly described by the researcher. Once again, every doubt posed by the participant was resolved. The output file of this task included: correct responses to target letter, errors of omission to the Go letter, errors of commission, rejections to the NoGo letter, reaction time and reaction time variability. The duration of the task was approximately 20 min.

Wisconsin card-sorting task. The WCST programmed in PEBL (Mueller & Piper, 2014), based on the template version presented in Berg (1948). This test is a “set-shifting” neuropsychological test in which the subject’s ability to display flexibility in the face of changing schedules of reinforcement is evaluated (Berg, 1948). In this task, participants were presented 60 different cards. Each card displayed one to four identical figures of a single color. The deck contained 4 distinct figures: stars, triangles, crosses and circles; four different colors: red, yellow, blue and green. These three characteristics were combined between them (i.e., a single card might have 2 blue circles, or four red, stars, or any other such combination). Each card could then be sorted according to its number, shape or color of the figures. In addition to the response cards, the

screen also displayed four stimulus cards: first, a red triangle; second, two green stars; third, three yellow crosses and; forth, four blue circles. Copies of these stimulus cards were also in the main deck.

The four stimuli cards were displayed in order at the bottom of the screen. Then the subjects were instructed to match the response cards to the stimuli cards according to one of the three different characteristics (number, shape or color). As soon as the participants play a card, the software warns him/her whether the chosen characteristic was correct or incorrect. If the response was correct, the participant should keep on matching the response cards according to the previously selected characteristic; if the response was wrong, the participant will have to choose a different category to match until he/she finds the correct one. When 5 response cards are matched correctly, the response category changes (randomly) to one of the used categories and the subject will have to re-learn which is the correct one. This cycle continues until the participant has responded to 5 different contingencies. Much like the previous tasks, the instructions were presented in both written and oral form. The output file of this task included: correct responses, total errors, perseverative responses, perseverative errors, non-perseverative errors, trials to complete the first category, failure to maintain set, as well as other compound variables (these compound variables will not be added in the analysis as they fall out of the spectrum of the present research). This task takes approximately 7 minutes.

Test of Nonverbal Intelligence (TONI-II). In order to collect a brief and convenient measure of IQ, the TONI-II was administered at the end of the protocol (Brown, et al., 2010). This test was developed as a language free intelligence measure which also helps in the assessment of aptitude, abstract reasoning and problem solving. The age of application of the TONI-II ranges from 6 to 86 years-old. Due to its non-verbal nature, it allows the assessment of people with certain conditions that limit the speaking/listening ability. This test also allows for a faster and less troublesome collection of IQ data that would not be possible otherwise due to the typical lengthiness of alternative questionnaires. The TONI has been tested for over 20 years with notorious results (Brown, et al., 2010). The included items are a variety of problem-solving tasks, organized in ascending order of difficulty. Each item includes one or several salient characteristics such as shapes, position, direction, rotation, contiguity, shading, size and movement. Furthermore, the abstract nature of the items, together with the elimination of language is able to reduce the

cultural loading of the test. Performance in the task is also not affected by prior information or exposure.

The TONI was also standardized on a nationally representative sample of more than 2,200 people, aged 6 through 89, with norms stratified by age, gender, race, ethnicity, geographic location, and SES (based on family income and educational attainment). Furthermore, it was analyzed for bias at both item and test levels. Item difficulty was compared across demographic variables, and item curve characteristics were determined. Potential bias was found to be insignificant, and floor effects were eliminated. The present sample reported a mean score of 115.33 (SD=13.101).

2.3. Psychophysiology – Electrocardiography

2.3.1. Data collection

The ECG data was collected via the Biopac MP-100, using the ECG 100C module on the Biopac Acqknowledge software. The sampling rate was set to 200ms. The ECG was collected using a standard LEAD II derivation (MP System Hardware Guide, 2015) with disposable electrodes. Both a high pass filter (0.05 Hz) and a low pass filter (35Hz) were applied to the module. The used amplification was the DA100C General-purpose transducer amplifier. The ECG data collection phase included two distinct moments, the baseline recordings (about five minutes at the start and end of the protocol) and the in-task recordings. ECG was recorded in each task, independently. Each relevant moment was triggered manually at the start and end of each task and baseline.

2.3.2. Data analysis for ECG

The data analysis followed the indications proposed by the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (1996). The first step included the manual organization of the collected data, also by including the individual participant code. Following this, the *Acqknowledge* output files (.acq) were converted into *Matlab* files (.m) through the use of previously created scripts (see *appendix 10*). The next step included the control of the unwanted wander of the ECG signal (i.e. this step was conducted

in order to remove the vertical oscillation of the ECG signal). To do this, another script was constructed (see *appendix 10*). The new ECG files were then manually inspected and checked for inconsistencies. To this step, 12 participants were eliminated due to a problematic signal (i.e. excessive noise, incomplete signal recording, weak signal). No filter was needed or used in the data processing phase. This step was the last of the signal processing stage.

In the following stage, a script was conceived in order to allow the detection the QRS peaks (established threshold of 0.35mV) within the signal (see *appendix 10*) resulting on the time stamps and amplitudes of each peak. At the same time, the temporal amplitudes of each relevant protocol moments were registered (baselines and tasks) allowing for heart-rate and heart-rate variability (root mean square of successive differences - RMSSD) calculations within each individual task. The previously mentioned calculations were executed in *Microsoft Excel*. During the physiological data analysis, 41 participants were eliminated due to bad signal data (N=32).

3. Results

3.1. Regression analysis

3.1.1. Psychopathy and Passive-Avoidance

The associations of psychopathy with the extracted variables from the passive-avoidance task were assessed using multiple regressions, defining the TONI score as covariate. The computed MANCOVAS had no significant values.

Commission errors

Table 14 shows regression analysis of the TriPM facets and TONI as predictors of commission errors in the passive-avoidance task. Disinhibition was positively related whilst the TONI score was negatively related to the total score of passive-avoidance errors. Disinhibition was a significant predictor (positive) of passive-avoidance errors in the value 1400. The TONI scores work as predictors (negatively) of errors in each of the four values (i.e. 1, 1400, 1700, 2000). Also, meanness worked as predictor (negatively) to passive-avoidance errors in blocks 6, 7 and 10. Disinhibition was a significant predictor (positively) of errors in blocks 6, 7, 10 and 12 whilst TONI predicted errors (negatively) from blocks 3 to 12.

Table 14 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of commission errors on the Passive Avoidance Task

Commission Errors	Boldness			Meanness			Disinhibition			TONI			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Total	-.044	.067	-.070	-.103	.094	-.146	.171	.096	.290*	-.193	.042	-.483***	.284
By value													
1	.006	.026	.025	-.028	.036	-.111	.040	.029	.187	-.062	.016	-.426***	.193
1400	-.003	.022	-.013	-.001	.031	-.006	.054	.025	.285*	-.054	.014	-.426***	.228
1700	-.018	.022	-.095	-.048	.030	-.227	.035	.024	.200	-.040	.013	-.334**	.177
2000	-.029	.029	-.121	-.025	.041	-.093	.042	.033	.185	-.037	.018	-.241*	.099
By block													
1	.002	.012	.024	-.020	.016	-.184	.021	.013	.228	.012	.007	.196	.078
2	-.006	.015	-.053	.002	.021	.016	-.014	.017	-.123	-.009	.009	-.122	.036
3	-.009	.017	-.065	.027	.023	.166	-.002	.019	-.012	-.037	.011	-.402**	.174
4	-.010	.017	-.072	.006	.024	.038	.006	.020	.042	-.024	.011	-.261*	.075
5	-.004	.012	-.039	-.010	.017	-.091	.020	.013	.208	-.024	.007	-.360**	.153
6	.002	.012	.019	-.036	.017	-.289*	.037	.014	.359**	-.028	.008	-.405***	.244
7	-.013	.011	-.132	-.035	.016	-.302*	.030	.013	.310*	-.021	.007	-.317**	.221
8	.000	.009	-.003	-.012	.012	-.145	.012	.010	.177	-.016	.005	-.332**	.130
9	-.006	.010	-.079	-.014	.014	-.151	.015	.011	.197	-.014	.006	-.263*	.108
10	.011	.007	.175	-.026	.009	-.364**	.030	.008	.507***	-.014	.004	-.351**	.278
11	-.005	.008	-.074	.010	.011	.140	.000	.009	.006	-.011	.005	-.265*	.084
12	-.004	.005	-.091	.004	.008	.070	.016	.006	.347*	-.008	.003	-.249*	.192

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Omission errors

Table 15 shows regression analysis of the TriPM facets and TONI as predictors of omission errors in the passive-avoidance task. Disinhibition was related (negatively) to omissions to the value 1400 whilst the TONI score was also a predictor of omissions to the value 1700. Also, the TONI score was associated negatively with omissions in blocks 1, 2 and 4.

3.1.2. Psychopathy and Go/No-Go

Table 16 shows regression analysis of the TriPM facets and TONI as predictors of the different scores of the Go/No-go task. Disinhibition was a significant predictor (negatively) of the reaction time in part 1 of the task. There were no other significant predictors.

3.1.3. Psychopathy and the Wisconsin card-sorting task

Table 17 shows regression analysis of the TriPM facets and TONI as predictors of the different scores of the Wisconsin card-sorting task. The TONI score was the only significant predictor of correct responses (positively) and total errors (negatively) in the task. There were no other significant associations.

3.1.4. Psychopathy and Heart-rate measures

Table 18 shows regression analysis of the TriPM facets as predictors of heart-rate and heart-rate variability data. Meanness was a significant predictor (negatively) of RMSSD in the WCST task. No other relevant results emerged.

Table 15 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of omission errors on the Passive Avoidance Task

Omission Errors	Boldness			Meanness			Disinhibition			TONI			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Total	.013	.094	.016	-.063	.130	-.071	-.140	.106	-.188	-.117	.058	-.232	.125
By value													
1	.079	.049	.204	-.015	.068	-.034	-.004	.055	-.011	-.002	.031	-.007	.039
1400	-.008	.050	-.020	.077	.069	.162	-.125	.056	-.315*	-.057	.031	-.214	.122
1700	-.063	.040	-.183	-.044	.056	-.113	-.018	.046	-.056	-.060	.025	-.270*	.165
2000	.005	.035	.017	-.080	.048	-.253	.007	.093	.027	.002	.022	.013	.054
By block													
1	.008	.010	.094	.007	.014	.074	-.009	.011	-.116	-.014	.006	-.257*	.084
2	-.017	.010	-.196	.002	.014	.019	-.008	.011	-.093	-.024	.006	-.418***	.247
3	.006	.011	.070	-.017	.016	-.181	.001	.013	.010	-.013	.007	-.218	.083
4	.010	.012	.101	-.013	.016	-.123	.004	.013	.040	-.017	.001	-.280*	.094
5	.003	.011	.030	.005	.016	.053	-.016	.013	-.180	-.011	.007	-.183	.064
6	.003	.011	.032	.000	.016	.004	-.021	.013	-.238	-.006	.007	-.106	.073
7	.003	.012	.026	-.002	.017	-.015	-.020	.014	-.218	.000	.008	.002	.051
8	-.007	.011	-.073	-.003	.015	-.031	-.021	.012	-.242	-.006	.007	-.095	.095
9	.004	.010	.043	-.009	.014	-.093	-.018	.011	-.228	-.003	.006	-.050	.090
10	-.001	.010	-.007	-.011	.014	-.117	-.012	.011	-.153	-.012	.006	-.230	.129
11	.005	.009	.061	-.012	.013	-.137	-.011	.010	-.161	-.007	.006	-.147	.099
12	-.003	.009	-.042	-.009	.013	-.109	-.010	.010	-.138	-.005	.006	-.107	.073

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 16 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of the Go/No-Go task scores

Blocks		Boldness			Meanness			Disinhibition			TONI			R ²
		<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Block 1	Hit count	-.023	.033	-.087	.021	.046	.041	.042	.037	.166	.004	.021	.023	.050
	Miss count	.027	.034	.100	-.027	.047	-.087	-.052	.038	-.201	.001	.021	.008	.070
	False alarms	-.009	.088	-.013	.062	.122	.076	.152	.099	.223	-.042	.055	-.090	.075
	Mean reaction time	-.537	.880	-.074	.382	1.223	.046	-2.309	.991	-.333*	-.221	.548	-.047	.109
Block 2	Hit count	-.003	.007	-.056	.000	.009	-.001	.001	.008	.025	.006	.004	.181	.035
	Miss count	.003	.007	.056	.000	.009	.001	-.001	.008	-.025	-.006	.004	-.181	.035
	False alarms	.026	.019	.169	-.028	.026	-.159	.041	.021	.280	-.019	.012	-.189	.095
	Mean reaction time	.089	.664	.016	-.724	.922	-.117	-1.037	.748	-.200	-.356	.414	-.101	0.98

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 17 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of the WCST task scores

	Boldness			Meanness			Disinhibition			TONI			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Correct responses	-.021	.070	-.038	.065	.099	.103	.014	.079	.027	.113	.045	.308**	.113
Total errors	.022	.071	.040	-.071	.100	-.111	-.017	.080	-.032	-.118	.045	-.317**	.122
Perseverative responses	-.063	.057	-.144	.174	.080	.344*	-.056	.064	-.133	.028	.036	.096	.086
Perseverative errors	-.014	.031	-.059	.081	.044	.289	-.037	.035	-.159	-.034	.020	-.206	.091
Non-Perseverative errors	.036	.077	.061	-.152	.109	-.221	.020	.087	.035	-.085	.050	-.212	.086

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

Table 18 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of Heart-rate and Heart-rate variability scores

		Boldness			Meanness			Disinhibition			R ²
		<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Heart-rate	<i>Baseline - 1</i>	.171	.369	.085	-.107	.517	-.045	.635	.477	.290	.073
	<i>WCST</i>	.396	.335	.213	-.088	.579	-.036	.756	.482	.371	.144
	<i>PA Task</i>	-.029	.474	-.011	.176	.664	.059	.326	.612	.119	.026
	<i>Go/No-Go - 1</i>	-.082	.382	-.040	.008	.536	.003	.345	.494	.156	.028
	<i>Go/No-Go - 2</i>	.012	.327	.007	-.179	.159	-.058	.533	.423	.277	.058
	<i>Baseline - 2</i>	-.133	.288	-.085	-.302	.401	-.163	.585	.370	.346	.100
Heart-rate variability	<i>Baseline - 1</i>	-.007	.033	-.038	-.009	.046	-.041	-.044	.043	-.227	.062
	<i>WCST</i>	.039	.045	.148	-.175	.063	-.550**	.101	.058	.347	.233
	<i>PA Task</i>	.001	.049	.003	-.032	.069	-.100	-.040	.064	-.138	.044
	<i>Go/No-Go - 1</i>	.005	.031	.033	-.008	.043	-.042	-.022	.040	-.124	.025
	<i>Go/No-Go - 2</i>	.005	.028	.031	.007	.039	.041	-.034	.036	-.208	.039
	<i>Baseline - 2</i>	.028	.038	.137	.004	.053	.015	-.038	.049	-.171	.052

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

3.2. Correlation Analysis

In an exploratory fashion and due to the limited results that emerged from the executed regression analysis, correlations were also computed between the variables in study. The associations of psychopathy with the experimental task scores were assessed using Spearman correlations, considering the non-normal distribution of the variables in study.

3.2.1. Psychopathy and Passive-Avoidance

Commission errors

There was no significant correlation between the three psychopathy facets and the error scores (both total and per block) within the passive-avoidance task (see *appendix 11*).

Omission errors

Table 19 shows the psychopathy correlations regarding omission error scores in the passive-avoidance task. Disinhibition and meanness (at marginal level) were negatively correlated to the total omission scores. Furthermore, Disinhibition scores were inversely correlated to PA omission scores from block 6 to block 12 (block 8 and 12 at a marginal level). Meanness was negatively correlated to omission scores from block 10 to 12 and, at a marginal level, to block 8 and block 9 scores. There were no relevant correlations regarding Boldness.

Table 19 - Associations between Boldness, Meanness and Disinhibition scores and Omission errors on the Passive Avoidance Task

Omission Errors	Boldness	Meanness	Disinhibition
<i>Total</i>	-.039	-.201	-.255*
<i>By value</i>			
1	.188	.004	-.027
1400	-.023	-.063	-.258*
1700	-.226	-.191	-.138
2000	-.050	-.229	-.116

<i>By block</i>				
1	.089	.032	-.070	
2	-.245*	-.156	-.162	
3	-.001	-.178	-.115	
4	.042	-.105	-.059	
5	.015	-.062	.167	
6	.008	-.133	-.243*	
7	.010	-.127	-.218	
8	-.108	-.195	-.270*	
9	.001	-.206	-.274*	
10	-.078	-.247*	-.260*	
11	-.008	-.241*	-.263*	
12	-.097	-.223	-.226	

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

3.2.2. Psychopathy and Go/No-Go

Table 20 shows the psychopathy correlations regarding Go/No-Go scores. Disinhibition was negatively correlated to the total miss scores (on block 1) and reaction time and positively correlated to false alarm scores on block 1. Furthermore, Meanness and disinhibition were negatively correlated to the reaction time on block 2. No significant correlations regarding Boldness.

Table 20 - Associations between Boldness, Meanness and Disinhibition scores and the Go/No-Go task scores

Blocks		Boldness	Meanness	Disinhibition
<i>Block 1</i>	Hit count	-.050	.153	.210
	Miss count	.060	-.180	-.248*
	False alarms	.009	.177	.242*
	Mean reaction time	-.083	-.159	-.304**

	Hit count	-.032	.028	.050
	Miss count	.032	-.028	-.050
<i>Block 2</i>	False alarms	.118	.012	.162
	Mean reaction time	-.039	-.235*	-.275*

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

3.2.3. Psychopathy and the Wisconsin card-sorting task

There was no significant correlation between the three psychopathy facets and the scores within the Wisconsin card-sorting task (see *appendix 12*).

3.2.4. Psychopathy and Heart-rate measures

Table 21 shows the correlations regarding heart-rate and heart-rate variability (RMSSD) measures and psychopathy. Meanness was negatively correlated to the RMSSD measure within the WCST. No other significant correlations arose.

