Supplemental Materials to:

Riskier Tests of the Validity of the Bifactor Model of Psychopathology

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Table S1. *Summary of fit statistics for confirmatory models on the subset of psychopathology where temperament data were available (N = 913).*

Model Description	X^2 (df)	RMSEA (90% CI)		TLI	CFI	BIC	AIC	SRMR	N params
One factor	7.00*** (90)	.09***	(.08, .09)	.54	.61	35731	35514	.09	45
Internalizing & Externalizing									
Two correlated factors	3.95*** (89)	.05	(.05, .06)	.84	.86	34958	34737	.06	46
Two uncorrelated factors	375.45*** (90)	.06**	(.05, .07)	.79	.82	35104	34887	.13	45
Bifactor with two correlated specific factors	187.42*** (74)	.04	(.03, .05)	.90	.93	34769	34475	.04	61
Bifactor with two uncorrelated specific factors	181.74*** (75)	.04	(.03, .05)	.90	.93	34765	34476	.04	60
Fear, Distress, & Externalizing									
Three correlated factors	281.73*** (87)	.05	(.04 .06)	.85	.87	34918	34687	.06	48
Three uncorrelated factors	581.36*** (90)	.08***	(.07, .08)	.63	.68	35504	35288	.17	45
Bifactor with three correlated specific factors	197.64*** (72)	.04	(.04, .05)	.88	.92	34770	34467	.04	63
Bifactor with three uncorrelated specific factors	238.31*** (75)	.05	(.04, .06)	.85	.90	34854	34565	.05	60

Note. ***p<.001, **p<.01, *p<.05.
N params=number of parameters.

Figure 1. *Best-fitting alternative structural models.*

Figure 1a.

Figure 1b.

Figure 1c.

Figure 1d.

Figure 1e.

Figure 1f.

Note. Parameter estimates are standardized factor loadings and correlations. Bolded are *p*<.001 and italicized are *p*<.01.
INA = Inattention; HYP = Hyperactivity; IMP = Impulsivity; ODD = Oppositional defiant disorder; CND = Conduct disorder; MDD = Major depressive disorder; GAD = Generalized anxiety disorder; PAN = Panic disorder; SOC = Social phobia; SEP = Separation anxiety; AGO = Agoraphobia; OBS = Obsessions; COM = Compulsions; TIC = Motor tics; SPH = Specific phobia.

Table S2. *Satorra-Bentler chi-squared difference tests equating fears' and distress' relations with external criteria.*

	ΔX^2	df	p
3 correlated factors			
All relations equal	109.64	9	.000
APSD equal	26.35	3	.000
EAS equal	16.66	4	.002
RPA equal	1.60	2	.005
Bifactor model with 3 correlated specific factors			
All relations equal	35.99	9	.000
APSD equal	15.60	3	.001
EAS equal	6.37	4	.173
RPA equal	11.56	2	.003
Bifactor model with 3 uncorrelated specific factors			
All relations equal	54.09	9	.000
APSD equal	14.89	3	.002
EAS equal	14.52	4	.006
RPA equal	2.72	2	.000

Note. Chi-squared difference tests reflect the difference between two nested models, one with fears' and distress' relations with external criteria freely estimated and the other with their relations equated.
APSD = Antisocial Process Screening Device; EAS = EAS Temperament Inventory; RPA = Reactive Proactive Aggression Questionnaire.

Table S3. *Factor loadings, intercorrelations, and reliability indices for 2-factor confirmatory factor analytic models.*

