

# Multidimensional scaling analysis of psychopathy in male juveniles using the PCL: YV

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## Abstract

**Purpose** – The purpose of this paper is to examine the structure of juvenile psychopathy, as measured by the Psychopathy Checklist: Youth Version (PCL: YV).

**Design/methodology/approach** – Using a sample of 2,042 male youths from the USA, Canada, and the UK, the study was a conceptual replication of Bishopp and Hare's (2008) multidimensional scaling (MDS) analysis of adult male offenders assessed with the Psychopathy Checklist-Revised.

**Findings** – The scaling analyses generally replicated those obtained by Bishopp and Hare, providing support for a multidimensional, four-factor model of juvenile psychopathy similar to that obtained with adults. However, a small number of items fell outside their predicted regions. Slight differences in the structure of juvenile psychopathy were found for incarcerated and supervised samples of youth, with the four-factor model breaking down slightly for the supervised sample. Item misplacements may indicate that certain items on the PCL: YV are being misinterpreted, reflect different dimensions for different samples, or cannot be reliably measured. Future research should examine these possibilities, with special attention being paid to supervised samples.

**Originality/value** – To the authors' knowledge, this is one of the first known attempts to use MDS analysis to examine the psychopathy structures that emerge for male juvenile offenders. The greater nuances afforded by using MDS offer a more comprehensive understanding of psychopathy between incarcerated and supervised youth using the PCL: YV.

**Keywords** Juvenile offenders, PCL: YV, Psychopathy, Multidimensional scaling, Juvenile psychopathy, Male young offenders

**Paper type** Research paper

## Introduction

Most clinicians and researchers describe psychopathy in terms of a combination of personality traits and behaviours (e.g. Cleckley, 1976; Hare *et al.*, 2012; Lykken, 1995). These traits and behaviours are commonly assessed in adult clinical and forensic populations with the *Hare Psychopathy Checklist-Revised* (PCL-R; Hare, 1991, 2003; Hare *et al.*, 2013). The PCL-R consists of 20 items, each scored according to explicit criteria on a three-point (0, 1, and 2) scale, using interview and file information. A youth version of the PCL-R was developed by revising the 20 adult items to make them more age appropriate for a youth population (see "Items from the PCL: YV"). This version of the checklist is known as the *Hare Psychopathy Checklist: Youth Version* (PCL: YV; Forth *et al.*, 2003). As we discuss below, the PCL: YV has been validated for the assessment of psychopathic traits in youth between the ages of 12 and 18 (e.g. Book *et al.*, 2013; Forth *et al.*, 2016; Kosson *et al.*, 2002).

Items from the PCL: YV:

1. Impression management
2. Grandiose sense of self-worth

3. Stimulation seeking
4. Pathological lying
5. Manipulation for personal gain
6. Lack of remorse
7. Shallow affect
8. Callous/lack of empathy
9. Parasitic orientation
10. Poor anger control
11. Impersonal sexual behaviour
12. Early behaviour problems
13. Lacks goals
14. Impulsivity
15. Irresponsibility
16. Failure to accept responsibility
17. Unstable interpersonal relationships
18. Serious criminal behaviour
19. Serious violations of conditional release
20. Criminal versatility

Although the primary goal of the PCL-R is to assess the psychopathy construct in adults (Hare *et al.*, 2013), the large number of studies reporting moderate positive relationships between PCL-R scores and outcome measures such as criminal recidivism and institutional violence has led to its use in risk assessment (e.g. Campbell *et al.*, 2009; Hurducas *et al.*, 2014; Leistico *et al.*, 2008; Olver *et al.*, 2013; Olver and Wong, 2015; Yang *et al.*, 2010). Others have reported that offenders with high PCL-R scores present difficult challenges for treatment programs (e.g. Olver and Wong, 2011, 2013; Swogger *et al.*, 2016; Tew and Atkinson, 2013).

Given the value of the PCL-R as an assessment instrument, researchers have examined whether the same is true of the PCL: YV. Specifically, does the PCL: YV provide reliable and valid assessments of psychopathy in youth populations? And does it predict outcomes such as recidivism, violent behaviour, and poor treatment results?

With respect to its ability to assess psychopathy, the PCL: YV has shown levels of reliability and validity in adolescent male populations comparable to those shown by the PCL-R in adult populations (Andershed *et al.*, 2007; Book *et al.*, 2013; Forth and Book, 2007; Kosson *et al.*, 2002; Neumann *et al.*, 2006; Pechorro *et al.*, 2015; Salekin *et al.*, 2006; Sevecke *et al.*, 2009; Villar-Torres *et al.*, 2014; Vincent *et al.*, 2008). The pattern of findings suggests that it is possible to use the PCL: YV to identify psychopathic traits in adolescence (Salekin and Lynam, 2010).

Similar to the PCL-R, evidence also supports the use of the PCL: YV as a risk assessment tool. Indeed, studies have revealed positive correlations between PCL: YV scores in youth and various outcome measures (e.g. recidivism, academic and behavioural problems in school, etc.; Andershed *et al.*, 2008; Book *et al.*, 2013; Campbell *et al.*, 2004; Forth and Book, 2010; Salekin *et al.*, 1997; Vincent *et al.*, 2008) as well as substantial within-individual stability (Hemphälä *et al.*, 2015). However, there is conflicting evidence regarding the applicability of the PCL: YV to female adolescents. Some research has found different patterns of construct validity in young females compared to young males (e.g. Das *et al.*, 2008; Sevecke *et al.*, 2009), whereas other research has found evidence for a pattern of correlations with a variety of external indices, which suggests that the construct of psychopathy is relatively similar in female and male youth (Bauer *et al.*, 2011; Forth and Book, 2007).

### The structure of psychopathy using the PCL-R and PCL: YV

Many studies have used exploratory and confirmatory factor analysis (CFA) to uncover the factor structure of psychopathy as defined by the PCL-R. As conceptualised by Hare and his colleagues (Hare, 2003, 2016; Hare *et al.*, 2013; Hare and Neumann, 2008; Neumann, Hare, and Newman, 2007; Neumann, Kosson, and Salekin, 2007), the PCL-R measures a superordinate factor (psychopathy) underpinned by four correlated first-order factors or dimensions: interpersonal, affective, lifestyle, and antisocial. From the pattern of correlations among these unidimensional factors, it is also possible to specify two second-order factors (see Hare, 2003; Hare and Neumann, 2008). In this hierarchical model, the second-order factors are interpersonal/affective and lifestyle/antisocial, often referred to as Factor 1 and Factor 2, respectively (Hare, 1991; Harpur *et al.*, 1988). Three-factor models of the PCL-R are also viable with Cooke and Michie (2001) reporting good fit for a 13-item model that includes the interpersonal, affective, and lifestyle factors, but omits the five items loading on the Antisocial factor.

