What’s in a Disruptive Disorder?
Temperamental Antecedents of Oppositional Defiant Disorder: Findings from the Avon Longitudinal Study

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Objective: Oppositional defiant disorder (ODD) is classified as a disruptive disorder, but shows a wide range of associations with other psychopathology, including internalizing problems. The reasons for these associations are unclear. Here we test the hypothesis that two distinct early temperamental precursors—emotionality and activity—underlie ODD and differentially predict its comorbidities. Method: The Avon Longitudinal Study of Parents and Children (ALSPAC) community-based representative sample was used. Temperamental dimensions at the age of 38 months were derived through exploratory factor analysis from the Emotionality Activity Sociability (EAS) scale and used in logistic regression predicting to psychiatric diagnoses at the age of 91 months. Results: Pure ODD was predicted by both emotionality (relative risk ratio [RRR] = 1.34, CI = 1.09 to 1.66) and activity (RRR = 1.39, CI = 1.07 to 1.81). The strongest predictions were from early temperament to ODD with comorbidity: from emotionality to ODD plus internalizing disorders (RRR = 3.33, CI = 2.14 to 5.19), and from activity to ODD plus ADHD (RRR = 3.24, CI = 1.48 to 7.11). Temperamental activity was a predictor of the hyperactive–impulsive and combined types of ADHD but not of the inattentive type. Conclusions: Classified as a disruptive disorder, ODD is predicted by early emotion dysregulation as well as by high levels of temperamental activity. The findings of this study suggest that early emotionality and activity differentially contribute to the phenotype of ODD in middle childhood and may determine its range of co-occurrence with other psychopathology. Taking into account the heterogeneous origins of childhood oppositionality may help to refine clinical approaches to ODD. J. Am. Acad. Child Adolesc. Psychiatry, 2010;49(5):474–483. Key Words: oppositional defiant disorder, attention-deficit hyperactivity disorder, depression, irritability, Avon Longitudinal Study of Parents and Children

Oppositional defiant disorder (ODD) is classified as a disruptive behavior disorder in DSM-IV and is a well-established risk factor for conduct disorder (CD) in some children. In addition, ODD has a wide range of cross-sectional and longitudinal associations with other disorders such as ADHD and internalizing disorders. Indeed ODD, by virtue of the pattern and range of associations with other disorders, is increasingly seen as occupying a central position in developmental psychopathology. However, the underlying reasons for these unique features of ODD development remain unclear. Recent findings suggest that youth oppositionality involves distinct dimensions each differentially predicting other psychopathology: an irritable dimension predicting primarily depression and generalized anxiety (GAD), a headstrong dimension as the predictor of attention-deficit/hyperactivity disorder (ADHD) and nonaggressive CD, and a hurtful dimension predicting aggressive conduct problems. Based on these findings, we have recently proposed that...
ODD represents the shared outcome of distinct risk pathways. In particular, we have proposed that different temperamental dimensions may contribute to the risk of ODD and underlie its wide range of relationships with other disorders. In addition, we have recently shown that a construct of mood lability, which shares features with temperamental emotionality, was not only a predictor of individual disorders but a particularly strong predictor of their co-occurrence.

“Temperament” is a term most commonly used to describe how individuals differ in emotions, activity, attention, and in their ability to regulate these. It has a genetic basis but is also subject to maturation and experience, and temperament is closely related to the concept of personality, showing developmental continuity. The nature of the relationship between temperament and psychopathology has long been debated. Among a number of possibilities, two nonmutually exclusive models are commonly invoked to explain this relationship: in the spectrum model, disorders are construed as the extremes of temperamental dimensions, whereas in a vulnerability model, temperament acts as a risk factor for psychopathology. Regardless of explanatory model, the evidence for the association between temperament and psychopathology is overwhelming. However, most studies emphasize the contributions of temperament to either individual mental disorders or to the two broad dimensions of internalizing and externalizing problems while focusing less on the co-occurrence of disorders. This is surprising given that the co-occurrence of psychiatric disorders is common—in particular for ODD—and frequently needs to be addressed by clinicians. Moreover, there are sound theoretical reasons for assuming that temperament may underlie the co-occurrence of disorders and may thus be a determinant of concurrent and sequential comorbidity. If disorders share the same risk factor, their chances of co-occurring will be increased.

