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Temper Tantrums in Young Children: 2. Tantrum Duration and Temporal Organization

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ABSTRACT. This article completes the analysis of parental narratives of tantrums had by 335 children aged 18 to 60 months. Modal tantrum durations were 0.5 to 1 minute; 75% of the tantrums lasted 5 minutes or less. If the child stamped or dropped to the floor in the first 30 seconds, the tantrum was likely to be shorter and the likelihood of parental intervention less. A novel analysis of behavior probabilities that permitted grouping of tantrums of different durations converged with our previous statistically independent results to yield a model of tantrums as the expression of two independent but partially overlapping emotional and behavioral processes: Anger and Distress. Anger rises quickly, has its peak at or near the beginning of the tantrum, and declines thereafter. Crying and comfort-seeking, components of Distress, slowly increase in probability across the tantrum. This model indicates that tantrums can provide a window on the intense emotional processes of childhood. *J Dev Behav Pediatr 24:148–154, 2003.* Index terms: *anger, crying, distress, emotion.*

Up to 3 or 4 years of age, many children have a tantrum on the average of once per day. When a child is tired, hungry, or upset, even parents highly skilled at redirection cannot prevent the occasional tantrum. Consistent with the experience of many parents, Mullen[1] and Parens et al[2] noted an apparent turning point before which an adroit intervention can forestall a tantrum and after which any intervention, no matter how adroit, only exacerbates it. Ignored, redirected, or timed out, at least some tantrums must be waited out. This may take awhile; one mother who decided to not intervene in her daughter's next tantrum told us that she clocked continuous screaming for an hour and a half. Because this wait can be frustrating or even anxiety-provoking, it would be helpful for parents to know something about the duration of tantrums in general and how long the particular one they are waiting for might last. Thus, there are practical questions about the normal range of tantrum duration and whether there are cues at tantrum outset that might signal its eventual duration. This article addresses these questions.

Beyond these practical questions are deeper issues concerning the processes that shape the time course of tantrums. Tantrums involve the expression of strong emotions, and understanding the time course of tantrums can provide some theoretical insight into the organization and trajectory of children's emotions. A few reports have suggested an intrinsic or emergent temporal organization in tantrum behavior. Parens[3] described ascending and descending phases of emotional intensity in the tantrums of toddlers. Camras[4] reported a pattern of anger followed by sadness in the tantrums of her 2-year-old daughter. These reports resemble Einon and Potegal's[5] proposal that tantrums might consist of a series of stages with shouting and angry behaviors occurring first and sobbing occurring later. In several generalized accounts of tantrums in conduct-disordered adolescents, complaints and hostility escalate to angry resistance and adult intervention, followed, in turn, by sadness, depression, withdrawal, and/or comfort seeking.[1,6,7] From a theoretical perspective, fluctuations in a single emotion variable might determine tantrum pattern with different responses being triggered at different levels of intensity. Camras suggested that "the sadness pattern in young infants reflects a waning or relatively low level of distress, while the anger and distress-pain patterns are distress responses of increasing intensity"[4] (p. 23). In his psychodynamically based interpretation of tantrums observed in a research nursery, Parens[3] noted "...as unpleasure mounts, it elicits crying and as it approaches the threshold of being experienced as excessive, anger is elicited" (p. 127). Some authors have also proposed that anxiety or panic at losing control can play an important role in shaping tantrums.[1] However, these contrasting conjectures are based on observations of relatively few subjects and lack a quantitative account of the actual tantrum behaviors; furthermore, the tantrums occurred in special institutional

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settings.[1,2] In contrast, most children's tantrums happen in the home.[5]

In an alternative model, based on our previously reported Principal Component (PC) (factor) analysis of tantrum behaviors, tantrums are composed of several independent emotional and behavioral processes, primarily identified as Anger and Distress.[8] Our analysis distinguished Anger factors reflecting three levels of intensity. The Distress factor was comprised of whining, crying, and affiliation (comfort-seeking). An additional factor, labeled Coping Style, had high positive loadings on dropping down and high negative loadings on running away. It was interpreted as reflecting the child's decision to either "submit" or "escape." These various factors related in a significant, orderly, and comprehensible fashion to tantrum variables such as total duration, autonomic activation, and judged intensity that were, by design, not included in the PC analysis. This article completes our analysis of tantrum organization, first by evaluating the factors contributing to tantrum duration, then by contrasting the time courses of the various tantrum behaviors and integrating them with the previous PC results in a general model of tantrum organization.

