Journal of Child and Family Studies (2018) 27:2668–2677
https://doi.org/10.1007/s10826-018-1101-9

ORIGINAL PAPER

Children's Temperament and Maternal Behavioral Control: Origins of Heterogeneity in Developmental Trajectories of Committed Compliance from Infancy to Age 3

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Published online: 7 May 2018

Abstract
Temperament and parental control are two important factors that influence the early development of children's committed compliance. However, there is a need to comprehensively depict the developmental profiles of committed compliance across the first 3 years and further examine the impacts of these two factors on the profiles. Thus, the current study examined how 92 participants (39 boys) differed in their trajectories of committed compliance throughout toddlerhood and how these individual variances were underpinning of their temperament fearfulness and distractibility in infancy and maternal behavioral control from infancy to toddlerhood. According to children's committed compliance observed in the clean-up task from 14 to 38 months, three groups with different developmental trajectories were identified: the high-level group, the low-level group, and the developmental group. Compared with the high-level group, the mothers reported that the low-level group displayed higher distractibility and lower fearfulness at 6 months. Maternal behavioral control was coded from two 5-min mother-child free plays at each age of 10, 14, 25 and 38 months. Results indicated that though the initial level of committed compliance of the two groups were similar at 14 months, the developmental group mothers had a lower mean intercept of behavioral control than the low-level group mothers at 10 months. Moreover, the developmental group mothers tended to decrease their use of behavioral control more slowly than the high-level group mothers. Limitations and implication for future research were discussed.

Keywords Committed compliance · Temperament · Parenting · Behavioral control · Latent class growth analysis

Introduction

In the first three years, children experience dramatic changes in the socioemotional abilities and self-control. Among many indicators of self-control, the ability to comply with adults' demands is regarded as the most important developmental achievement in toddlerhood, which was also shown to be the origin of later internalization and conscience (Kochanska and Aksan 2006). Based on the distinctive motivation, two categories of compliant behaviors were differentiated in previous studies (e.g., Braungart-Rieker et al. 1997; Feldman and Klein 2003; Kochanska and Aksan 1995): (a) situational compliance, described as though generally cooperative, the child requires frequent prompts to stay on the task; and (b) committed compliance, characterized as child's wholeheartedly compliant responses with willing stance towards parental agenda.

The developmental psychologists suggest that children who exhibit committed compliance towards parental signals throughout early development, are more likely to view themselves as embracing social values and regulations (Kochanska and Aksan 2006). In the typically developing population, children's committed compliance gradually increases with age and its trajectory appears to be linear across 1 to 3 years old (Kochanska et al. 2001). In this study, we aimed at investigating how individual developmental profile of committed compliance was differed under the influences of the intrinsic and extrinsic factors (e.g., Kochanska et al. 2001; Lickenbrock et al. 2013).

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Specifically, the vulnerability model assumed that some temperament predisposed children to disruptive problematic behaviors, in which noncompliant behaviors were included (Wahler 1994). This model stresses the importance of testing temperament as a candidate of the intrinsic factors for explaining individual differences in the early developmental process of (non)compliance (Kochanska and Aksan 2006). Temperament is defined as the biologically rooted individual differences in behavioral tendencies that are relatively stable across situations and over the course of time (Bates 1989). Individual differences in reactivity and self-regulation were said to be the key concepts of temperament (Gartstein et al. 2013).

Accordingly, two inhibitory systems of temperament were proposed to play a role in the developmental process of committed compliance (Kochanska and Aksan 2006). The first is behavioral inhibition system. The core of the system is temperament fearfulness or behavioral withdrawal, which refers to the proneness to experience anxious and apprehensive state when encountering novel environments or strangers (Fowles 1998; Kochanska and Aksan 2006). Aksan and Kochanska (2004) hypothesized that fearfulness would decrease children's speed of approach. Consequently, the fearful children act less impulsively in the daily activities, including those activities that are relevant to the compliant responses. Studies suggested that there was dramatic increase in infant's fear at approximately 6 months old. This process was associated with the neonatal amygdala functional connectivity (Braungart-Rieker et al. 2010; Graham et al. 2015). Thus, the age of 6 months might be a sensitive period to test how behavioral inhibition system, more specifically, temperament fearfulness, will impact the later development of compliance.