Since its development in 2003, a growing number of studies has examined the structure of psychopathy using the PCL: YV, most of which have relied on factor analysis (Neumann *et al.*, 2006). Table I provides a summary of the PCL: YV items, which describe the factors making up the proposed models. Thus far, studies have obtained results similar to those found in studies of the PCL-R. More specifically, the structure of the PCL: YV generally mirrors that of the PCL-R with the results suggesting that the two-factor model does not provide a particularly good fit to

**Table I** Comparison of three different factor models as applied to the PCL: YV

<i>Hare's (1991) two-factor model</i>	<i>Cooke and Michie's (2001) three-factor model</i>	<i>Hare's (2003) four-factor model</i>
<i>Interpersonal/affective (I)</i> Impression management Grandiose sense of self-worth Pathological lying Manipulation for personal gain Lack of remorse Shallow affect Callous/lack of empathy Failure to accept responsibility	<i>Arrogant, deceptive interpersonal (I)</i> Impression management Grandiose sense of self-worth Pathological lying Manipulation for personal gain	<i>Interpersonal (I)</i> Impression management Grandiose sense of self-worth Pathological lying Manipulation for personal gain
<i>Socially deviant lifestyle (II)</i> Stimulation seeking Parasitic orientation Lacks goals Impulsivity Irresponsibility Poor anger control Early behaviour problems Serious criminal behaviour Serious violations of conditional release	<i>Deficient affective experience (II)</i> Lack of remorse Shallow affect Callous/lack of empathy Failure to accept responsibility	<i>Affective (II)</i> Lack of remorse Shallow affect Callous/lack of empathy Failure to accept responsibility
	<i>Impulsive, irresponsible behaviour (III)</i> Stimulation seeking Parasitic orientation Lacks goals Impulsivity Irresponsibility	<i>Lifestyle (III)</i> Stimulation seeking Parasitic orientation Lacks goals Impulsivity Irresponsibility
		<i>Antisocial (IV)</i> Poor anger control Early behaviour problems Serious criminal behaviour Serious violations of conditional release Criminal versatility

**Notes:** Items 11 (impersonal sexual behaviour) and 17 (unstable interpersonal relationships) are not included in the table. Based on past studies, they tend to fall in either the interpersonal or affective cluster

**Source:** Adapted from Sevecke *et al.* (2009)

the pattern of item correlations, whereas both the three- and four-factor models do provide an acceptable fit in male and female adolescent samples (Hillege *et al.*, 2011; Kosson *et al.*, 2013; Jones *et al.*, 2006; Neumann *et al.*, 2006; Salekin *et al.*, 2006; Sevecke *et al.*, 2009).

### ***Multidimensional scaling (MDS) and the PCL assessment tools***

Most previous studies that have examined the structure of the PCL assessment tools have relied on factor analysis. While factor analysis is a powerful instrument for examining these sorts of issues, it is not the only option. Other tools also exist, such as MDS, which can be used for this purpose (e.g. Bishopp and Hare, 2008). In fact, in many ways, MDS is particularly well suited to such analyses. For example, unlike many forms of factor analysis, which require interval data and assume multivariate normality (Li, 2016), MDS can easily handle the ordinal data emerging from PCL-R and PCL: YV item scores and distributions of item scores that are sometimes skewed and kurtotic (Neumann, Hare and Newman, 2007; Neumann, Kosson, and Salekin, 2007)[1]. In addition, the visual displays produced by MDS, which illustrate the underlying (non-metric) relationships among items rather than the relationships between items and some assumed underlying factor, are easily interpreted (Shye *et al.*, 1994). The fact that MDS analysis can examine the relationships between PCL items in higher dimensionalities (and produce corresponding plots of the sort presented in this paper) is also potentially useful, especially if the relationships among the items are complex and require higher dimensionalities to adequately capture these relationships.

Even if there were no specific advantages associated with MDS, which would make one favour this form of analysis over the more commonly used factor analytic methods, there is still value in using MDS to examine the underlying structure of the PCL tools. Indeed, such analyses may serve to support existing interpretations of the factor structure of these tools if results that are similar to those found in the literature emerge from the analyses. This is especially true given that MDS and factor analysis do not necessarily produce the same findings even when applied to the same data. For example, Brazill and Grofman (2002) showed that MDS produced more parsimonious (and less misleading) solutions than factor analysis in their examination of binary voting decisions. Thus, support from MDS analysis for a previously proposed factor structure may serve as a form of triangulation (Wellington and Szczerbinski, 2007), increasing our confidence that the proposed structure is robust and reliable.

As indicated above, MDS analysis examines the relationships among variables (e.g. PCL: YV items). The analysis produces a plot in which the variables are illustrated by points in space. The goal of the analysis is to create a plot, in the lowest possible dimensionality, where the degree of association among the variables under investigation is inversely related to the distances between these points on the plot (i.e. the higher the degree of association between two variables, the closer they should appear on the plot (Shye *et al.*, 1994)). MDS analyses provide various stress measures to allow the researcher to determine the degree to which the distances between the variables on the plot map on to the original association matrix that acted as input in the analysis. The plot produced through MDS analysis can be examined, using both geometric and theoretical logic, to identify an underlying structure of the relationships among variables (e.g. to see if variable clusters map on to predictions of how the variables should be structured based on previous analyses).

As a way of testing the robustness of previously proposed factor solutions, Bishopp and Hare (2008) opted to use MDS analysis to examine the structure of the PCL-R. Their findings were consistent with a multi-faceted view of psychopathy that conformed to the two- and four-factor models, while suggesting the possibility of a fifth factor (i.e. a factor based on impulsivity). In addition, consistent with CFA findings, the two PCL-R items that have not loaded reliably on the validated three- and four-factor models in current models of psychopathy (i.e. many short term marriages and promiscuity; Neumann *et al.*, 2006) were only loosely associated with other items in Bishopp and Hare's study. To examine how the structure of psychopathy changed without these two items, Bishopp and Hare (2008) re-examined the PCL-R with only 18 items. Although there was some variable movement, this analysis provided additional corroboration of the two- and four-factor models. Specifically, the MDS analysis continued to provide evidence that the two-factor model was cohesive, while overall cohesion for the four-factor solution improved once items 11 (many short term relationships) and 17 (promiscuity) were removed.

Given the fact that MDS and factor analysis rely on different assumptions and different mathematical algorithms, these findings suggest convergence across methods, further strengthening the evidential basis for the two- and four-factor models. Even so, this study only provides evidence on the internal structure of psychopathy among adults.