	2CFs		Bifactor with 2CSFs			Bifactor with 2UNCSFs		
	INT	EXT	GEN	INT	EXT	GEN	INT	EXT
Psychopathology								
Agoraphobia	**.59**		*.19*	**.59**		**.27**	**.57**	
Compulsions	**.44**		*.19*	**.40**		**.25**	**.36**	
Generalized anxiety	**.77**		**.48**	**.58**		**.57**	**.50**	
Major depression	**.58**		**.76**	**.24**		**.77**	.13	
Obsessions	**.51**		**.35**	**.38**		**.40**	**.33**	
Panic	**.50**		*.15*	**.51**		**.22**	**.49**	
Separation anxiety	**.60**		*.13*	**.65**		**.24**	**.61**	
Social anxiety	**.42**		*.14*	**.40**		**.20**	**.38**	
Specific phobia	**.43**		.05	**.50**		**.14**	**.46**	
Tics	**.27**		**.16**	*.21*		**.21**	.16	
Conduct disorder		**.39**	**.54**		*.13*	**.53**		.08
Hyperactivity		**.80**	**.27**		**.80**	**.36**		**.79**
Impulsivity		**.75**	**.23**		**.74**	**.33**		**.69**
Inattention		**.69**	**.42**		**.55**	**.48**		**.49**
Oppositional defiant disorder		**.70**	**.55**		**.48**	**.60**		**.40**
Factor intercorrelations	INT-EXT: **.48**		INT-EXT: **.28**			INT-EXT: .00		
H index	.82	.84	.76	.76	.79	.80	.71	.76

Note. Bolded is *p*<.001; italicized is *p*<.01.
2CFs = 2 correlated factors; 2CSFs = 2 correlated specific factors; 2UNCSFs = 2 uncorrelated specific factors; INT = Internalizing; EXT = Externalizing; GEN = General.

Table S4. *Psychopathology symptom dimensions' loadings on the general factor as a function of dropped symptom dimensions for bifactor models with 3 specific factors.*

						Psychopathology Symptom Dimension Dropped									

Bifactor model with 3 correlated specific factors

	None	AGO	CND	COM	DEP	GAD	HYP	IMP	INA	OBS	ODD	PAN	SAD	SOC	SPH	TIC
AGO	.18	(.99)	-.02	.11	-.02	.02	.13	.13	.08	.03	-.05	.11	.12	.14	.16	.14
CND	.61	.61	(.01)	.62	-.08	.60	.58	.58	.56	-.48	-.45	.61	.60	.62	.61	.63
COM	.17	.10	.09	(.99)	.08	.03	.11	.12	.05	-.01	.02	.12	.13	.15	.16	.13
DEP	.68	.63	.03	.63	(-.09)	.48	.59	.61	.46	-.58	.32	.64	.64	.65	.67	.63
GAD	.37	.26	.05	.27	.04	(.90)	.25	.27	.13	-.16	-.04	.29	.29	.31	.34	.29
HYP	.40	.18	.77	.17	.71	.00	(.96)	.06	-.14	-.02	.33	.19	.17	.22	.22	.18
IMP	.22	.15	.61	.14	.58	-.03	.01	(.97)	-.14	.04	.33	.16	.14	.19	.19	.15
INA	.25	.35	.42	.34	.37	.17	.23	.26	(.84)	-.22	.10	.35	.34	.37	.38	.34
OBS	.38	.33	.01	.34	-.02	.29	.35	.35	.31	(-.89)	-.23	.34	.34	.37	.37	.36
ODD	.55	.50	.26	.50	.20	.33	.40	.42	.25	-.36	(-.65)	.51	.49	.53	.53	.50
PAN	.16	.08	.02	.09	.02	.02	.10	.11	.06	.05	-.01	(.99)	.10	.13	.14	.12
SAD	.14	.04	.14	.06	.15	-.08	.03	.04	-.06	.14	.14	.05	(.99)	.10	.10	.08
SOC	.09	.02	.02	.04	.02	-.08	.03	.04	-.03	.02	.05	.05	.04	(1.00)	.07	.05
SPH	.06	-.02	.18	-.01	.19	-.11	-.04	-.04	-.12	.16	.19	-.01	-.02	.03	(1.00)	.01
TIC	.14	.10	.14	.09	.14	.01	.07	.08	.00	-.03	.07	.10	.10	.12	.12	(.99)

