Psychology Research and Behavior Management

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ORIGINAL RESEARCH

A Network Analysis Approach to Understanding Centrality and Overlap of 21 Dark Triad Items in Adults of 10 Countries

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Background: Previous research has suggested that manipulation and callousness are central to Dark Triad traits, but it has not identified which specific manifestations are expressed across various countries.

Objective: This study aimed to identify the core and overlapping manifestations of Dark Triad traits across 10 countries.

Methods: We used the Short Dark Triad (SD3) scale and assessed a sample of 8093 participants (59.7% women, M(age) = 32.68 years). For graphical representation, the spinglass algorithm was applied to understand the cluster distribution among Machiavellianism, psychopathy, and subclinical narcissism traits. Centrality indices were used to identify the most influential items, and the clique-percolation algorithm was employed to detect shared attributes among multiple Dark Triad items.

Results: Straightforward SD3-21 items demonstrated better interpretability as aversive traits within the broader system. Items with higher centrality values were those related to short-term verbal manipulation from the psychopathy domain, clever manipulation, strategic revenge-seeking from Machiavellianism, and narcissistic motivations for connecting with significant individuals. The most predicted items were linked to planned revenge, using information against others from Machiavellianism, short-term psychopathic verbal manipulation, and narcissistic belief of specialness based on external validation. Items like short-term verbal manipulation had overlaps with both psychopathy and narcissism clusters, while clever manipulation overlapped with Machiavellianism and psychopathy.

Conclusion: This cross-cultural study highlights the central role of verbal manipulation within the Dark Triad traits, along with identifying overlapping items among traits measured using straightforward SD3 scale items. In line with our findings, future research that incorporates a wide range of cultural contexts is encouraged to establish the consistency of these findings with the SD3 Scale or alternative measures.

Keywords: dark triad traits, network analysis, personality, subclinical traits, cross-cultural

Introduction

Personality traits and contextual aspects influence how someone behaves, either prosocially (ie, behaving following social norms and caring about others' rights) or aversively (ie, behaving contrary to social norms and disregarding others' rights). In recent years, there has been a growing focus on understanding the development and expression of the Dark Triad traits within the general population.[1] Dark Triad traits, namely Machiavellianism, narcissism, and psychopathy, emerged because of pragmatic considerations, prompted by a substantial scientific interest in three personality traits characterized by callous and manipulative behaviors.[2] These traits have been associated with negative outcomes in various domains, including workplaces, relationships,

Received: 9 September 2023
Accepted: 11 November 2023
Published: 12 February 2024

and social settings.[1] Given the potential widespread impact of these traits, researchers are increasingly dedicated to uncovering commonalities and variations, particularly in diverse cultural contexts, to gain a deeper understanding of how the Dark Triad manifests and affects individuals across different societies.

The Dark Triad was proposed as a set of traits that consistently showed a shared core of malevolent characteristics, such as aggressiveness, duplicity, callousness, manipulation, and emotional coldness.[2–4] Despite having common characteristics, each trait has its own set of defining behaviors. Subclinical narcissism refers to people who tend to self-promote and show an exacerbated sense of grandiosity, believing they are the best in everything they do, requiring constant admiration and care. Highly narcissistic individuals tend to exhibit more social and extrovert tendencies, but they also have dominant and low empathy motivations, which can lead to aggression when serving self-enhancement motives.[5] Machiavellianism, based on the works of Machiavelli, characterizes people who behave in manipulative ways, lack concern for morality and ethics, can delay gratification, and its key difference from psychopathy is the levels of constraining shown by highly Machiavellian individuals.[6,7] Individuals with high levels of Machiavellianism are cold, strategic, and prefer to have power over attention, unlike those high in narcissism. The Machiavellian trait is associated with antisocial behavior when a person perceives that rewards are greater than risks, implying that highly Machiavellian individuals pay attention to environmental clues about punishment risks.[8] Finally, psychopathy is considered the most aversive trait, being associated with more negative outcomes in life.[9] Those scoring high in this trait are individuals who disregard others' feelings, are untrustworthy, lack empathy, guilt, and remorse, are irresponsible, impulsive, and often engage in criminal behavior.[10]

Certain environments may reinforce certain patterns of aversive manifestations. According to the evolutionary perspective, traits of the Dark Triad may share a fast life history strategy (fast life history strategy) that is based on a short-term approach to resource acquisition in contexts with limited resources and high competition.[11] The expression of aversive personality traits is typically not fixed but strongly influenced by shared environmental factors affecting multiple individuals. This is supported by the varying correlations between Dark Triad traits and sociocultural elements such as occupational outcomes, social status, economic conditions, and even emotional recognition.[12–15] From an evolutionary perspective, many motives behind the Dark Triad traits can be seen as adaptive responses that suit environments marked by intense competition for resources, sexual partners, and social status, essential for survival in the face of potential threats from others or their surroundings.[11] Moreover, these advantageous traits, including manipulative or opportunistic behaviors, may have become ingrained in the cultural norms of diverse societies.[16] In some contexts, personal success at any cost (individualism) may outweigh social values, while in others, cooperation among individuals to achieve greater collective benefits (collectivism) may hold more significance. Therefore, conducting assessments of dark personality traits across diverse settings can provide valuable insights into the prevalence and prominence of specific dark traits within a multicultural sample.[17]

Besides the shared multicultural perspective of these behaviors, researchers have tried to uncover the shared central features among the Dark Triad traits. According to some findings, callousness and interpersonal manipulation are the common and most consistent dispositions among these social aversive traits, demonstrated through high correlations between in latent variable studies[18] and network systems.[19,20] However, it is important to understand that these dispositions configure distinct motivations for each trait, as conceptualization of each trait points out. For example, highly narcissistic individuals may manipulate others to gain admiration and attention, while people with higher scores of psychopathy manipulate others for quick and impulsive material gain. Moreover, highly Machiavellian individuals use manipulation as a strategic tool to achieve their goals and maintain power.[1,21]

To assess these indicators, instruments must have been developed to differentially measure patterns of behavior, motivation, and beliefs in Dark Triad traits. One such instrument is the Short Dark Triad (SD3) developed by Jones and Paulhus.[18] The SD3 aimed to provide a brief assessment of these traits while ensuring item diversity and avoiding being too long or too short like other measures such as the MACH-IV, Narcissism Personality Inventory (NPI] or the Self Report Psychopathy (SRP). This instrument is one of the most widely used globally and has a higher item conceptual breadth than other brief Dark Triad measures.[22,23] This feature of the scale can be used to analyze the content of the Dark Triad traits items in more detail to examine the relationships between aversive behaviors from the Dark Triad model. However, there is also evidence that this measure may not reflect the distinct characteristics of each trait, and may not allow a clear evaluation to distinguish a clear structure or core features of each Dark Triad trait as they were originally conceived.[24,25] Therefore, a detailed examination of

the items on the SD3 scale can help identify which items are most relevant for accurate assessment of the Dark Triad, which may improve the accuracy of assessment in different cultural contexts.

Network analysis has gained popularity as an alternative for assessing psychological constructs, including personality research. Unlike factor models, network analysis does not address the fact that underlying latent variables are responsible for the interactions between observable variables. In contrast, in the network model, psychological phenomena are represented by a system where psychological characteristics emerge from the mutual interconnections between observable indicators. In this way, it focuses on the patterns of conditional relationships between items of similar content, and which reinforce each other, allowing the formation of groupings or clusters with the same common nature, analyzing the underlying structure and importance that each variable has in the network.[26] In the area of personality, this perspective can be especially useful as it allows for a new representation of complex psychological measures where there are no latent traits of common cause, but where observable traits together explain a system of specific patterns.[27] In fact, this methodology has already been applied to examine individual differences at both domain and item level.[20,28,29] Thus, network analysis is presented as an appropriate methodology for examining the complexity of relationships between personality variables, even those more aversive traits that expand other more classical models (eg, Big Five).