METHOD

Participant Selection and Tantrum Narrative Analysis

As described by Potegal and Davidson elsewhere in this issue,[8] parents of children aged between 18 and 60 months submitted a detailed written narrative of one of their child's tantrums. The sample was drawn largely from the white, college-educated, middle-class population in and around Madison, Wisconsin. Within each narrative, the tantrum was operationally defined as an outburst of negative emotion and behavior beginning with the first occurrence of one of the following: stiffening limbs/arching back (*stiffen*), getting *down*, *shout*ing, *scream*ing, *cry*ing, *push*ing/*pull*ing, stamping (*stamp*), hitting (*hit*), kicking (*kick*), throwing (*throw*), or running *away*. The tantrum ended when the last of these behaviors had stopped. The 335 usable narratives were converted into "tantrugrams," time × behavior matrices, in which time was partitioned into consecutive 0.5-minute units, and behavior in each of 13 different categories was scored as occurring or not occurring within each unit. A variety of checks indicated the internal consistency of parental reports.

RESULTS

Characteristics and Determinants of Tantrum Duration

Distribution of Tantrum Durations. The median tantrum duration reconstructed from the parental narratives was 3 minutes; the interquartile range was 1.5 to 5 minutes. The histogram of all tantrum durations is shown in Figure 1; its hazard plot was fitted by a Weibull function (inset in upper right) with equal parameter weights (goodness-of-fit log likelihood = −409.1, χ^2 [9] = 9.45, p = .4). Weibull functions characterize processes in which the first

