ONLINE SUPPLEMENTAL MATERIALS FOR *JOURNAL OF ABNORMAL PSYCHOLOGY* MANUSCRIPT “Genetic Overlap Between Personality and Risk for Disordered Gambling: Evidence from a National Community-Based Australian Twin Study”
by Slutske, Cho, Piasecki, & Martin

The following are presented in these supplemental materials:

I) A complete description of the scales in the Multidimensional Personality Questionnaire (1 Table).

II) A discussion of the rationale underlying the choice of the disordered gambling phenotype and comparisons with alternative approaches (2 Tables, 1 Figure)

III) A table reporting the proportion of genetic liability for DG explained by personality-related genetic variation (1 Table).

IV) References for the supplemental materials not found in the main manuscript

I) A complete description of the scales in the Multidimensional Personality Questionnaire.

Table S1. Multidimensional Personality Questionnaire (MPQ) Scale Descriptions	
MPQ scale	Description of a high scorer
Positive Emotionality	Individuals high on the higher-order dimension of positive emotionality have a lower threshold for the experience of positive emotions and for positive engagement in their social and work environments, and tend to view life as being essentially a pleasurable experience.
Well Being	Has a happy, cheerful disposition; feels good about self and sees a bright future
Social Potency	Is forceful and decisive; fond of influencing others; fond of leadership roles
Achievement	Works hard; enjoys demanding projects and working long hours
Social Closeness	Is sociable, likes people, and turns to others for comfort
Negative Emotionality	Individuals high on the higher-order dimension of negative emotionality have a low general threshold for the experience of negative emotions such as anxiety and anger, and tend to break down under stress.
Stress Reaction	Is nervous, vulnerable, sensitive, prone to worry
Alienation	Feels mistreated, victimized, betrayed, and the target of false rumors
Aggression	Hurts others for own advantage; will frighten and cause discomfort for others
Constraint	Individuals high on the higher-order dimension of constraint tend to endorse conventional social norms, avoid thrills, and act in a cautious and restrained manner.
Self-control	Is reflective, cautious, careful, rational, planful
Harm Avoidance	Avoids excitement and danger; prefers safe activities even if they are tedious
Traditionalism	Desires a conservative social environment; endorses high moral standards

II. Supplementary analyses supporting the disordered gambling trait

We address two issues in this section:

1) how the results based on a liability threshold model using a threshold of 1+ symptoms of disordered gambling will generalize to disordered gambling that is based on more extreme clinically-relevant symptom cut-offs

2) how the results based on biserial correlations using a dichotomous disordered gambling trait compare to results that would have been obtained based on Pearson correlations using a continuous disordered gambling symptom count.

(1) The liability threshold model that is commonly used in psychiatric genetics makes the assumption that underlying categorical diagnoses is a latent liability dimension. In fitting a liability-threshold model the threshold used will typically correspond to whether or not an individual is affected versus unaffected with a disorder. However, with dimensional diagnoses such as disordered gambling, this diagnostic cut-point also represents a count on a continuous symptom scale (i.e. 5 out of 10 symptoms for DSM-IV pathological gambling disorder). When the symptoms making up the scale are all indicators of the same unidimensional construct, as indicated by previous research using the DSM-IV (Strong & Kahler, 2007; Slutske et al., 2010) the cut-point used for the threshold in the liability-threshold model does not necessarily have to correspond to the cut-point used for a clinical diagnosis. The liability threshold model assumes that the causes of variation in risk will be the same at any point along the liability distribution and for any threshold imposed (Reich et al, 1975). Figure S1 below illustrates the concepts of a liability distribution and different thresholds imposed based on different symptom cut-points.

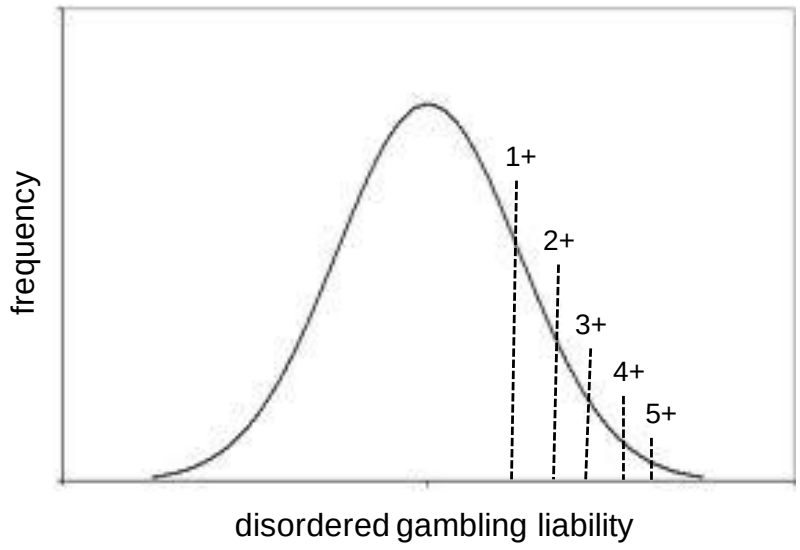

Figure S1. Liability threshold model of disordered gambling with five different thresholds imposed corresponding to the number of disordered gambling symptoms endorsed.