The first objective in the present study was to determine the aversive features with the highest centrality of influence and interconnectedness (expected and bridge-expected influence) in the overall network of the 10 countries. This was based on previous findings that highlighted the existence of specific traits that promote and maintain connections between the different domains of the Dark Triad. For example, research by Burtăverde et al[30] reported a manipulative interconnected nature of various Dark Triad traits expressions, specifically items such as verbal manipulation, aligning oneself with influential people, using information against others and planned revenge seeking. These dark patterns were found to show a higher number of connections, suggesting a central role in the overall network. These findings offer evidence of the presence of stable associations among items from different domains of Dark Triad traits. Collectively, these items are likely to strengthen and stabilize a concise structural system, reflecting a central core of the Dark Triad from a network perspective. Consequently, it is likely that a lower prevalence of these core behaviours would lead to a deterioration of the network system as the number or magnitude of network connections would be limited or reduced.[31] Although these findings have been observed in specific contexts,[19,30,32] it is necessary to examine which aversive characteristics may be more representative in diverse societies, both collectively and independently in each environment.

As a second objective of the study, it was proposed to identify the items with the highest predictability within the overall Dark Triad network. This was based on the known evidence of positive correlations that have been reported in the diverse literature on the Dark Triad; However, it is often not detailed which specific items are most strongly connected for each domain.[1] For this reason, we sought to identify the items with the highest shared variance, ie, those that are most strongly conditionally related to other items after multivariate control of the network system components. For example, network research conducted by Dodell-Feder et al[33] assessed a schizotypal personality trait (item) system comprised of three communities, where the highest predictability metrics were obtained for two schizotypal traits linked to social awkwardness and conversational awkwardness, both measures with the highest degree of association and significantly higher than the other network connections. In the case of the present study, this network metric is relevant to understand the commonality where certain indicators or aversive behaviours of each domain of the Dark Triad are reinforced. However, to date, most network studies only include facets and dimensions of the Dark Triad in conjunction with other variables in common contexts;[20,28] while other network studies that used only the SD3 measure did not report the predictability index.[30]

Finally, the third objective was to identify items that overlap between the three domains of the Dark Triad using the clique-percolation method, which allows us to recognize those items belonging not only to one grouping but to several groups or clusters at the same time. This objective builds on previous reports about the lack of clear distinction between subclinical traits such as psychopathy and Machiavellianism, which hinders the accuracy of measurement of each trait.[25,34] Nevertheless, certain measures have effectively distinguished these traits.[35,36] This implies that it might not be a problem inherent to the concepts themselves, although it remains possible that these traits share some common attributes to some extent. In any case, to detail these similarities and/or distinctions, other authors suggest decomposing each trait into its elementary parts to better understand its unique characteristics.[37] Based on the above, it would be

beneficial to assess whether certain items belong to multiple domains using this network metric, where shared characteristics among traits can be identified due to the common attributes measured with the SD3 Scale.

In summary, the study seeks to determine the aversive features with the highest centrality of influence and interconnectedness within the global network of the 10 countries studied, in relation to Dark Triad traits, to identify the items with the highest predictability within the global Dark Triad network; ie, those items that have a stronger conditional relationship with other items after multivariate control of the network system, and identify dark behaviors that overlap among the three Dark Triad domains, using the cluster percolation method. These analyses are particularly relevant given that understanding the dynamics of Dark Triad traits in varied cultural contexts can provide valuable insights into how aversive personality traits manifest and interrelate in different settings. By focusing on a multicultural sample of 10 countries, this study seeks to identify whether there are consistent patterns or notable differences in the way these traits are presented and connected in diverse cultural contexts.

Materials and Methods

Participants

First, we inquired about studies that used the SD3 during 2020–2022, and we invited the respective authors to participate in the present investigation. Among them, we obtained a response from researchers from India[38] and Italy[39] who offered direct availability to collaborate with their research data. Subsequently, we collected accessible data (ie, namely open databases), which used the SD3 instrument in various countries, including the United States[4] [https://osf.io/xey8h], Germany[40] [https://osf.io/x3pj8], Slovakia[41] [https://osf.io/67uh9/?view_only=6a9201f529d449b39b22261c78c89df8], Spain[42] [https://doi.org/10.6084/m9.figshare.14132984.v1], China[43] [https://osf.io/k4vab] and Japan[44] [https://osf.io/dzx5c/]. Regarding the data from participants from Peru and Brazil, these were collected simultaneously during the second semester of 2020. Data collection method involved the administration of online surveys across all conducted studies.

The final sample consisted of 8093 participants from 10 countries (59.7% female, M(age) = 32.68 years) after removing missing data (n=48) from the United States study [Vize et al[4] the initial sample had 1255 participants, and the present study, 1207]. The inclusion criteria for study selection encompassed the utilization of the SD3 scale and the recruitment of participants aged 18 years and older. Data is available at: https://osf.io/dxae3/?view_only=7b2ffdd31c374b758afbb5f311037f91.

The project received the approval of the Research Ethics Committee of the Universidad Peruana Unión (Registration Number: 2020-CEUPeU-0013). Data collection was conducted after obtaining the corresponding study approval and considering the guidelines established in the Declaration of Helsinki[45] in terms of informed consent, data privacy, and respectful treatment towards participants.

Instruments

The Short Dark Triad scale [SD3; Jones & Paulhus[18]] presents 27 items that are distributed in 9 items for each Dark Triad trait, as in the case of Machiavellianism (eg, "I like to use clever manipulation to get my way"), subclinical narcissism (eg, "I know that I am special because everyone keeps telling me so") and psychopathy (eg, "People who mess with me always regret it"). Participants responded to each item in a range from 1 = Strongly disagree to 5 = Strongly agree. Each measure was validated in the context and language of the respective countries, where all the studies reported adequate values of internal consistency for each trait of the Dark Triad. The general reliability of the instrument used in this 21-item study refers to adequate reliability through the Omega coefficient ($\omega = 0.86$).

Although this instrument presents inverse scoring items to minimize acquiescence in responses, this approach has faced criticism, particularly due to the potential for varying interpretations of items in cross-cultural studies,[46,47] which has also been referenced in works that examined the SD3 scale.[34,48–51] When recoded, in the present study these reversed items formed separate groups in the general and individual networks during initial network estimation. Also, they correlated negatively with other items, so we only considered those items with direct scoring that were interpretable according to the Dark Triad model. In turn, item 1 was withdrawn, because it evidenced a redundancy of collinearity with item 7, which was kept because it provides a better Machiavellian orientation.

Data Analysis

Packages

All processes were made in the R environment[52] with qgraph,[53,54] igraph,[55,56] bootnet,[57] NetworkComparisonTest,[58] networktools,[59] NetworkToolbox,[60] and CliquePercolation[61] packages.

General Network Estimation

The general network model was calculated with bootnet package, with the huge estimator,[62,63] a nonparanormal transformation of the data,[64] and the Rotation Information Criterion (RIC) for model selection;[65] all contained in the "estimateNetwork" function. The clusters were identified with the spinglass algorithm[66–68] this was calculated with "spinglass.community" function in igraph package, through the undirected adjacency matrix and 200 spins.

