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Schema mode networks for borderline, avoidant and obsessive-compulsive personality disorder

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Abstract

This study aims to examine differences between schema mode networks of borderline, avoidant, and obsessive-compulsive personality disorders. We seek to determine whether the networks identified through network analysis align with theoretical assumptions about each disorder's mode model.

We conducted a cross-sectional study using the Short Schema Mode Inventory (SMI) data from client of The Viersprong, National Institute of Personality Disorders that started treatment between 2012–2023. Diagnoses were based on Structured Clinical Interview interviews, and we focused on patients with borderline (n=386), avoidant (n=504), and obsessive-compulsive personality disorder (n=129). Network analyses were performed on the 14 schema modes as measured by the SMI using regularized partial correlations. Centrality metrics and group comparisons were conducted to examine diagnostic differences in mode networks.

Significant mean differences were found across all schema modes between the three groups. The networks for the borderline, avoidant, and obsessive-compulsive personality disorders groups were of considerable similarity.

Contrary to our hypothesis, mode networks showed notable overlap across the borderline, avoidant, and obsessive-compulsive PD groups. This finding raises questions about the added value of tailoring Schema Therapy interventions strictly based on diagnosis-specific mode patterns, although further research is needed to clarify the clinical relevance of these similarities.

Key Practitioner Message

- Mean scores on the modes can be used to differentiate between borderline, avoidant, and obsessive-compulsive personality disorders.
- Although mean levels of the modes vary across the different personality disorders investigated in this study, we found no evidence for differences in the relationship between the modes (the mode network) of these personality disorders.
- Schema mode patterns showed considerable similarity across different personality disorders, raising questions about the added value of diagnosis-specific adaptations to Schema Therapy.

Introduction

Given the worldwide prevalence of personality disorders at 7.8% [1], and the fact that psychotherapy is the preferred treatment, there is a strong need for effective therapeutic approaches to address these disorders. Schema Therapy (ST) has proven to be an effective psychotherapy for different types of personality disorders[2,3].

Schema Focused Therapy; schemas and modes

According to the theory of Schema Therapy (ST), symptoms of personality disorders (PDs) arise from the activation of maladaptive schemas. The founder of ST, Jeffrey Young, defined maladaptive schemas as deep-rooted patterns of thoughts, feelings, memories, and bodily sensations about oneself and the relationships with others. Schemas stem from unmet emotional needs in early childhood and can be seen as a blueprint for the way experiences are perceived. In addition to these schemas, Young and colleagues[4] introduced the concept of modes, as an emotional state a person is in, to clarify the abrupt changes in the emotional state of borderline personality disorder (BPD) patients. A mode is a distinct state of mind that consists of a pattern of thinking, feeling and behaving. A mode is triggered by the schema driven perception of a situation. For example, an unanswered text message is perceived as a sign of abandonment triggering the abandonment schema, which leads to the angry protector mode and as a result, making an argument with the text sender instead of realizing the unanswered text message is probably a sign of the other being busy. Young and colleagues originally identified ten different modes that are grouped into four clusters: the child modes, the maladaptive coping modes, the dysfunctional parent modes and the healthy modes. With the development of ST, a structured assessment tool became necessary. This led to the development of the Schema Mode Inventory (SMI), which was designed to measure 14 schema modes[5] (Table 1).

In modern ST, it is common practice to identify and work with the (fourteen) modes. By focusing on the modes, the therapist can employ targeted interventions according to the mode the patient is in during the session. For example, limit setting as an intervention for the Angry Child Mode or challenge as an intervention for the Putative Parent Mode.

Although Young[4] did not explicitly describe modes as forming a "network," he did emphasize that individuals can shift rapidly between modes, sometimes experience multiple modes simultaneously, and that certain modes are often activated together. This suggests a dynamic interplay between modes that could be understood as network-like. Edwards[6] calls this mode sequences, where - in one person - the modes alternate in recognizable patterns. In complex PD, like BPD, modes are considered to alternate more rapidly which explains the so-called mode-flipping[7].

Table 1: Clusters and Modes according to ST theory

Cluster	Modes
Child modes	Impulsive Child Vulnerable Child Angry Child Undisciplined Child Enraged Child
Maladaptive coping modes	Compliant Surrenderer Detached Protector Detached Self-soother Bully and Attack Self-aggrandizer
Dysfunctional parent modes	Putative Parent Mode Demanding Parent Mode
Healthy modes	Happy Child Mode Healthy Adult Mode

There is growing evidence for the mode theory in patients having a PD. With an experimental design Arntz, Klokman & Sieswerda[8] validated that modes are a state like response to a trigger in the environment. Yakin, Grasman & Arntz[9] found that modes are central to the change process in PD treatment and are a predictor of personality pathology.

When focusing on ST, Van Wijk-Hebrink and colleagues[10] showed that, as assumed in the ST theory, a patient's coping style mediates the relationships between schemas and modes, whereas the modes predict psychological symptoms.

Specific mode models were developed for different types of PD's[11,12]. Unique mode profiles for different PD's were found[11,13]. In clinical practice, depending on the DSM diagnosis, clients are offered different ST treatments with different therapeutic approaches[3,14,15]. For instance, clients diagnosed with cluster C and cluster B personality disorders are offered different ST treatments, varying in duration, intensity, phase structuring, and approach[14]. The therapeutic approach also differs: BPD treatment emphasizes safety and connection, whereas treatment for cluster C focuses more directly on confronting the avoidant coping style[15].

Treatments based on these specific mode models have been proven to be effective in recent studies, demonstrating reductions in symptom severity, improved global functioning, and sustained recovery over time[2,3].

Despite the proven effectiveness of ST[16,17,18] and the growing evidence for the mode theory, and although several studies have explored associations between schema modes with specific personality disorders[11,12,13,19], these have primarily relied on group comparisons, (partial) correlational analyses, and factor-analytic approaches, rather than dynamic or network-based models. To date, little is known about how the modes are connected to each other within each disorder, which may offer additional insight into the dynamic interplay between modes. The recent study by Aalbers and colleagues[20] suggests that schema modes form an interconnected structure, in which certain modes occupy central positions. While the causal dynamics between modes remain to be empirically tested, this network perspective opens possibilities for understanding how changes in one mode may influence others — a notion conceptually similar to symptom networks, though not yet supported by longitudinal evidence.