We empirically evaluated this by examining the biserial correlations between each of the MPQ personality scales and disordered gambling defined by five different symptom cut-points. The results of this analysis are presented in Table S2 below. Note that the cut-

off used in the present study was 1+ and the cut-off for a DSM-IV diagnosis of pathological gambling is 5+ (the preliminary criteria proposed for DSM-5 would be 4+). As Table S2 illustrates, the disordered gambling/personality correlations were relatively consistent across the different thresholds imposed. For example, the correlations between DG and Constraint ranged from -.11 to -.13. Thus, the results using the 1+ disordered gambling symptom count are generalizable to results that would have been obtained using a more stringent cut-off. Note that this table does not report the level of precision of these different estimates -- the estimates were more precise using a broader definition than a narrower one. The lower threshold was selected because it yielded similar results while providing more precise parameter estimates and hence greater statistical power.

Table S2. Generalizability of results based on a 1+ DG symptom count.

	DG symptom count cut-point				
MPQ scale	1+	2+	3+	4+	5+
Positive emotionality	-.06	-.09	-.12	-.10	-.11
Negative emotionality	.32	.30	.32	.29	.28
Constraint	-.11	-.10	-.10	-.10	-.13
Well Being	-.08	-.11	-.14	-.13	-.14
Social Potency	.06	.08	.03	.05	.04
Achievement	-.05	-.07	-.05	-.07	-.09
Social Closeness	-.10	-.14	-.16	-.12	-.10
Stress Reaction	.26	.26	.30	.28	.28
Alienation	.24	.23	.24	.21	.20
Aggression	.24	.22	.22	.20	.19
Self-control	-.17	-.17	-.18	-.19	-.20
Harm Avoidance	-.07	-.04	-.06	-.04	-.02
Traditionalism	.00	.00	.02	-.02	-.06

Note: cell entries are biserial correlations.

(2) We also compared the correlations between disordered gambling and personality based on biserial correlations using a dichotomized disordered gambling indicator and based on Pearson's correlations using a continuous disordered gambling symptom count. Table S3 below shows the original biserial correlations reported in the manuscript, and Pearson correlations based on DSM-IV disordered gambling symptom counts. The correlation obtained for the higher-order dimension of Constraint was -.11 with the biserial correlation and -.06 with the Pearson's correlation of symptoms counts. The similarity of these correlations suggests that the same level of covariation is being

captured using the biserial correlation (which assumes an underlying continuous dimension of disordered gambling liability) as would be observed using a continuous disordered gambling symptom count.

Table S3. Correlations between disordered gambling and Big Three higher-order and lower-order personality traits in the full sample.

	Correlation type	
	biserial[a]	Pearson[b]
Big 3 higher-order personality dimensions		
Positive emotionality	-.06	-.04
Negative emotionality	.32	.21
Constraint	-.11	-.06
lower-order dimensions of Positive Emotionality		
Well Being	-.08	-.06
Social Potency	.06	.04
Achievement	-.05	-.03
Social Closeness	-.10	-.07
lower-order dimensions of Negative Emotionality		
Stress Reaction	.26	.16
Alienation	.24	.18
Aggression	.24	.14
lower-order dimensions of Constraint		
Self-control	-.17	-.11
Harm Avoidance	-.07	-.02
Traditionalism	.00	.00

Note: Both sets of models adjust for the effect of sex. [a] correlations between disordered gambling symptom count dichotomized at zero versus 1 or more symptoms. All correlations were statistically significant at $p < .001$ *except* for Achievement and Traditionalism.
[b] correlations between log-transformed continuous disordered gambling symptoms counts. All correlations were statistically significant at $p < .001$ *except* for Positive Emotionality, Achievement, Harm Avoidance, and Traditionalism

III) Table S4 below reports the proportion of genetic liability for disordered gambling explained by personality-related genetic variation.

Table S4. Proportions of genetic variation in disordered gambling risk explained by Big Three higher-order and selected lower-order personality traits.

	Men[a]	Women[a]	Combined[b]
Big Three higher-order personality dimensions			
Positive emotionality	.00	.02	.00
	[-.02, .02]	[-.04, .08]	[-.01, .02]
Negative emotionality	.20	.32	.27
	[.00, .29]	[.09, .54]	[.12, .42]
Constraint	.02	.06	.01
	[-.06, .10]	[-.04, .16]	[-.02, .05]
All three Big Three dimensions	.22	.40	.29
	[.02, .42]	[.13, .66]	[.13, .44]
Selected lower-order personality dimensions			
Stress Reaction	.09	.11	.11
	[-.05, .23]	[-.04, .27]	[.01, .22]
Alienation	.21	.33	.28
	[.01, .41]	[.11, .56]	[.14, .43]
Aggression	.07	.30	.22
	[-.08, .21]	[.05, .54]	[.04, .39]
Self-control	.00	.26	.09
	[-.01, .01]	[.04, .47]	[-.01, .18]
All four lower-order dimensions	.22	.62	.42
	[.01, .43]	[.25, .99]	[.21, .63]

Note: [a] = includes same-sex twin pairs, [b] = includes same- and unlike-sex twin pairs. 95% confidence intervals are in brackets

References

Reich, T., Cloninger, C.R., & Guze, S.B. (1975). The multifactorial model of disease transmission: I. description of the model and its use in psychiatry. *British Journal of Psychiatry, 127*, 1-10.

Strong, D.R., & Kahler, C.W. (2007). Evaluation of the continuum of gambling problems using the DSM-IV. *Addiction, 102*, 713-721.