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Multidimensional Structure of the Hypomanic Personality Scale

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The structure of the Hypomanic Personality Scale was explored in a sample of young adults ($N = 884$); resulting structures were validated on subsamples with measures of personality traits, internalizing symptoms, and externalizing behaviors. Hierarchical cluster analysis and estimates of general factor saturation suggested the presence of a weak general factor, as well as 3 subordinate clusters. The 3-cluster subscales (Social Vitality, Mood Volatility, and Excitement) were moderately correlated but conceptually distinct and were correlated in opposing patterns with a range of personality and psychopathology measures. Results show that cluster subscales suppress total score associations with validity measures. Recommendations are made to analyze Hypomanic Personality Scale data by subscale, and theoretical implications are discussed.

Keywords: hypomanic personality, cluster analysis, negative emotionality, positive emotionality

Normal personality dimensions are increasingly acknowledged to provide an important conceptual framework for identifying latent factors underlying the structure of psychological disorders (Clark, 2005). Unipolar mood disorders (major depressive disorder and dysthymic disorder) have been repeatedly linked in concurrent designs to two of the Big Five (Goldberg, 1993) personality traits: high levels of neuroticism/negative emotionality (NE) and, less consistently, low levels of extraversion/positive emotionality (PE; Clark, Watson, & Mineka, 1994). The developmental literature suggests these traits may represent early-emerging precursors or predispositions for depression (Klein, Durbin, & Shankman, 2009). In adults, there is evidence that NE is both a premorbid risk factor evident before depression onset (e.g., Kendler, Kuhn, & Prescott, 2004; Ormel, Oldehinkel, & Vollebergh, 2004) and a marker of improvement in treatment above and beyond symptom change (Tang et al., 2009).

By contrast, research on personality risk factors for bipolar disorder has been less consistent, with some studies demonstrating high levels of PE in bipolar disorder, some high levels of NE, and many reporting no association for these traits (Klein et al., 2009; Tackett, Quilty, Selbom, Rector, & Bagby, 2008). Individuals thought to be vulnerable for bipolar disorder are described as energetic, gregarious, and driven to pursue ambitious goals (Akiskal & Akiskal, 2005; Eckblad & Chapman, 1986; Johnson, 2005). Their premorbid functioning may be characterized by subthreshold manifestations of mania, such as irritability, mood swings, entitlement, risk taking, and impulsivity (including substance abuse), and contentious social relationships (Eckblad & Chapman, 1986; Johnson, 2005; Krumm-Merabet & Meyer, 2005; B. Meyer, Rahman, & Shepherd, 2007). These hypothesized precursors are conceptually linked to several of the Big Five traits (Neuroticism, Extraversion, Agreeableness, and Conscientiousness) and include behaviors consistent with both internalizing and externalizing disorders (Kendler, Prescott, Myers, & Neale, 2003; Krueger, 1999; Vollebergh et al., 2001).

In an effort to capture the personality profile that might reflect risk for bipolar disorder in a single instrument, Eckblad and Chapman (1986) created the Hypomanic Personality Scale (HPS), a 48-item true–false scale measuring hyperactive, ambitious, and exhibitionistic behaviors as well as feelings of euphoria and flights of thoughts. Among an original sample of 1,519 undergraduates, high scorers on the HPS (those in the top 3%) were more likely to concurrently meet criteria for bipolar spectrum disorders than were control participants with average scores (Eckblad & Chapman, 1986). These 40 top HPS scorers reported more hypomanic (i.e., subthreshold mania) and depressive episodes and schizotypical features. They also reported less interview anxiety, more friction with family and friends, higher overall energy, and more artistic interests than controls, suggesting that the HPS identifies a broad pattern of personality functioning.

A 13-year follow-up of these same high-scoring participants showed that 75% developed hypomanic or manic episodes (Kwapil et al., 2000). Compared with controls, high scorers had more depressive episodes, borderline personality disorder symptoms, psychotic-like experiences, substance and alcohol problems, and a trend toward more arrests. Consistent with these findings, in a separate longitudinal study of a large adolescent sample (Klein, Lewinsohn, & Seeley, 1996), elevations on an abbreviated version of the HPS predicted both internalizing and externalizing problems about one year later as well as a broad range of measures of psychosocial dysfunction. Among participants who had a history of mood disorder, high HPS scores predicted a more severe course of depression and more suicide attempts.

The ability of the HPS to predict such a broad range of mental disorders and life-functioning outcomes suggests that this scale is likely multidimensional, tapping several underlying dimensions

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reflecting aspects of both abnormal and normal functioning. If this were the case, then one would expect the HPS to show associations with multiple personality traits. Only a few studies have examined the relationship between the HPS and normal personality traits. Two studies have found small to moderate (.25 to .45) zero-order correlations with the Big Five traits of Extraversion and Openness to Experience but have found weak or no effects for the other three traits (Furnham, Batey, Anand, & Manfield, 2008; T. D. Meyer, 2002). The lack of association with Neuroticism is puzzling, given that the HPS predicts depressive episodes and severity (Klein et al., 1996; Kwapil et al., 2000). Several studies have focused on the role of individual differences in self-report measures of the Behavioral Activation (or Facilitation) System (Carver & White, 1994), a broad neurobiological system hypothesized to underlie bipolar disorder (Depue & Iacono, 1989). HPS scores have been found to be positively associated with at least one Behavioral Activation System subscale (Reward Responsivity; B. Meyer, Johnson, & Carver, 1999; B. Meyer, Johnson, & Winters, 2001). However, Durbin, Schalet, Hayden, Simpson, and Jordan (2009) demonstrated that HPS scores were uniquely predicted by three higher order traits—Extraversion, Openness, and Conscientiousness—and that these associations were evident over and above self-reported Behavioral Activation System scales.

Taken together, the heterogeneous content of the HPS items (shown in Table 1), its range of psychiatric and normal functioning correlates, and evidence that the HPS is correlated with three of the Big Five personality dimensions strongly suggest the presence of multiple group factors within the HPS. For example, the HPS predicts both internalizing problems (such as depressive episodes) and externalizing disorders (e.g., substance abuse), which typically form distinct factors (Krueger, 1999; Vollebergh et al., 2001). Thus, it is possible that the overall scale score obscures group factors that may more cleanly account for the divergent correlates of the HPS. The estimate of reliability most commonly reported for studies using the HPS is Cronbach's alpha; however, although alpha indicates the extent to which a scale's total score may correlate with some other measure, it tells us little about the unidimensionality versus multidimensionality of the scale (Revelle & Zinbarg, 2009).

To date, efforts to elucidate the structure of the HPS have included only two published structural analyses and one item response theory analysis. In their original study, Eckblad and Chapman (1986) reported briefly on a principal components analysis with varimax rotation, which yielded 12 components with eigenvalues higher than 1. The first component accounted for 14.3% of the variance and included 15 items (loadings above .3) that mostly measured hypomanic symptoms. The second factor (containing six items with factor loadings above .3) accounted for 6.3% of the variance and seemed to reflect exhibitionism. Little variance was explained by each additional factor, leaving the structure of the additional 27 items unresolved. Of note, the orthogonal rotation precluded examination of whether the underlying factors were intercorrelated.

Rawlings, Barrantes-Vidal, Claridge, McCreery, and Galanos (2000) analyzed three samples, using maximum-likelihood factor analysis with promax rotation. The three samples produced somewhat different factor structures; these authors noted in their discussion that their Spanish translation of the HPS (which was not independently validated prior to the study) may have contributed to unreliable results for one of the samples. In addition, the second sample, consisting of Australian participants, was relatively small ($N = 158$) compared with their third sample ($N = 1{,}073$) of British participants. Analyzing the British sample, Rawlings et al. found that four factors emerged (interpreting the Cattel scree plot), accounting for 33% of the common variance in the HPS; the factors correlated moderately to weakly with one other. Rawlings et al. described these factors as Moodiness, Cognitive Elements, Hyper-Sociability, and Ordinariness. Inspecting the pattern matrix table of the largest sample, one finds that the first factor clearly includes the hyperactivity and mood fluctuations characteristic of manic and hypomanic symptoms. The remaining factors are more difficult to interpret. For example, the second factor contained a mix of cognitive capacity items ("Sometimes ideas and insights come to me so fast that I cannot express them all") and social potency items ("I have an uncommon ability to persuade and inspire others"). The Ordinariness (fourth) factor contained only reverse-coded items, suggesting that wording polarity likely influenced factor extraction. The first factor dominated the scale, with 19 items loading higher than .3. The remaining factors had approximately eight items, each loading greater than .3; six did not load higher than .3 on any factor. Given the number of low loadings, a high level of uniqueness may be associated with each item. Finally, it should be noted that neither Rawlings et al. nor Eckblad and Chapman (1986) validated the factors against any criterion measures.

Finally, Meads and Bentall (2008) applied a Rasch model (one-parameter item response theory) to a sample of 318 students who completed the HPS. This produced a 20-item unidimensional scale after redundancies and misfitted items were eliminated. The 20-item version and the original full scale had similar correlations with symptoms of depression, rumination, and reports of dangerous activities. A potential problem with this approach is that meaningful group variance may be eliminated when the aim is to produce a single scale with one dimension, rather than to explicitly model the empirical structure of the items.

The present study represents an attempt to clarify the structure of the HPS, improving on some of the analytic procedures of previous studies and validating this structure with a range of important criterion variables. One challenge to this aim is the dichotomous response format of the HPS. Dichotomous items may be prone to factor or cluster together on the basis of equal endorsement probability (Ferguson, 1941; Panter, Swygert, Dahlstrom, & Tanaka, 1997). For example, two items can achieve a perfect correlation only if their endorsement probabilities are also equal. Because items may be endorsed according to thresholds in addition to content, any analytic procedure that depends on interitem correlations may overestimate the number of factors and underestimate the factor loadings. One improvement is to estimate tetrachoric correlations on the basis of the item intercorrelations (Divgi, 1979; Wherry & Gaylord, 1944).