### The current study

The primary goal of the present study was to extend existing research on psychopathy and youth. More specifically, we attempted to determine if the robustness of the multidimensional structure of psychopathic traits observed in adults also applies to adolescents assessed with the PCL: YV. In addition, unlike Bishopp and Hare's study, which focused exclusively on incarcerated males, we examined the structure of psychopathy in both incarcerated and supervised samples of adolescent male offenders (separately and combined).

Based on the similarities in the correlates of psychopathic traits among youth and adults, and the evidence for similar factor structures for clinical measures of psychopathy among youth and adults, we expected that the MDS analysis for PCL: YV scores would suggest a four-factor model consisting of interpersonal, affective, antisocial, and lifestyle features (see Table I for a list of the items in each factor). Furthermore, given prior evidence that two of the items, Items 11 and 17, do not load significantly on any of the four validated dimensions of psychopathy, we expected that a four-cluster solution would still be evident after removal of items 11 and 17 from the analysis, as was found by Bishopp and Hare. Likewise, given that the structure of the PCL-R is stable across incarcerated and community samples, we expected that the four-factor model also would emerge from the analysis of the separate sub-samples. It is important to re-emphasise that finding a structure in the current study that is consistent with previously proposed PCL: YV factor structures is not inevitable, as previous research comparing MDS to factor analytic solutions has clearly shown (e.g. Brazill and Grofman, 2002). Considering the ability of MDS to show underlying constructs, it is possible that new patterns or factors may be found.

## Method

### Data

The data for this study were the PCL: YV scores of 2,042 young male offenders from three countries: the USA, Canada, and the UK. The data set included 17 samples ( $n = 2,254$ ) described in the PCL: YV manual (Forth *et al.*, 2003) and two additional samples provided by Forth and Kosson. Within this pooled sample, 1,605 (78.6 per cent) of the youth were institutionalized (incarcerated) and 437 (21.4 per cent) were supervised (probation/open custody/outpatient)[2].

All assessments of the young offenders were completed by individuals trained in the use of the PCL: YV. Intraclass correlation coefficients (ICCs) for both groups (institutionalized and supervised) were excellent for single rater total score ICCs[3]. The data take the form of a matrix, with different young offenders making up the rows and their scores on each PCL: YV item making up the columns. Each offender was characterised by a profile of 20 scores – one score for each item on the PCL: YV (see "Items from the PCL: YV"). Scores can include 0 (disposition or trait not present), 1 (disposition inconsistently present), or 2 (disposition consistently present).

### Procedure

The data from all offenders were subjected to MDS analysis using the Statistica computer program (version 9.0; StatSoft, 2009). This computer program allows the user to run MDS analyses on ordinal data (i.e. PCL: YV scores) and provides numerous options for association measures. In the current study, the Goodman-Kruskal gamma coefficient was used as a measure of association, as in Bishopp and Hare (2008). This measure of association is preferable to Spearman's R or Kendall's tau when the data contain many tied observations and is considered ideal for use with ordinal data (Davison, 1992).

As briefly discussed, MDS analysis represents variables (i.e. PCL: YV items) as points in a geometric space with varying Euclidean (i.e. direct-line) distances between the points.

The proximity of the points represents the strength of association between the variables. Statistica presents numerous measures of fit that can be used to determine whether the produced plot provides a good representation of the actual associations between scores on the variables. In the current study, the coefficient of alienation (CoA) was used as a measure of fit. The CoA is a common measure of stress in studies using MDS (Breakwell *et al.*, 2006). Scores on this measure range from 0 to 1, with lower scores representing a better fit. Generally speaking, scores less than 0.20 are interpreted as representing a satisfactory fit (Shye *et al.*, 1994).

MDS plots can be presented using different dimensionalities. Generally speaking, it is preferable to rely on low-dimensionality plots if those solutions provide adequate fit with the original data (CoA < 0.20). This is because lower dimensionality solutions are typically easier to interpret. However, in cases where low-dimensionality solutions do not fit the data well, MDS plots of increasing dimensionality are tested until a good fitting solution is found. In this study, we began by examining two-dimensional (2D) MDS plots. However, we ended up relying on three-dimensional (3D) plots because the 2D plots displayed relatively poor fit according to the CoA. The 3D plots we present were also adjusted visually (by rotating them) to provide the best view of all items.

MDS plots can be interpreted using both theoretical and geometric logic according to the spatial proximities of the points. We made a priori predictions about how the PCL: YV items would cluster together, based on Bishopp and Hare (2008) and on previous factor analytic studies of the PCL: YV (e.g. Kosson *et al.*, 2013; Neumann *et al.*, 2006; see the four-factor model in Table I for a breakdown of the hypothesised clusters). The MDS solutions were examined to determine if the hypothesised structures could be identified.

## Results

### *Total sample*

An MDS analysis was first conducted on the total sample of 2,042 offenders[4]. The MDS analysis indicated a relatively poor fit in 2D (CoA = 0.26) with three items being located outside of their predicted region (impression management, grandiose sense of self-worth, and failure to accept responsibility). Based on the relatively high value of the CoA, the 2D MDS solution was rejected.

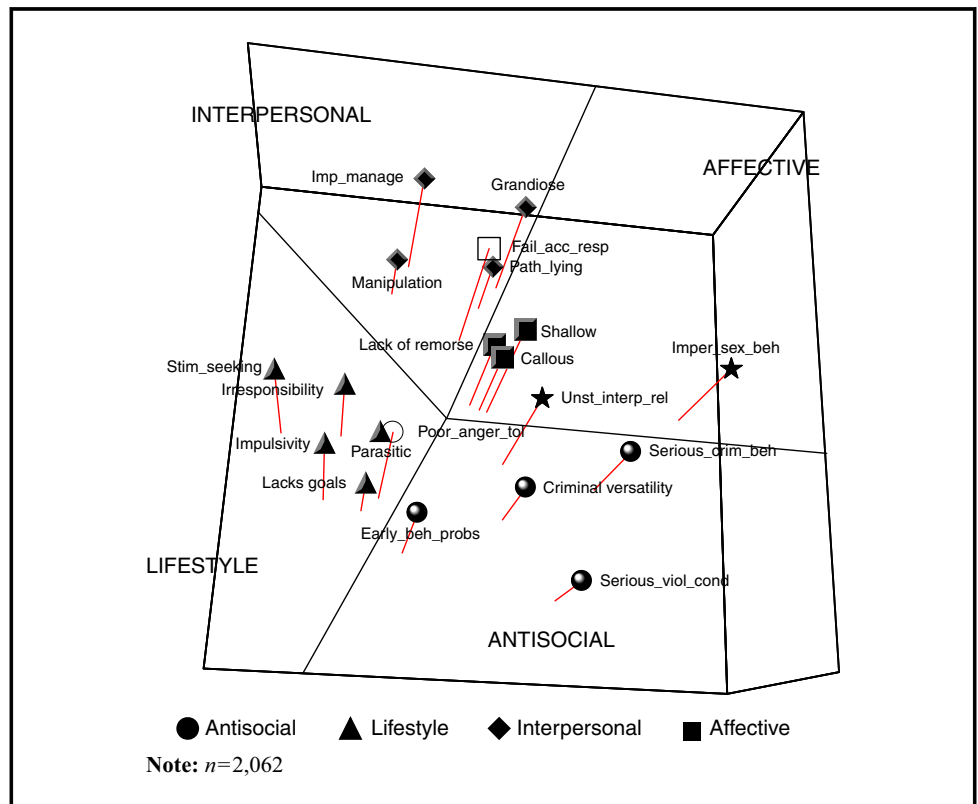
The 3D solution yielded an acceptable level of fit (CoA = 0.14)[5]. Inspection of Figure 1 shows that the 3D solution corresponds more closely to the predicted four-factor model[6]. However, poor anger control and failure to accept responsibility still remained outside of their predicted clusters. In addition, the antisocial cluster appeared quite spread out, suggesting looser associations among variables representing this particular cluster. Due to the fact that several items did not associate with other items in the predicted fashion, and Hare's (2003) four-factor model does not include items 11 and 17 (i.e. impersonal sexual behaviour and unstable interpersonal relationships), these two items were removed from the analysis in order to further examine the structure of the PCL: YV.