Complexity and Overlap in Personality Pathology

While distinct mode patterns have been described for different PDs, PDs rarely occur in isolation. They frequently co-occur with other forms of psychopathology, particularly mood and anxiety disorders, but also with one another. High rates of comorbidity have been consistently reported in both clinical and epidemiological studies, indicating substantial overlap between personality pathology and other psychiatric conditions[21,22,23]. In addition, many individuals meet criteria for multiple PD diagnoses simultaneously[21,24,25], highlighting the considerable conceptual and empirical overlap among PD categories. Beyond diagnostic comorbidity, individuals often display personality traits and symptom patterns that extend across traditional diagnostic categories, reflecting the heterogeneous and dimensional nature of personality pathology.

These patterns of overlap challenge the notion that psychiatric disorders represent discrete and independent disease entities. Instead, psychopathology may be better understood as a system of dynamically interacting symptoms and psychological processes that influence one another over time. Within this framework, comorbidity may arise because symptoms associated with different disorders are directly interconnected rather than reflecting the presence of multiple independent disorders. This perspective is central to the network approach to psychopathology, which conceptualizes mental disorders as networks of mutually interacting symptoms[26]. Such an approach may be particularly relevant for PDs, given their complexity, heterogeneity, and frequent co-occurrence with other psychiatric conditions.

Network Theory

A mode network describes the overall relation between different modes. The mode network in ST seamlessly joins with the network theory. Network theory considers mental disorders as a cohesive, complex system of mutually interacting symptoms[26]. In a network analysis, a model of nodes (e.g. psychological symptoms) is created where edges connect these nodes. The edges contain information about the strength of the relationship between the nodes and whether the nodes are positively or negatively related. The mode network of ST and the network theory both emphasize the dynamic and complex nature of mental disorders in their network approach. They acknowledge that symptoms and emotional states are interrelated within a complex system. Even more, both theories stress the importance that effective treatment should aim to understand and modify the interactions within the network.

In network theory, relations between symptoms are usually understood as relatively concrete, directly observable couplings (e.g., poor sleep leading to low mood). By contrast, interactions between modes in ST operate at a more abstract conceptual level, as modes represent broader, multimodal response patterns (with cognitive, affective, physiological, and behavioural components). Although such mode-to-mode activations are less directly observable than symptom–symptom links, ST nonetheless assumes their mutual activation, consistent with prior empirical work of Aalbers[20].

Network theory assumes that there is a difference in the degree of influence of psychological symptoms on other psychological symptoms in the network. A symptom with a central position in the network has a higher influence on the total network[27,28]. This suggests that central symptoms in the network have a strong influence on the development and maintenance of a mental disorder. For ST, this could mean that influencing a mode with a central position in the mode network is much more effective than influencing other modes. Even more, the results of a network analysis can also point to which modes have strong positive or negative connections to each other and how densely packed the network is.

A few studies have been done using network analysis to map the interconnectivity of schemas or modes. Although previous studies have provided important insights into the network structure of schemas and modes, several key gaps remain. Esmaeilian and colleagues[29] mapped associations between BPD features and early maladaptive schemas, but their work focused on schemas rather than modes and was limited to a single diagnostic group. Lazarus and colleagues[30] demonstrated that individual mode dynamics can be captured using intensive longitudinal designs, yet their findings were based on a non-clinical sample, leaving open the question of how these processes operate in PDs. Aalbers and colleagues[20] compared cross-sectional mode networks of patients with a PD to those of a non-clinical group, showing that network structures differ between clinical and non-clinical populations. However, their study did not examine how mode networks may vary across distinct PDs.

Taken together, these studies show that while network approaches can illuminate the structure and dynamics of schemas and modes, we still lack a systematic understanding of how mode networks differ across specific PD diagnoses. Conducting network analyses of modes across multiple PD groups therefore represents a crucial next step for identifying diagnosis-specific patterns, shared transdiagnostic structures, and potential targets for tailored interventions.

Mode Networks in Clinical Practice

Since ST is adapted for different PDs, it is highly relevant to know if there are any differences between the mode

networks for these different PDs. If differences are revealed, this could mean that different - causal relationships between - modes should be targeted or should be the focus of a treatment intervention in a different sequence depending on the PD. To enhance and customize treatment interventions within ST, targeting specific modes or specific relationships between modes could be a first step to enhance treatment success.

At present, clinicians typically start mode work based on the patient's presenting problems and their relation to the modes, rather than on empirically established central modes for a given PD. This pragmatic approach works well in many cases, but it also means that treatment may overlook mode interactions that are not immediately visible in the patient's narrative. A network-informed ST approach may help identify central patterns of mode activation, offering an empirical tool for more precise case conceptualization and for detecting influential mode interactions that might otherwise remain unnoticed.

To our knowledge none of the studies mentioned have focused on whether there are different mode networks for the various PD. Understanding differences between mode networks for various PD can be an important first step in enhancing ST. If distinct mode networks are identified, ST can target specific modes or relationships between modes, tailoring interventions to the disorder. This refined approach can improve treatment efficiency and success.

Present Study

According to schema mode theory we expect that the mode network of BPD, avoidant PD and obsessive-compulsive PD differ from each other. These three PDs represent the most common PDs for which patients are treated at The Viersprong. The present study therefore aims to examine and compare the mode network of these three PDs. We expect to find the following differences:

1. Based on the work of Young and colleagues[4], and confirmed in subsequent empirical studies[8,11], we expect that the most central dysfunctional schema modes in the mode network of patients diagnosed with BPD will be the Vulnerable Child, Angry Child, Punitive Parent, Detached Protector, and Undisciplined Child modes.
2. Based on the work and findings of Bamelis[12], Lobbestael[11] and Young[4], we expect the most central dysfunctional modes to be the Vulnerable Child, Punitive Parent, the Compliant Surrenderer, and Detached Protector in the avoidant PD mode network.
3. Based on the findings of Lobbestael[11] and the work of Arntz, as elaborated in the handbook of ST[31], in the mode network of patients with obsessive-compulsive PD we expect the Demanding Parent, Detached Self-soother, Bully and Attack and Self-aggrandizer to be the most central modes.

