Young Children's Ritualistic Compulsive-Like Behavior and Executive Function: A Cross Sectional Study

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ORIGINAL ARTICLE

Young Children's Ritualistic Compulsive-Like Behavior and Executive Function: A Cross Sectional Study

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Abstract The goal of this study was to test whether the development of executive function in young children could add to the explained variance in child ritualistic behavior beyond child and maternal traits previously found to have explanatory power. Routinized, ritualistic behavior is common and normative in young children between the ages of 2 and 5, after which it subsides. In this cross-sectional study, maternal reports on 1345 children between the ages of 2 and 6 included child variables such as temperament, fears, and behavioral problems. Mother's characteristics included perfectionism, her attachment style, and trait anxiety. The sample included ultra-orthodox families, an understudied minority, and thus it was possible to compare their ritualistic behavior with that of children from other rearing environments. Ultraorthodox children had more ritualistic behavior than age-matched children. This finding offers support for an environmental influence on level of ritualistic behavior in children. For the entire sample, we found that young children's ritualistic behavior was associated with shy and emotional temperament, fears, pervasive developmental behavioral problems, and that executive function delays in shifting and emotion regulation had an additional contribution. Ritualistic child behavior was only weakly related to maternal variables. The results were consistent with a maturational process for the trajectory of ritualistic behavior, rather than with an environmentally induced behavior. The development of executive function may be the process mediating the decline of ritualistic behavior over development.

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Introduction

Gesell et al. [1] made the observation that young children, 2–4 years old, are supremely ritualistic, i.e. engage in repetitive, rule-driven behavior which they may attempt to enforce on their environment. Gesell suggested that the normally developing child, in time, outgrows ritualistic behavior in favor of more flexible and contextual behavior. This may be referred to as the maturation principle as applied to ritualistic behavior in young children.

There is a strong phenomenological similarity of the ritualistic behavior of young children to obsessive–compulsive (OC) symptomatology in children and adults alike. Rule-driven behavior, repetitive acts, and insistence that behavior be "just right", symmetrical, and free of small or imaginary defects, is rife in toddlers and common in OC disorder. Evans et al. [2] called the toddlers' behavior routinized compulsive-like behavior (RCB) and devised a 19-item parental report to assess its prevalence and age of onset [Child Routines Inventory (CRI)].

Routinized, repetitive, rule driven behavior, including religious and secular rituals are found in all human cultures. They may be adaptive in some contexts, and maladaptive in others. As Eriksson [3] pointed out, they help people connect. However, even culturally meaningful rituals, used for rites of passage and for social cohesion in many different cultures, are very similar in structure to the obsessive–compulsive behavior of OCD patients [4]. Personal (rather than socially prescribed) ritualistic behavior is also reminiscent of OCD. Everyday rituals of university students and OCD patients' compulsive behavior are remarkably

similar [5]. While OCD is (by definition) a cause of distress and dysfunction, personal ritualistic behavior often seems to be adaptive. Elite athletes typically have very long preliminary motor rituals before competing [6]. Such rituals of everyday life might provide comfort and regularity, and for athletes may have an adaptive role in reducing tension and enhancing performance. There is also evidence that family rituals initiated by parents, provide support for infants and young children that improve important aspects of their life, such as infant sleep duration and quality [7]. Boyer and Liénard [8] claimed that cultural rituals, as well as personal ritualistic behavior at any developmental stage are best explained as a precautionary system, geared at detecting and warding off potential or inferred threats. Cultural rituals provide joint meaning, coherence, and identity to the social groups within which they are practiced [4] even though the underlying mechanism is not different from that which in hyper-activated in OCD patients. Cortical activity of young children when exposed to visual asymmetry shows a linear relationship to ritualistic behavior, suggesting a continuity in brain processes between normal RCBs and the OCD extreme [9].

RCBs are found in typically developing (TD) children, but there is some evidence that even when they are developmentally normative, they are not associated with optimal adaptation. Zohar and Felz [10] found that in TD children 2–4 years of age, RCB's were correlated with fears, and with negative- emotion and shy temperament, and with behavioral problems as measured by the CBCL. Children with developmental delays, such as Down syndrome, typically develop RCB's at an older chronological age and maintain a high level of RCB's much longer [11]. Children in the autistic spectrum exhibit repetitive behavior with extreme sensory motor sensitivity, as well as insisting on sameness, i.e. rigidly adhering to behavior, objects, and schedules [12]. Families which are critical, anxious, and perfectionistic might increase the risk for their children's OC behavior [13, 14]. A history of pregnancy and delivery complications may predispose the mother to be more anxious, obsessive–compulsive, and overprotective of her child [15]. The current study measured maternal characteristics that might predispose the children to greater ritualistic behavior: perfectionism, trait anxiety, her attachment style, her experience of rigid parenting, and a history of birth and delivery complications.

If toddlers' ritualistic behavior is normative, and the maturity principle is correct, then children in different cultures should exhibit the same developmental trajectory: RCBs should first be measurable when language and social interactions begin to make their observation possible, and wane when they are replaced by more sophisticated behavioral patterns around the age of six. Indeed there is evidence to support this understanding [16, 17].