Like factor analysis, hierarchical cluster analysis can be used to explore the structural relationship among items (Bacon, 2001; Revelle, 1979; Tate, 2003; van Abswoude, Vermunt, Hemker, & van der Ark, 2004). One type of hierarchical cluster analysis, ICLUST (Revelle, 1979) follows a four-step algorithm in which estimates of reliability form the basis for clustering decisions. In the first step, the two items with the highest corrected correlation are combined. As small clusters are matched on the basis of the

Table 1
Three-Cluster Model of the Hypomanic Personality Scale

Scale item	Social Vitality	Mood Volatility	Excitement
42. I seem to have an uncommon ability to persuade and inspire others.	**0.69**	0.22	0.30
40. At social gatherings, I am usually the "life of the party."	**0.67**	0.24	0.45
6. When with groups of people, I usually prefer to let someone else be the center . . .	**−0.64**	−0.27	−0.45
25. When I go to a gathering where I don't know anyone, it usually takes me a while . . .	**−0.59**	−0.09	−0.31
7. In unfamiliar surroundings, I am often so assertive and sociable that I surprise . . .	**0.58**	0.21	0.36
29. I have often persuaded groups of friends to do something really adventurous or crazy.	**0.56**	0.32	0.40
16. I can't imagine that anyone would ever write a book about my life.	**−0.55**	−0.16	−0.17
26. I think I would make a good actor, because I can play many roles convincingly.	**0.55**	0.33	0.33
39. I am so good at controlling others that it sometimes scares me.	**0.54**	0.28	0.22
2. It would make me nervous to play the clown in front of other people.	**−0.53**	−0.14	−0.31
4. I think I would make a good nightclub comedian.	**0.53**	0.23	0.25
34. There are so many fields I could succeed in that it seems a shame to have to pick . . .	**0.53**	0.19	0.18
1. I consider myself to be pretty much an average kind of person.	**−0.52**	−0.20	−0.14
36. I find it easy to get others to become sexually interested in me.	**0.52**	0.14	0.25
47. I would rather be an ordinary success in life than a spectacular failure.	**−0.49**	−0.30	−0.23
30. I would really enjoy being a politician and hitting the campaign trail.	**0.48**	0.06	0.15
23. I expect that someday I will succeed in several different professions.	**0.47**	0.18	0.19
13. People often come to me when they need a clever idea.	**0.46**	0.13	0.15
19. I have such a wide range of interests that I often don't know what to do next.	**0.46**	0.37	0.32
48. A hundred years after I'm dead, my achievements will probably have been forgotten.	**−0.45**	−0.11	−0.22
27. I like to have others think of me as a normal kind of person.	**−0.44**	−0.33	−0.30
14. I am no more self-aware than the majority of people.	**−0.31**	−0.17	−0.16
44. I frequently get into moods where I feel very speeded-up and irritable.	0.12	**0.70**	0.32
38. I frequently find that my thoughts are racing.	0.31	**0.67**	0.40
21. My moods do not seem to fluctuate any more than most people's do.	−0.23	**−0.65**	−0.41
20. There have often been times when I had such an excess of energy that I felt little . . .	0.26	**0.64**	0.51
37. I seem to be a person whose mood goes up and down easily.	−0.02	**0.63**	0.23
8. There are often times when I am so restless that it is impossible for me to sit still.	0.20	**0.61**	0.48
35. I often get into moods where I feel like many of the rules of life don't apply to me.	0.39	**0.59**	0.30
5. Sometimes ideas and insights come to me so fast that I cannot express them all.	0.35	**0.58**	0.35
31. I can usually slow myself down when I want to.	−0.22	**−0.57**	−0.38
45. I have often felt happy and irritable at the same time.	0.19	**0.55**	0.26
10. When I feel an emotion, I usually feel it with extreme intensity.	0.19	**0.55**	0.40
22. I very frequently get into moods where I wish I could be everywhere and do everything . . .	0.40	**0.55**	0.46
9. Many people consider me to be amusing but kind of eccentric.	0.28	**0.54**	0.44
43. I have often been so excited about an involving project that I didn't care about eating . . .	0.28	**0.53**	0.34
41. I do most of my best work during brief periods of intense inspiration.	0.20	**0.51**	0.28
32. I am considered to be kind of a "hyper" person.	0.37	0.48	**0.82**
33. I often get so happy and energetic that I am almost giddy.	0.35	0.46	**0.83**
3. I am frequently so "hyper" that my friends kiddingly ask me what drug I'm taking.	0.33	0.54	**0.79**
11. I am frequently in such high spirits that I can't concentrate on any one thing for too . . .	0.33	0.54	**0.79**
46. I often get into excited moods where it's almost impossible for me to stop talking.	0.32	0.57	**0.68**
17. I am usually in an average sort of mood, not too high and not too low.	−0.44	−0.42	**−0.66**
15. I often feel excited and happy for no apparent reason.	0.25	0.25	**0.62**
18. I often have moods where I feel so energetic and optimistic that I feel I could . . .	0.52	0.38	**0.59**
12. I sometimes have felt that nothing can happen to me until I do what I am meant to . . .	−0.25	0.28	0.21
24. When I feel very excited and happy, I almost always know the reason why.	0.14	−0.28	−0.36
28. I frequently write down the thoughts and insights that come to me when I am thinking . . .	−0.24	0.36	0.20

Note. Structure matrix of cluster loadings. ICLUST analysis was based on tetrachoric correlations. Items 12, 24, and 28 were dropped from the clusters prior to calculating cluster loadings. Items with loadings in bold were included in the corresponding cluster.

highest correlating pairs, the combination of two subclusters proceeds only when estimates of internal consistency (Cronbach's alpha) and of unidimensionality (as measured by Revelle's beta) of the combined cluster increase according to preselected criteria. Revelle's beta, the worst split-half correlation of any given set of items, is an estimate of the unidimensionality (or general factor saturation) of a set of intercorrelated items (Zinbarg, Revelle, Yovel, & Li, 2005). Because subclusters are combined only when beta increases, the general saturation factor is maximized in the final solution. This algorithm may prevent the pitfall of overfactoring, certainly in comparison with push-button factor analysis, applying the eigenvalue greater than 1.0 rule (Revelle, 1979). A second benefit of ICLUST is that the hierarchical cluster–subcluster relationships are easily inspected, such that researchers may select only those cohesive (sub)clusters that are of theoretical interest. By contrast, in traditional factor analysis, the relationships between items across different correlated factors are obscured. Finally, by identifying decreases in beta as individual items are added to each subcluster, ICLUST may identify items that fit poorly into the scale (see Cooksey & Soutar, 2006).

For the purposes of contrast, we also report on a more traditional factor analysis of the HPS, using ordinary least squares estimation.

In this analysis, we wished to improve on the factor selection methods of Eckblad and Chapman (1986) and Rawlings et al. (2000). Although Eckblad and Chapman did not specifically note the number of components in their brief description, they did reference the eigenvalue greater than 1.0 rule (Guttman, 1954; Kaiser, 1960). Rawlings et al. (2000), on the other hand, examined the scree plot to select four factors (Cattell, 1966). Both procedures are imperfect: The eigenvalue rule often leads to grossly overextracting factors, and interpreting the scree plot is somewhat subjective (Lance, Butts, & Michels, 2006). An improved approach may be the Very Simple Structure (VSS) criterion (Revelle & Rocklin, 1979), which operationalizes the informal procedure for selecting factors on the basis of the number of high loadings per factor. The VSS criterion indexes how well a simplified loadings matrix (with zero loadings replacing low loadings) is able to reproduce the original correlation matrix, given a tolerable level of complexity (defined by the number of nonzero loadings per item). A factor solution is then selected to maximize the VSS goodness of fit index. In the present study, we used the VSS index to assist in the factor number selection.

The goals of this research were therefore threefold. In Study 1, our goal was to explore the structure of the HPS, using hierarchical cluster analysis and factor analysis. Given the heterogeneous content of the HPS and the four-factor structure found by Rawlings et al. (2000), we expected that ICLUST and factor analysis would produce a multicluster structure. In Study 2, our aim was to test the criterion validity of the resulting subscales. We administered personality and psychopathology questionnaires to subsets of our larger sample, including measures of internalizing (e.g., worry and depression) and externalizing symptoms (e.g., aggression, drug use, sexual risk taking) and normal and abnormal personality traits. Our final aim was to use this structure (or structures) to generate testable hypotheses about the nature of hypomanic personality and, by extension, personality risk for bipolar disorder.

Study 1

Method

Participants. The sample consisted of 884 undergraduate students enrolled in introductory psychology courses at Northwestern University from 2006 through 2009. Students received course credit for participation. Because of institutional review board restrictions on maintaining identifying information during some of the data collection period, data on age and gender were available for 565 participants. Female participants were somewhat overrepresented (56.9%), and the mean participant age was 18.9 (SD = 1.02). Data on ethnicity were available for 443 participants. The sample was somewhat ethnically diverse; participants largely identified themselves as European American/White (60.9%), followed by Asian American (22.9%), biracial (7.2%), Hispanic American (5.4%), and African American/Black (3.6%).

Procedure. Most participants (n = 818) completed the HPS as part of a questionnaire packet administered during class. The remainder did so prior to participating in laboratory tasks designed to measure personality (Durbin et al., 2009).

Measure: HPS. The HPS (Eckblad & Chapman, 1986) measures dispositional hypomanic characteristics, consisting of 48 true–false items (see Table 1). An example of an item is, "There have often been times when I had such an excess of energy that I felt little need to sleep at night." The HPS has been shown to have high test–retest reliability over 15 weeks (Eckblad & Chapman, 1986). In the current sample, scores ranged from 0 to 45 (M = 17.74, SD = 8.36), and the internal consistency reliability was good (α = .87, ω_t = .88). The mean on the HPS in this sample was comparable with that from other recent studies using similarly aged participants (Meads & Bentall, 2008; T. D. Meyer, 2002; Rawlings et al., 2000) but was approximately one half of a standard deviation lower than that reported by Eckblad and Chapman (1986).

Data analysis. First, we used the dichotomous HPS data to create a tetrachoric correlation matrix. We estimated a tetrachoric correlation matrix, using the hetcor function of the **polycor** package (Fox, 2010) available in **R** (R Core Development Team, 2010). This procedure estimates the underlying Pearson correlation if the dichotomous data were taken from a bivariate normal distribution; it eliminates the effect of response frequency and thus corrects for the reduction in absolute correlation found in dichotomous correlations. The mean interitem correlation of the tetrachoric correlation matrix was .21 (compared with .12 for the original matrix). Cluster analysis of the HPS data set was done with the resulting matrix. Next, we ran ICLUST (**psych** package; Revelle, 2009), first applying the average beta criterion. The two crucial criteria are as follows: (a) for two clusters of three or more items, combine only if the resulting cluster increases alpha past the maximum of the two subclusters, and (b) for two clusters of four items or more, combine only if the resulting cluster increases beta beyond the average of the two. We subsequently explored a second solution by increasing the beta criterion such that the beta of the combined cluster must be higher than the maximum of the two subclusters.

Factor analysis proceeded as follows. The tetrachoric correlation matrix was factor analyzed with ordinary least squares estimation; the VSS (Revelle & Rocklin, 1979) criterion was applied to the correlation matrix to determine the number of factors to extract. VSS is an exploratory procedure that formalizes the selection of the number of factors by treating low factor loadings as zero loadings. A VSS index plot allows one to see how well a factor pattern matrix can reproduce the actual correlation matrix for solutions that differ by factor number and complexity (the number of nonzero loadings per item). To measure the similarity between the solutions from the factoring and clustering methods, we also calculated factor-cluster congruence coefficients of the loadings matrices. The congruence coefficient is the cosine of the angle of the two factor loading vectors, taken from the origin. Though similar in form to a correlation coefficient, the mean loading is not subtracted when doing the calculations.

Results

Hierarchical cluster analysis (ICLUST). We first applied the average-beta criterion ICLUST analysis to the tetrachoric correlation matrix. The result was a one-cluster solution (standardized α = .92, β = .68), with three identifiable subordinate clusters. When we increased the reliability beta criterion (combine only if the beta of the new cluster is higher than either subscluster), the clustering also stopped at three clusters. These clusters, broadly speaking, encompassed items tapping affect and cognition (26

items), social potency/sociability (13 items), and considering oneself to be average (9 items).

Before we finalized our cluster solution, we inspected the graphical output to detect poor fitting items, marked by steep reductions in beta as items/small subclusters are added to larger subclusters. Four items on the affect/cognition cluster (Items 12, 15, 24, and 28) resulted in a noticeable drop in beta. Before deciding to delete any of these items, we examined how beta changed with the addition of each single item to the 22-item affect cluster. With the addition of Items 12, 24, and 28, beta changed from .70 to quite low levels (.48, .43, and .50, respectively). The addition of Item 15, however, left beta virtually unchanged at .69. Given that our primary purpose was to determine unidimensional clusters, we dropped Item 12 ("I sometimes have felt that nothing can happen to me until I do what I am meant to do in life"), Item 24 ("When I feel very excited and happy, I almost always know the reason why"), and Item 28 ("I frequently write down the thoughts and insights that come to me when I am thinking especially creatively"), but we retained Item 15 to create a 45-item version of the HPS. Finally, it should be noted that the higher beta of the 45-item HPS (.66) compared with the 48-item HPS (.54) substantially changes the estimate of test variance explained by the general factor (44% vs. 25%).

