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# The Network of Psychopathic Personality Traits: A Network Analysis of Four Self-Report Measures of Psychopathy

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Psychopathy is often perceived as a constellation of personality traits, yet there is little consensus as to what constitutes the core features of psychopathy. We applied a network approach to investigate the psychopathy network, as operationalized by four self-report measures of psychopathy among a large sample of undergraduate students. Items assessing manipulativeness and irresponsibility/impulsivity had the strongest centrality indices in the item-level psychopathy network models. Stimulus seeking, social deviance, and interpersonal/affective traits were the most central domains in the psychopathy network derived from all factors in the four psychopathy measures. Network analysis may offer an alternative approach to help researchers identify characteristics that are important in the psychopathy network.

*Keywords:* Levenson Self-Report Psychopathy Scale, Personality Assessment Inventory—Antisocial Features subscale, Self-Report Psychopathy Scale-II, Psychopathic Personality Inventory–Short Form, network analysis

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Psychopathy is often conceptualized by a constellation of personality traits including interpersonal, affective, lifestyle, and antisocial features (Cleckley, 1941). Originally, psychopathy was perceived as a two-factor model encompassing an Interpersonal– Affective factor and an Irresponsible–Social Deviance factor (Harpur, Hare, & Hakstian, 1989). This two-factor model for psychopathy was initially based on data from Hare's Psychopathy Checklist (PCL; Hare, 1991) and Psychopathy Checklist–Revised (PCL-R; Hare, 2003). From the late 1980s onward, the PCL measures served as the primary way to systematically index psychopathy following Cleckley's (1976) delineation of the syndrome's most prominent characteristics more than 1 decade earlier. Eventually, the PCL-R yielded three- and four-factor models including interpersonal, affective, lifestyle, and antisocial facets (Hare, 2003).

Following the development of the PCL-R, self-report versions of psychopathy were constructed to reduce administration time, improve usability (e.g., in community settings), and eliminate the need for file information. A number of key self-report measures were developed, such as the Levenson Self-Report Psychopathy Scale (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995), the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996), and the Self-Report Psychopathy Scale-II (SRP-II; Hare, 1980). Other self-report measures that tap into elements of psychopathy are also useful, such as the Personality Assessment Inventory-Antisocial Features subscale (PAI-ANT; Morey, 1991) and the Elemental Psychopathy Assessment (Lynam et al., 2011). The PAI-ANT was housed in a multiscale inventory and had alignment with contemporary models of psychopathy (Cleckley, 1941; Hare, 1991). The Elemental Psychopathy Assessment was derived from traits underlying the five-factor model of personality, and found to be associated with other psychopathy measures (Lynam et al., 2011). Although some of these measures have the similar conceptual underpinnings, and the domains for each measure can be roughly grouped into interpersonal, affective, irresponsible, and social deviance domains, there remains little consensus regarding what are the core features of psychopathy.

In recent years, network analysis has gained momentum as an alternative approach to conceptualize psychopathology (Borsboom, 2017). The network approach posits that psychopathology is the result of the causal interaction between symptoms in a network (Borsboom & Cramer, 2013; Cramer, Waldorp, van der Maas, & Borsboom, 2010). As psychopathy is often perceived to include a myriad of personality traits, including interpersonal, affective, lifestyle, and antisocial features (Cleckley, 1941), the network approach offers an alternate framework to explore the interactions among these personality traits. Rather than assuming that there exists a latent construct of psychopathy, it is the interactions among these characteristics that constitutes psychopathy. In this view, the multitude of personality traits are not caused by an underlying psychopathy construct; it is the interrelations of

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these features that constitutes the complex network of psychopathy. Network analysis offers a plausible framework for exploring potential interactions among psychopathy features. For example, disinhibition or impulsivity motivates fearlessness, and stimulusseeking characteristics may contribute to involvement in antisocial behavior. It is also possible to identify features that are important to the network—features are typically placed in relatively central positions and well-connected with other features in the network model. These features may be essential to the network, with the endorsement of core symptoms likely to indicate the endorsement of other connected traits, thus potentially activating the entire network.