Moreover, infants' behaviors in the fear-elicited task were shown to closely relate to attention regulation at the same age (Braungart-Rieker et al. 2010), whereas attention regulation was also found to function on the basis of the neonatal amygdala-ventral anterior cingulate cortex connectivity (Graham et al. 2015). Thus, some researchers suggested that temperament fearfulness would facilitate the emergence and development of the second inhibitory system—effortful control (Aksan and Kochanska 2004). Effortful control can directly impact children's committed compliance (Spinrad et al. 2012). Compared with the reactive behavioral inhibition of fearfulness, effortful control requires child to deploy more active and voluntary control over their dominant responses in favor of their subdominant responses (Rothbart et al. 2011). It contains temperament attributes such as focusing and shifting attention, responding to stimulation, and inhibiting or initiating a response accordingly (Gartstein et al. 2013). Emerging between 6 to 12 months, attention regulation and attention focus were the precursors of effortful control in later toddlerhood, as the infants were particularly susceptible to regulate their attention from external signals at this period (Gartstein et al. 2013; Rothbart et al. 2011). Correspondingly, easily distracted infants are at greater risk of a low level of effortful control, and then, may encounter more difficulties in behavioral self-control in later years.

In addition, social information processing model posits that the contents of the requests and the parenting practices also affect children's motivation for complying with adults' directives (Grusec and Goodnow 1994). Defined as a cluster of behaviors through which parents excessively regulate children's activities, encourage their dependence, and instruct their thoughts and feelings (Barber 1996), parental control has been examined the most frequently among all the extrinsic factors for its effect on children's compliance and noncompliance (e.g., Chen et al. 2003; Kochanska 1995).

But scholars have proposed different approaches to categorize parental control: (a) positive control is giving directives through teaching and guidance, while negative control is power-assertiveness through harshness, criticism, and physical intervention (Karreman et al. 2006); or (b) behavioral control emphasizes on controlling children's behaviors and activities, whereas psychological control emphasizes on intruding into children's internal world (Barber 1996). Nevertheless, behavioral control consists of parental requests (the *Do* context; parents demand children to sustain attention on the tedious works) and prohibitions (the *Don't* context; parents give directives to prevent children from doing something dangerous), for which usually children's compliant responses and internalization of rules are expected (Kochanska and Aksan 1995). Hence, this category of parental control was selected in our study.

To sum up, the following factors were further specified for their relations with children's committed compliance: (a) fearfulness and distractibility, representing intrinsic, temperamental characteristics of children (Aksan and Kochanska 2004); and (b) maternal behavioral control, reflecting an extrinsic factor of early parenting environment (Power et al. 1994).

In past literature, researchers suggested that the fearful children complied with their caregivers' directives more frequently and more voluntarily because they were prone to experience the transgression-related distress in response to behaviors that led to the potential punishment (Kochanska 1995). By contrast, the fearless children were insensitive to parental signals or punishment. As a result, the frequent prompts were needed in order to prevent them from violating family rules (Frick and White 2008). Some studies found that temperament fearfulness was positively associated with committed compliance (Dix et al. 2007; Kochanska et al. 2001). However, in some other studies that fearfulness was aggregated as a part of negative

emotionality or negative reactivity, a nonsignificant correlation or a negative correlation was reported (Braungart-Rieker et al. 1997; Kok et al. 2013). Although an extremely low level of fearfulness was associated with greater risk of disruptive behaviors and a lack of conscience (Frick and White 2008), there was no consensus about how fearfulness impacted the development of committed compliance.

What's more, in the tasks such as cleaning-up toys, children need to not only suppress their impulsivity to play with the toys, but also perform the subdominant behaviors, for example, putting up toys into a basket (Kochanska and Aksan 2006; Kochanska et al. 2001). Since more focused attention and less casual attention were the indicators of the maturation of cognitive function in infancy (Ruff and Capozzoli 2003), temperament distractibility, as the opposite dimension of attention regulation, might be a potential risk of later cognitive ability and effortful control, which, in turn, undermines children's committed compliance. There is some evidence supporting this assumption. For instance, a positive correlation was found between focused attention at 8–10 months and committed compliance at age of 13–15 months in the clean-up task (Kochanska et al. 1998). Another study showed that those children who could regulate attention flexibly in infancy displayed more committed compliance at age of 3 (Hill and Braungart-Rieker 2002).

When it comes to the extrinsic factors, though a meta-analytic study has found that parental positive control was positively, while parental negative control was negatively, associated with committed compliance (Karreman et al. 2006), the studies that peel off warmth or hostility in maternal behaviors exhibited the mixed findings regarding how maternal behavioral control impacts children's committed compliance.

Braungart-Rieker et al. (1997) found that if the mother exhibited more behavioral control during the delay task, the child would show less committed compliance. However, another study showed a positive association, though children's compliant behaviors (situational compliance and committed compliance) were not differentiated in the study (Crockenberg and Litman 1990). In some other studies that focused on both the mother-child dyads and the father-child dyads, the mixed results were found. One study reported a negative correlation between these two variables in the mother-child dyads, while a positive correlation in the father-child dyads (Blandon and Volling 2008). Whereas, the other studies found the positive relations in both the mother-child dyads and the father-child dyads or only in the mother-child dyads (Feldman and Klein 2003; Kwon and Elicker 2012). Given these conflicting findings and the fact that parenting also changes over time, there is a need to illuminate this question via testing the longitudinally reciprocal associations between parental control and children's committed compliance at the mean-level and the individual-level.