The overlapped communities in the graph were calculated with the Clique Percolation Method (CPM) algorithm,[69] where a community is a several fully connected subgraphs that tend to share some of their nodes. Thus, the algorithm first finds all cliques of size k in the estimated network graph, then create a graph where nodes are cliques of size k, after adding edges if two nodes (cliques) share k-1 common nodes, and finally, each community is represented by each connected component in the final clique graph. A k = 7 cliques were used to identify the percolated nodes.

For the network, visualization edges represent the weight of the correlations between the individual nodes, whereas wider edges indicate stronger correlations between nodes. Nodes represent scores of each predictability (ie, how well a node can be predicted by all others it is connected to). Each group node color is an identified cluster, and two or more colors are percolated nodes; all were plotted with the "cpColoredGraph" function of the CliquePercolation package.

Stability and Centrality

The stability was calculated with the bootnet package in two forms: (a) using a person-dropping bootstrap (CS-coefficient), values upper than > 0.5 indicate strong stability and interpretability;[70] (b) A multiverse stability of bootstrap samples, where every row indicates an edge and every column a bootstrap, the color intensity indicates the strength of the edge in each bootstrap replication. If the network is stable, the figure shows straight horizontal lines of the same color.[71]

Then, the centrality indices, one and two step Expected Influence were estimated with the "expectedInf" function on networktools package, the first provides information on the direct relationships between each node and the rest by summing the weights of the edges, considering the absolute values or the sign of the value, and the second sums the weights of indirectly related edges.[72] Likewise, one and two step bridge expected influence were estimated with the "bridge" function in the same package, the first indicates the total connectivity of each node with nodes of other communities with which it is directly related, by summing the weights of the edges that connect the node with nodes of other communities considering absolute values, while the second considers indirect relationships with nodes in other communities.[31] Furthermore, the participation coefficient was estimated as a corrective for the centralities of nodes. This allows us to observe the consistency of the connections that a node has in comparison to different groups of nodes within the network.[73] This was estimated with the "participation" function in the NetworkToolbox package.

Networks by Countries Estimation

The individual countries' networks were estimated with the Local/Global (LoGo) method, which estimates a Graphical Gaussian Model (GGM) using a Triangulated Maximally Filtered Graph (TMFG) network,[74] the partial correlations were estimated through a nonparanormal transformation of the data,[64] and the Rotation Information Criterion (RIC) for model selection.[65] To view the dynamism of the communities, these were colored like the general network. And the centralities were explored with the Expected Influence metric for each network. Afterward, the comparison between networks of countries was conducted with the "NCT" function of the NetworkComparisonTest package, this was calculated with Bonferroni-Holm correction[75,76] and 100 permutations for each case.

Results

Regarding the descriptive data at a general level, the total number of participants was made up of 8093 people: 3265 males (40.3%) and 4828 females (59.7%), while the mean age was *M* = 32.68. Table 1 reports the descriptive analysis by country. On average, the oldest participants were those from Japan, Italy, and Slovakia, while the youngest were from India and China. On the other hand, a more equitable sample of men and women is evident in the countries of Slovakia and Japan; the opposite occurs in the sample of Germany, Italy, and China. The reliability of the instrument in each study through the omega coefficient was adequate.

First, we estimated a comprehensive network including all 27 items of the SD3 Scale (Figure 1) to examine whether these items were appropriately distributed across the Dark Triad clusters. However, we found that in the overall network, all items grouped as expected, except for the recoded (inverse) items, which formed a distinct cluster exhibiting a near-zero partial correlation with respective Dark Triad cluster (eg, SDT18-SDT20: r=0.03). This was also evident in nearly all individuals' networks by country, with negative associations or separate clusters formed by the reversed items. From a network perspective evaluating a system of items that collectively influence other SD3 items, we consider this cluster to present a challenging interpretation, contaminating subsequent centrality analyses and precluding the interpretation of overlap between these items. Correlation matrix and other analysis of the mentioned network are available at: https://osf.io/dxae3/?view_only=7b2ffdd31c374b758afbb5f311037f91).

Table 1 Descriptive Statistics by Country

Country (Sample)	*M* (Age)	Gender	Frequency (Percent)	ω (SD3)
BRAZIL (n = 760)	34.53	Male	207 (27.2%)	0.89
		Female	553 (72.8%)	
CHINA (n = 439)	21.41	Male	117 (26.7%)	0.84
		Female	322 (73.3%)	
GERMANY (n = 463)	25.78	Male	94 (20.3%)	0.84
		Female	369 (79.7%)	
INDIA (n = 826)	19.8	Male	490 (59.3%)	0.77
		Female	336 (40.7%)	
ITALIA (n = 715)	42.4	Male	188 (26.3%)	0.83
		Female	527 (73.7%)	
JAPAN (n = 1947)	44.81	Male	967 (49.7%)	0.83
		Female	980 (50.3%)	
PERU (n = 313)	24.56	Male	121 (38.7%)	0.87
		Female	192 (61.3%)	
SLOVAKIA (n = 600)	43.12	Male	300 (50.0%)	0.84
		Female	300 (50.0%)	
SPAIN (n = 823)	31.31	Male	282 (34.3%)	0.82
		Female	541 (65.7%)	
USA (n = 1207)	39.1	Male	499 (41.3%)	0.90
		Female	708 (58.7%)	

Abbreviations: *M* (age), Mean age; ω (SD3), omega reliability coefficient of the SD3 Scale.

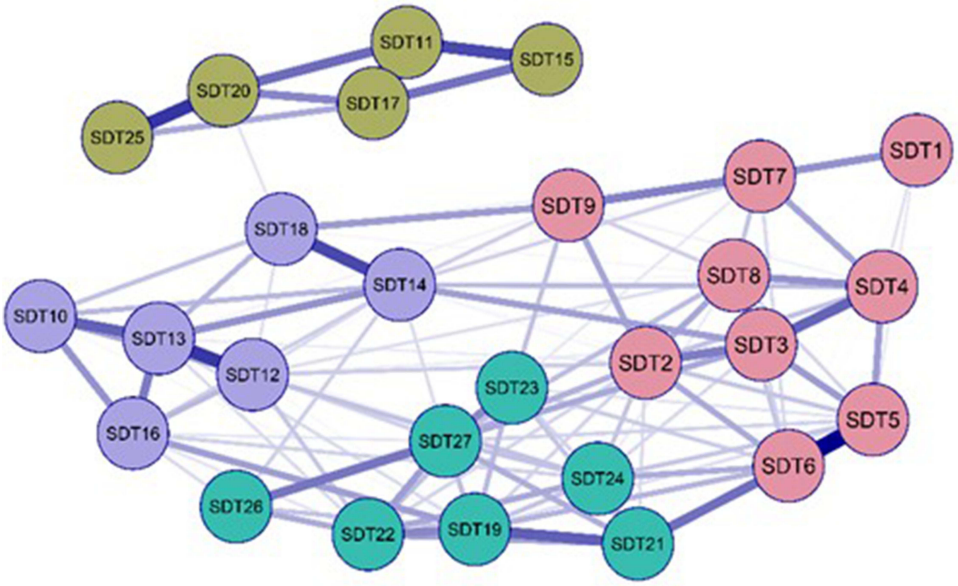

Figure 1 General Network of 10 Countries-27 SD3 items.

