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A Network Approach to Understanding Narcissistic Grandiosity via the Narcissistic Admiration and Rivalry Questionnaire and the Narcissistic Personality Inventory

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Abstract

The narcissistic admiration and rivalry concept (NARC) model of grandiose narcissism posits that striving for uniqueness, grandiose fantasies, and charmingness define narcissistic admiration, whereas striving for supremacy, devaluation, and aggressiveness define narcissistic rivalry. Given these complex interrelationships, we explored the structure of grandiose narcissism using the Narcissistic Admiration and Rivalry Questionnaire (NARQ) and Narcissistic Personality Inventory (NPI) via network analysis in four separate samples which allowed us to assess the extent to which these networks replicated across these samples (total N = 3,868). Overall, grandiose cognitions from the NARQ emerged as a highly central node in each network, providing compound evidence for its replicability and generalizability as an important feature of grandiose narcissism within the NARC model. Charmingness from the NARQ emerged as a central node throughout Samples 1, 2, and 3, with strong connections to features of narcissistic admiration and narcissistic rivalry (e.g., grandiose fantasies and aggressiveness), but was less central in Sample 4. To our knowledge, this is the first research to examine the replicability of the network structure of grandiose narcissism across various samples. These findings add to an increasingly important dialogue regarding replicability in psychological network science.

Keywords: grandiose narcissism; network analysis; narcissistic admiration; narcissistic rivalry

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Narcissism is typically conceptualized as a personality trait that involves inflated self-views, vanity, self-absorption, feelings of entitlement, and a willingness to exploit others (e.g., Morf & Rhodewalt, 2001). Empirical findings suggest, however, that narcissism is a complex and multidimensional construct with varying presentations (Krizan & Herlache, 2018). For example, a *grandiose* form of narcissism can be distinguished from a *vulnerable* expression of narcissism (see Miller & Maples, 2011, for a review). The current research focuses exclusively on the grandiose expression of narcissism as it refers to a continuous and normally distributed personality trait in the general population (Foster & Campbell, 2007). The goal of this research is to describe the structure of grandiose narcissism by examining the interrelationships among the various aspects of narcissism using network analysis, as well as assess the extent to which these network structures replicated across different samples.

Grandiose narcissism is often treated as if it is a unitary construct despite evidence that it is almost certainly multidimensional (Ackerman et al., 2011; Brown et al., 2009). The Narcissistic Admiration and Rivalry Concept (NARC) model (Back et al., 2013) provides a more nuanced understanding of grandiose narcissism by distinguishing between *narcissistic admiration* (an agentic form of narcissism characterized by assertive self-enhancement and self-promotion) and *narcissistic rivalry* (an antagonistic form of narcissism characterized by self-protection and self-defense). These agentic and antagonism forms of grandiose narcissism are consistent with prior trait-based conceptualizations of narcissism emphasizing the role of Big Five traits, such as extraversion and disagreeableness (Zajenkowski & Szymaniak, in press, but see Paulhus, 2001). However, narcissistic admiration and narcissistic rivalry represent quite different strategies for maintaining grandiose self-views that involve distinct cognitive, affective-motivational, and behavioral aspects (i.e., an agentic strategy vs. an antagonistic strategy). More specifically, narcissistic admiration is believed to result in a form of social potency that bolsters grandiose self-views through a dynamic interplay of grandiose fantasies (cognitive), striving for uniqueness (affective-motivational), and charmingness (behavioral). In contrast, narcissistic rivalry is believed to unintentionally weaken grandiose self-views due to social conflict that

stems from devaluation (cognitive), striving for supremacy (affective-motivational), and aggressiveness (behavioral).

Empirical evidence supports considerable differences between narcissistic admiration and narcissistic rivalry. For example, Wurst et al. (2017) found that narcissistic admiration was related to short-term romantic appeal, whereas long-term romantic problems were primarily attributable to narcissistic rivalry. Narcissistic admiration has also been shown to be associated with initial popularity among peers which seems to be driven by the expression of more dominant behaviors that promote assertiveness, whereas narcissistic rivalry has been found to be associated with social disapproval over time which seems to be largely due to aggressive behaviors that are evaluated unfavorably by peers (Leckelt et al., 2015). In addition, narcissistic admiration has also been found to be associated with higher and more stable levels of state self-esteem, whereas narcissistic rivalry appears to be associated with lower and more fragile self-esteem (Geukes et al., 2017). Further supporting this notion is evidence that narcissistic rivalry is also associated with lower emotional stability, whereas narcissistic admiration is associated with greater emotional stability (Rogoza et al., 2016).

Relatedly, existing research suggests that narcissistic admiration tends to be associated with a range of agentic outcomes (e.g., high self-esteem, interpersonal dominance), whereas narcissistic rivalry tends to be associated with antagonistic outcomes (e.g., interpersonal hostility, malicious envy; Back et al., 2013; Geukes et al., 2017; Grove et al., 2019; Zeigler-Hill et al., 2019). In addition, narcissistic admiration has been shown to be associated with an agentic orientation to pursuing status (e.g., using a flexible approach involving either dominance-based or prestige-based strategies), whereas narcissistic rivalry is associated with an antagonistic orientation to the pursuit of status (e.g., relying exclusively on dominance-based strategies) which lends support to the importance of distinguishing between these two strategies for maintaining grandiose self-views (Zeigler-Hill et al., 2019).

The complex interrelationships within both narcissistic admiration and narcissistic rivalry suggest that their aspects should be considered in a mereological fashion – parts-to-a-whole, as well as the relations of part-to-part within a whole – in order to understand the connections between these aspects of narcissism and how they define grandiose narcissism. Initial evidence for the NARC model came from psychometric studies of the Narcissistic Admiration and Rivalry Questionnaire (NARQ; Back et al., 2013). For example, confirmatory factor analyses across

differential samples provided support for the expected two-dimensional structure composed of narcissistic admiration and narcissistic rivalry factors, with these factors containing separable cognitive, affective-motivational, and self-reported behavioral components (Back et al., 2013; Leckelt et al., 2018). However, many studies using the NARC framework have focused primarily on its two-dimensional structure, relating narcissistic admiration and narcissistic rivalry to various interpersonal, intrapersonal, agentic, and antagonistic outcomes, with less research focusing on the specific components of these factors. Thus, a network analysis of these various aspects of narcissism can provide a visual depiction as well as a quantitative description of the structure of grandiose narcissism that has not otherwise been detailed by previous approaches.

Overview

Although the NARC framework was initially conceptualized to distinguish between narcissistic admiration and narcissistic rivalry, the associations among the specific cognitive, affective-motivational, and behavioral aspects that constitute narcissistic admiration (i.e., striving for uniqueness, grandiose fantasies, and charmingness) and narcissistic rivalry (i.e., devaluation of others, striving for supremacy, and aggressive behaviors) deserve greater empirical attention. One method for understanding these associations is network analysis. Network analysis includes a set of statistical techniques that examine relationships between nodes (e.g., aspects of narcissism) and depicts these complex relationships graphically (Epskamp, Waldorp, et al., 2018), providing a means to examine the structure of the various aspects of narcissistic admiration and narcissistic rivalry by determining whether these aspects are distinct and only minimally related to each another, or if they emerge as part of a coherent network. If these aspects of grandiose narcissism form a coherent network structure, then centrality indices can further assess which aspects are most influential within the network.

The network approach to narcissism is highly consistent with and can inform more well-known and newer models of narcissism. For example, the Narcissism Spectrum Model introduced by Krizan and Herlache (2018) conceptualizes features of narcissism as *transactional processes* between persons and their social environments. That is, narcissistic tendencies are seen as emergent via interactions between one's interests, abilities, emotions and different aspects of their environments, such as partners, opportunities, and work demands (Krizan & Herlache, 2018). Furthermore, the Trifurcated Model of Narcissism decomposes both grandiose and vulnerable narcissism, seeking to parsimoniously conceptualize the construct of narcissism as

interactions between maladaptive personality traits (Crowe et al., 2019). Within this model, the role of antagonism is highly implicated and is seen as an influential personality trait (Weiss et al., 2019) which is consistent with the idea of *centrality* within the network nomenclature. Relatedly, the recent status pursuit in narcissism (SPIN) model (Grapsas et al., 2020) emphasizes *moment-by-moment* self-regulatory processes (e.g., reflection, decision-making, and planning) related to the pursuit of status. As noted above, the NARC model posits *dynamic* relationships between specific components that make up narcissistic admiration and narcissistic rivalry, which are the focus of this research.

The present research examined associations among the aspects of narcissistic admiration and narcissistic rivalry that are outlined by the NARC model across four separate samples.[1] In addition, we examined whether the aspects of grandiose narcissism identified by the NARC model were associated with the narcissistic personality features captured by the Narcissistic Personality Inventory (Raskin & Hall, 1979) in each sample. We chose the NPI because the majority of research in social-personality psychology has used various forms of this measure to assess grandiose narcissism. In addition, the NPI has support for a three-factor structure comprised of leadership/authority, grandiose exhibitionism, and exploitation/entitlement (Ackerman et al., 2011). Further, the exploitation/entitlement factor is considered by some researchers to be the most indicative of narcissistic personality pathology, given its relationship with negative intra- and interpersonal outcomes (Brown et al., 2009). Conversely, the leadership/authority and grandiose exhibitionism factors are associated with higher self-esteem (Brown et al., 2009) which suggests this three-factor structure may discern between more "adaptive" or "socially toxic" components of grandiose narcissism (Ackerman et al., 2011), possibly helping to further examine the relationships between individual agentic and antagonistic components of the NARC. It is important to note that various measures of grandiose narcissism exist, such as the Five-Factor Narcissism Inventory (FFNI; Glover et al., 2012), the Psychological Entitlement Scale (PES; Campbell et al., 2004), the Narcissistic Grandiosity Scale (NGS; Rosenthal et al., 2019), and the Grandiose Narcissism Scale (GNS; Foster et al., 2015), among several others (e.g., Foster et al., 2018). Thus, it is quite possible that the NARQ and NPI may not capture all theoretically relevant components of grandiose narcissism. However, we

[1] Given the use of network analysis as an exploratory procedure, the data analytic plan was not pre-registered in an independent, institutional registry.

wished to explore the main components of the NARC framework specifically by using its corresponding questionnaire (i.e., the NARQ) and relating these components to agentic and antagonistic features of grandiose narcissism (using the NPI). As such, the networks we present may be best seen as hypothesis-generating structures of the dynamics embedded within the NARC framework.

Indeed, although statistical network analysis contains unique indices to isolate important features of a network, the estimation of cross-sectional networks is highly similar to structural equation models (Kruis & Maris, 2016). However, one important difference is the *theory* that underlies each model. That is, the selection of either model (i.e., a network or latent variable model) is made on the basis of gathering insight into the underlying data-generating mechanism (Jordan et al., in press). For the purposes of the present research, we were interested in examining whether grandiose narcissism (as specifically measured via the NARQ and NPI) could function as a model where, for example, one who envisions oneself as great and perceives that one day they will be famous may engage in aggressive and/or devaluative behaviors in order to maintain their grandiose sense of self, as opposed to examining whether these characteristics are simply manifestations of an underlying narcissism trait.