All in all, the primary goal of this study was to identify how children differed in their developmental trajectories of committed compliance across the first three years. Then, we tested what determinants could indicate the group differences in these trajectories. For intrinsic factors, children who were relatively more fearless and more easily distracted in infancy were expected to exhibit less committed compliance than their counterparts. For extrinsic factors, we attempted to explore whether the initial level and the change rate of maternal behavioral control are related to the group differences in children's developmental profiles of committed compliance.

Method

Participants

The initial sample consisted of 106 dyads of mother and infant (46% boys), who were recruited from several communities and maternal and child care hospitals in the urban areas of Beijing, China, from June 2010 to December 2010. Dyads of mother and infant aged 3–5 months were approached via individual introduction and brochures. Because of attrition, six 2-year-old children (5 boys and 1 girl) and two 3-year-old children (2 girls) were further included when the initial sample was assessed at 25 months and 38 months, accordingly. Because this 7-wave study ("BELONGS 2010", Beijing Longitudinal Study 2010) focused on the interactions of different caregiver-infant dyads and their associations with children's developmental outcomes, the eligibility criteria were as follows: (a) the infant should be the firstborn and singleton in the family; (b) the infant was full-term delivery with the birth weight >2500 grams; and (c) the mother was living with her husband.

Eighteen participants were excluded due to several reasons: (a) soon after they participated in the first assessment, they moved to another city or another country (44%); (b) after the first assessment, the parents quit voluntarily because of time conflict (33%); or (c) after the first assessment, the parents refused to continue for the reasons regarding their child (22%). Besides, four families who did not participate the home visits were omitted from the analyses for they had no data on the observational variables in this study. Mann-Whitney U tests showed that among all the demographic characteristics, only maternal education status was lower in those who were excluded due to attrition ($Z = 2.31$, $p = .02$). In addition, neither parental education status nor parental income was associated with the variables of interest. However, there were more boys excluded and more girls included, shown as $\chi^2(1) = 3.85$, $p = .05$.

In summary, the current study included ninety-two participants (39 boys) who have participated at least one of the assessments of committed compliance and maternal behavioral control. The mothers were, on average, 30.96 years old ($SD = 3.40$), and the fathers were 32.76 years old ($SD = 3.91$) when recruited. With 40% of the mothers and 71% of the fathers had a monthly income higher than 6000 yuan and 96% of the mothers and all the fathers had completed college education or postgraduate education, most of the participants were from the highly educated middle-class families in Beijing (Beijing Municipal Bureau of Statistics 2010, 2013).

Procedure

Data from the first 5 waves of BELONGS 2010 was used in the present study. Before each assessment, the mother signed the informed consent, and was debriefed any questions regarding the study. After each assessment, every family received an elaborate gift.

At wave 1 (T1, $M_{age} = 6.37$ months, $SD = 0.39$, range = 5.56–7.27 months), the mothers of 86 infants (36 boys) filled out the questionnaire of infants' temperament at home. At wave 2 (T2, $M_{age} = 9.61$ months, $SD = 0.46$, range = 8.84–10.68 months), two 5-min mother-child free plays were videotaped by two female experimenters during the 2-hour home visit for each of the 69 participants (27 boys). The mother was instructed to interact with her child as she normally would by using the provided toys. While one experimenter provided instructions and different toys between the interactions, the other one would minimize her presence when videotaping the mother-child interactions. The videos were then, coded by another two master students who did not know the hypothesis of this study. There were 77 toddlers (31 boys) participating in the 2-hour home visit at wave 3 (T3, $M_{age} = 14.09$ months, $SD = 0.85$, range = 12.99–16.14 months). The same two mother-child free plays were administrated. After the second interaction, the mother was instructed to give directives to have her child clean up all the toys in a basket. This measurement lasted for a maximum of 3 min or until the child has put up all the toys. The mothers were told not to directly help the child with the task. At wave 4 (T4, $M_{age} = 24.74$ months, $SD = 1.05$, range = 19.89–26.89 months), 74 children (32 boys) participated in the 1.5-hour home visit. The same procedure was used, and the age-appropriate toys were provided for all the interactions. At wave 5 (T5, $M_{age} = 37.81$ months, $SD = 1.05$, range = 36.00–41.69 months), the same procedure was administrated to 74 (29 boys) participants at the laboratory. Mothers were instructed to interact with her child in the same way they did at home.