Here we use data from a longitudinal community sample to address questions about risk factors for ODD with a focus on its comorbidity with other psychopathology. We use the well-established Emotionality Activity Sociability (EAS) scale of temperament measured at age 38 months as a predictor of ODD and other psychopathology clinically diagnosed at age 91 months. We test two specific hypotheses. First, our model predicts that ODD may be the shared outcome of distinct risk pathways; accordingly, we expect that temperamental emotionality and temperamental activity will both contribute to the prediction of ODD 5 years later. Second our model predicts that these distinct risk pathways will predict different patterns of associations between ODD and other psychopathology. In particular, we expect that early emotionality will predict comorbidity between ODD and internalizing disorders, whereas early activity will be particularly predictive of the co-occurrence between ODD and ADHD.

Our model did not lead us to anticipate that sociability, the third dimension of the EAS scale, would have specific associations with ODD or comorbidity; it was included in these analyses as a “control” variable to help rule out the possibility that any extreme temperament is associated with similar effects on ODD and comorbidity.

**METHOD**

**Study Sample**

We used the Avon Longitudinal Study of Parents and Children (ALSPAC) birth cohort (www.alspac.bris.ac.uk). Pregnant women living in the area of Avon (United Kingdom [UK]) with expected dates of delivery between April 1, 1991, and December 31, 1992, were recruited; thus the sample consisted of 14,541 pregnancies with 14,062 live births, of which 13,988 individuals were alive at 1 year. The county of Avon comprised a mixture of rural areas, inner city, suburbs, and mid-sized towns, and the population has been found to be broadly representative of children in the UK at that time. In particular, children in Avon were as likely as other children in the UK to be living with a single parent (4% ALSPAC versus 5% rest of the UK at the time the study was initiated), their parents equally likely to have a university degree (14% versus 13.7%), and were as likely to have non-European, non-Caucasian parents (5.1% versus 6.4%).

**Ethical Approval**

Ethical approval was obtained from the ALSPAC Law and Ethics Committee and the Local Research Ethics Committees. Informed consent was obtained from the parents of the children in the study.

**Measures**

At the age of 38 months, the 20-item Emotionality Activity Sociability (EAS) temperament measurement scale was administered to the mothers of the children in the study. The items, which are shown in Table 1,
are scored on a scale from 1 (“not at all like”) to 5 (“exactly like”).

At the age of 91 months, DSM-IV psychiatric diagnoses were ascertained based on parent and teacher report using the Developmental and Well-being Assessment (DAWBA), an extensively described structured interview that involves a mixture of closed questions with fixed response options and open-ended questions eliciting free text answers. The interview’s questions are closely related to DSM-IV diagnostic criteria and focus on current as opposed to lifetime problems. Experienced clinical raters review the closed and open-ended answers before making a diagnostic rating following DSM-IV criteria. The κ statistic for chance-corrected agreement between two raters on a series of 500 cases was 0.86 for any DSM-IV disorder (SE = 0.04), 0.57 for internalizing disorders (SE = 0.11), and 0.98 for externalizing disorders (SE = 0.02). As stipulated in the DSM, children are assigned a diagnosis only if their symptoms are causing significant distress or social impairment. Further information on the DAWBA is available from at http://www.dawba.com, including online and downloadable versions of the measures and demonstrations of the clinical rating process.