In sum, we examined whether network analysis provides additional insights into the NARC model by assessing the complex interrelationships among the principal aspects of narcissistic admiration and narcissistic rivalry. As noted previously, network analysis allows for an alternate conceptualization of trait constructs by exploring the importance of its individual features (termed "nodes") and their relationships with other features (termed "edges," which are statistically estimated). In addition, network analysis allows researchers to assess the influence of individual nodes via centrality statistics, namely *strength* centrality (Epskamp, Borsboom, et al., 2018), providing an index of the overall level of connectedness of the node within the network. Within the NARC framework, identifying a highly central node can provide insight into which specific cognitive, affective-motivational, or behavioral facet effectively "holds" the network together. That is, network analysis may allow us to uncover the core feature of grandiose narcissism as conceptualized by the NARC. Furthermore, assessing a highly central node's divergent relationships (i.e., edges) with other nodes, as well as the magnitude of these relationships, may also provide insight into possible mechanisms that promote the maintenance of a grandiose self. Conversely, should the distinct aspects of narcissistic admiration only share

edges with one another, as an example, then network analysis may provide further evidence for the two-factor structure of the NARC framework.

Method

Sample Characteristics

Four independent samples were used to examine the network structure of grandiose narcissism measured via the NARQ and NPI. The participants for Sample 1 were 1,297 undergraduates enrolled in psychology courses at a university in the Midwestern region of the United States who participated in exchange for partial fulfillment of a research requirement. Participants completed measures concerning narcissism– along with other measures that were not particularly relevant to the present study (e.g., spitefulness) – via a secure website. The full data set and a list of measures given as part of the study are available in the online supplement. Data were excluded for 67 participants who failed to successfully complete two or more of the directed response items that were included in the instruments to identify inattentive responding (e.g., "Answer this item with 'Strongly Disagree'") and 20 participants who failed to complete the measures of narcissism. The final 1,210 participants (919 women, 291 men) had a mean age of 19.88 years (*SD* = 2.64; range = 18-40 years) and the racial/ethnic composition of the final sample was 76% White, 10% Black, 6% Asian, 2% Hispanic, and 6% other. The data were also assessed for normality. All NARQ and NPI subscales were within normal limits (skew < ±2, kurtosis < ±2; Tabachnick & Fidell, 2013), aside from the devaluation subscale of the NARQ, which was slightly leptokurtic in this sample (kurtosis = 2.39). Fortunately, the data analysis detailed further below employs procedures that are robust against modest departures from normality (Epskamp & Fried, 2018; Flora & Curran, 2004). As such, these data were not transformed in any manner for the present analyses.

The full procedures for Sample 2 can be found elsewhere (see Burnell et al., 2020), as well as the full procedures for Samples 3 (see Sample 2 from Grosz et al., 2019) and 4 (Back et al., 2013; Grosz et al., 2017). Briefly, data for Sample 2 were collected from 814 U.S. undergraduate students at a large, southwestern university (76% female) who completed various questionnaires online, including the NARQ and NPI (Burnell et al., 2020). Data from a subset of this sample (i.e., those who completed the NARQ and NPI; *N* = 794) were used to construct the network detailed in the respective section for Sample 2 below. These data were requested from the first author of Burnell et al. (2020) and were downloaded through the article's associated

Open Science Framework (OSF) repository. Although this study did not employ attention checks or validity scales, the measures were also screened for normality. The distribution of the NARQ subscales, as well as the NPI subscales, were within normal limits (skew < ±2, kurtosis < ±2).

Data for Sample 3 were collected from 695 U.S. university students (56% female) who completed various questionnaires as part of a laboratory-based study, including the NARQ and NPI (Grosz et al., 2019). Data from a subset of this sample (i.e., those who completed the NARQ and NPI; N = 656) were used to construct the network for this sample. Similarly, these data were also downloaded from the OSF repository for Grosz et al. (2019). Further, as this study also did not incorporate in-person attention checks or validity measures, these data were also screened for normality. All NARQ and NPI subscales were within normal limits (skew < ±2, kurtosis < ±2), aside from the devaluation subscale of the NARQ, which was slightly leptokurtic in this sample as well (kurtosis = 3.43).

Lastly, data for Sample 4 were collected from 1,658 German internet users (72% female) who completed various questionnaires online, including the NARQ and NPI (Back et al., 2013). Data from a subset of this sample (i.e., those who completed the NARQ and NPI; N = 1,208) were used to construct the network detailed further below. These data were requested from the first author of Back et al. (2013) and were provided to the first author of this manuscript via email. As described in Grosz et al. (2017), which also used this sample, 24 participants were removed from the original full sample (N = 1,682) due to signs of careless responding (e.g., responding very quickly or invariantly). Similarly, for the purposes of the analyses for this manuscript, we also assessed the NARQ and NPI subscales for normality. All NARQ and NPI subscales were within normal limits (skew < ±2, kurtosis < ±2), aside from the devaluation subscale of the NARQ, which was again slightly leptokurtic in this sample (kurtosis = 2.83).

Measures

The NARQ (Back et al., 2013) is an 18-item self-report measure that captures two dimensions of narcissism: narcissistic admiration and narcissistic rivalry. Further, narcissistic admiration consists of three subscales: *grandiose fantasies* (3 items; e.g., “I am great”), *striving for uniqueness* (3 items; e.g., “I show others how special I am”), and *charmingness* (3 items; e.g., “Most of the time I am able to draw people’s attention to myself in conversations”). Narcissistic rivalry also consists of three subscales: *devaluation* (3 items; e.g., “Most people are somehow losers”), *striving for supremacy* (3 items; e.g., “I secretly take pleasure in the failure of my

rivals"), and *aggressiveness* (3 items; e.g., "I often get annoyed when I am criticized"). Participants were asked to rate how well each statement described them using scales that ranged from 1 (*not agree at all*) to 6 (*agree completely*).

The NPI (Raskin & Hall, 1979) is a 40-item measure that is intended to capture narcissistic personality features. Items on the NPI are presented in a forced-choice format such that participants must select either a narcissistic or a non-narcissistic response for each item (e.g., "I like having authority over other people" or "I don't mind following orders"). We used the three subscales of the NPI suggested by Ackerman et al. (2011): leadership/authority (11 items; e.g., "I am a born leader"), grandiose exhibitionism (10 items; e.g., "I really like to be the center of attention"), and exploitation/entitlement (4 items; e.g., "I will never be satisfied until I get all that I deserve"). Table 1 depicts the means, standard deviations of each subscale from each sample, whereas Table 2 depicts the reliability coefficients of each subscale using Cronbach's alpha and the mean inter-item correlation (Clark & Watson, 1995).

Network Estimation and Visualization

The networks were estimated using the R package *bootnet* (Epskamp & Fried, 2019). Nodes in each network include narcissistic personality facets from the NARQ and NPI subscales. The networks were estimated based on a Gaussian Graphical Model (GGM), a network of conditional associations. The GGM details nodes and edges, the latter representing the weighted connections between nodes. Edges themselves can be interpreted as partial correlation coefficients ranging from -1 to 1. Given multiple nodes and the numerous pairwise associations (i.e., edges) between them, there is a possibility for spurious edges. To reduce this likelihood, the graphical least absolute shrinkage and selection operator (LASSO) regularization technique in combination with an Extended Bayesian Information Criterion (EBIC) model was used to estimate the GGM (Epskamp, Borsboom, et al., 2018). The EBIC graphical LASSO regularization technique constrains very small edges (i.e., partial correlation coefficients) to zero to reduce the emergence of false positive edges that may result from sampling variation (Costantini et al., 2015). Lastly, each network was visualized using the R package *qgraph* (Epskamp et al., 2012) and the Fruchterman-Reingold algorithm (Fruchterman & Reingold, 1991), which places nodes with strong connections toward the center of the network.[2] In the

[2] The purpose of the Fruchterman-Reingold algorithm is to provide a graph based on minimizing the number of crossing edges. Importantly, the position of the nodes are *not* considered to have meaningful positions or correspond

present visualizations, blue lines between nodes represent positive associations, whereas red lines between nodes represent negative associations. The thicker the edge, the stronger the connection between two nodes.

Network Accuracy, Stability, and Significance Testing

In order to estimate edge weight accuracy, as well as centrality stability, we used the R package *bootnet* to apply bootstrapping routines to these edge weights and centrality indices (Epskamp, Borsboom, et al., 2018). More specifically, we used non-parametric edge-weight bootstrapping in *bootnet* to calculate the 95% confidence interval (CI) of all edges in the network (2500 iterations). Wide bootstrapped CIs around edge estimates are interpreted as indicating greater variability (and thus lower accuracy), and as being less likely to differ from other edges (Epskamp, Maris, et al., 2018). Overall, the CIs for many edges were relatively narrow, suggesting little variability in edge weight estimation in each sample.

We used the case-dropping subset bootstrap (2500 iterations) to examine the stability of the order of node centrality indices (strength). Next, the stability of the centrality indices was assessed by calculating the correlation stability coefficient (CS-coefficient). The CS-coefficient provides an index of the maximum proportion of the sample that can be dropped while maintaining a correlation of 0.70 between the centrality order of the original sample and the order of the subset sample (Epskamp, Borsboom, et al., 2018). Put another way, the CS-coefficient provides evidence that traits identified as highly central in the original data continue to function as central nodes when the network is continuously re-estimated with fewer cases, relating to the overall stability of these traits across differential sample sizes. Graphs depicting these results are listed as supplemental materials online.[3] The strength centrality estimate exhibited a CS-coefficient 0.75, 0.59, 0.75, and 0.67 for Samples 1, 2, 3, and 4, respectively. The R code for estimating and visualizing each network is also listed in the online supplement. Results from prior simulation studies indicate that a minimum CS-coefficient of .25 is needed in order to meaningfully interpret differences in measures of centrality, with a preferred coefficient above .50 (Epskamp, Borsboom, et al., 2018), which our strength centrality metrics exceeded.

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to certain factors; rather, the nodes are placed in a manner that allows for a more easily interpretable graph (Jones et al., 2018).

[3] These supplemental figures include the bootstrapped confidence intervals for estimated edge weights plots, case-dropping bootstrap plots, bootstrapped difference tests of strength centrality plots, and bootstrapped edge weight difference test plots.

Node Centrality

To examine the centrality of each node within the network, we assessed strength centrality. In weighted networks, strength is defined as the sum of all absolute edge weights connected to a given node *v* (Opsahl et al., 2010). Many psychological network analysis studies have reported other centrality metrics, such as "betweenness" and "closeness;" however, such metrics have come under recent scrutiny (Bringmann et al., 2019). Given empirical evidence that strength centrality remains a stable metric to assess node influence, we focus on this metric in our interpretation of each network.

Results – Sample 1

Figure 1 displays the estimated GGM of the narcissism facets indexed by the NARQ and NPI. Recent work on network estimation suggests that there be more observations than possible edges to estimate a stable network (Epskamp & Fried, 2018). As such, our initial sample size was deemed sufficient to estimate a reliable network, as the number of observations is greater than the number of possible edges. Cognitive, affective-motivational, and behavioral aspects of narcissistic admiration appear strongly related to one another, with a prominent connection between striving for uniqueness and grandiose fantasies, both of which share connections with charmingness. In addition, leadership/authority and grandiose exhibitionism are strongly related to grandiose fantasies and charmingness, highlighting the interrelatedness among these more agentic aspects of narcissism. Conversely, narcissistic rivalry is evident within the network, as detailed by strong connections between aggressiveness and striving for supremacy, as well as between striving for supremacy and devaluation. Further, exploitation/entitlement is strongly related to these aspects of narcissistic rivalry, not sharing any connections with nodes that define narcissistic admiration.

Quantifying the visual summary representation, charmingness emerged as the most central node in this network, as evidenced by its high strength centrality, which suggests that charmingness has multiple direct connections to several nodes in the network. Outside of its strong connections with aspects of narcissistic admiration, charmingness was also related to aggressiveness (regularized partial correlation edge weight = 0.10) and striving for supremacy (edge weight = 0.13). Grandiose fantasies also evidenced a high strength centrality value with strong associations with striving for uniqueness (edge weight = 0.47), leadership/authority (edge weight = 0.23), and grandiose exhibitionism (edge weight = 0.15).