Applying the maximum-beta criterion in ICLUST to the 45-item HPS, a three-cluster solution emerged. Table 1 shows the structure matrix of this solution and Figure 1 shows the hierarchical cluster–subcluster relationships.[1] According to the highest loading items, the three clusters seemed clearly distinguished by their content, with the first cluster—labeled *Mood Volatility* (tapping negative and unpredictable mood states and hypomanic cognition), *Excitement* (energetic and highly cheerful mood), and *Social Vitality* (social potency and vivaciousness). The Excitement and Mood Volatility clusters showed the highest intercorrelation ($r = .52$, $p < .05$); the Social Vitality cluster correlated moderately with both the Excitement ($r = .42$, $p < .05$) and the Mood Volatility cluster ($r = .35$, $p < .05$).[2] All items in the clusters were subsequently included in the corresponding subscales, regardless of their loading size.

Factor analysis. We started our analysis with the VSS procedure, using the full 48-item tetrachoric correlation matrix. We applied VSS with a variety of factoring methods (ordinary least squares, maximum-likelihood, principal axis, generalized least squares) and rotations (promax and oblimin). The VSS index peaked most frequently at two-factor solutions at a reasonable level of complexity (allowing one or two nonzero loadings per item). Increasing the level of complexity, the VSS index also peaked at three factors. We decided to examine the two- and three-factor structures.

The eigenvalues of the first two factors of the ordinary least squares analysis were 11.1 and 4.3, explaining 22% of the common variance. In the three-factor solution, the eigenvalue of the third factor was 2.7, with the three factors explaining 31% of the variance. These values contrast with the smaller eigenvalues of Rawlings et al.'s (2000) largest sample, which were 9.1, 2.7, and 2.2; our larger values are likely due to the use of tetrachoric correlations. The second and third factors correlated modestly, $r = .33$, with both factors reflecting emotional content (mood volatility and excitement). The first factor, reflecting mostly negatively scored extraversion items, correlated negatively with the factors tapping mood volatility ($r = -.32$) and excitement ($r = -.17$). The pattern matrix is shown in Table 2.

To test for similarity among the factor and cluster solutions, we calculated the factor–cluster congruence coefficients. This required us first to repeat the factor analyses on the 45-item scales. As shown in Table 2, the reduction to 45 items appears justified, given that the three items that we eliminated in the cluster analyses (Items 12, 24, and 28) also show the lowest loadings on any single factor as well as the lowest communality estimates. First, we compared the two-factor and two-cluster solutions. The two-cluster solution is easily derived from the three-cluster solution: Relaxing the beta criterion, the two emotional clusters (Mood Volatility and Excitement) combine into one, whereas the Social Vitality cluster remains intact. Factor–cluster congruence was nearly perfect for the two-group solutions (.99 and −.98); consequently, subscales derived from the loadings of either method were identical. Factor–cluster congruence for three-group solutions was also high (.99, .95, .91), reflecting only a single item (18) that would be assigned to a different subscale (to the Social Vitality subscale instead of the Excitement subscale) with factor analysis. Given the similarity between the factor and cluster methods and the theoretical coherence of the three-cluster solution, we selected the three-cluster solution for further reliability and validity analysis.

Comparison with the factor structure of Rawlings et al. (2000). Although Rawlings et al. (2000) reported on factor analyses of three samples, their British sample was by far the largest ($N = 1{,}073$); accordingly, we compare the four-factor pattern matrix of the British sample to ours. Importing this pattern matrix and repeating their analytic procedure (maximum-likelihood factor analysis, promax rotation, selection of four factors) on our dichotomous data, we found that factor congruence between the results of the two studies was low (.78, .82, .52, .52). To better understand how the results of the two studies were different, we mapped the factor assignments (based on the highest loading) onto our cluster solutions. In assigning items to factors extracted by Rawlings et al., we left out three of the lowest loading items (Items 7, 30, and 39). The first factor (Items 8, 10, 11, 15, 17,

[1] Figure 1 shows the solution for the maximum-beta criterion ICLUST prior to purification, which is slightly discrepant with the purified solution presented in Table 1. That is, to optimize ICLUST solutions, reshuffling a few items between clusters is sometimes necessary, based on any possible discrepant cluster–item correlations. Item 46 ("I often get into excited moods where it's almost impossible for me to stop talking") was moved from the Cluster 40 (Mood Volatility) to Cluster 35 (Excitement), and Item 22 ("I very frequently get into moods where I wish I could be everywhere and do everything at once") was moved from Cluster 42 (Social Vitality) to Cluster 40 (Mood Volatility). Figure 1 also shows that a four-cluster solution is defensible. In this structure, the Social Vitality cluster (Cluster 42) would be split into a Sociability/Exhibitionism cluster (Cluster 38) and a Surgency/Achievement cluster (Cluster 41). The reliability estimates for Cluster 38 were quite high ($\beta = .68$, $\omega_h = .74$, on tetrachoric correlations) but were lower for Cluster 41 ($\beta = .58$, $\omega_h = .51$, on tetrachoric correlations). Space limitations precluded us from describing validity correlations for this solution.

[2] These correlations are based on the dichotomous data. Cluster correlations based on the tetrachoric matrix were slightly higher for each (.61, .49, .39).

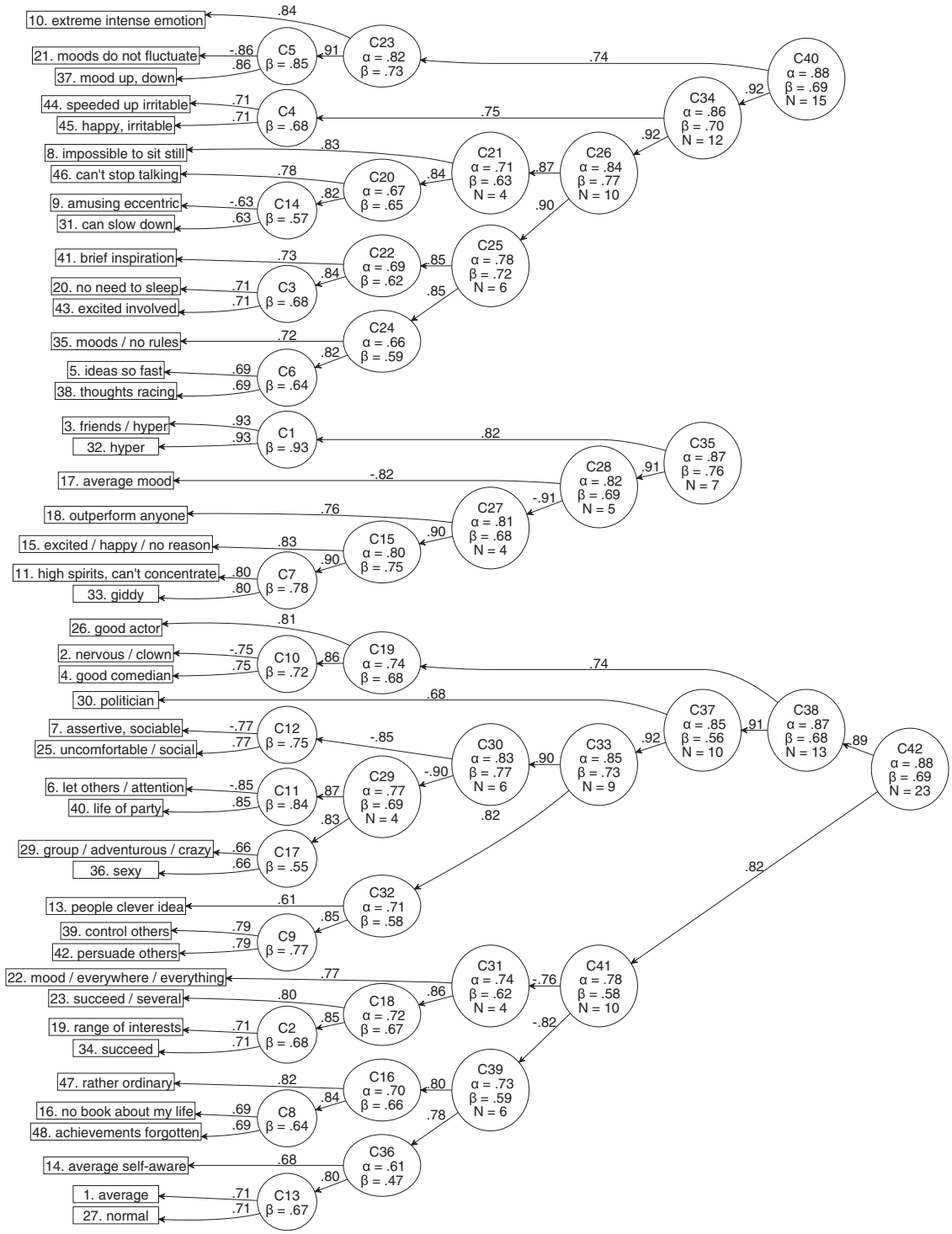

Figure 1. ICLUST output using the maximum beta criterion. Path coefficients represent reliability-corrected correlations. For clusters, alpha was used for the correction; for items, item–total correlations were used as an estimate of reliability. Note that the final purified solution in Table 1 is slightly different from the clustering solution in the figure (see footnote 1). C = Cluster.

Table 2
Three-Factor Model of the Hypomanic Personality Scale

Scale item	Factor 1	Factor 2	Factor 3	h^2
42. Persuade and inspire others	**−0.67**	0.00	0.02	0.47
40. Life of party	**−0.59**	−0.18	0.36	0.57
25. Social discomfort	**0.56**	0.26	−0.26	0.45
16. No book about my life	**0.56**	−0.16	0.19	0.31
36. Can elicit sexual interest	**−0.53**	−0.06	0.04	0.29
34. Succeed	**−0.53**	0.21	−0.21	0.31
7. Assertive, sociable	**−0.53**	−0.07	0.20	0.37
30. Politician	**−0.52**	−0.02	−0.10	0.25
39. Good at controlling others	**−0.52**	0.17	−0.08	0.30
6. Not center of attention	**0.51**	0.18	−0.43	0.54
13. Have clever ideas	**−0.49**	0.03	−0.08	0.22
1. Average person	**0.47**	−0.17	0.16	0.23
23. Succeed in several domains	**−0.46**	0.24	−0.20	0.25
2. Nervous about playing the clown	**0.46**	0.18	−0.27	0.33
26. Good actor	**−0.46**	0.14	0.11	0.30
29. Have persuaded others to be adventurous, crazy	**−0.45**	0.07	0.20	0.33
4. Good comedian	**−0.45**	0.01	0.12	0.26
48. Achievements will be forgotten	**0.43**	−0.09	0.08	0.19
47. Rather be ordinary	**0.43**	−0.27	0.11	0.25
18. Feel I can outperform anyone	−0.41	0.24	0.15	0.34
27. Normal person	**0.29**	−0.24	−0.06	0.19
38. Thoughts racing	−0.09	**0.61**	0.10	0.46
44. Speeded-up and irritable	0.10	**0.61**	0.12	0.42
37. Moods up and down	0.25	**0.58**	0.14	0.40
21. Moods do not fluctuate	−0.04	**−0.56**	−0.20	0.42
5. Ideas and insights too fast to express	−0.22	**0.51**	0.00	0.35
35. Mood rules don't apply	−0.26	**0.48**	−0.01	0.34
20. No need to sleep	−0.05	**0.46**	0.26	0.38
8. Impossible to sit still	0.08	**0.45**	0.35	0.40
45. Happy and irritable at same time	−0.03	**0.44**	0.09	0.24
41. Brief periods of inspiration	−0.07	**0.43**	0.04	0.22
31. Can slow down	−0.03	**−0.42**	−0.24	0.30
10. Extreme, intense emotion	0.02	**0.42**	0.24	0.29
22. Get into mood to do everything	−0.25	**0.41**	0.15	0.34
28. Write down creative thinking	−0.18	**0.39**	−0.09	0.18
43. Excited about project	−0.16	**0.39**	0.10	0.24
19. Range of interests	−0.33	**0.35**	−0.01	0.27
9. Amusing, eccentric	−0.04	**0.32**	0.32	0.28
32. A hyper person	−0.01	0.03	**0.85**	0.74
3. Friends say I'm hyper	0.04	0.13	**0.79**	0.70
33. Happy, energetic, giddy	−0.07	0.11	**0.66**	0.54
11. High spirits, can't concentrate	−0.07	0.24	**0.56**	0.50
46. Impossible to stop talking	−0.04	0.27	**0.55**	0.49
17. Average mood	0.18	−0.17	**−0.46**	0.38
15. Excited and happy, no reason	−0.11	0.02	**0.45**	0.25
24. Excited and happy, I know why	0.00	−0.20	−0.23	0.12
14. No more self-aware	0.28	−0.24	0.16	0.13
12. Nothing can happen to me	−0.22	0.26	−0.02	0.13

Note. Pattern matrix of factor loadings. Ordinary least squares factor analysis was based on tetrachoric correlations. Items 12, 24, and 28 were included in the analysis. Items listed are truncated versions. Items with loadings in bold correspond to items also assigned to the corresponding cluster.