Methods

Participants and Procedure

In this cross-sectional study we used existing data collected via Routine Outcome Monitoring (ROM) at The Viersprong, National Institute of Personality Disorders. The Viersprong offers outpatient, day hospital and inpatient psychotherapy for patients with personality disorders cluster B, C and PD-NOS in the Netherlands. Currently ST is offered for these clusters at seven sites. Exclusion criteria for all treatments at The Viersprong are the presence of an organic cerebral disorder, autism spectrum disorder, florid psychosis, IQ<80, insufficient understanding of the Dutch language, having no health insurance and no place of residence.

Before starting treatment, patients have a standard assessment as part of the intake procedure, including the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I)/ /The Structured Clinical Interview for DSM-5 (SCID-5) and the Structured Clinical Interview for DSM-IV Axis II Personality disorders (SCID-II)/ / SCID-5[32,33]. Because data collection spanned the transition from DSM-IV to DSM-5, diagnostic interviews were administered using the SCID-I and SCID-II for participants assessed before the introduction of DSM-5, and the SCID-5 for those assessed thereafter[32,34]. Patients are assigned to a relevant treatment program based upon their DSM-IV/DSM-5 classification.

All treatment programs at The Viersprong contain a standardized evaluation cycle as part of the ROM procedure. As a part of this evaluation cycle, patients were asked to fill in self-reported questionnaires. The number of times a patient was asked to complete these measures differed between every 6 weeks up to every 6 months (depending on the specific type of treatment). In the current study we used the baseline assessment at the start of the treatment, only one questionnaire per person was selected based on intention to treat.

As we were interested in the relationship between diagnosis and modes, we selected relevant questionnaires that were filled in at the start of the treatment. Patients starting ST had to fill in the Short Schema Mode inventory (SMI) at start of treatment to measure modes (see paragraph instruments). In this study we selected all SMI questionnaires that were filled in between January 2012 and September 2023 at the start of treatment. After removing duplicate questionnaires, in total, 3631 questionnaires were included in the study sample. Of these, 3438 questionnaires were filled in during ST-treatment by 1893 patients. As the SMI was part of the ROM procedure,

patients could fill in the questionnaire multiple times. All included patients were assigned to ST within the study timeframe, however treatment did not need to start or did not need to be finished within this timeframe. Treatment dropouts were not excluded, as this study focusses on the measurements at start of treatment. In this study, we compared the mode networks of three type of PD; BPD, avoidant PD and obsessive-compulsive PD. Participants with a primary diagnosis of Other Specified Personality Disorder or Unspecified Personality Disorder were excluded from the study, as there is currently no established theoretical model within ST for these diagnostic categories, and consequently, no hypotheses were formulated regarding these groups.

Diagnoses were based on the Structured Clinical Interview for DSM-IV or DSM-5. In total 386 questionnaires of clients with BPD, 504 clients with avoidant PD and 129 with obsessive-compulsive PD were selected in the study sample. In cases of comorbidity, only the primary diagnosis was used for group assignment. Comorbid PD traits or diagnoses were not excluded from the sample, reflecting the clinical reality that comorbidity is highly prevalent among individuals with PDs[21 22 23 24 25]. Excluding such cases would risk reducing the ecological validity and generalizability of our findings, as well as substantially decreasing statistical power. Even more, in clinical practice, the primary diagnosis is what guides treatment.

The Medical Ethical Review Committee Brabant provided a statement that the current research does not fall under the scope of the Medical Research Act Involving Human Subjects (NW2023-57).

Instruments

The Short Schema Mode Inventory (SMI) is a self-report measure of the schema modes. The questionnaire contains 118 items that reflect cognitive, emotional and behavioral states a person can experience. The SMI uses a 6-point scale ranging from "never or hardly ever" to "always". The questionnaire consists of 14 scales that correspond to the 14 modes (see Table 1). The scores of the different modes are determined by the average of the items of that scale[35]. In the present study, we used the standard version of the SMI, which assesses 14 established modes. While this instrument has strong psychometric properties and is widely used in clinical research, it does not include the additional modes that were introduced in the extended version (SMI-2) specifically designed for patients with Cluster C and certain other personality disorders[12]. The SMI-2, however, is not widely implemented in routine outcome monitoring systems, partly because it is not freely available. Consequently, the standard SMI was chosen as the most feasible instrument for this study.

The psychometric properties of the Dutch version of the SMI resulted in an adequate fit of the 14-factor model. The internal consistency for the 14 subscales ranged from 0.79 to 0.96 (Cronbach α's) which is considered acceptable. The test-retest reliability was adequate, ranging from .65 to .92 with a mean of .84. Construct validity has been previously established[5].

Statistical Analysis

The current analysis estimated a network of partial correlations as implemented in the R package MGM[36]. Briefly, this analysis allows for the estimation of bidirectional associations (in network analysis terminology - edges) between all 14 modes (equivalent to nodes in network theory), adjusting for all other modes. All modes were normally distributed, so a gaussian linear regression was used for edge estimation. A regularizing LASSO (Least Absolute Shrinkage and Selection Operator[37] algorithm is applied in order to shrink small associations towards zero and thus aid interpretability of the final network. The amount of shrinkage was selected using the Extended Bayesian Information Criterion (EBIC[38]), with the gamma parameter set to a standard 0.5. All estimates were bootstrapped with 1000 iterations to produce 95% bootstrapped confidence intervals. To plot the final network, the graph R package was used[39]. Stronger associations were visualized with thicker edges between modes. Negative associations were represented with red dashed edges and positive associations with solid green edges. Pie rings were plotted around each mode to represent the total R^2 and thus the total percentage of variance explained in each mode.

