

Editorial Manager(tm) for Journal of Youth and Adolescence
Manuscript Draft

Manuscript Number: JOYO209R3

Title: Impulsivity in juvenile delinquency: differences among early-onset, late-onset, and non-offenders

Article Type: Empirical Research

Section/Category:

Keywords: impulsivity; juvenile delinquency; early-onset offenders, late-onset offenders

Corresponding Author: Dr Annemaree Carroll, PhD

Corresponding Author's Institution: The University of Queensland

First Author: Annemaree Carroll, PhD

Order of Authors: Annemaree Carroll, PhD; Francene Hemingway, DCLinPsych; Julie Bower, MPhil; Adrian Ashman, PhD; Stephen Houghton, PhD; Kevin Durkin, PhD

Manuscript Region of Origin:

Running head: Impulsivity in Juvenile Offenders

Impulsivity in juvenile delinquency: differences among early-onset, late-onset, and non-offenders

Annemaree Carroll*, Francene Hemingway, Julie Bower, Adrian Ashman¹, Stephen Houghton² and Kevin Durkin³

¹ School of Education, The University of Queensland, Australia

² Graduate School of Education, The University of Western Australia

³ Department of Psychology, University of Strathclyde

*Requests for reprints should be addressed to: Dr Annemaree Carroll, School of Education, The University of Queensland, Brisbane Q 4072 Australia (email: a.carroll@uq.edu.au; phone 617 3365 6476; fax 617 3365 7199).

Acknowledgements: The research reported in this paper was supported by The Australian Research Council Linkage Grant Scheme.

AUTHOR AFFILIATIONS and RESEARCH INTERESTS

Dr Annemaree Carroll is Senior Lecturer in Educational Psychology at the School of Education, The University of Queensland, Brisbane, Australia. She received her PhD in educational psychology from The University of Western Australia. Her major research interests include at-risk behaviours of children and adolescents, self-regulation and goal setting, and developmental trajectories of antisocial and aggressive behaviours.

Francene Hemingway is a Doctor of Clinical Psychology student within the School of Psychology at The University of Queensland, Brisbane, Australia. Her research interests include at-risk children and adolescents, mental health in adolescents and adults, cognitive-behavioural interventions, and self-regulation.

Julie Bower is a Master of Philosophy student within the School of Education, The University of Queensland, Brisbane, Australia. Her research interests include self-regulation, youth at-risk, Indigenous youth issues, and prevention and intervention approaches.

Professor Adrian Ashman, is Professor of Education and Head of the School of Education, The University of Queensland, Brisbane, Australia. He received his PhD in educational psychology from the University of Alberta, Canada. His research interests include cognitive educational psychology, classroom-based instruction, strategy training, problem solving, and at-risk youth.

Professor Stephen Houghton is Professor of Education and Director, Centre for Attention and Related Disorders at the Graduate School of Education, The University of Western Australia. He received his PhD in educational psychology from the University of Birmingham, UK. His research interests include attentional disorders, severe antisociality in children and adolescents, emotion regulation, complex information processing and cognitive processes of at-risk adolescents.

Professor Kevin Durkin is Professor of Psychology in the Department of Psychology, University of Strathclyde, United Kingdom. He received his PhD in developmental psychology, specialising in cognitive and communicative development in childhood and adolescence from Cambridge University, UK. His research interests include developmental psychology, at-risk children and adolescents, and the impact of media on children's behaviour.

**Impulsivity in Juvenile Delinquency: Differences among Early-Onset, Late-Onset, and
Non-Offenders**

Impulsivity in Juvenile Delinquency: Differences among Early-Onset, Late-Onset, and Non-Offenders

Abstract

The present research investigated differences in levels of impulsivity among early-onset, late-onset, and non-offending adolescents. 129 adolescents (114 males, 15 females), of whom 86 were institutionalised (M age = 15.52 years) and 43 were regular school students (M age = 15.40 years) participated. Each participant completed the Adapted Self-Report Delinquency Scale, Stroop Colour and Word Test, Time Perception task, Accuracy Game, Risk-Taking Game, and the Eysenck Impulsiveness Questionnaire. Results suggest that adolescents who display rapid cognitive tempo, poor mental inhibitory control, and high impulsivity are more likely to be early-onset offenders. Offender and non-offender groups showed significant differences on several measures of impulsivity, which may suggest that late-onset offenders acquire or exacerbate impulse-related problems through social mimicry of early-onset offender peers. Potentially important implications for our understanding of delinquency and the design and provision of prevention programs are highlighted.

Keywords: impulsivity, juvenile delinquency, early-onset offenders, late-onset offenders

Impulsivity in Juvenile Delinquency: Differences among Early-Onset, Late-Onset, and Non-Offenders

Involvement in antisocial and delinquent behaviour is common during adolescence (Carroll, 1995; Carroll, Hattie, Durkin, & Houghton, 2001; Houghton & Carroll, 2002, 2004; Moffitt, 1993; Oyserman & Saltz, 1993; Rigby, Mak, & Slee, 1989). Youths account for a disproportionately large amount of offences relative to their numbers in the general population (Australian Institute of Criminology, 2004; Oyserman & Saltz, 1993). For some time, researchers have suggested that delinquent behaviour is a result of deficits in impulse control (Barratt & Patton, 1983; Eysenck & Eysenck, 1977; Robbins & Bryan, 2004; Romero, Luengo, & Sobral, 2001; White et al., 1994). Moreover, the age of onset of antisocial behaviour has been identified as being of central importance in understanding future antisocial behaviour. Specifically, the earlier the onset of antisocial behaviour the more likely those individuals will engage in further delinquent acts (Piquero & Chung, 2001). Moffitt (1993) distinguished between two patterns of delinquency, as a function of time of onset. She proposed that late-onset, adolescent-limited (AL) antisocial behaviour emerges during puberty and is common, normative, and relatively temporary. Life-course-persistent (LCP) antisocial behaviour, although rare, originates early in life and is persistent and pathological.