Table 21 - Associations between Boldness, Meanness and Disinhibition scores and the Heart-rate and Heart-rate variability scores

	Boldness	Meanness	Disinhibition
<i>Baseline - 1</i>	.045	.107	.254
<i>WCST</i>	.159	.195	.316
<i>PA Task</i>	-.032	.123	.152
<i>Heart-rate</i>			
<i>Go/No-Go - 1</i>	-.064	.089	.164
<i>Go/No-Go - 2</i>	-.029	.064	.231
<i>Baseline - 2</i>	-.128	.027	.271

	<i>Baseline - 1</i>	-.002	-.161	-.244
	<i>WCST</i>	124	-.371*	.030
	<i>PA Task</i>	.028	-.174	-.192
<i>Heart-rate variability</i>	<i>Go/No-Go - 1</i>	.054	-.111	-.152
	<i>Go/No-Go - 2</i>	.059	-.072	-.191
	<i>Baseline - 2</i>	.162	-.084	-.183

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

4. Discussion

The present study focused on developing ideas already explored in the previous studies, regarding the speculated link between psychopathic traits and stimulus-reinforcement learning deficits and sensation seeking. Past analysis, despite pointing in the right direction, lacked crucial experimental measures, such as a passive-avoidance learning task and a resting-state arousal measure, that would allow further consolidation of these hypotheses. In the previous studies, it was suggested that the relation between psychopathy and criminal intention mediated through criminal attitudes could be an outcome of deficits in stimulus-reinforcement learning abilities, which have been repeatedly associated with psychopathy (Birbaumer et al., 2005; Lykken, 1957; Newman & Kosson, 1986). Studies 1 and 2 also lent psychometric evidence concerning psychopathy's tendency towards seeking out antisocial behavior as a mean to restore arousal back to optimal levels in individuals often described as under aroused (Eysenck & Gudjonsson, 1989; Zuckerman, 1994; Portnoy et al., 2014). Building on these premises, this specific study analyzed the participant's stimulus-reinforcement learning ability through the use of a passive-avoidance experimental task as well as resting-state arousal via ECG data acquisition. Furthermore, a Go/no-Go task was also integrated allowing for an effective response inhibition measure. Along with these tasks, the Wisconsin card-sorting task was also included in the protocol in order to evaluate the participant's adaptation ability while facing changing schedules of reinforcement (Berg, 1948). An IQ measure was also included.

Overall, the general data regarding the passive-avoidance task was inconclusive. In fact, contrary to what was expected, no significant correlations arose between the psychopathic traits and the commission error scores within the task. The same happened when the error score was separated by block with the objective of controlling the learning curve that was expected to occur due to the participant's in-task experience (Blair, et al., 2004). Meanness and disinhibition showed a few significant associations with the errors per block however these results lacked consistency (passive-avoidance errors should have been evident across most of the blocks; Blair, et al., 2004). The inclusion of an IQ variable (TONI) showed that most of the reported errors in the passive-avoidance task have a strong influence of intelligence. In fact, the TONI score was statistically significant in almost every passive-avoidance-related variable, attesting for the major influence of intelligence in learning processes. The influence of the IQ was also evident in other experimental tasks (i.e. WCST). Despite this influence, some significant correlations were evident concerning the passive-avoidance omission errors. In fact, both meanness and disinhibition were inversely related to the omission scores. Furthermore, when separated by block, it was evident that only the later blocks were affected by the previously mentioned facets, implying that omission errors became more prevalent towards the end of the task. It does not make sense that these individuals "un-learned" which numbers they should press.

One could hypothesize that these individuals could have made a conscious decision of simply focusing on avoiding the "bad" numbers, rather than aiming to get more points. This way, they would keep the already acquired points without the risk of losing. However, research shows that highly disinhibited individuals are prone to be risk-seekers rather than loss averse (Eysenck & Gudjonsson, 1989; Zuckerman, 1994; Portnoy et al., 2014). This would lead to higher commission error scores and not fewer omissions. Also, this hypothesis fails to explain the learning regression, since the omission scores in the first blocks are not significantly correlated with psychopathy. Another possible explanation could be that these individuals get progressively tired as the task progresses. In fact, the longer the task, the more distracted they get, leading them to frequently miss rewarding numbers. Research has shown that individuals lacking self-control have a tendency to be more easily distracted (Gottfredson & Hirschi, 1990; Grasmick et al., 1993).

Even though no tendency regarding stimulus-reinforcement learning in psychopathy was evident within the passive-avoidance task, another result was evident. In fact, much like the expectation-value correlations in study 2, these results concerning the omission error scores are correlated to both meanness and disinhibition, and not to boldness (unlike study 1). As previously mentioned, the explanation behind these results may reside in the specificities of the non-forensic sample in contrast to the forensic one. In fact, some of the variance expressed by disinhibition in non-forensic samples may reflect characteristics related to abnormal amygdala structure (Refer to Study 2 – Discussion; Vieira et al., 2015).

According to Blair (2015), deficits in reinforcement-learning decision-making are not exclusive to psychopathic individuals. In fact, several other studies have come across the same type of impairments in individuals with other types of behavioral disorders, such as oppositional defiant disorder, conduct disorder and antisocial personality disorder (Finger et al., 2008; De Brito, 2013; White, et al., 2014) even when lacking specific psychopathic traits. The research seems to point out that passive-avoidance-related deficits are related to antisocial behavior rather than psychopathy in particular (Blair, 2015). This hypothesis is consistent with the reported results. In fact, in the light of these studies, since the used sample is normative in its nature (at least from a strictly criminal point of view) and, therefore, lacks actual relevant criminal experience/behavior, the inexistence of reinforcement-learning deficits is actually expected. Blair's sample (Blair et al., 2004) as previously mentioned, is composed of incarcerated individuals, therefore, the reported passive-avoidance learning deficits could be related to the nature of the sample (criminal/forensic) and not to its psychopathic characteristics.

Another tendency that arose from the experimental tasks is related to the decreased number of errors exhibited within the Go/No-Go task. In fact, individuals with higher disinhibition scores report fewer Go errors but, at the same time, also report a higher number of false alarms. The inherent characteristics of disinhibited individuals leads them to respond more often than the other participants, which also results in more false alarms (i.e. pressing the key in a No-Go situation). According to Patrick and colleagues (2009), higher disinhibition is associated with deficient behavioral control, as well as propensity towards impulse control problems. The same tendency is also reflected through the within-task

reaction times; disinhibited individuals take less time to answer the stimulus, which means they spend less time reviewing the stimulus and act more impulsively when answering to it. This tendency to act faster, combined with a weaker motor-response inhibition could explain the previously reported results.

Despite the already mentioned results, no other relevant information arose from the explored data. In fact, there were no other significant tendencies regarding both the tasks and psychophysiology measures. One possible reason behind this may be the small sample used in this study, especially in the case of the ECG measures. The used sample in the experimental tasks reached 73 participants but, due to poor signal, 41 participants had to be excluded. When taking a closer look, it seems that some of the ECG correlations are on the verge of becoming statistically significant if it were not for the small sample size. For this same reason, it was not possible to validate the risk-seeking/under-arousal hypothesis. The same seems to happen in regard to the laboratorial tasks, even though other studies also use small sample sizes (normally with higher scores of psychopathy). For instance, Blair and colleagues (2004) apply this same passive-avoidance task to a sample of 40 participants with clear results. However, the forensic nature of Blair's sample may explain these differences. The distinct psychopathy representation in forensic *vs.* non-forensic context, in which meanness associates with boldness (in the first) and disinhibition (in the latter) could also imply a different expression of the stimulus-reinforcement learning disabilities (perhaps related to the omission error scores) or even the inexistence of such disability. The same is also true in regard to other studies including Go/No-Go tasks; all the following studies include samples of less than 60 participants (Jodo & Kayama, 1992; Kamarajan et al., 2005; Boggio, Boggio, Nunes, Rigonatti, Nitsche, Pascual-Leone & Fregni, 2007; Casey, Trainor, Orendi & Schubert, 2008). It is important that future research takes this into account, especially in regard to the ECG data. Other limitations pointed out to Study 2 also apply to study 3 (i.e. scale battery in *online* format; academic sample).

In conclusion, the present data complements, to certain extent, Studies 1 and 2 on the underlying mechanisms of psychopathy. Even though no proof regarding learning disabilities in psychopathic individuals has risen from the reported data, some conclusions towards the disinhibition facet, as well as, its close relation to meanness in non-forensic samples have

been reached. Furthermore, future research should apply this same protocol in a forensic context, in order to compare and also explore the existence of stimulus-reinforcement learning deficits using a dual-process conceptualization of psychopathy. Once again, further implications of these results will be addressed in the general discussion.

STUDY 4 – Psychopathy and Loss Aversion: The influence of psychopathic traits on heuristics-based thinking

1. Introduction

The previously described studies focus on more rational elements of the decision-making process, however, psychopathy also seems to be connected to deficits regarding more automatic processes, such as some types of heuristics. The previously collected information about heuristics seemed to imply possible influences of psychopathic traits over heuristic processing. Since the literature on heuristics is vast, the current research focus exclusively on the impact of loss aversion (and other heuristics that are fundamentally dependent of loss aversion). The present study inspects the relationship between psychopathic traits, self-control and other personality components (Machiavellianism and Narcissism) and the use of heuristics (loss aversion, framing effect and the sunk costs effect). In a more specific fashion, the aim of the research was to explore the distinctions in the use of heuristics, as well as, the occurrence of cognitive biases in different spectrum gradients of distinct (but associated) personality traits. As previously mentioned, heuristics are simple automatic rules that act as shortcuts in the decision-making process when the individual lacks information or some kind of insight (Alan, 2008). These “shortcuts” can, however, be prejudicial to optimal decision-making, since they sometimes disregard crucial elements of the problem, causing systematic errors that compromise logical thinking (Tversky & Kahneman, 1974).

During the development of their research, Tversky and Kahneman (1984) came across a vast variety of different cognitive biases that are said to impact human decision. Loss aversion is one of such examples. According to the authors, the majority of people dislike taking risks, surfacing a clear preference for a sure outcome. This inclination towards prioritizing loss avoidance over obtaining equivalent rewards was entitled loss aversion (Kahneman & Tversky, 1979). This heuristic has been systematically researched and solidified over the years (ie. Baumeister, et al., 2001; Rozin & Royzman, 2001; Vaish, et al., 2008; Fiske, 1980; Rook, 1984; Costantini & Hoving, 1973; Ganzach & Karsahi, 1995) and, according to Tversky and Kahneman (1981) this tendency to be aversive to losses can lead to erroneous decisions when the problem involves pondering on possible losses and taking risks.

The framing effect is a cognitive bias that results from the use of the loss aversion heuristic (Tversky & Kahneman, 1981). According to Plous (1993), the framing effect is a

decision bias in which individuals respond in a different way to a particular judgement, depending on how the choices are presented. Tversky and Kahneman (1981) concluded that the way a problem is formulated can have a major influence on the final decision. In fact, when presented with two equal scenarios with different formulations (one involved “saving lives” and the other involved “losing lives”) the participants exhibited different responses even though the outcomes remained exactly the same; choices that resulted in gains led to risk averse responses, while choices involving losses led to risk taking ones (Tversky & Kahneman, 1981). Such a minor change in problem wording culminated in a massive shift from risk averse to risk taking. Several other studies (i.e. Mayhorn, et al, 2002; Mikels & Reed, 2009; Gonzalez, et al., 2005) have tested the impact of this bias and attested for its influence over human decision.

Also in line with the human tendency to loss aversion surfaces the sunk cost effect. According to Arkes and Blumer (1985), this heuristic is manifested by an illogical inclination to persevere in an endeavor once investment (money, effort, time, etc.) has been made, even if this endeavor leads to unpleasantness. This persistence is the result of a desire not to appear wasteful. In the case of the sunk cost effect the investment of resources acts as a motivator towards the behavior, even though it should have no impact over the decision. Arkes and Blumer’s research (1985) supports the existence and influence of this effect through several experimental scenarios. Several other studies also attest the importance of this heuristic to the decision process (i.e. Garland, 1990; Garland & Newport, 1991; Moon, 2001; Strough, Mehta, McFall & Schuller, 2008; Roodhooft & Warlop, 1999).

As previously described, all the heuristics under study are dependent on loss aversion. Several studies report the framing effect as a cognitive bias that results from loss aversion (e.g. Tversky & Kahneman, 1981; Mayhorn, et al., 2002; Mikels & Reed, 2009; Harinck, et al., 2007). The same happens in regard to *sunk costs* (e.g. Arkes & Blumer, 1985; Thaler, 1980); in fact, the prospect theory (Kahneman & Tversky, 1979) explains how aversive events, such as losses, lead to difficulties in ignoring illogical decision-making elements such as *sunk costs*. The last included heuristic scale (*risk perception*) is also closely linked to loss aversion; as previously mentioned, loss aversion is related to an active avoidance of risky behaviors due to their aversive nature (Kahneman & Tversky, 1979). Having *loss aversion*

as a common ground between all the heuristics in study will allow for a composite analysis of all three scales, attesting for the heuristic effect of *loss aversion* in decision-making. Due to this connection, the hypothesis in study will be formulated in regard to the general effect of loss aversion rather than the individual effect of each heuristic. Taking into account the already established link between psychopathic traits, emotional learning deficits and negative emotionality (fearlessness), it would be expected that psychopathic individuals (especially meanness) would present a higher resistance to loss aversion. The close link between loss aversion and emotion, paired up with difficulties in emotion processing exhibited by psychopathic individuals could lead to a greater resistance to this type of affect-based judgement biases. Furthermore, according to Tom, Fox, Trepel and Poldrack (2007), loss aversion is closely related to activity in the ventral striatum and pre-frontal cortex. These brain systems are often associated with low self-control and other impulse control problems (e.g. Carlson, et al., 2009; Blumer & Benson, 1975; Kim & Lee, 2011; Brevet-Aeby, Brunelin, Iceta, Padovan & Poulet, 2016). Considering this pre-established link between loss aversion and impulsivity-related brain regions, it would be expected that individuals with higher scores of disinhibition would also exhibit some type of resistance to the heuristic in study. Further consolidating this hypothesis is the link between impulsivity and risk seeking (e.g. Benning et al., 2003; Benning, et al., 2005; Patrick et al., 2009; Gatzke-Kopp, et al., 2002). Heuristics, such as the previously mentioned, are dependent of the loss aversion bias, which is characterized by the avoidance of losses and risk-prone behaviors, hence, individuals typically characterized as risk-seekers would seem to be resistant to loss aversion.

As complementary data, self-control (Grasmick scale) and other personality measures (Dark Triad – Machiavellianism and narcissism) were also added to the research. Even though the TriPM is an extensively validated self-reported psychopathy scale (e.g. Marcus, et al., 2006; Marcus, John & Edens, 2004; Walters, et al., 2015; Almeida et al., 2014; Drislane, et al., 2014; Vieira & Marsh, 2013) the inclusion of other measures would allow to control the frailties of using only a single scale. For this purpose, the Grasmick scale was included in other to control the externalizing element, whilst the Dark Triad covered the psychopathy component.

2. Method

2.1. Participants and procedure

Participants were 218 university students (81 male and 137 female) selected by convenience from the roster of several universities around Portugal (mean age = 25.10, SD = 7.202). The test batteries were administered in online format and were distributed *via* email using the university contact database. The used sample is composed of three groups. The first group filled-in the Sunk Cost scenarios, the second filled-in the Resistance to Framing scenarios and, the third filled-in Consistency in Risk Perception scenarios. All sample groups include every other scale listed. The number of participants in each part are: 92 for Sunk costs group, 92 for the Resistance to framing and 34 for Consistency in risk perception.

The battery compilation was arranged like the following: Triarchic Psychopathy Measure (Patrick, 2010) (TriPM), The Dark Triad scale (Jonason & Webster, 2010), Grasmick self-control scale (Grasmick, et al., 1993), Sunk Costs Scenarios /Resistance to Framing Scenarios/Consistency in Risk Perception scenarios (Bruine de Bruin, Parker & Fischhoff, 2007), sociodemographic data (gender, age, current job, education, degree). The used scenarios and some of the used scales were adapted and translated (using the *translate/back-translate* method; Prieto, 1992; Geisinger, 1994) by our research group. The translating procedure included the following steps: first, two different researchers translate the original scale into the desired language; second, both versions are compared, and all inconsistencies are corrected; lastly, the final scale is inspected and translated back to the original language by a third researcher in order to evaluate the resemblance with the original scale.

The following table (table 22) exhibits the different mean scores of the three scales, segregated by gender.

Table 22 - Mean and standard deviation scores for TriPM, Dark triad and Grasmick scales in both male and female participants

Scales	<i>Total</i>		Male		Female	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
<i>TriPM</i>						
<i>Boldness</i>	46.28	9.45	49.90	9.65	44.32	8.80
<i>Meanness</i>	29.08	7.74	30.91	7.62	28.00	7.63
<i>Disinhibition</i>	33.88	7.74	34.34	8.50	33.62	7.27
<i>Dark Triad</i>						
<i>Psychopathy</i>	13.40	2.21	12.82	2.18	13.75	2.17
<i>Machiavellianism</i>	13.57	2.50	13.28	2.72	13.75	2.35
<i>Narcissism</i>	10.16	2.76	9.96	2.62	10.28	2.84
<i>Grasmick</i>						
<i>Impulsivity</i>	12.05	2.73	11.74	2.82	12.24	2.67
<i>Preference for simple tasks</i>	12.07	2.73	12.72	2.65	11.69	2.65
<i>Risk seeking</i>	12.33	2.86	11.87	2.86	12.59	2.83
<i>Preference for physical activities</i>	11.39	2.87	10.61	2.72	11.85	2.86
<i>Self-centered orientation</i>	13.31	2.39	13.04	2.49	13.47	2.32
<i>Temperament</i>	12.34	2.78	12.76	2.47	12.10	2.93

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

2.2. Instruments

All participants completed the full-scale batteries.