Then, centrality was calculated to assess which variables had the highest relative influence on the network. It was calculated in two ways using the R package bootnet. First, the strength centrality index, which sums the absolute value of all edges for each mode. Higher relative strength for a mode means more and/or stronger edges with other modes. Second, expected influence (EI) was calculated, which is similar to strength except that the raw instead of the absolute value of all edges is summed. This allows the EI to be positive when modes are mostly positively connected to other modes, and negative in the vice versa.

The hypotheses of the current study were tested by ranking edges by their relative size and modes by their centrality indices. First an overall network for all patients, was estimated using the R package mgm[36]. Then, three separate networks for each clinical subgroup (i.e. borderline, avoidant, and obsessive-compulsive PD groups) were estimated. Differences between the three networks were tested in two ways. First, using the network comparison test as implemented by Borkulo and colleagues[40]. In an analogous procedure to ANOVA methods, global differences are first tested to see if the networks differ in any way.

Then, post-hoc group comparisons can be made for specific edges. Second, we tested for network moderation as implemented by Hasselbeck and colleagues[36]. This approach is analogous to testing interaction coefficients between group membership and each edge and seeing which ones are statistically distinguishable from the null hypothesis of zero.

Statistical assumptions were checked for normality, collinearity and mode equality of variance. Additionally, network stability was assessed by excluding increasingly large portions of the dataset, re-estimating the network on the reduced data and inspecting the overall correlation with the original network[41]. The current sample did not have missing data for any of the scales included in the network. All analyses and diagnostics were conducted using R (v 4.3.1).

The analysis code used in this study can be found at https://osf.io/3z9s7/.

Results

Table 2 presents the descriptives for the study sample. Our study included 386 patients with a BPD (88% female, age M=31.7, SD 9.9), 504 patients with avoidant PD (71% female, age M= 31.4, SD 11.1) and 129 patients with obsessive-compulsive PD (79% female, age M= 36.7, SD 11.2). A Kruskal-Wallis rank sum test was used to test whether there are significant differences on the mean scores of the schema modes between the BPD, avoidant PD and obsessive-compulsive PD. Significant mean differences were found across all schema modes between the three groups.

Network across PD groups

The overall network between schema modes of all three PD groups included in this study (N = 1019) is visualized in Figure 1. On average, 49.4% of variance was explained across the schema modes, ranging from 27.9% for Detached protector mode to 67.3% for Vulnerable Child mode. The biggest associations observed were between 1)

Table 2: Sample means by PD group

	Borderline N = 386[1]	Avoidant N = 504[1]	Compulsive N = 129[1]	p-value[2]
Age	31.7 (9.9)	31.4 (11.1)	36.7 (11.2)	< 0.001
Sex				< 0.001
Female	337 (88%)	352 (71%)	100 (79%)	
Male	46 (12%)	147 (29%)	27 (21%)	
Happy Child	2.66 (0.69)	2.53 (0.74)	2.89 (0.74)	< 0.001
Healthy adult	3.58 (0.73)	3.31 (0.65)	3.80 (0.63)	< 0.001
Impulsive child	2.93 (0.98)	2.06 (0.75)	2.16 (0.81)	< 0.001
Vulnerable child	3.86 (0.94)	3.99 (0.96)	3.42 (0.83)	< 0.001
Undisciplined child	3.45 (0.97)	3.37 (0.97)	2.85 (0.97)	< 0.001
Detached self-soother	3.23 (0.93)	3.33 (0.92)	2.85 (0.89)	< 0.001
Detached protector	3.79 (1.02)	3.52 (0.97)	3.57 (1.11)	< 0.001
Bully and attack	1.92 (0.76)	1.59 (0.56)	1.70 (0.62)	< 0.001
Enraged child	2.03 (0.89)	1.44 (0.62)	1.58 (0.69)	< 0.001
Punitive parent	3.07 (1.06)	3.22 (1.11)	2.85 (1.06)	0.002
Demanding parent	3.96 (1.02)	4.05 (0.97)	4.68 (0.82)	< 0.001
Compliant surrender	3.50 (0.99)	4.03 (0.94)	3.27 (0.98)	< 0.001
Angry child	3.29 (0.94)	2.63 (0.93)	2.65 (0.87)	< 0.001
Self-aggrandizer	2.66 (0.80)	2.31 (0.68)	2.82 (0.75)	< 0.001

[1] n (%); Mean (SD)

[2] Pearson's Chi-squared test; Kruskal-Wallis rank sum test

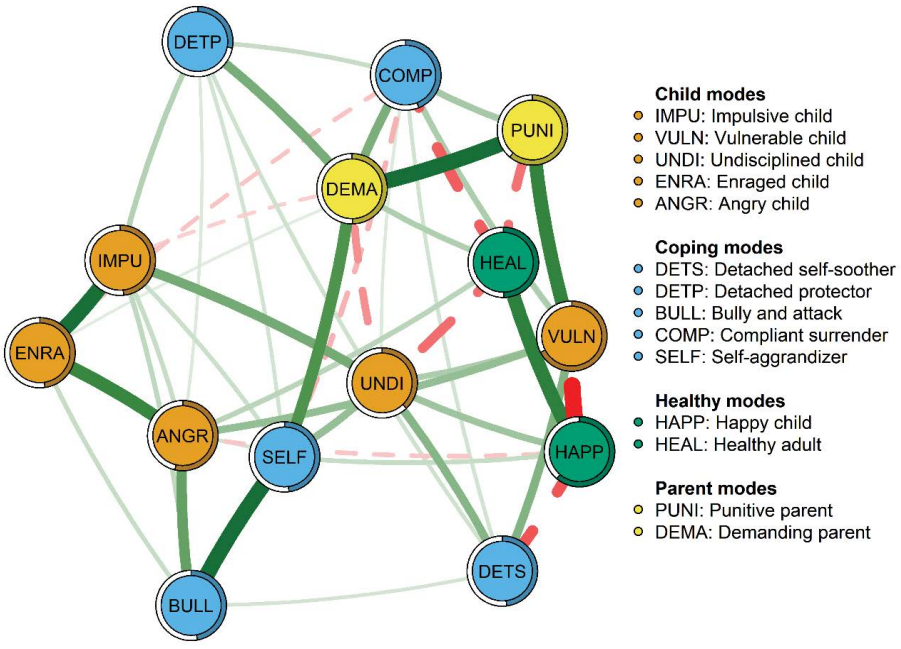

Figure 1: Regularized network results using full analysis sample (N = 1,019). Negative partial correlations are red and dashed, positive partial correlations are green and solid. Thickness of edges corresponds to the effect size of the partial correlation. Pie chart rings correspond to percentage of variance explained for each schema mode.