Measures

Infant temperament distractibility and fearfulness, T1

Infant temperament was measured via the Chinese version of Revised Infant Temperament Questionnaire (ITQ-R; Zhang et al. 2000; Carey and McDevitt 1978), a widely used 95-item questionnaire by which parents report infant's behaviors on a 6-point Likert-type scale. 1 represents that the infant "almost never" behaves like the description of an item, and 6 stands for that the infant "almost always" behaves like that. The higher the mean score is, the more apparently the infant displays the behavioral tendencies on the dimension. The dimension of distractibility has 10 items that reflect the extent to which the infant is interrupted and distracted by the stimuli in the environment. For instance, "The infant watches another toy when offered even though already holding one". Fearfulness was measured by the 11-item approach–withdrawal dimension, by which the infant's reactions to novel environments or strangers were rated, such as "For the first few minutes in a new place or situation (new store or home) the infant is fretful".

The test-retest reliability for the Chinese version of ITQ-R was .81, and for fearfulness and distractibility were .82 and .84, respectively (Zhang et al. 2000). In this study, Cronbach's alphas for distractibility was .53 and for fearfulness was .61, similar to those in another Chinese sample (Zhang et al. 2000) and the samples from some other countries (e.g., the United States; Frodi et al. 1989). Though no gender difference was found on fearfulness, $t(84) = 0.85$, $p = .40$, boys were rated as more easily distracted than girls, $t(84) = 2.30$, $p = .02$ (see also Baillargeon et al. 2012).

Committed compliance, T3–T5

Adopting Kochanska and Aksan's (1995) coding system, two master students coded the toddlers' behaviors in the clean-up task on six mutually exclusive categories: (a) committed compliance (the child willingly endorses the clean-up situation with little maternal control); (b) situational compliance (the child stops cleaning-up if the mother ceases to make requests for compliance); (c) passive non-compliance (the child ignores maternal requests); (d) refusal or negotiation (the child says "No" or shakes head to indicate that he/she does not want to comply with maternal requests); (e) defiance (the child responds to maternal directives with noncompliance and negative affect); and (f) other behaviors that are not relevant to the task (see also Dix et al. 2007 for the coding system). One of the six codes was given for the child's behaviors within every 10-s segment and the total number of segments was calculated by adding the frequency of each category.

The coders randomly selected 30% of the videos at each age to calculate interrater reliability, resulting in the adequate Cohen's kappa values ranging from .78 to .84 (e.g., Kochanska and Aksan 1995). The proportion score of committed compliance at each age was created via dividing the total number of segments by the frequency of committed compliance.

Maternal behavioral control, T2–T5

By using an event sampling or episodic approach (Liu and Guo 2010), we coded maternal behavioral control from the two mother-child free plays at each age. Two broad categories that can be subdivided into eleven sub-categories of maternal behaviors are: (a) low-power strategies, including polite request and suggestion, explanation or reasoning, positive comments and encouragement, and offering child alternatives; and (b) high-power strategies, including direct command without force (verbal and physical directives given without explanation), direct command with force (make requests for certain behaviors from the child), intrusiveness, reprimand, prohibition (forbid the child engaging in some activities), overt disapproval (clearly say "No" to child's requests), and threatening.

As Liu and Guo (2010) have put it, the low-power strategies represented a combination of warmth and behavioral control, while the high-power strategies reflected harshness with behavioral control. Thus, we only concentrated on the sub-categories of *direct command without force*, *direct command with force*, *prohibition*, and *overt disapproval* with the purpose that they are relevant to the "Do" context and the "Don't" context (Kochanska and Aksan 1995). Correspondingly, direct command without force and direct command with force represent the "Do" context (e.g., the mother gave directives to the child, "Pick up the bunny over there!"). Whereas, prohibition and overt disapproval represent the "Don't" context (e.g., when the child fiercely pulled the toy truck, the mother said, "Stop it! You shouldn't do it that way!").

Maternal verbal and nonverbal behaviors are coded as present if it matches the description of one sub-category. Although we adopted an event-sampling approach, if it lasts longer than 5 s, the behavior will be coded as present for two or more separate segments according to its duration. Maternal behavioral control was aggregated by the frequencies of those four sub-categories occurring in the two tallied 5-min free plays (600 s in total) at each assessment. After systematically training, two master students coded all the maternal behaviors from T2 to T5. Based on 15% of the videos at each assessment, the kappa values for the overall coding ranged from .93 to .97.