The psychopathy network, as operationalized by the PCL-R, was first examined by Verschuere et al. (2018). Callousness/lack of empathy was identified to be the most central item in the two U.S. offender samples, and relatively central in the Dutch forensic psychiatric sample. A close investigation of the network structures reveals that lack of empathy is strongly associated with lack of remorse/guilt and shallow affect. The network structure suggests that callousness/lack of empathy is prone to activate lack of remorse/guilt and shallow affects, which are likely to activate a cascade of other closely connected features. On the other hand, multiple short-term marital relationships was placed in the peripheral, with much weaker associations with other features in the psychopathy networks. Having many short-term marital relationships, thus, is not as important and may not activate as many traits in the psychopathy network.

The importance of the PCL-defined psychopathy symptoms, as operationalized by the PCL-R or the Psychopathy Checklist: Screening Version (PCL: SV; Hart, Cox, & Hare, 1995), was further explored in two U.S. forensic patient samples (Preszler, Marcus, Edens, & McDermott, 2018). Lack of remorse had the largest centrality coefficients in both samples, suggesting that this symptom is relatively important in the psychopathy network. Although Verschuere et al. (2018) and Preszler et al. (2018) did not yield identical psychopathy network models, both studies suggested that affective deficits may be the core features of PCL-Rdefined psychopathy network. It is possible that such deficiencies in affective features may promote the expression of other symptoms indicative of psychopathy, which may in turn, further encourage the development affective features, and thus facilitate the manifestation of the psychopathy network, as operationalized by the PCL-R/SV.

The network approach was recently applied to investigate how the "Dark Triad" personality traits—psychopathy, narcissism, and Machiavellianism—are interrelated in two community samples (Marcus, Preszler, & Zeigler-Hill, 2018). Callousness and interpersonal manipulation were reported to be central in the dark traits networks. Although Marcus et al. (2018) did not explicitly examine the network structure of psychopathy, their findings correspond with the previous study, in which callousness occupied central positions in the psychopathy networks among forensic samples (Verschuere et al., 2018).

With only a few applications of the network approach to psychopathy, it may be premature to conclude that callousness/lack of empathy is the most important feature in the psychopathy network. Furthermore, questions remain as to whether similar psychopathy networks can be obtained when assessed with different instruments, and/or in different populations. The present study aims to address some of these concerns by estimating the psychopathy network operationalized by four self-report psychopathy measures in a community sample.

Our primary objective is to examine how characteristics indicative of the latent psychopathy trait are interrelated to one another among a community sample. As the four self-report psychopathy measures were administered to all participants, this study has the unique opportunity of comparing the network models of different psychopathy instruments. The secondary purpose is to investigate how the network structures of different instruments assessing psychopathy are similar to, or different from, each other. Considering that each psychopathy measure taps into different domains of psychopathy, our third goal is to examine the associations among these psychopathy domains. Using network analysis, we aim to investigate what are the core features of psychopathy among a college sample.

## Method

#### **Participants**

Data in this study were initially collected from 1,257 (378 men, 869 women) undergraduate students enrolled in a southeastern university in the United States. Details of the original study procedure were described in Lester, Salekin, and Sellbom (2013). For the purpose of the current study, participants with more than 10% missing data on each of the instrument (>2 items on the LSRP and PAI, >2 items on the SRP-II<sup>1</sup>, and >6 items on the PPI–Short Form [PPI-SF]) were excluded. Subsequent analyses utilized data from 1,180 (350 men, 827 women) participants; the average age was 19 (SD = 2.3, range = 17 to 51) years old. The majority of the participants self-identified as Caucasians (83.8%), with smaller proportions of African Americans (11.0%), and other racial/ethnic groups (5.2%). The study was approved by the Institutional Review Board at the university.