One reason for this trajectory of RCBs may be the development of executive functions. There is evidence for a substantial gain in executive function in normally developing children after age five [18], which would coincide with the normative decline in ritualistic behavior. In a cross-sectional study, repetitive behavior of children 3–9 years of age was associated with less cognitive flexibility as measured by the card sorting test [19].

The current study looked at two aspects of executive function as possibly contributors to change in RCB's, both behavioral regulation functions that seemed particularly relevant to child ritualistic behavior. Shifting, i.e. the ability of the child to move from one task to another, and altogether to tolerate change thus flexibility versus rigidity. The other was emotional control, the ability to respond in an appropriate manner to different situations, to emotionally contextualize behavior.

The observation that religiosity is closely related to ritualistic behavior originates with Freud [20], and has been examined in different religions and cultures. For Protestants, more religious participants report higher levels of OC symptomatology than less religious individuals [21]. Similar results have been shown for Italian Catholics [22]. For Muslims in Iran, [23] no relationship between devoutness and OC symptomatology was found, leading to the conclusion that Islamic ideas may be expressed in the OC cognitions of devout Muslims but do not promote them. For adult Jews in Israel, there was no linear relationship between religiosity and OC symptomatology [24]. Huppert et al. [25] point out that Judaism is a religion of practice, and this may explain why Jewish religiosity does not seem to exacerbate obsessive doubt or OC behavior. The prevalence of ritualistic behavior of young children, as well as that of OCD and of OC symptomatology among the ultra-orthodox Jews has not been studied, as it is a difficult group to study.

In Israel, there is a sizable minority of ultraorthodox Jews. Because of large family size, it is the fastest growing minority of Jews in Israel [26]. For religious and cultural reasons, they tend to live in closed communities, and to have very large families. Their daily practice is highly rule-driven and ritualized. There are prescriptions for dressing, washing, praying, making an appropriate blessing for any foodstuff before eating, as well as for going to bed [27]. Because of the highly ritualistic nature of ultra-orthodox daily life, children are taught rules and rituals very early, starting with language acquisition. An argument could be made that these children's need for ritualistic behavior would be satisfied by the culturally approved ritualistic way-of life and this that they would be less personally ritualistic than other children. It is also possible to hypothesize that these children would be more ritualistic than other children because they are steeped in rule-driven

repetitive behavior by education and upbringing. This potential cultural influence is rarely studied, because of the closed nature of the ultra-orthodox community. Thus we left our hypothesis un-directional, suggesting that the ultra-orthodox children would be different from others in their level of ritualistic behavior, even when controlling for family size.

The study of ritualistic behavior in young children has important implications for discriminating between adaptive and maladaptive development, and for describing trajectories of normal and pathological behavior patterns. The current study extends our knowledge of ritualistic behavior in young children, within the normative developmental peak of this behavior. It does so by examining a wide range of potential correlates of ritualistic behavior—measuring many child and parent characteristics as well as cultural influences.

Study Hypotheses:

1. Shy and emotional child temperament, fears, behavior problems and executive function measures will all correlate positively with ritualistic behavior. A significant proportion of the variance in child ritualistic behavior will be accounted for by these child characteristics.
2. The parents' childhood experience of authoritarian parenting, their perfectionism, trait anxiety, and their attachment-anxiety and -avoidance will correlate positively with as well as explain variance in child ritualistic behavior.
3. The children of mothers with a history of pregnancy and delivery complications will have more ritualistic behavior than other children.
4. Children in ultraorthodox families will display a different level of RCB's from that of the non-ultra-orthodox children.

Method

Participants

Participants were 1345 Hebrew-speaking volunteers from the community, parents of children 2–6 years old, of whom 23 were fathers. Families had a mean of 2.44 children, with a range of 1–12 children. Nearly all the parents were married, (93.4 %); the remainder in order of frequency were cohabiting, divorced, single, or widowed. Geographically the participants were dispersed, with two thirds living in cities, which is less urban than the general Hebrew speaking population [28]. More than half of the parents, (53.7 %), reported being secular. The rest were traditional Jews, observant Jews, and ultraorthodox about equally represented. The distribution of these demographic variables is similar to that of the general Hebrew speaking population in Israel [29]. The 1345 children reported on were 52.1 % male. Children ranged in age between 2 and 6 with a mean of 3.4 years and a SD of 1.0. Over half of the children were firstborn, (55.2 %); however, there were children who were lower down in the birth order, including 2 who were 10th (both from ultraorthodox families in which birth control is not practiced). The mean birth order of the child for the entire sample was 1.8. Nearly all (98.7 %) of the children were born in Israel, the remaining 18 were born in the United States and Europe. Most (82.6 %) of the mothers reported an uncomplicated pregnancy and delivery. Of the remainder, complications of pregnancy mentioned included fertility treatments such as IVF, pregnancy diabetes, pre-eclampsia toxemia, hypercoagulation, premature contractions, hypertension, and infections. The most common deviations from normal delivery reported were cesarean section, vacuum extraction, premature birth, multiple births, and fetal distress.