Bridge Centrality

As charmingness evidenced high centrality in the present network (i.e., with many connections to aspects of both narcissistic admiration and narcissistic rivalry), we further assessed the role of charmingness via bridge centrality using the R package *networktools* (Jones, 2019). Bridge centrality in psychological networks is a relatively new statistic that examines connectivity between theoretically-based communities, quantifying the degree to which certain nodes connect these pre-defined communities (Jones et al., in press).[4] For these analyses, we defined three communities: (1) narcissistic admiration, which consisted of the "grandiose fantasies," "striving for uniqueness," and "charmingness" nodes; (2) narcissistic rivalry, which consisted of the "devaluation," "striving for supremacy," and "aggressiveness" nodes; and (3) the NPI, which consisted of the "leadership/authority," "grandiose exhibitionism," and "exploitation/entitlement" nodes.

Bridge centrality produces analogues to common centrality measures in traditional psychological networks (e.g., strength). More specifically, *bridge strength* denotes the total connectivity of a node with other communities (i.e., by summing the absolute value of every edge connecting the node to other nodes of the pre-defined communities; Jones et al., in press). The graphical representation of bridge nodes within the present network is presented in Figure 2. Bootstrapping and stability testing plots for the bridge strength centrality metric are available in the online supplement. Overall, charmingness emerged as a highly central node in the context of bridge centrality, as evidenced by its high bridge strength. The emergence of charmingness as a central node once again is consistent with previous studies suggesting that there is little overlap between the most influential bridge nodes and most overall central nodes (e.g., Heeren & McNally, 2018), but bridge centrality provides the best evidence that charmingness is indeed the node linking aspects of narcissistic admiration and narcissistic rivalry without relying solely on a visual representation. Interestingly, grandiose exhibitionism also evidenced high bridge strength and bridge closeness, quantifying its role in connecting the NPI community with the narcissistic admiration and narcissistic rivalry communities.

Results – Sample 2

[4] More specifically, these communities are based on information independent of the network structure itself and are not based on any network estimation procedure (such as community detection analyses).

Recent advances to network estimation have allowed for simulation studies that can approximate a power analysis, namely via the "netSimulator" function in *bootnet*, which allows one to determine the relationship between sensitivity and sample size, between specificity and sample size, and how closely the estimated network is related to the "true" network (i.e., the network structure underlying the data) based on the correlation between their edge weights (Epskamp & Fried, 2018). Sensitivity in this case refers to the proportion of edges present in the true network that were detected in the estimated network, whereas specificity refers to the proportion of missing edges in the true network that were also detected correctly (Epskamp & Fried, 2018). We were interested in using this function, as the sample size for these data is lower than in Sample 1 and wanted to ensure that this sample size was appropriate for estimating these numerous pairwise connections.

Given these tools, we were able to use the previously estimated network from Sample 1 as input to determine the degree of sensitivity, specificity, and correlation between the estimated network for Sample 2 and its true network, based on varying sample sizes (100, 250, 500, 750, and 1000). At $N = 750$, correlation and sensitivity reached values of > 0.90 when using the network from Sample 1 as input data, suggesting that the estimated networks from Sample 2 reliably approximated its true network structure. Specificity was moderate and more variable (across all sample sizes), likely as the regularization technique (i.e., *EBICglasso*) sacrifices specificity to maximize sensitivity (Epskamp & Fried, 2018). As such, a sample size of 794 was deemed appropriate to properly estimate the presence of edges, should they exist (i.e., based on the sensitivity value for $N = 750$ from the simulation).

Network Description

Figure 3 displays the estimated GGM from this sample. Overall, this network has some notable differences from the network for Sample 1. First, charmingness is more strongly connected to aggression (edge weight = 0.21) and devaluation (edge weight = 0.27). Second, devaluation and exploitation/entitlement share a strong, negative connection (edge weight = -0.11), which differs from the positive connections in Sample 1. However, grandiose fantasies again evidenced high strength centrality, sharing notable connections with striving for uniqueness (edge weight = 0.21), striving for supremacy (edge weight = 0.18), and charmingness. Thus, Sample 2 replicates the high centrality of grandiose fantasies, as this node was also highly central in Sample 1.

Bridge Centrality

We also assessed the role of individual nodes in this network via bridge centrality. We again defined the same three communities as in the previous samples, assessing the extent to which individual node(s) connected these communities. See Figure 4 for a graphical representation of bridge nodes from this network. In this sample, charmingness was highly central in the context of bridge strength, replicating the results from Sample 1. Further, grandiose fantasies was also implicated as an important bridge node alongside charmingness, linking the rivalry and NPI communities in this network.

Results – Sample 3

Figure 5 displays the estimated GGM from this sample.[5] Overall, this network is rather similar in its structure to the first two networks, albeit sparser. For example, the facets that make up narcissistic admiration are strongly connected, as are the facets that make up narcissistic rivalry. Further, the nodes comprising narcissistic rivalry are connected to exploitation/entitlement, with devaluation (edge weight = 0.12) and striving for supremacy (edge weight = 0.21) sharing strong connections with this node. Lastly, grandiose fantasies is again highly central, with prominent connections to striving for uniqueness (edge weight = 0.41), charmingness (edge weight = 0.24), and leadership/authority (edge weight = 0.18).

Bridge Centrality

We used the same communities as in the previous networks, and we assessed the extent to which individual node(s) connected these communities. See Figure 6 for a graphical representation of bridge nodes from this network. In this sample, charmingness was highly central in the context of bridge strength, replicating the results from Sample 1 and 2. In addition, leadership/authority was also a bridge node, as it was in Sample 2. Taken together, there is some consistency in bridge nodes throughout these samples, with charmingness and leadership/authority as important links between these different communities of grandiose narcissism.

Results – Sample 4

[5] The netSimulator function in *bootnet* was also used to examine the degree of sensitivity and specificity for this network using the network from Sample 1 as input data. Similarly, a sample size of 656 was deemed appropriate for detecting the presence of edges in this network.

Figure 7 displays the estimated GGM from this sample of German participants (who completed a German translation of the NARQ and NPI). Overall, this network appears slightly denser compared to the networks for the first three samples (e.g., there are 31 edges in this network compared to 24 in Sample 1). Like the previous samples, however, the cognitive, affective-motivational, and behavioral components of narcissistic admiration are strongly interrelated, as are the distinct components of narcissistic rivalry. Again, exploitation/entitlement shares strong connections with the components of narcissistic rivalry, similar to the previous samples, although exploitation/entitlement also shares (weak) connections with components of narcissistic admiration.

The main difference in this network, however, is the role of charmingness. Compared to Sample 1 (which has a similar *N*), charmingness no longer emerges as the most central node, sharing weak connections to nodes outside of leadership/authority and the other narcissistic admiration nodes. Rather, grandiose fantasies evidenced the highest strength centrality (and was highly central in the previous samples), sharing prominent connections with striving for uniqueness (edge weight = 0.45), devaluation (edge weight = 0.13), grandiose exhibitionism (edge weight = 0.15), and leadership/authority (edge weight = 0.16). Thus, whereas the central role of charmingness did not replicate across each sample, grandiose fantasies still appear to play an important role in the network structure of grandiose narcissism.

Network Comparison Test

As we were interested in whether the networks in these studies replicated, we formally assessed for differences between the network structures of Sample 1 and Sample 4 using the R package *NetworkComparisonTest* (NCT; van Borkulo, 2016), given the similarity in sample size. The decision to only compare the networks from Sample 1 and Sample 4 was made on the basis that the NCT typically requires considerable power to detect statistically-significant differences between network structures, as well as recommendations that NCT be used when the sample sizes of the two groups are roughly equal (Peckham et al., 2020). The NCT is a two-tailed permutation test in which the difference between two groups is calculated repeatedly (100,000 times) for randomly regrouped individuals. This test results in a distribution under the null hypothesis (i.e., both group networks are equal), which can be used to test the observed difference between such groups (van Borkulo, 2016).

Both the global invariance test and the maximum edge-weight test were significant (p = .04 and $p < .001$, respectively), suggesting that the null-hypothesis the networks did not differ in terms of network structure and specific edge weights can be rejected. However, when correlating the adjacency matrices from these two networks, there was a moderate, but significant correlation, $r = 0.54$, $p < .001$, suggesting there was likely some degree of similarity between the two network structures as a whole, and is consistent the global invariance test's marginal p-value reported above. Some notable, significant edge weight differences were between grandiose fantasies and exploitation/entitlement (connected in Sample 4, but not in Sample 1), between charmingness and grandiose exhibitionism (a stronger connection in Sample 1), and between striving for uniqueness and aggression (a stronger connection in Sample 4). Notwithstanding these differences in network structures, it is important to note the cultural differences between Sample 1 and Sample 4. That is, Sample 1 consisted of university students from the United States, whereas Sample 4 consisted of German community members. Thus, it is likely that the NCT employed to assess these structural differences may in fact be assessing measurement invariance across age and cultures (as well as translations of these measures). To further support this notion, we also correlated the adjacency matrices between the three first samples, finding a modest, but significant, correlation between Sample 1 and Sample 2 ($r = 0.25$, $p < .05$), between Sample 2 and Sample 3 ($r = 0.32$, $p < .01$), and a moderate correlation between Sample 1 and Sample 3 ($r = 0.53$, $p < .001$).

Bridge Centrality

We again defined the same three communities as in previous samples, assessing the extent to which individual node(s) connected these communities. See Figure 8 for a graphical representation of bridge nodes from this network. Contrary to Sample 1, charmingness no longer served as a bridge node. Instead, leadership/authority and grandiose exhibitionism were highly central in the context of bridge strength, possibly serving as the two nodes that link distinct features of narcissistic admiration and narcissistic rivalry to one another. Figures 9 and 10 depict strength and bridge strength centrality metrics across all four samples.

Secondary Analyses: Comparison of Non-Partialed Correlation Networks

Replicability is an increasingly important issue in psychological network science, with many studies assessing the replicability of *network structures* (Borsboom et al., 2018). It is important to note that differences among network structures that are taken from samples can

likely emerge as a function of these samples themselves (e.g., due to cultural, language, or age differences). However, one important factor that has received growing attention within personality science relates to *partialing* and its effects on replicability, among other issues (e.g., less reliable variance; Miller et al., 2019; Sleep et al., 2017). GGMs are based on regularized partial correlation coefficients to help uncover the unique associations between nodes while controlling for other nodes in the network. Recent work by Vize and colleagues (2020) has shown that item-level analyses of Dark Triad constructs (i.e., narcissism, psychopathy, and Machiavellianism) evince poor replicability when partialed across separate samples, suggesting these associations are less stable as a result. As such, these recent findings are highly applicable to network-based approaches in personality science, although the extent to which regularization procedures (i.e., *EBICglasso*) may mitigate these issues remains an empirical question.

To this end, we also ran these networks as association networks (i.e., based on zero-order correlations) and assessed their replicability and stability using the same functions as described for our partial correlation networks.[6] Supplemental Figures 29-33 detail comparisons between these four association networks, as well as bootstrapped estimated edge weights for each association network. Of note, the confidence intervals for these estimated edge weights are slightly narrower compared to the confidence intervals for their partial correlation network analogues, suggesting less variability in edge weight estimation. We also again used the NCT to assess for structural differences between the association networks for Samples 1 and 4, given their similar sample sizes. Differing from the results comparing these samples' partial correlation networks, the NCT revealed no structural differences between these two networks in terms of global invariance ($p = .85$). Similarly, we also correlated the adjacency matrices of each association network with one another. All adjacency matrices were significantly correlated at $p < .001$ (r range: 0.58 – 0.93). Thus, these secondary analyses may provide further insight into the structural differences noted among some of these samples, aside from the cultural or language differences that have already been emphasized.