# Measures

**Levenson Self-Report Psychopathy Scale.** The LSRP (Levenson et al., 1995) consists of 26 items assessing two domains of psychopathy—primary psychopathy representing low agreeableness (L1; 16 items) and secondary psychopathy denoting low conscientiousness/disinhibition (L2; 10 items<sup>2</sup>). Participants rate the extent to which they agree to each item on a 4-point scale (1 = *disagree strongly*; 2 = *disagree somewhat*; 3 = *agree somewhat*; 4 = *agree strongly*).

**Personality Assessment Inventory—Antisocial Features Scale.** The PAI-ANT scale (Morey, 2007) includes 24 items, with eight items each assessing three factors: Antisocial Behavior (ANT), Egocentricity (EGO), and Stimulus Seeking (SS). Each

<sup>&</sup>lt;sup>1</sup> We chose to exclude participants who had more than 10% missing data on SRP-II items that assess the Interpersonal/Affective (nine items) and Social Deviance factors (13 items), rather than 10% missing data on the 60-item SRP-II scale, because the subscales were used for the network analysis.

 $<sup>^{2}</sup>$  One item in the Secondary Psychopathy subscale (Item 17: "I find myself in the same kinds of trouble, time after time") was not included in the study.

item is rated on a 4-point scale (0 = false/not at all true; 1 = somewhat true; 2 = mainly true; 3 = very true).

**Psychopathic Personality Inventory–Short Form.** The PPI-SF consists of 56 items that have the highest factor loadings on the original PPI (Lilienfeld, 1990). The PPI-SF assess the following eight domains: Blame Externalization (BE), Social Potency (SP), Machia-vellian (ME), Fearlessness (F), Coldheartedness (C), Impulsive Non-conformity (IN), Stress Immunity (SI), and Carefree Nonplanfulness (CN). Each item is scored on a 4-point scale (1 = *false*, 2 = *mostly false*, 3 = *mostly true*, 4 = *true*).

**Self-Report Psychopathy Scale-II.** The SRP-II (Hare, Harpur, & Hemphill, 1989) includes 60 items meant to assess the two factors that correspond to those in the PCL-R.<sup>3</sup> Nine items are designed to assess the Interpersonal/Affective (INT) factor, and 13 items designed to assess the Social Deviance (SOC) factor. Each item is scored on a 7-point scale ( $1 = disagree \ strongly$ ;  $2 = disagree \ moderately$ ;  $3 = disagree \ slightly$ ; 4 = neutral;  $5 = agree \ slightly$ ;  $6 = agree \ moderately$ ;  $7 = agree \ strongly$ ).

#### **Network Analysis**

A network model is represented by a network of nodes and edges. Each symptom is indicated by a node, and the association between two symptoms is represented by an edge connecting between the two nodes. The current study estimated an association network, based upon zero-order correlations, such that the edges represent the magnitude of association between two domains. Positive associations are illustrated in blue solid lines, whereas negative associations are displayed in red dashed edges. The width of the edges corresponds to the magnitude of association, with thicker edges reflecting stronger correlations between two symptoms. An item-level network model was estimated for each selfreport psychopathy measure. To explore the network of psychopathic features assessed by the different domains in the four self-report psychopathy measures, a domain-level association network was also estimated.

For the ease of direct comparison between our study and prior work, we present findings of the association network models in the main text. We also estimated a regularized partial correlation network model for the four item-level networks and the domainlevel network. The regularized partial correlation network was estimated using the graphical least absolute shrinkage and selection operator (LASSO; Friedman, Hastie, & Tibshirani, 2008); the edges represent the magnitude of association between two symptoms, after taking into account correlations with all other symptoms in the network (Epskamp & Fried, 2017). The resulted network model is weighted and undirected, reflecting the strength but not causal relations between symptoms. Results from the regularized partial correlation network models are included in the online supplemental materials (Figures S3–S7) for interested readers.