Maternal depression was assessed with the widely used Edinburgh Post-Natal Depression Scale (EPDS) collected when the children were 33 months of age. The scale has been shown to have high specificity and sensitivity during pregnancy, the postpartum period, and early years of parenting, as judged against standardized psychiatric interviews. In addition, data were collected on maternal and paternal social class, age of mother at the time the child was born, and whether the mother smoked during pregnancy.

Only participants with data on both the EAS and the DAWBA were included in the analysis and this resulted in an end-sample of N = 7,140 (51% boys). Participants excluded from the analyses came from a more disadvantaged socioeconomic background, as suggested by significantly higher prevalences among those with missing data of mothers without educational qualifications (7% versus 3%, odds ratio [OR] = 2.34), mothers who smoked during pregnancy (32% versus 19%, OR = 2.05), teenage mothers (8% versus 2%, OR = 4.51), and mothers (26% versus 16%, OR = 1.89) and fathers (52% versus 39%, OR = 1.70) in manual as opposed to nonmanual occupations. Of the three temperamental dimensions studied in this study, only activity was significantly associated with an increased risk of attrition (t = 2.1, OR = 1.08), whereas emotionality (t = 1.32, OR = 1.02), and sociability (t = 0.24, OR = 0.97) were not.

### Statistical Analysis

We subjected the items of the EAS questionnaire to an iterated principal axis factor analysis. This was done to ensure that the present sample mirrored previously studied samples in terms of the factor structure of the EAS. Factor analysis led to the identification of three factors with an eigenvalue of greater than 1 accounting...
for 75% of the variance. Following orthogonal rotation, these corresponded well to the previously described\textsuperscript{22,28} “emotionality,” “activity,” and “sociability” factors, respectively (Table 1). Given that a split of the sociability factor into a shyness and a sociability component has been reported in some samples, we also calculated item loadings for a four-factor solution; this yielded three factors, corresponding to emotionality, activity, and shyness with an eigenvalue of greater than 1, and a sociability factor with an eigenvalue of 0.72. For the purposes of the analyses presented here, the more parsimonious three-factor solution was used. The standardized factor scores were used throughout, involving a mean of 0 and a standard deviation of 1 for all three dimensions of temperament. The factor scores were used in preference to standardized sums of the item loading most heavily on each dimension (sum scores) because the orthogonal extraction of factor scores mean that they do not overlap, whereas sum scores are not fully orthogonal and do overlap, potentially blurring distinctions between temperaments. We also conducted sensitivity analyses using sum scores, and the overall pattern of our results was unchanged. The emotionality scale showed a normal distribution, whereas activity and sociability where skewed toward low scores.

Two different analytic approaches were used to test the study’s hypotheses. The first was to use multinomial logistic regression to create an overall model that was particularly suitable for graphical display (Figure 1). For these purposes, an unordered, eight-level categorical indicator of disorder at 91 months was created comprising the following: 1) participants without a psychiatric diagnosis (N = 6,710); 2) those with ODD only (N = 90, 72% male); 3) those with ADHD only (N = 92, 84% male); 4) those with internalizing disorders only—a category that includes major depression, dysthymia, generalized anxiety disorder, specific phobia, posttraumatic stress disorder (PTSD), social phobia, and agoraphobia (N = 177, 55% male); 5) those with ODD comorbid with ADHD only (N = 25, 84% male); 6) those with ODD comorbid with internalizing disorders only (N = 18, 68% male); 7) those with ADHD comorbid with internalizing disorders only (N = 18, 82% male); and 8) those with ODD comorbid with both internalizing disorders and ADHD (N = 10, 93% male). This variable was used as the outcome in a multinomial logistic regression model, and participants without any psychiatric diagnosis were used as the reference group; the three orthogonal factor scores of the EAS temperament scale were the predictor variables. The mlogit command option in STATA was used (Version 10; Stata Corporation), and relative risk ratios (RRR) with confidence intervals (CI) were calculated. Multinomial models, as all logit models, pair each response category with a baseline category. Here, all persons without ODD or ADHD or internalizing disorders comprised the baseline (N = 7,140), and each of the other categories (e.g., ODD or ODD comorbid with internalizing problems) was compared to that baseline. Thus the RR refers to the change in RRR for a 1-SD increase in one of the temperament factor scores (e.g., emotionality) for one of the categories (e.g., ODD with internalizing problems), relative to the baseline category, given that the other variables in the model are held constant.