Happy Child and Vulnerable Child (-.39 [-0.43, -0.35]); 2) Punitive Parent and Demanding Parent (0.37 [0.32, 0.42]); 3) Bully and Attack and Self-Aggrandizer (0.36 [0.31, 0.43]; 4) Impulsive child and Enraged child (0.36 [0.30, 0.43] and 5) Happy Child and Healthy Adult (0.33 [0.27, 0.39]). All coefficient estimates are visualized in Figure 1.

In Figure 2, the Strength and Expected Influence centrality indices are visualized for all schema modes. According to the Strength index, the relatively most central mode was estimated to be Demanding Parent, the association being mostly positive with other modes according to Expected Influence. This was followed by Healthy Adult, which was mostly negatively associated with other modes. Third and finally, Vulnerable Child was again positively associated with other modes.

The stability of the presented estimates was found to be acceptable, the correlation coefficient for the Strength index dropping below .7 only after losing more than 60% of the sample. Diagnostic visuals are presented in Figure 2.

Networks within the different PD groups

The networks for the BPD, avoidant PD and obsessive-compulsive PD groups are presented in Figure 3. The resulting networks were of considerable similarity. For the BPD group the strongest associations were between 1) Punitive Parent and Demanding Parent (0.42 [0.35, 0.52]); 2) Bully and Attack and Self-Aggrandizer (0.44 [0.32, 0.49]) and 3) Happy Child and Vulnerable child (-0.34 [-0.42, -0.27]). The strongest associations for the avoidant PD group were between 1) Happy Child and Vulnerable Child (-0.41 [-0.49, -0.35]); 2) Punitive Parent and Demanding Parent (0.30 [0.22, 0.38]) and 3) Vulnerable child and Punitive Parent (0.29 [0.22, 0.37]). For the obsessive-compulsive PD group, those were between 1) Bully and Attack and Self-Aggrandizer (0.36 [0.24, 0.51]); 2) Happy

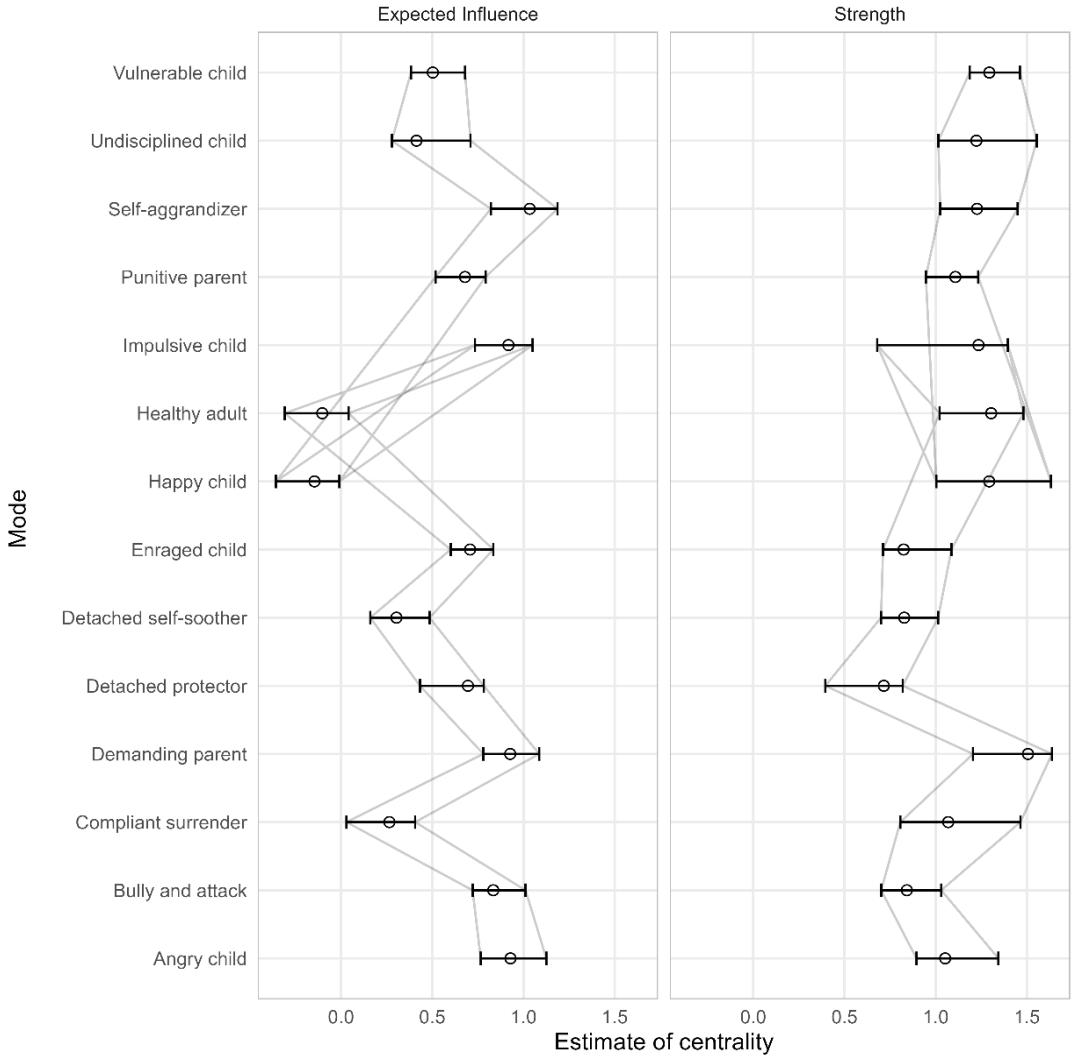

Figure 2: Centrality estimates from network analysis on full analysis sample. Presented Expected Influence (EI) and Strength indices alongside corresponding bootstrapped 95% confidence intervals.