18, 20, 21, 22, 24, 31, 33, 35, 37, 38, 44, 45, and 46) represents a merging of mostly Mood Volatility items (11 out of 15) and the Excitement items (six out of eight). This is consistent with our data to the extent that these two clusters are highly correlated and merge into a single cluster in a two-cluster model. Our Social Vitality cluster, however, is represented by three different factors in Rawlings et al.'s analysis. Although items reflecting the second factor (Items 5, 9,12, 13, 19, 23, 26, 28, 34, 36, 41, 42, and 43) were scattered across the subclusters of Social Vitality, items loading high on the third factor (Items 2, 3, 4, 6, 25, 29, 32, and 40) reflected exhibitionist tendencies and mostly clustered together (six out of eight items). Items loading highly on the fourth factor (Items 1, 14, 16, 27, 47, and 48) reflected the reverse-scored items of Ordinariness and entirely cluster together before merging into the larger Social Vitality cluster (see Figure 1 for the location of these items in the cluster hierarchy).

Estimates of reliability. Before testing validity correlations with our subscales, we compared estimates of reliability of the subscales (shown in Table 3). Although coefficient beta may be used as an estimate of the proportion of variance in a scale accounted for by a general factor, ω_h may actually be a more accurate estimate of the general factor saturation than coefficient

Table 3
Estimates of Reliability for Subscales of the Hypomanic Personality Scale

Scale	Common factor variance		General factor variance		AIC	Items
	α	ω_t	β	ω_h		
HPS-48	.93 (.87)	.94 (.88)	.54 (.62)	.47 (.44)	.21 (.12)	48
HPS-45	.92 (.87)	.94 (.88)	.66 (.62)	.47 (.44)	.21 (.13)	45
Social Vitality	.88 (.79)	.90 (.82)	.68 (.54)	.56 (.48)	.25 (.15)	22
Mood Volatility	.87 (.79)	.90 (.81)	.69 (.61)	.58 (.52)	.32 (.19)	15
Excitement	.88 (.87)	.91 (.83)	.80 (.68)	.67 (.64)	.47 (.30)	8
R1 (Moodiness)	.88 (.81)	.91 (.83)	.57 (.48)	.58 (.58)	.31 (.19)	18
R2 (Cognitive Elements)	.78 (.67)	.83 (.71)	.59 (.51)	.55 (.40)	.22 (.14)	13
R3 (Hyper-Sociability)	.84 (.71)	.91 (.81)	.62 (.50)	.68 (.54)	.40 (.25)	8
R4 (Ordinariness)	.73 (.59)	.83 (.68)	.59 (.48)	.46 (.38)	.31 (.19)	6

Note. Estimates outside of parentheses are based on tetrachoric correlations; estimates in parentheses are calculated from the original dichotomous data. AIC = average interitem correlation; HPS = Hypomanic Personality Scale. HPS-45 excludes Items 12, 24, and 28. Estimates listed for R1, R2, R3, R4 are based on subscales derived from the highest loading items on each factor reported by Rawlings et al. (2000) in their largest sample. Three items with the lowest loadings (30, 7, and 39) were excluded.

beta (Revelle & Zinbarg, 2009; Zinbarg et al., 2005). We therefore calculated ω_h for the entire scale and the different solutions by subjecting the data to maximum-likelihood exploratory factor analysis, oblimin rotation, followed by a Schmid–Leiman transformation (Schmid & Leiman, 1957).[3] (See the Appendix for the general loadings and group factor loadings.) The general factor saturation estimates (ω_h and β) were either the same or higher for the three-group solution compared with the total scale estimates, and acceptable internal consistency (ω_t and α) estimates were maintained. The fact that general factor saturation is low for the total scale but tends to increase for each subscale supports the hypothesis that the HPS is probably best scored with several subscales.

Although the estimates of reliability for the subscale scores derived from the first three factors reported by Rawlings et al. (2000) were mostly comparable with the cluster-based subscales, scores on the fourth factor subscale (Ordinariness) appear to be less reliable than scores of the cluster subscales. Notably, estimates of general factor saturation were lower for the Ordinariness subscale (β = .59, ω_h = .46) than for the larger Social Vitality cluster that subsumes it (β = .68, ω_h = .56). This difference is not a function of item number, as these estimates are also relatively low for the entire 48-item scale (β = .54, ω_h = .47).

Study 2

To explore the criterion validity of the HPS clusters, we also collected other questionnaire measures from subsets of Study 1 participants. The questionnaires covered the domains of normal personality psychopathology and abnormal personality traits, drug use and sexual behavior, and social adjustment. As two of the inventories we used are based on the Big Three theory of adaptive and maladaptive personality traits (Tellegen, 1985; Watson & Clark, 1992), we generated hypotheses accordingly (with the understanding that other organizations of measures may be equally valid). For traits related to PE, we hypothesized that the Social Vitality and Excitement clusters would correlate positively with PE constructs, whereas the Mood Volatility cluster would correlate more positively with NE and related constructs. We predicted that the Social Vitality and Excitement clusters would show differential correlations, such that the latter would correlate with measures of agreeableness and social closeness, but the former would correlate more strongly with measures of social potency and achievement.

We anticipated that only the Mood Volatility cluster would correlate with NE constructs. Because some of our NE measures (Aggression, Manipulativeness, and Mistrust) represent a more externalizing form of NE, we hypothesized that they would have small associations with Mood Volatility, given that the later also taps irritability. In four-factor solutions of personality trait inventories, these subscales load together with Agreeableness on a factor labeled *Disagreeable Disinhibition* (Markon, Krueger, & Watson, 2005).

Given past findings indicating a negative (but small) relationship between the HPS and Conscientiousness (Durbin et al., 2009) and a positive relationship between HPS and drug/alcohol use (Krumm-Merabet & Meyer, 2005; Kwapil et al., 2000; B. Meyer et al., 2007), we expected to replicate these associations. Specifically, we anticipated that the Social Vitality cluster would correlate negatively with Constraint constructs. With respect to alcohol and substance use, we did not have any a priori hypotheses for differential association with the Social Vitality and Mood Volatility clusters. However, given the relatively agreeable and well-adjusted content of the Excitement cluster, we hypothesized that it would either be uncorrelated or negatively correlated with measures of drug use and sexual activity.

We expected previous findings of a positive association between Openness to Experience and the HPS (Furnham et al., 2008; T. D. Meyer, 2002) to also emerge in our data. However, given that items reflecting creativity, diverse interests, and eccentricity seem to be scattered across the HPS clusters, it was not clear whether measures of Openness would associate differentially with each cluster. Nevertheless, to the extent that the Mood Volatility cluster taps the most pathological content, we expected it to associate more strongly with those Openness constructs linked to personality pathology, namely, Absorption and Eccentric Perception (Glisky,

[3] Note that this function is available as omega in the **psych** package (Revelle, 2009) of **R** (R Core Development Team, 2010).

Tataryn, Tobias, Kihlstrom, & McConkey, 1991; Watson, Clark, & Chmielewski, 2008).

As there are findings that individuals scoring high on the HPS have more contentious relationships (Eckblad & Chapman, 1986), we expected that poorer social adjustment would be associated with one or more HPS clusters. Given the items on irritability and intensity of emotion in the Mood Volatility cluster, we hypothesized that Mood Volatility would be positively associated with difficulty in various social settings (such as school and work), whereas Excitement and Social Vitality would not. We suspected that Excitement and Social Vitality would likely be related to fewer problems engaging in leisure activities.

Method

Participants. To explore the criterion validity of the HPS clusters, we also collected other questionnaire measures from subsets of Study 1 participants. To reduce burden, each participant completed only some of the measures, resulting in different sample sizes for each set of measures. These included normal personality ($n = 315$), psychopathology and abnormal personality traits ($n = 178$), drug use and sexual behavior ($n = 137$), and social adjustment ($n = 203$). Participant characteristics (gender, age, and ethnicity) of the subsamples who completed each of these batteries mirrored those in the larger sample. None of the four subsamples differed significantly from the larger sample ($N = 884$) on total HPS, Mood Volatility, or Excitement scores; however, the participants in the subsample measuring psychopathology and abnormal personality traits ($n = 178$) scored slightly lower on Social Vitality (Cohen's $d = -.21$) compared with the larger sample.

Measures.

HPS. The HPS (Eckblad & Chapman, 1986) measures dispositional hypomanic characteristics and consists of 48 true–false items (see Table 1).

Normal personality measures. A subset of participants ($n = 315$) also completed the Big Five Mini-Markers (Saucier, 1994) and the Multidimensional Personality Questionnaire–Brief Form (MPQ-BF; Patrick, Curtin, & Tellegen, 2002). The Mini-Markers taps extraversion, neuroticism, openness to experience or intelligence, conscientiousness, and agreeableness. Each trait is measured by eight adjectives that are rated on a 9-point Likert-type scale. Alphas for Mini-Markers scales in our study ranged from .80 to .89 (omega total estimates ranged from .88 to .92). The MPQ-BF is a 155-item true–false questionnaire that assesses three broad personality dimensions that roughly correspond with extraversion, neuroticism, and conscientiousness: PE, NE, and Constraint. The higher order dimensions are marked by the following lower order scales: Wellbeing, Social Potency, Achievement, and Social Closeness (PE); Stress Reaction, Alienation, and Aggression (NE); and Control, Harm Avoidance, and Traditionalism (Constraint). The MPQ-BF also includes a subscale labeled *Absorption*, which taps the tendency for imaginative and self-involved experiences and is conceptually similar to the Big Five O dimension. (The Absorption subscale was administered to a larger subset, $n = 432$.) Alphas for the MPQ-BF subscales ranged from .74 to .86 ($Mdn = .82$), and omega total estimates ranged from .77 to .88 ($Mdn = .85$).