General Discussion

The present analyses explored the interrelationships among aspects of grandiose narcissism measured by the NARQ and NPI in order to assess their network structure. In these analyses, aspects of narcissistic admiration were strongly related to the more agentic personality

[6] We thank Joshua Miller for this suggestion.

features of the NPI across each sample (e.g., leadership/authority), whereas aspects of narcissistic rivalry were more strongly related to exploitation/entitlement. Further, grandiose fantasies – a core cognitive feature of narcissistic admiration – emerged as a highly central node in each sample. We emphasized the utility of network analysis in examining these interrelationships given that network analysis represents complex personality phenomena by revealing the specific relationships among personality traits or constructs which may not otherwise be accounted for if one focuses exclusively on latent variable analysis.

Another aim of the present research was to assess the replicability of these network structures, and there was some evidence that the network structure of grandiose narcissism failed to replicate across four separate samples. However, non-replication itself is a heterogeneous term that can be indicative of meaningful differences between the samples themselves (e.g., between the first three samples and Sample 4), random sampling variation, and poor reliability in measurement, among other possibilities (Fried & Cramer, 2017). Taken together, the few structural differences that were observed across these analyses were likely due to cultural differences stemming from our use of geographically-diverse samples. However, to our knowledge, this is the first set of network analyses examining the aspects of grandiose narcissism emphasized within the NARC framework, as well as one of the few studies to examine network replicability in personality science (but see Borsboom et al., 2018, for an overview of this issue in clinical science). Moreover, aside from some differences between these network structures and samples, three important similarities emerged: (1) the high strength centrality of grandiose fantasies; (2) the role of charmingness as a bridge node; and (3) the strong connections within individual components of narcissistic admiration and narcissistic rivalry.

The emergence of grandiose fantasies as a central node in these networks is consistent with prior conceptualizations of grandiose narcissism, a trait concept that describes individuals who are also confident, outgoing, vain, manipulative, and aggressive (Ackerman et al., 2011). However, the high centrality of grandiose fantasies should be interpreted in light of the items that constitute this construct more specifically. That is, this subscale of the NARQ consists of three items: “I am great,” “I will someday be famous,” and “I deserve to be seen as a great personality.” According to the NARC, fantasies surrounding one’s greatness and unique abilities are highlighted, given their influence on charmingness, their bidirectional relationship with striving for uniqueness, and the impact that socially potent outcomes have in reinforcing these

fantasies (Back et al., 2013). It may be the case that this facet of narcissistic admiration is actually capturing something akin to a more cognitive aspect of "grandiosity" rather than "grandiose fantasies," in line with its conceptualization within the NARC. Given its high centrality within these networks, the items from this subscale likely reflect aspects of both narcissistic admiration and narcissistic rivalry. For example, consider a narcissistic individual who continuously appraises oneself as "great." As such, they may feel they deserve to be in the company of other great people (reflecting narcissistic admiration), or feel as if they are better than other people (reflecting narcissistic rivalry). Furthermore, feeling as if one deserves to be seen as a "great personality" may influence other features of narcissistic admiration and narcissistic rivalry, such that these feelings lead one to show others how "special" they are, or become annoyed when they are criticized. Lastly, the perception that one will "someday be famous" can also foster perceptions that others "will never achieve anything" and promote a grandiose sense of self by believing their uniqueness gives them strength. Notably, within each network, grandiosity also shared strong connections with grandiose exhibitionism and leadership/authority, two subscales of the NPI that index the more "adaptive" features of narcissism (Ackerman et al., 2011). Future research may benefit from using more specific measures of the distinct facets of grandiose narcissism and examining whether the associations that emerged from the present research differ based on pathology because the NARC was developed as a process model of subclinical manifestations of narcissism (Back, 2018).

The emergence of charmingness as a highly central node is also consistent with prior conceptualizations of grandiose narcissism. For example, grandiose narcissists place great value on being admired by others, and attempt to gain this admiration by being charming in social settings and making positive first impressions (Back et al., 2010). Unfortunately for these individuals, however, the appeal of their charm tends to deteriorate over time (Leckelt et al., 2015). In addition, the emergence of charmingness as a highly central bridge node between narcissistic admiration and narcissistic rivalry suggests the intriguing possibility of the "Janus-faced" nature of charm. That is, individuals may be charming because they have a strong need to have other individuals think highly of them (e.g., "I manage to be the center of attention with my outstanding contributions"), which may explain the links between charmingness and the other nodes that comprise narcissistic admiration. For example, individuals who believe they are often the center of attention because of their outstanding contributions to social situations may also

develop a desire for fame or showing others how special they are (Back et al., 2013). However, charmingness can also suggest manipulativeness (e.g., "I am very adept at dealing with other people") and may serve to disguise some of the more antagonistic aspects of narcissism (e.g., "I secretly take pleasure in the failure of my rivals"). Taken together, the centrality of charmingness is a novel – and somewhat unexpected – finding. Future research should continue to assess the role of charmingness in other narcissism networks, in line with our caveat regarding the items that make up these subscales assessed by the NARQ (e.g., charmingness may be more specific to grandiosity surrounding one's own interpersonal abilities).

Notwithstanding the roles of grandiosity and charmingness, striving for uniqueness and striving for supremacy were also highly central across these samples, with a strong connection between these nodes and the nodes that make up their respective domains (i.e., narcissistic admiration and narcissistic rivalry). Within the NARC, both striving for uniqueness and striving for supremacy are important affective-motivational features, as they spur assertive self-promotion and antagonistic self-protection, respectively (Back et al., 2013). More specifically, striving for uniqueness interacting with grandiosity and expressions of charm can evoke desirable outcomes (e.g., positive attention and status), whereas striving for superiority over others interacting with devaluation of others and aggressive behavior may be met with rejection, unpopularity, and/or criticism (Back et al., 2013; Grove et al., 2019). These intertwined processes appear evident in these networks, such that striving for uniqueness shares strong connections with charmingness and grandiosity, whereas striving for supremacy shares strong connections with devaluation and aggression. Further, the individual components of narcissistic admiration appear consistently connected to leadership/authority and grandiose exhibitionism, whereas the individual components of narcissistic rivalry are more strongly and consistently related to exploitation/entitlement.

As such, the novelty of the present research lies in the use of a statistical method that allows researchers to consider alternative explanations to personality traits or constructs. For example, at least within the context of the NARC, latent motivational dynamics, such as self-promotive or self-defensive tendencies, may not necessarily spur the cognitive, affective-motivational, and behavioral facets that make up narcissistic admiration and narcissistic rivalry. Instead, one may wish to focus on viewing self-promotive and self-defense tendencies as emergent via the interactions between their respective cognitive, affective-motivational, and

behavioral features. This conceptualization may also account for the impact of social potency and social conflict on these features. For example, within the present analyses, charmingness shared a strong connection with grandiose exhibitionism. In this context, a narcissistic individual who finds themself adept at dealing with others interpersonally may use this opportunity to remain in the center of attention, "show off," or receive compliments which, in turn, may serve to provide ego-boosts that maintain these self-promotive tendencies.

As such, applying the network model to grandiose narcissism provides a structural approach to the relationship between its individual components that suggests the direct relationships among certain features of this construct could explain why these distinct facets often covary (Costantini & Perugini, 2018), providing a potentially more parsimonious way of viewing this construct that does not rely on factorial trait labels to explain *why* such relationships occur (Baumert et al., 2019). Instead, within the network approach, the interactivity of the components that comprise narcissism (e.g., grandiose self-views, feelings of entitlement, and vanity), as well as the structure and processes of these components, *are* narcissism. By viewing or conceptualizing narcissism within a latent variable framework, one misses the opportunity to investigate any unique patterns of relationships among manifestations of narcissism if it is assumed that these manifestations are conditionally independent given trait narcissism. However, by viewing narcissism from a network approach, the focus shifts to understanding the possible mechanisms other than latent variables or traits that explain the relationships between individual components that are meaningful to many narcissists.

Indeed, the network approach is also highly relevant to existing models of narcissism. For example, these models aim to elucidate the "core" features of narcissism, as well as its specific structural components, aspects which network analysis may help further uncover. Within the Narcissism Spectrum Model (Krizan & Herlache, 2018), the distinct features of narcissistic grandiosity and vulnerability are explicated by emphasizing the influences of antagonistic personality features. Applying network analysis to the Narcissism Spectrum Model, then, may further refine or uncover which specific features of narcissism are most strongly related to antagonism, and centrality metrics may help further assess the relative importance of antagonism within the Trifurcated Model of narcissism as an additional example. Within the SPIN model (Grapsas et al., 2020), putative moment-by-moment interactions can also be explored or conceptualized with the network approach. It is beyond the scope of the present studies to assess

the various components of these other models of narcissism but it is our hope that the theoretical insights and statistical tools afforded by the network approach will continue to help refine the varied conceptualizations of narcissism.

Limitations

One possible limitation is the robustness of these networks based on their sample sizes. For example, it is possible that combining these four samples would have likely increased statistical power. However, given that these samples were geographically diverse (e.g., Sample 4 includes participants from Germany), we were hesitant to combine these samples and possibly conflate possible cultural differences, which was likely a prominent factor influencing the structural differences between these networks, most notably between Sample 1 and Sample 4. Nonetheless, although these networks did not replicate *per se*, there is compound evidence for replicability and generalizability of node centrality, such as grandiosity. As such, these analyses implicate grandiosity as an important feature within the structure of NARC. However, the present analyses are best seen as exploratory. Although there is evidence that grandiose fantasies may play an important role in these networks, it may soon be able to test *confirmatory* network structures (Kan et al., 2019), with the present analyses providing an evidence base that future researchers can draw from when testing these confirmatory network structures. Similarly, the present results may also inform other research questions as to how the processes underlying grandiose narcissism within the NARC unfold *over time* (Back, 2018; Jordan et al., 2020).

In addition, another limitation is the use of a limited set of questionnaires to assess grandiose narcissism and their low internal consistency within each sample, with the latter limitation likely being a function of the subscales themselves (i.e., containing three items, as in the NARQ). However, the mean inter-item correlation for many subscales throughout each sample fall within the recommend range discussed in Clark and Watson (1995). Inter-item correlations are a useful analogue to present information on unidimensionality and internal consistency that is less influenced by the number of items on a scale (Piedmont, 2014). For example, whereas the charmingness subscale from the NARQ showed poor to modest reliability (based on alpha values) in each sample, its mean inter-item correlations (range: .27 – .36) suggest that these items are reasonably homogenous and contain sufficient variance so as not to be completely orthogonal (Piedmont, 2014). Further, the use of subscales as nodes is likely beneficial as there are many network analysis studies that have relied on single-item indicators of

constructs (which may contribute to measurement error; Epskamp, Borsboom, et al., 2018). Nevertheless, many measures of narcissism exist (e.g., Pincus et al., 2009), and may capture important aspects of this construct that are not included in the NARQ or the NPI, as we have emphasized previously. That is, whereas the NARQ stems from a process-based model of grandiose narcissism, the items within the NARQ are not all-inclusive of the broader construct of grandiose narcissism itself. Further, the NPI has also received criticism as a result of its response format and content coverage (Ackerman et al., 2018). Other measures such as the FFNI, PES, NGS, and the GNS may add further explanatory value or resolve issues pertaining to reliability. For example, the FFNI includes 148 items that index both grandiose and vulnerable narcissism, and has been shown to be a valid and reliable measure of these constructs (Miller et al., 2013). In addition, the GNS measures more multifaceted components of grandiose narcissism, such as superiority, self-sufficiency, and vanity (Foster et al., 2015). Indeed, future research may benefit from assessing the interrelationships among a broader set of instruments that are intended to capture grandiose narcissism.