Bifactor model with 3 uncorrelated specific factors

	None	AGO	CND	COM	DEP	GAD	HYP	IMP	INA	OBS	ODD	PAN	SAD	SOC	SPH	TIC
AGO	.46	(.97)	.46	.40	.61	.23	.47	.45	.46	.39	-.05	.38	.33	.40	.40	.45
CND	.36	.46	(.99)	.38	.21	.63	.31	.31	.27	.33	-.45	.38	.42	.43	.39	.37
COM	.36	.27	.35	(1.00)	.46	.22	.36	.35	.35	.30	.02	.30	.29	.33	.33	.34
DEP	.77	.77	.72	.80	(.82)	.57	.75	.78	.76	.80	-.32	.81	.80	.77	.79	.79
GAD	.84	.70	.92	.83	.63	(.74)	.84	.85	.90	.90	-.04	.82	.74	.74	.81	.84
HYP	.32	.36	.24	.32	.26	.38	(1.00)	.13	.11	.31	.33	.33	.33	.35	.32	.32
IMP	.31	.35	.24	.31	.29	.36	.12	(1.00)	.12	.30	.33	.31	.31	.33	.31	.31
INA	.41	.47	.34	.42	.32	.49	.26	.28	(.99)	.39	.10	.42	.43	.44	.42	.41
OBS	.44	.40	.41	.41	.49	.41	.45	.44	.42	(.99)	-.23	.40	.40	.46	.42	.43
ODD	.49	.57	.41	.49	.35	.62	.36	.37	.34	.46	(.98)	.50	.52	.54	.50	.49
PAN	.36	.24	.35	.30	.52	.21	.36	.35	.35	.28	-.01	(1.00)	.24	.32	.30	.34
SAD	.42	.28	.43	.36	.61	.23	.43	.41	.42	.34	.14	.33	(.98)	.37	.34	.41
SOC	.36	.25	.38	.33	.44	.13	.37	.36	.37	.34	.05	.32	.27	(.98)	.32	.35
SPH	.28	.18	.28	.23	.43	.15	.28	.27	.28	.21	.19	.20	.14	.22	(.99)	.26
TIC	.25	.24	.25	.23	.28	.17	.25	.24	.24	.22	.07	.23	.23	.25	.23	(1.00)

Note. Convergent correlations between the factor scores for the general factor (1) from the full model (with no indicators dropped) and (2) from the model with each symptom dimension dropped are displayed along the diagonal.

Table S5. *Psychopathology symptom dimensions' loadings on the general factor as a function of dropped symptom dimensions for bifactor models with 2 specific factors.*