Data Analyses

Trajectories of children's committed compliance and maternal behavioral control

We first conducted latent growth modeling (LGM; Kline 2005) in M*plus* Version 7.4 (Muthén and Muthén 1998–2016) to examine the developmental trajectories of children's committed compliance. According to the recommendation, our sample size is sufficient for LGM (Hamilton et al. 2003). The robust maximum likelihood estimation (MLR) was chosen because it is robust to non-normality and non-independence of the variables.

The best-fitted model was determined based on the following indices: (a) the nonsignificant chi-square statistics; (b) the comparative fit index (CFI), with values >.90; and (c) the root mean square error of approximation (RMSEA), with values ≤.08 (Kline 2005). Under the missing at random assumption, the missing data were handled by full information maximum likelihood. By using the Satorra-Bentler scaled chi-square difference test (Satorra and Bentler 2001), the linear model with the intercept (the mean starting value) and the slope (the rate of growth) was compared with the intercept-only model. In addition, for maternal behavioral control from T2 to T5, model comparisons were also performed to determine whether the quadratic-factor (the rate of change of increase or decrease) model fitted the data better than the linear model.

Heterogeneity in the development of committed compliance

Gender differences in trajectories of committed compliance were examined by multi-group LGM analyses (Nelemans et al. 2013). First, the same LGM model (i.e., model with the same growth factors) fitted the data for boys and girls separately. Second, a fully unconstrained model (i.e., all the parameters were freely estimated across the groups) was tested against a fully constrained model (i.e., all the parameters were constrained to be equal across the groups).

Next, the latent class growth analysis (LCGA) was used to find the possible classification for the individual's trajectory of committed compliance. LCGA examines the probability that individual variance can be captured in the relatively homogenous subgroups with the similar developmental trajectories (Feldman et al. 2009). As a special type of growth mixture model (GMM), there is no within-group variance of the growth parameters in the LCGA models (Feldman et al. 2009).

We used five criteria to determine the best solution: (a) adding an additional group should improve model fit,

indicated by the decrease of Bayesian Information Criterion (BIC; Kline 2005); (b) the higher the entropy values are, the more likely the participants will be classified to an accurate group (Feldman et al. 2009); (c) the adjusted Lo-Mendell-Rubin likelihood ratio test is significant (Lo et al. 2001); (d) the most parsimonious model (the fewest number of groups with the relatively acceptable model fit) with reasonable interpretability was selected (Nelemans et al. 2013); and (e) each group should take up at least 5% of the sample (Feldman et al. 2009). The best-fitting model was used to further test group differences in temperament and maternal behavioral control.

Results

Means, standard deviations, and correlations among the variables were presented in Table 1. T1 fearfulness tended to positively relate to children's committed compliance at T5 ($r = .22$, $p = .08$). T1 distractibility was negatively associated with T5 committed compliance. These showed that the two behavioral inhibitory systems were related to children's committed compliance. Most of the cross-time correlations among maternal behavioral control were significant, with *r*s ranging from .17 to .49, however, all the cross-time correlations among committed compliance were nonsignificant, which might suggest that children's committed compliance was less stable.

Next, LGM results suggested that the linear model of committed compliance, $\chi^2(1) = 0.03$, $p = .87$, CFI = 1.00, RMSEA = 0, 90% CI = [.00, .15], fitted the data better than the model only with an intercept, $\Delta\chi^2_{SB}(3) = 34.39$, $p < .01$. Both the mean intercept and the mean slope were significant. The initial level of committed compliance was 0.29 and the level increased 0.05 over each time unit.

Then, the linear model for boys and girls separately has met the first-step criteria of the multi-group LGM, shown as nonsignificant chi-square statistics for the models, CFIs > .95, and RMSEAs < .08. In the second step, compared with the fully constrained model, the fully unconstrained model fitted the data better, $\Delta\chi^2_{SB}(2) = 7.95$, $p < .05$. Consequently, we reported the results from the fully unconstrained LGM model, $\chi^2(2) = 0.16$, $p = .93$, CFI = 1.00, RMSEA = 0, 90% CI = [.00, .10]. Specifically, indexed by Wald tests, there was significant gender difference in the intercept ($p < .01$), but not in the slope ($p = .14$). Girls showed higher initial level of committed compliance than boys.

However, because neither the variance of intercept nor the variance of slope was significant in the linear model, and because BICs indicated that LCGAs provided better solutions than GMMs for the data (see Table 2), LCGA was suitable for identifying group heterogeneity in the trajectories of committed compliance in this study. Nevertheless, we expected that there would be significant differences in the proportions of gender between different groups.

In Table 2, we summarized the indices of model fit for the LCGAs. Based on the five criteria described above, the three-class model provided the best classification solution for the data, which was depicted in Fig. 1. Comprising 41.30% of the sample, the first group exhibited a sharp increase of committed compliance from a lower initial level. The second group, which consisted of 14.13% of the children, showed a slight increase of committed compliance from a lower initial level. The third group, composed by 44.57% of the sample, was characterized by a relatively high initial level of committed compliance that remained stable throughout toddlerhood. Accordingly, we labeled the first group as *developmental group*, the second as *low-level group*, and the third as *high-level group*.