Psychopathy scale. This study also included the TriPM scale as psychopathy measure (refer to Study 1). In the present sample alpha coefficients were $\alpha = .864$ for Boldness, $\alpha = .864$ for Meanness, and $\alpha = .831$ for Disinhibition. Boldness was positively correlated with

Dark triad - narcissism ($r = .152, p = .024$) and Dark triad - Machiavellianism ($r = .220, p = .001$). Meanness was positively correlated to DT - narcissism ($r = .167, p = .014$), DT - Machiavellianism ($r = .495, p = .000$), DT - psychopathy ($r = .718, p = .000$) and with the total Grasmick score ($r = .638, p = .000$). Disinhibition was also positively correlated to DT - narcissism ($r = .380, p = .000$), DT - Machiavellianism ($r = .393, p = .000$), DT - psychopathy ($r = .384, p = .000$) and with the total Grasmick score ($r = .640, p = .000$).

Dark Triad: Dirty Dozen scale. The “Dirty Dozen” is a 12-item self-report scale that measures three different personality constructs: *Narcissism*, *Machiavellianism* and *psychopathy* (Jonason & Webster, 2010). This scale has been extensively validated (Jonason & Luévano, 2013; Maples, Lamkin, & Miller, 2014; Rauthmann & Kolar, 2012; Webster & Jonason, 2013, Jonason, Kaufman, Webster & Geher, 2013) and has been proven to have good psychometric properties. This inventory is a shorter version of the original Dark Triad scale which included 91 items, a compilation of the Narcissistic Personality Inventory (NPI; Raskin & Terry, 1988), MACH-IV (Christie & Geis, 1970) and SRP-III (Self-Report Psychopathy Scale-III; Paulhus, Hemphill, & Hare, in press). There are 4 items for each construct. Items are responded in a 4-point Likert scale.

Narcissism is conceptualized as a grandiose sense of self-importance, egotistical thinking and exhibitionism. Machiavellianism, on the other hand, involves a degree of detachment and a calculating nature. The psychopathy construct focus on the characteristic lack of regard and concern for others. Together these constructs are manifested as a callous, manipulative and malevolent personality (Wright, et al., 2016).

The Portuguese version of the DT was constructed by ourselves, using the typical *translate – translate back* method (Prieto, 1992; Geisinger, 1994). In this sample alpha coefficients were $\alpha = .770$ for Narcissism, $\alpha = .723$ for Machiavellianism, and $\alpha = .571$ for psychopathy. Narcissism, machiavellianism and psychopathy were all positively correlated with the total Grasmick score ($r = .214, p = .002$; $r = .406, p = .000$; $r = .505, p = .000$),

Grasmick self-control scale. The Grasmick scale is a 24-item self-report inventory that measures self-control. This questionnaire was created from Gottfredson and Hirschi’s General Theory of Crime (1990) and it measures six different self-control-related personality traits: *Impulsivity*, *Preference for simple tasks*, *Risk seeking*, *preference for physical activities*

(*in contrast to more cerebral-based ones*), *self-centred orientation* and *low frustration tolerance*.

The *impulsivity* component is defined by a tendency to immediately act on stimuli and rejection for delayed gratification. The *Preference for simple tasks* element takes into account the individual's lack of tenacity and persistence, which leads the individual into choosing the simplest path towards its objectives. *Risk seeking* is conceptualized as a propensity towards adventure, danger, and of risky decision-making in detriment of safety. The *preference for physical activities* is directed towards a frequent rejection of more cognitive activities such as reading. The *self-centered orientation* component characterizes an individual that is mainly focused on himself, often disregarding others. Lastly, *temperament* refers to the low level of tolerance, difficulty to inhibit violent responses when faced with conflict (Grasmick, et al., 1993).

Items are responded in a 4-point Likert scale. The Portuguese version of the Grasmick was constructed by our university's research group for previous use in other studies. In this sample alpha coefficients for the six dimensions were $\alpha = .736$ for *impulsivity*, $\alpha = .791$ for *Preference for simple tasks*, $\alpha = .794$ for *Risk seeking*, $\alpha = .729$ for *preference for physical activities*, $\alpha = .698$ for *self-centered orientation*, and $\alpha = .694$ for *temperament*.

Adult Decision-making Competence. The Adult Decision-making Competence (ADMC). The ADMC (Bruine de Bruin, et al., 2007) is a test battery that was derived from the YDMC (Youth Decision-Making Competence) (Bruine de Bruin, et al., 2007) and is composed of seven scales that measure different branches of the decision-making process. For the present study, we chose only three of the seven scales. The selection of the specific scales was based on the size of the samples, as well as, the relevance of each specific heuristic. In fact, only loss aversion-related scales were included. Furthermore, the inclusion of every subscale would lead to a reduced sample size in each separate scale along with a significant and unwanted increase in questionnaire duration. For these reasons, only three out of the total seven scales were included.

The Resistance to Framing scale measures the degree to which the assessment of value is influenced by unrelated variations to the problem description. This scale consists of fourteen risky-choice scenarios, with equivalent gain and loss versions (7 with positive and

7 with negative wording) of the decision problems (each with a risky-choice option and a sure-thing option). These items include a strength-of-preference rating scale (each endpoint reflects a strong preference for each of the two options) with 6-points.

The Sunk Costs scale is composed of 10 scenario-like items focused on the individual resistance to the sunk cost effect. These scenarios include not only money-related investments, but also time and effort related ones. Each item has a 6-point Likert scale that fluctuates between low to high susceptibility to the effect in question, specific to each scenario.

The Consistency in Risk Perception scale is designed to evaluate the individual's ability to follow probability rules. This measure is composed of 20 items in which the participant is asked to judge the chance of a specific event happening to them on a linear scale that ranges from 0% to 100%. Each event is evaluated twice; the first time in regard to the probability within the next year and, the second, in regard to the likelihood in the following 5 years.

In the present sample alpha coefficients for the three heuristics in study were $\alpha = .783$ for *Resistance to Framing*, $\alpha = .412$ for *Sunk Costs*, and $\alpha = .711$ for *Consistency in Risk Perception*. The present scale was translated using a back-translating method involving three different researchers from the research group.

3. Results

In order to test the relation between the psychopathy elements and loss aversion a composite measure of collected heuristic data was compiled using the three heuristic scales (i.e. sunk costs, framing effect and consistency in risk perception). This compilation was motivated by the common etiology of the three heuristics in study. This procedure also allowed for a larger sample size, composed of all the samples combined (N=218). This variable was computed as the mean of the ZScores from each heuristic total. Furthermore, analysis have been conducted to both male and female participants separately due to the reported gender differences in loss aversion (Byrnes, Miller & Schafer, 1999; Schubert, 2006; Rau, 2014).

3.1. Regression analysis

A) *TriPM and loss aversion in male sub-sample*

Table 23 shows regression analysis of the TriPM facets as predictors of the composite measure of loss aversion in the male sub-sample. None of the TriPM facets worked as a significant predictors of loss aversion.

Table 23 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of loss aversion in the male sub-sample

Blocks	Boldness			Meanness			Disinhibition			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Loss Aversion	.009	.012	.089	.005	.017	.036	-.008	.015	-.069	.015

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

B) *TriPM and loss aversion in female sub-sample*

Table 24 shows regression analysis of the TriPM facets as predictors of the composite measure of loss aversion in the female sub-sample. Boldness acted as a significant predictor (negatively) of loss aversion. There were no other significant associations.

Table 24 - Regressions of Boldness, Meanness and Disinhibition scores as predictors of loss aversion in the female sub-sample

Blocks	Boldness			Meanness			Disinhibition		
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β
Loss Aversion	-.019	.010	-.172*	-.014	.013	-.105	-.013	.014	-.092

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

C) Dark Triad and loss aversion in male sub-sample

Table 25 shows regression analysis of the Dark Triad components as predictors of the composite measure of loss aversion in the male sub-sample. There were no significant associations.

Table 25 - Regressions of Psychopathy, Machiavellianism and Narcissism scores as predictors of loss aversion in the male sub-sample

Blocks	Psychopathy			Machiavellianism			Narcissism		
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β
Loss Aversion	-.064	.046	-.170	-.035	.049	-.097	.054	.056	.119

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

D) Dark Triad and loss aversion in female sub-sample

Table 26 shows regression analysis of the Dark Triad components as predictors of the composite measure of loss aversion in the female sub-sample. Only Machiavellianism acted as a significant predictor (positively) of loss aversion.

Table 26 - Regressions of Psychopathy, Machiavellianism and Narcissism scores as predictors of loss aversion in the female sub-sample

Blocks	Psychopathy			Machiavellianism			Narcissism		
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β
Loss Aversion	-.021	.031	-.059	.096	.039	.227*	.018	.041	.038

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

E) Grasmick and loss aversion in male sub-sample

Table 27 shows regression analysis of the Grasmick components as predictors of the composite measure of loss aversion in the male sub-sample. *Preference for physical activities* was the only significant predictor (negatively) of loss aversion.

Table 27 - Regressions of the Grasmick scale components as predictors of loss aversion in the male sub-sample

Grasmick		Loss aversion
	<i>b</i>	.010
<i>Impulsivity</i>	SE <i>b</i>	.044
	β	.028
<i>Preference for simple tasks</i>	<i>b</i>	-.099
	SE <i>b</i>	.047
	β	-.024
<i>Risk seeking</i>	<i>b</i>	-.058
	SE <i>b</i>	.042
	β	-.168
<i>Preference for physical activities</i>	<i>b</i>	-.095
	SE <i>b</i>	.044
	β	-.260*
<i>Self-centered orientation</i>	<i>b</i>	.010
	SE <i>b</i>	.047
	β	.024
<i>Temperament</i>	<i>b</i>	-.012
	SE <i>b</i>	.053
	β	-.031
	R ²	.107

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

F) Grasmick and loss aversion in female sub-sample

Table 28 shows regression analysis of the Grasmick components as predictors of the composite measure of loss aversion in the female sub-sample. Only risk seeking acted as a significant predictor (positively) of loss aversion.

Table 28 - Regressions of the Grasmick scale components as predictors of loss aversion in the female sub-sample

Grasmick		Loss aversion
	<i>b</i>	.010
<i>Impulsivity</i>	SE <i>b</i>	.040
	β	.027
<i>Preference for simple tasks</i>	<i>b</i>	.001
	SE <i>b</i>	.034
	β	.004
<i>Risk seeking</i>	<i>b</i>	.085
	SE <i>b</i>	.035
	β	.242*
<i>Preference for physical activities</i>	<i>b</i>	-.033
	SE <i>b</i>	.034
	β	-.096
<i>Self-centered orientation</i>	<i>b</i>	.010
	SE <i>b</i>	.041
	β	.023
<i>Temperament</i>	<i>b</i>	.000
	SE <i>b</i>	.034
	β	.001
	R ²	.056

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

3.2. Correlation analysis

In an exploratory fashion and due to the limited results that emerged from the executed regression analysis, correlations were also computed between the variables in study. The associations of psychopathy and the other personality components with the loss aversion composite measure were assessed using Spearman correlations, considering the non-normal distribution of the variables in study.

A) *TriPM and loss aversion in male sub-sample*

There were no significant correlations regarding the TriPM facets and the loss aversion composite measure in the male sub-sample (see *appendix 13*).

B) TriPM and loss aversion in female sub-sample

Table 29 shows the correlations regarding the three TriPM subscales and the loss aversion composite measure in the female-only sample. Both boldness and meanness were inversely related to the effect of loss aversion. No other correlation was evident.

Table 29 - Associations between Boldness, Meanness and Disinhibition scores and loss aversion in the female sub-sample

	Boldness	Meanness	Disinhibition
<i>Loss aversion</i>	-.190*	-.188*	-.142

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

C) Dark Triad and loss aversion in male sub-sample

There were no significant correlations regarding the Dark Triad and the loss aversion composite measure in the male sub-sample (see appendix 14).

D) Dark Triad and loss aversion in female sub-sample

Table 30 shows the correlations regarding the three Dark Triad subscales and the loss aversion composite measure in the female-only sample. Only Machiavellianism was positively related to loss aversion. No other correlations emerged.

Table 30 - Associations between Psychopathy, Machiavellianism and Narcissism scores and the loss aversion in the female sub-sample

	Psychopathy	Machiavellianism	Narcissism
<i>Loss aversion</i>	.110	.225**	.005

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

E) Grasmick and loss aversion in male sub-sample

Table 31 shows the correlations regarding the individual components of the Grasmick scale subscales and the loss aversion measure in the male-only sample. Only the *risk seeking* and *preference for physical activities* components were inversely related to the heuristic effect.

Table 31 - Associations between the Grasmick scale components and the loss aversion in the male sub-sample

Grasmick	Loss aversion
<i>Impulsivity</i>	-.048
<i>Preference for simple tasks</i>	.102
<i>Risk seeking</i>	-.219*
<i>Preference for physical activities</i>	-.287**
<i>Self-centered orientation</i>	.006
<i>Temperament</i>	.028

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

F) Grasmick and loss aversion in female sub-sample

Table 32 shows the correlations regarding the individual components of the Grasmick scale subscales and loss aversion in the female-only sample. Only the *risk seeking* component was positively related to the heuristic effect.

Table 32 - Associations between the Grasmick scale components and the loss aversion in the female sub-sample

Grasmick	Loss aversion
<i>Impulsivity</i>	.081
<i>Preference for simple tasks</i>	-.025
<i>Risk seeking</i>	.221*
<i>Preference for physical activities</i>	.012
<i>Self-centered orientation</i>	.067
<i>Temperament</i>	.088

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

4. Discussion

The present study focused on exploring the influence of psychopathic and impulsivity-related traits on three distinct decision-making heuristics (*framing effect*, *sunk costs* and *consistency in risk perception*). It was hypothesized that psychopathic individuals would present a higher resistance to the sunk cost effect, mainly due to the frequently reported learning difficulties regarding negative outcomes of their behavior (Blair, 2005; Gorenstein & Newman, 1980; Lykken, 1957), as well as their tendency towards sensation-seeking behavior (Gottfredson & Hirschi, 1990; Patrick et al, 2009). The same was expected in regard to the framing effect. As previously mentioned, this heuristic is connected to loss aversion. Since psychopathic individuals are often characterized as risk-seekers (Patrick et

al., 2009) some degree of resistance towards this heuristic should emerge. Lastly, and in regard to *consistency in risk perception*, it was hypothesized that individuals with higher psychopathy scores would exhibit less consistent risk-perception. Also, the close link between impulsivity and risk-seeking behavior should also be evident in regard to the heuristics in study.

Contrary to what was expected, no significant results were extracted from the analysis of the three heuristics in study. Since the samples for each heuristic was relatively small in size (as previously stated) a compiled measure of all three heuristics was calculated through the use of Zscores and further analysis were conducted. Even though, initially, no new data emerged from the computed correlations when using the full sample, posterior examination led to a few significant associations in a female-only sub-sample, extracted from the main one.

Consistent with the previously mentioned hypothesis, higher scores of psychopathic traits (as defined by the TriPM) were associated with lower vulnerability to loss aversion (in the female sub-sample). As previously mentioned, the researched heuristics (framing effect and sunk cost) share a common ground with loss aversion (Tversky & Kahneman, 1981). Individuals who are described as loss averse, with fear of losing resources, will refrain from taking risks as long as they see those risks as probable, even when equal gains are at stake (Tversky & Kahneman, 1984). Putting it into perspective, loss aversive behavior is conceptually opposed to risk-seeking. As previously stated, sensation-seeking behavior is a common characteristic among several psychopathy models (e.g. Benning et al., 2003; Benning, Patrick, Blonigen, et al., 2005; Patrick et al., 2009). In fact, within the triarchic conceptualization of psychopathy (Patrick et al, 2009) thrill-seeking behavior is perceived as an integrated part of both trait-fearfulness-related subscales: boldness and meanness. “Boldness can be viewed as the nexus of (...) thrill-adventure seeking. (...) The term mean describes a constellation of phenotypic attributes including (...) excitement seeking” (Patrick et al, 2009). Furthermore, Gottfredson and Hirschi’s GTC (1990) also mentions the importance of this type of behavior as a main characteristic within the conceptualization of low self-control. Given this proximity between psychopathic traits and risk-seeking behavior, the assumption that individuals with higher psychopathic traits will be less susceptible to the

loss aversion heuristic seems fundamentally plausible. The same seems to be true in regard to the *framing and sunk costs effects*, since their mechanisms are, fundamentally, modulated by loss aversion (Tversky & Kahneman, 1984; Arkes & Blumer, 1985).

Psychopathic individuals are often defined as empathy deficient, with severe emotional processing impairments, related to consistently proven amygdala abnormalities (Patrick et al, 2009). Since emotion plays an important role in the decision-making process, its impact on heuristic-based thinking should be noted (Kahneman et al., 1999; Druckman & McDermott, 2008). According to Thaler (1980) the role of emotion in heuristic use (*framing effect*) is evident with the *mental accounting* process (this process describes the way people seek to organize, trade-off, evaluate and rationalize different options and events with their lives). According to the author, when mental accounts come to a close, they induce strong emotions and individuals must draw up some type of mental balance sheet for particular experiences. Choosing to either indulge or close a mental account sustains punishments or rewards and their timing is determined, at least partially, by the individual (Kahneman & Tversky, 2000). The sunk cost effect is a clear manifestation of this. In fact, in a normative assessment, sunk costs should never be weighted in the decision of future actions, however, its emotional charge frequently pulls in the opposite direction, which may lead individuals to delay the closing of a specific mental account (Druckman & McDermott, 2008). Furthermore, according to Druckman and McDermott (2008) emotion can moderate framing effects in particular contexts and have distinct impacts depending on which emotion works as a vessel. For instance, anger encourages risk-seeking whilst distress leads to a more cautious approach (Druckman & McDermott, 2008). In their 2016 study, Schulreich, Gerhardt and Heekeren concluded that fear (through exposure to fearful faces) caused an increase in loss aversion. The important role of emotion within heuristic use could also contribute to explain the reason behind psychopathy's resistance to these heuristics (framing and sunk costs). Impaired emotional processing might also imply attenuated loss aversion influence. In fact, Schulreich, Gerhardt and Heekeren's (2016) data shows that fearless-dominance, in its interpersonal facet, lessened the effect of incidental fear cues on loss aversion, consistent with reduced fear reactivity.