						Psychopathology Symptom Dimension Dropped									
Bifactor model with 2 correlated specific factors															
	None	AGO	CND	COM	DEP	GAD	HYP	IMP	INA	OBS	ODD	PAN	SAD	SOC	SPH	TIC
AGO	.19	(.99)	-.04	.10	.50	.11	.10	.11	.04	-.03	.08	.12	.12	.13	.17	.14
CND	.54	.54	(.15)	.55	-.05	-.48	.52	.51	.51	.47	-.38	.54	.53	.55	.54	.55
COM	.19	.11	.07	(.99)	.32	.04	.11	.12	.05	.03	.04	.13	.14	.14	.17	.14
DEP	.76	.71	.13	.71	(-.06)	-.58	.68	.71	.59	.68	-.54	.73	.73	.72	.75	.73
GAD	.48	.37	.12	.39	.42	(-.87)	.36	.38	.25	.26	-.10	.41	.41	.41	.46	.41
HYP	.27	.23	.83	.22	.11	-.06	(.97)	.11	-.06	.15	.13	.24	.23	.24	.26	.23
IMP	.23	.18	.61	.18	.17	.01	.03	(.98)	-.07	.09	.19	.19	.18	.20	.22	.19
INA	.42	.38	.45	.38	.10	-.22	.26	.30	(.91)	.31	-.06	.39	.38	.39	.41	.38
OBS	.35	.28	.01	.30	.29	-.14	.30	.30	.25	(.94)	-.14	.30	.31	.32	.34	.32
ODD	.55	.52	.29	.52	.09	-.34	.42	.43	.32	.43	(-.80)	.52	.51	.53	.53	.52
PAN	.15	.06	-.01	.07	.46	.11	.07	.07	.01	-.05	.11	(.99)	.08	.10	.13	.09
SAD	.13	.02	.10	.04	.61	.21	.01	.01	-.09	-.11	.24	.05	(.99)	.07	.10	.07
SOC	.14	.06	.02	.07	.34	.10	.06	.07	-.02	.01	.07	.09	.09	(.99)	.12	.09
SPH	.05	-.03	.14	-.02	.48	.21	-.06	-.05	-.13	-.13	.26	-.01	-.02	.00	(1.00)	-.01
TIC	.16	.12	.14	.12	.15	-.01	.10	.11	.04	.07	.00	.13	.13	.14	.15	(.99)
Bifactor model with 2 uncorrelated specific factors															
	None	AGO	CND	COM	DEP	GAD	HYP	IMP	INA	OBS	ODD	PAN	SAD	SOC	SPH	TIC
AGO	.27	(.98)	.12	.16	.44	-.03	.24	.24	.23	.09	.31	.17	.15	.18	.21	.22
CND	.53	.57	(.53)	.57	.06	.65	.50	.49	.50	.54	.42	.55	.55	.57	.54	.56
COM	.25	.16	.18	(.99)	.28	.04	.21	.22	.21	.13	.27	.18	.17	.19	.21	.20
DEP	.77	.69	.33	.71	(.28)	.57	.76	.79	.77	.66	.90	.73	.74	.72	.75	.74
GAD	.57	.45	.35	.48	.39	(.91)	.53	.53	.51	.43	.58	.49	.46	.48	.52	.51
HYP	.36	.39	.82	.37	.22	.31	(.98)	.15	.07	.40	.14	.37	.34	.38	.35	.35
IMP	.33	.36	.75	.34	.27	.28	.09	(.98)	.07	.38	.12	.34	.30	.35	.32	.33
INA	.48	.50	.67	.49	.21	.43	.30	.34	(.97)	.52	.30	.49	.46	.49	.47	.48
OBS	.40	.32	.14	.34	.28	.25	.38	.38	.38	(.96)	.40	.34	.33	.37	.37	.37
ODD	.60	.64	.64	.63	.22	.58	.46	.47	.43	.67	(.94)	.62	.59	.63	.59	.61
PAN	.22	.12	.13	.14	.43	.00	.19	.19	.17	.08	.24	(.99)	.12	.16	.17	.17
SAD	.24	.14	.25	.17	.67	-.03	.18	.18	.15	.11	.26	.16	(.99)	.18	.17	.20
SOC	.20	.10	.14	.13	.29	-.06	.17	.18	.14	.11	.22	.14	.12	(.99)	.15	.16
SPH	.14	.08	.22	.09	.53	-.05	.08	.09	.07	.06	.15	.08	.04	.10	(1.00)	.10
TIC	.21	.17	.21	.17	.15	.08	.17	.18	.16	.16	.19	.17	.17	.18	.18	(.99)

Note. Convergent correlations between the factor scores for the general factor (1) from the full model (with no indicators dropped) and (2) from the model with each symptom dimension dropped are displayed along the diagonal.