Using ANOVA as post hoc for the classification has found the significant group differences in committed compliance at each age, $F(2, 67) = 133.74$ at T3, $F(2, 68) = 7.84$ at T4, and $F(2, 63) = 61.92$ at T5; *p*s < .01. Then, the

Table 1 Means, Standard Deviations, and Correlations among the Variables

Measure	1	2	3	4	5	6	7	8	9
1. Fearfulness, T1									
2. Distractibility, T1	.11								
3. Behavioral control, T2	.14	–.13							
4. Behavioral control, T3	.13	–.04	.49**						
5. Behavioral control, T4	.19	.06	.24†	.29*					
6. Behavioral control, T5	.10	–.11	.17	.27*	.21†				
7. Committed compliance, T3	.18	–.08	.01	.10	–.00	–.02			
8. Committed compliance, T4	–.01	–.23†	.05	.04	–.06	–.16	.14		
9. Committed compliance, T5	.22†	–.40**	–.22	–.12	–.20	–.04	.23	.18	
M	2.61	2.47	39.10	39.75	33.80	26.17	0.41	0.55	0.75
SD	0.71	0.42	16.20	13.88	12.72	10.89	0.35	0.39	0.27

†$p < .10$, *$p < .05$, **$p < .01$

Table 2 Parameters of model fit of latent class growth analysis

Class	BIC (BIC in GMM)[a]	Entropy	Adj. LMR-LRT	Proportion of each class (%)				
				1	2	3	4	5
1	154.40(163.27)	–	–	100	–	–	–	–
2	140.87(160.05)	.72	< 0.01**	58.7	41.3	–	–	–
3	**135.87**(142.14)	**.71**	**< 0.01****	**41.3**	**14.1**	**44.6**	–	–
4	154.84(183.14)	.73	.14	3.3	54.3	30.4	12.0	–
5	140.53(156.18)	.73	.58	31.5	23.9	9.8	14.1	20.7

Note: The best-fitting model for the trajectories of committed compliance is in boldface. Entropy values and the adjusted LMR-LRT are not available for 1 class solution in latent class growth analyses. *GMM* growth mixture model, *BIC* Bayesian Information Criterion, *Adj. LMR-LRT* the significance of adjusted Lo-Mendell-Rubin likelihood ratio test

[a]BIC in GMMs was reported for model comparison

**$p < .01$

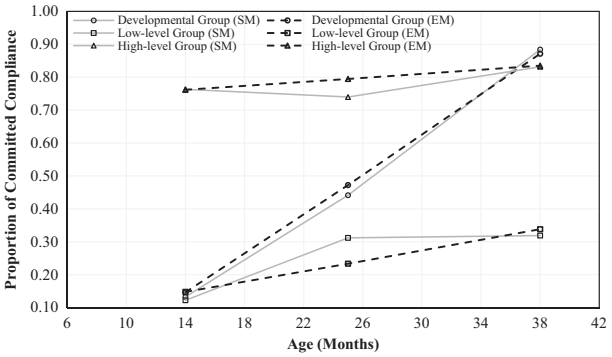

Fig. 1 Three classes for developmental trajectories of committed compliance from 14 to 38 months. *Note*: The Developmental Group is composed of 41.30% of the sample; the Low-level Group is composed of 14.13% of the sample; the High-level Group is composed of 44.57% of the sample. SM sample means, EM estimated means

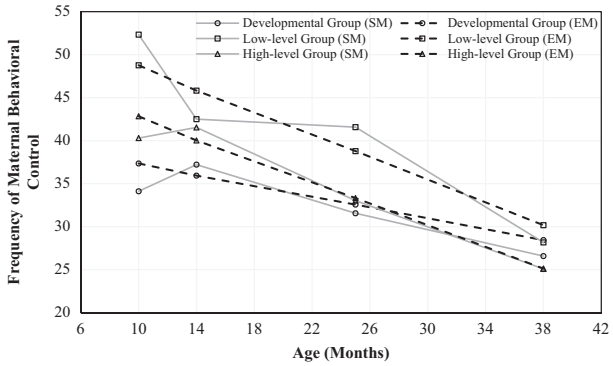

Fig. 2 Differences among three groups in maternal behavioral control from 10 to 38 months. SM sample means, EM estimated means

chi-square test for gender composition of each subgroup, $\chi^2(2) = 8.80$, $p = .01$, showed that there were more boys (69.23%) in the low-level group, more girls (73.17%) in the high-level group, and equal numbers ($n = 19$) of boys and girls in the developmental group.

