



## Social cognition in Intermittent Explosive Disorder and aggression



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### ABSTRACT

Social-emotional information processing (SEIP) was assessed in individuals with current DSM-5 Intermittent Explosive Disorder (IED:  $n = 100$ ) and in healthy ( $n = 100$ ) and psychiatric ( $n = 100$ ) controls using a recently developed and validated self-rated questionnaire. SEIP vignettes depicted both direct aggressive and relationally aggressive scenarios of a socially ambiguous nature and were followed by questions assessing subjects' reactions and judgments about the vignettes. IED subjects differed from both healthy and psychiatric controls in all SEIP components. While hostile attribution was highly related to history of aggression, it was also directly correlated with negative emotional response. Further analysis revealed that this component, as well as response valuation and response efficiency, rather than hostile attribution, best explained history of aggressive behavior. A reformulated SEIP model, including self-reported history of childhood trauma, found that negative emotional response and response efficiency were the critical correlates for history of aggressive behavior. Psychosocial interventions of aggressive behavior in IED subjects may do well to include elements that work to reduce the emotional response to social threat and that work to restructure social cognition so that the tendency towards overt, or relationally, aggressive responding is reduced.

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## 1. Introduction

Intermittent Explosive Disorder (IED), as operationalized in DSM-5, is a disorder of impulsive aggression (Coccaro, 2011). Recent epidemiological surveys reveal that IED is relatively common with the largest such study estimating the lifetime prevalence of DSM-5 IED at about 3.5% (Coccaro et al., in press), a lifetime prevalence rate greater than that of schizophrenia and bipolar disorder combined. In addition, IED aggregates in first-degree relations (Coccaro, 2010), is associated with reductions in indices of serotonin function (Coccaro et al., 2010), as well as abnormalities in indices of other neurotransmitter function (Coccaro et al., 1998, 2012a; 2012b, 2013; Lee et al., 2009), and responds to both psychopharmacologic (Coccaro et al., 2009a) and cognitive-behavioral intervention (McCloskey et al., 2008).

Improved understanding of cognitive-emotional processes involved in aggression is needed to advance the scope of treatment approaches.

### 1.1. Social information processing (SIP) in aggression

Our biopsychosocial model of impulsive aggression posits that central neurotransmitters set the threshold at which one will “explode” in response to social threat, with other factors contributing to how this threshold is reached in each “here and now” moment of social interactions (Coccaro et al., 2011). These other factors include, but are not limited to, a dysfunction in social information processing (SIP) where SIP represents a series of cognitive – and emotional – steps individuals take in social situations when they respond to the actions of others towards them.

Models of SIP, first introduced over fifty years ago, seek to explain selected social behaviors such as decision making and problem solving (e.g., Abelson, 1968; Simon, 1969; Wyer, 1974). Later, a number of information processing models were developed

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to account for individual differences in aggressive behaviors (e.g., Crick and Dodge, 1994; Dodge, 1980; Huesmann, 1982, 1988, 1998). These models have focused on two broad sets of processes underlying aggressive behavior. First, encoding and interpretation of cues (e.g., attribution of intent, including hostile attribution) and, second, response assessment, response choice, and enactment (e.g., evaluation of the likelihood that each alternative will produce the desired outcomes) which Fontaine et al., 2008 has referred to as “response evaluation and decision making”.

Hostile attribution (HA) is the tendency to interpret the intent of others as “hostile” when in ambiguous interactions (Milich and Dodge, 1984). HA has been identified as a key etiologic element in the development and maintenance of aggressive behaviors (Orobio de Castro et al., 2002). “Aggressive” individuals are reported to attribute hostile intent more often than their “non-aggressive” counterparts (e.g., Fontaine and Dodge, 2006) and several studies report a positive relationship of HA with aggressive behavior (e.g., Bailey and Ostrov, 2008; Crick, 1995; Dodge, 1980; Dodge and Somberg, 1987; Feldman and Dodge, 1987; Hubbard et al., 2001; Orobio de Castro et al., 2002).

Relationships between HA and aggression have been examined primarily in samples of children or adolescents (Orobio de Castro et al., 2002 for review). In the past decade, the results of only a small number of studies in adults have been published (i.e., Bailey and Ostrov, 2008; Barefoot et al., 1989; Basquill et al., 2004; Epps and Kendall, 1995; MacBrayer et al., 2003; Matthews and Norris, 2002; Miller and Lynam, 2006), mostly in college students or in adults with mild mental retardation. Accordingly, the role for HA in aggression in adults with IED remains largely unexplored.