Child and Vulnerable Child (-0.33 [-0.47, -0.17]) and 3) Punitive Parent and Demanding Parent (0.30 [0.18, 0.44]). Thus, in line with the hypothesized relative importance, Vulnerable Child, Punitive Parent, Demanding Parent and Self-Aggrandizer participated in the strongest associations across all groups. All individual associations are presented in Figure 3.

Centrality indices are presented for each group in Figure 4. For the BPD group, the most central modes were Demanding Parent, Punitive Parent and Healthy Adult. The hypothesized most central modes Vulnerable Child, Angry Child, Undisciplined Child and Detached Protector were 4th, 9th, 11th and 14th (last) respectively.

For the avoidant PD group, the most central modes according to the Strength index were Demanding Parent, Vulnerable Child and Undisciplined Child. Punitive Parent and Detached Protector were also hypothesized to be of particular importance for the avoidant PD network and those modes ranked 5th and 14th (last) respectively. Lastly, Compliant Surrender ranked 11th.

For obsessive-compulsive PD, the three most central modes according to the Strength index were Vulnerable Child, Punitive Parent and Happy Child. The hypothesized Bully and Attack, Self-Aggrandizer, and Demanding Parent and Detached self-soother were 5th, 6th, 11th and 12th.

Formal testing of differences between the groups supported the networks were similar in structure for the BPD, avoidant PD and obsessive-compulsive PD groups. The Network Comparison Test indicated no significant differences for network associations between the avoidant PD and BPD groups (p = .467), the avoidant PD and obsessive-compulsive PD groups (p = .429) and the BPD and obsessive-compulsive PD groups (p = .921). Likewise,

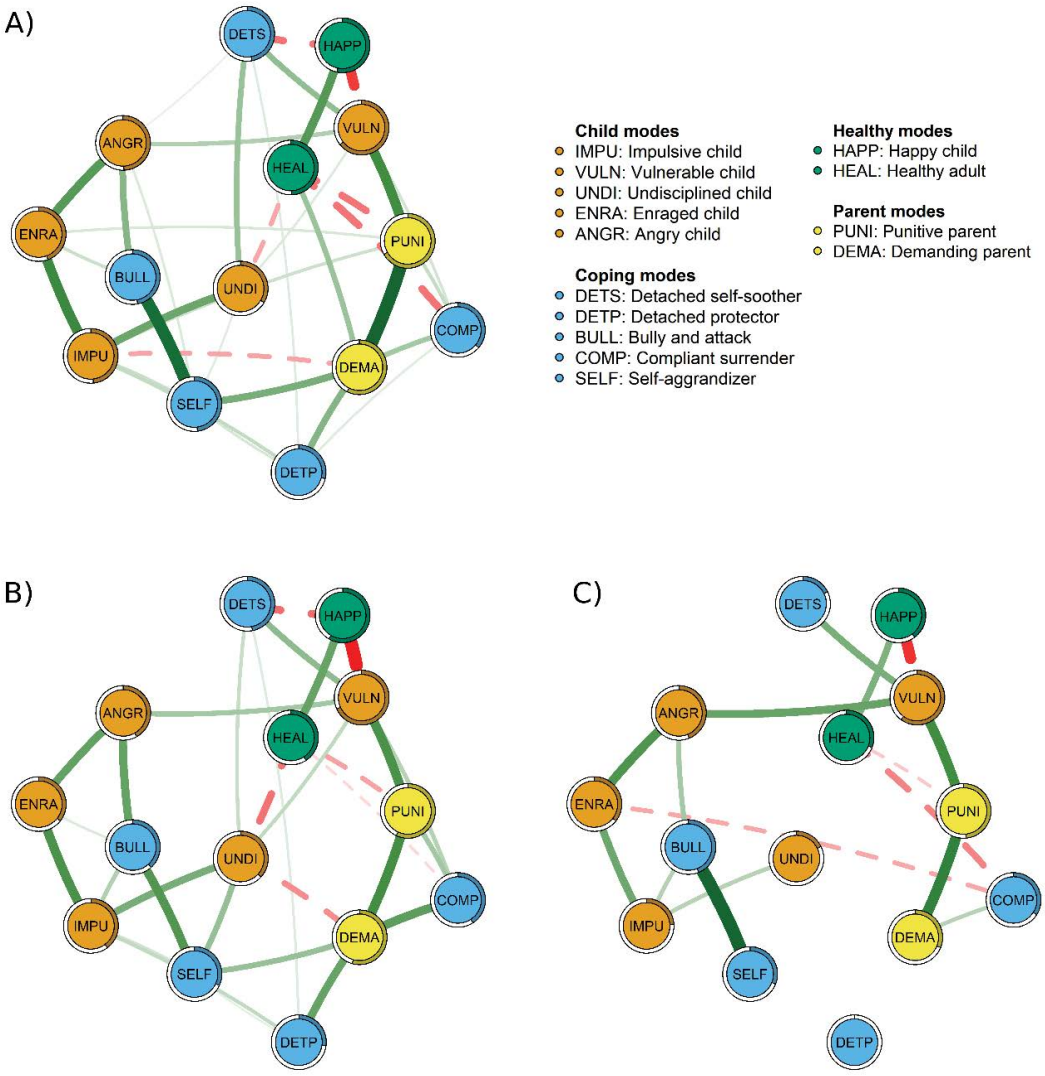

Figure 3: Regularized network results from three clinical subgroup analysis consisting of the (A) BPD group (B) avoidant group and (C) OCPD group. Negative partial correlations are red and dashed, positive partial correlations are green and solid. Thickness of edges corresponds to the effect size of the partial correlation. Pie chart rings correspond to percentage of variance explained for each schema mode.