In addition, for the intrinsic factors, ANOVA tests showed that neither the temperament fearfulness, $F(2, 83) = 1.53$, $p = .22$, nor the distractibility, $F(2, 83) = 2.26$, $p = .11$, was significantly varied among three groups. However, post hoc tests indicated that the low-level group was rated with a higher score on distractibility than the high-level group, $t(49) = 2.13$, $p = .04$, and slightly higher than the developmental group, $t(45) = 1.73$, $p = .09$. The low-level group tended to have a lower score of fearfulness than the high-level group, $t(49) = -1.93$, $p = .06$. Thus, the above results suggested that the low-level group was not only more easily distracted, but also more fearless in a trend in their temperamental characteristics.

For maternal behavioral control, we first examined how it changed over time. Model comparisons exhibited that the linear model, $\chi^2(5) = 4.80$, $p = .44$, CFI = 1.00, RMSEA = 0, 90% CI = [.00, .14], fitted the data better than the intercept-only model, $\Delta\chi^2_{SB}(3) = 87.09$, $p < .01$. The LGM with an intercept, a linear slope and a quadratic slope also fitted the data well, $\chi^2(1) = 1.13$, $p = .29$, CFI = 1.00, RMSEA = .04, 90% CI = [.00, .28]. But the linear model was selected for the reason of model parsimony because the quadratic model did not significantly differ, $\Delta\chi^2_{SB}(4) = 3.66$, $p > .10$.

Then, we examined the group differences in maternal behavioral control based on children's profiles of committed compliance and children's gender. Though the same model was eligible for the boys' mothers and the girls' mothers separately, no gender difference was found in maternal behavioral control, resulting from the nonsignificant chi-square difference between the fully constrained model and the fully unconstrained model, $\Delta\chi^2_{SB}(2) = 0.50$, $p > .10$. Whereas, the comparison between the fully constrained model and the unconstrained model indicated that there was a trend that maternal behavioral control varied across three groups, $\Delta\chi^2_{SB}(4) = 7.70$, $p = .10$. In the fully unconstrained model (see Fig. 2), $\chi^2(15) = 17.20$, $p = .31$, CFI = .91, RMSEA = .07, 90% CI = [.00, .19], compared with the developmental group mothers, the initial level of behavioral control was higher in the low-level group mothers ($p < .01$) and slightly higher in the high-level group mothers

($p = .07$). Besides, the developmental group mothers decreased their use of behavioral control slightly more slowly than the high-level group mothers ($p = .08$). These results suggested that though the developmental group mothers showed less behavioral control in infancy, they firmly used this parenting practice across toddlerhood.

Discussion

The various factors, including children's gender, temperament, parental responsiveness, and parental control strategies, have been shown to influence children's committed compliance (e.g., Kochanska et al. 2001; Lickenbrock et al. 2013). But how these factors are associated with the developmental trajectories of committed compliance is less known. Thus, we specified on the trajectories of committed compliance from 14 to 38 months and tested group differences in these developmental profiles. It has been found that 14.13% of the sample was classified into the low-level group. Comparatively, 44.57% of the children were highly compliant across toddlerhood. In infancy, the low-level group exhibited higher distractibility and lower fearfulness than the high-level group. Moreover, 41.30% of the children belonged to the developmental group, characterized by a sharp increase of committed compliance from 14 to 38 months, whose mothers were found to have a lower intercept and a relatively smaller decreasing rate of behavioral control across the first three years.

Committed Compliance and Temperament

As expected, the results revealed that children from the low-level group were more easily distracted than the high-level group at 6 months old. The low-level group was also rated as more fearless than the high-level group, but only at a marginally significant level. According to the delineation of their developmental trajectories, two groups were extremely different in the initial levels and the overall performance on the clean-up tasks across early development. Since the individual differences in temperament are mainly biologically rooted, it is possible that both the high-level group and the low-level group were born with some biological differences that disposed of the distinction of their behavioral tendencies in the clean-up tasks.

Compatible with the previous studies in which effortful control and its component like attention regulation were positively associated with later committed compliance (e.g., Hill and Braungart-Rieker 2002; Spinrad et al. 2012), we found that the low-level group was at greater risk of attentional distraction in daily activities from infancy, which, in turn, might make them hard to follow parental signals and directives. Infants who were unable to regulate their attention were more easily irritated and less likely to comply voluntarily in the situations that contradicted to their desires and needs (Hill and Braungart-Rieker 2002). Thus, they might have problems in using the "top-down" regulation to voluntarily suppress their predominant behavioral tendencies in the clean-up context. What's more, because children from the low-level group also had a lower score on fearfulness, they were less likely to activate behavioral inhibition system with maternal signals and, thus, tended to behave impulsively. Overall, the vulnerability from two inhibitory systems leads the low-level group to negatively respond to the unwilling socialization stimuli, for example, maternal requests and prohibitions.