Deficits in neuropsychological functioning are commonly associated with antisocial behaviour (Loeber, 1990; Moffitt, 1990). According to Moffitt (1993), the criminal behaviour of LCP offenders may be due to neuropsychological impairments sustained during childhood. Such deficits in neuropsychological functioning, such as self-control (especially impulse control), may serve to maintain antisocial behaviour throughout life. In contrast, Moffitt purports that antisocial behaviour that emerges during adolescence is, on this account, the result of an individual reaching biological maturity prior to reaching social maturity

(where he or she has legal access to such liberties to consume alcohol, and operate a motor vehicle). Observing peers who already have the resources and privileges associated with social maturity, some individuals deal with the developmental tensions by turning to delinquency, illegitimate means of achieving rationally motivated social goals.

The distinction between LCP and AL patterns of offending offers important developmental insights into the nature of delinquent behaviour. Henry, Caspi, Moffitt, and Silva (1996) showed that 50-60% of all crimes committed in the United States can be attributed to approximately 5% of offenders, most of whom have histories of early emerging problem behaviour, and are at risk of longer term criminal careers. The remaining 95% of offenders are classified in the AL subgroup; not only does their offending begin later in life, but it also occurs less frequently and tends to be less violent. Several studies in the U.S. and New Zealand have shown that LCP adolescents are characterized by a number of risk factors such as social and familial disadvantages, poor parenting, and impulsivity and attention deficits (Fergusson, Lynskey, & Horwood, 1996; Jeglum Bartusch, Lynam, Moffitt, & Silva, 1997; Moffitt & Lynam, 1994; Caspi et al., 1997; White et al., 1994).

There is extensive evidence that impulsivity, or the inability to regulate self-control, is an important determinant of delinquent behaviour (Farrington et al., 1990; Gottfredson & Hirschi, 1990; Kindlon, Mezzacappa, & Earls, 1995; Vitacco & Rogers, 2001; White et al., 1994). Furthermore, Vitacco, Neumann, Roberston, and Durrant (2002) found that, among adjudicated male adolescents, scoring high on impulsivity predicted greater antisocial behaviour at an 18 month follow up. However, findings have been inconsistent and contradictory, partly because of definitional and measurement issues. The construct *impulsivity* does not appear to be used with one common definition, but covers several behaviours or inferred processes, including cognitive, behavioural, and personality variables. Impulsivity is seen as a specific construct of self-regulation covering a broad range of

behaviours (Baumeister & Vohs, 2004; Eysenck & McGurk, 1980). Several deficits in various dimensions of impulsivity have been associated with delinquent behaviours, including, cognitive variables, such as the inability to exercise inhibitory control and the tendency to respond quickly without thinking due to differences in cognitive tempo; behavioural variables, such as willingness to trade accuracy for speed when processing information and risk-taking behaviours; and the personality variable of impulsiveness. Therefore, the present research aimed to incorporate these various dimensions of impulsivity through the selection of relevant measures based on cognitive, behavioural, and personality variables previously unaccounted for in studies of the impulsivity of juvenile delinquents.

Inhibitory control is associated with neuropsychological functioning and is concerned with impairments in the inhibition of a dominant response. Barkley (1997) suggested that inhibition be assessed by performance on cognitive and behavioural tasks that require withholding of responding, delayed responding, cessation of responding, and resisting distraction or disruption by competing events. In addition, deficits in executive functions have also been linked to impulsivity and delinquent behaviour. Specifically, Moffitt (1990) found that individuals who performed poorly on neuropsychological tests of frontal lobe functioning (executive functioning), such as the Stroop Colour and Word Test (SCWT), were more likely to be antisocial in nature.

Barratt and Patton (1983) have argued that the tendency to respond quickly without thinking arises from biologically determined differences in cognitive tempo. Lawrence and Stanford (1999) found that individuals with high impulsivity display lower accuracy and faster time estimation than individuals with low impulsivity. They argued that this provides the basis for impulsive behaviours such as making quick decisions and acting without thinking. Much earlier, researchers defined cognitive impulsivity as the speed and the number of errors associated with making a decision (Kagan, Rosman, Day, Albert, &

Phillips, 1964). Dickman and Meyer (1988) hypothesised that impulsivity was associated with a preference for information-processing strategies that emphasise speed at the expense of accuracy. Dickman and Meyer's results suggest that in spite of their generally faster response times and higher error rates, highly impulsive participants carry out at least one stage of processing, response execution, just as slowly and accurately as other individuals. The authors suggested that the advantage of high versus low impulsive individuals will depend on the nature of the task itself, suggesting that a lack of sensitivity in the measures commonly used to assess individuals' bias toward speed or accuracy in information processing and the lack of empirical research for the speed-accuracy trade-off model of impulsivity was responsible for the mixed findings.