Figure S2a. *Variability in each symptom dimensions' loadings on the general factor when each other symptom dimension is dropped from the general factor.*
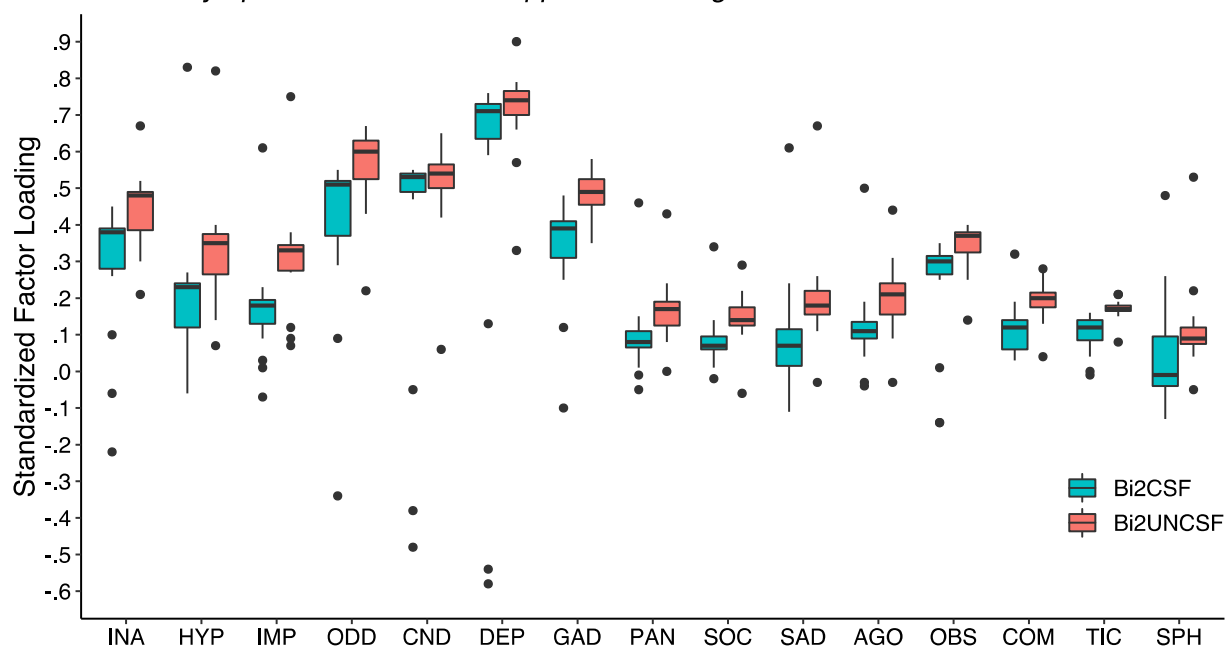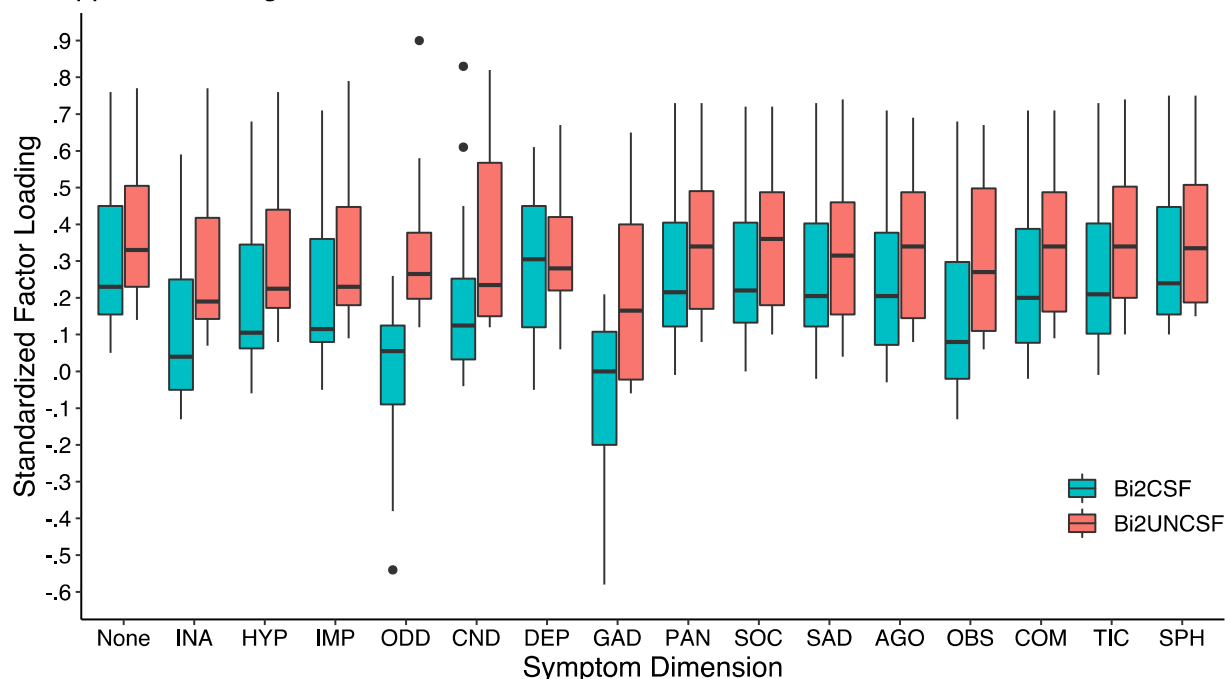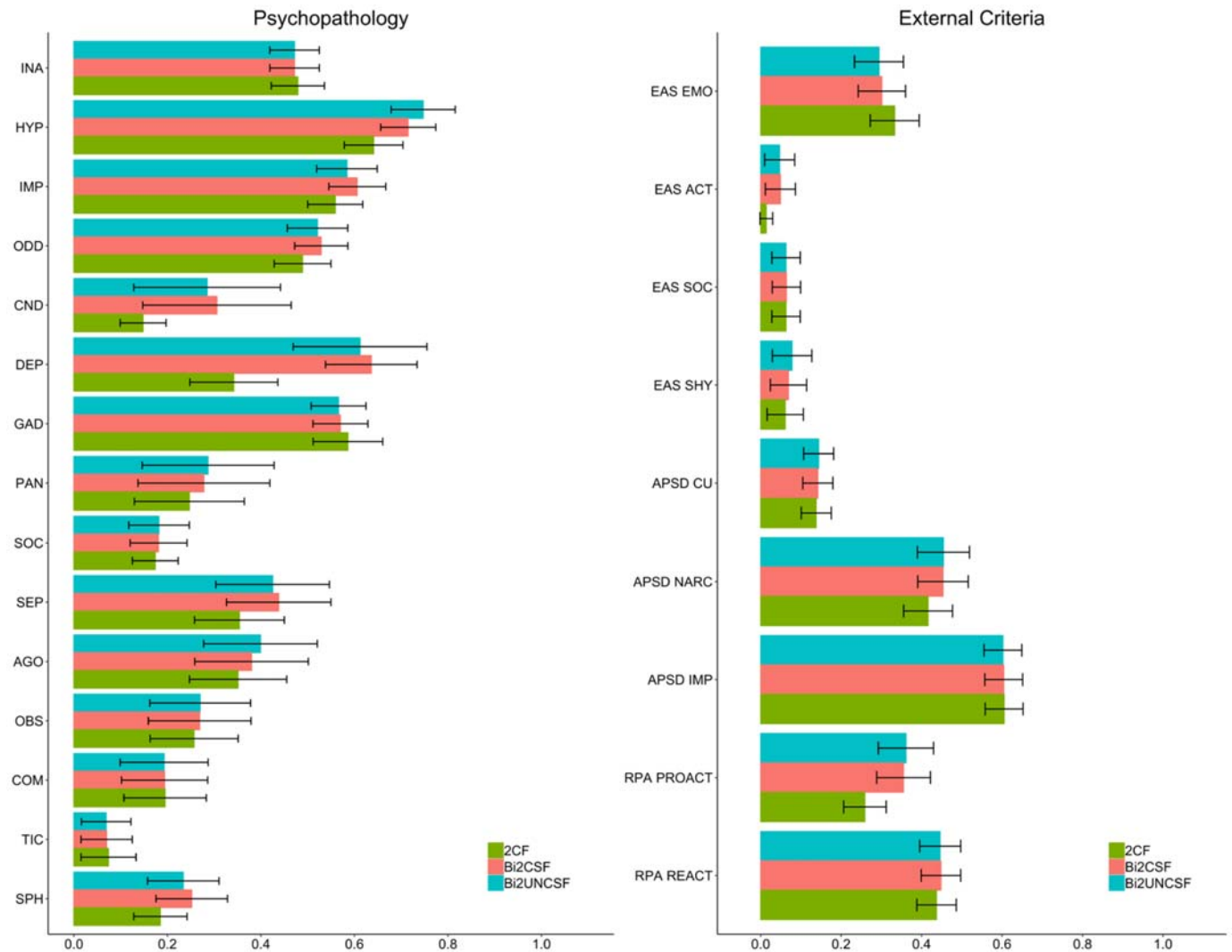