To quantify the structural importance of each symptom to the network, three indices of node centrality were estimated (Opsahl, Agneessens, & Skvoretz, 2010). Node strength is the sum of the weights of the edges connected to a node, reflecting how strongly a node is directly correlated with all other nodes in the network. Closeness is the inverse of the weighted sum of the shortest path lengths of a node to all other connected nodes, indicating the average distance a particular node is connected to all other nodes

in the network. Betweenness reflects the number of times a node is on the shortest path between two other nodes. The normalized (*z*-scored) values of each centrality index are presented for each node, with higher values indicating greater centrality in the network. All network analyses were conducted using the "qgraph" package (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012) in R (R Development Core Team, 2015).

# Results

## **Descriptive Statistics**

Table 1 shows the descriptive statistics of the four self-report psychopathy measures. Total scores and corresponding subscale scores are computed for each instrument, with higher scores indicative of stronger tendency of psychopathic traits. The bivariate correlations between the four self-report psychopathy measures and their subscales are shown in Table 2.

## LSRP Network

The zero-order correlation network model for LSRP is shown in Figure 1. The placement of the nodes reflect how closely they are associated with each other. Items in the Primary Psychopathy subscale are mostly clustered together. With the exception of one item in the Secondary Psychopathy subscale (Item 19: I find that I am able to pursue one goal for a long time), all the LSRP items were closely connected.

Centrality indices for the LSRP items are illustrated in Figure 2a. Item 2 (For me, what's right is whatever I can get away with) had the highest strength, betweenness, and closeness centrality index. Item 3 (In today's world, I feel justified in doing anything I can get away with to succeed) also had among the highest strength and closeness centrality indices. As illustrated in Figure 1, Items 2 and 3 are placed almost in the center of the cluster, closely related to many other items in the LSRP network, with moderate associations with many items.

## **PAI-ANT Network**

Figure 3 illustrates the network model of the PAI-ANT items. Strong associations were observed between many of the PAI-ANT items. Most of the items were clustered together, except Items 9 (I've borrowed money knowing I wouldn't pay it back) and 15 (I look after myself first; let others take care of themselves). Centrality indices for the PAI-ANT items are shown in Figure 2b. Items with the highest strength and closeness centrality indices include Items 18 (I do a lot of wild things just for the thrill of it), 19 (My behavior is pretty wild at times), and 5 (I like to see how much I can get away with); these items are located in the center, with many connections to other nodes in the network. This finding corresponds to the moderate to strong associations between these

<sup>&</sup>lt;sup>3</sup> A rationally derived 36-item four-factor model of the SRP-II was previously derived using the current data (Lester et al., 2013): Interpersonal (IP: 16 items), Disinhibition/Impulsivity (DI: nine items), Fearlessness (F: five items), and Coldheartedness (C: six items). We included results of the network analysis using these 36 SRP-II items in the online supplementary materials (Figures S1 and S2).

Table 1	
Descriptive Statistics of Four Self-Report Measures of	f
Psychopathy and Their Subscales	

Scale	Measure	Items	M(SD)	Min	Max
LSRP	Primary Psychopathy	16	29.45 (8.02)	16	60
	Secondary Psychopathy <sup>a</sup>	9	19.77 (4.46)	9	35
	Total	25	49.22 (10.71)	25	89
PAI ANT	Antisocial Behavior	8	7.53 (5.20)	0	24
	Egocentricity	8	5.49 (3.80)	0	24
	Stimulus Seeking	8	8.18 (4.68)	0	24
	Total	24	21.23 (11.29)	0	71
PPI-SF	Blame Externalization	7	14.64 (4.46)	7	28
	Social Potency	7	20.20 (4.21)	7	28
	Machiavellian	7	14.94 (3.60)	7	27
	Fearlessness	7	15.64 (5.06)	7	28
	Coldheartedness	7	13.84 (3.15)	7	27
	Impulsive Nonconformity	7	13.78 (3.66)	7	27
	Stress Immunity	7	18.14 (4.26)	7	28
	Carefree Nonplanfulness	7	12.88 (3.09)	7	24
	Total	56	124.05 (14.80)	84	187
SRP-II	Interpersonal/Affective	9	34.46 (6.28)	11	52
	Social Deviance	13	41.17 (13.13)	13	89
	Total	60	214.14 (35.74)	118	386

Note. LSRP = Levenson Self-Report Psychopathy Scale; PAI ANT = Personality Assessment Inventory-Antisocial Features scale; PPI-SF = Psychopathic Personality Inventory-Short Form; SRP-II = Self-Report Psychopathy Scale-II.