Maladaptive personality. We asked 178 participants to complete the Schedule for Nonadaptive and Adaptive Personality Self-Description Rating Form (SNAP-SRF; Harlan & Clark, 1999), a measure of normal and abnormal personality traits relevant to personality disorders. The SNAP-SRF includes 33 paragraph descriptors describing individuals who are low versus high on the characteristic of interest; each item is rated on a 6-point scale. It assesses three higher order dimensions, Negative Temperament, Positive Temperament, and Disinhibition, marked by 15 subordinate scales. Each scale contains two or three items, with the exception of Eccentric Perceptions, which has only one item. The scales are Mistrust ($\alpha = .57$), Manipulativeness ($\alpha = .55$), Aggression ($\alpha = .40$), Self-Harm ($\alpha = .21$), Eccentric Perceptions, Dependency ($\alpha = .34$), Exhibitionism ($\alpha = .81$), Entitlement ($\alpha = .43$), Detachment ($\alpha = .53$), Impulsivity ($\alpha = .43$), Propriety ($\alpha = .33$), Workaholism ($\alpha = .43$), Negative Temperament ($\alpha = .62$), Positive Temperament ($\alpha = .63$), and Disinhibition ($\alpha = .67$). With the exception of Self-Harm and Dependency, alphas from our sample are similar to those reported by Harlan and Clark (1999).

Psychopathology measures. We had 178 participants complete the Inventory to Diagnose Depression, a 25-item measure of current depression symptoms (Zimmerman, Coryell, Corenthal, & Wilson, 1986). We did not administer the suicide item and excluded Items 23 (timing of depression symptoms) and 25 (similarity to grief) from analyses. The remaining 22 items had an alpha of .79 ($\omega_t = .82$). We had 178 participants complete the Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988), a 21-item measure of anxiety symptoms ($\alpha = .82$, $\omega_t = .85$), and 100 participants completed the Penn State Worry Questionnaire (T. J. Meyer, Miller, Metzger, & Borkevec, 1990), a 16-item measure of excessive worry ($\alpha = .94$, $\omega_t = .95$). Both the Penn State Worry Questionnaire and the Inventory to Diagnose Depression items (21 out of 22) use a 5-point scale of severity. The Beck Anxiety Inventory uses a 4-point scale for all items.

Drug use and sexual activity. To assess behavioral indicators of externalizing psychopathology, we administered nine self-report items tapping drug use (five items) and risky sexual behavior (four items) to 137 participants. The drug questions included the following: (a) maximum number of drinks participant had consumed in a 24-hr period, (b) lifetime number of intoxications, (c) number of times they had driven drunk or high, (d) lifetime number of times they had used marijuana, and (e) total number of different drug classes used. Although we also assessed legal problems involving drugs, we eliminated the variable from analysis because of a low endorsement rate. The sexual behavior questions included the following: (a) number of lifetime oral sexual partners, (b) total number of lifetime vaginal/anal sexual partners, (c) number of times participant had unprotected sex, and (d) number of times participant had sex while drunk or high. These items are common measures of sexual risk taking that have been linked to the personality trait of Constraint (Hoyle, Fejfar, & Miller, 2000). Not surprisingly, all of the variables were skewed. Because quantitative differences in these answers can be misleading (i.e., the difference between 0 and 2 times having unprotected sex is more meaningful than the difference between 40 and 42 times), we grouped answers for the variables (with the exception of number of drug classes used) into four response categories (abstinent, a few times, occasionally, more than occasionally). The resulting nine variables were moderately intercorrelated (average $r = .54$, range .25–.79, $ps < .05$). The average interitem correlation was slightly higher within each content group ($r = .63$ for drug use, $r = .62$ for

sexual behavior). Hierarchical cluster analysis suggested the presence of one unidimensional cluster; the reliability estimates were good (standardized $\alpha = .91$, $\beta = .79$). The drug and sex variables clustered together separately as expected on the basis of content, with both showing unidimensionality ($\beta = .79$, $\beta = .73$, respectively). Therefore, we created drug and sex composites by summing the drug and sex items separately. The resulting two composites were highly correlated ($r = .64$).

Social adjustment. A subset (203 participants) completed a shortened version of the Social Adjustment Self-Report (SAS-SR; Weissman & Bothwell, 1976), a widely used measure that assesses various domains of functioning. To tailor this measure to a college-aged population, we deleted questions on housework, marriage, parenting, and unit functioning. The remaining 32 items include sections on school, family (parents, siblings, extended family), spare time (leisure and social activities), and finances. Students completed the Social Adjustment Self-Report questions on paid work only if they worked 5 hr or more per week (59 students completed these questions). Because four items correlated negatively with their respective corrected subscale total, we deleted those items. Alphas for the remaining modified subscales were .59 (work, four items), .63 (school, six items), .54 (spare time, 10 items), and .66 (family, seven items). Because respondents on the full Social Adjustment Self-Report complete only questions that are relevant to their particular social roles, internal reliability estimates for subsections have not typically been reported (Weissman, 1978; Weissman & Bothwell, 1976; Ro & Clark, 2009). Because of an error in printing, only 137 participants completed the single question on financial difficulty. Intercorrelations among the domain subscales were low to moderate, ranging from .05 to .34 (mean $r = .23$, $SD = .10$).

Data analysis. Subscales from the cluster solution were correlated with validity measures. We also regressed the cluster subscales on the criterion variables to find each subscale's unique variance associated with each criterion variable. We completed all analyses in **R** (R Core Development Team, 2010), using the **psych** package for most of the functions (Revelle, 2009).

Results

To test for criterion validity of the three-cluster solution, we (a) examined zero-order correlations between subscales and a variety of validity measures and (b) regressed the three subscales on each measure to examine the unique associations of each cluster with each validity measure. Although unique associations of highly correlated predictors should be interpreted cautiously (Lynam, Hoyle, & Newman, 2006), we felt justified in doing so, given the relative homogeneity and good internal consistency of the subscales, as well as the fact they were only moderately intercorrelated (.35–.51).

Table 4 shows descriptive statistics (mean, standard deviation) for item averages for each validity scale and their correlations and unique associations with each of the three HPS clusters. To ease interpretation, we reversed the scoring for SNAP-SRF Detachment (higher scores reflect less detachment), Disinhibition, and Impulsivity (higher scores indicate less disinhibited or less impulsive behaviors). Intercorrelations among NE measures ranged widely (mean $r = .23$, $SD = .18$), from $-.17$ between SNAP-SRF Dependency and Aggressiveness to .71 between SNAP-SRF Negative Temperament and MPQ-BF Stress Reaction. For PE measures, the intercorrelations ranged from .06 between SNAP-SRF Entitlement and Detachment to .73 between SNAP-SRF Exhibitionism and Mini-Marker Extraversion (mean $r = .38$, $SD = .19$). For Constraint measures, intercorrelations ranged from .02 between sexual activity and MPQ-BF Harm avoidance to .75 between MPQ-BF Control and reversed SNAP-SRF Impulsivity (mean $r = .31$, $SD = .20$). Measures related to Openness correlated as follows: Mini-Marker Openness and MPQ-BF Absorption correlated .41. SNAP-SRF Eccentric Perceptions correlated .27 with Openness and .31 with Absorption.

NE. At the zero-order level, Mood Volatility was positively related to NE scales tapping internalizing tendencies (including measures of frank symptoms of anxiety and depression) with coefficients ranging from .29 to .50 (all ps $< .05$). Controlling for the shared variance among the clusters, the unique associations of Mood Volatility with internalizing symptoms was strong, with beta weights ranging from .41 to .75 (ps $< .05$). The association of Mood Volatility with externalizing NE measures was weaker. Two of these measures (SNAP-SRF Manipulativeness, MPQ-BF Aggression) were significantly related to Mood Volatility ($r = .20$, $r = .24$, respectively, ps $< .05$), whereas the others, SNAP-SRF Aggressiveness and Mistrust, were not ($r = .13$, $r = .14$, respectively, ps $> .05$). However, at the unique level, all four measures were positively associated with Mood Volatility, with betas ranging from .21 to .31 ($p < .05$). SNAP-SRF Dependency was unrelated to the Mood Volatility cluster ($r = .00$). Consistent with this finding, Dependency also had no or small correlations with the other internalizing NE measures (mean $r = .10$, $SD = .09$).

Consistent with the hypothesis that Social Vitality represents a healthier aspect of the HPS compared with Mood Volatility, NE measures were either uncorrelated with Social Vitality or showed negative associations. Significant zero-order negative associations were found for SNAP-SRF Negative Temperament ($r = -.19$, $\beta = -.35$, ps $< .05$) and Dependency ($r = -.24$, $\beta = -.18$, ps $< .05$). Unique negative associations were also found for Mini-Marker Neuroticism, Stress Reaction, Self-Harm, and Penn State Worry Questionnaire, with beta weights ranging from $-.19$ to $-.31$ (ps $< .05$).

Similar to the Social Vitality cluster, the Excitement cluster was uncorrelated with NE measures at the zero-order level. The exception to this pattern was the small positive correlation with the Beck Anxiety Inventory ($r = .19$, $p < .05$), but this association disappeared at the unique level ($\beta = .00$), suggesting the association was due to the shared variance between Excitement and Mood Volatility. Consistent with our hypotheses, unique negative associations between Excitement and NE were significant for MPQ-BF Stress Reaction ($\beta = -.18$, $p < .05$), Mini-Marker Neuroticism ($\beta = -.17$, $p < .05$), and the Inventory to Diagnose Depression ($\beta = -.19$, $p < .05$), as well as SNAP-SRF Aggressiveness ($\beta = -.17$, $p < .05$), Mistrust ($\beta = -.19$, $p < .05$), and MPQ-BF Aggression ($\beta = -.21$, $p < .05$). Although small, these unique and opposite associations draw a sharp distinction between Mood Volatility and Excitement that is obscured in the HPS total scale. A similar contrast is seen for Agreeableness, where the unique association with Excitement is positive ($\beta = .27$, $p < .05$), but the unique association with Mood Volatility is negative ($\beta = -.24$, $p < .05$). The combination of internalizing and externalizing NE traits associated with the Mood Volatility cluster is suggestive of

Table 4
Validity Correlations and Unique Associations With Three-Cluster HPS Subscales