In addition, given the reliance on three undergraduate samples, future research may also benefit from examining the associations between aspects of grandiose narcissism in more diverse samples (e.g., greater variety with regard to demographic characteristics such as age and racial-ethnic background) in order to gain a better understanding of the extent to which these results are generalizable. The final limitation of the present study was our reliance on self-report measures of grandiose narcissism. As narcissists tend to see themselves in an overly positive light, and are prone to self-enhancement (Grijalva & Zhang, 2016), future research may benefit from utilizing strategies that are designed to capture aspects of grandiose narcissism without being completely reliant on self-reports (e.g., peer-ratings). Furthermore, the NARC framework emphasizes "behavioral" and "affective-motivational" features of grandiose narcissism, with the former being less likely to be fully captured via self-report measures. Future research may also benefit from examining more specific behavioral features that constitute grandiose narcissism, such as charmingness or aggressiveness.

Conclusions

The main substantive contributions from these results include support for the distinction between narcissistic admiration and narcissistic rivalry, at least as conceptualized within the NARC model. That is, narcissistic admiration and narcissistic rivalry were originally

conceptualized as two separate sets of "behavioral dynamics," that, via the interactions between their distinct affective-motivational, cognitive, and behavioral states, lead to socially potent or conflicting outcomes (Back, 2018). Within each network, the distinct features of narcissistic admiration (i.e., cognitive grandiose features, striving for uniqueness, and charmingness) shared stronger edges with one another than with other nodes in these networks. Similarly, the distinct features of narcissistic rivalry (i.e., aggression, striving for supremacy, and devaluation) were also more strongly related to one another than to other nodes in each network. Although the features of narcissistic admiration and narcissistic rivalry were not completely independent across these samples (e.g., there were connections between the charmingness node from admiration and nodes comprising narcissistic rivalry in each sample), the strong connections within these two domains and their divergent relationships detailed throughout these networks provide further evidence for the theoretical significance of the NARC model.

Further, finding that cognitive grandiose features and charmingness served as highly central (bridge) nodes in these networks also suggest that there is value in conceptualizing grandiose narcissism as a unitary construct. Importantly, however, these results also suggest that the distinct features that make up grandiose narcissism should not be treated as interchangeable. That is, the centrality of these features depends on the strength of their connections with other features and as such, finding the "core" features of grandiose narcissism or any other personality trait will depend on the relationships between these features and other features that make up the construct. Network analysis may be one tool that could prove to be fruitful in isolating these key features and delineating any divergent relationships that emerge within the varied models of narcissism, as alluded to previously. Lastly, the differences between the U.S. samples (Samples 1 – 3) and the German sample (Sample 4) raise the possibility that there may be cultural variations in how narcissism is structured and experienced. For example, charmingness was highly central in the U.S. samples, whereas it was less central in the German sample. It may be that the influence of key cognitive, affective-motivational, and behavioral features of the NARC, as well as their relationships with one another, differ both within and across cultures. As such, researchers should continue to be mindful of the influence of culture, language, and age on the varied conceptualizations of grandiose narcissism.

Summary

In sum, we examined a series of network structures of grandiose narcissism across four samples. Grandiosity was implicated as an important feature of the NARC model, given its high strength centrality in each sample and its associations with features of both narcissistic admiration and narcissistic rivalry. In examining these network structures, we emphasized the interactions between the specific components of narcissistic admiration and narcissistic rivalry, highlighting the different relationships between certain nodes in each sample. We incorporated state-of-the-art estimation procedures in network analysis (e.g., bridge centrality), with an overarching goal of examining whether these networks replicated. Given the variability across these samples, neither network truly replicated. As such, future work (such as simulation studies) can continue to offer methodological insight as to which estimation and regularization procedures can account for such sampling variability or foster network replication.

Disclosure Statement

No potential competing interest was reported by the authors.

Open Practices

Materials and data from Sample 1 are available at https://osf.io/3pzuw/?view_only=be2595070d894ac0a428b0ec62deb837.

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Table 1

Means (and Standard Deviations) of the NPI and NARQ Subscales from each Sample

Measure/Subscale	Sample 1	Sample 2	Sample 3	Sample 4
Leadership/Authority (NPI)	5.31 (2.93)	4.59 (2.29)	5.41 (2.93)	3.70 (2.58)
Grandiose Exhibitionism (NPI)	3.20 (2.48)	3.24 (2.31)	3.64 (2.41)	3.41 (2.41)
Exploitation/Entitlement (NPI)	0.89 (0.99)	1.09 (0.96)	0.92 (0.96)	1.23 (1.10)
Grandiose Fantasies (NARQ – Admiration)	3.65 (1.05)	2.81 (1.00)	3.40 (0.91)	2.40 (1.05)
Striving for Uniqueness (NARQ – Admiration)	3.77 (1.04)	3.32 (0.97)	3.65 (0.87)	3.05 (1.13)
Charmingness (NARQ – Admiration)	3.22 (0.97)	2.33 (0.96)	3.32 (0.86)	2.86 (1.10)
Devaluation (NARQ – Rivalry)	1.69 (0.97)	2.60 (1.11)	1.63 (0.81)	1.66 (0.84)
Striving for Supremacy (NARQ – Rivalry)	2.57 (1.22)	3.10 (0.89)	2.49 (1.13)	2.46 (1.25)
Aggressiveness (NARQ – Rivalry)	2.75 (1.01)	2/04 (0.87)	2.55 (0.94)	2.33 (0.91)

Note. NPI = Narcissistic Personality Inventory; NARQ = Narcissistic Admiration and Rivalry Questionnaire.

Table 2

Reliability Coefficients (Alphas and Mean Inter-Item Correlations) of the NPI and NARQ Subscales from each Sample

Measure/Subscale	Sample 1	Sample 2	Sample 3	Sample 4*
Leadership/Authority (NPI)	.78 (.24)	.59 (.12)	.78 (.25)	.75
Grandiose Exhibitionism (NPI)	.76 (.24)	.66 (.16)	.72 (.20)	.73
Exploitation/Entitlement (NPI)	.41 (.15)	.47 (.09)	.32 (.11)	.41
Grandiose Fantasies (NARQ – Admiration)	.65 (.38)	.65 (.38)	.60 (.32)	.73
Striving for Uniqueness (NARQ – Admiration)	.68 (.41)	.51 (.26)	.56 (.29)	.71
Charmingness (NARQ – Admiration)	.61 (.34)	.62 (.36)	.55 (.27)	.76
Devaluation (NARQ – Rivalry)	.81 (.59)	.73 (.47)	.59 (.33)	.72
Striving for Supremacy (NARQ – Rivalry)	.85 (.64)	.33 (.14)	.83 (.61)	.83
Aggressiveness (NARQ – Rivalry)	.65 (.39)	.53 (.28)	.69 (.44)	.65

Note. NPI = Narcissistic Personality Inventory; NARQ = Narcissistic Admiration and Rivalry Questionnaire. Mean interitem correlations (Clark & Watson, 1995) are presented in parentheses beside Cronbach's alpha values. *Internal consistency statistics for Sample 4 are the same as those reported in Grosz et al. (2017). The data received for Sample 4 did not include individual items from the NPI and NARQ. As such, mean interitem correlations were unable to be computed for this sample.

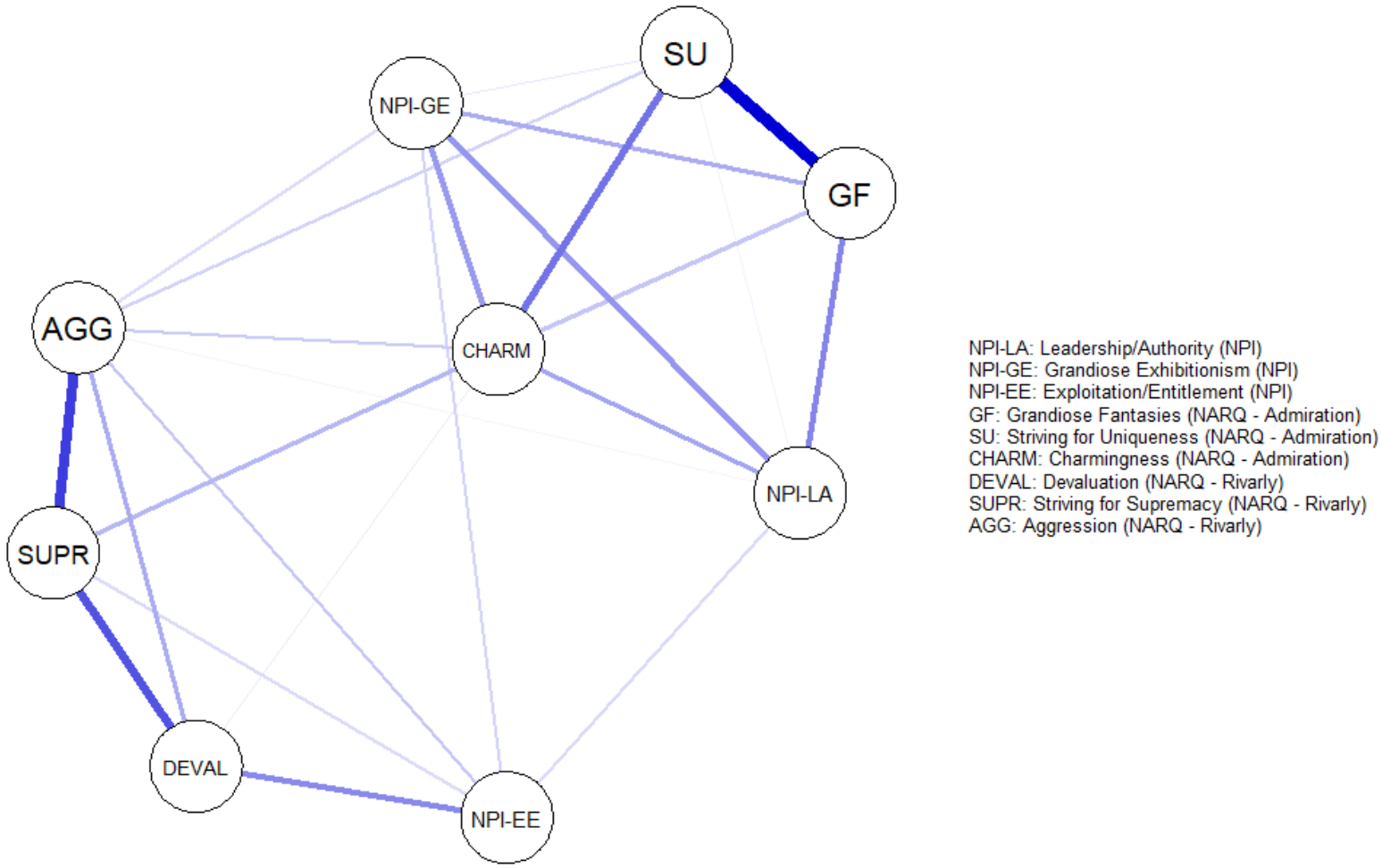

Figure 1. Graphical representation of the *EBICglasso* network from Sample 1. Blue lines represent positive associations and the red line (between "AGG" and "NPI-LA") represents a negative association. Edge thickness represents the magnitude of the association.

