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Published in final edited form as:

Title: Specific Contributions of Age of Onset, Callous-Unemotional Traits and Impulsivity to Reactive and Proactive Aggression in Youths with Conduct Disorders.

Authors: Urben S, Habersaat S, Pihet S, Suter M, de Ridder J, Stéphan P

Journal: The Psychiatric quarterly

Year: 2017 Mar 27

Pages: NA

DOI: 10.1007/s11126-017-9506-y

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**Specific contributions of age of onset, callous-unemotional traits and
impulsivity to reactive and proactive aggression in youths with conduct
disorders**

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Conflict of interest: none

Acknowledgements

The present study was funded by a grant from the Swiss National Science Foundation (grant no. 100014-130553). The authors would like to thank the adolescents and the staff of the participating institutions for their kind cooperation, as well as Sandie Ackermann, Cybèle Bertoni, Tamara Borovicinanin, Marcello Cantarella, Margaux Clément, Nathalie Grégoire, Tatiana Mabillard, Laura Moizeau, Sheila Ramos and Yoann Uehlinger for their help in data collection.

Abstract

Youths with conduct disorder (CD) are particularly studied for their violent and aggressive behaviors. Many researchers considered aggressive behaviors as being either reactive or proactive. Moreover, factors such as age of CD onset, impulsivity, and callous-unemotional traits, separately, have been related to these different types of aggressive behaviors. However, very few studies addressed the combined contribution of these three factors on proactive and reactive aggression. This question was tested in a sample composed of 43 male adolescents with CD. A single regression analysis including all predictors and outcomes, using Bayesian statistics, was computed. Results indicated that impulsivity was related to reactive aggression, while CU traits were related to proactive aggression. These results suggest first, an important heterogeneity among youth with CD, probably leading to different trajectories and, second, that youths with callous-unemotional traits should receive special attention and care as they are more at risk for proactive aggression.

Keywords: *conduct disorders; impulsivity; age of onset; callous-unemotional traits; aggression*

1. Introduction

Conduct disorder (CD) is characterized by a repetitive and persistent pattern of behavior that violates the rights of others, or major age-appropriate societal rules, as well as by aggression (American Psychiatric Association (APA), 2013). CD is an important psychiatric disorder as it is related to delinquency and criminality (Frick, 2012; Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005; Kimonis & Frick, 2010). Like all major categories of psychopathological problems, it has been described as a constellation of symptoms and behaviors that can vary in terms of presence/absence and severity. One deviant behavior associated with CD is aggression, which is also reported as being the most predictive factor of later negative outcomes related to CD (Hyde, Burt, Shaw, Donnellan, & Forbes, 2015).

Aggression is in itself a complex concept that could be separated into two different subtypes, reactive and proactive (Dodge & Coie, 1987). The reactive form could be described as hostile and angry reactions in situations of frustration or threat (Dodge, 1991). On the opposite, the proactive (offensive and premeditated) form of aggression refers to behaviors controlled by external rewards, and is instrumental, organized, and cool-blooded (Dodge, 1991). Although reactive aggression behaviors are considered quite normal in adolescents' life, proactive aggression is considered as a pathological behavior (Raine et al., 2006).

First of all, many authors demonstrated the link between impulsivity and aggressive behaviors in youths with CD (e.g. Beaver, Lawrence, Passamonti, & Calder, 2008; Critchfield, Levy, & Clarkin, 2004; Marmorstein, 2013; Stanford et al., 2009). However, besides impulsivity, researchers suggested to consider two factors related to aggression and modulating trajectories of adolescents with CD: age of CD onset, and the presence of callous unemotional (CU) traits (e.g. Dandreaux & Frick, 2009; Moffitt, 1993; Pardini & Frick, 2013).

More specifically, age of CD onset is divided into two subtypes (e.g. Moffitt, 1993; Odgers et al., 2008; Patterson & Yoerger, 1993): (1) the childhood-onset subtype (at least, one symptom

of CD before the age of 10 years) ; (2) and the adolescent-onset subtype (CD symptoms after the age of 10 years (APA, 2013)). Childhood-onset CD has been related to more severe and chronic antisocial behavior compared with adolescence-onset CD (Frick & Loney, 1999; Moffitt, Caspi, Harrington, & Milne, 2002; Woodward, Fergusson, & Horwood, 2002) and to more aggressive behaviors (Hyde et al., 2015).