However, as previously pointed out, these hypotheses only appear to be true concerning the female sub-sample. The reason behind these gender-segregated results may rest in different reasons. On one hand, even though female subjects almost always report lower psychopathy scores than males (Falkenbach, Reinhart & Larson, 2017; Bolt, Hare, Vitale & Newman, 2004; Stickle, Marine & Thomas, 2011; Sutton, Vitale & Newman, 2002; Jackson, Rogers, Neumann & Lambert, 2002), some studies have reported that female individuals with high psychopathy scores also exhibit higher levels of callous-unemotional trait (CU) than males with equally high levels of psychopathy (Stickle, et al., 2011). Furthermore, according to other studies (Jackson, et al., 2002; Rogstad & Rogers, 2008), results show that affective features seem to be particularly salient when comparing psychopaths Vs. non-psychopaths in females. These studies show that psychopathy in women also encompasses severe emotional deficits and, in some cases, even greater than in men. In a speculative manner, the reason behind the gender unilateral psychopathy correlations to heuristic biases may rest within these exacerbated emotional deficits; the results only show up in the female sub-sample because the representation of psychopathy in that group is more severe than in males, not in terms of psychopathy scores, but in regard to the severity of specific traits that appear to be more salient in the female sub-group.

The reason behind the gender-segregated data may also reside in salient gender differences in regard to heuristic processing, specifically in the case of loss aversion/risk-taking. Several studies, including a meta-analysis, showed a tendency for female participants to be more loss averse than male participants (Charness & Gneezy, 2012; Rau, 2014; for meta-analysis refer to Byrnes, et al., 1999). This difference also arises in regard to the disposition effect, which is a behavioral finance anomaly that related to a tendency of investors to sell shares whose prices have increased, while keeping assets that have dropped in value (Shefrin & Statman, 1985). In their 1985 study, Shefrin and Statman verified that people dislike losing significantly more than they enjoy winning. These findings follow the same direction of Kahneman and Tversky's prospect theory (1979). Women seem to report higher disposition effect, as well as, higher loss aversion than men (Rau, 2014). Experiments with risky gambling (Powell, Schubert & Gysler, 2001; Levin, Snyder & Chapman, 1988; Johnson & Powell, 1994; Powell & Ansic, 1997) and contextual risk decision problems (Barsky, Juster, Kimball & Shapiro, 1997; Jianakoplos & Bernasek, 1998; Eckel &

Grossmann, 2008) showed that women strongly avoid risky decisions in comparison to male subjects. This risk avoidance is especially evident when concerning property loss (Schubert, 2006). As previously mentioned, emotion plays an important role in the decision-making process and, according to Schubert (2006), female participants exhibit stronger, more intense emotions than their male counter-parts, which contributes to their risk-averse tendency (especially in regard to fear). These findings may help in the explanation of the reported results. On one hand, women experience higher loss aversion and, on the other, more intense emotions. Since psychopathic traits encompass severe deficits concerning emotional processing, these deficits should, once again, appear more salient in female populations, which could explain why higher levels of psychopathy correlated with lower levels of loss aversion (heuristic effect) in the female sub-sample but not in the male.

Another relevant question to point out stands with psychopathic individual's tendency to remain indifferent to moral dilemmas. In their aptly named paper *Psychopaths know right from wrong but don't care*, Cima, Tonnaer and Hauser (2010) aimed to debunk the assumption that psychopathic individuals lack understanding in regard to moral rights and wrongs. Alternatively, the authors' data suggests that psychopaths' patterns of judgement were, all around similar, to non-psychopaths', leading into the conclusion that individuals with higher levels of psychopathic traits choose to ignore the wrongness of certain actions, disregarding the possible consequences that might ensue from their morally inappropriate behavior; even though they can make a clear distinction between what is considered morally right and what is not. Psychopathy's typical functioning concerning moral dilemmas stands out when dealing with *framing effect* scenarios. In fact, as previously mentioned, the used scenarios include subtle changes in the way the presented problems are worded. Certain scenarios are worded in form of losses (e.g. People dying; Money being lost, etc) and others as winnings (e.g. Saving lives; earning money, etc). If moral considerations are irrelevant to psychopathic individuals, then the different wording in the *framing* problems might also be. In that case, there seems to be some type of intra-group non-systematic variability within the psychopathic group (regarding the answers to the framing scenarios) that might explain the lack of correlations regarding the male sub-sample.

Besides the already mentioned elements, some limitations characteristic of this study may also justify the reported data. First of all, the used sample is of relatively small size (N=218), with an evident majority of female respondents (106 female participants Vs. 77 male). The higher number of female respondents can also explain why the results were circumscribed to only females. Even though efforts were made in order to even out the sample it was not successfully accomplished. In future research, the samples should be increased and balanced in regard to gender. Furthermore, the translation process of the ADM-C could also have hindered the data. Since the questionnaire is mainly composed of decision scenarios, with large bulks of text and, sometimes, very specific, finance-related jargon some errors might have occurred with the translation/back-translation process. Follow-up research within this theme should take these translation issues into account when creating new versions of the ADM-C. It is also worth mentioning that the test battery was administered via online format, with its inherent pros and cons (refer to previous studies). In conclusion, the present research delved into the complex world of heuristic-based thinking and its influence on the decision-making process. The reported results, despite their flaws, illustrate the influence of cognitive biases on human judgment. Furthermore, it allowed for a superficial description of how these biases influence psychopathic decision-making differently from non-psychopathic. The research also shed some light on gender-related decision-making specificities which are, without a doubt, worth of further pursue in following studies. Yet again, further implications of these results will be addressed in the general discussion.

SECTION C

General Discussion

1. General Discussion

Human decision-making is a very complex process that involves a myriad of underlying elements. In the present work, a personality view of the criminal decision-making process has been undertaken, with a specific emphasis in the influence of psychopathic traits and impulsivity in human judgement. Furthermore, the research has also been complemented with studies regarding the less rational aspects of this process; the influence of heuristics and cognitive biases (i.e. loss aversion) and the impact of gender differences in human decision.

As previously mentioned, overwhelming evidence supported the existence of flaws in psychopathic individual's decision-making process (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005; Bjork, et al., 2012; Buckholtz et al., 2010). Elements such as passive avoidance and aversive conditioning deficits (e.g. Lykken, 1957; Newman & Kosson, 1986; Blair, 2005), emotional learning impairments (e.g. Patrick, et al., 2009; Hastings, et al., 2008; Marsh, et al., 2008; Jones, et al., 2009; White et al., 2012; Viding, et al., 2012; Lozier, et al., 2014), blind focus and over-sensitiveness to rewards and disregard for punishments (e.g. Bjork, et al., 2012; Buckholtz et al., 2010), as well as other disabilities (e.g. Patterson & Newman, 1993; Baskin-Sommers, et al., 2011) have a significant impact on these individual's criminal decision, contributing to a more frequent criminal involvement. These characteristics are also expected to have influence on the way heuristics, especially loss aversion, are processed (Slovic, et al., 2004). Concerning gender differences in psychopathy and criminal behavior, several studies have shown the impact of gender nuances (i.e. physical and relational aggression, Stickel, Marini & Thomas, 2011; facet scorings, De Vogel & Lancel, 2016; emotional processing, Rogstad & Rogers, 2008); deceitfulness and low self-control, Strand & Belfrage, 2005; and others, Weizmann-Henelius, Grönroos, Putkonen, Eronen, Lindberg & Häkkänen-Nyholm, 2010) on criminal behavior highlighting the importance of a gender-separated analysis of psychopathy traits.

Study 1 focused on the relationship between psychopathic traits, criminal attitudes and intention regarding theft. As expected, boldness and meanness (trait fearlessness-related facets) were associated with increased intention to reoffend with this effect also being mediated by the perceived benefits of reoffending. Furthermore, the reported data also supported the hypothesis that these fearlessness-related traits were associated with an

underestimation of the expected likelihood of negative outcomes, and increased expectation and increased clue attribution to the positive consequences of stealing (in the case of meanness). A link has also been established between psychopathy and hypersensitivity to rewards, especially in the case of sensation-seeking tendencies. This first study also lent evidence regarding the relevance of dual-process models of psychopathy. Study 2 works as an extension of Study 1; using similar methodology and hypotheses, Study 2 analyzes attitudinal and intention elements of the antisocial decision-making process in a non-forensic context, with different research behaviors (academic cheating and shoplifting). In general, psychopathic traits had a degree of impact over the intention to perform academic cheating and shoplifting. Furthermore, this effect was also mediated by the perceived consequences of the behaviors, especially in the case of perceived penalties. Despite the differences, a mediation effect from personality characteristics (psychopathy traits) to attitudes was also present in Study 2. In addition, the tendency towards under/overestimation of the likelihood of penalties/rewards, as well as the tendency regarding reward sensitivity were also present in the data. In Study 2, the segregation of the different psychopathy facets was not as clear as was the case of Study 1. Study 3 focused in psychopathy's learning deficits and psychophysiological differences through the use of both laboratorial tasks and heart-rate measures. In this study, attitude and intention formation, as well as psychopathic traits, were analyzed from a physiological perspective. Even though there were no consistent results regarding passive-avoidance learning deficits in psychopathy, external correlates regarding psychopathy facets were similar to the ones reported in Study 2 with meanness correlating with disinhibition in a non-forensic context. Furthermore, disinhibition was correlated with increased motor impulsivity in the Go/No-Go task. At last, Study 4 investigated psychopathy's use of heuristics, specifically in the case of loss-aversion. This last study also emphasizes the importance of gender differences. The results showed that higher scores of psychopathic traits were associated with lower vulnerability to loss aversion in females. In addition, the gender-segregated results also pull towards the importance of a separate analysis of psychopathy and loss aversion in both genders.

In this last chapter, an integrated view of the previously mentioned results is made in regard to three main topics: the conceptualization of psychopathy, *criminal optimism* and the link between psychopathic and morality.

1.1 A different look on psychopathy

One of the most unexpected results that emerged from the acquired data is the inconsistency with which the TriPM facets aggregate with each other. Taking a closer look into Study 1, the meanness facet heavily correlates with boldness. In consequence, most of the expectancy/value components of criminal attitudes seem to be correlated equivalently with these two components. According to Patrick's dual-process model (Patrick et al., 2009), this connection makes sense since both these facets are phenotypic expressions of trait fearlessness. However, when replicating the same protocol on a non-forensic context, the correlates of the different psychopathic scales seem to shift. For instance, in Study 2 the external correlates of the meanness facet are no longer consistent with the external correlates of the boldness component. Instead, now meanness aggregates with disinhibition, even though the protocol remained the same between studies (changes only having occurred in relation to the behaviors in study). Furthermore, in Study 4, the external correlates of all three facets aggregated mutually and exclusively in a female sub-group extracted from the main sample. The way these facets interchange with each other seems to imply the external influence of other elements (i.e. gender, context). In fact, several other studies, reviewed below, have also reported different correlates between the TriPM facets.

Craig, Gray and Snowden (2013) examined whether attachment functioning would mediate parenting effects on psychopathy traits using the TriPM. The used community sample included 214 participants (153 female and 61 male). When observing the reported correlations, it is fairly evident that, in this specific context, meanness aggregates with disinhibition, much like Study 2. In their report, these two facets (almost) always correlate together and in the same direction while boldness tends to point the opposite way. Anderson, Sellbom, Wygant, Salekin and Kruger (2014) inspected the associations between the TriPM facets and personality traits representing the DSM-5 Section III Antisocial Personality Disorder in two different community samples. In this research, much like the previous, meanness aggregated with disinhibition in regard to several DSM-5 traits (i.e. deceitfulness, callousness, impulsivity, irresponsibility, hostility and distractibility). Blagov, Patrick, Kathryn, Goodman and Pugh (2016) tested the reliability and convergence/discriminant validity of the TriPM in respect to differing models of personality and other criterions that

reflect social-emotional adjustments in a sample of undergraduates (N=120). Once again, the reported correlations showed the aggregation of the meanness with the disinhibition facet of the TriPM (i.e. conscientiousness (NEO-FFI), agreeableness (NEO-FFI), suppression of aggression (WAI-SF), impulse control (WAI-SF), consideration of others (WAI-SF), responsibility (WAI-SF), defensiveness (WAI-SF), manipulateness (SNAP), aggression, pure disinhibition (SNAP)). This same tendency emerged from Drislane, Patrick and Aarsal (2014) in a comparative research between the TriPM and several other scales (NEO-PI-R, MPQ, PPI, SRP-III, LSRP, YPI, CPS, APSD, ICU) in a non-forensic context. Other studies report similar findings in non-forensic context (e.g. Poy, et al., 2014; Fanti, Kyranides, Drislane, Collins & Andershed, 2015; Sica et al., 2015).

In forensic contexts the TriPM measures seem to behave in a different manner. Stanley, Wygant and Sellbom (2013) examined the TriPM construct validity in a sample of 141 inmates. In spite of some occasional aggregation of meanness with disinhibition (i.e. NPI Entitlement/exploitativeness and BFI conscientiousness), the main tendency is the aggregation of the external correlates for meanness with the external correlates for the boldness facet (i.e. in their associations with NPI total score, leadership, grandiose exhibitionism). Venables, Hall and Patrick (2013) sought to evaluate how the TriPM constructs are represented in scores from other commonly used psychopathy assessment tools, using two inmate samples (N1 = 157 inmates; N2 = 169 drug patients/inmates). In their first sample, boldness also aggregated with meanness in their patterns of association with several components (i.e. PCL-R factor 1, interpersonal style and antisocial tendencies). The meanness facet also aggregated with disinhibition in *adult antisocial behavior* and, with both boldness and disinhibition in PCL-R factor 2 and conduct disorder. In their drug user sample, however, meanness most frequently aggregated with disinhibition (i.e. PCL-R factor 2, antisocial tendencies, impulsive behavioral styles and conduct disorder). All three components correlated with PCL-R factor 1 and interpersonal style. These results seem to imply that the external correlates of the TriPM facets are also modulated in regard to drug-related contexts. Wall, Wygant and Sellbom (2014) tested the degree to which the boldness facet represents the distinct difference between psychopathy as antisocial personality disorder in sample composed of 152 male inmates. In their data, meanness external correlates mainly aggregated with disinhibition (i.e. PCL-R factor 2, lifestyle and antisocial facets and

APSD score). Wygant, Sellbom, Sleep, Wall, Applegate and Krueger (2016) compared the section III alternative model's conception of ASPD with the TriPM and other differing models of psychopathy (N=200 inmates). Regarding correlations with PID-5, meanness mainly correlated with disinhibition (i.e. deceitfulness, callousness, hostility, irresponsibility, impulsivity, withdrawal and distractibility); all three facets aggregated in manipulateness, risk-taking and restricted affectivity. Concerning the DSM-5 personality trait rating form, the reported data was less consistent with meanness and disinhibition correlating to irresponsibility and impulsivity; meanness and boldness to manipulateness, callousness and grandiosity; and all three components to hostility and risk taking.

Considering the previously mentioned data, the most salient aspect resides in the way the meanness facet interacts with the other two. In fact, boldness and disinhibition remain, somewhat, stable and isolated from each other while meanness shifts correlates in-between sampling contexts and even gender-wise. According to Patrick and colleagues (2009), the disinhibition facet, is the phenotypic expression of externalizing vulnerability, whilst the boldness and meanness facet are both expressions of trait fearlessness. This means that the disinhibition facet should be conceptually segregated from boldness and meanness. This segregation should occur at both the etiological level and in regard to underlying brain functioning, however, not at the operationalization level. When looking into the reported data, boldness and disinhibition are, indeed, isolated (for the most part) in both forensic and non-forensic context. The same can not be proclaimed about meanness. Instead of solely aggregating with boldness, *via* trait-fearlessness, this facet frequently aggregates with disinhibition, especially in forensic context. This meanness overflow to disinhibition, along with a seemingly isolated boldness and disinhibition raises doubts about the way the meanness facet is conceptualized. Despite often being associated with trait-fearlessness, it also seems to be associated with externalizing vulnerability, almost implying that meanness is influenced by both etiological processes, while retaining some specificity.

Following this hypothesis, and as a way to complement this point in the discussion, we undertook a follow-up analysis. Within this analysis, linear regressions were computed in which boldness and disinhibition were introduced as predictors of meanness. From this analysis, the residuals of meanness were then extracted. This measure is understood as the

core expression of the meanness facet; a meanness variable without the influence of boldness and disinhibition. This meanness core was then tested in relation to the previously reported results. This analysis was conducted in every reported sample, as well as other accessible TriPM samples (see *appendices 15 to 31*).

A few interesting elements are evident. First of all, both boldness and disinhibition acted as predictors of meanness in every sample, especially within Study 2 male sub-sample, where $R^2 = .516$. Disinhibition weighted more on disinhibition within the non-forensic context (i.e. $b = .638$ in the Study 2 male sub-sample). Despite disinhibition always functioning as the strongest predictor of meanness, the explained variance within the female sub-samples was constantly smaller. In the forensic sample, beta values for disinhibition and boldness were equivalent, and the explained variance was also less than the non-forensic counterparts. While inspecting these results, it can be understood that the meanness facet is far from being hermetic; apparently, a larger portion of this facet is, in fact, either an effect of boldness or of disinhibition. Furthermore, both forensic and female participants seem to report a purer expression of meanness, with less exogenous facet influence. Also, the weight of boldness remains static in-between samples, whilst the influence of disinhibition grows larger within a non-forensic context. This indicates that non-forensic meanness has a stronger influence of disinhibition and, therefore, is more dependent of it.