As indicated in Figure 2, when items 11 and 17 were removed from the analysis, the 3D plot continued to fit the data very well (CoA = 0.14), and the four-factor model was clearly identified with no items out of place. In other words, although the CoA did not change from Figure 1 to Figure 2, the removal of items 11 and 17 resulted in a better fit with the expected structure. Items assigned to the affective cluster showed the highest within-cluster associations overall compared to items in other clusters. The affective items were also positioned near the middle of the plot, reflecting their relatively high frequency of occurrence compared to items in other clusters. Within this plot, items in the antisocial cluster remained more dispersed than the items in the other clusters, suggesting again that this cluster is somewhat less cohesive than the other clusters.

### *Incarcerated subsample*

Next, to examine the impact of setting on the structure of the PCL: YV, the sample was separated into two groups – incarcerated ( $n = 1,605$ ) and supervised ( $n = 437$ ). The MDS analysis of incarcerated males again indicated a marginally poor fit in 2D (CoA = 0.21), but acceptable fit in the 3D solution (CoA = 0.12). For both plots, two items were located outside of their predicted cluster (poor anger control and early behaviour problems), but otherwise the 3D solution

**Figure 1** Three-dimensional MDS solution for the 20-item PCL: YV set for the total sample of male young offenders



corresponded well with the four-factor model (see Figure 3). As in the full sample analyses, the antisocial cluster appeared less cohesive than the other clusters.

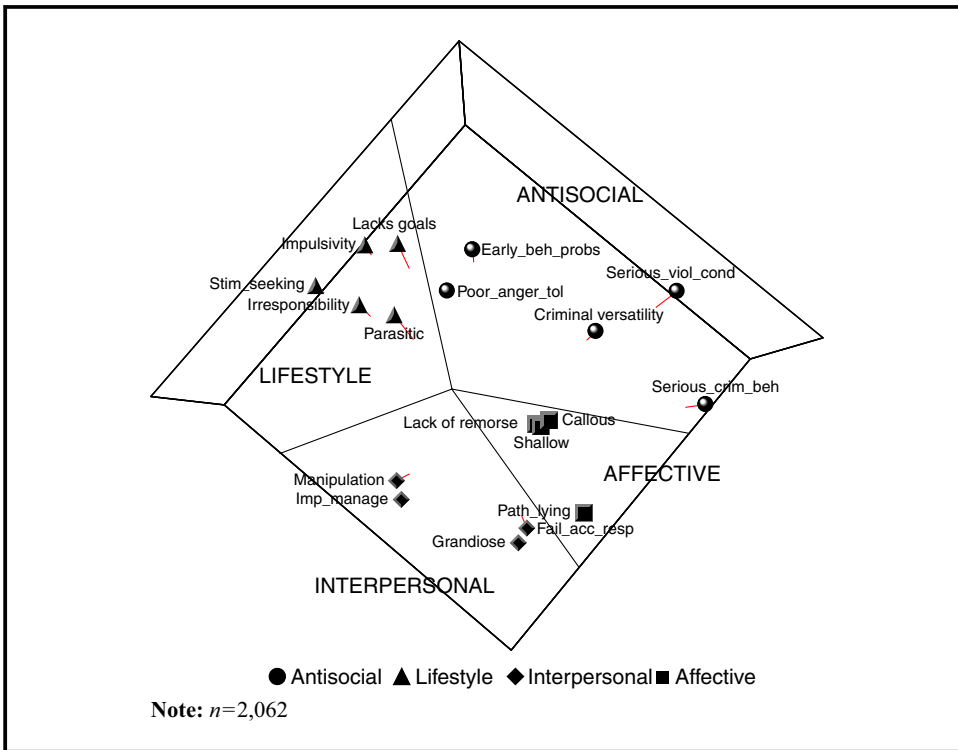
When items 11 and 17 were removed from the analysis for the incarcerated subsample, the plot continued to provide an excellent fit in 3D (CoA = 0.12). However, Figure 4 reveals that poor anger control and lacks goals remained outside of their predicted clusters. In addition, the antisocial cluster remained less cohesive than the other clusters.