<sup>a</sup> Item 17: "I find myself in the same kinds of trouble, time after time" was not included.

three items and their surrounding nodes. Items 9 and 15 scored the lowest on all three centrality indices, reflecting their relatively peripheral placement from the rest of the PAI-ANT items.

Table 2 E

Bivariate Correlations Between the Four Psychopathy Measures and Their Subscales													
Scale	LSRP		PAI-ANT		PPI-SF								
	L1	L2	AB	EGO	SS	BE	SP	ME	F	С	IN	SI	CN
LSRP													
L2	.43***												
PAI-ANT													
AB	.49***	.44***											
EGO	.58***	.38***	.46***										
SS	.45***	.43***	.56***	.50***									
PPI-SF													
BE	.30***	.38***	.29***	.24***	.23***								
SP	.04	05	.09**	.11***	.21***	05							
ME	.55***	.39***	.45***	.53***	.32***	.34***	0						
F	.20***	.15***	.30***	.18***	.59***	.07*	.14***	.09**					
С	.21***	0	.09**	.11***	$.08^{**}$	$11^{***}$	.06*	0	.05				
IN	.18***	.29***	.37***	.24***	.46***	.21***	.02	.16***	.44***	.07*			
SI	.04	$19^{***}$	.07*	.04	.16***	$21^{***}$	.25***	$15^{***}$	.27***	.34***	.13***		
CN	.27***	.46***	.34***	.23***	.32***	.11***	$07^{*}$	.27***	.16***	.12***	.26***	05	
SRP-II													

Note. LSRP = Levenson Self-Report Psychopathy Scale; L1 = Primary Psychopathy; L2 = Secondary Psychopathy; PAI-ANT = Personality Assessment Inventory—Antisocial Features scale; AB = Antisocial Behavior; EGO = Egocentricity; SS = Stimulus Seeking; PPI-SF = Psychopathic Personality Inventory-Short Form; BE = Blame Externalization; SP = Social Potency; ME = Machiavellian; F = Fearlessness; C = Coldheartedness; IN = Impulsive Nonconformity; SI = Stress Immunity; CN = Carefree Nonplanfulness; SRP-II = Self-Report Psychopathy Scale-II; INT = Interpersonal/Affective; SOC = Social Deviance. \*\* p < .01. \*\*\* p < .001. p < .05.

.30\*\*\*

.17\*\*\*

.02

.46

\*\*\*

.18\*\*\*

.46\*\*\*

.35

.11\*\*\*

.06

.42

## **PPI-SF** Network

With the exception of Items 4 (I might enjoy flying across the Atlantic in a hot-air balloon) and 37 (I often feel very nostalgic when I think back to peaceful moments in my childhood), all of the PPI-SF items were placed relatively close together, reflecting moderate to strong associations between items (see Figure 4). The centrality indices plot (Figure 2c) showed that Item 22 (I've always considered myself to be something of a rebel) had the strongest betweenness, closeness, and strength centrality among all the items. Other items that obtained high strength centrality include Items 7 (I'm the kind of person who gets "stressed out" pretty easily), 11 (In school or at work, I sometimes try to "stretch" the rules a little bit just to see how much I can get away with), and 16 (I usually strive to be the best at whatever I do). On the other hand, Item 37 (I often feel very nostalgic when I think back to peaceful moments in my childhood) was weak on all three centrality indices, in correspondence to its relatively remote placement in the network model.