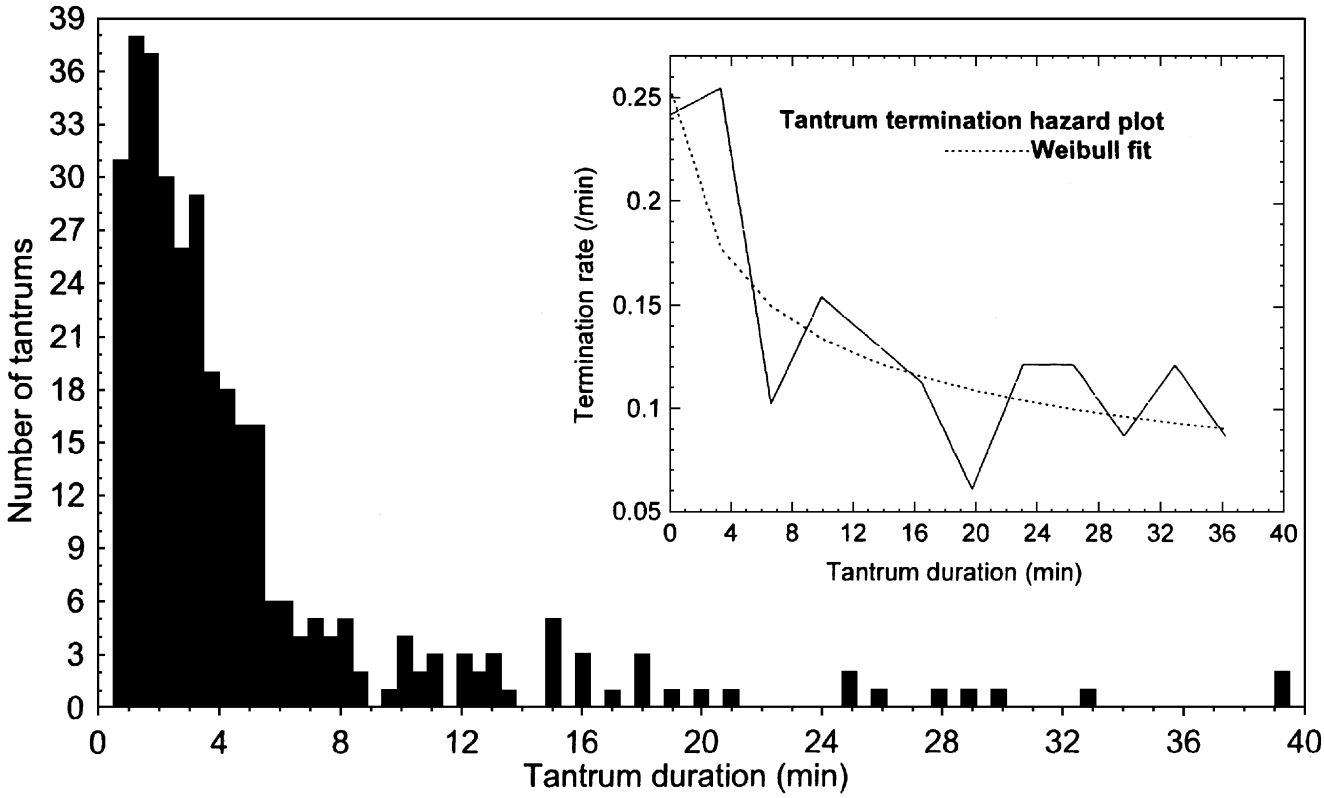

FIGURE 1. Frequency histogram and hazard plot of the duration of tantrums reconstructed from parental narratives.

occurrence of any one of a number of independent random events can terminate the process. Such processes could include parental intervention, a shift of the child's attention, or self-limiting processes intrinsic to the tantrum.

Status and Intratantrum Variable. Analysis of variance (ANOVA) showed that log-transformed tantrum duration did not differ as a function of gender (F [1, 327] = 0.36) or age (F [3, 327] = 1.53), nor was there a significant Gender × Age interaction. Tantrum duration was also not affected by the child's pre-tantrum mood or the issue triggering the tantrum. Autonomic activation visible to parents (e.g., flushing) was associated with longer durations, an effect reported elsewhere in detail.[9] Judged tantrum intensity was correlated with tantrum duration (r [331] = .4, $p < .001$).

Behavioral Predictors of Tantrum Duration. To determine if behaviors occurring at tantrum onset predict its eventual duration, we first compared the number of different behaviors occurring in the first 30 seconds or first minute of brief and prolonged tantrums. The 75 tantrums that were 5.5 minutes or greater in duration were matched by child's gender and age to 75 tantrums drawn from the pool of 106 tantrums that were 1.5 minutes or less in duration. For just the first 30 seconds, the mean (±SD) number of different behaviors for brief and prolonged tantrums, 2.1 ± 1.0 and 1.9 ± 0.9, respectively, was not different (t [73] = 0.15). A larger, 1-minute sample of behavior in each tantrum could be compared for subsets of 50 brief and 50 long tantrums. For the first and second 0.5-minute periods of the brief tantrums, the means were 2.0 ± 1.0 and 0.8 ± 0.9, respectively; for the corresponding periods of the long tantrums the means were 2.0 ± 0.9 and 0.6 ± 0.9, respectively. A repeated measures ANOVA showed that these means did not differ (F [1, 49] = 0.7).

Individual behaviors whose occurrence at tantrum onset predicted overall tantrum duration were first identified by a discriminant analysis of shorter (duration ≤ 4.0 min) versus longer (duration > 4.0 min) tantrums. *Down* or *stamp* occurring in the first 30 seconds predicted shorter tantrums (Wilks λ = .95, F [1, 321] ≥ 11.3, $p < .001$). The issue presented for this analysis by the non-normal distribution of tantrum durations was addressed by a survivor analyses of tantrum durations stratified by the initial occurrence or nonoccurrence of these two behaviors. As shown in Figure 2, occurrence of either *down* or *stamp* in the first 30 seconds predicted a shorter tantrum (log-rank statistics ≥ 2.76, $p < .003$).

Time Course of Individual Behaviors

Momentary Poisson Rates. To provide an appropriate statistical base for evaluating the time course of tantrum behaviors, while allowing for the possibility that tantrums of different duration might have different dynamics, tantrums were first partitioned into four duration groups: 0.5 to 2.0 minutes (n = 136), 2.5 to 4.0 minutes (n = 92), 4.5 to 10.5 minutes (n = 71), and 11 to 39.5 minutes (n = 36). Under the working assumption that processes within a duration group are approximately homogeneous, the momentary probability of each behavior within successive time epochs for each group was estimated by calculating a