Figure S2b. *Variability in loadings on the general factor when each symptom dimension is dropped from the general factor.*

Note. Figure S2A displays the variability of each symptom dimension's (x-axis) loading on the general factor (y-axis) as a function of dropping each other symptom dimension from the general factor one at a time across the 15 models tested. Figure S2B displays loadings on the general factor (y-axis) when each symptom dimension is dropped from the general factor one at a time (x-axis).

Bi2CSF = Bifactor model with 2 correlated specific factors; Bi2UNCSF = Bifactor model with 2 uncorrelated specific factors; INA = Inattention; HYP = Hyperactivity; IMP = Impulsivity; ODD = Oppositional defiant disorder; CND = Conduct disorder; DEP = Major depression; GAD = Generalized anxiety; PAN = Panic disorder; SOC = Social anxiety; SAD = Separation anxiety; AGO = Agoraphobia; OBS = Obsessions; COM = Compulsions; TIC = Tics; SPH = Specific phobia; None = Full model with no symptom dimensions dropped.

Figure S3. *Explained variance in psychopathology and external criteria by psychopathology model.*

Note. Explained variance = R^2. All error bars reflect 95 percent confidence intervals.
2CF = 2 correlated factors; Bi2CSF = Bifactor model with 2 correlated specific factors; Bi2UNCSF = Bifactor model with 2 uncorrelated specific factors;
INA = Inattention; HYP = Hyperactivity; IMP = Impulsivity; ODD = Oppositional defiant disorder; CND = Conduct disorder; DEP = Major depression; GAD = Generalized anxiety; PAN = Panic disorder; SOC = Social anxiety; SAD = Separation anxiety; AGO = Agoraphobia; OBS = Obsessions; COM = Compulsions; TIC = Tics; SPH = Specific phobia; EAS EMO = EAS Emotionality; EAS ACT = EAS Activity; EAS SOC = EAS Sociability; EAS SHY = EAS Shyness; APSD CU = APSD Callous-unemotional; APSD NARC = APSD Narcissism; APSD IMP = APSD Impulsivity; RPA PROACT = RPA Proactive Aggression; RPA REACT = RPA Reactive Aggression.

Table S6. *Zero-order and partial correlations between psychopathology factors and external criteria.*

		EAS Shyness		EAS Activity		EAS Emotionality		EAS Sociability		APSD Callous-Unemotional		APSD Narcissism		APSD Impulsivity	
		r	*ß*	*r*	*ß*	*r*	*ß*	*r*	*ß*	*r*	*ß*	*r*	*ß*	*r*	*ß*
2CF	INT	**.20**	**.29**	.09	.03	**.44**	**.18**	.11	-.03	**.11**	**-.13**	**.44**	.10	**.46**	.03
	EXT	.01	*-.15*	**.12**	*.10*	**.55**	**.45**	**.23**	**.25**	**.35**	**.42**	**.65**	**.59**	**.78**	**.76**
	GEN	.12	.10	-.02	-.09	**.48**	**.35**	.09	.02	**.28**	**.25**	**.62**	**.54**	**.65**	**.54**
Bi2CSF	INT	**.21**	**.23**	*.12*	.09	**.34**	**.16**	.09	.01	-.01	**-.14**	**.23**	.00	**.25**	-.02
	EXT	-.07	**-.15**	**.17**	**.16**	**.47**	**.35**	**.26**	**.25**	**.29**	**.29**	**.51**	**.41**	**.66**	**.57**
	GEN	**.14**	*.13*	.02	-.06	**.54**	.43	.12	.05	**.28**	**.27**	**.64**	**.59**	**.68**	**.60**
Bi2UNCSF	INT	**.22**	**.19**	.10	.11	**.25**	.14	.05	.03	-.07	**-.14**	.11	-.03	*.11*	-.04
	EXT	*-.12*	**-.15**	**.17**	**.18**	**.40**	.30	**.26**	**.25**	**.28**	**.23**	**.44**	**.33**	**.60**	.49
3CF	DIST	**.18**	.11	.10	.00	**.49**	.19	*.14*	.11	**.13**	**-.19**	**.50**	**.34**	**.53**	.22
	FEAR	**.21**	.18	.08	.03	**.40**	.01	.09	-.12	*.08*	**.04**	**.38**	*-.20*	**.39**	-.17
	EXT	.01	-.14	**.12**	.10	**.56**	**.44**	**.23**	**.22**	**.35**	**.44**	**.65**	**.54**	**.79**	**.73**
	GEN	.11	.09	-.04	*-.13*	**.51**	**.35**	.07	-.03	.32	**.31**	**.65**	**.55**	**.66**	**.53**
Bi3CSF	DIST	**.20**	.03	*.14*	.15	**.38**	.13	*.13*	.17	-.03	**-.24**	**.29**	.11	**.31**	.09
	FEAR	**.22**	.22	.11	-.03	**.34**	.06	.09	-.13	-.01	**.06**	**.23**	-.08	**.25**	-.08
	EXT	-.06	**-.15**	**.17**	**.17**	**.48**	**.35**	**.27**	**.26**	**.28**	**.28**	**.51**	**.40**	**.67**	**.10**
	GEN	**.18**	**.18**	.06	.04	**.45**	**.41**	.11	.09	**.14**	**.13**	**.49**	**.46**	**.51**	**.48**
Bi3UNCSF	DIST	-.07	-.02	-.13	*-.14*	-.08	-.11	-.04	-.08	**.19**	**.16**	.05	.02	.09	.05
	FEAR	*.14*	.10	.08	.05	*.17*	.07	.02	-.01	-.03	**-.03**	-.02	-.08	-.02	*-.08*
	EXT	*-.13*	**-.14**	**.13**	*.14*	**.39**	**.36**	**.67**	**.23**	**.33**	**.31**	**.48**	**.44**	**.63**	**.59**