CU traits (Frick, Cornell, Barry, Bodin, & Dane, 2003; Frick & Ellis, 1999; Pardini & Frick, 2013) are described as specific affective (lack of guilt, flattened emotion) and interpersonal (lack of empathy, callous use of others) patterns of behaviors that lead to serious crimes and assaults (i.e. violent aggression). Studies investigating the relationship between CU traits and aggression in a sample with CD showed that adolescents without CU traits used more reactive aggressive behaviors (Frick et al., 2003; Kruh, Frick, & Clements, 2005), while youths with CU traits showed both reactive and proactive aggression (Enebrink, Andershed, & Langstrom, 2005; Frick et al., 2003; Frick & Dickens, 2006; Frick & White, 2008; Kruh et al., 2005), suggesting that CU traits represent a risk factor for pathological aggression.

1.1 The current study

To sum up, CD is a serious problem in adolescents that could lead to delinquent and criminal trajectories. However, youths with CD are a heterogenous population with different symptoms, behaviors and response to interventions. In particular, some studies suggested that adolescents exhibiting proactive aggression are at higher risk for chronic and persistent criminal activity. However, interventions targeting proactive aggressive behavior are difficult to implement. It is therefore of great importance to identify factors related to proactive aggression to also integrate those factors in treatment program and provide the more appropriate and efficient care to these youths. Previous literature suggested that high impulsivity, early onset of CD symptoms and CU traits are associated with more violent behavior, and sometimes proactive aggression. However, to the best of our knowledge, no

studies explored in a single analysis (controlling each other factors impact) the mutual and specific influence of these three factors on types of aggressive behaviors in adolescent with CD. This is the aim of the current study.

2. Method

2.1 Population

This study is part of a larger study conducted in boarding schools and forensic facilities in the French-speaking part of Switzerland¹. For this specific study, 111 male adolescents from forensic facilities and boarding schools were eligible. Inclusion criteria were: (1) a diagnosis of Conduct Disorder (assessed by the Schedule for Affective Disorders and Schizophrenia for School-Age Children -Present and Lifetime Version (Kiddie-SADS-PL; Chambers et al., 1985), (2) no lifetime presence of psychotic disorders, (3) sufficient reasoning ability assessed with the Standard Progressive Matrices of Raven (Raven, Court, & Raven, 1998), (3) being aged from 12 to 18, and (4) sufficient French language skills. Forty-three male adolescents (38.7%) fulfilled all inclusion criteria. Noticed that the majority of drop out are due to no CD diagnosis. Table 1 shows sociodemographic characteristics of the sample.

2.2 Ethical consideration

Each participant was informed about the objective and the setting of the study and signed a consent form. Formal authorizations were obtained from the Institutions hosting the youths, and the youths' legal representative (parents or Juvenile Court). The procedure was approved by the Ethics Committee for Research on Human in the State of Vaud.

2.3 Measures

2.3.1 Aggression

The Reactive-Proactive Questionnaire (RPQ; Raine et al., 2006) is a 23-item questionnaire composed of a reactive aggression subscale (RPQ reactive) and a proactive aggression

¹ « Revisiting the role of impulsivity in conduct disorder: An ecological study of disruptive behaviors in incarcerated adolescents », supported by the Swiss National Science Foundation (# 100014-130553).

subscale (RPQ proactive). Participants rated on a three-point Likert-type Scale (from 0 = “never” to 2 = “often”), the extent to which they engage in the two forms of aggression. The RPQ was shown to be valid and to have good psychometric properties (Cima, Raine, Meesters, & Popma, 2013). The Cronbach’s α s in the current sample are of .78 for the proactive score and of .82 for the reactive one.

2.3.2 Age of onset

The presence of CD including its age of onset was assessed by the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL; Chambers et al., 1985). This is a reliable and validated semi-structured interview designed to evaluate current and past episodes of psychiatric disorders of the Axis I, in children and adolescents (including CD), according to the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) criteria (American Psychiatric Association, 1994). This instrument allowed determining the age of onset of CD.