The relationship between risk-taking behaviours and delinquency has been clearly documented, with young offenders tending to take significantly more risks than non-offenders (Arnett, 1992; Luengo, Carrillo-de-la-Pena, Otero, & Romero, 1994). Moreover, high impulsive adolescents and young adults have been found to more frequently engage in risk-taking behaviour than individuals with low levels of impulsivity (Stanford, Greve, Boudreaux, & Mathias, 1996; Vitacco et al., 2002). Interestingly, Dåderman, Meurling, and Hallman (2001), using Zuckerman's sensation seeking model, investigated why some sensation seekers become well socialised and engage in socially acceptable thrills, while others become socially delinquent. They concluded that juvenile delinquents were not interested in socially desirable forms of sensation seeking, but in fact gained arousal of the mind and senses through novel situations such as social drinking, drug use, and gambling.

Personality traits are continuous dimensions that may be used as instruments for the analysis of individual differences in behaviour (Dåderman, 1999). In investigating delinquency, Romero et al. (2001) suggested that particular attention has been paid to *temperament* (or personality) variables. The majority of researchers in this field have tended

to adopt Eysenck's (1967) three fundamental dimensions (extraversion, neuroticism, psychoticism) of personality. Impulsiveness and sensation seeking have been regarded as the major factors making up the extraversion scale and subsequently the Eysenck Personality Questionnaire – Impulsiveness (EPQ-I; Eysenck & Eysenck, 1978) was developed. Dåderman (1999) investigated personality traits, including the EPQ-I as a measurement of impulsivity, in a group of severely conduct-disordered juvenile males and normal juvenile males. Juvenile delinquents were found to score significantly higher on the measure of impulsiveness compared to normal juvenile males. Similarly, White et al. (1994) utilized the EPQ-I, which was found to correlate significantly with delinquency at 10, 12, and 13 years of age. The EPQ-I was also found to differentiate reliably among serious delinquents, other delinquents, and non-delinquents.

There is considerable evidence, then, pointing to impulsivity as a characteristic of juvenile offenders, and linking impulsivity to risk-taking behaviours. There is also evidence that problems with impulsivity are detectable early in the lives of individuals who subsequently become long-term persistent offenders. Nevertheless, much of the research to date has focused on comparisons between offenders and non-offenders. There is a need for further investigation of the information processing and personality characteristics of offenders with different developmental trajectories. The primary purpose of the present research was to compare early-onset, late-onset, and non-offending youths on a range of measures pertaining to impulsivity. In light of the theoretical account and previous findings summarised above, the broad prediction was that early-onset adolescent offenders would display greater impulsiveness than late-onset or non-offenders. More specifically, it was hypothesised that early-onset offenders would display poor mental inhibitory control; a more rapid cognitive tempo; perform significantly more inaccurately on a test of speed and accuracy; and be unable to withhold risk-taking on a gambling task. Non-offending

adolescents were expected to obtain the most favourable scores on these measures, and late-onset offenders were expected to be intermediate. It was also expected that early-onset offenders would score higher than each of the other groups on The Eysenck Impulsiveness Questionnaire.

Method

Participants

Participants were 129 Australian adolescents, in three equal sized ($n = 43$) groups of early-onset offenders, late-onset offenders (drawn from the Brisbane Youth Detention Centre, Queensland, Australia) and non-offenders (drawn from ten Brisbane state high schools). The groups were matched on age, gender, and Aboriginality. Queensland has ten times more Indigenous (Aboriginal and Torres Strait Islander) people in youth detention than non-Indigenous people (Cahill & Marshall, 2002). The majority of persons (c. 95%) in youth detention are male (Cahill & Marshall, 2002). The demographic characteristics of the sample are summarised in Table 1. The proportions of males and of individuals with Aboriginal or Torres Strait Islander (ATSI) ethnicity are consistent with those of the Queensland juvenile delinquent population (Cahill & Marshall, 2002). A three-way (early; late; non) between-groups multivariate analysis of variance revealed no significant differences between offender groups on age $F(2, 126) = .74, ns$. Chi-square analysis revealed no significant differences on Aboriginality $\chi^2[2] = 2.67, p = .26, ns$, or gender $\chi^2[2] = .00, p = 1.00, ns$.

Insert Table 1 here

Participants in the early-onset and late-onset offender sample were selected from a list of young people serving various lengths of time in detention (between 4 weeks and 2 years with an average sentence of 3 months). The majority of offences committed by the participants related to vehicle-offending (40%), property offences (38%), theft (40%), assault

(31%), and drug-related offences (17%). All young people detained in the detention centre during the one-year period of the project were invited to participate. There was an 82% response rate. Those on murder or sex offender charges were excluded from the study.

The non-offender sample was recruited from 10 state high schools, with students being excluded from the study if they had any past offending history. Two schools were categorised as upper socioeconomic status, three as lower socioeconomic status, and five in the middle ranges, thus representing a broad range of socioeconomic conditions. The response rate was 88%, however, acceptance into the study for the non-offender group was dependent on matched demographic variables. Written informed consent was obtained from the parents of all participants.