Committed Compliance and Maternal Behavioral Control

Compared with children's committed compliance, maternal behavioral control differed less apparently in our study. In the subsequent multi-group LGM analyses, however, we did find that the initial level of maternal behavioral control in the developmental group mothers was lower than that in the low-level group mothers. Since both the developmental group and the low-level group had a similar lower level of committed compliance at T3, it was interesting to find that there were group differences in maternal behavioral control 4 months before the first time we assessed children's compliance.

This finding was contradictory to the assumption in one previous study that it is because the Indian mothers give directives more frequently from a very early age to practice their children's compliant behaviors that the Indian children outperform their British counterparts on the daily compliance-relevant task (Reddy et al. 2013). Although another study exhibited that infants who displayed spontaneous restraint to maternal prohibitions at 8–10 months were more compliant at 13–15 months, the researchers did not confirm whether the continuity of self-control was resulting from parenting attempts or children's temperamental proneness (Kochanska et al. 1998).

The maternal behavioral control in our study was coded from free plays, instead of the videos from the clean-up task in some other studies (e.g., Kochanska and Aksan 1995). It ensures that we coded maternal parenting practices and maternal attempts that maximumly mimic those in the naturalistic settings (Kochanska and Aksan 2006). Since the developmental group did not differ significantly from the low-level group on temperament fearfulness or distractibility, the maternal behavioral control at 10 months old was more likely to reflect maternal attempts to practice children's compliant behaviors than to reflect maternal reactions to children's temperament display. Maybe before the age of 1, children have limited words comprehensions and

their brain is still experiencing functional and structural development (Rothbart et al. 2011). Hence, we speculate that maternal directives given before children are able to comprehend might not be likely to foster toddlers' committed compliance at the emerging age.

Much to our surprise, even though children's performance on the clean-up task was quite distinctive throughout toddlerhood, the slopes of maternal behavioral control did not significantly differ among three groups. Only a trend of group difference was found between the developmental group mothers and the high-level group mothers, shown as the frequencies of maternal behavioral control in the developmental group mothers decreased relatively more slowly.

The explanation that the predictability of parental discipline could promote children's socialization was used to account for this finding (Strand 2000). The developmental group mothers appeared to be highly consistent on training their children towards socialization goals across the first three years. This explanation has also been applied to that because Chinese mothers gave directives at a stable frequency across ages, Chinese children displayed more committed compliance than their Canadian counterparts (Chen et al. 2003). Linking to the profiles of the developmental group and the high-level group, despite the developmental group was less obedient at 14 months old, they caught up with the high-level group on committed compliance at age of 3 when they were about to go to kindergarten in China, owing to their mothers' acting more predictably across toddlerhood in using behavioral control.

Future Research and Limitations

Though it is not hypothesized in this study, our findings provide some insight for gender difference in committed compliance. Some researchers argued that it was because parents encouraged independence more in their boys and their control attempts were more direct towards their girls that girls outperformed boys on compliance (Power et al. 1994). But no gender difference was found on maternal behavioral control in this study. In fact, we conferred that the gender differences were only observed in the trajectories of committed compliance and temperament distractibility. As Chen et al. (2003) noted that the biological factors influenced the emergence of such difference, researchers should figure out whether temperament distractibility has caused the robust gender difference in committed compliance in the present study and the other studies (e.g., Kochanska et al. 2001).

The current study also has some limitations. First, the sample size was small, in which children were mainly from the highly educated population. A more representative community sample that also includes the pre-terms and the second- or third-born is needed to further confirm our findings of the classification. Second, the attrition in this study was relatively complicated, which might cause that in some between-group comparisons, the tests were only marginally significant. Third, children's temperament was measured only by maternal reports. Apart from the "Do" context, the "Don't" context of children's compliance was not included in this study. A more comprehensive assessment of temperament and compliance in various contexts will generalize our findings.

Acknowledgements We thank the parents and children who participated in this study and the research staff who were responsible for conducting numerous assessments with these families.

Author Contributions S.D.: designed the study, analyzed the data, and wrote the paper. Z.W.: collaborated in the data analyzing and writing of the manuscript. S.L.: collaborated in the editing of the manuscript. X.L.: collaborated in the editing of the manuscript. X.X.: collaborated in the editing of the manuscript.

Funding This study was funded by the National Science Foundation of China (No. 31470994 and No. 31400894) and Beijing Social Science Fund (No. 15JYB016).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of Peking University First Hospital and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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