Notes: Blue paths are positive relationships. Red cluster: Machiavellianism; Purple Cluster: Psychopathy; Green Cluster: Narcissism. Olive cluster: Reversed items. Items: SDT1=It's not wise to tell your secrets. SDT2= I like to use clever manipulation to get my way. SDT3= Whatever it takes, you must get the important people on your side. STD4=Avoid direct conflict with others because they may be used in the future. STD5= It's wise to keep track of information that you can use against people later. STD6=You should wait for the right time to get back at people. STD7= There are things you should hide from other people to preserve your reputation. STD8= Make sure your plans benefit yourself, not others. STD9= Most people can be manipulated. STD10= People see me as a natural leader. SDT11=I hate being the center of attention, STD12= Many group activities tend to be dull without me. STD13= I know that I am special because everyone keeps telling me so. STD14= I like to get acquainted with important people. SDT15= I feel embarrassed if someone compliments me. STD16= I have been compared to famous people. SDT17= I am an average person. STD18= I insist on getting the respect I deserve. STD19= I like to get revenge on authorities. SDT20= I avoid dangerous situations. STD21= Payback needs to be quick and nasty. STD22= People often say I am out of control. STD23= It's true that I can be mean to others. STD24= People who mess with me always regret it. SDT25= I have never gotten into trouble with the law. STD26= I enjoy having sex with people I hardly know. STD27= I will say anything to get what I want.

As a result of the above, the general network of 10 countries was re-estimated with only straightforward 21 items (Figure 2). This approach revealed the interconnection of each element with its respective Dark Triad trait, which improved the exploration of additional network analyses. Within this network, highest relationships were between SDT3 and SDT4 ($r = 0.176$); SDT5 and SDT6 ($r = 0.298$); and SDT12 and SDT13 ($r = 0.228$). In the predictabilities SDT6 ($r^2 = 0.282$) and SDT5 ($r^2 = 0.264$) were the highest values, while SDT26 ($r^2 = 0.101$) and SDT7 ($r^2 = 0.083$) were the lowest. On the other hand, the network showed a good stability coefficient (CS = 0.75) through parametric bootstrap iteration.

The clusters explored with the spinglass algorithm were in accordance with the original theoretical framework. Then, they were percolated and plotted, the results suggest that SDT2 (I like to use clever manipulation to get my way) item is influenced by Machiavellianism and psychopathy dimensions, and SDT27 (I will say anything to get what I want) item is influenced by psychopathy and narcissism dimensions. The multiverse stability plot (Figure 3) showed that all edges in the general network are stable through each bootstrap iteration executed; this can be visualized in the straight horizontal lines formed. The highest value was between SDT5(It's wise to keep track of information that you can use against people later) and SDT6 (You should wait for the right time to get back at people) edge weight (0.359) in the 366 iterations, while SDT3 (Whatever it takes, you must get the important people on your side)- SDT23 (People who mess with me always regret it) edge weight (−0.109) was the lowest in the 474 iterations.

Moreover, in the general network the highest expected influence and the bridge expected influence (Figure 4) were in node SDT27 (I will say anything to get what I want; EI1 = 1.089; BEI1 = 0.468). However, the lowest Expected Influence was between SDT7 (I have been compared to famous people; EI1 = 0.503) and SDT26 (I enjoy having sex with people I hardly know; EI1 = 0.483) nodes; while the lowest Bridge Expected Influence was SDT10 (People see me as a natural leader; BEI1 = 0.020).

Figure 5 presents the network graphs corresponding to the Short Dark Triad scale in 10 countries: Spain, Brazil, Japan, Slovakia, India, Germany, Peru, China, Italy, and the United States. It can be observed that in some cases, such as

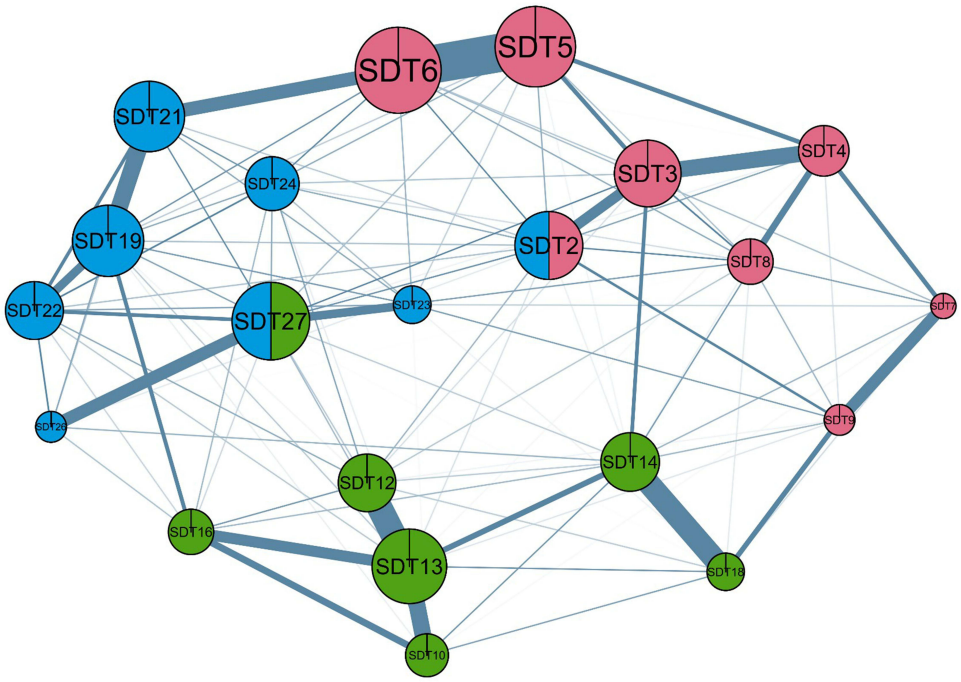

Figure 2 General Network of 10 Countries - Straightforward items.

Notes: Blue paths are positive relationships. Red cluster: Machiavellianism; Blue Cluster: Psychopathy; Green Cluster: Narcissism. Node size is defined by its predictability index. Items: SDT2= I like to use clever manipulation to get my way. SDT3= Whatever it takes, you must get the important people on your side. STD4=Avoid direct conflict with others because they may be used in the future. STD5= It's wise to keep track of information that you can use against people later. STD6=You should wait for the right time to get back at people. STD7= There are things you should hide from other people to preserve your reputation. STD8= Make sure your plans benefit yourself, not others. STD9= Most people can be manipulated. STD10= People see me as a natural leader. STD12= Many group activities tend to be dull without me. STD13= I know that I am special because everyone keeps telling me so. STD14= I like to get acquainted with important people. STD16= I have been compared to famous people. STD18= I insist on getting the respect I deserve. STD19= I like to get revenge on authorities. STD21= Payback needs to be quick and nasty. STD22= People often say I am out of control. STD23= It's true that I can be mean to others. STD24= People who mess with me always regret it. STD26= I enjoy having sex with people I hardly know. STD27= I will say anything to get what I want.