Participants who had committed an offence that had been convicted in a court of law prior to 12 years of age or had been in detention prior to that age and who were currently serving time in detention, were assigned to the early-onset group in accordance with Moffitt's theory of developmental taxonomy (Moffitt, 1991, 1993; Moffitt & Lynam, 1994). Those who had no offending history until 13 years of age were assigned to the late-onset group, and all participants in the non-offender group had no history of offending behaviour. Information pertaining to offence history of participants was checked and verified through perusing official criminal records.

Measures

Adapted Self-Report Delinquency Scale (Carroll, Durkin, Houghton, & Hattie, 1996) comprises 44 items covering a wide range of frequently occurring delinquent acts in Australia with wording consistent with adolescent usage. Responses relate to the number of times delinquent acts were engaged in during the last 12 months, using a six-point scale ranging from 'never' (= 1) to 'more than once a week' (= 6). Factor analysis of the 44 items revealed seven internally homogenous subscales. These subscales and their reliability coefficients are

Stealing Offences, $\alpha = .90$; School Misdemeanours, $\alpha = .86$; Soft Drug Use, $\alpha = .88$; Vehicle-Related Offences, $\alpha = .94$; Abuse of Property, $\alpha = .91$; Physical Aggression, $\alpha = .88$, and Hard Drug-Related Offences, $\alpha = .89$ (Carroll et al., 1996). In line with previous studies, items 2, 3, 32, 33, 37 were dropped from the study. In addition, items 4, 17, and 19 also did not load satisfactorily ($>.3$) to warrant inclusion in further analyses. Maximum-likelihood factor analysis with oblimin rotation of the final 36-item scale confirmed the seven factor solution previously established by Carroll et al. (1996) and explained 63% of the variance with all factors having eigenvalues greater than 1. Current reliability estimates ranged from $\alpha = .78$ to $\alpha = .93$.

Stroop Colour and Word Test (Golden, 1978). This task is generally considered a test of response inhibition or selective attention. The test consists of three pencil and paper parts. The first part requires the participant to read the words RED, GREEN, BLUE printed in black ink on an A4 page. The second part of the test requires the participant to name the colour of the ink in which XXXX are printed. The colour of the ink is red, green, or blue. The third part of the test, the interference trial, consists of the original words RED, GREEN, and BLUE, but these are now printed in different coloured ink (e.g., green, blue, red). That is, the colour of the ink does not correspond to the colour of the word. In this part of the task, the participant is instructed to name the colour of the ink, e.g., the word RED is printed in blue ink requiring the response 'blue'. If the participant should make any errors on any of the trials, these are pointed out immediately for correction. Time allowed for each condition is 45 seconds. Interference was calculated from the interference trial (colour-word) where the interference score is not dependent on the participant's reading or colour naming speed (controlled for by using a 45-second time period). By completing the formula: $CW - CW'$ where the predicted colour-word score (age-corrected word x colour scores divided by the age-corrected word + colour scores) is subtracted from the colour-word score the result is a

measure of “pure” interference corrected for speed factors. The more interference the participant showed, the higher the interference score, and the higher the t score. Scores below 35 reflect better-than average resistance to interference. All Stroop scores are calculated by summing the number of correct responses and then the raw score is converted into normative data via t-scores ($M = 50$, $SD = 10$) for ease of comparing scores across participants.

Time Perception (White et al., 1994). White et al. (1994) “operationalised the concept of cognitive tempo by using time estimation and production tasks” (p. 195). In time estimation, a stopwatch is run for six intervals (2, 4, 12, 15, 45, 60 seconds) and participants are asked after each interval, to estimate how many seconds have passed. In time production, participants signal when they think intervals of 2, 4, 12, 15, 45, and 60 seconds have passed. The present study created a distinct measure of time perception computed separately for estimation and production tasks. For estimation, the error in seconds for each second estimated was found for each participant (original time estimated subtract the actual time interval, e.g., 5 seconds estimated – 2 second interval = 3 seconds error). Similarly, for production, the error in seconds for each second estimated was found for each participant, where the signal stop time in seconds was subtracted from the actual time interval in seconds, (e.g., time signalled to stop at 3 seconds – 2 second interval = 1 second error). In the present study, high error scores for the estimation task and low error scores on the transformed production task represent a rapid cognitive tempo. The production variable was transformed such that the absolute value variation was taken from a direction-free measure of magnitude of error for under- and over-estimators. Overestimation was determined via the mean number of seconds passed for each group, with a cut-off score of 25 seconds. The current study reported high reliability for time estimation ($\alpha = .79$) and time production ($\alpha = .76$).

Accuracy Game (Adapted) (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956). In order to overcome previous methodological inconsistency, the present study introduced an

interactive measure of the speed-accuracy trade-off that is expected to differentiate reliably between individuals with a predisposition towards speed or accuracy in information processing. The original development of the continuous-performance test (Rosvold et al., 1956) consisted of responses to the presentation of the letter 'X' or 'XA', recorded by the press of a button. The present study adapted the continuous-performance test to consist of a series of trials in which participants are presented with 50 red hexagons in a honeycomb type configuration comprising 15 possible positions, with hexagons appearing in isolation in random positions over a period of 2 minutes on a computer screen. The participant is required to click on the hexagons (which are presented at a progressively faster rate) using the computer mouse. The number of correct presses out of 50 measures accuracy, with those that score highly (e.g., over 25) indicating a preference for accuracy over speed.