We further used this core element of meanness to explore the results from the previous studies (see *appendices 15 to 31*). First of all, the *criminal optimism* tendency (the under/overestimation of the probability of penalties/rewards) is clear in every reported sample when relating the expectation of punishment and reward to the core element of meanness, especially in the non-forensic male sub-sample. Furthermore, these results also support psychopathy's *reward hypersensitivity* in every sample group (the female sub-sample exhibits milder hypersensitivity). Finally, in the specific case of the non-forensic male sub-sample it is also clear a tendency for *punishment immunity* (lower value attributed to negative consequences of the behavior). All these three tendencies seem to be consistently supported by emerging and past literature (e.g. Gorenstein & Newman, 1980; Lykken, 1995; Newman, et al., 2005; Buckholtz et al., 2010; Bjork, et al., 2012). A similar isolating procedure was carried through in regard to the remaining two facets of the TriPM (boldness and

disinhibition). However, *core meanness* is the only facet that is related to the over/underestimation of consequences (*criminal optimism*) in a context where, previously both boldness (forensic sample) and disinhibition (non-forensic sample) were predictors of the phenomenon. The same happens in regard to the higher value attributed to rewards of crime (*reward hypersensitivity*) and the lower value attributed to penalties (*punishment immunity*) in the non-forensic sample. These results seem to further support the importance of segregating the three TriPM facets. Also, when the same analysis was conducted for the female sub-sample, the exhibited results were inconsistent, with disinhibition sporadically aggregating with meanness. This calls to attention the importance of designing a distinct psychopathy model concerning females, since different mechanisms (or, at least, different expressions of the same mechanisms) seem to underlie the expression of psychopathy in women (e.g. Falkenbach, et al., 2017; Bolt, et al., 2004; Stickle, et al., 2011; Sutton, et al., 2002; Jackson, et al., 2002; Stickle, et al., 2011; Jackson, et al., 2002; Rogstad & Rogers, 2008).

When inspecting the results regarding the experimental tasks and physiological measures used in Study 3 in regard to the *core meanness* an unexpected tendency also emerged. First of all, the same reported results concerning meanness and the HRV measure on the WCST task is evident, consolidating *core meanness* as a purer representation of the TriPM meanness facet. However, results concerning psychopathy and the WCST scores are no longer absent. In fact, with this new *core meanness* variable, a significant correlation emerged between the facet and the perseverative errors on the task. These types of error imply that these individuals keep on responding in regard to the old (previous) task rule and are related to learning difficulties when integrating the new rule. This correlation is absent from every other psychopathy facet and is consistent with literature concerning psychopathy and learning disabilities (e.g. Colledge & Mitchell, 2001; Mitchell et al., 2002; Blair, 2013). This tendency might be related to pre-frontal functioning (e.g. Carlson, et al., 2009; Blumer & Benson, 1975; Kim & Lee, 2011; Brevet-Aeby, et al., 2016).

A deeper look at the relation between *core meanness* and the scores of other scales (Dark Triad and Grasmick) also brought up interesting results. In relation to the dark triad a significant correlation is evident between *core meanness* and both the Psychopathy and

Machiavellianism elements of the DT. No correlation emerged in regard to narcissism. These results might imply that *core meanness* has a mixture of characteristics from both these concepts (this is evident in both male and female sub-samples) once again implying its externalizing nature. Also, when inspecting the self-control scale, the significant associations that arise are related to the *self-centered orientation* and *temperament* elements (in the male sample). All these previously reported elements describe a lack of regard and concern for others (Dark Triad – Psychopathy; Jonason & Webster, 2010), a degree of detachment and a calculating nature (Dark Triad – Machiavellianism; Jonason & Webster, 2010), an individual that is mainly focused on himself, often disregarding others (Grasmick – Self-centered orientation; Grasmick, et al., 1993), and a low level of tolerance and difficulty to inhibit violent responses when faced with conflict (Grasmick – Temperament; Grasmick, et al., 1993). In regard to the female sub-sample, *core meanness* was also related (besides the previously mentioned) to the *risk seeking* and *preference for simple tasks* elements from the Grasmick scale. The clearly distinct results between male and female participants indicate the need for a distinct approach for psychopathy conceptualization gender-wise.

This short analysis raises awareness to the importance of a different conceptualization of the meanness facet. In fact, meanness can be perceived as the actual core of psychopathy, and its nature should be isolated from other elements. This facet should not encompass externalizing characteristic, neither trait-fearlessness-related influence, as it should be seen as an independent constellation of traits related to antagonism (Derefinko & Lynam, 2006) composed of low agreeableness and conscientiousness. Much like in the way meanness was conceptualized by Patrick and colleagues (2009), this facet should be composed of traits related to lack of empathy, cruelty, self-centeredness, manipulateness, exploitativeness, coldheartedness (Lilienfeld & Widows, 2005), callousness (Frick, O'Brien, Wootton, & McBurnett, 1994), low affiliation (Blackburn, 2006) and every other characteristic related to interpersonal antagonism. This new concept of meanness approximates Patrick's model to the one developed by Cleckley (1976) in which psychopathy is expressed by interpersonal and affective characteristics such as superficial charm, unreliability, untruthfulness and insincerity, lack of remorse or shame, pathologic egocentricity, unresponsiveness in general interpersonal relations. However, even Cleckley's approach includes other unrelated elements more closely related to externalization and trait-fearlessness. Patrick and colleagues

(2009) also report the interaction of other traits, such as trait-fearlessness, that should be, in fact, independent of meanness, even though its existence may influence the way *core meanness* behaves. Furthermore, even though Patrick's design of the meanness facet is somewhat consistent with the one being described here, the way the TriPM scale attempts to measure fails in doing so, as the items related to meanness also capture an heavy influence of the other two facets (boldness and disinhibition).

Here, the concept of psychopathy is perceived as equivalent to the concept of *antagonism (core meanness)*, while the externalizing and fearlessness components are seen as distinct factors that sustain a degree of influence over this core concept. This type of design may explain the distinct results that arise from different sampling contexts (forensic/non-forensic). Since the scores of meanness remain the same in-between samples one could say that the psychopathy levels are equivalent in both samples, with only clear distinctions in regard to the externalizing element. Meanness is much more an interpersonal and affective impairment rather than a behavioral deficit, especially in regard to criminal behavior. This is also evident when inspecting the relation between *core meanness* and the previously reported Grasmick and Dark Triad subscales. The aggregation of these definitions designs this concept of *core meanness*. This *core meanness* facet, much like other personality-based traits, can co-exist in the same individual with disinhibition and even boldness, creating either a more impulsive approach or a more socially dominant/stress-impervious one. Furthermore, the different results regarding gender also demonstrates the importance of a different conceptualization of psychopathy for both men and women. Further studies should collect TriPM data in females from a forensic context in order to understand how the different correlates aggregate and to also compare them with non-forensic female samples, as well as male samples in both contexts.

The previously reported data seems to point towards a bi-factorial conceptualization of psychopathy rather than a dual process one. According to Yung, Thissen and McLeod (1999), these types of models (also known as "hierarchical models") provide an empirically and conceptually distinct account of the relationship between factors in a multilevel factor model. The bi-factorial approach still assumes a general factor underlying all variables (much like the approach used to develop the PCL-R; Patrick, Hicks, Nichol & Krueger, 2007) and

a specific factor for each. However, it also includes several uncorrelated group factors consisting of two (or more) variables (Holzinger & Swineford, 1937). In these models, the group variables are uncorrelated and distinct and not incorporated by a general factor (Gustafsson & Balke, 1993). In this kind of conception, there is still a broad general factor that saturates each specific scale, although this factor does not split into correlated subfactors. In fact, the specific measures saturate with both the general factor as well as with the other subordinate factors (which are mutually uncorrelated; Patrick, et al., 2007). From a conceptual perspective, the main, superordinate factor would be represented by *antagonism (core meanness)*, which is characterized by the previously mentioned interpersonal and affective deficits, whilst the secondary, subordinate factors would include the two remaining TriPM elements (boldness and disinhibition) that together explain the excess variance in *core meanness*.

This section has revolved around speculation about the etiology of psychopathy and the problematics associated with it. Taking from the previously reported literature, the *core meanness* concept seems to be a common ground between different theories of psychopathy (e.g. Leary, 1957; McCord & McCord, 1964; Quay, 1964; Cleckley, 1976; Wiggins, 1982; Harpur et al., 1989; Saucier, 1992; Frick et al., 1994; Lilienfeld & Widows, 2005; Blackburn, 2006; Derefinko & Lynam, 2006). Meanness did not appear as the central concept of psychopathy in criminal samples, since the meanness scores in both forensic and non-forensic samples remain fundamentally the same. The real element segregating criminal psychopathy from community psychopathy seems to be the level of disinhibition. There is an evident tendency concerning the isolation of psychopathy from other externalizing and impulse-control-related pathologies. In fact, psychopathy traits appear to exist in either disinhibited and controlled individuals, proving their mutual independence. This externalizing component has a clear influence in the individuals' behavior and can co-exist with psychopathy, yet, it does not define it. When *antagonism (core meanness)* interacts with high externalizing vulnerability the criminal propensity increases, however, by itself it does not seem to be as strongly related to crime as expected. The same appears to happen in regard to the trait-fearlessness. Even though Patrick and colleagues (2009) conceptualize both boldness and meanness as different expressions of the same fearless genotype (a more benevolent and a more evil one), they do not seem to have the same origin. The reported data appears to drift

towards also separating boldness from psychopathy. Once again, psychopathic individuals are not defined by trait-fearlessness. Psychopathy (*antagonism/core meanness*) should be seen as isolated from the externalizing and fearless components. These three can co-exist and modulate the individual's behavior according to their own idiosyncrasies, however, they all are separated personality constructs.

1.2. A different view of *Criminal Optimism*

When developing the research protocol to be used in the laboratorial study (Study 3), a hypothesis was advanced in regard to psychopathy's passive-avoidance learning deficits. In fact, in the conception of Study 1, one of the major tendencies exhibited was the overestimation of the probability of theft, paired with an underestimation of the probability of punishment in individuals with higher scores of psychopathy (boldness and meanness). This tendency, later on coined *Criminal optimism*, made a second appearance in Study 2, when testing similar hypotheses in a non-forensic context. In previous discussions of this result, the genesis of *criminal optimism* was thought to be associated with learning problems similar to what was postulated by Blair and colleagues (2004). In order to test this hypothesis, Blair's passive-avoidance task was integrated in the experimental protocol for Study 3. As previously mentioned, even though the used sample size was superior to the one used by the original author, no results arose in regard to psychopathy. The primary reason pointed out rested in the nature of Blair's sample; it being forensic and highly psychopathic, in contrast with a low-psychopathy non-forensic sample. However, this explanation seemed frail and further exploration led to more coherent conclusions.

The first line of reasoning was constructed around the origin of Ajzen's concept of attitude. Since the expectation/value design was inspired by Fishbein and Ajzen's TPB (Ajzen, 1991) it seemed important to inspect the foundations of their constructs looking for possible explanations for psychopathy's *criminal optimism*. The differences could not reside in the genesis of such attitudes but rather in the evaluation and use of these in the decision-making process. Fishbein and Ajzen's conception of attitudes differs slightly from other historically relevant theories (e.g. Thomas & Znaniecki, 1918; Watson, 1930; Thurstone, 1931; Allport, 1935; Heider, 1946; Rosenberg & Hovland, 1960; Katz, 1960; Krech,

Crutchfield & Ballachey, 1962). For these authors, an attitude is the perceived consequence (be it positive or negative) of a specific behavior (Fishbein & Ajzen, 1975). When opting for a specific course of action the subject will ponder on these outcomes (attitudes) and act in conformity to the “score” obtained from the relevant attitudes. Taking a closer look into this concept, it is perceivable that these attitudes have a very clear affective nature. In fact, the authors themselves define attitudes with a clear emphasis on the affective component (Fishbein & Ajzen, 1975).

As already previously mentioned, there is a well-established link between psychopathy and emotional processing deficits. In fact, psychopathic individuals are considered to be impaired in regard to emotional processing, be it in emotional recognition in facial expressions (Hastings, Tangney & Stuewig, 2008), lack of empathy (e.g. Marsh, et al., 2013; Decety, Skelly & Kiehl, 2013) or immunity to fear cues (e.g. Marsh, et al., 2008; Marsh & Cardinale, 2012; Jones, et al., 2009; White et al., 2012; Viding, et al., 2012; Lozier, et al., 2014). Furthermore, neuroimaging studies have also found malformities (e.g. Kiehl, Smith, Hare, Mendrek, Forster, Brink & Liddle, 2001; Yang, Raine, Narr, Colletti, & Toga, 2009; Pardini, Raine, Erickson, & Loeber, 2014; Müller, et al., 2003) and sub-activation (e.g. Yoder, et al., 2014; Marsh, et al., 2008; Jones, et al., 2009) in the amygdala and limbic system, which are components responsible for the processing of emotion. Since the nature of Ajzen’s attitudes is affective, these firmly established emotional deficits might be one of the reasons behind the abnormal evaluation of the expectancy of the consequences of the behavior. Still, this hypothesis does not seem to specifically explain the *criminal optimism*.

The second line of reasoning was constructed around the nomenclature, *criminal optimism*. *Criminal optimism* has been called to the optimistic nature of psychopathic individuals in regard to the consequences of their criminal behavior. In fact, when inspecting the under/overestimation tendency it is clear that it is, no more, no less, than an optimistic approach to criminal decision-making. From this train of thought arose an important question: Is *criminal optimism*, in fact, just *optimism*? Are psychopathic individuals more generally optimistic than non-psychopaths? These questions led to a deeper analysis of the

construct of optimism in the light of several personality-based inventories (i.e. BFI, NEO-PI-R, NEO-FFI).

There are several authors that have explored the modulation of optimism through personality traits. In 1989, Smith, Pope, Rhodewalt and Poulton investigated how optimism was influenced by neuroticism, using the Life Orientation Test (LOT), as well as the Generalized Expectancy for Success scale (GESS) as an effective measure of optimism and the Manifest Anxiety scale (TMAS) as a measure of neuroticism. The creators of the LOT define optimism as “the expectation that good things will happen” (Scheider & Carver, 1985). Using two different samples (N1=156; N2=103) the authors (Smith, Pope, Rhodewalt & Poulton, 1989) concluded that the LOT scores were highly correlated to the neuroticism measure in both samples. Marshall, Wortman, Kusulas, Hervig and Vickers (1992) also conducted a study regarding the interaction of optimism with personality characteristics. Using the LOT, along with the NEO five-factor inventory (NEO-FFI) and the Positive and Negative Affect Schedule, the authors determined that optimism was primarily (positively) correlated to extraversion and positive affect and also negatively correlated to neuroticism and negative affect. Later, in 1994, Marshall and colleagues developed a second study regarding personality traits and optimism with a military sample and the exhibited results also supported the close relation between optimism and low neuroticism, high extraversion, as well as high conscientiousness. Andersson (1996) also conducted a meta-analytic review regarding the study of optimism through the LOT. With 56 studies (98 effect size estimates), the author concluded that the most reliable association that arose from the data was between optimism and negative affect. Ebert, Tucker and Roth (2002) also explored optimism within their study regarding health status and physical symptom reporting, utilizing the NEO-FFI. According to their data, optimism was strongly related to low neuroticism, moderately related to high extraversion, and conscientiousness and weakly correlated to openness and agreeableness. A few other studies reach these same conclusions, especially in regard to the association between optimism and low neuroticism (e.g. Scheider, Craver & Bridges, 1994; Segerstrom, Castañeda & Spencer, 2002; Lounsbury, Saudargas & Gibson, 2004; Sharpe, Martin & Roth, 2011; Fultz & Bernieri, 2018).

According to Fultz and Bernieri (2018), although the existence of a specific personality profile for optimism across the five major personality traits is certainly plausible, little evidence was found in their study suggesting that anything other than lower neuroticism contributes to the influence that optimism might have on one's relationships and social life. From this previous overview, it can be concluded that there is a well-established relation between both neuroticism and extraversion (Sharpe, Martin & Roth, 2011) that is heavily supported by research. According to Patrick and colleagues (2009), psychopathy (meanness) is closely associated with low neuroticism, configuring a structure of high emotional stability. The strong relation between low neuroticism and both optimism and psychopathy leads into the belief that individuals with high scorings of meanness might be, in fact, more optimist than the rest, which could be the reason behind the previously reported *criminal optimism*. This hypothesis is merely speculative; however, it seems to accurately explain the reported tendency.

1.3. The link between Psychopathy and Morality: Guilt and Shame

One of the most interesting results that surfaced in study 2 was the correlations between psychopathy and both the expectancy and value components of *feeling shame and guilt* in shoplifting and cheating behavior. In a last analysis utilizing the *core* constructs of the TriPM facets, the same associations between meanness and both components of shame and guilt were also evident. Within this analysis, every other correlation between boldness and disinhibition and the shame/guilt beliefs vanished, with the exception of the negative relation between *core disinhibition* and the expectancy of feeling guilt in both cheating and shoplifting behaviors. This result is strongly consistent with the research regarding psychopathic traits and morality.

According to Tangney, Stuewig and Mashek (2007), both shame and guilt are considered negatively valenced self-conscious moral emotions. Several attempts have been made to differentiate these two moral emotions, leading into three different categories: a distinction based on types of elicitation events; a distinction based on the public vs private nature of the transgression, and; a distinction based on the degree to which the individual builds the emotion-eliciting event as a failure of self or behavior (Tangney, et al., 2007). Guilt

seems to be a more adaptative emotion, benefiting individuals and their relationships (Baumeister, et al., 1994; Tangney, 1991) while shame can have other negative consequences. Both these moral emotions are evoked by self-reflection and self-evaluation, and can be expressed either implicitly or explicitly, consciously or sub-consciously. These emotions provide immediate punishment (or reinforcement) of the behavior as the self reflects upon the self, providing instant feedback on the individual's social and moral acceptability (Tangney, et al., 2007).

Several studies have shown that psychopathic individuals exhibit difficulties when faced with moral judgments, specifically exhibiting a reduced ability to distinguish moral from conventional transgressions. According to Blair (1995), non-psychopaths were effective in their moral/conventional distinction while psychopaths failed in doing so. Furthermore, psychopathic individuals also treated conventional transgressions as moral transgressions. Later, in a study with a children sample Blair (1997) also concluded that children with higher psychopathic traits made significantly less moral/conventional distinctions than controls, and that these children were also less likely to attribute moral emotions to story protagonists. For example, contrary to non-psychopaths, psychopathic individuals will typically judge a left-handed handshake (conventional) and a physical assault towards another person (moral) as equally forbidden transgressions. Other studies also showed that youth with high psychopathic traits seem to be unaffected by the mechanisms of moral disengagements and that these results are originated by emotional impairments (e.g. DeLisi, Peters, Dansby, Vaughn, Shook & Hochstetler, 2014).