**Supervised subsample**

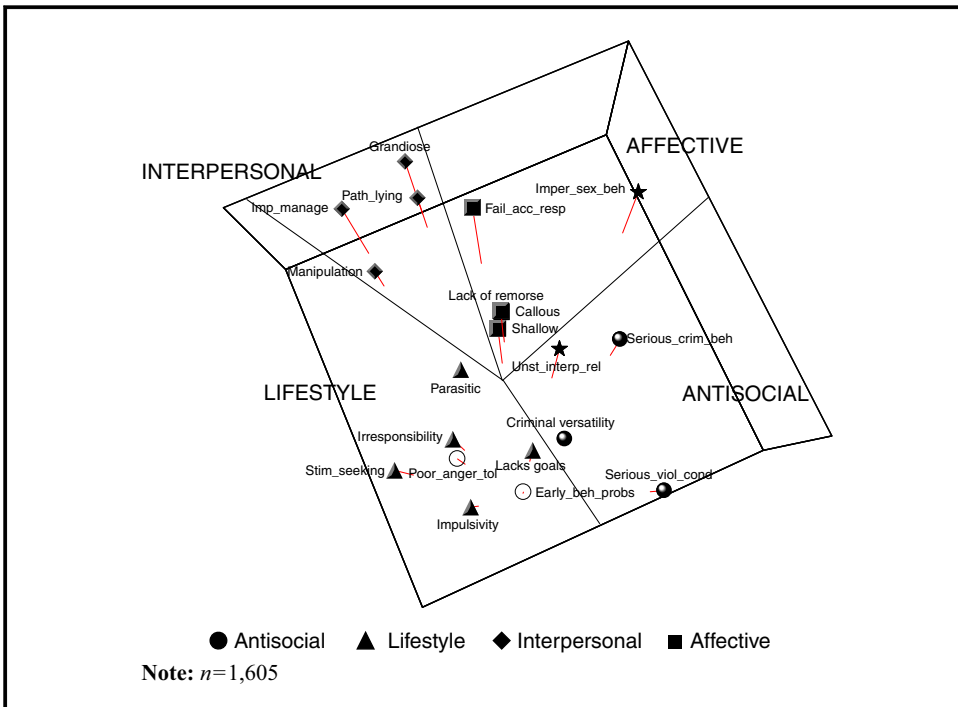
The MDS analysis of all 20 items for the supervised males indicated a relatively poor fit in 2D (CoA = 0.23). As for the incarcerated sample, the degree of fit was acceptable for the 3D solution (CoA = 0.17). Although the two CoAs could not be compared statistically, it appears that the CoA for the supervised sample was slightly higher than that found for the incarcerated males (0.17 vs 0.12). In addition, as illustrated in Figure 5, items in all four clusters were more spread out (the clusters were less cohesive) for the supervised sample than was the case for incarcerated males. In addition, early behaviour problems and shallow affect fell outside of their predicted clusters.

When items 11 and 17 were removed from the analysis for the supervised subsample, the plot yielded an acceptable fit (CoA = 0.14; see Figure 6). Although the configuration for the 18 items showed slightly tighter clusters compared to the 20-item solution, early behaviour problems and grandiose sense of self-worth were located outside their predicted clusters. Pathological lying and impression management are closely associated. While still in their predicted interpersonal cluster, pathological lying and impression management are very close to the affective cluster and shallow affect item specifically. The proximity of these variables suggests that pathological lying and impression management may be more aligned with shallow affect than with the predicted interpersonal cluster items for the supervised subsample.

**Figure 2** Three-dimensional MDS solution for the PCL: YV set for the total sample of male young offenders, excluding items 11 and 17

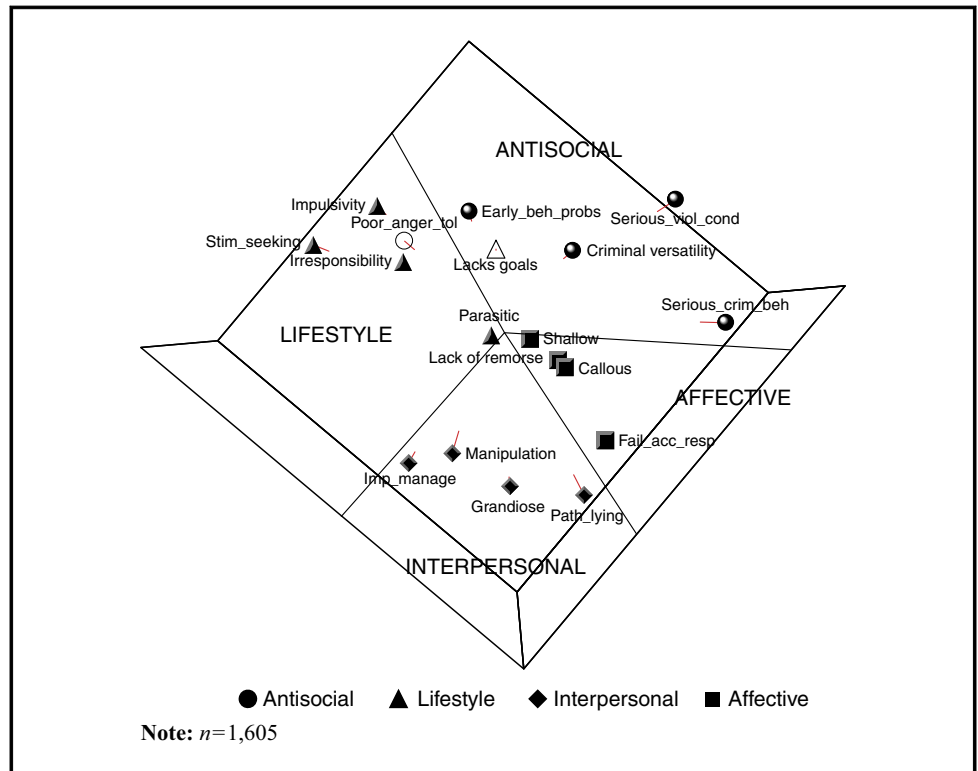


**Figure 3** Three-dimensional MDS solution for the 20-item PCL: YV set for incarcerated young male offenders





**Figure 4** Three-dimensional MDS solution for the PCL: YV set for incarcerated young male offenders, excluding items 11 and 17



## Discussion

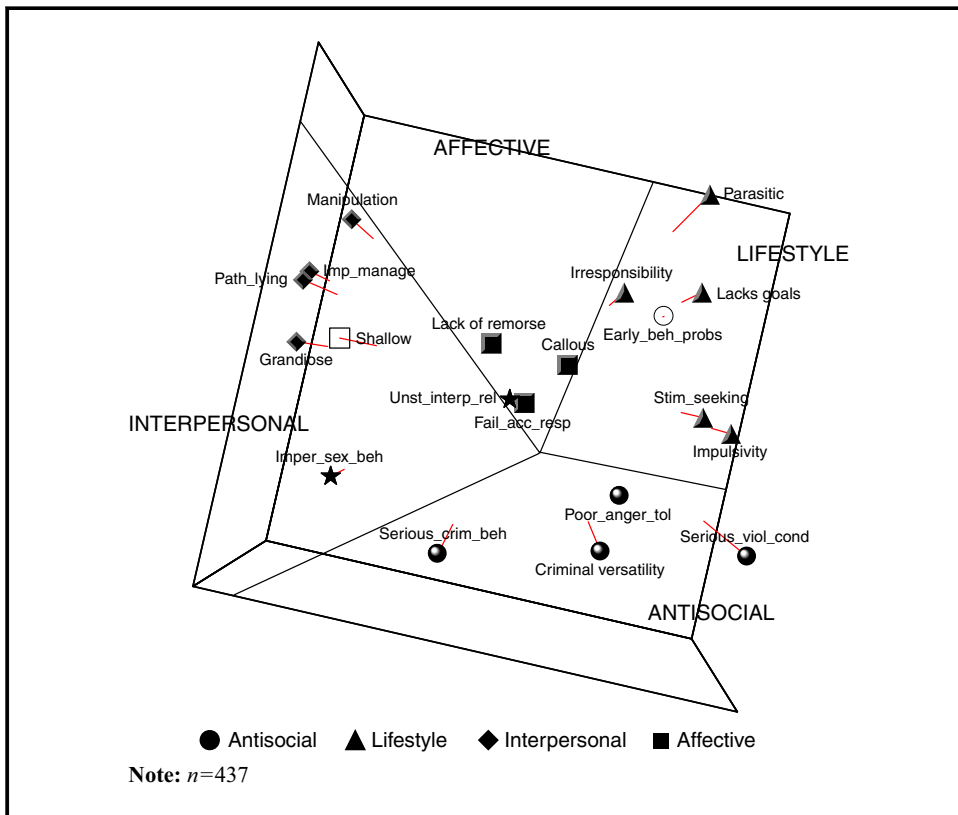
Research that examines psychopathy in youth is a necessary step in determining how the fundamental characteristics of the construct develop and when the psychopathy syndrome emerges. A better understanding of psychopathy in youth could also provide information for use in developing improved risk assessment and treatment strategies. The goal of the current study was to contribute to our understanding of the structure underlying PCL: YV scores in young males.