2.3.3 CU traits

CU traits were assessed using the Inventory of Callous-Unemotional Traits (ICU; Frick, 2003; Kimonis et al., 2008). The ICU is a 24-item self-report questionnaire. Participants were asked to estimate the degree to which each individual item applied to them, answering on a 4-point Likert-type scale ranging from 0=“not at all true” to 3=“definitely true”. Previous research demonstrated the validity and usefulness of the ICU in community samples (Essau, Sasagawa, & Frick, 2006; Fanti, Frick, & Georgiou, 2009) as well as in incarcerated samples (Kimonis et al., 2013; Kimonis et al., 2008). The French version of the ICU (Pihet, Suter, & Stephan, 2010) was administered, and showed good psychometric properties (Pihet, Etter, Schmid, & Stephan, 2013). The Cronbach’s α s in the current sample is .65.

2.3.4 Impulsivity

The Adolescent version of the Barratt Impulsiveness Scale – 11 (BIS, Fossati, Barratt, Acquarini, & Di Ceglie, 2002) was used to assess impulsivity. This scale consisted of 30 items scored on a 4-point Likert-type scale (from 1=“never-rarely” to 4=“almost always-always”). The reliability and validity of the BIS have been established by numerous studies (see for a review Stanford et al., 2009), and the adolescent version has shown good internal consistency as well as satisfying concurrent validity (Fossati et al., 2002). The Cronbach’s α in the current sample is of .70.

2.4 Data analysis

First, we computed the descriptive and the Bravais-Pearson coefficients of correlations between variables (Table 2). Then, we explored the mutual contributions of the age of onset of CD (onset), as well as of callous-unemotional traits (ICU) and impulsivity (BIS) to reactive and proactive aggression in a single regression model (Figure 1 and Table 3).

In particular, we used Bayes as an estimator in all analyses with the software Mplus v7.11. Bayesian statistics offer the advantage to be less influenced by the modest sample size of our study. The default setting of Mplus was used except that we used 10’000 iterations and put 4 chains to estimate the parameters. We computed analyses on z-scores (mean at 0), so that the default priors are more appropriate. Bayesian statistics are reported in a slightly different way compared to frequentist statistics. Indeed, in Bayesian statistics, credibility intervals (versus confidence intervals in frequentist terms) are used to indicate the 95% probability that the estimates will lie between lower and upper bound of the interval. So, when zero is not included within the credibility interval, the null hypothesis is rejected and the effect is assumed to be present or “significant” (see for a deeper discussion of the Bayesian statistics Lynch, 2007; van de Schoot et al., 2011).

3. Results

Table 2 presents the means and standard deviations of each score. We observe a significant correlation between both forms of aggression. Furthermore, reactive aggression correlates with the BIS. In contrast, the proactive aggression score correlates with the ICU score.

The Figure 1 illustrates the results and presents graphically the model tested, and Table 3 presents the results in details. In the global regression model, the correlation between proactive and reactive aggression is 0.568 ($p < .001$; CCI (95%): .305 - .769). The predictors explain 24.7% of the variance in reactive aggression ($p < .001$; CCI (95%): 5.5 - 43.3) and 30.3% of the variance in proactive aggression ($p < .001$; CCI (95%): 9.8 - 49.2). In particular, whereas reactive aggression is explained by the BIS score, proactive aggression is explained by the ICU score.

4. Discussion

In the current study, we aimed to explore the contribution of age of CD onset, CU traits and impulsivity to reactive and proactive aggressive behaviors in a sample of adolescent boys with CD. The results could be summarized as follows: whereas reactive aggression was related to impulsive traits, proactive aggression was related to CU traits. This is the first study examining these links in a single statistical model, thus taking into account the mutual influence of each other factors.

4.1. Reactive aggression

The relationship between impulsivity and reactive aggressive behaviors are in line with previous literature studying the unique influence of impulsivity on aggressive behaviors (Caspi, 2000; Derefinko, DeWall, Metzger, Walsh, & Lynam, 2011; Krueger, Caspi, Moffitt, White, & Stouthamer-Loeber, 1996). More precisely, DeWall, Baumeister, Stillman, and Gailliot (2007) observed that people with low self-control (high impulsivity) showed increased aggression in response to insult (i.e. reactive aggression). Our results added to this

knowledge that impulsivity was an important predictor of reactive aggressive behaviors (and not proactive aggression) even when age of CD onset and CU traits were taken into account. Thus, our results are in line with the conceptualization of reactive aggression as hostile and angry reactions in situations of frustration or threat (Dodge, 1991) which includes high impulsivity and immediacy (Dollard, Miller, Ford, & Hovland, 1962).