Procedure

The study was approved by the institutional review board for research in the social sciences. Most of the parents were approached via internet sites that related to family and parenthood, or to community organizations. Some were ascertained via social networking. Great care was taken to diversify the internet sites and the contacts for social media so as to get a wide range of the Israeli Hebrew speaking population. These participants were sent a link to an online study questionnaire. In addition ultra-orthodox mothers, from communities that do not use internet were approached by community liaisons, door to door, and completed the questionnaires on paper. All online participants checked an informed consent box, while pen and paper participants signed an informed consent form. On completion, participants were mailed a child-age-appropriate book. Ultraorthodox mothers were handed child-age- and culture-appropriate books. Of the 1345 participants, 66.4 % provided an email addresses for future contact. All parental reports were collected between June 2012 and June 2014. Participants were self-selected to have a child between 2 and 6 years of age and to have internet access, as well as having the competence in Hebrew required to answer a long questionnaire.

Measures

Child characteristic measures:

1. *Child Routine Inventory* (CRI), composed by Evans et al. [2] is a measure of compulsive like behavior in

young children. The CRI includes 19 items half of which measure "just right" behaviors, and the rest measure repetitive actions. It has good reliability and validity and is parent-friendly [10]. The CRI first introduces a potential routine behavior and asks about its intensity on a Likert-type scale, such as "insisted on putting certain things in the house in certain places" and then asks if this routine behavior worries the parent or not. In Hebrew the CRI has a single factor structure. The CRI in the present study had a lower bound reliability estimate of $\alpha = 0.87$, and the number of items that the parents found worrying ranged between 0 and 16. About two thirds (66.2 %) of the sample did not worry about any CRI item, and only one parent endorsed 16.

2. *Emotion Activity and Sociability* (EAS) is a parental report on child's temperament composed by Buss and Plomin [30] and includes 20 items that load onto four temperament sub-scales: negative emotionality (E), level of activity (A), level of sociability (S) and shyness (SH). The EAS performs well in different languages and cultures. In the current study, the lower bound reliability estimates of the temperament sub-scales were: E: $\alpha = 0.84$; A: $\alpha = 0.70$; S: $\alpha = 0.71$; SH: $\alpha = 0.65$.
3. *Child Behavior Checklist* (CBCL) [31]. The CBCL is widely used to assess behavioral problems, and has age-appropriate versions for each age group. In the current study the overall lower bound reliability estimate of the CBCL was $\alpha = 0.92$; for the affective subscale it was $\alpha = 0.53$; for the anxiety subscale it was $\alpha = 0.65$; for the PDD subscale it was $\alpha = 0.67$; for the ADHD subscale it was $\alpha = 0.75$; for the oppositional behavior subscale it was $\alpha = 0.78$. For the Internalizing subscale the overall lower bound reliability estimate was $\alpha = 0.75$; and $\alpha = 0.84$ for the externalizing subscale. The CBCL includes 12 items of free text report, on specific behavioral problems. On the fears item, 26 % wrote a text comment, and the most frequent fear mentioned was fear of dogs. On the item that asks about problems with eating, 12 % of parents wrote a comment, and the themes most frequently mentioned were pickiness, fear of new foods, and a restricted range of food, in particular an avoidance of vegetables.
4. *Fears Inventory for Young Children* (FIYC), [10], includes 23 items on a Likert-type scale going from 1 (not afraid at all) to 4 (very afraid). It includes items that list common childhood fear stimuli and requests the parent to list the intensity of fear the child exhibits for each. The FIYC has good reliability and convergent validity. In the current study the FIYC had a lower bound reliability estimate of $\alpha = 0.82$; convergent validity was supported in the current study by the CBCL: the FYIC correlated $r = 0.484$, ($p < 0.001$) with the anxiety sub-scale of the CBCL. The FIYC has four subscales: fear of imaginary figures and stories (Monsters) which had a lower bound reliability estimate of $\alpha = 0.69$; Fear of strangers and novel situations (Strangers) which had a lower bound reliability estimate of $\alpha = 0.68$; Fear of harm and death (Harm) which had a lower bound reliability estimate of $\alpha = 0.68$; and fear of dark and night terrors (Night) which had a lower bound reliability estimate of $\alpha = 0.52$.
5. *Behavior Rating Inventory of Executive Function Pre-school version* (BRIEF-P), [32]. The BRIEF-P has structure validity as well as convergent and divergent validity when measured against the CBCL [33]. Two subscales of the BRIEF-P were used, both part of behavior regulation: shifting and emotional control. In the current study the shifting subscale had a lower bound reliability of $\alpha = 0.89$, while the emotional control had a lower bound reliability estimate of $\alpha = 0.92$.