The second approach involved breaking down the multinomial logistic regression model into a series of separate logistic regression models. This is a more flexible approach giving results in the form of the more
familiar odds ratios. The first hypothesis stated in this article was tested in a model in which ODD was the outcome variable and the three temperamental dimensions were the predictor variables. The second hypothesis was tested in the subsample of those people in the study who were diagnosed with ODD. Two separate logistic regression models were run: in the first model, internalizing disorders were the outcome, and the three temperamental dimensions were the predictors; in the second model, ADHD was the outcome, and the three temperamental dimensions were the predictors. Therefore, these models were estimating the relative contribution of the temperamental dimensions 1) to internalizing problems in those with ODD, or 2) to ADHD in those with ODD. To compare the size of coefficients of emotionality and activity in each model, we used a z-test (implemented in STATA’s linear combination, lincom, postestimation function). This tests the null hypothesis that the difference between two coefficients—in this case, emotionality versus activity—with a given standard error does not differ from zero.

The following variables were used as covariates in the models described above: sex, maternal professional class (coded dichotomously as manual occupation or not), and score on the EPDS when the children were aged 33 months.

To ensure that the logistic regression models were not affected by outliers, the standardized residuals were inspected and the analyses re-run after excluding cases with standardized residuals more than 2 SDs from the mean.

Significance was set at a p value of < .05.

RESULTS

Figure 1 shows the prediction from the three EAS dimensions to the seven diagnostic categories. The two strongest predictions were to ODD with comorbidity: from emotionality to ODD plus internalizing disorders (RRR = 3.33, CI = 2.14 to 5.19), and from activity to ODD plus ADHD (RRR = 3.24, CI = 1.48 to 7.11). There were weaker but still significant predictions to the three pure disorders: from emotionality and activity to pure ODD (RRR = 1.34, CI = 1.09 to 1.66, and RRR = 1.39, CI = 1.07 to 1.81, respectively), from emotionality to internalizing disorders (RRR = 1.34, CI = 1.09 to 1.66), and from emotionality and sociability to pure ADHD (RRR = 1.26, CI = 1.02 to 1.56, and RRR = 1.33, CI = 1.04 to 1.69). There was also a prediction from emotionality to ADHD with comorbid internalizing disorders (RRR = 1.59, CI = 1.01 to 2.51). None of the temperamental dimensions was a significant predictor of the remaining categories, although these analyses may have been underpowered, as the remaining categories were all relatively uncommon.

The multinomial logistic regression model showed that although activity was the strongest predictor of the comorbidity between ODD and ADHD, it did not predict pure ADHD. We conducted post hoc analyses of this unanticipated effect. First, we examined the relative proportions of different types of ADHD (inattentive, hyperactive–impulsive, combined) in the groups with pure ADHD and comorbid ODD/ADHD. Of the 92 case of pure ADHD, 50 (54%) were inattentive type, 11 (12%) were hyperactive–impulsive type, and 31 (34%) were combined type. Among the 25 cases of comorbid ODD/ADHD, two (8%) were inattentive type, two (8%) were hyperactive–impulsive type, and 21 (84%) were combined type. The different distribution of ADHD inattentive and combined type between the pure and the comorbid ADHD groups was highly significant (χ² = 20.7; df = 2; p < .000). In logistic regression models, the temperamental dimension of activity was a significant predictor of the hyperactive–impulsive type of ADHD (OR = 4.25, CI = 1.65 to 10.93) and of the combined type of ADHD (OR = 1.90, CI = 1.32 to 2.73), but was not a significant predictor of inattentive ADHD (OR = 0.87, CI = 0.67 to 1.13).