4.2. Proactive aggression

Second, our results showed an association between CU traits and proactive aggression. This is consistent with the literature in adults (Cornell et al., 1996), adolescents (Caputo, Frick, & Brodsky, 1999; Kruh et al., 2005) or children (Frick et al., 2003), reporting an association between CU traits and severe forms of aggression. Furthermore, CU traits have a good predictive value for adult antisocial behaviors (Frick & Loney, 1999) and for severe and violent aggressive behaviors (e.g. Edens, Skeem, Cruise, & Cauffman, 2001). Moreover, our results shows that, in adolescents with CD, CU traits are much more predictive of pathological aggression than age of onset and impulsivity, suggesting that CU traits may be one of the major factors that differentiate individual at high risk for long-term delinquent and criminal trajectories and must be identified as early as possible in adolescents with CD. As pathways to CU were related to low temperamental fears and deficits in taking in account salient emotional social cues which might interfere with various socialization processes leading to the development of moral emotions (Pardini & Frick, 2013), our results highlights the necessity to design more CU-targeted intervention and prevention program to reduce long-term difficulties.

4.3. Limitations

Some limitations of the study should be acknowledged. First, the sample size was modest, but we adopted a cautious analytic plan and used Bayesian statistics in order to reduce type I error. However, replications of our results on larger samples could be helpful in order to

control for type II error. In addition, the cross-sectional design did not allow a clear interpretation in terms of causal link. In the future, longitudinal studies exploring all these dimensions together would be of great importance. We included only boys with CD in our study in order to have a more homogenous sample. But in order to generalize the present results to girls and to youths with externalizing behaviors, further studies are needed. Finally, all data were obtained by questionnaires, so a self-report bias must not be underestimated when interpreting those results.

4.4. Conclusions

In conclusion, this is the first study which simultaneously took into account three important predictors of proactive and reactive aggressive behaviors in a sample of adolescents with CD, namely impulsivity, age of CD onset and CU traits. In particular, we observed that impulsivity mainly related to reactive aggression, whereas CU traits were related to proactive aggression. These results might help to design more specific prevention program allowing preventing the apparition of severe form of antisocial problems.

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Table 1. Description of the socio-economic status.

Domain	Categories	Percentage	Mean	SD	Min	Max
Age			15.29	1.07	13.0	17.0
Status of the parents	Married	48.5				
	Separated	18.2				
	Divorced	30.3				
	Single	3.0				
Income earners:	Mother and father	36.4				
	Mother or father	42.4				
	Stepfather	15.2				
	Other	6.1				
Scholar situations of the youths	Secondary	24.2				
	High school	3.0				
	Apprenticeship	6.1				
	Drop out from school ¹	51.5	4.59	4.97	0.0	15.0
	Others	15.2				
Father highest level of education	Unknown	43.8				
	Elementary school	6.3				
	Apprenticeship	28.1				
	University	15.6				
	Other	6.3				
Mother highest level of education	Unknown	37.5				
	Elementary school	15.6				
	Apprenticeship	15.6				
	High school	9.4				
	University	18.8				
	Other	3.1				

Note. ¹Percentage and then duration in months

Table 2. Descriptive and correlations between variables

	Mean	SD ^a	1.	2.	3.	4.	5.
1. RPQ REA	1.04	0.37	-	.479**	-.167	-.128	-.254
2. RPQ PROA	0.57	0.33		-	-.246	.475**	.051
3. Age of onset	9.91	2.85			-	-.118	-.160
4. ICU	1.22	0.31				-	.664**
5. BIS	2.36	0.32					-

Note. ^aMean and standard deviation (SD) of the mean score of each instruments. Reactive: reactive aggression score of the RPQ. Proactive: proactive aggression score of the RPQ. Age of onset in years, for correlations (1 : childhood-onset and 2 : adolescents-onset); ICU: Inventory of Callous-Unemotional traits; BIS: Barratt Impulsiveness scale; ** $p < .01$.

Table 3. Regression analysis on both aggression scores.

Criterion	Predictors	Estimates	SD	CCI (95%)	Two-tailed <i>p</i> -value
Reactive	Age of onset	-.088	.156	-.398 - .217	.572
	ICU	-.164	.167	-.392 - .124	.326
	BIS	.491	.163	.168 - .808	.004
Proactive	Age of onset	-.159	.152	-.450 - .142	.288
	ICU	.480	.161	.154 - .790	.002
	BIS	.264	.159	-.057 - .571	.100

Note. Age of Onset: age of onset of conduct disorder; ICU: Inventory of Callous-Unemotional traits; BIS: Barratt Impulsiveness scale; Proactive : proactive aggression score of the RPQ; Reactive: reactive aggression score of the RPQ.