Scale	*N*	*M*	*SD*	HPS-48	Social Vitality		Mood Volatility		Excitement		Mult *R*
				r	*r*	β	*r*	β	*r*	β	
Constructs related to Negative Emotionality											
Neuroticism (MM)	315	4.67	1.22	.07	−.08	−.19*	.29*	.45*	.00	−.17*	.38
Stress Reaction (MPQ-BF)	313	0.45	0.29	.19*	−.09	−.29*	.50*	.71*	.08	−.18*	.60
Alienation (MPQ-BF)	313	0.18	0.19	.20*	.05	−.06	.35*	.45*	.07	−.14	.38
Aggression (MPQ-BF)	313	0.24	0.23	.11*	.09	.06	.20*	.28*	−.03	−.21*	.26
Negative Temperament (SNAP-SRF)	178	3.20	0.99	.03	−.19*	−.35*	.32*	.57*	.00	−.18	.50
Mistrust (SNAP-SRF)	178	2.68	1.03	.02	−.02	−.06	.14	.27*	−.06	−.19*	.23
Manipulativeness (SNAP-SRF)	178	2.57	0.95	.16*	.08	.01	.24*	.31*	.05	−.13	.27
Aggressiveness (SNAP-SRF)	178	2.64	1.00	.07	.06	.04	.13	.21*	−.04	−.17*	.19
Self-Harm (SNAP-SRF)	178	1.96	0.83	.11	−.12	−.30*	.32*	.46*	.12	−.02	.43
Dependency (SNAP-SRF)	178	3.71	1.06	−.13	−.24*	−.30*	.00	.07	.00	.08	.27
Worry (PSWQ)	100	3.03	0.83	.06	−.15	−.31*	.32*	.48*	.06	−.07	.44
Anxiety (BAI)	178	0.40	0.33	.25*	.06	−.10	.37*	.41*	.19*	.00	.38
Depression (IDD)	178	0.48	0.36	.17*	.01	−.11	.35*	.50*	.05	−.19*	.40
Constructs related to Positive Emotionality											
Extraversion (MM)	315	5.66	1.48	.50*	.58*	.54*	.19*	−.18*	.41*	.29*	.63
Well-Being (MPQ-BF)	313	0.75	0.24	.29*	.36*	.34*	−.02	−.37*	.34*	.40*	.52
Social Potency (MPQ-BF)	313	0.53	0.26	.52*	.66*	.67*	.20*	−.12*	.31*	.10	.67
Achievement (MPQ-BF)	313	0.63	0.27	.13*	.17*	.16	.04	−.05	.09	.05	.17
Social Closeness (MPQ-BF)	313	0.77	0.23	.17*	.22*	.19*	.00	−.21*	.22*	.25*	.31
Positive Temperament (SNAP-SRF)	178	4.44	0.81	.47*	.48*	.36*	.23*	−.14	.46*	.40*	.57
Entitlement (SNAP-SRF)	178	3.25	0.96	.26*	.38*	.42*	.11	−.02	.07	−.09	.38
Exhibitionism (SNAP-SRF)	178	3.46	1.17	.53*	.62*	.59*	.26*	−.08	.35*	.16	.64
Detachment (SNAP-SRF)[a]	178	2.85	0.97	.33*	.40*	.39*	.10	−.17*	.27*	.22*	.44
Constructs related to Constraint											
Conscientiousness (MM)	315	6.09	1.29	−.20*	−.07	.04	−.32*	−.39*	−.08	.11	.34
Agreeableness (MM)	315	7.01	1.07	.08	.09	.08	−.07	−.24*	.17	.27*	.26
Control (MPQ-BF)	313	0.71	0.25	−.42*	−.38*	−.26*	−.33*	−.20	−.29*	−.07	.43
Harm Avoidance (MPQ-BF)	313	0.58	0.24	−.28*	−.32*	−.31*	−.18*	−.11	−.09	.09	.33
Traditionalism (MPQ-BF)	313	0.48	0.23	−.02	−.03	−.03	−.07*	−.13	.05	.13	.13
Disinhibition (SNAP-SRF)[a]	178	2.53	1.00	−.27	−.20*	−.11	−.28*	−.24*	−.17	.01	.30
Impulsivity (SNAP-SRF)[a]	178	2.86	1.01	−.42*	−.32*	−.17*	−.39*	−.28*	−.31*	−.08	.43
Propriety (SNAP-SRF)	178	3.99	1.03	−.11	−.10	−.09	−.14*	−.19*	−.01	.16*	.20
Workaholism (SNAP-SRF)	178	3.78	0.98	.04	.04	.08	.03	.02	−.11	−.15	.13
Drugs/Alcohol	137	—	—	.22*	.34*	.41*	.13	.11	−.04	−.26*	.40
Sexual activity	137	—	—	.20*	.30*	.36*	.14	.13	−.05	−.27*	.37
Constructs related to Openness to Experience											
Openness (MM)	315	6.59	1.08	.41*	.43*	.40*	.23*	.06	.22*	.03	.44
Absorption (MPQ-BF)	432	0.59	0.25	.50*	.36*	.19*	.46*	.34*	.34*	.08	.50
Eccentric Perceptions (SNAP-SRF)	178	2.00	1.22	.20*	.15*	.08	.17*	.11	.15*	.06	.20
Social Adjustment Scale Self-Report											
Paid Work	59	1.27	0.30	.26*	.12	−.01	.34*	.47*	.10	−.19	.37
Family	203	1.58	0.47	.19*	.06	−.15	.35*	.45*	.06	−.14	.38
School	203	1.92	0.45	.14	.03	−.07	.31*	.43*	.02	−.17*	.36
Spare Time	203	2.21	0.45	−.20*	−.28*	−.29*	.02	.17*	−.16*	−.13	.32
Finances	137	1.47	0.84	.15	.12	.10	.22*	.28*	−.01	−.19	.27

Note. Mean scores are mean item scores. Higher scores on the Social Adjustment Scale Self-Report indicate poor social adjustment. HPS = Hypomanic Personality Scale; Mult *R* = Multiple *R*; MM = Mini-Markers; MPQ-BF = Multidimensional Personality Scale–Brief Form; SNAP-SRF = Schedule for Nonadaptive and Adaptive Personality Self-Reporting Form; PSWQ = Penn State Worry Questionnaire; BAI = Beck Anxiety Inventory; IDD = Inventory to Diagnose Depression.
[a] Scale was reverse coded.
* $p < .05$, two-tailed.

emotional and behavioral patterns seen in borderline personality disorder (Clark, 1993; Morey et al., 2003). By contrast, the other two HPS clusters (Social Vitality and Excitement) seem to reflect healthier emotional patterns.

PE. Cluster relationships to PE scales were also largely as hypothesized for both zero-order and unique associations. The Social Vitality cluster correlations with PE measures (mean $r = .43$, $SD = .17$) were higher than the corresponding correlations between Mood Volatility and PE (mean $r = .12$, $SD = .10$). Of note, MPQ-BF Social Potency was more strongly associated with Social Vitality ($r = .66$, $\beta = .67$, $ps < .05$) than with Mood Volatility ($r = .20$, $\beta = -.12$, $ps < .05$), further suggesting a close

kinship between the MPQ-BF Social Potency construct and the Social Vitality cluster. At the unique level, associations between PE and Social Vitality and Excitement mostly remain significant (and in the same direction), whereas the unique associations between PE and Mood Volatility tend to become more negative, with correlation coefficients generally positive and beta weights negative (mean $\beta = -.15$, $SD = .10$). In the case of MPQ-BF Social Potency (as well as for Mini-Marker Extraversion), a significant positive association with Mood Volatility actually becomes significant and negative once the shared variance due to the other two HPS clusters is removed. These findings reveal that the negative associations between PE and the Mood Volatility cluster are suppressed by the other two HPS clusters.

In contrast to Mood Volatility, the Excitement cluster associated uniquely and positively with Extraversion ($r = .41$, $\beta = .29$, $ps < .05$) and Well-Being ($r = .34$, $\beta = .40$, $ps < .05$). The Excitement cluster also showed unique positive associations with Social Closeness ($r = .22$, $\beta = .25$, $p < .05$), SNAP-SRF Positive Temperament ($r = .46$, $\beta = .40$, $ps < .05$), and reversed Detachment ($r = .27$, $\beta = .22$, $ps < .05$). The Excitement cluster was also distinguished from the Social Vitality cluster in that PE constructs with an element of dominance (MPQ-BF Social Potency, MPQ-BF Achievement, SNAP-SRF Entitlement, and SNAP-SRF Exhibitionism) correlated more strongly with Social Vitality (mean $r = .46$, $SD = .23$) than with Excitement (mean $r = .20$, $SD = .15$). Consistent with this, unlike the residualized Social Vitality cluster, the residualized Excitement cluster was unrelated to these dominant PE traits, with betas ranging from $-.09$ to .16.

Given the central role that achievement motivation has been proposed to play in premorbid manic vulnerability (Johnson, 2005), it should be noted that MPQ-BF Achievement showed a surprisingly weak relationship with the HPS total score and the three clusters. This may, in part, be explained by the fact that the Achievement construct on the MPQ-BF is maximally distinct from Social Potency. Whereas MPQ-BF Social Potency represents an ability and desire to influence others and take on leadership or performance roles, Achievement items describe a tendency to work hard and accomplish much (regardless of social visibility). Consistent with this, SNAP-SRF Workaholism was also unrelated to the HPS and the clusters. Our results, which are based on a rather broad range of PE measures, may be useful in identifying which aspects of PE are primarily involved in hypomanic vulnerability.

Constraint. In general, questionnaire measures related to Constraint were less strongly related to the HPS clusters than were the NE and PE measures. Mean correlation coefficients and beta weights suggest that Constraint is more negatively related to Mood Volatility than to Excitement. Excluding the drug and sex composites, the Constraint measures were most strongly correlated with Mood Volatility (mean $r = -.19$, $SD = .14$), followed by Social Vitality (mean $r = -.14$, $SD = .17$), and Excitement (mean $r = -.09$, $SD = .15$). Furthermore, residualized Mood Volatility was more closely related to Constraint (mean $\beta = -.20$, $SD = .12$) than was residualized Social Vitality (mean $\beta = -.09$, $SD = .14$) or Excitement (mean $\beta = .05$, $SD = .13$).[4]

Mini-Marker Conscientiousness stood out as the only Constraint measure that was significantly and uniquely associated with only one HPS cluster, namely, Mood Volatility ($r = -.32$, $\beta = -.39$, $ps < .05$) and unrelated to the other clusters. This result is consistent with research showing that, in five-factor models, Conscientiousness has a larger (negative) loading on the Neuroticism factor compared with the MPQ-BF Constraint scales (Markon et al., 2005). This association between Conscientiousness and Neuroticism (and Mood Volatility) may be due to the nature of the Conscientiousness items, such that being *organized* implies a level of positive psychological adjustment that may be lacking in individuals scoring high on Mood Volatility. The fact that Mini-Marker Conscientiousness was unrelated to both Social Vitality and Excitement may have been due to the fact that Mini-Marker items such as *efficient* imply both cautiousness and self-efficacy; these two attributes may relate in opposing directions to both Social Vitality and Excitement.

Mini-Marker Agreeableness also stood out for the divergent pattern of its associations with the HPS clusters. Agreeableness was unrelated to the total HPS score ($r = .08$, $p < .05$) and Social Vitality ($r = .09$, $\beta = .08$, $ps > .05$), and showed opposite patterns of unique association for Excitement ($r = .17$, $\beta = .27$, $ps < .05$) and Mood Volatility ($r = -.07$, $p > .05$; $\beta = -.24$, $p < .05$). The unique associations with Agreeableness (and the aggression scales) for the Mood Volatility cluster are also consistent with a borderline personality profile (Morey et al., 2003).

Drug and sex variables. Unlike the other Constraint measures, the sexual activity and drug/alcohol use composites were most closely related to Social Vitality, rather than to Mood Volatility. Whereas the HPS total score was modestly related to the drug and sex composites ($r = .22$ and $r = .20$, respectively, $ps < .05$), the HPS clusters differed in the magnitude of association, such that the multiple correlation coefficients were clearly larger (.40 and .37, respectively) than the total HPS correlation coefficients. The Social Vitality cluster was most highly related to both drug and sex composites ($r = .34$ and $r = .30$, respectively, $ps < .05$), followed by Mood Volatility ($r = .13$ and $r = .14$, respectively, $ps > .05$), and Excitement ($r = -.04$ and $r = -.05$, respectively, $ps > .05$). The unique association for the Social Vitality cluster was significant and positive ($\beta = .41$ and $\beta = .36$, respectively, $ps > .05$), whereas for Excitement, the association was significantly negative ($\beta = -.26$ and $\beta = -.27$, respectively, $ps > .05$). Mood Volatility was not uniquely related to drug use and sexual activity. These relationships suggest that individuals high on the Social Vitality cluster are most likely to engage in sexual risk taking and drug and alcohol use, particularly in comparison with those who score high on Excitement.

Openness and related constructs. Zero-order correlations show that all of the clusters were significantly related to Openness, though to varying degrees (.22 to .41, $ps < .05$). However, only the Social Vitality cluster was uniquely related to Openness ($\beta = .40$, $p < .05$). This association with Openness may reflect not simply a desire to impact the social environment but a desire to do so in a wide variety of arenas and professions (see HPS Items 34, 23, 19, and 26).