Table 2 shows logistic regression models based on the sample as a whole, using the three temperamental dimensions as predictors and ODD as the outcome, with and without covariates. As can be seen, in all cases ODD was significantly predicted by emotionality and activity, but not by sociability; the findings were not changed by adjusting for gender, mother’s social occupation, mother’s depression (EPDS score), or all of these factors combined. In the model that included all covariates, the difference between the odds ratio estimate for emotionality with the odds ratio estimate for activity was not significant (OR = 0.95, CI = 0.70 to 1.29), i.e., the two dimensions were equally predictive of ODD. An additional analysis was conducted with logistic regression models with the three temperamental dimensions as predictors and ODD as the outcome stratified for gender. Activity and emotionality were significant predictors of ODD for boys (emotionality: OR = 1.38, CI = 1.13 to 1.69; activity: OR = 1.40, CI = 1.22 to 2.23), and for girls (emotionality: OR = 1.65, CI = 1.22 to 2.23; activity: OR = 1.83, CI = 1.15 to 2.90).
Table 3 shows logistic regression models restricted to participants with ODD. The first column uses the three temperamental dimensions as predictors and comorbid internalizing disorders as the outcome. In all cases, ODD comorbid with internalizing disorders was significantly predicted by emotionality but not by activity or sociability; these findings did not change after adjusting for single or multiple covariates. In the model that included all covariates, a comparison of the odds ratios for emotionality with those for activity showed that the difference between these two dimensions was significant (OR = 2.30, CI = 1.04 to 5.09), i.e., emotionality was significantly

### TABLE 2  Temperamental Predictions of Oppositional Defiant Disorder (ODD) (n = 7,140)

<table>
<thead>
<tr>
<th>Temperament</th>
<th>Control Variables</th>
<th>ODD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotionality</td>
<td>None</td>
<td>1.38 (1.17–1.63)</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>1.46 (1.24–1.72)</td>
</tr>
<tr>
<td></td>
<td>Mother’s Occupation</td>
<td>1.37 (1.15–1.64)</td>
</tr>
<tr>
<td></td>
<td>Mother’s Depression</td>
<td>1.27 (1.07–1.51)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1.31 (1.08–1.58)</td>
</tr>
<tr>
<td>Activity</td>
<td>None</td>
<td>1.55 (1.24–1.94)</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>1.50 (1.20–1.87)</td>
</tr>
<tr>
<td></td>
<td>Mother’s occupation</td>
<td>1.47 (1.17–1.85)</td>
</tr>
<tr>
<td></td>
<td>Mother’s depression</td>
<td>1.49 (1.19–1.88)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1.37 (1.01–1.75)</td>
</tr>
<tr>
<td>Sociability</td>
<td>None</td>
<td>1.07 (0.89–1.29)</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>1.09 (0.91–1.31)</td>
</tr>
<tr>
<td></td>
<td>Mother’s occupation</td>
<td>1.11 (0.91–1.35)</td>
</tr>
<tr>
<td></td>
<td>Mother’s depression</td>
<td>1.13 (0.93–1.37)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1.18 (0.96–1.45)</td>
</tr>
</tbody>
</table>

Note: Odds ratios and confidence intervals in brackets are shown from logistic regression models. In each model, all three temperamental dimensions were entered as predictors of ODD. Models were either not covaried for any other variable (“none”) or covaried with the variables listed in the second column; “all” refers to covariation using all three control variables. Significant (p < 0.05) odds ratios are shown in boldface type.