Currently, several factor structures have been proposed for the PCL scales. Although rival models have emerged, the four-factor model is arguably the one that is preferred by clinicians and researchers. Bishopp and Hare's (2008) analysis of the PCL-R using MDS analysis confirmed the robustness of the four-factor model in adult males by identifying clusters in the MDS plot that related to interpersonal, affective, lifestyle, and antisocial items. The current study replicated this finding using the PCL: YV in the full sample. This study also provided evidence that the four-factor model yielded an acceptable fit to the data in both incarcerated youth and supervised youth. Nevertheless, several kinds of evidence suggest that the fit was somewhat better for the incarcerated sample than for the supervised sample. Given that slightly different solutions were found for the incarcerated and supervised youth, these solutions will be discussed separately.

### *Psychopathy among incarcerated youth*

The 20-item 3D MDS solution for incarcerated youth was very similar to the 2D MDS solution presented by Bishopp and Hare (2008), but showed marginally better fit with the four-factor model than the 20-item solution that Bishopp and Hare found. With respect to their similarity, both MDS solutions (ours and the MDS plot presented by Bishopp and Hare) supported the four-factor model of psychopathy established by Hare (2003). Another important similarity between the 20-item MDS solution presented here and the 2D solution presented by Bishopp and Hare is that, in both studies, the item related to promiscuous sexual behaviour

**Figure 5** Three-dimensional MDS solution for the 20-item PCL: YV set for supervised young male offenders



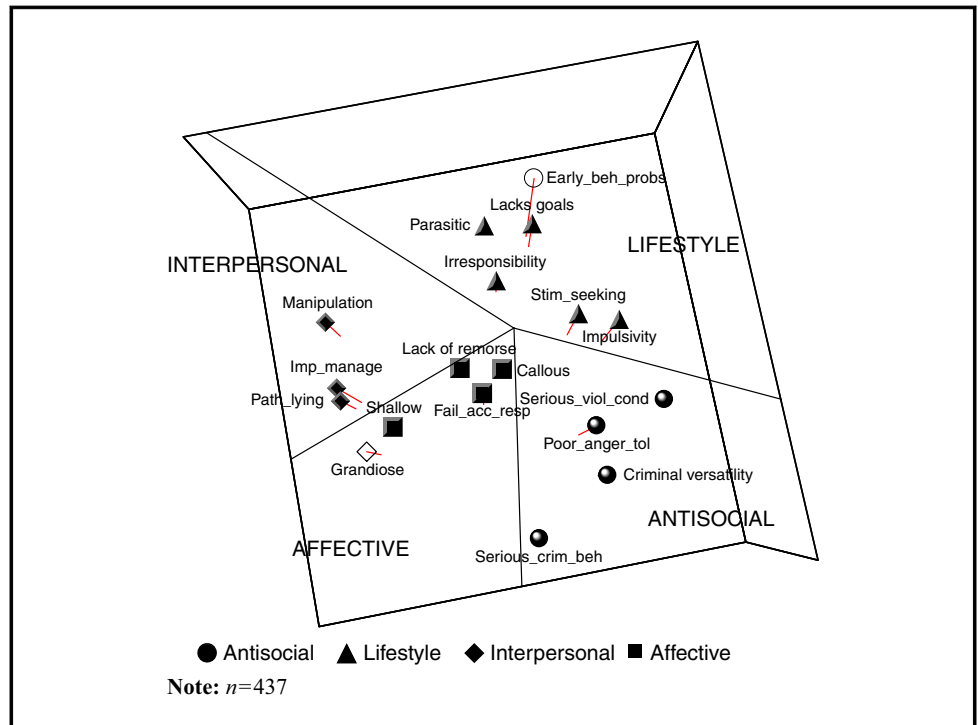
(here, impersonal sexual behaviour) was spatially distant from the majority of items in the plot. This suggests that the behaviours measured by this item may not be strongly associated with any particular cluster and is perhaps not an essential feature for assessing psychopathy. Another possibility is that impersonal sexual behaviour may represent a potential fifth factor that has yet to be developed in existing research.

Despite these similarities, there were some notable differences between the 20-item 3D plot of incarcerated youths compared to Bishopp and Hare's (2008) analysis of adults, which may reflect important things about the development of psychopathy. For example, while stimulation seeking, irresponsibility, and impulsivity are closely aligned with one another in the lifestyle region for both young males and adults, parasitic orientation was less closely associated with these items for the incarcerated male youth (see Figure 3). This finding may reflect the low frequency of high scores on this particular item (e.g. only 12.8 per cent of incarcerated youths scored a 2 on parasitic orientation), which could reflect the age of the youth. Indeed, this finding might suggest that a parasitic orientation is a trait honed with time and experience, something that most male youth clearly lack.

Also worthy of mention is the fact that lacks goals, another item that typically loads on the lifestyle factor, was in close proximity to the antisocial region among the incarcerated subsample, which could indicate that this item is more closely related to early and persistent criminal behaviour for incarcerated youth compared to incarcerated adults. Further confirmation that antisocial and lifestyle characteristics may be more closely connected in incarcerated youth than in incarcerated adults is the position of poor anger control, which is clearly situated in the lifestyle region rather than in the predicted antisocial region.

The looser clustering of items in the antisocial region compared to that seen in Bishopp and Hare's (2008) analysis could also reflect important differences between youth and adults. For example, the less cohesive antisocial region suggests that there is greater variability

**Figure 6** Three-dimensional MDS solution for the PCL: YV set for supervised young male offenders, excluding items 11 and 17



(or less consistency) among youth in how this component of psychopathy is expressed. It may also reflect the possibility that the antisocial component of psychopathy is less well measured in the PCL: YV than in the PCL-R.