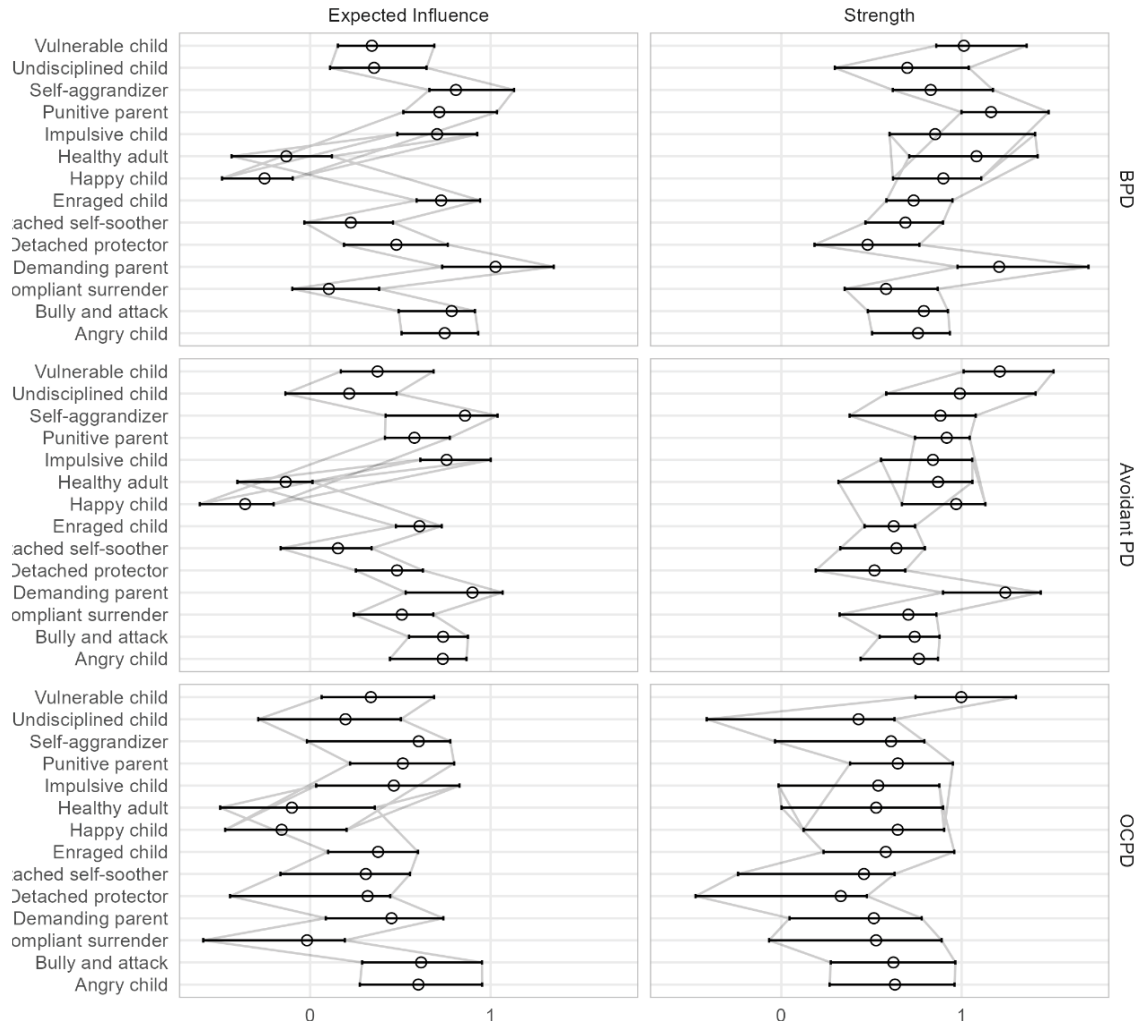

Figure 4: Centrality estimates from network analysis for BPD, avoidant PD and obsessive-compulsive PD groups. Presented Expected Influence (EI) and Strength indices alongside corresponding bootstrapped 95% confidence intervals.

there were no statistical differences between groups for the Strength centrality indices using the same method (p = .457; p = .571; p = .933 respectively). The moderated network analysis also showed no significant interaction coefficients between group status and any of the associations (all p > 0.05, see Figure 4).

Discussion

The present study investigated network structures across patients with BPD, avoidant PD, and obsessive-compulsive PD. While we observed significant differences in mean scores between the groups, no differences were found in their network structures. The associations between nodes and their corresponding centrality indices were statistically comparable across the three groups. We expected differences between the PD groups on the mode networks, based on ST theory and research of the mode models for PD groups[4,11,12,13], clinical practice and because of the differences in mode networks found by Aalbers and colleagues[20] between patients with a PD and a non-clinical sample. Surprisingly -and interestingly- our findings did not reveal significant differences between the mode networks of patients with BPD, avoidant PD and obsessive-compulsive PD.

These findings on some point correspond with previous literature. Our results indicate that mean scores on the modes can be used to differentiate between PD groups, which corresponds with the findings of Bach & Farrel[13]. In their study Bach & Farrel found that Angry Child, Impulsive Child and (low) Happy Child distinctly differentiated patients with BPD from those with other PDs. Our findings suggest that, although mean levels of the modes can vary across these different PDs, the relationship between the modes – how the modes interact, influence and activate one another - does not differ between the different PDs investigated in this study.

Our finding that mean scores on variables (in our study the modes) differ between clinical subgroups but network structures do not, aligns with the study by Radhoe

and colleagues[42]. They found differences in the network structure of autistic patients versus a non-clinical sample (as in the study of Aalbers[20]). They also found differences in mean levels of the variables for different autism subgroups, but they did not find differences in network structures for different autism subgroups.

Our results do not align with the conclusions of the study by Bamelis and colleagues[12]. They did find differences in how different modes were related to each other across four PD groups. However, they compared the PD groups looking at raw correlations, while our method uses partial correlations. Partial correlations take all other modes into account, so they give a clearer picture of which relationships are really meaningful. Lobbestael and colleagues[11] also identified differences in the correlations between certain modes for specific PDs, while controlling for other PDs. They also did not use network analyses to look at the unique relationships in the network between the modes for the different PDs.