Parent characteristic instruments:

1. *Experience in Close Relationships* (ECR) is a measure of adult attachment with two subscales, anxious and avoidant attachment. A low score on both indicates secure attachment. The ECR has excellent psychometric properties, and several versions of varying length [34]. The current study used a 16-item version with 8 items for each sub-scale; the anxious attachment subscale had a lower bound reliability of $\alpha = 0.79$; the avoidant attachment subscale had a lower bound reliability of $\alpha = 0.63$. All participants completed the ECR.
2. *Parental Attitude Questionnaire* (PAQ) [35]. The PAQ includes 30 items, 10 for each of the subscales: Permissive parenting, Authoritarian parenting and Authoritative parenting. Mothers completed the PAQ in respect to the parenting they themselves experienced as children. In the current study the Permissive parenting subscale had a lower bound reliability estimate of $\alpha = 0.77$; the Authoritarian parenting subscale had a lower bound reliability estimate of $\alpha = 0.91$; the Authoritative parenting subscale had a lower bound reliability estimate of $\alpha = 0.89$.
3. *Frost Multidimensional Perfectionism Scale* (FMPS) [36]. The FMPS has good reliability and construct validity. The original scale contains 6 sub-scales, four of them were used in current research: Concern over mistake (CM), Doubts about Actions (DA), Parental Expectations (PE) and Parental criticism (PC). These sub-scales usually are related to maladaptive

perfectionism. Responses are scored on a 5-point scale ranging from strongly disagree (1) to strongly agree (5). The subscale lower bound reliability estimates in the current study were: CM $\alpha = 0.86$; DA $\alpha = 0.82$; PE $\alpha = 0.86$; PC $\alpha = 0.76$.

4. *Spielberger Trait Anxiety Inventory* (STAI) [37]. The trait anxiety scale includes 20 items that are scored on a Likert-type five point scale. In the current study trait anxiety had a lower bound reliability estimate of $\alpha = 0.90$.

Data Analysis

The data were entered electronically by self-report into Qualtrics [38] and downloaded into SPSS 21.0 files. All of the analyses were conducted in SPSS 21.0. Missing data was treated on a participant and on a scale-by-scale basis: scales with more than two missing items were not included in the analyses.

Results

The Pearson correlations of the study variables with the CRI scores are presented in Table 1 below. The CRI scores correlated positively with emotional and shy temperament, and negatively with outgoing and active temperament. The CRI scores correlated positively with all the childhood fears subscale scores, with the CBCL subscale scores, and with the BRIEF subscale scores. Of the maternal characteristics, three of the four perfectionism subscales, maternal anxious and avoidant attachment, and maternal trait anxiety correlated positively with the CRI scores. The correlations ranged from weak to moderate, but were highly significant because of the large sample size. The mother's experience of parenting style did not correlate with child's ritualistic behavior.

Child's age correlated negatively though weakly with the ritualistic behavior score, $r = -0.054$, $p = 0.052$. When controlling for temperament the correlation grew ($r = -0.135$, $p < 0.001$), and grew further when in addition controlling for childhood fears ($r = -0.179$, $p < 0.001$), the correlation remained significant when controlling in addition for the CBCL subscales ($r = -0.151$, $p < 0.001$) and also when the BRIEF subscales were additionally controlled for ($r = -0.144$).

In order to examine the contribution of the independent variables to the variance of ritualistic behavior, we conducted linear hierarchical multiple regression analysis. The predictor blocks followed a developmental logic. First block: child's age and gender, second block: child temperament scales, third block: child fears, fourth block: behavior problems, and fifth block: executive function. The final model is presented in Table 2. The overall variance explained in the fifth model is adjusted $R^2 = 0.31$; the significant predictors are child's age (negative); the temperament subscale of negative emotionality (positive); childhood fears (positive) the PDD subscale of the CBCL (positive) and finally both BRIEF subscales, i.e. emotion-control and shifting.

Maternal age was significantly and negatively related to child's ritualistic behavior $r = -0.134$, $p < 0.001$.

Table 1 Pearson correlations of CRI scores with child and mother characteristics

Child characteristics	CRI behavior score	CRI worry score
Child temperament (EAS)		
Emotionality	0.305***	0.257***
Outgoing	−0.097***	−0.158***
Shyness	0.275***	0.201***
Activity	−0.05	−0.121***
Childhood fears (FIYC)		
Monsters	0.179***	0.150***
Strangers	0.341***	0.227***
Harm	0.122***	0.125***
Night terrors	0.270***	0.221***
Child behavioral problems (CBCL)		
Oppositional	0.174***	0.188***
ADHD	0.104***	0.073**
Affective	0.200***	0.214***
PDD	0.229***	0.194***
Anxiety	0.282***	0.248***
Executive function (BRIEF)		
Shifting	0.227***	0.280***
Emotional control	0.152***	0.258***
Mother characteristics	**CRI behavior score**	**CRI worry score**
Perfectionism (FMPS)		
Parental expectations	0.128***	0.031
Parental criticism	0.049	0.071
Concern over mistakes	0.134***	0.148***
Doubts about actions	0.123***	0.177***
Attachment		
Anxious	0.155***	0.212***
Avoidant	0.127***	0.129***
Trait anxiety	0.086*	0.200***
Parenting style experienced as a child		
Permissive	0.073	0.062
Authoritative	−0.006	0.021
Authoritarian	0.059	0.043

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2 Summary of hierarchical multiple regression for predicting child's ritual behavior by child's characteristics (N = 708)

