



Review

The role of emotions and physiological arousal in modulating impulsive behaviour

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ABSTRACT

Impulsivity received considerable attention in the context of drug misuse and certain neuropsychiatric conditions. Because of its great health and well-being importance, it is crucial to understand factors which modulate impulsive behaviour. As a growing body of literature indicates the role of emotional and physiological states in guiding our actions and decisions, we argue that current affective state and physiological arousal exert a significant influence on behavioural impulsivity. As ‘impulsivity’ is a heterogeneous concept, in this paper, we review key theories of the topic and summarise information about distinct impulsivity subtypes and their methods of assessment, pointing out to the differences between the various components of the construct. Moreover, we review existing literature on the relationship between emotional states, arousal and impulsive behaviour and suggest directions for future research.

1. Introduction

The importance of impulsivity has long been recognised, both in everyday life, as it plays a vital role in the decision-making process, and in many neuropsychiatric conditions. Impulsive behaviour is a diagnostic criterion of several neuropsychiatric conditions including personality disorders (borderline and antisocial personality disorders), substance use disorders, or attention deficit and hyperactivity disorder (ADHD; American Psychiatric Association, 2013). High levels of trait impulsivity are also associated with risk-taking and increased alcohol use in social drinkers (Granö, Virtanen, Vahtera, Elovainio, & Kivimäki, 2004; Graue & Ortet, 1999), and predict increased food intake in normal-weight healthy women (Guerrieri, Nederkoorn, Jansen, 2007; Guerrieri, Nederkoorn, Stankiewicz, et al., 2007).

Therefore, impulsivity has a great clinical as well as general-health importance. A better understanding of modulators of impulsive behaviour could help identify risky states and support impulsive individuals in a clinical and general population. One of the factors which may exert an impact on our impulsive state is emotions. A growing body of evidence shows that emotions influence our cognition and behaviour, including memory and learning, attention, or perception (Asutay & Västfjäll, 2012; Dolan, 2002; Sharot, Delgado, & Phelps, 2004; Talarico & Rubin, 2007; Zadra & Clore, 2011). It seems that impulsivity is not independent of emotional influences either. The tendency to act

impulsively while experiencing distress (negative urgency, Whiteside & Lynam, 2001) is a well-established personality trait. Cyders and Smith (2007, 2009); Cyders and Smith, 2007 also proposed another facet of mood-based rash action, which is driven by strong positive emotions (positive urgency). Moreover, research suggests that engaging in impulsive actions, which may result in negative consequences in the future, such as emotional eating, heavy drinking or smoking, while experiencing negative affect might serve as a means of alleviating one's mood state (Abrantes et al., 2008; Bekker, Van De Meerendonk, & Mollerus, 2004; Cooper, Frone, Russell, & Mudar, 1995; Magid, Colder, Stroud, Nichter, & Nichter, 2009; Smyth et al., 2007). Indeed, impulsive behaviour, such as episodes of binge eating and purging in bulimia nervosa, are thought of as maladaptive attempts to alleviate one's mood state (Smyth et al., 2007).

This review aims to indicate the role of emotional and physiological states as important modulators of impulsive actions and decisions. When growing body of literature shows the detrimental effects of inability to regulate one's emotions (Cisler, Olatunji, Feldner, & Forsyth, 2010; Wilcox, Pommy, & Adinoff, 2016) and a high prevalence of mood disorders in society (Kessler, Chiu, Demler, & Walters, 2005), it seems particularly important to understand how affective states modulate behaviour and decision-making. While there are other relevant factors such as gender, age or genetic polymorphisms, these are beyond the scope of this review. A better understanding of the relationship between

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emotion, physiological states, and impulsivity, as well as the neural circuitry underlying these relationships, could facilitate treatment of impulse-related disorders and promote methods to improve decision-making of those suffering from mood disorders. However, in this review, we focus on healthy volunteers as most of the work looking at the role of emotional and physiological states on impulsivity has been conducted in healthy individuals. Since the term ‘impulsivity’ incorporates a wide range of behaviours, it is important to describe the complex construct of impulsivity before discussing the role of emotional and physiological states in shaping impulsive action. Therefore, the first sections will deal with research trying to define and systematise the construct of impulsivity.

2. Defining impulsivity

Although impulsivity is considered a symptom of many psychiatric and neurological conditions (American Psychiatric Association, 2013), it is also an element of a personality of healthy individuals (Evenden, 1999a, 1999b). There are, however, many definitions of this construct (Evenden, 1999a, 1999b; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001).

According to Daruna and Barnes (1993), impulsivity is reflected in a variety of maladaptive behaviours, unplanned or prematurely expressed, inappropriate to situations, risky or resulting in undesirable consequences. Other authors define impulsivity as an inability to delay gratification and as the opposite of self-control (Monterosso & Ainslie, 1999). American Psychiatric Association (2013) describe impulsivity as a failure to control impulses or temptations to perform actions which are detrimental to the individual or other people.

According to Moeller (Moeller et al., 2001), impulsivity should be defined as a predisposition for rapid, unplanned actions in response to external and internal stimuli without considering potential negative consequences of these actions. Importantly, impulsivity, in this definition, is associated with automaticity: quick decision-making, lack of planning and foresight, which prevents from an appropriate assessment of the consequences. Likewise, Eysenck (Eysenck & Eysenck, 1978) discriminates between *impulsiveness* and *venturesomeness*, the latter being related to conscious risk-taking.