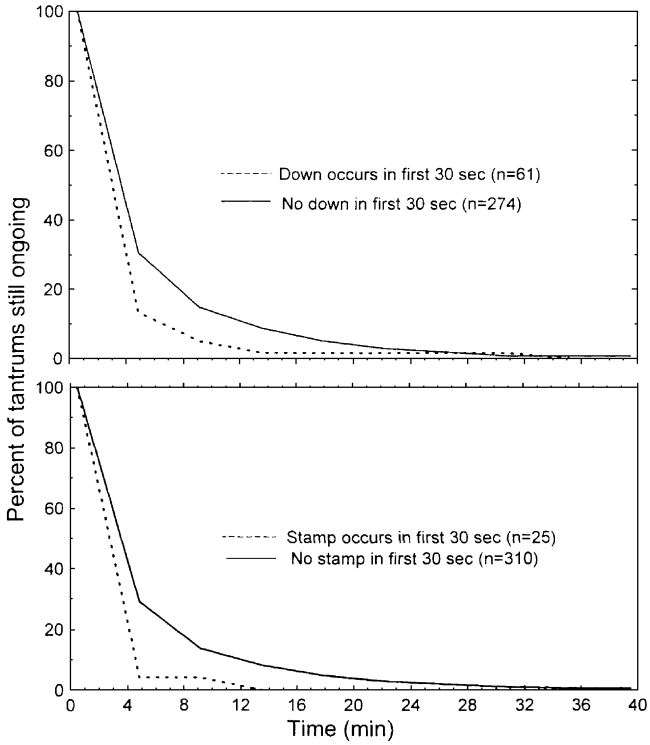

FIGURE 2. Cumulative survival plots of tantrum duration partitioned by the presence or absence of down (top) and stamp (bottom) in the first 30 seconds.

Poisson rate parameter, λ, for each epoch across the group from the expression:

$$\lambda = \frac{-\log\,(1-p)}{T}$$

where p, the probability of the behavior, is estimated by the fraction of corresponding epochs (e.g., the first epoch in each tantrum) during which the behavior occurred. T = the duration of the epoch.

We used these momentary Poisson rates (MPRs) in our analysis to estimate behavior likelihood rather than the directly derived probabilities, because λs derived from epochs of different durations are comparable, whereas probabilities are not. Standard errors and p values were obtained by bootstrap calculations from the MPRs. (In our bootstrap procedure, original data sets were randomly sampled with replacement to obtain 200 new data sets of the same size as the original. Statistical quantities derived in this way from the new data sets are free of parametric assumptions, and all approximations are at least as accurate estimates of true population values as those obtained in the conventional way.[10])

The MPR distributions of representative behaviors shown in Figure 3 are grouped by their tendency to occur toward the beginning or end of the tantrum.* *Kick*, *throw*,

*The analysis in the present report includes a greater number of tantrums and a more accurate calculation of the tails of the momentary Poisson rate distributions than does the analysis in Potegal et al, 1996.[11] Thus, Figure 3 in this report supersedes the earlier figure in that article and should be regarded as the data of record.

and *stamp*, behaviors associated with the High, Intermediate, and Low Anger factors,[8] respectively, are shown in the three leftmost columns to have MPR peaks at or near tantrum onset. A contrasting pattern is shown by *cry*, the rightmost column, which tends to increase progressively across the tantrum. *Cry* was previously found to be a major contributor to the Distress factor.[8]

Skew and Its Multidimensional Scaling. The skews of the MPR distributions, calculated as the signed cube root of the third central moment, were used to quantify these temporal characteristics (the more positive the skew, the more the behavior tends to occur toward the beginning of the tantrum). A bootstrap procedure with 200 resamples estimated the reliability of these skew values. This procedure showed that the variance in the skews of several behaviors in the longest duration group was 10-fold greater than in the other duration groups. The longest duration group was therefore dropped from this skew analysis. The means ± standard errors of the skews are shown in Table 1; the small values of the standard errors indicate the reliability of the skew estimates. Note that the skew of every behavior expressing anger verbally (*shout*, *scream*) or physically (*pull/push*, *kick*, *hit*, *stamp*, *throw*) is positive and greater than the skew of each behavior found to indicate Distress in our previous work (*whine*, *affiliate*, and *cry*).[8] Thus, Anger tends to escalate relatively quickly and then resolve, whereas Distress tends to build up across the tantrum.