Variable	B	SE B	β	R^2_{change}	F_{change}
Step 1					
Child's age	−0.04	0.02	−0.06		
Child's gender	−0.02	0.05	−0.02	0.00	1.39
Step 2					
Sociability	−0.07	0.04	−0.08*		
Emotionality	0.22	0.03	0.33***		
Shyness	0.15	0.04	0.16***		
Activity	−0.05	0.03	−0.05	0.19	39.74***
Step 3					
Fears	0.02	0.00	0.32***	0.07	65.83***
Step 4					
Affective problems	−0.01	0.01	−0.04		
Anxiety problems	−0.01	0.01	−0.02		
Pervasive Dev. problems	0.06	0.01	0.25***		
ADHD problems	−0.02	0.01	−0.01		
Oppositional problems	−0.03	0.01	−0.01	0.03	6.24***
Step 5					
Emotional control	0.19	0.10	0.11*		
Shifting	0.28	0.10	0.15**	0.02	8.34***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Comparing children whose mothers reported having pregnancy or delivery complications (N = 231) with those who didn't (N = 1093) showed that those who did had significantly higher CRI scores (t = −2.134, $p < 0.05$).

We measured the mothers' perfectionism, her childhood experience of her parents parenting style, her trait anxiety and her attachment style. Three out of four of the mothers' perfectionism sub-scales correlated positively with the child's ritualistic behavior: Concern over Mistakes (r = 0.129, $p < 0.01$); Doubts about Actions (r = 0.130, $p < 0.01$); and Parental Expectations (r = 0.104, $p < 0.05$). The mothers' avoidant attachment correlated with the child's ritualistic behavior (r = 0.113, $p < 0.01$) as did anxious attachment (r = 0.139, $p < 0.001$). The parental style the mother experienced as a child was not significantly correlated with the child's ritualistic behavior score.

A linear hierarchical multiple regression did not add significantly to explained variance of child's ritualistic behavior, and so these results are not presented here.

We compared the children raised in ultraorthodox families to those raised in religious, traditional, and secular homes (descending order of religious observance). We hypothesized that ultraorthodox children would be different in their personal ritualistic behavior. Table 3 shows the results of the analysis of variance, which shows that children from ultraorthodox families had significantly more ritualistic behavior than children in each of the other three groups.

In an attempt to clarify the meaning of this result, we conducted post hoc analyses to examine the relationship of ritualistic behavior within the ultraorthodox children with the variables measuring fears, negative emotional temperament, pervasive developmental delays, and the BRIEF set-shifting subscale (i.e. the strongest predictors in the regression analysis). In the ultraorthodox children, as in the rest, ritualistic behavior correlated significantly with all four of these variables. However, the correlation between CRI behavior and the CBCL PDD subscale in the ultraorthodox children was significantly higher than that of the other children, and the CRI behavior with the Shifting subscale of the BRIEF was significantly lower than in the other children. These correlations are summarized in Table 4.

Discussion

In this cross-sectional study we found a weak inverse relationship between age and level of ritualistic behavior, which was strengthened by controlling for the child's shy and emotional temperament, the child's fears, and remained robust when controlling further for behavior problems and executive function. This seems further confirmation of the maturity principle as related to ritualistic behavior. Moreover the fact that controlling for the temperament and fears increased the correlation suggests that the degree of ritualistic behavior a child exhibits declines with age as long as the child is not overly shy, emotional, fearful, etc. This maturation effect has been found in many previous studies. The decline in typically developing children has been shown cross-sectionally [16, 45] as well

Table 3 Means, standard deviations, and one way anova analysis of ritual behavior between religion groups (N = 1317)

	Secular[a] (n = 720)		Traditional[b] (n = 167)		Religious[c] (n = 266)		Ultraorthodox[d] (n = 165)		*F*
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	
Ritual behavior	2.19[d]	0.61	2.11[d]	0.66	2.21[d]	0.63	2.47[abc]	0.67	11.36***

[a] Group 1; [b] Group 2; [c] Group 3; [d] Group 4

The letters in superscript denote the groups from which the current group's mean is significantly different. Thus the ultraorthodox group 4 is significantly different from all three other groups 1, 2, and 3

Table 4 Post-hoc examination of correlations between ritual behavior and relevant child variables in the ultraorthodox children (N = 165) and all the other children (N = 1135)

	Negative- emotion temperament	Childhood fears	CBCL PDD[a]	BRIEF difficulty shifting[a]
Rituality (CRI)				
Ultraorthodox	0.20*	0.30***	0.47***	0.21**
All others	0.32***	0.39***	0.23***	0.46***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a] The correlations for the two groups were compared using the Fisher r-to-z transformation. For the CBCL- PDD-subscale the correlation with ritualistic behavior in the ultraorthodox children was significantly higher ($z = 3.28$, $p < 0.001$). For the BRIEF shifting subscale, the correlation with ritualistic behavior was significantly lower in the ultraorthodox children ($z = -3.38$, $p < 0.01$)

as longitudinally [11]. The decline continues toward adolescence [16, 17] although there is a minority of children who maintain a high level of RCBs, and these are associated with anxiety and social difficulties [17, 46].