## **SRP-II** Network

As shown in Figure 5, items in the Social Deviance subscale are mostly clustered together, with close connections with three items in the Interpersonal/Affective subscale (Item 10: I am usually very careful about what I say to people; Item 31: Not hurting others' feelings is important to me; Item 60: I am the most important person in this world and nobody else matter). Items 6 (I worry a lot about possible misfortunes), 25 (I often worry unnecessarily), and 47 (Sometimes at night I get so worried about something that my heart pounds and I cannot fall asleep) in the Interpersonal/Affective subscale formed a separate cluster, whereas the remaining

.48\*

.11\*\*\*

-.05

.36\*\*\*

.14\*\*\*

INT

SOC

19\*

57

\*\*\*

-.13\*

.50\*\*\*

.10\*\*

.63\*\*\*

.15\*\*\*

.50\*\*\*

.14\*\*

.69\*\*\*

-.15\*\*\*

.28\*\*\*

SRP-II INT



*Figure 1.* Association network model of the Levenson Self-Report Psychopathy Scale. See the online article for the color version of this figure.

items in the Interpersonal/Affective subscale were placed further away in the network model. The estimated centrality indices for the SRP items are shown in Figure 2d. Items 28 (I got in a lot of trouble at school) and 31 (Not hurting others' feelings is important to me) had among the strongest centrality on all three indices, and Item 29 (Rules are made to be broken) scored relatively high on the strength and closeness centrality indices.

#### **Psychopathy Network**

Figure 6 displays the estimated association network model of all the subscales assessed by the four self-report psychopathy measures and the corresponding centrality indices. Two distinct clusters of nodes can be observed. The first cluster consists of the LSRP subscales, PAI-ANT subscales, five PPI-SF subscales (Blame Externalization, Machiavellian, Fearlessness, Impulsive Nonconformity, and Carefree Nonplanfulness), and the SRP-II Social Deviance subscale. Moderate to strong interrelations were observed between these subscales. The second cluster consists of three PPI-SF subscales (Social Potency, Stress Immunity, and Coldheartedness) and the SRP-II Interpersonal/Affective subscale. These four subscales are moderately correlated with each other. Weak positive associations and negative correlations are observed between subscales in the two different clusters.

Among all the subscales, the PAI-ANT Stimulus Seeking subscale had among the largest values on the three centrality indices (see Figure 7). The PAI-ANT Antisocial Behavior and SRP-II Social Deviance subscales scored high on the strength centrality index, reflecting their strong associations with the other subscales connected with them. On the other hand, the PPI-SF Social Potency and Coldheartedness subscales and the SRP Interpersonal/ Affective subscale scored the lowest in the closeness and strength indices. As illustrated in Figure 6, these three subscales are placed toward the peripheral of the network model, forming a separate cluster with the PPI-SF Stress Immunity subscale.

## Discussion

The current study was an effort to explore the network structure of psychopathy, as operationalized by four self-report measures of psychopathy among a community sample of university students. The LSPR, PAI-ANT, and PPI-SF showed densely connected networks, with the exception of a few individual items that were less related to the main network. Two distinct clusters of items were apparent for the SRP-II, one consisted of all items in the social deviance domain and three items in the interpersonal/affective domain, and one included three items in the interpersonal/ affective domain.

Although the four psychopathy measures tap into potentially different domains of psychopathy, items found to be central in different models may shed light on features that are more important in the psychopathy networks. The two items most central to the LSRP network assess features indicative of primary psychopathy (interpersonal affective traits or low agreeableness): "For me, what's right is whatever I can get away with" (Item 2) and "In today's world, I feel justified in doing anything I can get away with to succeed" (Item 3). In the SRP-II network, "Not hurting others' feelings is important to me" (Item 31) in the Interpersonal/Affective subscale had one of the highest centrality on all three indices. These findings suggest that manipulative/low agreeableness characteristics may be central in the psychopathy networks assessed with the LSRP, PAI-ANT, and the PPI-SF. In relation, Marcus et al. (2018) showed that interpersonal manipulation was one of the most central components of the dark traits in a community sample.



*Figure 2.* (a–d) Centrality indices of the zero-order correlation network models for each of the self-report psychopathy measures. LSRP = Levenson Self-Report Psychopathy Scale; PAI-ANT = Personality Assessment Inventory—Antisocial Features scale; PPI-SF = Psychopathic Personality Inventory–Short Form; SRP-II = Self-Report Psychopathy Scale-II.