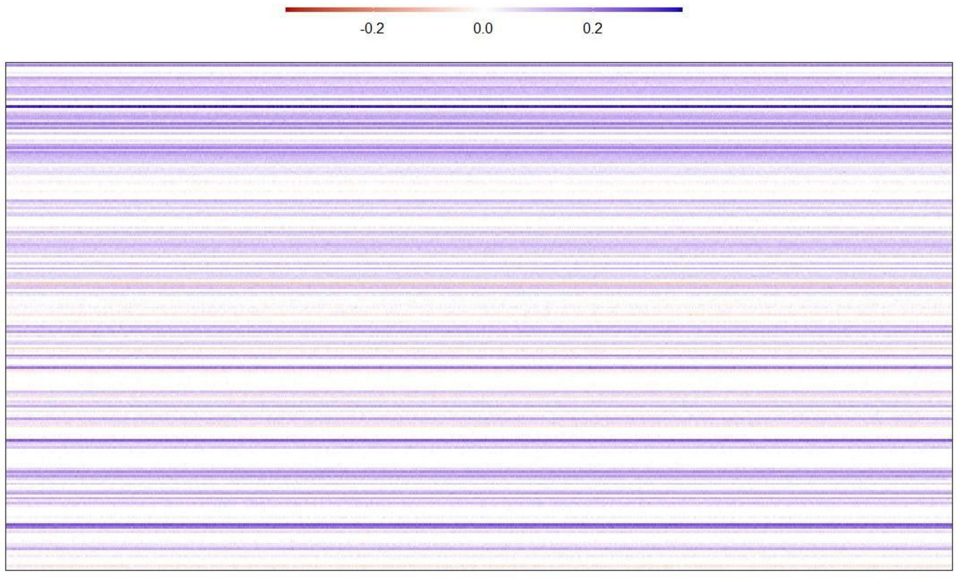

Figure 3 Multiverse Stability Plot.

Notes: Every row indicates an edge, and every column is a bootstrap. Blue lines = Positive Edges; Red lines = Negative edges. The color intensity indicates the strength of the edge in each bootstrap replication.

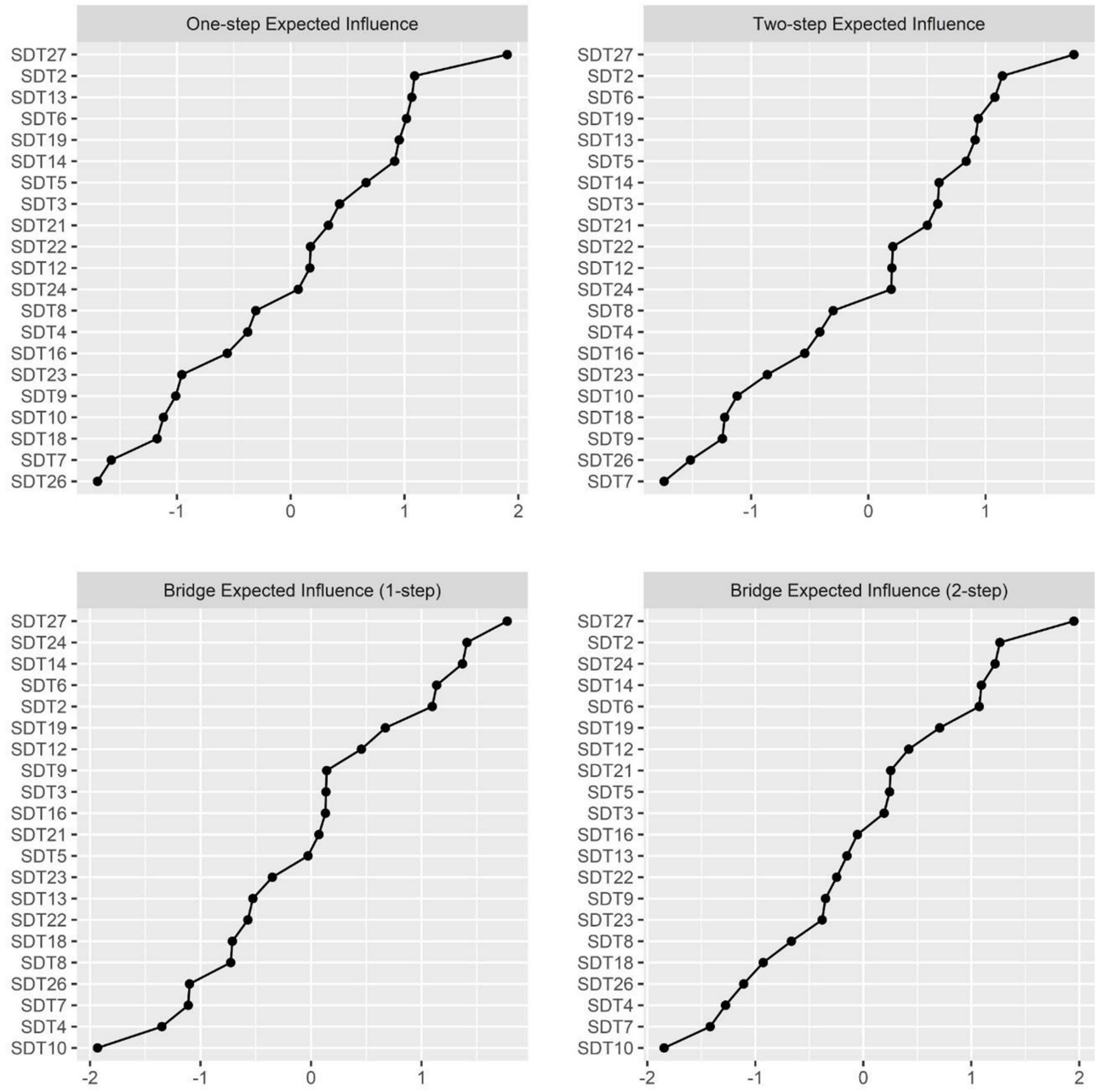

Figure 4 General Network Centrality indices.

Notes: Values greater than 1 refer to greater centrality in the network. Items: SDT2= I like to use clever manipulation to get my way. SDT3= Whatever it takes, you must get the important people on your side. STD4=Avoid direct conflict with others because they may be used in the future. STD5= It's wise to keep track of information that you can use against people later. STD6=You should wait for the right time to get back at people. STD7= There are things you should hide from other people to preserve your reputation. STD8= Make sure your plans benefit yourself, not others. STD9= Most people can be manipulated. STD10= People see me as a natural leader. STD12= Many group activities tend to be dull without me. STD13= I know that I am special because everyone keeps telling me so. STD14= I like to get acquainted with important people. STD16= I have been compared to famous people. STD18= I insist on getting the respect I deserve. STD19= I like to get revenge on authorities. STD21= Payback needs to be quick and nasty. STD22= People often say I am out of control. STD23= It's true that I can be mean to others. STD24= People who mess with me always regret it. STD26= I enjoy having sex with people I hardly know. STD27= I will say anything to get what I want.

China, Japan, and Slovakia, the network structures are more uniform for each trait of the Dark Triad compared to other countries.