Overall, we have replicated the finding, that ritualistic behavior in TD young children, even within the developmental window in which it peaks, is related to maladaptive behavior. It is associated with a more negatively-emotional and shy temperament, as well as with behavioral problems as reported by parents and pre-school teachers [10]. It is also positively associated with childhood fears as previously found [10]. These findings are also consistent with a cross-sectional English study of TD children [16], which found that childhood ritualistic behavior was correlated with OCD symptoms. Thus there is justification for calling the child's ritualistic behavior routinized compulsive-like behavior [2] and viewing it as a mild sub-clinical form of obsessive–compulsive behavior, which may spontaneously remit toward latency.

In addition we found that the ritualistic behavior was related to the autistic spectrum tendencies. The CBCL PDD subscale was a contributor in this study to explained variance in ritualistic behavior. This was true for the complete sample, and particularly strong for the ultra-orthodox children. This finding is consistent with a large literature showing the prominence of routinized compulsive like behavior in children with ASD [12, 39]. Wolff et al. [40] showed that the level of repetitive routinized behavior in infants 12–24 months of age predicted prospectively the onset of ASD at age 3 within children at familial risk for ASD as well as in comparison to typically developing infants. The persistence of RCBs in individuals with ASD was one of the strongest distinguishing features between them and those who recovered from ASD.

There seem to be at least two distinct trajectories connecting a relatively high level of ritualistic behavior within the said developmental window to future psychopathology: one that relates to anxiety and OCD and another that relates to ASD.

An interesting finding in the current study is the contribution of executive function: the better developed shifting and emotional control are as measured by the BRIEF subscales, the less the child engages in ritualistic behavior. The contribution of these subscales was significant even when entered in the last block of predictors (after child age and gender, temperament, fears, and the CBCL subscales, all of which have explanatory power). Shifting measures the child's flexibility and ability to move from one activity to the other. Emotion control measures the child's ability to respond appropriately to varying circumstances. This connection between the development of executive function as a mechanism that moderates ritualistic behavior and allows its replacement with more flexible age-appropriate behavior in the older child, is supported directly and indirectly by previous research. Evans et al. [11] found that individuals with Down syndrome had more RCBs than typically developing children even when matched for mental rather than chronological age. Furthermore, typically developing children in the Evans et al. study were more likely to exhibit CBCL attention problems the higher their RCBs were two years before. Thus the significant spurt of development of executive function after age 5 [18] may play a role in the decline of ritualistic behaviors after this age. The younger children, as well as the children whose trajectory is such that executive functions develop less

or later, are those with the highest levels of RCBs. The suggestion that executive function may play this role was made in the context of ASD [41] and is supported in the current study in typically developing children, and has been shown in TD children using other measures of executive function [19, 44] There is also support for the reverse proposition, i.e. that improvement in executive function is associated with more flexible and contextual behavior: the ability of TD children 3–10 years of age to self-regulate goal-directed everyday activities such as dressing, grooming, homework, and play, correlated with the development of executive functions as measured by the BRIEF [42]. Neuropsychological measures of cognitive flexibility were inversely related to the CRI score of TD children under and over the age of six [42]. An inverse relationship between executive function measured by self-directed behavior and shifting was found for non-human primates [43]. The findings of the current study are consistent with much previous research: as children mature and executive functions develop, self-regulated goal-oriented behavior takes precedence over RCBs.

Although many characteristics of the mother correlated as expected with the child's ritualistic behavior score, they had at best a weak relationship with ritualistic behavior. More perfectionistic and insecurely attached mothers, as well as mothers who reported complications of pregnancy or delivery had slightly more ritualistic children. The direction of these findings is as expected. The results may signify that in a wide range of home environments, the child is not molded into this repetitive behavioral pattern by the mother's anxiety and stress. Rather the child carries within him these tendencies that manifest in early temperament and are not much altered by environment. An exception is the ultraorthodox culture which is highly proscriptive. Children in this environment were found to be more RCB than their non-ultraorthodox peers. Moreover, even in these children, their personal routinized behavior, was related to the same child characteristics. It seems that the more structured and ritualistic lifestyle of the ultraorthodox is not protective against, and indeed may exacerbate the need for personalized routinized behavior of the child.

In TD children, the distinction between adaptive and maladaptive ritualistic behavior might rely on frequency and intensity: some RCB's are much better than none, or a chaotic existence, while too many are part of a more anxious, obsessive, and perseverative tendency. Another is in timing: while RCB's may serve an adaptive function within the window described by Gesell et al. [1] their presence in latency and adolescence is probably part of a continuing or newly arising tendency toward obsessive–compulsive behavior, a trajectory of ASD, or an anxiety disorder [17].

For the ultraorthodox children, the benefit of socially prescribed culturally meaningful rituals may be counterbalanced by other risk factors, such as the stress of being part of a very large family, and of being relatively poor [26]. It would be interesting to follow their development over time, as well as to compare them to other groups which favor closed communities, large families, and highly structured religious observance.

Understanding early childhood ritualistic behavior and its developmental trajectories requires large scale longitudinal studies. The Evans et al. [11] short term longitudinal study is an important step in this direction. Extending the length of time studied, as well as diversifying and enlarging the sample of TD children, might help in understanding more of this intriguing developmental phenomenon.