Also, there is a solid hypothesis regarding the origin of these moral judgement impairments as the result of psychopathy's inherent emotional processing deficits. This hypothesis is supported by the heavy research surrounding the link between emotional experience and moral judgement (Cima, et al., 2010). Research has shown that it is possible to change people's judgement facing particular moral scenarios by priming their emotional states. For instance, Valdesolo and DeSteno (2006) concluded that by engaging people in happy states their tendency to allow themselves to be used as a means to some greater good was increased. Other studies have shown that by inducing disgust, it would increase the severity of moral disapproval (e.g. Wheatley & Haidt, 2006; Schnall, Haidt, Clore & Jordan,

2008). Furthermore, other studies have also linked psychopathy's deficits in moral judgements with specific neurological deficiencies, for instance a reduced activation of structures such as the amygdala or the ventromedial prefrontal cortex (e.g. Marsh, et al., 2011; Harenski, Harenski, Shane & Kiehl, 2010)

The role of emotion in moral judgement is also supported by neuroscientific research. Different studies have revealed clear activation patterns in the amygdala and limbic systems when subjects are reading about moral dilemmas (e.g. Greene, 2003; Greene, Nystrom, Engell, Darley & Cohen, 2004; Moll, Oliveira-Souza & Eslinger, 2002). Other studies have also found significant deficits in moral judgement in subjects with severe emotional processing impairments (e.g. Ciaramelli, Miccioli, Ladavas & Pellegrino, 2007; Koenigs, Young, Adolphs, Tranel, Cushman, Hauser, & Damasio, 2007). Blair (2007) also significantly tested a model where the amygdala enables the association of actions that harms others with the aversive reinforcement of the victims' distress through stimulus-reinforcement learning. In psychopathic individuals, the existing dysfunctions in these structures compromise care-based moral reasoning leading into a higher probability of engaging in antisocial behavior.

When designing the research protocol for Study 2 no hypotheses were advanced in regard to the link between psychopathy and moral concerns. In the process of collecting criminal beliefs from the elicitation study to construct the final criminal attitudes questionnaire the beliefs regarding the feeling of shame and guilt as negative outcomes of antisocial behavior (Shoplifting and cheating) spontaneously emerged. In the later analysis, correlations between psychopathy and these moral beliefs were evident, in a completely bottom-up approach. The spontaneity of these results lends credibility towards the importance of morality and emotion as mechanisms underlying the etiology of psychopathy.

Concluding Remarks

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As a conclusion note, it seems appropriate to further discuss other elements and concepts that could help in shedding some extra light in the literature regarding human decision-making. Due to the limited space and resources and to the overwhelming nature of this specific field of study, it was not conceivable to analyze, in an in-depth manner, every other aspect that is responsible and influential over human judgement. The present chapter functions as a mean to present other possible research paths that would be of the utmost importance for a deeper understanding of the phenomena under study. More than an empirical overview of what else should have been done, this part, conceptual in its nature, highlights important theoretical aspects that should, eventually, be integrated in the present research.

This first element to be mentioned in this chapter is the research on decision under uncertainty. Even though “uncertainty” has had several definitions across audiences, the present concept is considered to be the psychological state in which a decision maker lacks knowledge regarding what outcome should follow from what choice (Platt & Huettel, 2008). Uncertainty typically arises in situations that have limited or incalculable information regarding the predicted outcomes of behavior (Huettel, Song, McCarthy, 2005). In the study on uncertainty, the most commonly considered aspect by researchers is risk. The successful detection, processing and resolving of uncertainty is essential to successful adaptive behavior. According to Dimitrakakis and Ortner (2018), the problem of decision-making under uncertainty can be broken down into two sections: How do we learn about the world (i.e. involves the problem of modeling our initial uncertainty about the world and the drawing of conclusions from evidence and our initial belief) and how should we decide what to do (taking into account future events and observations that may change our conclusion). This type of decision will involve long-term plans that cover possible future eventualities; when planning under uncertainty one has to take into account future knowledge that could be created when implementing our plans. According to the authors (Dimitrakakis & Ortner, 2018), the choice between doing something that is already known to produce good results and experiment with something new is called exploration-exploitation dilemma. This concept is at the base of the interaction between learning and planning.

Decision making with uncertain consequences is very frequent in the everyday life (e.g. investment decisions). In order to successfully cope with similar situations, our nervous system has to be able to estimate, represent and solve uncertainty at various levels (Preuschoff, Mohr & Hsu, 2013). Furthermore, not only are there different kinds of uncertainty with distinct behavior and learning consequences but also, research shows that the processing of uncertainty is highly dependent of situation and context. Despite the growing research on brain mechanisms responsible for our choices during conditions of uncertainty, it is becoming clear that uncertainty is not comprised of a single dimension. In fact, recent research is starting to differentiate different neural correlates responsible for estimating, representing and resolving different forms of uncertainty (Bland & Schaefer, 2012). Different studies have highlighted different correlates for reward expectancy and variance (e.g. Preuschoff, Bossaerts & Quartz, 2006; Tobler, O'Doherty, Dolan, & Schultz, 2007), reward probability and magnitude (e.g. Knutson, Taylor, Kaufman, Peterson, & Glover, 2006) and ambiguity and risk (e.g. Hsu, Bhatt, Adolphs, Tranel, & Camerer, 2005; Huettel, Stowe, Gordon, Warner & Platt, 2006).

Some studies have also focused on the different brain mechanisms underlying decision under uncertainty. In functional magnetic resonance imaging experiments (e.g. Volz, Schubotz, & von Cramon, 2003; Volz, Schubotz, & von Cramon, 2004), participants were asked to make a series of decisions under different degrees of uncertainty (from 60 to 100% likelihood that the correct decision would be rewarded). Even though subjects were never given explicit information about these probabilities they ended up learning them over time through feedback produced from their decisions. According to these studies, activation of the dorsomedial prefrontal cortex was correlated (inversely) to reward probability; this effect is different from the effects associated with learning about probabilities. Furthermore, the medial prefrontal cortex has also been connected to in different protocols (i.e. learning about uncertainty through trial and error), for example, hypothesis testing (e.g. Elliott & Dolan, 1998) and sequence prediction (e.g. Schubotz & von Cramon, 2002). In a different protocol in which subjects based their decision in on a binary structure of eight stimuli (so that uncertainty changed dynamically over time depending on the presented stimulus), Huettel, Song and McCarthy (2005) concluded that activation in prefrontal, parietal and insular cortices increased with increasing uncertainty. Moreover, activation did not increase

with uncertainty in other specific regions such as the medial frontal regions, motor and visual cortices. These results led to the conclusion that the brain response to uncertainty is dependent on the demands of the used tasks; when uncertainty depends on learned associations between stimuli and responses it modulates activity in the medial frontal lobes, when uncertainty develops over (short) time scales, with data being built towards a decision, the activation resides in dorsal prefrontal and posterior parietal regions.

Taking into account that antisocial and criminal behavior often involves a decision process with various degrees of uncertainty, the inclusion and further exploration of such a topic would be highly beneficial to the research on criminal decision-making. Moreover, more externalization-based psychopathic traits have been associated with brain region (i.e. prefrontal cortex; Finger et al., 2008; De Brito, et al., 2013; White, et al., 2014) that are also responsible for the modulation of decision-making under uncertainty. This possible link might imply different processing of uncertainty in psychopathic individuals.

Another interesting component that would be of the utmost relevance for the aforementioned research is the subject of moral judgement. According to Garrett (2011), “the activity of moral judgement is that of thinking about whether something has a moral attribute”. The assessed object can be of different natures (i.e. an action, a person) and the considered attribute might be general (i.e. right or wrong) or specific (i.e. loyalty or injustice). The basis of our moral judgements has been a long-standing focus of both philosophy and empirical investigation (Koenigs, Young, Adolphs, Tranel, Cushman, Hauser & Damasio, 2007). The traditional rationalist approach to the study of moral cognition stresses the role of conscious reasoning from explicit principles (Kohlberg, 1981) while the more modern accounts highlight the importance of both conscious and unconscious emotional processes (Damasio, 1994, Haidt, 2001). In reference to the latter, research has showed significant associations between emotional processing deficits and disturbances in moral behavior (e.g. Eslinger, Grattan & Damasio, 1992; Anderson, Bechara, Damasio, Tranel & Damasio, 1999; Blair, 1995; Mendez, Anderson & Shapiro, 2005). The same data arose from neuro-imagiological research, in which activation in the limbic system and amygdala have been linked to tasks involving moral judgement (e.g. Moll, Oliveira-Souza, Bramati & Grafman, 2002; Heekeren, Wartenburger, Schmidt, Schwintowski & Villringer, 2003; Greene,

Sommerville, Nystrom, Darley & Cohen, 2001; Greene, Nystrom, Engell, Darley & Cohen, 2004; Luo, Nakic, Wheatley, Richell, Martin & Blair, 2006). Furthermore, behavioral studies have also demonstrated that the manipulation of affective states can also alter moral judgments (e.g. Wheatley & Haidt, 2005; Valdesolo & DeSteno, 2006).

The importance of moral judgements to criminal decision-making is evident. According to Raine and Yang (2006), the failure to follow moral guidelines is a common feature of antisocial behavior and is central to description of criminal and psychopathic individuals. The brain regions most frequently implicated in the neural correlates of morality are the polar/medial prefrontal cortex, ventral prefrontal cortex and angular gyrus, and also the posterior cingulate and the amygdala (Raine & Yang, 2006). Activation in some of these underlying brain regions are also overlapped by antisocial, aggressive and psychopathic behavior (i.e. prefrontal cortex, amygdala and angular gyrus). This juxtaposition highlights the importance of the study of moral judgements in the criminal decision-making context, even though some of the data related to morality and specific brain mechanism is not too consistent (i.e. hippocampus and anterior cingulate). According to the authors (Raine & Yang, 2006), the immoral behavior of psychopathic and antisocial individuals may have some strong influence from the impairment in some of the previously mentioned brain regions that are responsible for morality, cognition and emotion. Future research on the topic of criminal decision should include a closer look into the influence of morality in both the behavior and the individual.

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Legislation

Código Penal (1995). Decreto-Lei nº48/95, march, 15th.

APPENDIX

APPENDIX 1

Formulário de Consentimento Informado

O presente estudo tem como objectivo analisar um conjunto de elementos individuais (atitudes, crenças, traços de personalidade) de forma a melhor compreender a forma como se processa o comportamento humano, mais especificamente o comportamento de furto. A sua tarefa consiste em preencher um conjunto de questionários nos quais lhe pediremos a opinião acerca de um conjunto de questões.

Salienta-se que a sua participação deve ser completamente voluntária e que, da sua participação ou recusa de participar, não advêm quaisquer benefícios ou penalizações.

Garante-se a confidencialidade dos dados e anonimato dos participantes. Os dados não serão tratados individualmente mas apenas em grupo e serão única e exclusivamente utilizados para fins da presente investigação científica. Estes dados não serão divulgados a qualquer elemento dos Estabelecimentos Prisionais ou a qualquer outra autoridade prisional ou judiciária. Se assim entender, o participante poderá desistir a qualquer momento. Caso solicite ser-lhe-ão fornecidos resultados de grupo divulgados em publicações científicas.

A assinatura deste consentimento pressupõe que tomou conhecimento dos objetivos do estudo e procedimentos a realizar e que aceita que as informações prestadas sejam utilizadas no âmbito da investigação.

Eu _____, declaro que aceito participar voluntariamente na investigação conduzida por João Cardoso da Silva Próspero Luís no âmbito da dissertação de mestrado em Criminologia, da Faculdade de Direito da Universidade do Porto.

Fui esclarecido sobre os objetivos deste trabalho, tendo sido igualmente informado de que este estudo se realizará com recurso a instrumentos de avaliação psicológica. Foi-me transmitido que sou livre para interromper ou desistir a qualquer momento do estudo. Foi informado de que da minha participação ou recusa em participar não advém qualquer benefício ou penalização. Asseguraram-me que os meus dados não serão transmitidos a qualquer instância de controlo ou autoridade ou a qualquer elemento do estabelecimento

prisional ou autoridade judiciária. De igual modo, foi-me garantida a salvaguarda da confidencialidade e anonimato e fui informado de que os dados não serão tratados individualmente, mas apenas em grupo.

Tomei conhecimento dos objetivos do estudo e aceito que as informações decorrentes da minha participação sejam analisadas e utilizadas pela equipa científica, no âmbito deste estudo.

_____, ____ de _____ de _____

Assinatura do participante:

Assinatura do investigador:

APPENDIX 2

ID Estudo: _____

ID Sujeito: _____

Data: _____

Instruções: Por favor leia as perguntas abaixo e escreva o que pensa sobre cada uma.

Quando um indivíduo encontra um objeto que não é seu mas que gostaria de ter:

1. Quais seriam as **vantagens** de o roubar? _____

2. Quais seriam as **desvantagens** de o roubar? _____

3. Há mais alguma coisa que queira dizer sobre o que pensa relativamente a roubar um objeto? _____

4. Há alguma pessoa, amigo, familiar ou grupo que **aprovaria** que roubasse um objeto? _____

ID Estudo: _____

ID Sujeito: _____

Data: _____

5. Há alguma pessoa, amigo, familiar ou grupo que **desaprovaria** que roubasse um objeto?

6. Há mais alguma coisa que queira dizer sobre o que julga que os outros pensam relativamente a roubar um objeto?

7. Que acontecimentos o poderiam **ajudar ou facilitar** a roubar um objeto?

8. Que acontecimentos **poderiam dificultar ou impedir** que roubasse um objeto?

9. Há mais algum assunto que lhe venha à cabeça quando pensa em roubar um objeto?

APPENDIX 3

Código				
Formulário de Recolha de Dados de Processo				
Estabelecimento Prisional		Paços de Ferreira <input type="checkbox"/>	Santa Cruz do Bispo <input type="checkbox"/>	
Nome				
Idade		Número		
Nível de Escolaridade				
Profissão				
A cumprir pena por				
Furto <input type="checkbox"/>	Furto Qualificado <input type="checkbox"/>	Roubo <input type="checkbox"/>	Outro <input type="checkbox"/>	
Consumado <input type="checkbox"/>		Tentativa <input type="checkbox"/>		
Primário <input type="checkbox"/>		Reincidente <input type="checkbox"/>		
Duração da Pena			Termo da Pena	
Concurso	Não <input type="checkbox"/>	Sim <input type="checkbox"/>		
Processos Pendentes				
Não <input type="checkbox"/>			Sim <input type="checkbox"/>	
Infrações Disciplinares				
Não <input type="checkbox"/>	Sim <input type="checkbox"/>		Quantas: _____	
Número de crimes cometidos até à data				
Furtos	Furtos Qualificados	Roubos	Outros	Total
				257

Consumos	Não <input type="checkbox"/>	Sim <input type="checkbox"/>	Que drogas: _____
Observações:			

APPENDIX 4

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 1.1

Instruções: Esta parte do questionário contém afirmações que poderiam ser usadas para expressar possíveis *vantagens* e *desvantagens* de furtar um dado objeto (ou até dinheiro). Cada afirmação é seguida por números de 1 a 5, sendo que 1 representa algo **Pouco Provável** e 5 representa algo **Muito Provável**.

Na sua opinião, quão provável é cada uma destas *vantagens/desvantagens* quando alguém furta. Assinale com um círculo o número que corresponde à sua resposta.

1. Se eu cometer furtos poderei usar os objetos furtados.	Pouco Provável	1	2	3	4	5	Muito Provável
2. Se eu cometer furtos irei prejudicar os outros.	Pouco Provável	1	2	3	4	5	Muito Provável
3. Se eu cometer furtos voltarei a ser preso.	Pouco Provável	1	2	3	4	5	Muito Provável
4. Se eu cometer furtos sentirei adrenalina.	Pouco Provável	1	2	3	4	5	Muito Provável
5. Se eu cometer furtos ganharei dinheiro fácil.	Pouco Provável	1	2	3	4	5	Muito Provável
6. Se eu cometer furtos ficarei mal visto pela sociedade.	Pouco Provável	1	2	3	4	5	Muito Provável
7. Se eu cometer furtos poderei magoar-me.	Pouco Provável	1	2	3	4	5	Muito Provável

Responda apenas se consome ou consumiu drogas.

8. Se eu cometer furtos ganharei dinheiro para droga.	Pouco Provável	1	2	3	4	5	Muito Provável
--	----------------	---	---	---	---	---	----------------

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 1.2

Instruções: Classifique as seguintes afirmações de acordo com o quanto gostaria que elas acontecessem. Cada afirmação é seguida por números de 1 a 5, sendo que 1 representa algo **Pouco Desejável** para si e 5 representa algo **Muito Desejável** para si.

Assinale com um círculo o número que corresponde à sua resposta.

9. Ficar com o objeto furtado é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
10. Prejudicar os outros é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
11. Voltar a ser preso é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
12. Sentir adrenalina é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
13. Ganhar dinheiro fácil é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
14. Ser mal visto pela sociedade é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
15. Magoar-me é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável
Responda apenas se consome ou consumiu drogas.							
16. Ganhar dinheiro para droga é:	Pouco	1	2	3	4	5	Muito
	Desejável						Desejável

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 2.1

Instruções: Esta parte do questionário contém afirmações que descrevem as opiniões de diferentes *peessoas e grupos* sobre o crime de furto. Cada afirmação é seguida por números de 1 a 5, sendo que 1 representa algo que a *peessoa/grupo* acha que **Não Deveria** fazer e 5 representa algo que a *peessoa/grupo* acha que se **Deveria** fazer.

De acordo com aquilo que sabe, qual a opinião das seguintes *peessoas/grupos* sobre praticar o crime de furto. Assinale com um círculo o número que corresponde à sua resposta.

17. A minha família acha que eu

Não Devo 1 2 3 4 5 Devo
furtar.

18. Os meus amigos que furtam acham que eu

Não Devo 1 2 3 4 5 Devo
furtar.

19. Os meus vizinhos acham que eu

Não Devo 1 2 3 4 5 Devo
furtar.

20. As pessoas que compram bens furtados acham que eu

Não Devo 1 2 3 4 5 Devo
furtar.

21. Os meus amigos que não furtam acham que eu

Não Devo 1 2 3 4 5 Devo
furtar.