Figure 6 presents the expected influence index for each country. The item SDT5 (it's wise to keep track of information that you can use against people later) showed the highest values (>1) of this index, particularly in countries

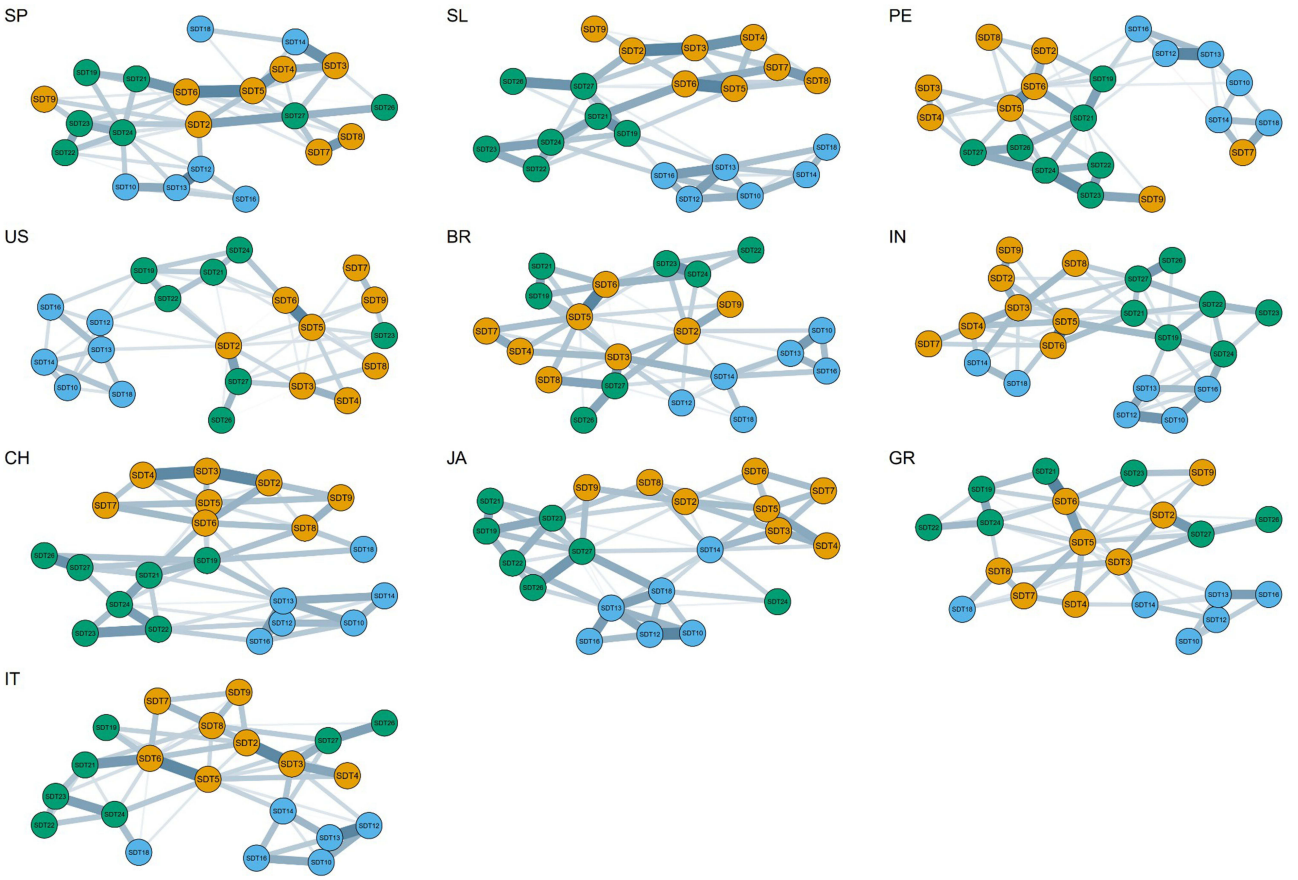

Figure 5 SD3 Networks by country (10 countries).
Notes: Blue paths represent positive relationships. Orange cluster: Machiavellianism; Blue Cluster: Narcissism; Green Cluster: Psychopathy. Items: SDT2= I like to use clever manipulation to get my way. SDT3= Whatever it takes, you must get the important people on your side. STD4=Avoid direct conflict with others because they may be used in the future. STD5= It's wise to keep track of information that you can use against people later. STD6=You should wait for the right time to get back at people. STD7= There are things you should hide from other people to preserve your reputation. STD8= Make sure your plans benefit yourself, not others. STD9= Most people can be manipulated. STD10= People see me as a natural leader. STD12= Many group activities tend to be dull without me. STD13= I know that I am special because everyone keeps telling me so. STD14= I like to get acquainted with important people. STD16= I have been compared to famous people. STD18= I insist on getting the respect I deserve. STD19= I like to get revenge on authorities. STD21= Payback needs to be quick and nasty. STD22= People often say I am out of control. STD23= It's true that I can be mean to others. STD24= People who mess with me always regret it. STD26= I enjoy having sex with people I hardly know. STD27= I will say anything to get what I want.
Abbreviations: BR, Brazil; CH, China; GR, Germany; IN, India; IT, Italy; JA, Japan; PE, Peru; SL, Slovakia; SP, Spain; US, United States.

such as Germany, India, Brazil, Spain, USA, Italy, and Peru. Likewise, the item SDT6 (you should wait for the right time to get back at people) displayed higher expected influence indices in Peru, Italy, Germany, and Slovakia.

Network comparison tests according to countries are shown in Table 2. More significant differences in network structures were found in the United States and Spain. Additionally, more significant centrality indexes were found in countries such as India and the United States.

Other analysis figures are included on the OSF link (https://osf.io/dxae3/?view_only=7b2ffdd31c374b758afbb5f311037f91). Bootstrap difference test (cent_diff_cor figure) are edge weights based on the 95% Bootstrap interval, where the significant differences of any two edges can include a zero value (dark squares) or not (gray squares). The diagonal displays the magnitude of the original edge, where blue squares are positive values. Values at the top were significantly higher than all others. Bootstrap bridge expected influence (cent_diff_bridge figure) indicates black boxes show significant differences in that index, and gray area non-significant differences. Bootstrap confidence intervals of network edges (Accuracy figure) indicate accuracy of estimated correlations. The sample values are represented by the red line, while the bootstrapped confidence intervals are indicated by the gray area. Each horizontal line corresponds to each association in the network, in descending order from the highest to the lowest association. Finally, in the Stability figure, the red line shows stability of edges in the general network (>.50 correlation between the original and bootstrapped sample).