Future large scale longitudinal research on ritualistic behavior in children will help us to understand the variety of normal developmental trajectories, and to differentiate them from those that precede psychopathology; to inform us when intervention is called for and which behaviors are the most important targets of such interventions.

The results of the current study should be viewed with consideration of its limitations. The sample was a convenience sample, and is different from a representative sample in at least two ways: non-urban families are over-represented, and most families had internet access and therefore the sample is biased to middle class participants. In addition this is a cross-sectional study, relying on one data-point. All the data were derived from a single informant, the child's parent. Our attempts to include fathers were unsuccessful, and of the 1345 participants reported here, only 23 were fathers, making the data set one of maternal reports.

Summary

Routinized, ritualistic behavior is common in young children between the ages of 2 and 5, after which it normatively subsides. The current cross-sectional study examined 1345 maternal reports on children between the ages of 2 and 6. Reports included child variables such as temperament, fears, behavioral problems and executive function. Mother variables included perfectionism, her attachment style, trait-anxiety, history of pregnancy and delivery complications and recalled parental style. We showed the expected maturation affect, i.e. that the child's age correlated negatively with his ritualistic behavior score, and the correlation was strengthened when controlling for the child's temperament, fears, and behavioral problems. Young children's ritualistic behavior was associated with shy and emotional temperament, fears, pervasive developmental behavioral problems, and executive function delays in shifting and emotion regulation. Maternal variables correlated with child's ritualistic behavior but did not explain significant variance. Children of mothers with a history of pregnancy or delivery

complications exhibited more ritualistic behavior. Ultraorthodox children exhibited more ritualistic behavior than their peers. The developmental trajectory of ritualistic behavior, peaking between 2 and 6 and then waning may be explained by the concurrent development of executive function. For those children with more ritualistic behavior, it may also be associated with an obsessive–compulsive tendency, or an ASD trajectory. Child-initiated high levels of routinized repetitive behavior seem maladaptive, especially if they persist beyond the developmental window in which they are normative.