Zero-order correlations between Absorption (MPQ-BF) and the three cluster subscales were all significant and moderate (.34 to .46). Examining unique associations, the relationship between Absorption and the Excitement cluster reduced to zero ($\beta = .08$,

[4] In calculating mean correlation coefficients and beta weights, we reversed the direction of SNAP-SRF Impulsivity and Disinhibition.

$p > .05$). However, the Social Vitality cluster ($\beta = .19$, $p < .05$) and the Mood Volatility cluster ($\beta = .34$, $p < .05$) were uniquely associated with Absorption. Both Absorption and Mood Volatility may be more closely related to internalizing pathology than Openness or the other two HPS clusters. In fact, factor analyses of personality traits in large samples show that MPQ-BF Absorption cross-loads on the Neuroticism factor, whereas Big Five Openness does not (Markon et al., 2005).

Finally, given the pattern with Absorption, we expected the Eccentric Perceptions subscale of the SNAP-SRF to relate more closely to the Mood Volatility cluster than to the other subscales. Contrary to our expectation, this subscale showed equivalent small zero-order associations with each cluster ($.15 \leq rs \leq .17$, $ps < .05$). However, the Eccentric Perceptions subscale consisted of a single item and was therefore rather unreliable compared with the Absorption and Openness measures. The correlations between Eccentric Perceptions and Absorption and Openness were likewise small but significant ($r = .24$ and $r = .23$, respectively, $ps < .05$).

Social adjustment. Consistent with expectation, Mood Volatility was associated with poorer social adjustment, whereas the other clusters were either unrelated or negatively related with poor adjustment. Specifically, Mood Volatility was significantly associated with problematic adjustment in the areas of work, family, school, and finances (mean $r = .30$, $SD = .06$), whereas Social Vitality (mean $r = .08$, $SD = .04$) and Excitement (mean $r = .04$, $SD = .05$) were unrelated to poor social adjustment in those areas. The unique associations showed a similar pattern: Mood Volatility showed significant associations (mean $\beta = .41$, $SD = .09$), whereas Social Vitality (mean $\beta = -.03$, $SD = .11$) was unrelated and Excitement was unrelated or negatively associated (mean $\beta = -.17$, $SD = .02$). Mood Volatility was unrelated to leisure time problems ($r = .02$) but showed a small positive unique association ($\beta = .17$, $p < .05$), indicating more social problems at the unique level. By contrast, both Social Vitality ($r = -.28$, $\beta = -.29$, $ps < .05$) and Excitement ($r = -.16$, $p < .05$; mean $\beta = .13$, $p > .05$) were related to fewer leisure time problems.

Summary of validity results. HPS subscales derived from hierarchical cluster analysis (ICLUST) demonstrated considerable criterion and discriminant validity, especially when considering their unique associations with measures of PE and NE. The Mood Volatility cluster was moderately related to measures of internalizing symptoms and NE. In addition, it was uniquely and positively associated with aggression and negatively related to Agreeableness (also known as the Disagreeable Disinhibition factor; Markon et al., 2005). By contrast, the Social Vitality cluster was either unrelated or negatively related to measures of NE.

With respect to the PE measures, the three-cluster solution provided a clear picture of how group clusters within the HPS may dampen the total HPS variance available to associate with other variables. The Social Vitality cluster was positively related to all measures of PE, the strongest association being with Social Potency. The Mood Volatility cluster was uncorrelated or weakly correlated with PE. Residualized Mood Volatility, however, tended to be negatively associated with measures of PE, particularly Well-Being. The Excitement cluster stood in particular contrast to Mood Volatility, showing significant positive associations with those PE measures that lack a dominance component, both at the zero-order and residualized levels.

Both the Social Vitality and the Mood Volatility clusters related to measures of Constraint, but each cluster related to somewhat contrasting aspects of this trait. The Social Vitality cluster related negatively to Harm Avoidance, whereas the Mood Volatility cluster seemed to be more broadly related to Constraint. Of particular note, Mood Volatility was negatively related to Conscientiousness (residualized Mood Volatility was also negatively related to Agreeableness), whereas Social Vitality was unrelated to both. For individuals high on Social Vitality, these patterns might reflect a more narrow desire for risk taking, whereas individuals high on Mood Volatility might exhibit a more general tendency toward disorganized and inefficient behavior. This distinction between Social Vitality and Mood Volatility may further be seen in their differential association with the drug use and sexual activity variables. The Social Vitality cluster was uniquely related to drug use and sexual activity (which may be viewed as a particular type of risk taking), whereas the Mood Volatility was not related to either. The Excitement cluster was generally more weakly related to Constraint measures, particularly compared with Mood Volatility.

Openness and Absorption showed a different pattern of association with the clusters that seemed to be in proportion to the level of highly extroverted behaviors reflected in each cluster. That is, the Social Vitality cluster was uniquely related to Openness, whereas the other clusters' smaller associations with Openness were reduced to zero when residualized. This relationship may reflect a tendency on the part of individuals high on Social Vitality to be socially potent in a variety of diverse (and creative) contexts. We suspect that this link was due to items expressing a range of interests and a desire to succeed in a number of professions. Individuals high on Volatility (who are also less extraverted) may have fewer opportunities to engage in a variety of social experiences. Finally, individuals high on Excitement may also be less open (compared with individuals high on Social Vitality) by virtue of their being less socially potent and exhibitionistic. In contrast to Openness, the more pathological Absorption construct was moderately related to all clusters.

General Discussion

Hierarchical cluster analysis (ICLUST) of a large student sample revealed that the HPS has a multidimensional structure, consistent with earlier studies demonstrating it has a wide variety of correlates. Furthermore, estimates of reliability for the three-cluster subscales were at least as good, if not better, than the reliability estimates for the total HPS scale. Multiple regressions on validity measures produced multiple *R*s of larger magnitude than the total scale correlation coefficients in most cases. These validity measures cover a wide range of conceptually important variables: normal traits, personality pathology, internalizing symptoms, and externalizing behavior. The findings support the claim that total score HPS correlations with related variables may be attenuated because of group factors within the HPS.

Implications for Future Research

On the basis of these results, we suggest that analyses based on HPS total scores should be interpreted very cautiously. Although the HPS subscales we examined were moderately correlated, they nevertheless contained variance that effectively suppressed total

scale associations with other variables. Therefore, conclusions based on total score analyses may be unwarranted. For example, on the basis of modest total HPS correlations with depression (Klein et al., 1996), researchers might conclude that individuals scoring high on the HPS exhibit only slight depressive tendencies, leading them to control for differences in depression (Krumm-Merabet & Meyer, 2005). However, zero-order effects for depressive symptoms are significantly different on Mood Volatility compared with Social Vitality and Excitement. Individuals scoring high on Mood Volatility may, in fact, be quite vulnerable to depressive episodes, given Mood Volatility's associations across NE measures. By contrast, some high scorers on the HPS (those scoring high only on Social Vitality and Excitement items) might actually be less likely to develop depression compared with average HPS scorers.

Our findings are important because of the stark contrast among the clusters with respect to overall mental health and measures of abnormal (vs. healthy) functioning. The Mood Volatility cluster was clearly related to a range of pathological tendencies, whereas the Excitement cluster tends more toward positivity and adaptive functioning. On the basis of these data, it would be inappropriate to characterize individuals scoring high on the Excitement cluster as pathologically vulnerable; rather, this cluster might reflect aspects of *hypomanic personality* that are, in fact, indicative of superior functioning. The Social Vitality cluster seemed to represent a combination of mentally healthy and unhealthy traits. Social Vitality was either not related or negatively related to a range of NE measures and was positively related to PE measures, including more pathological traits, such as Entitlement and Exhibitionism, suggesting a possible link with aspects of manic behavior. Its relationship with Constraint was not as broad as with Mood Volatility; however, the Social Vitality cluster did show moderate correlations with sexual activity and drug use.

Predicting Risk for Bipolar Disorder From the HPS

Our results raise a number of questions with respect to the power of the HPS to predict bipolar episodes (as well as other disorders). The central question is whether elevations on the HPS in any given study reflect elevations only on particular subscales or more broadly on all items (the general factor). It would be important to know, for example, if only Mood Volatility (but not Social Vitality) can predict the development of manic episodes. This would be a reasonable hypothesis, given that the Mood Volatility items of racing thoughts, mood swings, and irritability are conceptually similar to several criteria for a manic episode in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; American Psychiatric Association, 2000).

Achievement Motivation

An additional implication of this research concerns the role that achievement motivation plays in theories of bipolar disorder development (Johnson, 2005). If we are to assume that the HPS (and to varying levels the clusters therein) are valid predictors of bipolar disorder, our results seem inconsistent with theory and clinical research evidence that achievement striving is a central premorbid trait (Johnson, 2005; Lozano & Johnson, 2001). Achievement items on the MPQ-BF were only weakly related to the HPS Social Vitality cluster and HPS total score, especially compared with the effects of MPQ-BF Social Potency, and SNAP-SRF Exhibitionism and Entitlement. These results are consistent with Eckblad and Chapman's (1986) assessment of high scorers on the HPS. They found that high scorers were boastful and had high self-esteem but had no more actual accomplishments than control participants. One alternative explanation, of course, is that actual achievement is still central to premorbid characteristics of bipolar disorder but that the HPS simply does not capture it very well. It should be noted that our methodological limitations prevent us from concluding anything about the relative importance of premorbid traits to the future development of manic episodes.

Links to Psychopathology

Mood Volatility was clearly the most pathological cluster, showing moderate to large positive effects for internalizing aspects of NE, moderate negative effects for Constraint, and modest (unique) effects for Aggression. In addition, it was the only cluster to exhibit a negative (unique) effect for Well-Being. Items on this cluster included having high mental energy, irritability, and mood swings. The cluster bears a close relationship to the Big Five Volatility aspect of NE (DeYoung, Quilty, & Peterson, 2007), which includes a tendency toward emotional lability, irritability, and difficulty controlling emotional impulses. This Volatility aspect may be contrasted with the Withdrawal aspect, which represents negative affect directed inward. In our data, the broad relationship between the Mood Volatility cluster and Constraint measures supports this connection. Furthermore, few if any of the Mood Volatility items on the HPS may be characterized as reflecting withdrawal, even though this cluster clearly covaried with withdrawal symptoms (as represented by the Inventory to Diagnose Depression, the Penn State Worry Questionnaire, and the Beck Anxiety Inventory) at both the zero-order and unique level. DeYoung, Quilty, and Peterson (2007) suggest that Volatility may be governed by a separate brain system—the fight–flight–freeze system—rather than Withdrawal, which is linked to the behavioral inhibition system (Gray & McNaughton, 2000).

The Mood Volatility cluster also bears a close conceptual link to the emotional dysregulation that is characteristic of borderline personality disorder. We suspect that this cluster of items was probably responsible for the elevations on borderline symptoms found by Kwapil et al. (2000) in their longitudinal study of HPS high scorers. Consistent with this hypothesis, a meta-analysis of fight–flight–freeze system traits and personality disorders in both clinical and nonclinical samples shows that borderline personality disorder was positively associated with Neuroticism and negatively associated with Agreeableness and Conscientiousness, though the effects of the later two were smaller (Saulsman & Page, 2004). Similarly, in a study of SNAP scales (Clark, 1993) and personality disorders, individuals with borderline personality disorder were distinguished from both depressed and other personality disorder groups by negative temperament, self-harm, and aggression (Morey et al., 2003). Given the likely close association between the HPS Mood Volatility cluster and borderline personality disorder, HPS subscales may assist future research efforts in disentangling comorbidity among borderline personality disorder, depressive episodes, and manic episodes.