### TABLE 3  Temperamental Predictions of Comorbid Oppositional Defiant Disorder (ODD) (n = 143)

<table>
<thead>
<tr>
<th>Temperament</th>
<th>Control Variables</th>
<th>ODD + Internalizing</th>
<th>ODD + ADHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotionality</td>
<td>None</td>
<td>1.97 (1.29–3.02)</td>
<td>0.59 (0.38–0.92)</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>1.97 (1.30–2.98)</td>
<td>0.62 (0.40–0.96)</td>
</tr>
<tr>
<td></td>
<td>Mother’s Occupation</td>
<td>2.19 (1.36–3.51)</td>
<td>0.68 (0.44–1.07)</td>
</tr>
<tr>
<td></td>
<td>Mother’s depression</td>
<td>1.94 (1.22–3.08)</td>
<td><strong>0.56 (0.35–0.90)</strong></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td><strong>2.06 (1.23–3.45)</strong></td>
<td>0.69 (0.43–1.13)</td>
</tr>
<tr>
<td>Activity</td>
<td>None</td>
<td>1.03 (0.58–1.85)</td>
<td><strong>2.16 (1.05–4.65)</strong></td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>1.03 (0.58–1.84)</td>
<td><strong>2.19 (1.02–4.69)</strong></td>
</tr>
<tr>
<td></td>
<td>Mother’s Occupation</td>
<td>1.03 (0.57–1.86)</td>
<td><strong>2.16 (1.01–4.62)</strong></td>
</tr>
<tr>
<td></td>
<td>Mother’s depression</td>
<td>0.94 (0.50–1.75)</td>
<td><strong>2.36 (0.98–5.67)</strong></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td><strong>0.90 (0.48–1.70)</strong></td>
<td>2.51 (1.04–6.07)</td>
</tr>
<tr>
<td>Sociability</td>
<td>None</td>
<td>0.74 (0.50–1.10)</td>
<td>1.05 (0.72–1.53)</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>0.74 (0.50–1.09)</td>
<td>1.06 (0.73–1.55)</td>
</tr>
<tr>
<td></td>
<td>Mother’s occupation</td>
<td>0.67 (0.44–1.03)</td>
<td>1.05 (0.72–1.54)</td>
</tr>
<tr>
<td></td>
<td>Mother’s depression</td>
<td>0.79 (0.51–1.22)</td>
<td>1.18 (0.77–1.82)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>0.74 (0.46–1.19)</td>
<td>1.21 (0.78–1.88)</td>
</tr>
</tbody>
</table>

Note: Odds ratios and confidence intervals (in parentheses) are shown from logistic regression models. In each model, all three temperamental dimensions were entered as predictors and one of the two outcomes. The models were either not covaried for any other variable (“none”) or covaried with the variables listed in the second column; “all” refers to covariation using all three control variables. Note differing N values between models because of missing data for Mother’s occupation (n = 126), Mother’s depression (n = 133), and all (N = 118). Significant (p < .05) odds ratios are shown in boldface type.
more predictive than activity of comorbid internalizing disorders. An additional analysis was conducted with logistic regression models with the three temperamental dimensions as predictors and ODD comorbid with internalizing disorders as the outcome stratified for gender. Emotionality only was a significant predictor of ODD comorbid with internalizing disorders for girls (OR = 4.46, CI = 1.42 to 14.03) but fell short of significance for boys (emotionality: OR = 1.60, CI 0.97 to 2.61; p = .063).

The second column of Table 3 is restricted to individuals with ODD and uses the three temperamental dimensions as predictors, with comorbid ADHD as the outcome. In all cases, ODD comorbid with ADHD was significantly predicted by activity, but not by emotionality or sociability. These findings did not generally change after adjusting for single or multiple covariates, with two exceptions: emotionality was found to be a significant negative predictor of comorbid ADHD when maternal depression was taken into account; and that the effect of activity was rendered nonsignificant after controlling for maternal depression. However, when all covariates were entered in the model, the prediction from activity to comorbid ADHD was significant. In the model that included all covariates, a comparison of ORs for emotionality with those for activity showed that the difference between these two dimensions was significant (OR = 0.28, CI = 0.10 to 0.77), i.e., activity was significantly more predictive than emotionality of comorbid ADHD. A further analysis was conducted with logistic regression models, with the three temperamental dimensions as predictors and ODD comorbid with ADHD as the outcome stratified for gender. Activity, only, was a significant predictor of ODD comorbid with ADHD for boys (OR = 3.00, CI = 1.15 to 7.82) but was nonsignificant for girls (emotionality: OR = 0.65, CI = 0.15 to 2.91).