22. Os meus amigos que consomem droga acham que eu

Não Devo 1 2 3 4 5 Devo

Data: _____

Parte 2.2

Instruções: Nesta parte do questionário é-lhe pedido que indique quão importante para si é a opinião de cada uma das *peessoas/grupos* apresentados.

Assinale com um círculo o número correspondente à sua resposta tendo em conta que 1 indica que a opinião da *pessoa/grupo* é **Nada Importante** para si e 5 indica que a opinião dessa *pessoa/grupo* é **Muito Importante** para si.

23. Para mim, a opinião da minha família é:	Nada	1	2	3	4	5	Muito
	Importante						Importante
24. Para mim, a opinião dos meus amigos <u>que furtam</u> é:	Nada	1	2	3	4	5	Muito
	Importante						Importante
25. Para mim, a opinião dos meus vizinhos é:	Nada	1	2	3	4	5	Muito
	Importante						Importante
26. Para mim, a opinião das que compram bens roubados é:	Nada	1	2	3	4	5	Muito
	Importante						Importante
27. Para mim, a opinião dos meus amigos que <u>não furtam</u> é:	Nada	1	2	3	4	5	Muito
	Importante						Importante
Responda apenas se é ou foi consumidor de drogas.							
28. Para mim, a opinião dos meus amigos que consomem droga é:	Nada	1	2	3	4	5	Muito
	Importante						Importante

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 3.1

Instruções: Imagine que se encontra numa situação em que tem **oportunidade de furtar** determinado objeto ou dinheiro (seja de uma casa, veículo ou mesmo de uma pessoa). Das seguintes frases, responda de acordo com aquilo que acha mais provável acontecer.

Assinale com um círculo o número correspondente à sua resposta tendo em conta que 1 indica algo **Pouco Provável** de acontecer e 5 indica algo **Muito Provável**.

29. Quão provável é haver vigilância (camaras, alarmes, cães) no local em que vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
30. Quão provável é haver pessoas no local em que vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
31. Quão provável é haver autoridades (polícia, guardas noturnos, carros patrulha) no local	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
32. Quão provável é ter comigo ferramentas (chaves de fendas, velas, pés de cabra) quando vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
33. Quão provável é ter acesso difícil aos bens que quero furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
34. Quão provável é conhecer o local onde vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
35. Quão provável é ter comigo armas (pistolas, facas) quando vou	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> </table>	Pouco	1	2	3	4	5	Muito							
Pouco	1	2	3	4	5	Muito									
36. Quão provável é ter comigo luvas, máscaras ou gorros quando vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
37. Quão provável é o objeto que quero furtar estar à vista.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
38. Quão provável é estar nervoso ou stressado quando vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									
39. Quão provável é estar a ressacar quando vou furtar.	<table border="1"> <tr> <td>Pouco</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>Muito</td> </tr> <tr> <td>Provável</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Provável</td> </tr> </table>	Pouco	1	2	3	4	5	Muito	Provável						Provável
Pouco	1	2	3	4	5	Muito									
Provável						Provável									

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 3.2

Instruções: As seguintes afirmações apresentam diferentes situações em que é possível cometer um furto. Na sua opinião, indique a probabilidade de cometer um furto quando algum destes obstáculos está presente.

Assinale com um círculo o número correspondente à sua resposta tendo em conta que 1 indica uma situação em que será **Menos Provável** furtar e 5 indica uma situação em que será **Mais Provável**.

40. Quando há algum tipo de vigilância (camaras, alarmes, cães) no local é

Menos Provável 1 2 3 4 5 Mais Provável
 eu furtar.

41. Quando há pessoas no local é

Menos Provável 1 2 3 4 5 Mais Provável
 eu furtar.

42. Quando há autoridades (polícia, guardas noturnos, carros patrulha) no local é

Menos Provável 1 2 3 4 5 Mais Provável
 eu furtar.

43. Quando tenho comigo ferramentas (chaves de fendas, velas, pés de cabra) é

Menos Provável 1 2 3 4 5 Mais Provável
 eu furtar.

44. Quando tenho difícil acesso aos bens que quero furtar é

Menos Provável 1 2 3 4 5 Mais Provável
 eu furtar.

45. Quando conheço o local onde vou furtar é

Menos Provável 1 2 3 4 5 Mais Provável

ID Sujeito: _____

46. Quando tenho comigo armas (pistola, faca) é							
Menos Provável	1	2	3	4	5	Mais Provável	
eu furtoar.							
47. Quando tenho comigo luvas, máscaras ou gorros é							
Menos Provável	1	2	3	4	5	Mais Provável	
eu furtoar.							
48. Quando o bem que quero furtoar não está à vista é							
Menos Provável	1	2	3	4	5	Mais Provável	
eu furtoar.							
49. Quando me encontro nervoso ou stressado é							
Menos Provável	1	2	3	4	5	Mais Provável	
eu furtoar.							
50. Quando me encontro a ressacar é							
Menos Provável	1	2	3	4	5	Mais Provável	
eu furtoar.							

ID Estudo: _____

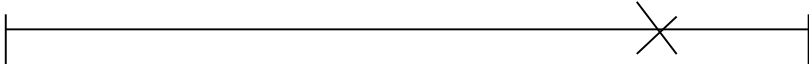
ID Sujeito: _____

Data: _____

Parte 4.1

Instruções: As seguintes afirmações dizem respeito à intenção de cometer um crime de furto. Responda de acordo com aquilo que pensa.


Assinale nas linhas abaixo uma cruz de acordo com a sua resposta. Veja o exemplo.

Eu tenho a certeza absoluta que não voltarei a vestir uma camisola verde.  Eu acho que que vou voltar a vestir uma camisola

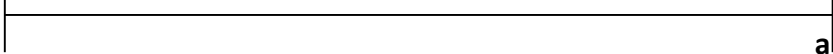
51.

Eu tenho a certeza absoluta que não voltarei a furtar.  Eu acho que que vou a furtar.

52.

É impossível eu voltar a furtar  Se calhar eu vou voltar a furtar.

53.

Nunca mais na minha vida irei furtar.  Poderei voltar a furtar.

ID Estudo: _____

ID Sujeito: _____

Data: _____

Parte 4.2

Instruções: As seguintes afirmações dizem respeito à intenção de cometer um crime de furto.

Responda de acordo com aquilo que pensa.

Assinale com um círculo o número correspondente à sua resposta tendo em conta que 1 indica algo com que **Discorda Completamente** e 5 algo com que **Concorda Completamente**.

54. Eu espero vir a cometer um furto quando sair da prisão.

Discordo	1	2	3	4	5	Concordo
Completamente						Completamente

55. Eu quero cometer um furto quando sair da prisão.

Discordo	1	2	3	4	5	Concordo
Completamente						Completamente

56. Eu tenho a intenção de cometer um furto quando sair da prisão.

Discordo	1	2	3	4	5	Concordo
Completamente						Completamente

APPENDIX 5


ESQ1 (Elicitation Study Questionnaire 1)

O presente questionário é constituído por duas partes distintas, cada uma composta por duas questões acerca das VANTAGENS e DESVANTAGENS de dois comportamentos diferentes. Escreva todas as vantagens e desvantagens que lhe vierem à cabeça. Tente não demorar mais do que 3 minutos por questão.

Os dados aqui recolhidos são anónimos e confidenciais e serão utilizados estritamente para o propósito da presente investigação.

Separe cada vantagem/desvantagem com uma vírgula.

[Continue »](#)

 20% completed

ESQ1 (Elicitation Study Questionnaire 1)

* Required

Sexo *

Masculino

Feminino

Idade *

Profissão *

[« Back](#) [Continue »](#)

 40% completed

ESQ1 (Elicitation Study Questionnaire 1)

* Required

Parte 1

Na sua opinião, quais são as VANTAGENS de retirar algo de uma loja sem pagar? *

Na sua opinião, quais são as DESVANTAGENS de retirar algo de uma loja sem pagar? *

« Back Continue »

60% completed

ESQ1 (Elicitation Study Questionnaire 1)

* Required

Parte 2

Na sua opinião, quais são as VANTAGENS de copiar durante um exame? *

Na sua opinião, quais são as DESVANTAGENS de copiar durante um exame? *

« Back Continue »

80% completed


ESQ1 (Elicitation Study Questionnaire 1)

Obrigado pela participação!

« Back

Submit

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 100%: You made it.

APPENDIX 6

Questionário

A presente investigação, realizado no âmbito de um estudo da Escola de Criminologia da Faculdade de Direito da Universidade do Porto, tem como objetivo analisar um conjunto de elementos individuais (atitudes, crenças, traços de personalidade) de modo a melhor compreender a forma como se processam alguns comportamentos que podem ser considerados transgressivos.

Pretende-se então que preencha um conjunto de questionários onde será pedida a sua opinião acerca de um conjunto de questões. Neste questionário não existem respostas certas ou erradas, sendo que apenas nos interessa saber a sua opinião.

A sua resposta é fundamental para o nosso estudo, pelo que pedimos que responda com a máxima sinceridade.

Salienta-se que a sua participação deve ser completamente voluntária, garantindo-se a confidencialidade dos dados e anonimato dos participantes. Os dados não serão tratados individualmente e serão única e exclusivamente utilizados para fins da presente investigação científica.

NEXT

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Questionário

* Required

Parte 1

Sexo *

- Masculino
- Feminino

Idade *

Your answer

Profissão *

Your answer

Nível de Escolaridade Completo *

- 1º Ciclo (1º ao 4º ano)
- 2º Ciclo (5º e 6º ano)
- 3º Ciclo (7º ao 9º ano)
- Secundário (10º ao 12º ano)
- Licenciatura/Mestrado/Doutoramento

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Questionário

* Required

Parte 2.1

Instruções: Esta secção do questionário contém afirmações que poderiam ser usadas para expressar possíveis vantagens (consequências positivas) e desvantagens (consequência negativas) de levar um objeto de uma loja sem o pagar.

Cada afirmação é seguida por números de 1 a 7, sendo que 1 significa que a consequência é "Nada Provável" e 7 significa que a consequência é "Extremamente Provável". Utilize os número intermédios se a sua opinião se situar entre estes extremos.

Na sua opinião, quão provável é cada uma destas vantagens/desvantagens na sequência de levar um objeto de uma loja sem pagar?

Se eu levar um objeto de uma loja sem pagar irei prejudicar o proprietário dessa loja. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei ganhar dinheiro vendendo o objeto. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei sentir-me envergonhado. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei sentir adrenalina. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei poupar dinheiro. *

1 2 3 4 5 6 7

Nada Provável Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei sentir-me culpado. *

1 2 3 4 5 6 7

Nada Provável Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei sentir-me bem psicologicamente. *

1 2 3 4 5 6 7

Nada Provável Extremamente Provável

Se eu levar um objeto de uma loja sem pagar irei ser punido pelas autoridades. *

1 2 3 4 5 6 7

Nada Provável Extremamente Provável

BACK

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Questionário

* Required

Parte 2.2

Instruções: De seguida irá ler um conjunto de afirmações. Classifique cada uma delas relativamente ao quão desejáveis são para si.

Cada afirmação é seguida por uma escala de 1 a 7, sendo que 1 significa que o item referido é algo "Nada Desejável" para si e 7 significa que o item referido é algo "Muito Desejável" para si. Utilize os número intermédios se a sua opinião se situar entre estes extremos.

Para mim, sentir adrenalina é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, sentir-me culpado é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, poupar dinheiro é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, sentir-me envergonhado é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, ganhar dinheiro é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, ser punido pelas autoridades é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, prejudicar proprietários de lojas é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, sentir-me bem psicologicamente é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

BACK

NEXT

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Questionário

* Required

Parte 2.3

Instruções: As seguintes afirmações referem-se a um possível cenário no qual tenha oportunidade de levar um objeto de uma loja sem pagar.

Para cada um dos itens responda numa escala de 1 a 7, de acordo com a sua opinião, o mais sinceramente possível. Sendo que 1 significa que considera o item "Falso" e 7 significa que considera o item "Verdadeiro". Utilize os números intermédios se a sua opinião se situar entre estes extremos.

Se tivesse oportunidade, levaria um objeto de uma loja sem pagar. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

Eu poderei levar um objeto de uma loja sem pagar no futuro. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

Eu nunca levaria algum objeto de uma loja sem pagar. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

BACK

NEXT

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Questionário

* Required

Parte 3.1

Instruções: Esta secção do questionário contém afirmações que poderiam ser usadas para expressar possíveis vantagens (consequências positivas) e desvantagens (consequência negativas) de copiar num exame ou teste.

Cada afirmação é seguida por números de 1 a 7, sendo que 1 significa que a consequência é "Nada Provável" e 7 significa que a consequência é "Extremamente Provável". Utilize os número intermédios se a sua opinião se situar entre estes extremos.

Na sua opinião, quão provável é cada uma destas vantagens/desvantagens ocorrer na sequências de copiar num exame ou teste?

Se copiar no exame não precisarei de me esforçar tanto no estudo para o exame. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame evitarei deixar questões em branco. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame tirarei melhor nota. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame irei passar no exame. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame não terei a noção do meu verdadeiro conhecimento sobre o tema. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame sentir-me-ei envergonhado. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame errarei nas questões copiadas. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame darei a resposta correta. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame não aprenderei tão bem a matéria. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame evitarei dar respostas erradas. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame serei apanhado. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame sentir-me-ei culpado. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

Se copiar no exame o meu exame será anulado. *

	1	2	3	4	5	6	7	
Nada Provável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente Provável

BACK

NEXT

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Questionário

* Required

Parte 3.2

Instruções: Irá novamente ler um conjunto de afirmações. Classifique cada uma delas relativamente ao quão desejáveis são para si.

Cada afirmação é seguida por uma escala de 1 a 7, sendo que 1 significa que o item referido é algo "Nada Desejável" para si e 7 significa que o item referido é algo "Muito Desejável" para si. Utilize os número intermédios se a sua opinião se situar entre estes extremos.

Para mim, não aprender bem a matéria lecionada é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, acertar em questões num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, não deixar questões em branco num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, sentir-me envergonhado é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, não ter de me esforçar para estudar para um exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, sentir-me culpado é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, não errar perguntas num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, ser apanhado a copiar num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, ter o exame anulado é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, passar num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, errar questões que copiei num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, tirar melhor nota num exame é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

Para mim, não ter a noção acerca dos meus verdadeiros conhecimentos sobre materia lecionada é *

	1	2	3	4	5	6	7	
Nada Desejável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito Desejável

BACK

NEXT

Never submit passwords through Google Forms.

Questionário

* Required

Parte 3.3

Instruções: As seguintes afirmações referem-se a um possível cenário no qual tenha oportunidade de copiar num exame ou teste.

Para cada um dos itens responda numa escala de 1 a 7, de acordo com a sua opinião, o mais sinceramente possível. Sendo que 1 significa que considera o item "Falso" e 7 significa que considera o item "Verdadeiro". Utilize os números intermédios se a sua opinião se situar entre estes extremos.

Se tivesse oportunidade, copiaria num exame. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

Eu nunca copiaria num exame. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

Eu poderei copiar num exame no futuro. *

	1	2	3	4	5	6	7	
Falso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Verdadeiro

BACK

NEXT

Never submit passwords through Google Forms.

Questionário

* Required

Parte 4

Instruções: As seguintes questões dizem respeito a comportamentos que poderá ou não ter levado a cabo nos últimos 12 meses.

Por favor responda de forma sincera.

Quantas vezes levou um objeto de uma loja sem o pagar, nos últimos 12 meses? *

- nunca
- uma vez
- duas vezes
- três vezes
- quatro vezes
- cinco vezes
- mais de cinco vezes

Quantas vezes copiou num exame, nos últimos 12 meses? *

- nunca
- uma vez
- duas vezes
- três vezes
- quatro vezes
- cinco vezes
- mais de cinco vezes

BACK

NEXT

Esta investigação terá uma segunda fase, para a qual serão seleccionados indivíduos com perfis particulares, de especial relevo para a investigação. Se estiver disponível para participar na fase seguinte, coloque, por favor, o seu endereço de e-mail abaixo.

Relembramos que todos os dados são confidenciais.
A sua participação é muito importante para o estudo.

Obrigado.

Endereço de email (facultativo):

Short answer text
.....

APPENDIX 7

Boa Tarde,

Antes de mais gostaria de agradecer o tempo que disponibilizou para preencher o meu questionário. A investigação onde este questionário se enquadra esta a avançar num bom sentido e, sem a sua participação, tal não teria sido possível.

No entanto, chegou a altura de avançar para a segunda fase do estudo. No final do referido questionário solicitou-se a cada um dos participantes que escrevesse o seu endereço de e-mail, se desejasse integrar as fases seguintes deste projeto.

Assim, a segunda etapa desta investigação passa pela participação num curto conjunto de tarefas laboratoriais (todas em computador) combinado com uma medição não invasiva de eletrocardiograma (EEG) e condutância elétrica da pele (GSR). Será de ressaltar que ambos os testes são indolores.

Os voluntários que decidirem participar nesta fase estarão automaticamente habilitados a receber um cheque FNAC no valor de 50,00€ no sorteio final.

A recolha decorrerá no Laboratório de Criminologia da Faculdade de Direito da Universidade do Porto, às terças e as quintas-feiras das 9h as 18h da tarde (sendo que, no caso de não haver disponibilidade da sua parte nestes dias, haverá sempre a possibilidade de arranjar uma outra data, de acordo com a sua conveniência.

Se estiver interessado em participar, por favor, envie-me um e-mail, indicando dia e hora da sua conveniência.

Antecipadamente grato,

Atenciosamente,

João Próspero-Luís

APPENDIX 8

Formulário de Consentimento Informado

O presente estudo tem como objetivo analisar um conjunto de traços de personalidade e a sua relação com a tomada de decisão. A sua tarefa consiste em completar três diferentes tarefas num computador, enquanto lhe é medido o ritmo cardíaco (ECG) e a condutância elétrica da pele através de métodos não invasivos e não dolorosos.

Salienta-se que a sua participação deve ser completamente voluntária e que, da sua participação ou recusa de participar, não advêm quaisquer benefícios ou penalizações.