Social Vitality was strongly related to a number of PE measures (Extraversion, Social Potency, and Exhibitionism). Among these, Exhibitionism stands out as the most clearly pathological and is conceptually linked to features of histrionic personality disorder. Social Vitality was also positively related with SNAP-SRF Positive Temperament, Entitlement, and Impulsivity, which is in turn consistent with Clark's (1993) SNAP profile of histrionic personality disorder. This histrionic personality disorder–hypomania hypothesis is also consistent with longitudinal research of Shahar, Scotti, Rudd, and Joiner (2008), who found that hypomanic symptoms (as assessed by the Millon Clinical Multiaxial Inventory; Millon, 1987) predicted increases in histrionic and narcissistic (but not borderline) features in a suicidal sample. However, Social Vitality differs from histrionic personality disorder with respect to shallowness, which is considered a core feature of histrionic personality disorder (Blagov, Fowler, & Lilienfeld, 2007). Accordingly, although Social Vitality was robustly related to Openness in our data, histrionic personality disorder is unrelated to Openness (Samuel & Widiger, 2008). Thus, although the Social Vitality cluster may be related to some aspects of disordered personality, its links to PE measures suggests it may also tap the high end of normal agentic Extraversion.

Diverging Results for Constraint

The results with respect to Constraint broadly support the hypothesis that both Social Vitality and Mood Volatility are negatively related to elements of Constraint (whereas Excitement is either positively related or unrelated). However, the results show a diverging pattern for the clusters—the most striking difference is that Mood Volatility is related to Mini-Marker Conscientiousness (and Social Vitality is not), whereas Social Vitality is related to drug use and sexual activity (and Mood Volatility is not). Considering that the Social Vitality cluster is also negatively related to Harm Avoidance, the difference might be explained by risk-taking versus disorganization components of Constraint: Individuals high on Mood Volatility may be disorganized and careless, whereas individuals high on Social Vitality like to do risky things. An alternative interpretation might be that Mood Volatility is more broadly related to measures of Constraint than Social Vitality, whereas the drug use and sexual activity variables in this sample are too limited in the upper range to adequately tap externalizing tendencies. If we were to recast the drug use and sexual activity variables as manifestations of experimentation and sensation seeking, their association with the Social Vitality cluster is consistent.

Contrast With Factor Structure Found by Rawlings et al. (2000)

In light of our divergent findings with validity measures, it is important to consider whether the alternative structure identified by Rawlings et al. (2000) would show the same pattern of associations. As noted earlier, the four factors found by Rawlings et al. overlap to varying degrees with our three clusters. Given that Rawlings et al.'s first factor essentially merged our Mood Volatility and Excitement clusters into one, it is clear that none of the diverging effects for the relatively healthy Excitement cluster would have been uncovered with this four-factor structure. Nevertheless, we would expect the first factor to show the same divergent pattern for NE and PE measures, though perhaps with smaller differences. Although it is unclear how the second factor reported by Rawlings et al. may have differed from the larger Social Vitality cluster, the third factor clearly reflects a narrower exhibitionist tendency, and the fourth factor reflects ordinariness (or entitlement) items that form a subcluster within Social Vitality. However, the Social Vitality cluster correlated highly with SNAP-SRF Exhibitionism ($r = .62$), so it is unknown whether Rawlings et al.'s third factor would prove more useful than the larger cluster. In addition, given that the scores on the fourth factor's subscale show lower estimates of common factor variance, especially when measured dichotomously, the proportion of variance available for association with another measure is smaller. Nevertheless, the narrower constructs implied by the third and fourth factors from Rawlings et al.'s analysis are theoretically cohesive and could be useful to researchers interested in these constructs.

Limitations

Several limitations to this study should be noted. One potential limitation involves the use of multiple regression analysis to explore unique associations of subscales. When unique (or residual) associations are quite different from the zero-order associations (in the case of suppression), it is problematic to interpret the residual association in terms of the original construct (Lynam et al., 2006; Miller & Chapman, 2001). This is especially problematic when the predictors are highly correlated, heterogeneous in content, and have low internal consistency (ensuring that the residual scores are more unreliable). Under these circumstances, suppressor effects are difficult to interpret (Lynam et al., 2006) and are often considered spurious, even though they do occur in personality psychology and may reveal important distinctions between related constructs (Paulhus, Robins, Trzesniewski, & Tracy, 2004).

We have tried to minimize the problems of interpreting partials in the present study. First, we have made an effort to ensure the conceptual distinctness of the subscales, as ICLUST maximizes estimates of internal consistency (alpha) and of homogeneity (beta). Each cluster identified distinct domains of social behavior, positive mood, and negative/dsyregulated emotions and cognition. Second, the pattern of unique associations we found frequently shows a larger discrepancy among the unique portions of the variables compared with the differences already apparent in the zero-order correlations. Admittedly, the correlation between Excitement and Mood Volatility in the three-cluster solution was high (.51), with internal consistencies that were adequate (.79 for both). In addition, substantial covariance with two other subscales was partialled out to calculate unique associations for each cluster. It is therefore unclear how representative subscale items can be of the residual associations. Nevertheless, Excitement items were highly homogeneous, suggesting that diverging unique associations were probably not due to the variance of a conceptually distinct subset of items. Although we should be cautious about interpreting the unique (and small) associations between Excitement and the validity variables not reflected in the zero-order associations (e.g., associations with the drugs/sex variables, Agreeableness, and aggression scales), these associations suggest that some portion of the Excitement cluster corresponds to superior health and social well-being, which was already implied by zero-order associations with Well-Being and Positive Temperament. Given the less ho-

mogeneous nature of the Mood Volatility/Social Vitality clusters, however, the unique associations for these clusters should be interpreted cautiously in terms of original scale content.

A second limitation is the fact that our data are not longitudinal; therefore, we do not know to what extent the subscales represent premorbid vulnerability and how they might differentially predict aspects of bipolar spectrum disorders. This would be an important line of future research. It is possible that only some clusters are predictive of the development of psychopathology. Furthermore, some clusters (such as Excitement) may actually be negative predictors of mental problems generally, and internalizing disorders specifically.

Although some of the HPS items reflect symptoms of mania, the bulk of its content does not assess frank symptoms of bipolar disorder; the multidimensional structure of the HPS and the variety of its correlates indicate that hypomanic personality is not synonymous with the clinical syndrome of hypomania. Thus, another limitation of our study is that we did not include other measures of frank manic symptoms. Therefore, we do not know how each subscale may be specifically related to or predictive of mania. Although it appears from our data that Mood Volatility would predict depressive episodes (and the other clusters would not), the relationship between mania and each cluster is unclear. Future research may address the following possibilities: (a) Mood Volatility predicts depressive episodes, whereas Social Vitality predicts manic episodes; (b) Mood Volatility predicts both depressive and manic episodes, whereas Social Vitality predicts only manic episodes; (c) Mood Volatility predicts both types of bipolar episodes, but Social Vitality predicts neither; and (d) Mood Volatility and Social Vitality predict different aspects of mania. We suspect that Excitement might predict manic episodes at the zero-order level but that it would not predict mania (and may even be a negative predictor) once its shared variance with Mood Volatility is removed.

Finally, our sample, though large, was drawn from a nonclinical and relatively well-adjusted and homogeneous population. Although the sample size may have resulted in relatively large ranges with respect to personality variables and internalizing symptoms, the variability for externalizing behavior may have been limited. As indicated earlier, compared with a sample drawn from a community or clinical population, our sample was probably limited to the extent that externalizing behavior was socially and physically dangerous or otherwise dysfunctional.

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(*Appendix follows*)

Appendix

Item Loadings on General and Group Factors Following Schmid–Leiman Transformation

Scale item	*g*	Factor 1	Factor 2	Factor 3	h^2
32. Hyper person	0.69	−0.01	0.03	0.65	0.89
3. Friends say I'm hyper	0.67	0.10	0.02	0.59	0.81
33. Happy, energetic, giddy	0.55	0.14	0.12	0.40	0.50
46. Impossible to stop talking	0.53	0.26	0.07	0.33	0.47
11. High spirits, can't concentrate	0.52	0.27	0.12	0.28	0.44
17. Average mood	−0.48	−0.17	−0.18	−0.28	0.37
6. Not center of attention	−0.43	0.12	−0.51	−0.24	0.52
8. Impossible to sit still	0.43	0.41	−0.07	0.22	0.40
20. No need to sleep	0.42	0.41	0.04	0.15	0.37
40. Life of party	0.41	−0.11	0.58	0.18	0.56
9. Amusing, eccentric	0.40	0.29	0.04	0.20	0.28
22. Get into mood to do everything	0.40	0.36	0.21	0.08	0.34
21. Moods do not fluctuate	−0.39	−0.51	0.05	−0.12	0.43
38. Thoughts racing	0.39	0.54	0.05	0.05	0.45
18. Feel I can outperform anyone	0.37	0.23	0.38	0.05	0.34
15. Excited happy, no reason	0.35	0.07	0.15	0.23	0.20
29. Have persuaded others to be adventurous, crazy	0.35	0.10	0.43	0.08	0.33
31. Can slow down	0.35	0.39	0.03	0.13	0.29
10. Extreme intense emotion	0.34	0.41	0.00	0.09	0.30
26. Good actor	0.34	0.13	0.41	0.06	0.30
5. Ideas and insights too fast to express	0.33	0.45	0.18	−0.02	0.34
7. Assertive, sociable	0.32	−0.02	0.51	0.08	0.37
44. Speeded-up and irritable	0.32	0.57	−0.10	0.03	0.44
19. Range of interests	0.31	0.28	0.26	0.02	0.24
35. Mood rules don't apply	0.31	0.46	0.23	0.07	0.36
2. Nervous about playing the clown	−0.30	0.14	−0.44	−0.16	0.33
43. Excited about project	0.30	0.36	0.14	0.02	0.24
42. Persuade and inspire others	0.29	0.02	0.62	0.02	0.47
45. Happy and irritable at the same time	0.29	0.40	0.01	0.05	0.24
4. Good comedian	0.28	0.01	0.41	0.08	0.26
25. Social discomfort	−0.28	0.18	−0.55	−0.11	0.43
27. Normal person	−0.28	−0.20	−0.24	0.04	0.18
37. Mood up and down	0.26	0.54	−0.24	0.06	0.42
41. Brief periods of inspiration	0.26	0.39	0.05	0.01	0.22
24. Excited and happy, know why	−0.25	−0.20	−0.01	−0.12	0.12
39. Good at controlling others	0.23	0.18	0.48	−0.10	0.32
47. Rather be ordinary	−0.21	−0.24	−0.36	0.10	0.24
12. Nothing can happen to me	0.20	0.23	0.19	−0.03	0.13
36. Can elicit sexual interest	0.20	−0.01	0.51	−0.05	0.30
28. Write down creative thinking	0.18	0.36	0.14	−0.09	0.19
34. Succeed	0.18	0.15	0.43	−0.11	0.25
16. No book about my life	−0.17	−0.12	−0.46	0.11	0.27
23. Succeed in several domains	0.17	0.17	0.37	−0.10	0.21
48. Achievements will be forgotten	−0.17	−0.06	−0.36	0.03	0.17
1. Average person	−0.16	−0.13	−0.39	0.10	0.21
13. Have clever ideas	0.16	0.02	0.43	−0.06	0.22
30. Politician	0.14	0.02	0.46	−0.07	0.24
14. No more self-aware	−0.12	−0.19	−0.22	0.09	0.11

Note. Maximum-likelihood factor analysis, followed by oblimin rotation and Schmid–Leiman transformation, was based on the tetrachoric correlation matrix. Items 12, 24, and 28 were included in the analysis. Items listed are truncated versions.

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