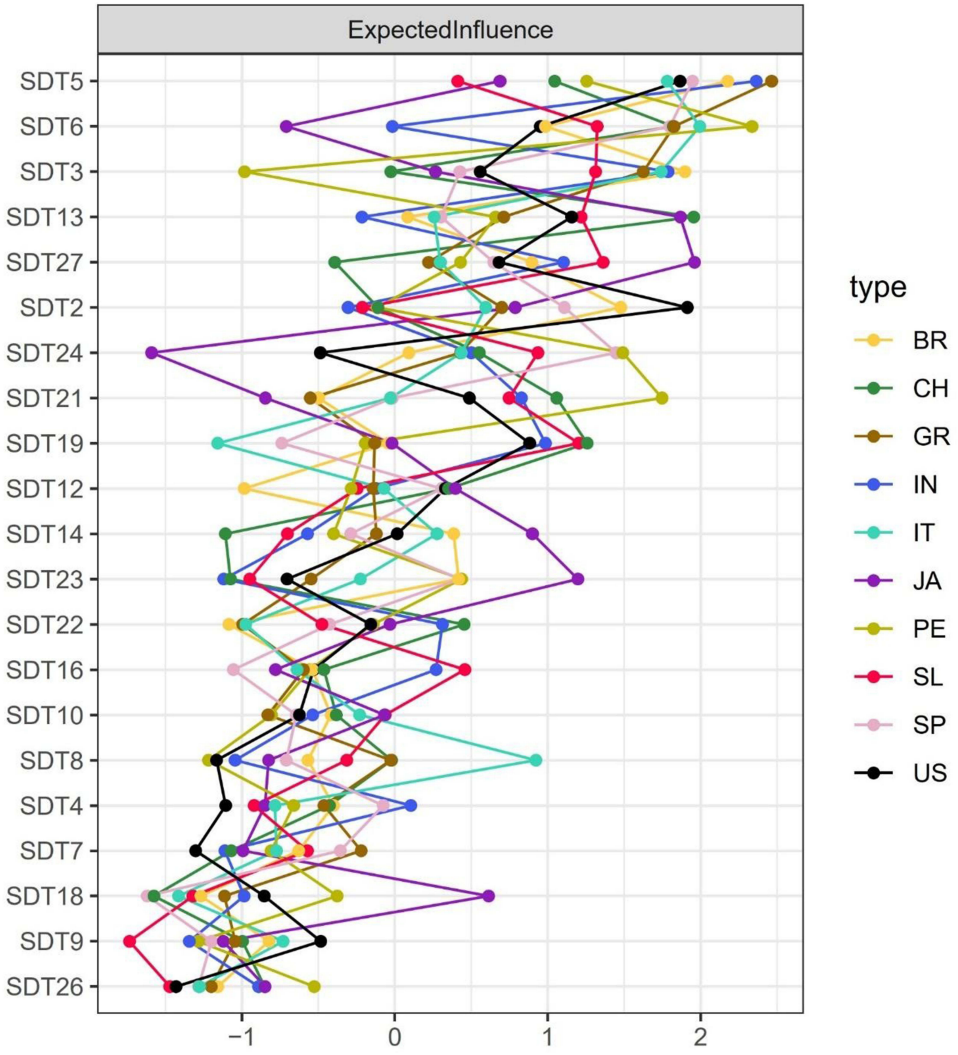

Figure 6 Countries Networks Centrality plot.

Notes: Values greater than 1 refer to greater centrality in the network. Items: SDT2= I like to use clever manipulation to get my way. SDT3= Whatever it takes, you must get the important people on your side. STD4=Avoid direct conflict with others because they may be used in the future. STD5= It's wise to keep track of information that you can use against people later. STD6=You should wait for the right time to get back at people. STD7= There are things you should hide from other people to preserve your reputation. STD8= Make sure your plans benefit yourself, not others. STD9= Most people can be manipulated. STD10= People see me as a natural leader. STD12= Many group activities tend to be dull without me. STD13= I know that I am special because everyone keeps telling me so. STD14= I like to get acquainted with important people. STD16= I have been compared to famous people. STD18= I insist on getting the respect I deserve. STD19= I like to get revenge on authorities. STD21= Payback needs to be quick and nasty. STD22= People often say I am out of control. STD23= It's true that I can be mean to others. STD24= People who mess with me always regret it. STD26= I enjoy having sex with people I hardly know. STD27= I will say anything to get what I want.

Abbreviations: BR, Brazil; CH, China; GR, Germany; IN, India; IT, Italy; JA, Japan; PE, Peru; SL, Slovakia; SP, Spain; US, United States.

Discussion

Personality models can be represented by an ecosystem where traits, behaviours, domains, or facets that interact with each other are integrated, while other connections tend to be reduced according to the degree of importance in the network, thus allowing the structuring of a unique causal system emerging from the associations between these personality measures.[26,27] Therefore, the application of this systemic approach that considers associative patterns of individual differences in subclinical personality traits is important, as it offers an integrative perspective on aversive behavior in everyday life across different cultures. Specifically, the present study is essential as it proposes to identify the most representative behaviors according to the network centrality metrics of the universal Dark Triad given the inclusion of a multicultural sample of 10 different geographical regions.

Table 2 Network Comparison Test

Country	Network.p	Centrality.p	Country	Network.p	Centrality.p	Country	Network.p	Centrality.p
BR–CH	0.38	0.90	CH–GR	0.09	0.20	PE–SL	< 0.001	0.59
BR–IN	0.23	< 0.001	CH–IT	0.79	0.20	PE–SP	0.10	0.04
BR–JA	< 0.001	0.25	IN–JA	0.11	< 0.001	PE–US	0.03	< 0.001
BR–PE	0.25	0.74	IN–PE	0.25	< 0.001	PE–GR	0.07	0.21
BR–SL	0.25	0.36	IN–SL	0.09	< 0.001	PE–IT	0.08	0.16
BR–SP	0.03	0.01	IN–SP	0.04	< 0.001	SL–SP	0.02	< 0.001
BR–US	0.06	< 0.001	IN–US	0.12	< 0.001	SL–US	0.53	0.01
BR–GR	0.20	0.27	IN–GR	0.64	0.01	SL–GR	0.22	0.03
BR–IT	0.26	0.12	IN–IT	0.95	< 0.001	SL–IT	0.07	0.01
CH–IN	0.95	< 0.001	JA–PE	0.01	0.76	SP–US	0.11	< 0.001
CH–JA	0.45	0.47	JA–SL	0.10	0.73	SP–GR	0.33	0.39
CH–PE	0.52	0.85	JA–SP	0.15	< 0.001	SP–IT	< 0.001	0.43
CH–SL	0.33	0.36	JA–US	< 0.001	< 0.001	US–GR	0.56	< 0.001
CH–SP	0.12	0.04	JA–GR	0.01	0.12	US–IT	< 0.001	< 0.001
CH–US	< 0.001	< 0.001	JA–IT	0.12	0.02	GR–IT	0.04	0.82

Abbreviations: Network.p, network structures; centrality.p, network centrality by country; BR, Brazil; CH, China; GR, Germany; IN, India; IT, Italy; JA, Japan; PE, Peru; SL, Slovakia; SP, Spain; US, United States.

The Short Dark Triad (SD3) is a widely used measure that has advantages over other similar short measures due to its diverse and specific conceptual breadth.[28,77] However, from a network analysis perspective, the SD3-21 item version yielded more coherent and interpretable communities compared to the full 27-item SD3. This aligns with prior research that has suggested the need to refine the model in some instances to achieve a more concise structure.[48,78] In that sense, we explored the systemic representation of Dark Triad traits using a network analysis framework, enabling the study of interconnected items reflecting common aversive behavior that mutually reinforce one another, giving rise to specific domains (eg, Machiavellianism).[27] Thus, we consider network analysis a valuable method for assessing the SD3 scale's structure in a broad transcultural sample, particularly in underrepresented international contexts.

The first objective was to identify the dark features of greater centrality (expected and bridge expected influence) in the systemic model given a greater number of connections and sum of weights of items and network communities. This reinforces the interconnectedness of the system of Dark Triad traits and provides greater stability to the network.[31] The present study highlights pathways of interconnection between all three dark clusters through specific traits. Specifically, the short-term verbal manipulation item (SDT27, psychopathy) had the highest centrality values in the general network. Additionally, items of clever manipulation to get their way (SDT2, machiavellianism), waiting for the right time to get back at people (SDT6, machiavellianism), and getting acquainted with important people (SDT14, narcissism) were those more consistently repeated in all centrality measures. These findings suggest that these particular manipulative tendencies and social influence tactics are prevalent even in diverse cultural contexts, highlighting the widespread exploitation of others for instrumental purposes and their resources at the expense of harming other people and society as a whole.[79,80]

The prevalence of 'saying anything to get what one wants can encompass broad patterns of behavior (seduction, dominance, lying) that are commonly associated with the Dark Triad, as referenced in a meta-analysis.[1] At the socio-cultural level, if the most central item "saying anything to get what they want" (SDT27) found in this study is present within resource-poor environments, individuals with these Dark Triad traits may resort to deceptive behavior and

exploitation to enhance their social and economic position. For example, they may use their skills to influence others through lying, emotional blackmail or flattery to gain access to valuable resources such as take advantage of job opportunities lacking the qualifications required, to obtain money and protection through illegal activities.[81] On the other hand, in more developed environments, people with these Dark Triad characteristics may use behaviours such as manipulation, influence and deception to gain power, status and social recognition. For example, they may persuade and convince others to obtain leadership positions at work or in politics. These persuasive behaviours have also been used to manipulate and exploit others in financial or work settings to gain competitive advantage and achieve their personal goals of power and social status.[80] These findings of interpersonal manipulation are in line with previous network analysis studies that examined various antagonistic traits within individual countries, such as Germany and the United States.[19,82] Interestingly, these countries, including Spain, Brazil, Italy, and Japan, emerged as having the highest centrality indexes in the present study as well, although we specifically found it was the item of saying anything to get a personal benefit.