Other differences between the 20-item solution of Bishopp and Hare (2008) and that of the incarcerated sample in the current study are that the only items that fell outside of their predicted regions in the prior study were early behaviour problems (which related more to lifestyle items than antisocial items) and pathological lying (which related more to affective items than interpersonal items). In contrast, in the 20-item solution for the incarcerated youth, poor anger control and early behaviour problems were located in the lifestyle cluster rather than in their predicted antisocial cluster.

Finally, in our MDS solution for incarcerated youth, items making up the affective cluster (with the potential exception of failure to accept responsibility) were more highly associated than items in the other regions and were positioned near the middle of the plot (reflecting their relatively high frequency of occurrence). This suggests that, for young male offenders, affective items may be especially central to the psychopathy construct. This finding also appears consistent with results from studies drawing on item response theory. Some of these studies have indicated that affective items on the PCL: YV have the highest degree of “discriminative value” given that these characteristics occur frequently in psychopathic individuals but infrequently in non-psychopathic individuals (Hillege *et al.*, 2011).

### *Psychopathy among supervised youth*

With respect to the analysis of supervised youth, the 20-item 3D MDS solution also supports the four-factor model. Although the CoA indicated an adequate fit, the structure was slightly less cohesive than it was for incarcerated youth, with the associations between items being noticeably lower for many items. This difference may be explained by the greater heterogeneity present in the supervised subsample than in the incarcerated subsample. For example, the supervised subsample consisted not only of adolescents under arrest, but also those on probation or in open

custody (the size of the supervised subsample prevented separate analyses of these groups). The less cohesive four-factor solution for the supervised subsample could also suggest that youth who have not displayed extreme forms of criminal behaviour (i.e. requiring incarceration) do not share the same characteristics as incarcerated youth, or do not express them to the same degree; or that the PCL: YV does not work as well for this subset of youth as it does with incarcerated youth.

Not only was the four-factor model including all 20 items slightly less cohesive for the supervised group, there were also some potentially important structural differences between this sample and the incarcerated sample. Similar to the incarcerated youth, the affective items for the supervised youth were positioned near the middle of the plot, potentially indicating the central role that affective characteristics play in psychopathy. However, when compared to the plot for incarcerated youth, the plot for supervised youth revealed a wider dispersion of the affective items.

The placement of shallow affect is particularly surprising in the plot of supervised youth because scores on this item were consistently found to be highly associated with scores on callous/lack of empathy and lack of remorse in the analysis of the total and incarcerated youth samples, as well as in other studies (Hillege *et al.*, 2011; Jones *et al.*, 2006; Kosson *et al.*, 2013; Neumann *et al.*, 2006; Salekin *et al.*, 2006; Sevecke *et al.*, 2009). In the analysis of supervised youth, shallow affect actually had a closer association with interpersonal behaviours, such as pathological lying and grandiose sense of self-worth. The strong association between these variables, as demonstrated by the association matrix and their close proximity on the MDS plots, suggests that shallow affect may be more associated with, and therefore more similar to, deceitful behaviours than with the other affective features of psychopathy in supervised male youth.

Despite these differences between the plots for supervised and incarcerated youth, there were also several similarities that emerged for the 20-item plots. For example, in contrast to what was predicted, early behaviour problems was more highly associated with lifestyle items than antisocial items for both samples. If this finding proves replicable in other samples, it would suggest that it might be useful to reconceptualise early behaviour problems as a lifestyle feature rather than as an antisocial feature for young males. This pattern of association seems to change in adult male populations as the potential for criminal behaviour develops (Bishopp and Hare, 2008).

A second similarity that is important to discuss is the fact that impulsivity was located in close proximity to the antisocial cluster for both the incarcerated and supervised samples of male youth. This finding may suggest that impulsivity plays a more predominant role in adolescent than in adult criminal offending. This is not necessarily surprising when we consider the prevalence of impulsivity-related disorders, such as attention deficit hyperactivity disorder (ADHD), in young offenders. International studies, including those conducted in Canada, Scotland, Germany, Norway, and Sweden report prevalence rates of up to 71 per cent for ADHD in young male offender samples and approximately 45 per cent for persistent ADHD (Young, Adamou, Bolea, Gudjonsson, Müller, Pitts, ... and Asherson, 2011). Impulsivity is also a significant predictor of institutional infractions committed by incarcerated offenders (Young, Misch, Collins, and Gudjonsson, 2011; Young and Thome, 2011). More research is needed to investigate the role that impulsivity plays in criminal offending among male youth who score high on psychopathy as it could suggest a possible treatment target for that group.

A final similarity worth mentioning relates to the results that emerged when items 11 (impersonal sexual behaviour) and 17 (unstable interpersonal relationships) were removed from the analysis. As indicated previously, there has been a debate about the inclusion of items 11 and 17, and previous analyses suggesting a stable four-factor model have not included these items. The current analysis indicated that the removal of these items had little impact on the structure of the MDS plots or their overall fit with the PCL: YV data. This was the case for the combined and separate samples, although some differences were found between the 18-item plots for incarcerated and supervised youth (e.g. in the 18-item plot for the supervised youth, grandiose sense of self-worth was located in the affective region rather than in the interpersonal region where it was located in the corresponding plot for the incarcerated youth).

The four-factor structure found for the 18-item plots appears to support the decision by previous researchers (e.g. Bishopp and Hare, 2008; Neumann *et al.*, 2006) to omit these variables from models

of psychopathy and raises the question of their significance. Alternately, considering the relatively strong association between the scores on these two items in the present findings, it is conceivable that these two items represent a potential fifth cluster or factor within psychopathy, one that is based on relationship behaviours. Further research would be required to explore this possibility.

### Limitations and future research

The current MDS analysis of the PCL: YV supports a multi-faceted interpretation of psychopathy consistent with that of the PCL-R. The fact that current results are consistent with previous studies of the PCL: YV that have used CFA is important. Despite the fact that MDS and CFA rely on different assumptions and mathematical algorithms, and are fundamentally different with respect to how they model underlying latent constructs, a similar four-factor model has emerged for the PCL: YV, which provides further support for its stability.

Although MDS does not depend on the same assumptions as factor analysis, it is similar to factor analysis in that it only provides an indication of whether or not there is an interpretable structure. These forms of analysis cannot provide answers as to why the traits and behaviours that form the psychopathy construct cluster in the way they do, and additional research is necessary to address this issue. In addition, current analyses cannot provide explanations for the apparent differences in the structure of psychopathy between youth and adults. The looser configuration of items found for the antisocial component of psychopathy in the youth samples examined in this study (compared to studies using adult samples) suggest that developmental issues may be at work. Considering the proximity of impulsivity to the antisocial cluster, as well as interpersonal items to the antisocial cluster, it is possible that a fifth factor surrounding impulsivity may be extrapolated. However, additional research will be required to address this issue more directly.