Building on Aalbers[20], who identified distinct differences between clinical and non-clinical groups, our results add to these findings by showing that within the clinical population, the interactions between symptoms are highly comparable across different PD groups. This suggests a potential common structure in how symptoms co-occur and influence one another, regardless of diagnostic category.

There could be several explanations for why we did not identify significant differences in the networks between different clinical PD populations; as we compared a clinical sample to another clinical sample, our groups could be more homogeneous than in the study of Aalbers[20] wherein a clinical sample was compared to a non-clinical sample. Even more, the data was gathered in a highly specialized mental healthcare centre, the patient population that is treated there might not be as heterogeneous as expected. Additionally, our groups were already selected for ST treatment, which also may have made them more homogeneous. Another possible explanation for the absence of differences on the mode networks between PDs is that the distinction between DSM diagnoses may not be the best way to make a clinically relevant distinction between different groups of patients. Criticism of the clinical utility of DMS-5 PD diagnoses state that dimensional models of PD, based on underlying general factors[43], are more clinically relevant than categorical PD models[44].

Limitations and Strengths

To our knowledge, the current study is the first to use network analyses to examine mode networks across different PDs. As in the study of Aalbers and colleagues[20], a strength of this research is its ability to directly test the network theory of PDs, which hypothesize the interactions between different modes.

Second, a strength of this study is its large sample size of diagnostic subgroups. While previous research has only investigated clinical and subclinical networks, our study was the first to differentiate between different clinical subgroups of PDs.

Despite its clinical relevance, some limitations of the current study need to be mentioned. Firstly, the generalizability of these findings is limited by the fact that all participants were recruited from a specialized treatment center and were specifically indicated for schema therapy. Also, only three types of PD were investigated (BPD, Avoidant and OCPD). As such, the mode network structures observed here may not fully reflect individuals with these PDs in the broader population.

While comorbidity among PDs is common, our study focused on participants' primary diagnosis. This choice was guided both by the structure of our dataset and by methodological constraints: excluding all comorbid PD traits or diagnoses would have substantially reduced sample sizes and statistical power within each diagnostic group (given the high rates of comorbidity among personality disorders[31,33]). Nevertheless, this decision might have limited the ability to detect differences between the different PDs. As such, the similarity observed across networks may in part reflect this constraint. Future research, especially those using The Alternative DSM-5 Model for Personality Disorders (AMPD), may offer a more comorbidity-sensitive view of personality pathology in the network analysis of the mode networks.

The standard 118-item version Schema Mode Inventory (SMI) was administered to assess 14 established modes. This version does not include the additional Cluster C–specific modes included in the SMI-2, which should be considered a limitation of the present study. As a result, our assessment may not have fully captured the range of modes particularly relevant to Cluster C pathology. Although the absence of Cluster C–specific modes in the standard SMI represents a limitation, it is still noteworthy that the mode networks in our study did not differ substantially between groups. This suggests that the interaction between the modes originally defined by Young and colleagues[4] does not seem to differ for different PDs.

Finally, the precision of the estimates for the obsessive-compulsive PD group was limited by its relatively small sample size.

Clinical Implications

The fact that mean scores on the modes vary across PDs but the mode network seems to interact in a similar pattern across the PDs, is an important finding for clinical practice. While certain PDs are associated with stronger activation of specific modes (e.g., higher scores on the modes), the

underlying interaction patterns between modes seem to remain consistent in our study. These findings raise a critical question for treatment design: should therapy prioritize addressing the highest-scoring modes specific to each PD, or should it focus on the most disruptive connections within the mode network? The first approach aligns with current clinical practice, where distinct mode models and tailored therapeutic strategies are developed for each PD. In contrast, the latter approach suggests a more generalized treatment approach, targeting universally important vicious cycles within mode networks regardless of the specific diagnosis. In this context, the finding that mode networks do not differ across PDs simplifies this task and may offer practical advantages for treatment design. Treatment protocols can then focus on modifying universal mode interactions rather than being tailored based on PD diagnoses. While tailoring ST interventions to specific subgroups may still be beneficial, DSM diagnoses may not represent the most valid or clinically useful basis for identifying these subgroups or adapting treatment approaches accordingly.

Future Research

Future research should investigate the therapeutic effect of ST interventions on the network structure of patients with PDs during treatment. As the current results indicate similar interactions between modes across all investigated PDs, therapy such as ST should have similar impact on the mode network of all patients. These implications should be tested empirically using dynamic longitudinal data of modes and their relationships. Additionally, future research should investigate the longitudinal mode networks of patients who benefit from treatment compared to those who show limited improvement. Such comparison may provide insights into why some patients do not respond well to ST and which modes might be better targeted by an alternative treatment approach. Another direction for future research would be to examine whether a network-informed ST approach yields advantages over standard ST in terms of treatment efficiency and clinical outcomes.

As a final recommendation for further research, it could be of interest to explore network structures in relation to dimensional models of personality pathology, such as the Alternative Model for Personality Disorders developed for the DSM-5. These dimensional assessments measure the level of personality functioning and pathological personality traits, which could be better suited to reveal network differences and therapeutic targets than the traditional diagnostic classification.

Conclusion

Though we hypothesized, based on ST theory, that there would be different relations between modes for different PD groups, we observed a surprisingly stable network structure across patients with BPD, avoidant PD, and obsessive-compulsive PD. The observed similarity in network structures across PD groups raises the possibility that diagnosis-specific adaptations in ST may be of limited added value, though this hypothesis should be tested in future longitudinal or intervention-based studies.

Conflict of Interest

All authors have approved of submission of this manuscript and state that there is no conflict of interest.

Ethical Statements

Presented at a meeting; no

Data use in previous publications: no

The Medical Ethical Review Committee Brabant provided a statement that the current research does not fall under the scope of the Medical Research Act Involving Human Subjects (NW2023-57).

Data Availability Statement

The analysis code used in this study can be found at https://osf.io/3z9s7/.

There are no other studies under review, in press or published in which the same dataset is used.

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