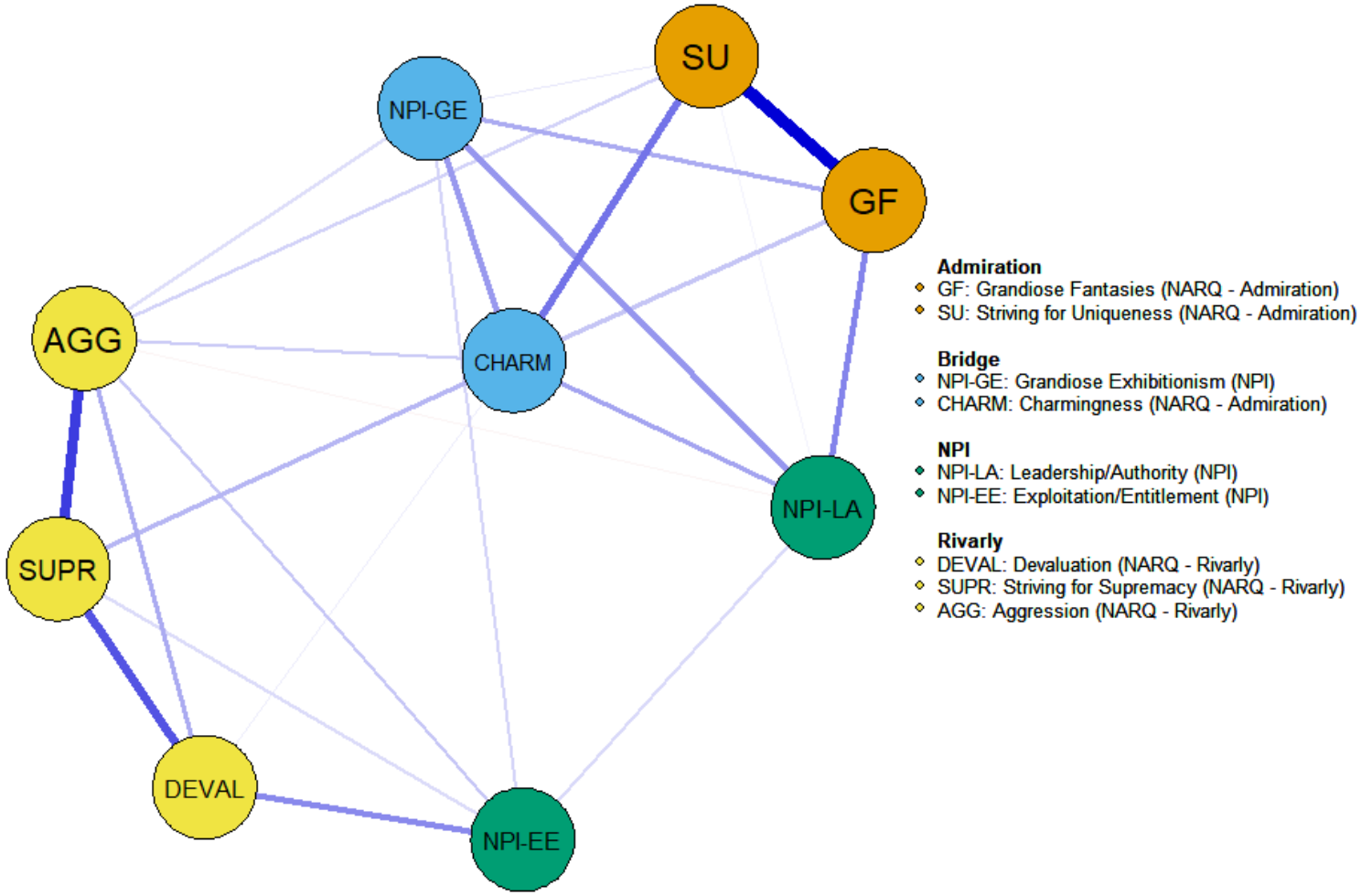

Figure 2. Graphical representation of bridge nodes and pre-defined communities from Sample 1's network. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

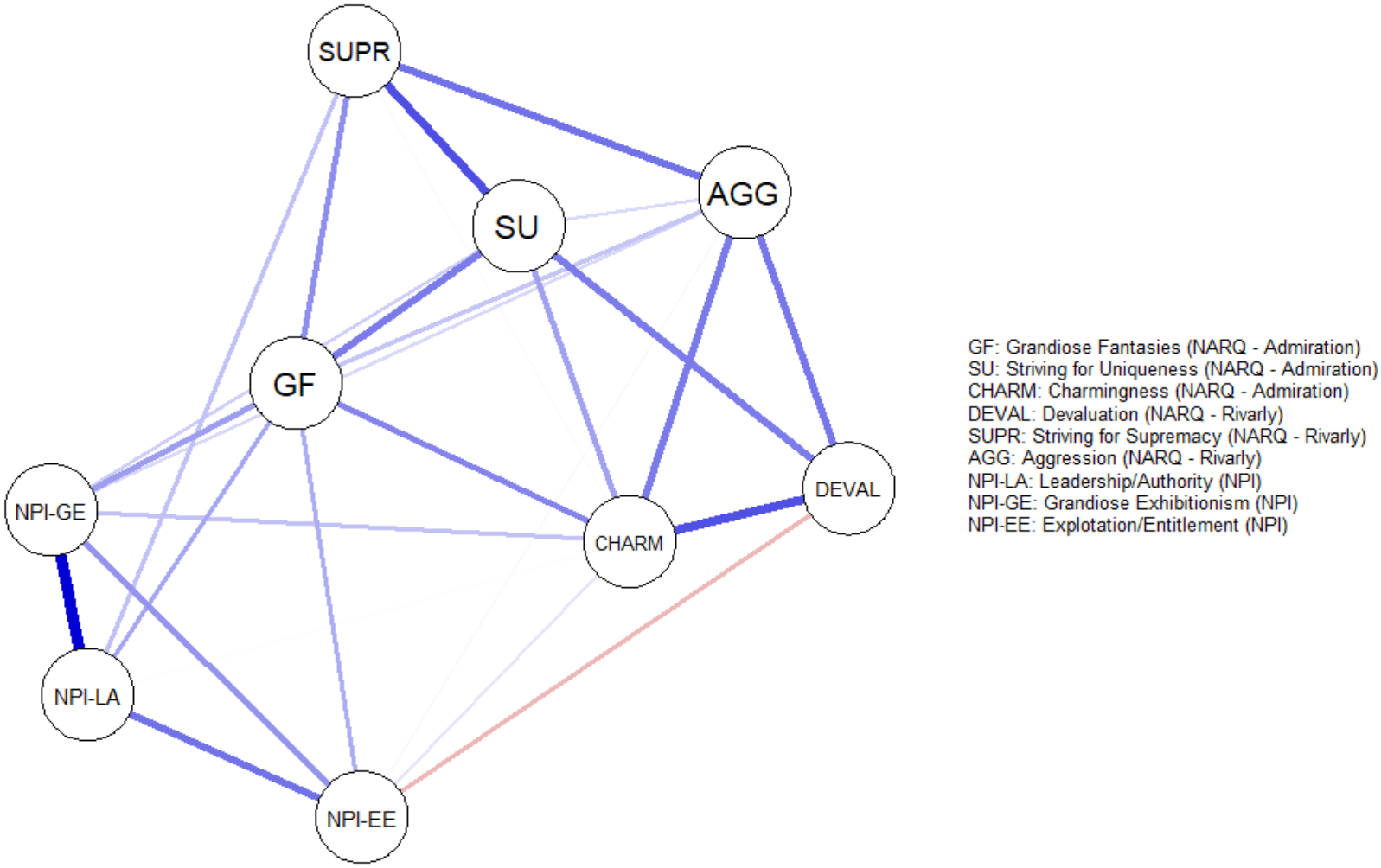

Figure 3. Graphical representation of the *EBICglasso* network from Sample 2. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

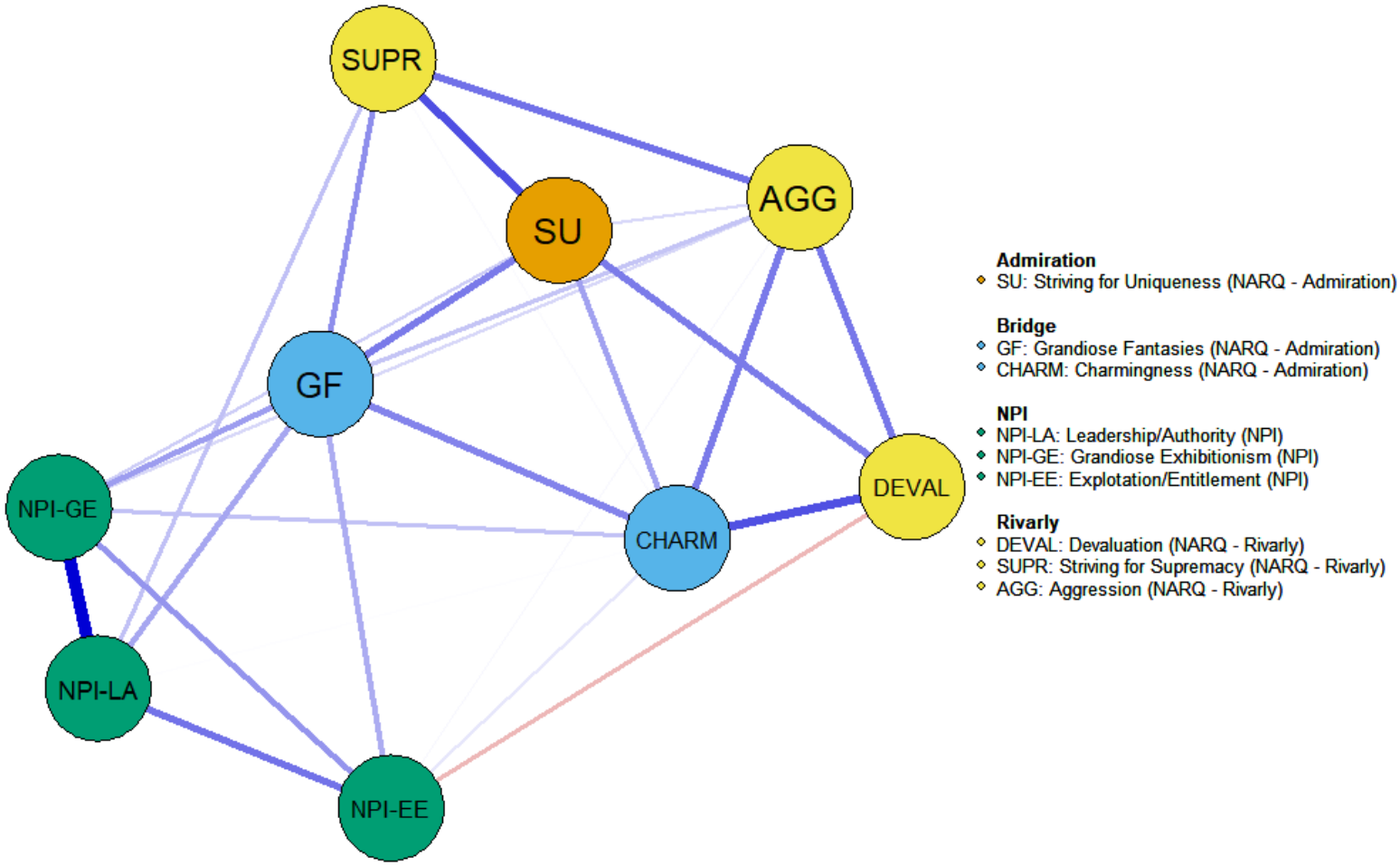

Figure 4. Graphical representation of bridge nodes and pre-defined communities from Sample 2's network. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