To provide an overall picture of the relationship between these temporal characteristics of the tantrum behaviors and their factor organization found in our previous analysis, we next performed a multidimensional scaling of skew. A distance matrix among behaviors was generated by calculating the distances between pairs of points, each of which was defined by a three-vector component composed of the respective skew values from the three duration groups for a given behavior. Examination of the scree and Shepard plots of raw stress (D* and D, respectively) for all behaviors indicated that two dimensions were adequate to describe the distribution of behavior skews.

Convergence and Validity of the Analyses. The different symbols on the skew plane in Figure 4 represent the factors with which each of the behaviors was associated. If there were no relationship between the multidimensionally scaled skew and the factor organization, the symbols would be distributed at random across the skew plane. Instead, physical and verbal angry behaviors cluster together in the left of the plane, whereas Distress-related behaviors cluster

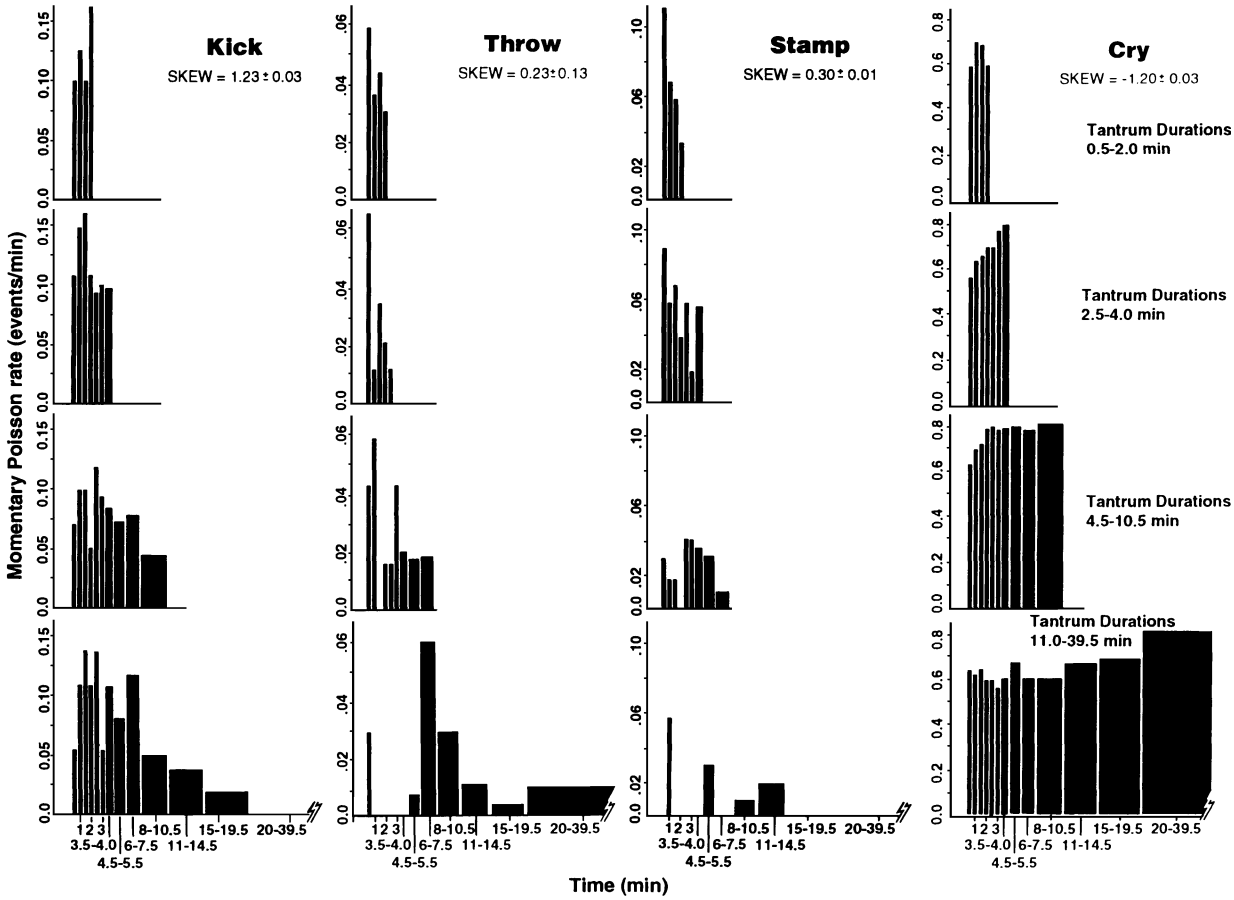

FIGURE 3. Momentary Poisson rates (MPR) of four representative tantrum behaviors. Behaviors are ordered, left to right, by their association with High, Intermediate, and Low Anger, and Distress, respectively. Epochs for the first 3 minutes were set equal to the minimum 0.5-minute units originally used to score behavior. To offset the reduction in the number of tantrums still occurring at longer durations, epochs on the right side of the graphs for the last two duration groups were made progressively longer to include a larger sample of data from each remaining tantrum.