Risk-Taking Game (Adapted) (Newman, Kosson, & Patterson, 1993). The Risk-taking Game is a computer game adapted by Carroll (2001). This task is designed to assess risk-taking behaviour via a simulated gambling task. The task consists of participants identifying the amount of money they wish to risk, starting with a balance of \$100. Participants were given the option of participating in the game or keeping the hypothetical \$100. The participant then chooses a black or red card by clicking on it with the mouse, then clicking on 'Deal a Card', where the win or loss is displayed on the balance. The game is over when the money is spent or after 10 trials. The dependent measure is the absolute weighted average of bets over the 10 trials, where high risk-taking is represented by values over 0.50 and low risk-taking below 0.50. The reliability estimate for the task was $\alpha = .78$.

The Eysenck Impulsiveness Questionnaire (Adapted) (Eysenck & Eysenck, 1978) is a self-report questionnaire of impulsive behaviour consisting of 23 items (e.g., "Do you get bored more easily than most people, doing the same old things?"). For the present study, the 23-item questionnaire was reduced to consist of items that reported the highest factor

loadings on impulsiveness (Eysenck & Eysenck, 1978), resulting in 13 items. Questions are scored on a Likert-type scale where 1 = Never and 4 = Always, with higher scores indicating higher impulsivity. The reliability co-efficient for the scale in the present study was $\alpha = .84$.

Procedure

All participants agreed to a 60-minute session administered independently by trained researchers. Both high school and detention centre participants were administered the session individually during normal school hours in a private enclosed room. Prior to starting the session, each participant was given the same briefing outlining the purpose of the study and issues related to confidentiality. The measures were administered in the following order: Time Perception; Stroop Colour and Word Test; Self-Report Delinquency Scale; The Eysenck Impulsiveness Questionnaire; and the Accuracy Game and Risk-Taking Game.

Results

Results are presented in the following order: Self-Reported Delinquency Scale; Stroop Colour and Word Test; Time Perception; the Accuracy Game; the Risk-Taking Game, and the Eysenck Impulsiveness Questionnaire. Mean ratings are presented in Table 2 for each of the dependent scales by offending history.

Insert Table 2 here

Adapted Self-Report Delinquency Scale

A one-way MANOVA based on the seven dependent variables of self-reported delinquency revealed a significant multivariate main effect for Offending History $F(14, 238) = 21.51, p < 0.001, \eta^2 = .56$. The follow-up Univariate F tests revealed significant differences for all seven dependent variables, namely Stealing Offences $F(2, 128) = 88.70, p < .001, \eta^2 = .59$; School Misdemeanours $F(2, 128) = 7.79, p < .01, \eta^2 = .11$; Soft Drug Use $F(2, 128) =$

151.46, $p < .001$, $\eta^2 = .71$; Vehicle-Related Offences $F(2, 128) = 60.89$, $p < .001$, $\eta^2 = .49$; Abuse of Property $F(2, 128) = 15.82$, $p < .001$, $\eta^2 = .20$; Physical Aggression $F(2, 128) = 46.55$, $p < .001$, $\eta^2 = .43$; and Hard Drug Use $F(2, 128) = 28.75$, $p < .001$, $\eta^2 = .32$. Scheffé post hoc comparisons revealed that with the exception of Abuse of Property and Soft Drug Use, early-onset offenders reported significantly higher involvement than late-onset offenders on all seven variables of self-reported delinquency. Early- and late-onset offenders reported significantly higher involvement in all self-reported delinquency, except for School Misdemeanours where there were no significant differences between late-onset offenders and non-offenders. The observed means for offender groups are shown in Table 2.

Stroop Colour and Word Test

A three-way (early, late, non) between-groups multivariate analysis of variance (MANOVA) was performed on three dependent variables of the Stroop Colour and Word Test: Stroop word t-score, Stroop colour t-score, and Stroop interference t-score. A significant between groups difference in performance on the Stroop task was found, $F(6, 238) = 5.74$, $p < .001$, $\eta^2 = .13$. Univariate ANOVAs for each of the scales confirmed this pattern for the Stroop word t-score, $F(2, 121) = 14.19$, $p < .001$, $\eta^2 = .19$, the Stroop colour t-score, $F(2, 121) = 9.50$, $p < .001$, $\eta^2 = .14$, and the Stroop interference t-score, $F(2, 121) = 3.66$, $p < .05$, $\eta^2 = .06$. On both the word and colour naming tasks, Scheffé post hoc analysis demonstrated a significant difference between non-offenders and early- and late-onset offenders, in that early-onset and late-onset offenders had significantly greater difficulty with the word naming and colour naming tasks. Unexpectedly interference was greater for non-offenders than for early- and late-onset offenders. On the interference trial, there was a significant difference between early-onset and non-offenders, such that non-offenders were more likely to experience higher levels of interference than early-onset offenders, although it should be noted that these differences were within the healthy functioning range. No

differences were found between early- and late-onset offenders in each of the three Stroop tasks and no difference was found between late- and non-offenders on the interference trial.