*Figure 3.* Association network model of the Personality Assessment Inventory—Antisocial Features subscale. See the online article for the color version of this figure.

A second feature that is important in the psychopathy network may be characteristics reflecting daringness. For instance, two items with high centrality indices in the PAI-ANT network were in the Stimulus Seeking subscale: "I do a lot of wild things just for the thrill of it" (Item 18) and "My behavior is pretty wild at times" (Item 19). The item with the highest centrality among all PPI-SF items, "I've always considered myself to be something of a rebel" (Item 22), was in the Impulsive Nonconformity subscale. Two of the items with the strongest centrality indices in the SRP-II network were in the Social Deviance subscale: "I got in a lot of trouble at school" (Item 28) and "Rules are made to be broken (Item 29). These items may be representing traits associated with



*Figure 4.* Association network model of the Psychopathic Personality Inventory–Short Form. See the online article for the color version of this figure.



Figure 5. Association network model of the Self-Report Psychopathy Scale-II. See the online article for the color version of this figure.

sensation seeking, impulsive behavior, and/or lack of fear for consequences.

Results from these item-level network models can be interpreted using the five-factor model of personality framework (Lynam & Miller, 2015; Miller & Lynam, 2015). This basic trait approach of psychopathy posits that agreeableness and conscientiousness are the two most central features of psychopathy. These characteristics showed relatively high scores on the centrality indices in our study, indicating that they are relatively important to the network structure.

The psychopathy network constructed with all subscales assessed by the self-report psychopathy measures illustrate associations between related domains. The majority of the subscales (11 out of 15) formed one cluster, and the remaining four subscales



*Figure 6.* Association network model of the subscales of the four self-report psychopathy measures. See the online article for the color version of this figure.



Figure 7. Centrality indices of the association network model for the subscales in the four self-report psychopathy measures.

formed another cluster. Stimulus seeking, social deviance, and primary psychopathy (i.e., interpersonal affective traits) were the three most central domains in the psychopathy network. In addition to strong associations with neighboring domains, these three components were located in the center of the network, with many moderate to strong connections with other subscales. These findings are in startling contrast with the psychopathy network model (Preszler et al., 2018; Verschuere et al., 2018) and dark traits network model (Marcus et al., 2018), in which callousness or lack of empathy was the most central among U.S. samples in both studies.

In the current study, the Coldheartedness subscale in PPI-SF did not stand out in any of the centrality indices. In fact, the Coldheartedness subscale was located in the peripheral, with low values in all three centrality indices. Results showed that coldheartedness is not highly central in our psychopathy network, suggesting that these individuals may be better able to use and positively display warm emotions to obtain what they desire from the environment. These findings could be important in terms of understanding the psychopathy construct although it should be noted that the findings are specific to coldheartedness and perhaps not necessarily more broadly the deficient affective experience indexed by the PCL that is most commonly used with inmate samples.

The current findings provide new insights with respect to Lykken's (1957, 1995) fearlessness model of psychopathy. The model posits that deficiency in the capacity to experience anxiety and/or fear give rise to other characteristics indicative of psychopathy, such as lack of remorse, superficial charm, callousness, and impulsivity. In our study, the Fearlessness subscale in PPI-SF showed modest correlations with other subscales in the psychopathy network model. Fearlessness had the third highest betweenness centrality index, but did not stand out in the strength or closeness centrality indices, contrasting Lykken's (1957, 1995) view that fearlessness is the core feature of psychopathy. In fact, our findings suggest that fearlessness may be associated with many other components of psychopathy, but the deficiency of experiencing fear may not be sufficient to bring about all hallmark features of psychopathy (Lilienfeld et al., 2018).