Table 1. Skew of the Momentary Poisson Rate Distributions of Tantrum Behaviors

	Shout		Pull/Push		Scream		Kick		Hit		Stamp	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Skew	2.41	.02	1.85	.01	1.67	.04	1.23	.03	1.21	.02	.30	.01
PC	IA		HA		HA		HA		HA		LA	

PC is the Principal Component (factor) on which the behavior loaded most highly in our previous work.[8] HA, High Anger; IA, Intermediate Anger; LA, Low Anger; D, Distress; CS, Coping Style.

below and to the right, and Coping Style behaviors are above and to the right. This clustering indicates that behaviors that previously loaded highly on a given factor share the same temporal profile in the current analysis. Note that the durations of tantrum behaviors that were the basis of the previous factor analysis are completely independent of their skew (i.e., the total duration of a behavior in a tantrum is independent of *when* it occurs during the tantrum). The striking convergence of these independent analyses validates the basic tantrum structure they define.

Parental Intervention

Effects of Parent Intervention on Momentary Poisson Rate. As in our previous article,[8] we examined the data for only the most robust parent-child interactions because of issues of source variance. Comparing tantrums for which no intervention at all was reported (n = 72) with those in which at least one intervention was reported (n = 263), we found that total mean MPR values (average area under the curve) for each behavior were increased by parental intervention. The range of increase was from less than 1% to 100%. The significance of the increases was established by calculating the simultaneous (i.e., adjusted for multiple tests) 95% confidence interval of the bootstrapped distributions of MPR values. Only the increase in *stiffen* was statistically significant ($p < .05$). That *stiffen* was the behavior most sensitive to intervention was entirely expected from the parental narratives in which it was clear that *stiffen* is generally a response to being held, restrained, picked up, and/or carried and rarely occurred without this stimulation. One other finding was that the occurrence of either initial *down* or initial *stamp* was also associated with a reduced likelihood of parental intervention; for initial *stamp*, the association with nonintervention was significant (χ^2 [1] = 13.1, $p < .0005$).

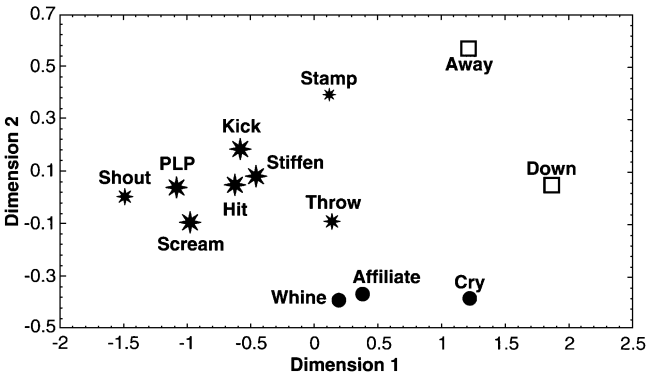

FIGURE 4. Multidimensional scaling of the skew of the temporal distributions of tantrum behaviors. Dimension 1 negative skew reflects a tendency to appear early in the tantrum; positive skew reflects appearance toward the end. The location of each behavior on the skew plane is represented by a symbol indicating its associated factor in the Principal Component (PC) analysis. Filled circles are Distress; open squares are Coping Style. Behaviors loading on Low, Intermediate, and High Anger are represented by stars of increasing size. PLP is pull/push.