DISCUSSION
In keeping with the first hypothesis, we found that two different temperamental dimensions, emotionality and activity, measured at the age of 38 months, were significant predictors of ODD at the age of 91 months. Also, consistent with our second hypothesis, we show that each of these dimensions predicted different patterns of comorbidity between ODD and other disorders. In particular, it was emotionality that strongly predicted comorbidity between ODD and internalizing disorders, whereas it was activity that strongly predicted the overlap between ODD and ADHD.

Temperament refers to the study of interindividual differences in emotions, activity, attention, and regulatory capacities that manifest in the period between infancy and the early school years. The dimensions of emotionality, activity, and shyness/sociability, as assessed by the EAS, seem to show strong overlap with those of other major temperamental models. In particular it has been argued that emotionality shows conceptual overlap with negative emotionality and negative affectivity and relates to the personality dimension of neuroticism, whereas activity is related to activity level in the Thomas and Chess model and whereas both activity and shyness/sociability seem related to surgency in the Rothbart model.

Our finding that both activity and emotionality predict to oppositional defiant disorder is in keeping with recent findings showing that these two scales predict oppositional problems measured using the CBCL and that both emotionality and activity were predictors of aggressive problems in a longitudinal twin study. We have recently suggested that ODD—or, more broadly, a phenotype of oppositionality and defiance—may be the common outcome of different early risks and that these convergent pathways may form the basis for the wide range of subsequent associations with other psychopathology. Thus, children displaying high levels of activity in early childhood may become disruptive and may receive a diagnosis of ODD by virtue of their impulsivity and hyperactivity; the same children would also, because of their high levels of temperamental activity, be at increased risk for ADHD or CD. Similarly, children high in temperamental emotionality may behave in an oppositional manner in stressful or arousing situations that other children might take in stride; their emotional dysregulation would also increase their risk for anxiety/depressive disorders.

Emotionality was a predictor of internalizing disorders in this study, consistently with previous findings. Moreover, emotionality was a strong and differential predictor of the co-occurrence of internalizing disorders with ODD. To our knowledge, this is a new finding, as most previous studies have not focused on comorbidity, and it suggests that temperamental emotion-
ality represents a shared risk factor for oppositional and emotional problems.

Activity was a strong and differential predictor of the co-occurrence of ADHD with ODD. Analogously to emotionality, these findings point to temperamental activity as a shared risk factor between oppositional and conduct problems. Surprisingly, temperamental activity did not predict pure ADHD. This is in contrast with the findings of a recent study but in accordance with results from a previous longitudinal study that failed to find an association between temperamental activity and the attention scale of the CBCL. Posthoc analyses suggest that our finding was explained by the fact that pure ADHD in our sample was mostly of the inattentive type, whereas ADHD that was comorbid with ODD was mostly of the combined type. Temperamental activity did not predict subsequent inattentive ADHD but did predict subsequent hyperactive–impulsive and combined ADHD. Future studies of the temperamental antecedents of ADHD could usefully distinguish between types of ADHD to see whether the effects found in our sample replicate more widely.

The temperamental dimension of sociability did not show strong associations with comorbidity, thus making it further unlikely that the study’s findings are due to the nonspecific effects of temperament. Previous findings have shown sociability to be weakly and negatively associated to internalizing psychopathology, which was not replicated here. Instead, we found that sociability was weakly but significantly related to pure ADHD—an effect that is probably best regarded as a chance finding unless it can be replicated in future studies.