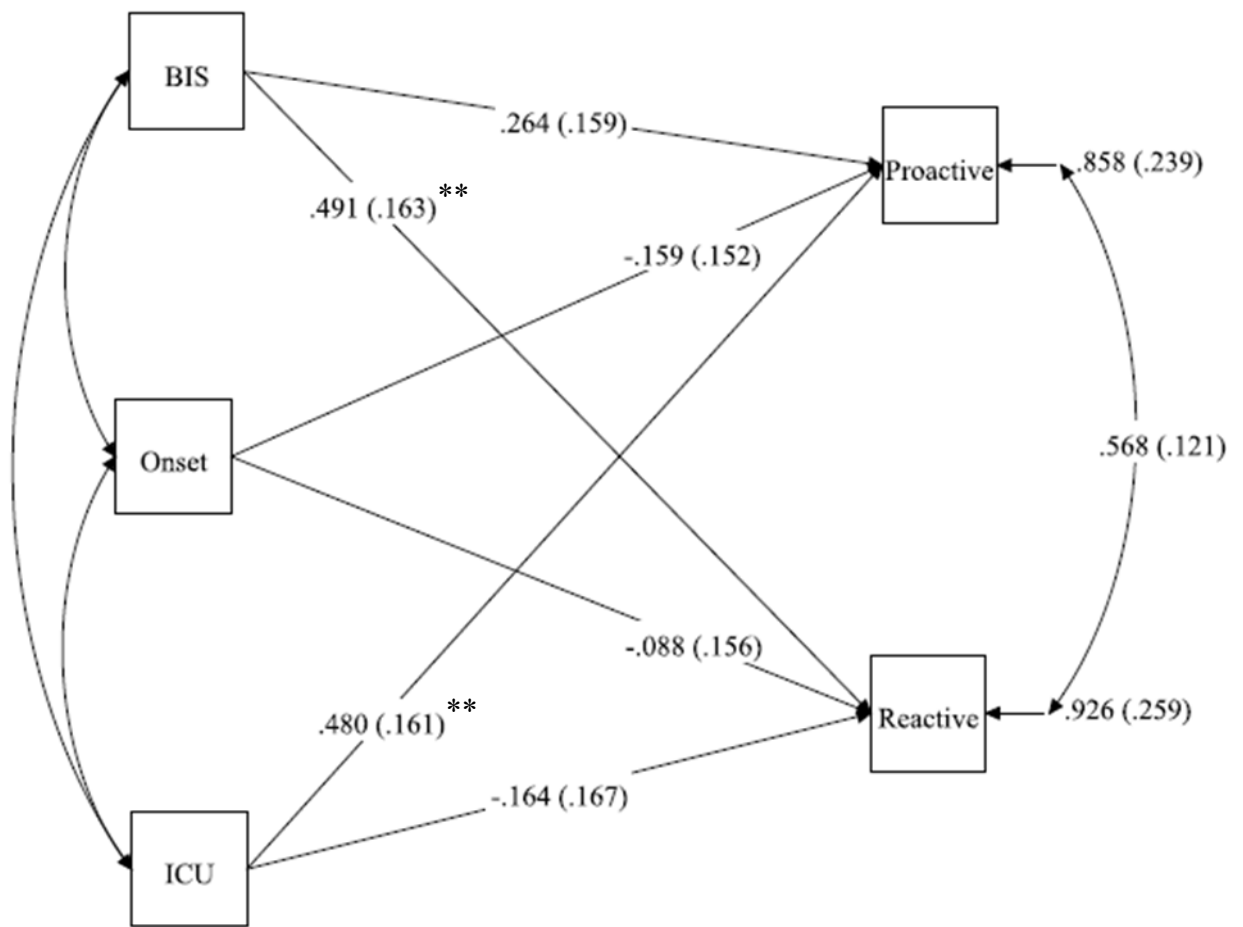


Figure 1. Illustration of the regression pathways tested.

Note. BIS: Barratt Impulsiveness scale; Onset: age of onset of conduct disorder; ICU: Inventory of Callous-Unemotional traits; Proactive: proactive aggression score of the RPQ; Reactive: reactive aggression score of the RPQ. ** $p < .01$