There are differences between our study and the previous ones that may have contributed to the contrasting findings. The previously reported psychopathy networks were derived using PCL-R items administered to offenders (Verschuere et al., 2018) or forensic patient (Preszler et al., 2018) samples. In addition to potential differences between clinician-rated assessments in the PCL-R/ PCL:SV and the current self-report assessments, psychopathic tendencies among offenders are generally higher than among college students. It is possible that the differences in how domains of psychopathy are connected within a network may reflect differences in the degree of psychopathic tendencies between offender and undergraduate samples. There can also be differences in conceptualization and scoring that limit direct comparison across studies. For instance, the Coldheartedneess subscale is inferred from reversed warmth and empathy (Crego & Widiger, 2014) whereas the PCL-R or PCL-SV more directly assesses a lack of empathy and remorse via interview questions. This can also lead to some differences in the nomological network for the scale (Berg, Hecht, Latzman, & Lilienfeld, 2015; Long, Felton, Lilienfeld, & Lejuez, 2014; Miller, Maples-Keller, & Lynam, 2016; Sörman et al., 2016; Watts, Bowes, Latzman, & Lilienfeld, 2017). In addition to psychopathy domains, Marcus et al. (2018) included assessments of Machiavellianism, narcissism, spitefulness, and aggressiveness in their dark traits network model. None of the domains included were particularly comparable with the stimulus seeking and social deviance domains assessed with the PAI-ANT and SRP-II, respectively. Without replication studies, and further comparisons across the various scales, it may be premature to conclude whether certain domains are indeed core features of psychopathy in offender or community samples.

A few limitations of this study should be noted. Considering that participants in this study were college students, with relatively lower levels of psychopathy, whether the network structures presented are generalizable to clinical and/or forensic samples is unknown. In the future it will be important to examine the interrelatedness of items in these psychopathy measures in various key samples (e.g., inmates, forensic patients, community). Differences in the network structures may identify core features of psychopathy that contributes to the differences in psychopathy levels between forensic and community individuals. Another issue of concern relates to the large number of items included in the network models, especially for the PPI-SF and SRP-II networks. Although there is yet recommended sample size for network analysis (Epskamp, Kruis, & Marsman, 2017), we recognize that our current sample size may not be sufficient for the estimation of network models with 22 to 56 nodes. The PPI-SF and SRP-II network models presented here should be considered as preliminary findings, and replication of our work in larger, more representative samples is needed to better understand how the psychopathy features assessed in these measures are interrelated. Another limitation could be the use of self-report measures of psychopathy. Although some contend that there are arguably good reasons to consider using self-reports psychopathy scales (Sellbom, Lilienfeld, Fowler, & McCrary, 2018), others have suggested that the use of self-report measures may not be an accurate reflection of psychopathic tendencies. According to some, it is possible that participants' responses to the questions may not truly reflect their behavior, especially because some items in these instruments require a certain amount of self-reflection. However, the field has increasingly relied on self-report measure of psychopathy and some research has shown investigations using self-report measures to offer a valuable contribution to our knowledge regarding the psychopathic condition. Reflecting these two viewpoints, Sellbom

et al. (2018) recently stated that "Notwithstanding a host of potential pitfalls (Lilienfeld, 1994, 1998), the use of questionnaires to detect psychopathy may prove considerably more fruitful than once believed" (p. 211). Although we recognize our use of selfreport as a limit, these countering viewpoints highlight the need for future studies that compare whether the network structures identified from self-report measures are replicable using clinician-rated measures of psychopathy.

Although our study had a number of limitations, it is among the first efforts to explore the network structure of psychopathy personality traits among a large college sample. Features that are most central for the item-level psychopathy networks are manipulative and irresponsibility/impulsivity. Using all domains assessed by the four self-report psychopathy measures, stimulus seeking, social deviance, and interpersonal affective traits were the most central features in the psychopathy network. These characteristics showed relatively high centrality indices in our study, indicating that they may be relatively important to the network structure of psychopathic traits, as they share many correlations with other features. It is possible that individuals who endorse these central features are also likely to endorse other closely associated characteristics, thus potentially promote the manifestation of the psychopathy network. Network analysis may offer an alternative approach to identify core features of psychopathy, which may help better understand what constitutes the trait of psychopathy.

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