Time Perception

A three-way (early, late, non) between-groups MANOVA on the two dependent variables of Time Perception (estimation scores and production scores) yielded no significant differences. Given that the use of multivariate analysis is known to inflate type II error when effects are small (Haase & Ellis, 1987) and the primary hypothesis predicted a significant group difference in time perception among early-onset, late-onset, and non-offenders, a series of ANOVAs was subsequently conducted to investigate any differences among time perception of the groups. With respect to time estimation, there was a significant difference among groups, $F(2, 123) = 3.51, p < .05, \eta^2 = .05$. Table 2 shows that early-onset offenders and late-onset offenders were markedly more likely to over-estimate the amount of time that had passed than non-offenders. Scheffé post hoc comparisons revealed that early-onset offenders were significantly more likely to over-estimate than non-offenders during the estimation task. Likewise, there was a significant difference between late-onset and non-offenders during the estimation task, where late-onset offenders tended to over-estimate more than non-offenders. However, there was no significant difference between early-onset and late-onset offenders in their estimation scores. That is, post hoc analysis revealed that the non-offending group provided significantly lower time estimates than did each of the offending groups, which did not differ reliably from each other.

Similarly, a significant between groups effect was found for production scores, $F(2, 123) = 3.63, p < .05, \eta^2 = .06$. Early-onset offenders and late-onset offenders were more likely to over-estimate the amount of time that had passed than non-offenders. Scheffé post hoc analysis found that early-onset offenders were significantly more likely to over-estimate

than non-offenders during the production tasks, and that late-onset offenders were also significantly more likely to over-estimate than non-offenders. However, there were no significant differences between early-onset and late-onset offenders.

Accuracy Game and Risk-Taking Game

A one-way between subjects analysis of variance indicated that participants' rate of accuracy did not differ significantly among groups, $F(2, 121) = 3.03, ns$. Additionally, a one-way analysis of variance indicated that the groups' risk-taking behaviour did not differ significantly, $F(2, 86) = 1.70, ns$.

Eysenck Impulsiveness Questionnaire

A one-way between-subjects analysis of variance revealed that participants' performance on the Eysenck Impulsiveness Questionnaire differed across the three groups, $F(2, 122) = 15.17, p < .001, \eta^2 = .20$. Post hoc tests indicated that each offender group was significantly more impulsive than the non-offenders. However, there was no significant difference in impulsivity between early-onset and late-onset offenders. Intercorrelations between the scales of the dependent variables are displayed in Table 3.

Insert Table 3 here

There was an expected strong positive correlation between the time perception scales, estimation and production, $r(126) = .66, p < .01$. Interestingly, there was a strong negative correlation between Stroop interference and the magnitude produce scale, $r(126) = -.27, p < .01$, such that as inhibitory control increases it is likely that cognitive tempo decreases.

Discussion

This study compared early-onset, late-onset and non-offending adolescents on a battery of tests of self-reported delinquency, inhibitory control, time perception, accuracy, risk taking, and impulsiveness. Findings on the Self-Report Delinquency Scale revealed significant differences between the three offender groups on almost all of the seven variables of delinquency. This confirms differential patterns of offending behaviour according to age of onset, with early-onset offenders reporting the highest levels of involvement.

In light of previous research and theory pointing to substantial and enduring problems related to impulsivity in early-onset offenders, the early-onset group was expected to yield the least favourable scores on the several dependent measures. Non-offending adolescents were expected to obtain the most favourable scores (indicating lower levels of impulsivity, cognitive tempo and risk taking), and late-onset offenders were expected to be intermediate.

The results are mixed. On the Stroop interference measures, both offending groups' scores were significantly different from those of the non-offending group, suggesting an absence of inhibition deficits in early-onset offenders. This finding stands in contrast to existing literature holding that deficits in inhibitory control are often associated with impulsive behaviour and subsequent delinquent tendencies (Giancola, Mezzich, & Tarter, 1998; Schachar & Logan, 1990; White et al., 1994). Formal assessment approaches of executive functioning (i.e., inhibition and self-control) such as the Stroop task, permit normative comparisons and a standardised context for making qualitative interpretations of impaired performances on such tests. However, despite the accessibility of this approach in the present study, the findings within the healthy functioning range showed that early-onset offenders had slightly greater inhibitory control above that of late-onset or non-offenders, although the overall means were generally quite close.

An alternative suggestion for this atypical finding may be situated in differences in information processing ability, rather than effortful inhibitory control. For example, it could be suggested that early-onset offenders are actually displaying high levels of controlled processing ability, whereby information is processed with conscious intent, and difficulty in automatic processing which subsumes the detection of familiar stimuli (i.e., word reading) and the initiation of an appropriate response. In other words, early-onset offenders are simply consciously processing the colour name without difficulty and not dealing with the automatic process of word reading, resulting in no interference effects between the automatic and controlled processing which is specific to the Stroop task.

With respect to the temporal perception measures, non-offending youths were clearly differentiated from each of the offending groups, and the patterns of means are consistently in the predicted direction, where early-onset and late-onset offenders were significantly more likely to estimate more time had passed than non-offenders. However, differences between the two offending groups were not significant. Barkley, Edwards, Laneri, Fletcher, and Metevia (2001) reported that investigations of sense of time in adolescents and children with Attention Deficit Hyperactivity Disorder revealed that given difficulties with distractibility and attention, impulsive individuals would be more likely to manifest greater impairments in sense of time than non-impulsive individuals. Supporting this proposition, the current study revealed that early-onset and late-onset offenders provided significantly higher temporal estimation and production data than their non-offender counterparts.

Utilising a newly developed speed-accuracy task, the present study did not yield any significant differences in preferences for accuracy in a sample of juvenile early-onset, late-onset, and non-offenders. Previous research has suggested that impulsive behaviour is categorised by rapid, inaccurate performances on various tasks, although results have been mixed (Dickman & Meyer, 1988). Subsequently, the present finding may be due to a lack of

sensitivity in the speed-accuracy task, such that the situational pressure to be very fast or to be very accurate was not apparent.