Note. Bolded is *p*<.001; italicized is *p*<.01. Partial correlations (presented as standardized Betas) were derived from simultaneous regressions in single
simultaneously onto all psychopathology factors in the model.
CF = Correlated factors; CSF = correlated specific factors; UNCSF = uncorrelated specific factors; Bi = Bifactor model; INT = Internalizing; EXT = Exte
EAS = Emotionality Activity Sociability Temperament Inventory; APSD = Antisocial Process Screening Device; RPA = Reactive Proactive Aggression C

ummary of fit statistics for confirmatory models where panic disorder loaded onto distress as opposed to fears.

Model Description	X^2 (df)	RMSEA (90% CI)		TLI	CFI	BIC	AIC	SRMR
ss, & Externalizing – Panic disorder on Distress								
ated factors	546.20*** (87)	.05	(.04, .05)	.82	.85	86426	86147	.06
rrelated factors	1147.58*** (90)	.07***	(.07, .07)	.59	.65	87983	87721	.17
three correlated specific factors	272.10*** (72)	.03	(.03, .04)	.90	.93	85752	85385	.04
three uncorrelated specific factors	436.13*** (75)	.04	(.04, .05)	.83	.88	86141	85792	.05

001, **p<.01, *p<.05.
umber of parameters.

Table S8. *Factor loadings, intercorrelations, and reliability indices for confirmatory models in which panic disorder loaded o...*
fears.

| | 3CFs | | | 3UNCFs | | | Bifactor with 3CSFs | | | | |
	FEAR	DIST	EXT	FEAR	DIST	EXT	GEN	FEAR	DIST	EXT	
Inattention			.70			.68	.43			.54	
Hyperactivity			.80			.83	.29			.80	
Impulsivity			.74			.76	.25			.74	
Oppositional defiant disorder			.71			.68	.55			.47	
Conduct disorder			.39			.37	.53			.13	
Major depression		.62			.61		.78		.21		
Generalized anxiety		.78			.89		.51		.54		
Panic		.48			.39		.17		.49		
Social anxiety	.42			.39			.14	.40			
Separation anxiety	.61			.66			.14	.65			
Agoraphobia	.62			.62			.20	.58			
Obsessions	.51			.48			.35	.37			
Compulsions	.45			.43			.19	.39			
Tics	.26			.22			.17	.21			
Specific phobia	.45			.50			.06	.50			
Factor intercorrelations	FEAR-DIST: **.92** FEAR-EXT: **.41** DIST-EXT: **.54**			FEAR-DIST: .00 FEAR-EXT: .00 DIST-EXT: .00			FEAR-DIST: **1.07** FEAR-EXT: **.28** DIST-EXT: **.24**				

Note. Bolded are $p<.001$; italicized are $p<.01$.
CFs = Correlated factors; UNCFs = Uncorrelated factors; CSFs = Correlated specific factors; UNCSFs = Uncorrelated spec...
DIST= Distress; EXT = Externalizing; GEN = General.