The looser clustering of items found for the supervised youth (compared to the incarcerated youth) suggests that the 20-item MDS plot for supervised youth did not fit the four-factor model as well as the MDS plot for incarcerated youth (as indicated by a slightly higher CoA for the supervised youth plot). There are a number of potential explanations for this finding. For example, the sample size for the supervised group may have been too small to obtain a stable structure. Alternatively, the heterogeneous nature of the supervised sample may explain the looser configurations. Whatever the explanation, current findings suggest the importance of additional research involving larger samples of non-incarcerated youth. Such research would be useful to inform treatment strategies for psychopathy.

Treatment for psychopathy in general is a contentious issue in regard to its effectiveness. Harris and Rice (2006) had conducted extensive reviews of treatment evaluations of psychopathy in adult and young offenders with mixed results at best and some treatment strategies increased recidivism in psychopathic offenders. The ineffectiveness of treatments for psychopathic individuals is believed by some to be in part because psychopathy is "hard-wired" in the brain, demonstrating abnormalities in the pre-frontal cortex and amygdala (Umbach *et al.*, 2015). Despite the initial findings, more recent evaluations have found potentially promising strategies for treatment of psychopathy, particularly for young offenders (Caldwell, 2013; da Silva *et al.*, 2013; Frick *et al.*, 2014; Viding *et al.*, 2012). Some believe that treatment of psychopathy may be more effective at younger ages when the psychopathic traits are still becoming more ingrained (Caldwell, 2013; da Silva *et al.*, 2013). The looser clustering of items in the young offenders for the incarcerated and supervised samples in the current study compared to the tighter adult clustering in Bishopp and Hare's (2008) results would suggest that the concept of these traits being less ingrained at younger ages may be true. Therefore, if at least some traits are less ingrained at younger ages, this could indicate that intervention and treatment for individuals with psychopathy may prove more successful for youth with a higher probability for therapeutic change compared to adults (da Silva *et al.*, 2013). There is still a need for more research in regard to treatment for those high in psychopathy traits. It is also important to note that this study was restricted to male young offenders. We do not know whether the results from the MDS analyses will generalise to female young offenders. Although research indicates that some young female offenders do exhibit high scores on the PCL: YV (Dillard *et al.*, 2013; Kosson *et al.*, 2013; Salekin *et al.*, 2006; Sevecke *et al.*, 2009), we cannot know whether the MDS structure found for young males will be replicable among

young females. Because MDS can provide information different from that provided by factor analyses, future MDS studies should explore whether the multidimensional structure of psychopathy is similar for both male and female youth using MDS analysis.

## Conclusions

The results of the current study indicated that 3D MDS solutions were required to capture the complexity of associations between PCL: YV items. Under these conditions, a clear four-factor model emerged, which provides additional evidence of a multi-faceted conceptualization of juvenile psychopathy as assessed with clinical measures of juvenile psychopathy. The resulting four-factor model of PCL: YV data, consisting of interpersonal, affective, lifestyle, and antisocial clusters, is similar to the structure found by Bishopp and Hare (2008) when they analysed PCL-R data. However, the four-factor model obtained for youth was somewhat more similar to the model found in adults for incarcerated youth than for supervised youth.

Nevertheless, even the multidimensional model obtained for the incarcerated sample of youth differed in some ways from the multidimensional model obtained for incarcerated adults. Notably, the antisocial cluster was somewhat less coherent among youth than among adults. In addition, a small number of variables were located outside of their predicted regions in some of the plots, co-occurring with other PCL: YV items in unexpected ways. There are several possible interpretations of these findings. Notably, it is possible that some of the differences in the structure of PCL: YV psychopathy may reflect the possibility of developmental differences in the structure of psychopathy. On the other hand, common interpretations of certain PCL: YV items (e.g. early behaviour problems) may be incorrect or these items may load on different components of psychopathy in different samples, or may be less reliably measured in some sub-samples. In addition, the fact that the removal of items 11 and 17 (impersonal sexual behaviour and unstable interpersonal relationships) had little impact on the structure of the MDS plot raises the possibility that they are less related to psychopathy in youth than in adults or that a potential fifth factor made up of relationship behaviours should be explored.

In spite of the small differences noted for incarcerated vs supervised youth, the fact that the structure of the PCL: YV was found to remain fairly stable across settings is important and suggests that the tool can be used in a generally similar way across these contexts. Nonetheless, it is important to replicate current results in a larger sample of supervised youth and to extend this work to an examination of young females so that we can develop a more comprehensive understanding of psychopathy in youth. Given the small number of misplaced items in the current study, and the fact that items 11 and 17 appear somewhat irrelevant to the four-factor structure of psychopathy, future research should also explore the possibility that we should refine how psychopathy is measured in young people. Evidence that current findings are robust in different youth samples would suggest the possibility that slight refinements to some of the PCL: YV antisocial items would make this tool even more valuable for assessment and prediction purposes than it already appears to be. Longitudinal research to capture more dynamic change in the features associated with youth criminality may also prove beneficial for improving our understanding of the stability of the structure of psychopathic traits in youth and young adults.

## Notes

1. Relatively recent advances in factor analysis have produced methods that can also deal with these issues. For example, robust maximum likelihood can be used in confirmatory factors analysis in cases where the normality assumption is violated, and diagonally weighted least squares is suitable with ordinal data (Li, 2016).
2. The samples of youth that were examined in the PCL: YV manual also included youth in community settings ( $n = 212$ ), but because of a large amount of missing data in these samples ( $n = 77$ ), they were not selected as one of the primary samples in the current study. For completeness, however, an MDS was run on the community sample. The resulting solution did not adhere to the four-factor model. We note that the relatively small community sample size was even smaller because MDS methods omit cases with missing data. Because we were unable to examine the community sample in a satisfactory fashion, it is not currently known whether the results of the primary analyses are generalisable to community populations.

3. For example, one sample of institutionalized youth ( $n = 103$ ) had a total score ICC of 0.93. For supervised youth, the total score ICC was 0.90. For more information, please refer to the PCL: YV manual (Forth *et al.*, 2003).
4. The association matrices that were used to generate the MDS solutions for the combined and separate samples are available upon request from the first author.
5. The lines connecting the points (PCL: YV items) with the base of the plot are anchors in the direction of the x-axis. These lines are intended to facilitate the comparisons between points within the plot.
6. Note that the lines in the figures were drawn by the authors and reflect the division of the items into the predicted clusters. The positioning of the lines in each figure minimises the number of items falling outside of their predicted cluster.

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