Cognitive variables beyond HA such as response assessment, outcome expectation, and response decision making, following an ambiguous social interaction, have been examined only recently, and most frequently, in children/adolescents (Fontaine et al., 2002, 2010). Response assessment involves evaluation of the “pros and cons” of different types of behavioral responses that the individual may choose in the context of socially ambiguous situations. Typically, individuals choose from socially appropriate, overtly aggressive, or relationally aggressive, responses. Outcome expectation is the consideration of what outcome may be expected if one chooses to enact one response or another. Response efficiency refers to the assessment of how easy it is for the individual to display a given response in a social interaction. Assessment of such factors can be readily added following controlled exposure to ambiguous social interactions.

Current SIP models of aggression have begun to go beyond cognition and are now examining the role of emotion and how the two are interrelated (Loeber and Coie, 2001). Both HA and emotion reactions to social threat are closely related components of SIP (Crick and Dodge, 1994; Guerra and Huesmann, 2004; Lemerise and Arsenio, 2000). Specifically, the presence of HA typically leads to a negative emotional response, suggesting that negative emotional response may mediate the relationship between HA and aggression (Coccaro et al., 2009b, 2016). Not surprisingly, negative emotions are positively associated with both aggressive behaviors (e.g., Arsenio et al., 2000; Cornell et al., 1999; Deater-Deckard et al., 2010; Eisenberg et al., 2009) and HA (Lemerise and Maulden, 2010) and are likely to be important in influencing response and outcome evaluation (Harper et al., 2010). That said, previous studies have not taken an integrative perspective of HA and negative emotional responding by examining the simultaneous effects of these two processes on aggression.

## 1.2. The role of childhood trauma/maltreatment in SIP models of aggression

Another key factor related to aggressive behavior appears is history of childhood trauma which consistently correlates with aggressive behavior later in childhood (Singer et al., 2013) and adolescence (Song et al., 1998). The relationship between childhood trauma and later aggressive behavior has also been found in adult subjects with prominent histories of impulsive aggressive behavior (Fanning et al., 2014). This relationship is mediated by hostile attribution (Dodge et al., 1990), a finding that has been replicated in subsequent studies including one of our own in a population-based sample of adults (Coccaro et al., 2009b). While the mechanism underlying this observation is unknown, experimental maltreatment of rodent pups has been shown to lead to heightened stress responses due to a failure to turn off genes regulating stress response (Zhang et al., 2013). This suggests that epigenetic changes associated with childhood trauma/maltreatment may affect social-emotional processing circuits. Accordingly, assessment for history of childhood trauma/maltreatment is a critical variable to include in studies of SIP and aggression.

## 1.3. The present study

Over the past decade, the authors developed a social and emotional information processing questionnaire (SEIP-Q) assessment in which both psychometric properties as well as patient-control differences in adult healthy volunteer and impulsive aggressive individuals were evaluated (Coccaro et al., 2016). The present work reports on a large number of patient and control subjects and is the first study in adult psychiatric participants to examine several aspects of SEIP simultaneously, including cognitive and emotional processing variables. Based on our previous data, and that of work in children and adolescents discussed above, we had three aims: Aim I: Examine how SEIP-Q variables differ among impulsively aggressive, psychiatric control, and healthy control, subjects. Aim II: Investigate the relationships between SEIP-Q variables and history of aggressive behavior, including testing how SEIP-Q variables explain variance in the relationship between HA and aggression. Aim III: Examine how SEIP-Q variables explain variance in the relationship between hostile attribution and aggression and between history of childhood trauma/maltreatment and aggression in later life.

## 2. Methods

### 2.1. Subjects

300 adult participants, with and without syndromal (formerly Axis I) or personality (formerly Axis II) disorders, were included in this study. This sample does not overlap with participants previously reported in our prior publications (Coccaro et al., 2009b, 2016). All study participants were systematically evaluated for impulsive aggressive and other personality-related behaviors. Subjects were recruited from clinical settings and through public service announcements seeking out individuals who: a) reported psychosocial difficulties related to one or more DSM-5 diagnoses (Psychiatric Controls: PC or Intermittent Explosive Disorder: IED) or, b) had little evidence of psychopathology (Healthy Controls: HC). All participants provided written informed consent and the study was approved by the Institutional Review Board (IRB). Potential participants with a life history of bipolar disorder,

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