Overall, the results of this study lend support to a “convergence–divergence” model of oppositionality that seeks to account for the substantial cross-sectional and longitudinal comorbidities of ODD. This model postulates that different risk factors may contribute to the phenotype of oppositionality in middle childhood (convergence) but that the distal outcomes will be distinct (divergence). In this study, two distinct risks—temperamental emotionality and activity—converge by being significant contributors to ODD; these two temperamental dimensions may also determine the patterns of divergence, that is, different outcomes that give rise to the differential comorbidities of ODD. The present study suggests that early emotionality is an antecedent of an irritable dimension of oppositionality that has been shown to predict emotional disorders cross-sectionally, 3 years later, and 20 years later. Irritability also predicts suicidality. Likewise, our findings suggest that early activity level is an antecedent of a headstrong dimension of oppositionality predicting cross-sectionally and longitudinally to ADHD and conduct problems.

The findings presented here illustrate two general principles in nosology—namely, that different risks may give rise to a single diagnostic category, and that shared risk factors underlie the co-occurrence of different disorders. Clinically, these findings suggest that a single diagnostic label—in this instance, ODD—should not be taken to imply a single treatment. Indeed, as frequently experienced by clinicians, effective treatments may vary among children with the same diagnosis; this may be due partly to the differences in the risk pathways that give rise to the diagnosis of ODD.

This study has several strengths, such as a large representative sample and prospectively collected information using well-validated instruments. It also has a number of limitations. First, as is generally the case for longitudinal samples, there was attrition over time. Hence, the findings are more likely to apply to children with parents who are better educated and older, who come from better socioeconomic backgrounds, and whose mothers are less likely to smoke during pregnancy; this calls for replication of the findings in longitudinal samples enriched for such risk factors. However, although this can lead to underestimation of the prevalence of psychiatric disorders, it is unlikely to affect the patterns of associations between disorders and risk factors. A further consideration is that attrition could have led to a loss of power to detect differences. This cannot be excluded, especially for the findings relating to temperamental activity that was itself a predictor of attrition. Similarly, the size of our sample means that stratified analyses are difficult to perform; for example, only limited inferences can be drawn from models stratified by gender in this sample because of the small cell size. Secondly, our measures of temperament and diagnosis both rely on maternal report, which could lead to informant bias; however, it should be noted that teacher reports were also used to reach the clinical diagnoses in this sample, thus reducing the possibility of bias. Although maternal depression or maternal social position could have confounded the temperamental ratings, covarying for these factors did not alter the pattern of our results.
Third, the outcome of this study is based on diagnostic information in middle childhood and, thus, it is unclear whether its results also apply to later stages of development. Fourth, our study does not account for events in the intervening time between the assessment of temperament and the ascertainment of psychiatric diagnoses years later. It is plausible that environmental effects during this time may have influenced the outcomes. Moreover, it is possible that different temperamental dimensions elicit different types of environment and thus lead to different exposures.11,37 Fifth, this study does not ascertain psychopathology in the preschool age. There is now emerging evidence that psychiatric diagnoses can be reliably ascertained in preschool populations,38,39 and it is possible that what is measured as an extreme of temperament in this study may, in fact, be better regarded as an early-onset disorder. If this were the case, then our results would indicate continuity of disorders from 38 months to 91 months of age, rather than predictions from temperamental risk factors to disorder. However, as has been argued before, the distinction between temperament and early emerging psychopathology is useful from both a conceptual and practical point of view.11 Finally, the study's instruments were not designed to ascertain severe mood dysregulation (SMD)—a recently proposed ad hoc category to describe children with extreme irritability.40 It would be particularly instructive to compare the temperamental antecedents of SMD to those of ODD.

Future studies should assess preschool psychopathology alongside temperament to differentiate between the predictive value of early-onset psychiatric disorders as opposed to temperamental variation within the normal range. In addition, future studies involving longitudinal prediction will be stronger if they include careful measurements of the environment and biological markers such as the results of imaging or genotyping.

REFERENCES