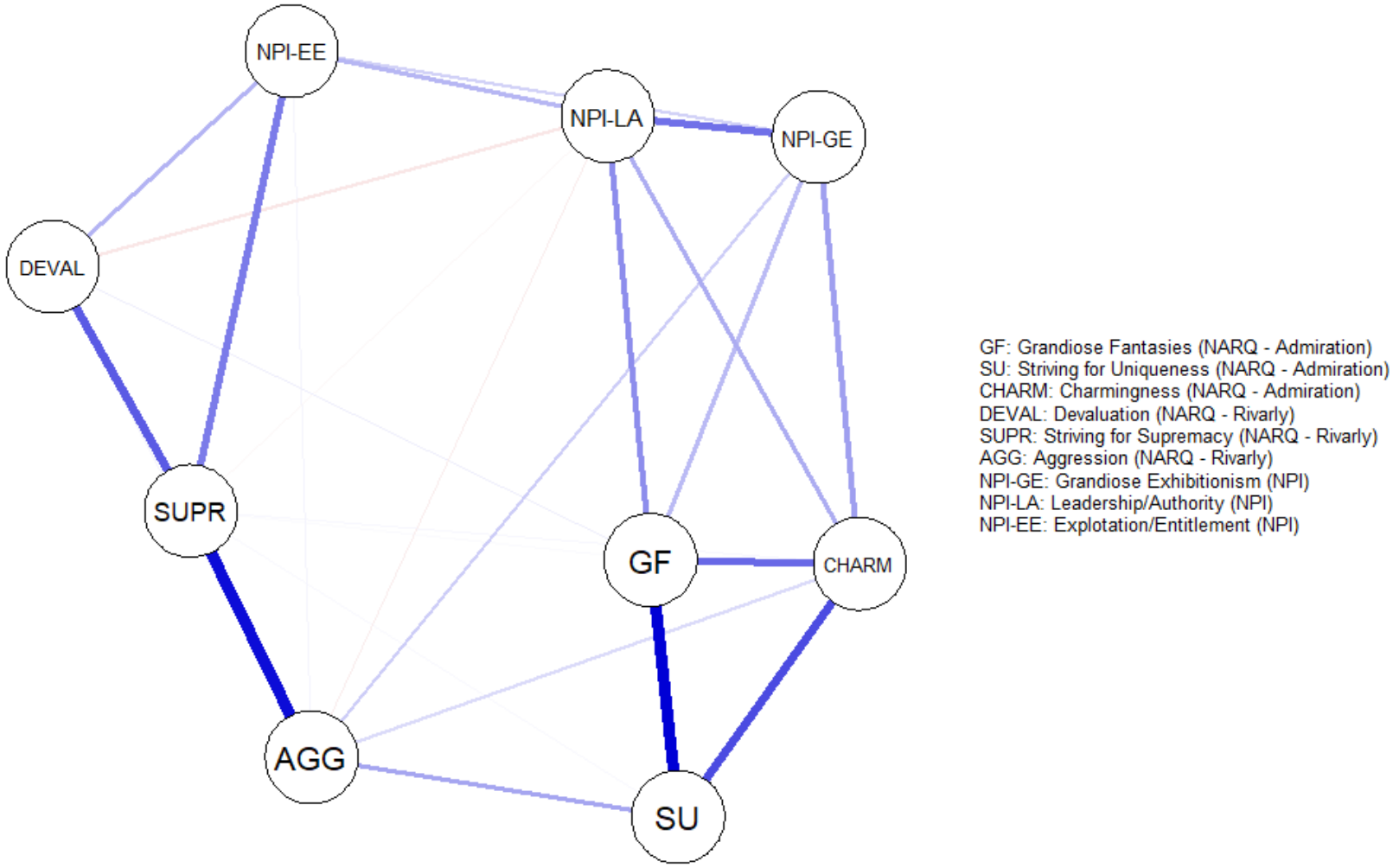

Figure 5. Graphical representation of the *EBICglasso* network from Sample 3. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

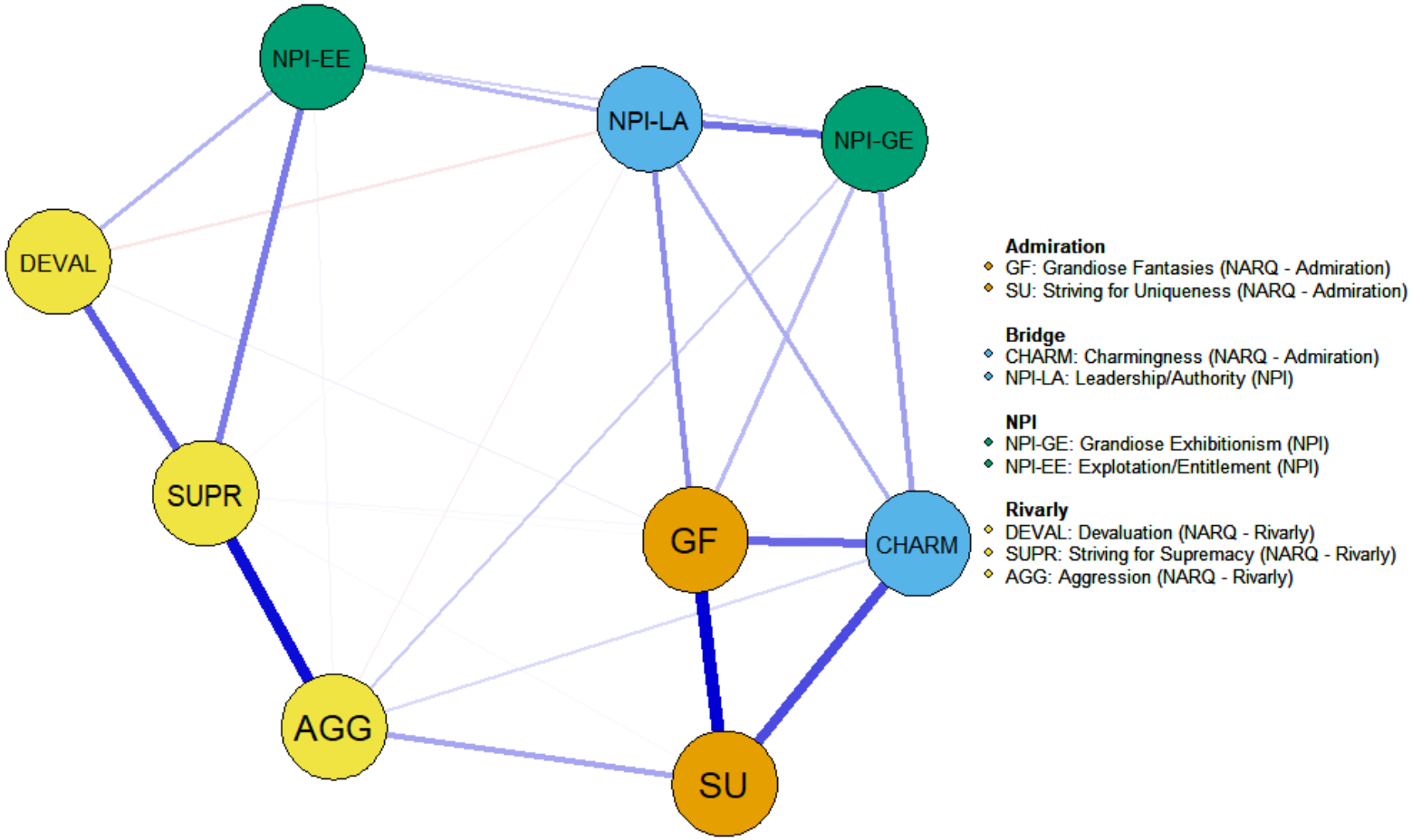

Figure 6. Graphical representation of bridge nodes and pre-defined communities from Sample 3's network. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

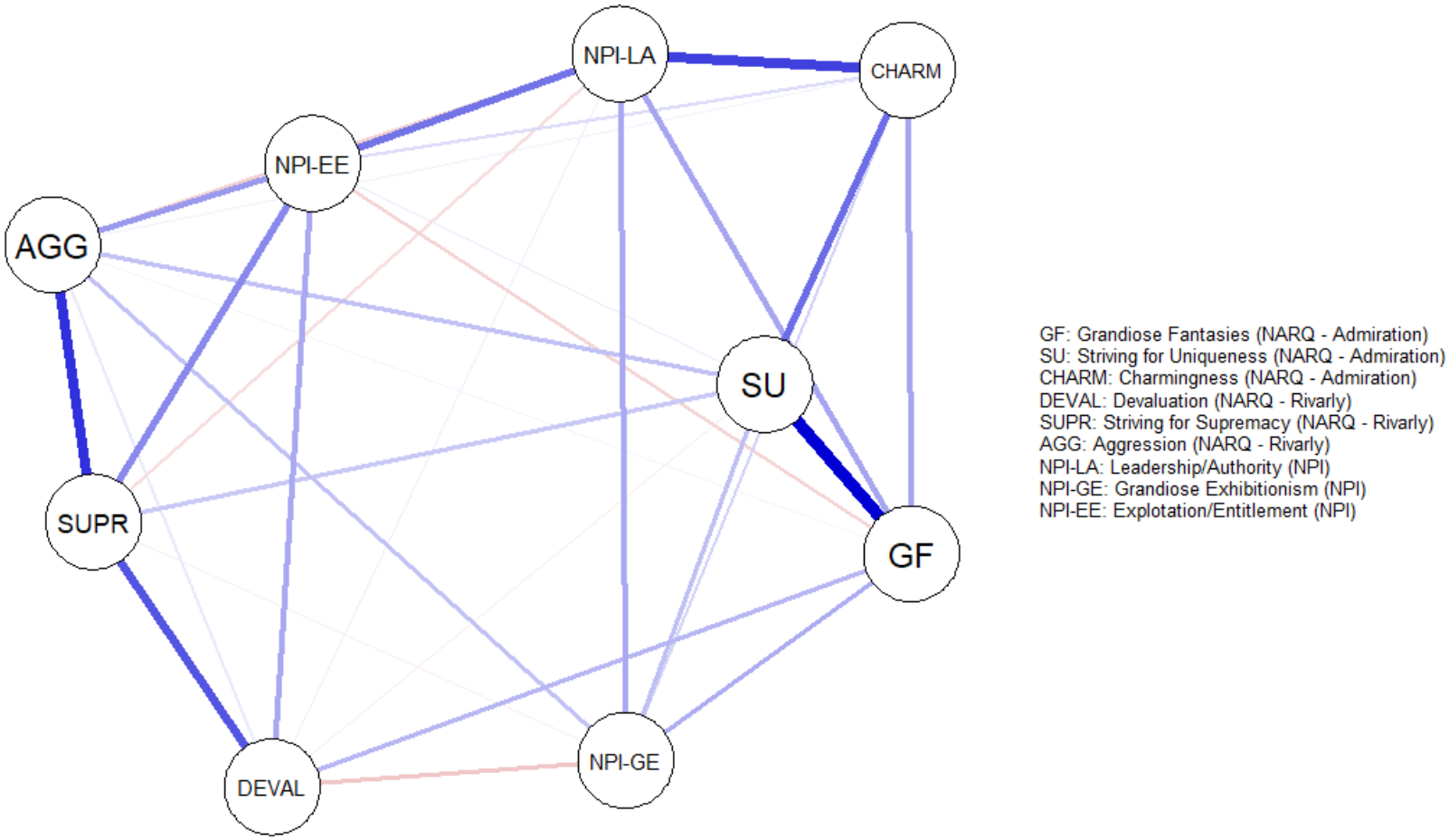

Figure 7. Graphical representation of the *EBICglasso* network from Sample 4. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