The present study yielded no significant differences between the three offender groups on risk-taking behaviour. According to the Zuckerman (1994) model of sensation seeking, risk-taking behaviour in adolescence can be viewed as “the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risk for the sake of such experiences” (Arnett, 1992, p. 344). A possible explanation for the lack of differences found in risk-taking behaviour in the present study may partly result from what Arnett (1992) labels “a failure of probability reasoning” (p. 350). Probability reasoning refers to the cognitive factors introduced in the Zuckerman sensation-seeking model, whereby adolescents distort the perceived risk of a given behaviour in their favour, i.e., one set of probabilities applies to others, and another unique set applies to themselves. Subsequently, in the present study, adolescents may not have had the cognitive ability to perceive that gambling higher amounts of money would more likely result in winning more; hence, those who would likely be labelled high risk-takers acted somewhat conservatively in the face of poor probability assessment. Furthermore, prior to undertaking the risk-taking task, participants were given the option to either keep the hypothetical \$100 or to gamble it. It would be assumed that high risk-takers would automatically offer to play the game and gamble, however it remains unclear if the 30% of participants that kept the hypothetical \$100 were either high- or low risk-takers, whereby their inclusion may have assisted to find significant differences between the offending groups.

Impulsiveness, viewed as a personality trait, has been found to be a reliable indicator of delinquent behaviour (Dåderman, 1999; Romero et al., 2001; White et al., 1994), and the results of the present study were no exception. According to the findings on the Eysenck Impulsiveness Questionnaire, individuals who start offending prior to 12 years of age are

more likely to display high levels of impulsiveness beyond that of non-offenders. This result is analogous to Piquero and Chung's (2001) finding that early onset is predictive of serious offending by age 18, with the earliest onset ages relating to the most severe delinquency patterns. Once again there were no significant differences found between early-onset offenders and late-onset offenders.

Taken together, the time perception measures and Eysenck impulsiveness measure suggest that late-onset offenders do not differ reliably from early-onset offenders, though both are very different from non-offending youths. It could be that impulsivity places an individual at risk of involvement in antisocial behaviours, and that some (early-onset) individuals may, in disadvantageous circumstances, manifest problems from an early stage. Other individuals may be developing in contexts which do not place them at such risk, or perhaps act as a buffer, but on reaching adolescence may elect for new contexts (e.g., new peers, pursuit of more 'adult' activities); in these more risky environments, their impulsivity may be less constrained and this may lead them towards late-onset offending. Given the elements of social mimicry suggested in Moffitt's (1993) account of late-onset delinquency, it is also possible that such individuals adopt characteristics that are highly salient in riskier peers, such as impulsiveness. The present, cross-sectional study does not allow us to test these possibilities directly, but the findings do indicate that once antisocial careers are underway, the two groups demonstrate only modest differences on measures of impulsiveness. Longitudinal research is required to test whether this is due to a transient convergence or to longer-term similarities.

Significant findings in relation to impulsiveness and time perception provide further evidence of the need for strategies to nurture self-control in the prevention of juvenile delinquency. Such information has implications for teachers, psychologists, juvenile justice personnel, parents, and adolescents for guiding their development of prevention programs,

particularly for targeting late-onset offenders. For example, programs specifically developed to address issues related to social problem solving and risk taking behaviour in the context of a supportive network would assist late-onset offenders to redirect their trajectory. Research has suggested that early-onset offenders are often resistant to rehabilitation (Salekin, Rogers, Ustad, & Sewell, 1998), highlighting the significance of developing prevention programs for late-onset offenders. However, in order to address this, future research could provide an empirical understanding of the developmental trajectories of early-onset life course persistent antisocial behaviour and its relationship with social problem solving. Therefore, prevention directed at all young offenders' impulsivity and difficulties of self-control may contribute to the reduction of future crimes, potentially having far reaching economic and social benefits.

The present study has confirmed and extended previous research indicating that, among adolescents, offender and non-offender groups are reliably differentiated in respect of several measures of impulsivity. However, it has not been able to confirm that, within the offending population, there are significant differences between those showing early versus late onset. This raises intriguing questions for future research, particularly concerning the developmental history of problems with impulsivity in late-offending youth. Are these individuals with long-term impulsivity characteristics who happen not to have offended/ been caught? Or have they acquired problems with impulse control as a consequence of their more general involvement in delinquent activities, perhaps through processes of social mimicry in the context of peer relations with early onset offenders who may suffer impulse problems for different (e.g., biologically determined) reasons? Longitudinal research, particularly of youths identified as at-risk but not yet offending, would provide valuable evidence.