Comment. The patterns of correlation between the various components of child behavior and parental acts reported in our previous article were specific and highly significant. Within the context of our data analyses, however, the effects of parental intervention seem somewhat limited. It may be that, with the clear exception of an almost reflex-like elicitation of stiffening by parental manipulation, once a tantrum has started, many parental acts are a response to, rather than a shaper of, tantrum behaviors. For example, an association of children's moving *away* with the parental behavior of *restrain* was the result of parents' restraint of children who had started to run away.[8] Similarly, an explanation for the correlation between a child's screaming and parents separating from the child as probably the result of parental avoidance of the screams was suggested by the finding that the separation followed the screaming in 95% of the cases.[9] However, the nature of our database, including the relatively large time units used, and the issue of source variance, preclude microanalysis of parent-child interaction contingencies. Thus, these generalizations are most appropriately regarded as working hypotheses to be tested.

DISCUSSION

Focus on Convergent Results

We have applied several statistical techniques to our complex data set to elucidate the determinants of tantrum duration and the prevalence and dynamics of individual behaviors. Different techniques can yield disparate results; therefore, we have conservatively focused on convergent results to develop a model of tantrum behavioral structure. The following is a synopsis of our current tantrum model drawn from the previous[8] and present articles.

Synopsis of the Current Tantrum Model

Duration Characteristics. Tantrums in our data set began with an average of two reported behaviors in the first 30 seconds, regardless of their eventual duration. The most common tantrum durations were 0.5 to 1 minutes; 75% of the tantrums lasted between 1.5 to 5 minutes. If the child

Throw		Whine		Affiliate		Away		Cry		Down	
Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
.23	.13	.21	.02	−.03	.02	−1.1	.05	−1.2	.03	−1.98	.08
IA		D		D		CS		D		CS	

stamped or dropped to the floor in the first 30 seconds, the tantrum was likely to be shorter and the likelihood of parental intervention less. The number of different tantrum behaviors increased with progressively longer tantrums, but if the tantrum persisted beyond 3 to 4 minutes, most behaviors were repetitions or continuations of behaviors already shown.

Parent Intervention. Parents reported intervening in approximately 80% of tantrums. Intervention probability seemed unrelated to the child's age or gender; it increased with tantrum duration and intensity. Many parental interventions during a tantrum may be more of a response to, rather than a shaper of, the child's behaviors.

Emotional Core. The core of our current model is the finding that tantrums involve the expression of two independent but temporally overlapping emotional and behavioral processes: Anger and Distress. The likelihood of the physical expression of anger increased quickly, had its peak at or near the beginning of the tantrum, and declined thereafter. Angry behaviors cohered within three components apparently reflecting levels of intensity. *Scream* and *kick* were the core elements of the highest level of Anger, with *hit* and *stiffen* as more variable elements. Shout and throw comprised an intermediate level, and stamping defined the lowest level. The duration of high-level Anger decreased in those aged 18 to 60 months; the duration of low-level Anger increased (this was the primary age effect found in these data).

Whine, affiliate, and cry comprised the factor termed Distress. *Affiliate* and *cry* tended to increase across the course of the tantrum. This finding, and the high correlation found between Distress and overall tantrum duration, indicates that the longer tantrums may have been extended primarily by the prolongation of Distress. Distress clearly involves the emotion of sadness that Camras[4] observed as occurring later in tantrums. In this context, it is noteworthy that all surveys of adults agree that episodes of sadness last longer than episodes of anger.[12–14] An associated conclusion, that all emotions, but especially sadness, last longer in the presence of familiar others,[13] implies that the presence of the parents may prolong tantrums.

A final point is that emotions may be associated with cognitions. Comments by some parents in our survey echoed the suggestions of Camras[4] and of Stein and Levine[15] that children initially become angry when they realize that their parents will thwart their wishes, but they still hope to prevail. Sadness predominates later when children realize that their anger is ineffectual, and that they will not get their way.

Current Progress and Future Developments

Progress in the development of the tantrum model is suggested by contrasts with earlier conceptualizations, our own included. In contrast with suggestions that an out-of-control panic contributes to tantrums, we found no indication in parent reports that their young children experienced anxiety or related feelings during their tantrums. We also found that tantrum Anger and Distress are more appropriately modeled as two independent emotional and behavioral processes than as a single general emotion process with different thresholds. However, these processes partially overlap in time, rather than appearing as discrete stages.[5] Further understanding will be generated by comparing multiple tantrums had by the same child to the current analyses of single tantrums had by different children. More generally, all of these generalizations are working hypotheses that need further testing and refinement to provide the deepest insight into the complexity of children's emotions.

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