References

1. Gesell A, Ames LB, Ilg FL (1974) Infant and the child in culture today. Harper and Row, New York
2. Evans DW, Leckman JF, Carter A, Reznick JS, Henshaw D, King RA, Pauls DL (1997) Ritual, habit and perfectionism: the prevalence and development of compulsive-like behavior in normal young children. Child Dev 68:58–68
3. Eriksson EH (1977) Toys and reasons. W. U. Norton & Company, New York
4. Fiske AP, Haslam N (1997) Is OCS a pathology of the human disposition to perform socially meaningful rituals? Evidence of similar content. J Nerv Ment Dis 185:211–222
5. Muris PH, Merckelbach H, Clavan M (1997) Abnormal and normal compulsions. Behav Res Ther 35(3):249–252
6. Keren H, Mort J, Weiss O Boyer P, Eilam D (2013) Irrelevant idiosyncratic acts as preparatory, confirmatory, or transitional phases in motor behaviour. Behaviour 150(5):547–568
7. Mindell JA, Telofski LS, Wiegand B, Kurtz ES (2009) A nightly bedtime routine: impact on sleep in young children and maternal mood. Sleep 32(5):599–606
8. Boyer P, Liénard P (2006) Why ritualized behavior? Precaution systems and action parsing in developmental, pathological and cultural rituals. Behav Brain Sci 29:595–650
9. Evans DW, Maiken A (2011) Cortical activity and children's rituals, habits and repetitive behavior: a visual P300 study. Behav Brain Res 224:174–179
10. Zohar AH, Felz L (2001) Ritualistic behavior in young children. J Abnorm Child Psychol 29:121–128
11. Evans DW, Kleinpeter FL, Slane MM, Boomer KB (2014) Adaptive and maladaptive correlates of repetitive behavior and restricted interests in persons with Down syndrome and developmentally-matched typical children: A two-year longitudinal sequential design. PloS One 9(4):1–9 e93951
12. Bishop SL, Hus V, Duncan A, Huerta M, Gotham K, Pickles A,… Lord C (2013) Subcategories of restricted and repetitive behaviors in children with autism spectrum disorders. J Autism Dev Disord 43(6):1287–1297
13. Leonard HL, Goldberger EL, Rapoport JL, Cheslow DL, Swedo SE (1990) Childhood rituals: normal development of OC symptoms? J Am Ac Child Adolesc Psychiatry 29:17–23
14. Hibbs ED, Hamburger SD, Lenane M, Rapoport JL, Kruesi MJP, Keysor CS, Goldstein MJ (1991) Determinants of EE in families of disturbed and normal children. J Child Psychol Psychiatry 32:757–770
15. Brier N (2004) Anxiety after miscarriage: a review of the empirical literature implications for clinical practice. Birth 31:138–142
16. Glenn S, Cunningham C, Nananidou A (2012) A cross-sectional comparison of routinized and compulsive-like behaviours in typical children aged from 2 to 11 years old. Eur J Dev Psychol 9(3):614–630
17. Zohar AH, Bruno R (1997) Normative and pathological OCB and ideation in childhood: a question of timing. J Child Psychol Psychiatry 38(8):993–999
18. Best JR, Miller PH, Jones LL (2009) Executive functions after age 5: changes and correlates. Dev Rev 29(3):188–200
19. Tregay J, Gilmour J, Charman T (2009) Childhood rituals and executive functions. Br J Dev Psych 27:283–296
20. Freud S (1909/1955) Notes upon a case of obsessional neurosis. In: Strachey J (ed) The standard edition of the complete psychological works of Sigmund Freud. Hogarth Press, London
21. Abramowitz JS, Deacon BJ, Woods CM, Tolin DF (2004) Association between Protestant religiosity and obsessive–compulsive symptoms and cognitions. Depress Anxiety 20:70–76
22. Sica C, Novara C, Sanavio E (2002) Religiousness and OC cognitions and symptoms in an Italian population. Behav Res Ther 40:813–823
23. Shams G, Milosevic I (2013) OC cognitions, symptoms and religiousness in an Iranian population. Int J Clin Med 4:479–484
24. Zohar AH, Goldman E, Calamary R, Mashiah M (2005) Religiosity and obsessive compulsive behavior in Israeli Jews. Behav Res Ther 43:857–868
25. Huppert JD, Siev J, Kushner ES (2007) When religion and OCD collide: treating scrupulosity in ultra-orthodox Jews. J Clin Psychol 63(10):925–941
26. CBS (2004) Ultraorthodox Jews in Israel. Retrieved from http://www.cbs.gov.il/www/publications/int_ulor.pdf, August 13, 2014
27. Friedman M (1991) The ultraorthodox society: origins, trends and processes. Jerusalem Institute: Jerusalem. In particular, chapter 8, pp 115–143
28. CBS (2012) Distribution of the Israeli population by urban vs. rural homes. Retrieved from http://www.cbs.gov.il/shnaton64/st02_20x.pdf, July 28, 2014
29. CBS (2012) Distribution of the Israeli population by self-reported religious observance. Retrieved from http://www.cbs.gov.il/shnaton64/st02_02x.pdf, July 28, 2014
30. Buss AH, Plomin R (1984) Temperament: early developing personality traits. Lawrence Earlbaum, Hillsdale
31. Auerbach J, Yirmia N, Kamel FN (1996) Behavior problems in Jewish and Palestinian preschool children. J Clin Child Psychol 25:398–405
32. Gioia GA, Espy KA, Isquith PK (2002) Behavior rating inventory of executive function, preschool version (BRIEF-P). Psychological Assessment Resources, Odessa
33. Isquith PK, Crawford JS, Espy KA, Gioia GA (2005) Assessment of executive function in preschool-aged children. Ment Retard Dev Disabil Res Rev 11(3):209–215
34. Fraley RC, Heffernan ME, Vicary AM, Brumbaugh CC (2011) The experiences in close relationships—Relationship Structures Questionnaire: a method for assessing orientations across relationships. Psychol Assess 23(3):615–625
35. Buri JR (1991) Parental authority questionnaire. J Pers Assess 57(1):110–119
36. Frost RO, Lahart CM, Rosenblate R (1991) The development of perfectionism: a study of daughters and their parents. Cognit Ther Res 15(6):469–489
37. Spielberger C, Sydeman SJ (1994) State-Trait Anxiety Inventory and State-Trait Anger Expression Inventory. In: Maruish ME (ed) The use of psychological testing for treatment planning and outcome assessment. Lawrence Erlbaum Associates, Hillsdale, pp 292–321
38. Qualtrics (2002) http://www.qualtrics.com

39. Troyb E, Orinstein A, Tyson K, Eigsti IM, Naigles L, Fein D (2014) Restricted and repetitive behaviors in individuals with a history of ASDs who have achieved optimal outcomes. J Autism Dev Disord 1–17. Epublication ahead of print, PMID 25030967
40. Wolff JJ, Botteron KN, Dager SR, Elison JT, Estes AM, Gu H,… Piven J (2014) Longitudinal patterns of repetitive behavior in toddlers with autism. J Child Psychol Psychiatry 55(8):945–953
41. South M, Ozonoff S, Mcmahon WM (2007) The relationship between executive functioning, central coherence, and repetitive behaviors in the high-functioning autism spectrum. Autism 11(5):437–451
42. Frisch C, Rosenblum S (2014) Reliability and validity of the Executive Function and Occupational Routines Scale (EFORTS). Res Dev Disabil 35(9):2148–2157
43. Judge PG, Evans DW, Schroepfer KK, Gross AC (2011) Perseveration on a reversal-learning task correlates with rates of self-directed behavior in nonhuman primates. Behav Brain Res 222:57–65
44. Pietrefesa AS, Evans DW (2007) Affective and neuropsychological correlates of children's rituals and compulsive-like behaviors: continuities and discontinuities with OCD. Brain Cog 65:36–46
45. Çevikaslan A, Evans DW, Dedeoğlu C, Kalaça S, Yazgan Y (2013) A cross-sectional survey of repetitive behaviors and restricted interests in a typically developing Turkish child population. Child Psychiatry Hum Dev 45(4):472–482
46. Evans DW, Gray FL, Leckman JF (1999) Rituals, fears and phobias in young children: insights from development, psychopathology and neurobiology. Child Psychiatry Hum Dev 29:261–276