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Table 1

Mean Ages and Total Number of Participants by Age, Gender and Aboriginality in the Early-Onset, Late-Onset, and Non-Offender Groups

	Early-onset	Late-onset	Non-offender	Age
Age (<i>M</i> years)	15.37	15.67	15.40	15.48
(<i>SD</i>)	(1.38)	(1.06)	(1.37)	(1.28)
Male	<i>n</i> = 38	<i>n</i> = 38	<i>n</i> = 38	<i>n</i> = 114
<i>M</i> years	15.47	15.79	15.53	15.60
(<i>SD</i>)	(1.39)	(1.04)	(1.35)	(1.27)
Female	<i>n</i> = 5	<i>n</i> = 5	<i>n</i> = 5	<i>n</i> = 15
<i>M</i> years	14.60	14.80	14.40	14.60
(<i>SD</i>)	(1.14)	(.84)	(1.14)	(.99)
ATSI	<i>n</i> = 25	<i>n</i> = 24	<i>n</i> = 18	<i>n</i> = 67
<i>M</i> years	15.32	15.67	14.83	15.31
(<i>SD</i>)	(1.55)	(1.17)	(1.34)	(1.38)
Non-ATSI	<i>n</i> = 18	<i>n</i> = 19	<i>n</i> = 25	<i>n</i> = 62
<i>M</i> years	15.44	15.68	15.80	15.66
(<i>SD</i>)	(1.15)	(.95)	(1.26)	(1.13)
Totals	<i>n</i> = 43	<i>n</i> = 43	<i>n</i> = 43	<i>N</i> = 129

Note. Standard deviations are given in parentheses. ATSI = Aboriginal and Torres Strait Islanders.

Table 2

Mean Performance Measures as a Function of Offending History (Standard deviations in parentheses)

Dependent Scale	Early-Onset	Late-Onset	Non-Offenders
Self-Reported Delinquency			
Stealing Offences	4.77 _a (1.49)	3.68 _b (1.61)	1.17 _c (0.41)
School Misdemean	4.27 _a (1.22)	3.57 _b (1.38)	3.20 _b (1.28)
Soft Drug Use	5.16 _a (0.99)	4.67 _a (1.12)	1.71 _b (0.85)
Vehicle Offences	3.82 _a (1.44)	2.73 _b (1.21)	1.17 _c (0.44)
Abuse of Property	2.55 _a (1.26)	2.12 _a (1.16)	1.32 _b (0.53)
Physical Aggress	3.50 _a (1.52)	2.27 _b (1.13)	1.17 _c (0.41)
Hard Drug Use	2.77 _a (1.39)	1.91 _b (1.25)	1.00 _c (0.03)
Stroop word t-score	34.38 _a (6.95)	35.73 _a (8.98)	43.17 _b (8.35)
Stroop colour t-score	34.93 _a (6.70)	38.00 _a (7.81)	42.21 _b (8.45)
Stroop interference t-score	51.38 _a (5.64)	53.28 _{a,b} (6.81)	55.29 _{b,c} (7.27)
Time Perception			
Time estimation	79.71 _a (102.65)	61.27 _a (125.94)	23.28 _b (57.66)
Time production	49.81 _a (31.89)	44.05 _a (35.06)	31.56 _b (27.85)
Accuracy	32.88 _a (4.04)	30.24 _a (4.90)	32.36 _a (6.17)
Risk Taking Task	0.33 _a (0.37)	0.24 _a (0.23)	0.20 _a (0.20)
Eysenck Impulsiveness Scale	35.67 _a (7.52)	32.43 _a (7.25)	27.56 _b (5.42)

Note. Means within rows having no letter in their subscripts in common differ at $p < .05$

using the Scheffé method.

Table 3

Intercorrelations Between Scales of Dependent Variables

Scale	StroopInt	Estimate	Production	Eysenck	Accuracy
Estimation	-.10	—			
Production	-.27*	.66*	—		
Eysenck	-.17	.07	.01	—	
Accuracy	.05	-.07	-.13	.06	—
RiskTaking	.02	.19	.09	.19	-.06

* $p < .01$.

Professor Roger Levesque
Editor-In-Chief
Journal of Youth and Adolescence

8 March, 2006

Dear Professor Levesque,

Re: MS # JOYO209 Impulsivity in juvenile delinquency: Differences among early-onset, late-onset, and non-offenders

Thank you for your letter of 6 March concerning this manuscript requesting minor amendments before acceptance of the manuscript for publication in the *Journal of Youth and Adolescence*. We have now carried out the suggested minor revisions as follows:

1. We have added the word “and” in the designated locations for both Professor Ashman and Professor Durkin in the author’s research interests.
2. We have changed the paragraph on page 6 that commences with “*The relationship between*” so it now reads:

“The relationship between risk-taking behaviours and delinquency has been clearly documented, with young offenders tending to take significantly more risks than non-offenders (Arnett, 1992; Luengo, Carrillo-de-la-Pena, Otero, & Romero, 1994). Moreover, high impulsive adolescents and young adults have been found to more frequently engage in risk-taking behaviour than individuals with low levels of impulsivity (Stanford, Greve, Boudreaux, & Mathias, 1996; Vitacco et al., 2002). Interestingly, Dåderman, Meurling, and Hallman (2001), using Zuckerman’s sensation seeking model, investigated why some sensation seekers become well socialised and engage in socially acceptable thrills, while others become socially delinquent. They concluded that juvenile delinquents were not interested in socially desirable forms of sensation seeking, but in fact gained arousal of the mind and senses through novel situations such as social drinking, drug use, and gambling.”

We have included the reference for Dåderman, Meurling, and Hallman (2001) in the reference list.

From the revisions carried out, we hope that we now have a manuscript acceptable for publication in the *Journal of Youth and Adolescence*. We look forward to hearing from you.

Yours sincerely,

Dr Annemaree Carroll
Senior Lecturer in Educational Psychology