Garante-se a confidencialidade dos dados e anonimato dos participantes. Os dados não serão tratados individualmente mas apenas em grupo e serão única e exclusivamente utilizados para fins da presente investigação científica. Se assim entender, o participante poderá desistir a qualquer momento. Caso solicite ser-lhe-ão fornecidos resultados de grupo divulgados em publicações científicas.

A assinatura deste consentimento pressupõe que tomou conhecimento dos objetivos do estudo e procedimentos a realizar e que aceita que as informações prestadas sejam utilizadas no âmbito da investigação.

Eu _____, declaro que aceito participar voluntariamente na investigação conduzida por João Cardoso da Silva Próspero Luís no âmbito da dissertação de doutoramento em Criminologia, da Faculdade de Direito da Universidade do Porto.

Fui esclarecido sobre os objetivos deste trabalho, tendo sido igualmente informado de que este estudo se realizará com recurso a tarefas de avaliação psicológica. Foi-me transmitido que sou livre para interromper ou desistir a qualquer momento do estudo. Fui informado de que da minha participação ou recusa em participar não advém qualquer benefício ou penalização. De igual modo, foi-me garantida a salvaguarda da confidencialidade e anonimato e fui informado de que os dados não serão tratados individualmente, mas apenas em grupo.

Tomei conhecimento dos objetivos do estudo e aceito que as informações decorrentes da minha participação sejam analisadas e utilizadas pela equipa científica, no âmbito deste estudo.

_____, ____ de _____ de _____

Assinatura do participante:

Assinatura do investigador:

APPENDIX 9

REGISTO DE CONTROLO - NBP2

(PTDC/PSI-PCO/099528/2008)

Dados pessoais do participante:		Data:	Hora:
Nome:			
Grupo:	Código:	Origem:	
Sexo:	Data de nascimento:	Escolaridade:	
Perímetro cefálico:	Lateralidade:		
Morada:			
Telefone:	E-mail: @		

Questões de controlo – Não aplicável a pacientes, excepto nas questões assinaladas com **					
Consumo de Drogas:	Dependência de drogas duras				
	Dependência de álcool e/ou drogas leves				
	Consumo experimental ou social ¹ de drogas duras				
	Consumo moderado ² de álcool e/ou drogas leves				
	Sem história de consumo de álcool ou drogas				
História de doença mental		História de lesões neurológicas		Visão	
Sim:	Não:	Sim:	Não:	Normal:	Corrigida:
Medicação		Problemas auditivos **		Dormiu bem? **	
Não:	Sim (descrição):	Não:	Sim (descrição):	Sim:	Não:
				Quantas horas?	

Dados referentes à recolha de dados:			Observações:		
Ordem de aplicação dos blocos:					
Desempenho no ODDBAL (tons contabilizados):					
Bloco 1:	Bloco2:	Bloco 3:			

Investigadores que realizaram a recolha de dados:

APPENDIX 10

Matlab Script – Multiload .acq

```

directory_name = uigetdir;
cd(directory_name);
files = dir(fullfile(directory_name, '*.acq'));

fileIndex = find(~[files.isdir]);

for i = 1:length(fileIndex)

fileName = files(fileIndex(i)).name;
[PATH, NAME, EXT] = fileparts(fileName);

Data = load_acq (fileName, 0);

save ([NAME, '.mat'], 'Data');

clear Data fileName PATH NAME EXT

end

%Hooray!
disp('*** All files successfully exported! ***');

```

Matlab Script – Baseline Wander

```

directory_name = uigetdir;
cd(directory_name);
files = dir(fullfile(directory_name, '*Wnd.mat'));

fileIndex = find(~[files.isdir]);

for i = 1:length(fileIndex)

fileName = files(fileIndex(i)).name;
[PATH, NAME, EXT] = fileparts(fileName);

```

```

load(fileName);

ecg = Data.data(:,1)';

for a = 1 : 1 : length(ecg)
    if a == 1
        m(a)=ecg(a+1)-ecg(a);
    end
    if a > 1
        m(a)= ecg(a)-ecg(a-1);
    end
end

%plot(m(1:2000));

Data.data(:,1) = m';

ECG.setname=[NAME, '_Wnd'];

save ([ECG.setname, '.mat'], 'Data');

clear Data a m ecg;

end

```

Matlab Script - Extract ECG

```

directory_name = uigetdir;
cd(directory_name);
files = dir(fullfile(directory_name, '*_Wnd.mat'));

fileIndex = find(~[files.isdir]);

for i = 1:length(fileIndex)

fileName = files(fileIndex(i)).name;
[PATH, NAME, EXT] = fileparts(fileName);

load(fileName);

ECG = Data.data(:,1)';

NewNAME=[NAME, '_ECG'];

```

```
save (NewNAME, 'ECG');

clear ECG
end

%Hooray!
disp('*** All files successfully exported! ***');
```

Matlab Script - Detect QRS

```
a=max(ECG);
past_pos=1;
count=0;
for i = 1 : 1 : length(ECG)
    if ECG(i)<(0.35*a)
        continue
    else if (i-past_pos)>(10)
        count=count+1;
        pos(count)=i;
        val(count)=ECG(i);
        past_pos=i;
    end
end
end
stem(pos(1:60),val(1:60));
```

APPENDIX 11*Associations between Boldness, Meanness and Disinhibition scores and Commission errors on the Passive Avoidance Task*

Commission Errors	Boldness	Meanness	Disinhibition
<i>Total</i>	-.142	-.061	.133
<i>By value</i>			
1	-.035	-.044	.072
1400	-.044	.090	.214
1700	-.173	-.166	.027
2000	-.163	-.061	.080
<i>By block</i>			
1	-.001	-.044	.124
2	-.065	-.073	-.123
3	-.055	.103	.038
4	-.087	.006	.021
5	-.093	-.042	.091
6	-.077	-.123	.140
7	-.224	-.192	.088
8	-.070	-.097	.038
9	-.129	-.079	.078
10	.069	-.075	.252*
11	-.066	.080	.039
12	-.077	.205	.340*

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 12

Correlations of Boldness, Meanness and Disinhibition scores as predictors of the WCST task scores

	Boldness	Meanness	Disinhibition
Correct responses	.033	.136	.114
Total errors	-.035	-.148	-.124
Perseverative responses	-.038	.234	.061
Perseverative errors	-.010	.160	-.015
Non-Perseverative errors	-.017	-.202	-.110

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 13

Associations between Boldness, Meanness and Disinhibition scores and loss aversion in the male sub-sample

	Boldness	Meanness	Disinhibition
<i>Loss aversion</i>	.104	.022	-.063

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 14

Associations between Psychopathy, Machiavellianism and Narcissism scores and the loss aversion in the male sub-sample

	Psychopathy	Machiavellianism	Narcissism
<i>Loss aversion</i>	.060	-.110	-.196

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 15

Regressions of Boldness and Disinhibition scores as predictors of Meanness score on female sub-sample (Study 2).

	Boldness			Disinhibition			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Meanness	.161	.034	.225***	.392	.037	.501***	.264

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 16

Regressions of Boldness and Disinhibition scores as predictors of Meanness score on male sub-sample (Study 2).

	Boldness			Disinhibition			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Meanness	.313	.066	.293***	.644	.062	.638***	.516

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 17

Associations between Boldness, Meanness and Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating (female sample)

Belief	Component	Boldness	Meanness	Disinhibition
<i>Better grades</i>	Expectancy	-.087	.038	.155**
	Value	.043	-.023	-.035
<i>Less effort</i>	Expectancy	-.032	.110*	.136*
	Value	-.149**	.250***	.247***
<i>Correct answer</i>	Expectancy	-.077	-.009	.000
	Value	.011	-.055	-.074
<i>Avoid blank questions</i>	Expectancy	-.043	.067	.079
	Value	.005	-.034	.021
<i>Avoid wrong answers</i>	Expectancy	-.025	.040	.069
	Value	.109*	-.008	-.124*
<i>Pass the exam</i>	Expectancy	-.094	.018	.093
	Value	.027	-.066	-.165**
<i>Being caught</i>	Expectancy	-.108*	-.198***	-.190***
	Value	-.041	.089	.058
<i>Copying wrong answers</i>	Expectancy	.002	.009	-.024
	Value	-.079	-.062	-.083
<i>Acquiring less knowledge</i>	Expectancy	-.045	-.077	-.087
	Value	-.071	.209***	.196***
<i>Wrong perception of knowledge</i>	Expectancy	.025	-.093	-.137*
	Value	-.094	.139*	.142**
<i>Null exam</i>	Expectancy	-.097	-.133*	-.194***
	Value	-.019	.068	.051
<i>Feeling ashamed</i>	Expectancy	-.025	-.395***	-.320***
	Value	-.025	.194***	.144**

<i>Feeling guilty</i>	Expectancy	-.099	-.344***	-.290***
	Value	.000	.150**	.066

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 18

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating

Belief	Component	Core Boldness	Core Meanness	Core Disinhibition
<i>Better grades</i>	Expectancy	.030	.084	.104
	Value	-.055	-.009	-.069
<i>Less effort</i>	Expectancy	.118	.152	-.025
	Value	-.116	.219*	.070
<i>Correct answer</i>	Expectancy	-.036	.088	-.012
	Value	.008	.040	-.119
<i>Avoid blank questions</i>	Expectancy	.011	.111	.082
	Value	-.019	.076	-.081
<i>Avoid wrong answers</i>	Expectancy	.131	-.015	.213
	Value	-.105	-.059	-.005
<i>Pass the exam</i>	Expectancy	-.059	.105	.004
	Value	-.042	-.019	.005
<i>Being caught</i>	Expectancy	-.312***	-.237**	.141
	Value	.181*	.153	.103
<i>Copying wrong answers</i>	Expectancy	-.067	.083	.052
	Value	-.013	.045	-.071
<i>Acquiring less knowledge</i>	Expectancy	-.037	-.027	-.022
	Value	-.026	.147	-.012
<i>Wrong perception of knowledge</i>	Expectancy	.093	-.198*	.072
	Value	.104	.087	.117
<i>Null exam</i>	Expectancy	-.117	-.175*	.098
	Value	.026	.050	-.032

<i>Feeling ashamed</i>	Expectancy	.011	-.402***	.164
	Value	-.031	.116	-.028
<i>Feeling guilty</i>	Expectancy	-.125	-.354	.065
	Value	-.105	.248**	.052

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 19*Associations between Core Meanness scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Shoplifting (female sample)*

Belief	Component	Core Boldness	Core Meanness	Core Disinhibition
<i>Save money</i>	Expectancy	-.047	.131*	.046
	Value	-.114*	.091	-.084
<i>Adrenaline</i>	Expectancy	-.132*	.145**	.026
	Value	.295***	.112*	.009
<i>Earn money</i>	Expectancy	-.072	.062	-.005
	Value	.024	.070	-.037
<i>Feeling good</i>	Expectancy	.009	.184**	.170**
	Value	.030	-.066	-.048
<i>Being punished</i>	Expectancy	-.085	.025	-.201***
	Value	.077	-.019	.067
<i>Hurting the owner</i>	Expectancy	.073	-.112*	-.138*
	Value	-.093	-.019	.045
<i>Feeling ashamed</i>	Expectancy	-.019	-.142**	-.202***
	Value	-.084	.134*	-.066
<i>Feeling guilty</i>	Expectancy	-.029	-.136*	-.190***
	Value	-.051	.111*	-.031

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 20

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Shoplifting (male sample)

Belief	Component	Core Boldness	Core Meanness	Core Disinhibition
<i>Save money</i>	Expectancy	-.070	.175*	-.047
	Value	-.035	.108	-.036
<i>Adrenaline</i>	Expectancy	-.012	.025	.076
	Value	.181*	.230**	.070
<i>Earn money</i>	Expectancy	.065	.170	-.007
	Value	-.025	.185*	-.104
<i>Feeling good</i>	Expectancy	.095	.452***	.101
	Value	.005	-.336***	-.096
<i>Being punished</i>	Expectancy	-.192*	-.228**	-.002
	Value	.038	.181*	.113
<i>Hurting the owner</i>	Expectancy	-.127	-.140	-.100
	Value	-.129	.430***	.011
<i>Feeling ashamed</i>	Expectancy	-.126	-.453***	-.102
	Value	.110	.144	.062
<i>Feeling guilty</i>	Expectancy	-.156	-.369***	-.205*
	Value	.075	.256**	.115

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 21*Correlations of Core Boldness, Core Meanness and Core Disinhibition scores and the WCST task scores*

	Core Boldness	Core Meanness	Core Disinhibition
Correct responses	.014	.074	.055
Total errors	-.015	-.079	-.060
Perseverative responses	-.117	.263*	-.088
Perseverative errors	-.083	.221	-.130
Non-Perseverative errors	.020	-.164	-.033

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 22

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and the Heart-rate and Heart-rate variability scores

		Core Boldness	Core Meanness	Core Disinhibition
<i>Heart-rate</i>	<i>Baseline - 1</i>	.084	-.038	.242
	<i>WCST</i>	.208	-.001	.315
	<i>PA Task</i>	-.011	.049	.009
	<i>Go/No-Go - 1</i>	-.040	.003	.130
	<i>Go/No-Go - 2</i>	.007	-.071	.231
	<i>Baseline - 2</i>	-.084	-.137	.289
<i>Heart-rate variability</i>	<i>Baseline - 1</i>	-.037	-.035	-.190
	<i>WCST</i>	.146	-.464**	.290
	<i>PA Task</i>	.003	-.084	-.115
	<i>Go/No-Go - 1</i>	.033	-.035	-.104
	<i>Go/No-Go - 2</i>	.030	.035	-.174
	<i>Baseline - 2</i>	.136	.012	-.143

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 23

Regressions of Boldness and Disinhibition scores as predictors of Meanness score on female sub-sample (Study 4 and other samples; N=238).

	Boldness			Disinhibition			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Meanness	.167	.046	.203***	.524	.057	.511***	.279

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 24

Regressions of Boldness and Disinhibition scores as predictors of Meanness score on male sub-sample (Study 4 and other samples; N=119).

	Boldness			Disinhibition			R ²
	<i>b</i>	SE <i>b</i>	β	<i>b</i>	SE <i>b</i>	β	
Meanness	.262	.064	.311***	.483	.072	.512***	.336

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 25

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and the Value and Expectancy Components of Criminal Attitudinal Beliefs in Cheating (female sample)

Belief	Component	Core Boldness	Core Meanness	Core Disinhibition
<i>Better grades</i>	Expectancy	-.059	-.038	.135*
	Value	.043	-.017	-.016
<i>Less effort</i>	Expectancy	-.032	.037	.083
	Value	-.172**	.160**	.095
<i>Correct answer</i>	Expectancy	.019	.019	-.014
	Value	.010	-.012	-.049
<i>Avoid blank questions</i>	Expectancy	-.046	.034	.039
	Value	.021	-.056	.047
<i>Avoid wrong answers</i>	Expectancy	-.020	.004	.050
	Value	.080	.041	-.112*
<i>Pass the exam</i>	Expectancy	-.077	-.013	.073
	Value	.003	.037	-.145**
<i>Being caught</i>	Expectancy	-.098	-.044	-.128*
	Value	-.057	.074	.002
<i>Copying wrong answers</i>	Expectancy	-.008	.027	-.033
	Value	-.085	.022	-.080
<i>Acquiring less knowledge</i>	Expectancy	-.044	-.007	-.065
	Value	-.091	.121*	.082
<i>Wrong perception of knowledge</i>	Expectancy	.019	-.014	-.097
	Value	-.106	.090	.055
<i>Null exam</i>	Expectancy	-.112*	.031	-.171**
	Value	-.029	.047	.013

<i>Feeling ashamed</i>	Expectancy	.020	-.204***	-.138*
	Value	-.053	.124*	.042
<i>Feeling guilty</i>	Expectancy	-.066	-.139*	-.153**
	Value	-.034	.122*	-.016

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 26

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and loss aversion in the male sub-sample

	Core Boldness	Core Meanness	Core Disinhibition
<i>Loss aversion</i>	.085	.035	-.065

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 27

Associations between Core Boldness, Core Meanness and Core Disinhibition scores and loss aversion in the female sub-sample

	Core Boldness	Core Meanness	Core Disinhibition
<i>Loss aversion</i>	-.158	-.087	-.083

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 28*Associations between Core Boldness, Core Meanness, Core Disinhibition scores and Psychopathy, Machiavellianism and Narcissism in the male sub-sample*

	Core Boldness	Core Meanness	Core Disinhibition
Psychopathy	-.021	.470***	.135
Machiavellianism	.235*	.223*	.206*
Narcissism	.137	-.067	.342***

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 29*Associations between Core Boldness, Core Meanness, Core Disinhibition scores and Psychopathy, Machiavellianism and Narcissism in the female sub-sample*

	Core Boldness	Core Meanness	Core Disinhibition
Psychopathy	-.163*	.622**	-.103
Machiavellianism	.079	.209**	.191**
Narcissism	.222**	-.055	.273***

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 30

Associations between Core Boldness, Core Meanness, Core Disinhibition scores and the Grasmick scores in the male sub-sample

	Core Boldness	Core Meanness	Core Disinhibition
<i>Impulsivity</i>	-.003	-.048	.514***
<i>Preference for simple tasks</i>	-.459***	.152	.034
<i>Risk seeking</i>	.363***	.083	.202*
<i>Preference for physical activities</i>	.283**	-.081	.116
<i>Self-centered orientation</i>	-.068	.520***	.008
<i>Temperament</i>	-.171	.295**	.194*

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed

APPENDIX 31

Associations between Core Boldness, Core Meanness, Core Disinhibition scores and the Grasmick scores in the female sub-sample

	Core Boldness	Core Meanness	Core Disinhibition
<i>Impulsivity</i>	.023	.097	.501***
<i>Preference for simple tasks</i>	-.369***	.135*	.206**
<i>Risk seeking</i>	.216*	.192**	.216**
<i>Preference for physical activities</i>	.154*	-.040	.286***
<i>Self-centered orientation</i>	-.019	.543***	-.040
<i>Temperament</i>	-.161*	.309***	.245***

* $p < .05$; ** $p < .01$, *** $p < .001$ one tailed