The above definitions consider impulsivity as a maladaptive and pathological feature; yet, it is widely accepted that impulsivity is a part of a normal behaviour, and every person can be characterised on their impulsive tendencies. Therefore, impulsivity may be perceived as a personality trait. For instance, in his original theory, Hans Eysenck proposed that personality consists of two dimensions of higher-order traits, i.e. extraversion vs introversion and emotional stability vs neuroticism. In this primary construct, impulsivity was considered to be a part of extraversion; however, in the revised model, impulsivity is regarded as a part of the third dimension – psychoticism vs impulse control (Eysenck & Eysenck, 1985). In Eysenck’s notion, impulsivity is related to risk-taking, lack of planning, and making up one’s mind quickly. A similar concept was proposed by Martin Zuckerman under the name “sensation seeking”. According to Zuckerman, high sensation seekers are people who show a constant need for stimulation and novel experiences, despite the risks (Zuckerman, 1984).

Gray (1972, 1981), on the other hand, argued that impulsivity and anxiety are the major factors of personality with which other features should be described. In this model, extraversion is characterised by low anxiety and high impulsivity levels, while neuroticism – with high anxiety and high impulsivity levels. Grey proposed an existence of two behavioural systems which underlie these personality traits. The behavioural activation system is related to impulsivity and is associated with sensitivity to reward and approach behaviours, while the behavioural inhibition system underlies anxiety and is activated in response to punishment signals and novelty. Noteworthy, the Barratt Impulsiveness Scale (BIS; Barratt, 1959; Patton, Stanford, & Barratt, 1995), a questionnaire commonly used both in clinical setting and research to

assess impulsivity levels, was primarily developed to separate the personality trait of impulsiveness from the personality trait of anxiety.

3. Subtypes of impulsivity

Difficulties in unequivocally defining impulsivity and placing it within personality models prove that impulsivity is a multidimensional construct, where components are independent of one another and reflect different aspects of behaviour (Congdon & Canli, 2008; Evenden, 1999a; Moeller et al., 2001). Various approaches to the complex construct of impulsivity led to distinguish different subtypes of this feature.

For instance, two commonly used impulsivity scales, identify various components of impulsivity construct. In BIS (version BIS-11) three dimensions of impulsivity are defined: inattention (a difficulty in focusing on the task at hand), motor (acting on the spur of the moment or inability to withhold the response), and non-planning (which refers to the lack of consideration or not planning tasks carefully) (Patton et al., 1995). Whiteside and Lynam (2001), on the other hand, performed a comprehensive factor analysis of various impulsivity scales to separate distinct subtypes of impulsivity which were previously grouped together. Their analysis led to distinguishing four personality facets related to impulsive behaviour: urgency (a tendency to act under the influence of strong impulses, often associated with negative affect), lack of premeditation (a tendency to take actions without careful planning or thinking of consequences), lack of perseverance (an inability to fulfil the task despite boredom or tiredness), and sensation seeking (a tendency to seek novelty and excitement). Measures of each personality dimensions together form the UPPS (Urgency, Premeditation, Perseverance, Sensation seeking) Impulsive Behaviour scale. Subsequently, Cyders and Smith (2007, 2008), proposed an additional component called Positive Urgency, which refers to a tendency to act impulsively while experiencing strong positive emotions.

Opposite to generally held view, Dickman (1990) argued that impulsivity is not solely a maladaptive feature. He pointed out that making snap decisions about matters of little importance (“what am I having for dinner tonight?”) is beneficial. Moreover, spontaneous behaviours enable us to seize opportunities, gain new experiences, which enrich our lives. Additionally, impulsive individuals outperform less impulsive subjects in tasks when a little time is available to reach a decision (Dickman & Meyer, 1988). Therefore, Dickman distinguished ‘functional impulsivity’, which reflects the advantageous aspects of spontaneous behaviour, from ‘dysfunctional impulsivity’, which is a maladaptive feature associated with negative consequences. Similarly, others argued that when it comes to everyday situations, fast and frugal decisions may be beneficial and better than in-depth considerations as they lead to optimising strategies in the face of limited time and resources (Gigerenzer et al., 1999). One showed that the consequences of impulsive traits depend on the nature of the task: When delayed rewards are favoured over immediate rewards, low-impulsive individuals outperform highly impulsive ones; however, when immediate gratification is preferred, highly impulsive individuals perform better study (Otto, Markman, & Love, 2012). Taken to extreme, the urge to override immediate gratification in favour of the long-term goals may be maladaptive and even life-threatening, which is best exemplified with patients suffering from anorexia nervosa, who suppress their urge to eat and show decreased preference towards immediate rewards compared to healthy controls, a feature reversed with treatment (Decker, Figner, & Steinglass, 2015).

In behavioural approach, impulsivity construct is often divided into at least two major dimensions. The first reflects disinhibition, and is often referred to as motor impulsivity or impulsive action, while the second dimension reflects impulsive decision-making (also referred to as impulsive choice or cognitive impulsivity; Bechara, Damasio, & Damasio, 2000; Broos et al., 2012; Brunner & Hen, 1997; Reynolds, Ortengren, Richards, & de Wit, 2006). Impulsive action can be further divided into action cancellation and action restraint, while impulsive

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