Another item on the SD3 scale that consistently emerged as central in all samples was about waiting for the right time to seek revenge on others (SDT6). This was reinforced by the item of using information against others (SDT5), which in turn was also connected to the item of motivation for quick and cruel revenge (SDT21). These associations suggest that these behaviours may be common across cultures. Indeed, people who plan revenge against others are probably more likely to realize these motivations using information to damage the reputation of others. However, these behaviours may also result in less empathetic behaviours related to seeking quick and cruel revenge as a way of repairing the perceived harm of unforgiveness and resentment caused in these individuals.[83,84]

The second objective of the study was to identify the items with the highest predictability (r^2) in the overall SD3 network. These elements stood out for being the most predicted by other items due to their strong connections with them. Here, the planned revenge item (SDT6) had the highest predictability index in the network, reinforced by using information against others (SDT5), which followed closely in high predictability. Additionally, quick and cruel revenge from the domain of psychopathy (SDT21) also showed a stronger association with item 6 of Machiavellian revenge. While this poses a difference in the mode of revenge for each trait, more calculated in highly Machiavellian individuals and more callous or impulsive in those scoring high in psychopathy,[21] these connections make sense as both forms of revenge involve a desire for no one to interfere with their personal gain objectives, although each trait differs in approaches and execution of their actions. However, it can also be hypothesized that both forms of revenge may manifest in both traits, depending on other individual characteristics, such as sensation seeking or emotional instability that need to be addressed in future studies.[9]

Another item with high predictability index was the belief of being special based on external validation (SDT13) in the narcissism cluster, which was mainly reinforced by the belief of being indispensable in social groups (SDT12) and being perceived as a natural leader (SDT10). These indicators exemplify the significance of grandiosity in these individuals. Highly narcissistic individuals often assume leadership positions, showcase their talents or accomplishments, and actively seek recognition from others. These behaviors are driven by their desire to obtain social validation, which serves to reinforce their self-esteem and perceived superiority, as some authors have highlighted.[5,85] In addition, the belief that others need their presence in various activities may also lead the individual to seek to take control given the need to be the center of attention in any social dynamic, to reinforce a sense of personal importance and esteem.[86]

Regarding the third objective, consideration was given to recognizing traits that can be simultaneously included in more than one domain of SD3. This builds on existing evidence of an unclear measurement of subclinical Dark Triad traits[25,34] and aims to elucidate their similarities or distinctions. Among them, we found that verbal manipulation to get anything (SDT27 item) belonged both to the psychopathy and narcissism cluster. In highly psychopathic individuals, verbal manipulation aligns with the manipulative nature of this trait, which involves lying and disregarding the rights and feelings of others to obtain immediate benefits.[87] Similarly, individuals with higher levels of narcissism may use self-expression to manipulate others' perceptions and achieve a desired image, sense of power, and control. This is in line with previous studies that report that those scoring high in narcissism are driven by a desire to be seen as possessing grandiose abilities, and they may even use social influence to fulfill their own desires.[88] As a result, they often exhibit a lack of empathy and engage in exploitative behaviors towards others.[85,89]

Another interesting finding was that the item of clever manipulation (SDT2) was found to be shared between the Machiavellianism and psychopathy clusters. This is possible due to the shared nature of both traits of gaining benefits through

deception and exploitation, which makes it more likely that this measure using such traits in a general way shares a common identification with both personality domains in the network.[90] However, theories of both traits point out that there are differences between the two traits that can help differentiate them depending on the nature of the manipulation used. Those scoring high in Machiavellianism are often associated with a strategic and rational approach to manipulation, where people may use calculated and well-planned tactics to achieve their goals. In contrast, highly psychopathic individuals are often associated with a more impulsive and emotional approach to manipulation, where people may use deception and manipulation for immediate gratification without considering the physical or psychological consequences they may cause in others.[18,90]

Limitations

Regarding the limitations, although some samples were composed of participants from the general population, there was a greater number of university students, which is not necessarily representative of the cultural context in a society. In addition, although there are other measurements of broader aversive traits (eg, Dark Tetrad), such measures are not yet validated in some environments such as South America. Another important limitation is that reversed items of the SD3 Scale were not used, due to analysis revealed they did not provide an accurate representation of the intended traits within the network estimation. Future studies should address this issue further.

Implications and Future Perspectives

Despite these limitations, we believe that this study has relevant implications and practices. One of the main strengths of the current study lies in the use of network structure analysis, a more informative analytical method. This approach provided a deeper insight into the associations and dynamics among the different traits, which traditionally could not have been achieved with more conventional analysis techniques. In addition, the study has shed light on the universality of certain manipulative patterns in social behavior. Across different cultures, it could be observed that certain patterns are not only prominent, but also can reinforce each other. This is particularly important as it highlights the pervasiveness of these traits and how they can manifest themselves in different cultural contexts. Similarly, this study revealed some important issues regarding the measurement of the complexity of some traits with the SD3 Scale. Finally, by adding to the growing literature on the Dark Triad of personality, this study emphasizes the need to expand our understanding from a cross-cultural perspective, because it brings us closer to a more holistic understanding of these personality traits, recognizing the richness and diversity of human expressions across cultures. Future studies should examine aversive personality scales like SD3, SD4, or alternatives in diverse multicultural samples, while also disaggregating data by sociodemographic factors or cultural values as individualism-collectivism to understand global variations in malevolent patterns.

Conclusion

In summary, by estimating a global network using items from the SD3 scale in 10 countries, we found that certain items promoted connections between clusters and contributed to the overall stability of the network. These items included short-term verbal manipulation (psychopathy), waiting for the right moment for revenge, clever manipulation (Machiavellianism), and motivations for establishing relationships with important individuals (narcissism). On the other hand, the most predicted items in the overall network of the SD3 were waiting for the right moment to seek revenge on others (SDT6), using information against others (SDT5), verbal manipulation (SDT27) and the belief of being special based on external validation (SDT13). Finally, using the percolation algorithm, we identified that certain items belonged to more than one cluster of the SD3 Dark Triad, including clever manipulation (Machiavellianism and psychopathy) and short-term verbal manipulation (psychopathy and narcissism). In essence, our findings highlight the importance of verbal manipulation and its intricate interplay within the network dynamics as measured by the SD3 Scale. This shows the multifaceted nature of Dark Triad traits, revealing the diverse patterns through which verbal and short-term manipulation can be intertwined in a calculated, vengeful manner, while also projecting a high-status image.

Disclosure

The authors declare that there are no conflicts of interest for this work.

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