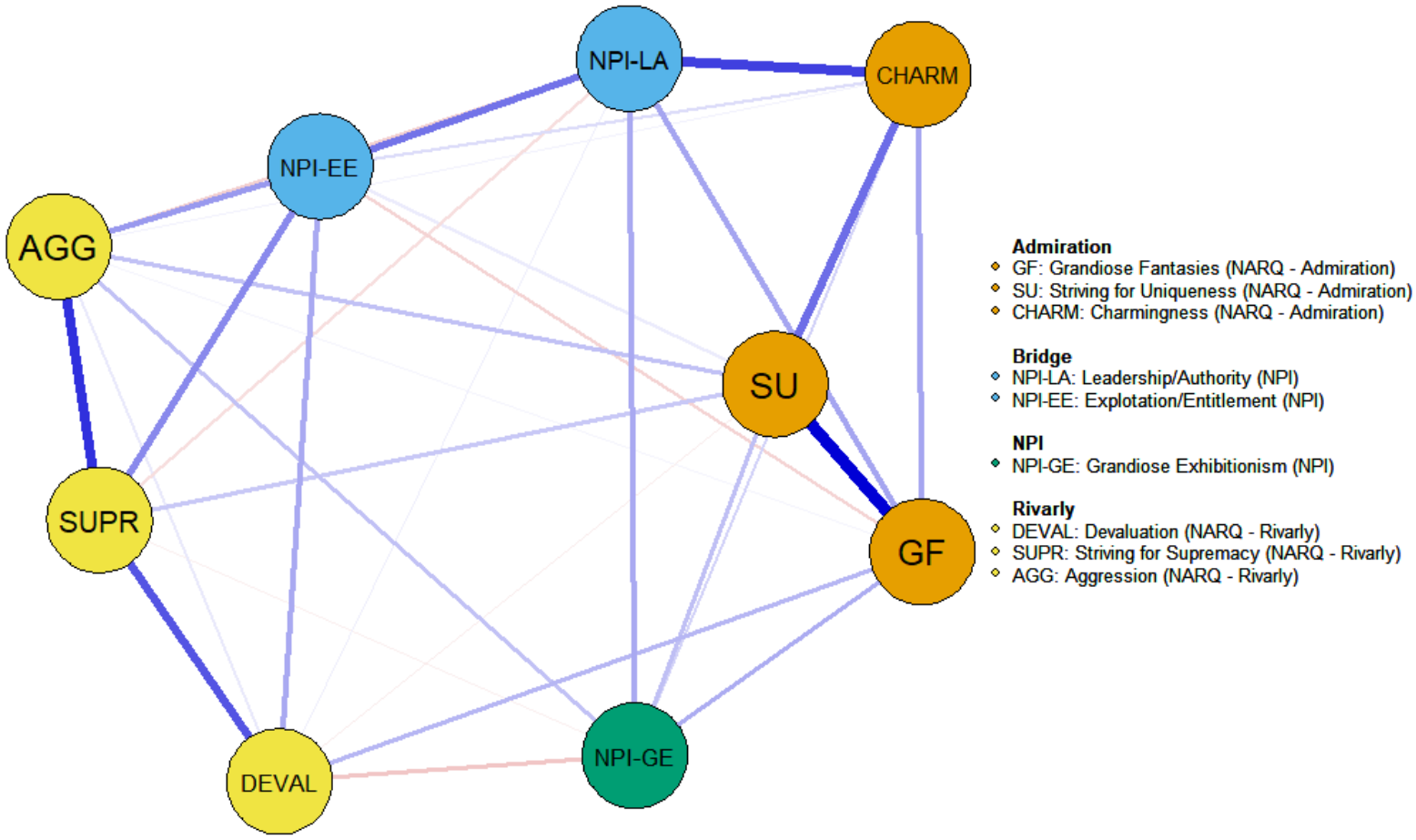

Figure 8. Graphical representation of bridge nodes and pre-defined communities from Sample 4's network. Blue lines represent positive associations and red lines represent negative associations. Edge thickness represents the magnitude of the association.

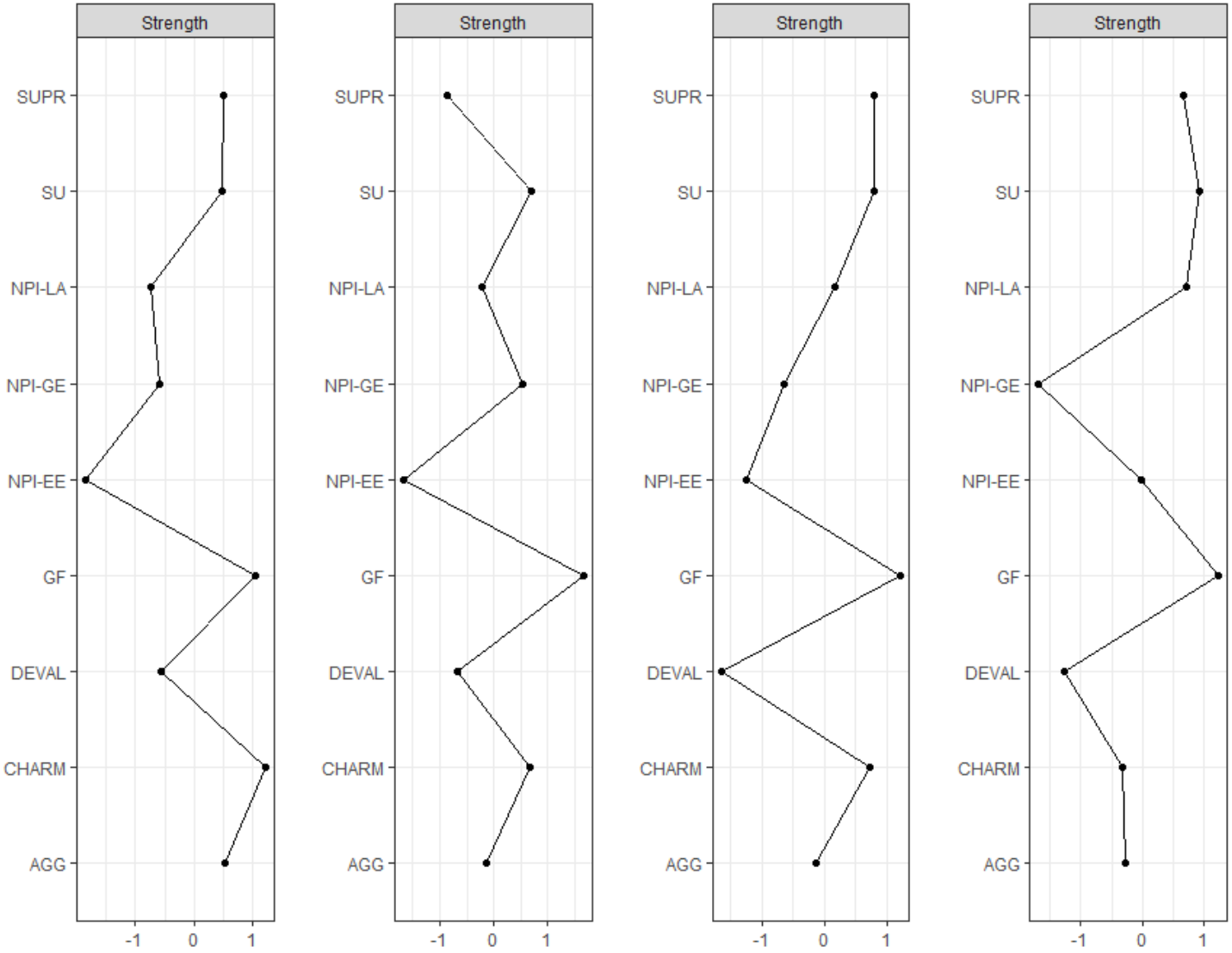

Figure 9. Strength centrality metrics (standardized) for the four networks presented in this manuscript. From left to right: Sample 1, Sample 2, Sample 3, and Sample 4.

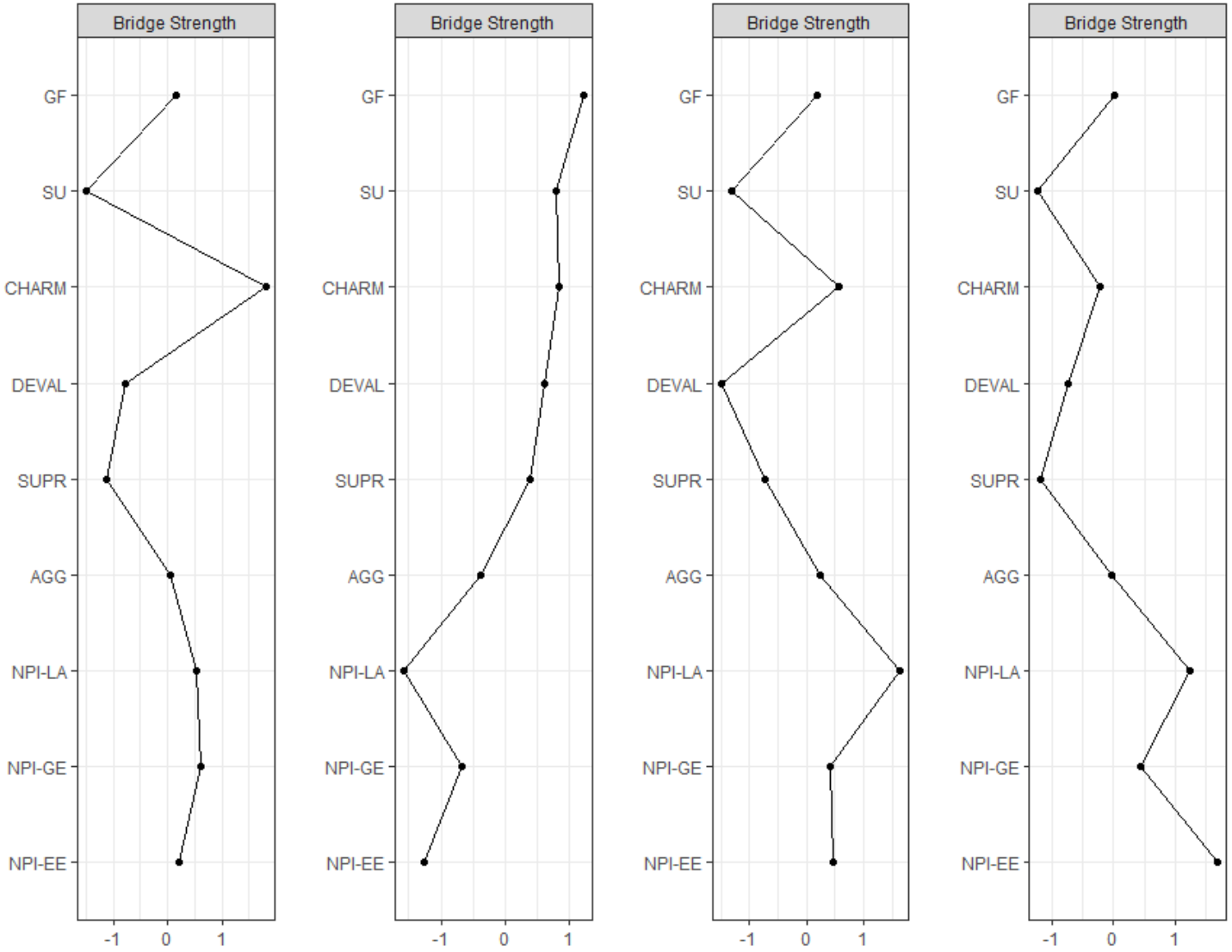

Figure 10. Bridge strength centrality metrics (standardized) for the four networks presented in this manuscript. From left to right: Sample 1, Sample 2, Sample 3, and Sample 4.