

Evidence for Childhood Origins of Conscientiousness: Testing a Developmental Path From Toddler Age to Adolescence

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We tested empirically a theoretical model of early origins of conscientiousness proposed by Eisenberg, Duckworth, Spinrad, and Valiente (2014). The model posited a developmental interplay between children's early effortful control (EC) and internalized or committed compliance with parents as leading to future conscientiousness. We followed a community sample of 102 community mothers, fathers, and children from toddlerhood to adolescence. Observers coded children's EC in batteries of behavioral tasks (at ages 2 and 3) and committed compliance in lengthy discipline interactions with each parent, observed from preschool to early school age (at ages 4.5, 5.5, and 6.5). Parents rated adolescents' conscientiousness using an established personality questionnaire (at age 14). We supported several components of the theoretical model. Mediation analyses, conducted at the family level (across mother-child and father-child dyads) and separate analyses for mother-child and father-child dyads all supported the mediated path, from child EC to committed compliance to conscientiousness. Analyses for mother-child dyads additionally revealed that the indirect effect was present only for children with relatively low EC scores but not those with relatively high EC scores (moderated mediation), also as anticipated in the theoretical model.

Keywords: conscientiousness, effortful control, compliance, longitudinal studies

Supplemental materials: <http://dx.doi.org/10.1037/dev0000608.supp>

Research interest in the trait of conscientiousness has skyrocketed over the last 15 years. The perusal of Web of Science, with “conscientiousness” entered as title, reveals a 10-fold increase in the number of citations (from 143 in 2002 to more than 1,400 in 2017). Conscientiousness has come to be broadly seen as a key personality factor, implicated in multiple facets of lifelong human capital, including health behaviors, externalizing psychopathology, sexual risk taking, positive aging, professional success, academic achievement, job performance, positive social relationships, rule-abiding conduct and good citizenship, and overall adaptive functioning (e.g., Bogg & Roberts, 2004; Hoyle, Fejfar, & Miller, 2000; Poropat, 2009; Roberts, Jackson, Fayard, Edmonds, & Meints, 2009).

Surprisingly, in the context of this flourishing field, an issue of etiology and developmental path to future conscientiousness is emerging as one that is most poorly understood and most understudied, and yet it is also one that is critical for research progress. Referring to the dearth of research on developmental antecedents of conscientiousness, Roberts, Lejuez, Krueger, Richards, and Hill (2014) characterized it as

... a glaring fact that needs further attention; very little is known about how someone arrives in adulthood possessing any form of conscientiousness. Well-informed longitudinal studies tracing the development of conscientiousness and its formative antecedents from childhood to adulthood would appear imperative. (p. 1325)

The studies that do exist have provided evidence of early developmental antecedents of conscientiousness and its course over time. Caspi (2000) reported important findings from the well-known Dunedin study of a large cohort of children who were followed from ages 3 to 21. Children who were classified as “undercontrolled” at age 3 on the basis of observers' ratings (i.e., impulsive, lacking persistence, inattentive) were rated as low on conscientiousness (e.g., not reliable or trustworthy) by people who knew them well. A similar early self-control composite continued to predict a remarkably broad range of functioning at age 31 (Moffitt et al., 2011).

The findings from the Dunedin study dovetail with much of the extant evidence on early origins of conscientiousness that comes from temperament research. That research has broadly focused on early self-regulation, most often labeled *inhibitory* or *effortful*

This article was published Online First November 1, 2018.

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This work was funded by Grants R01 MH63096 and K02 MH01446 from the National Institute of Mental Health and Grants R01 HD069171 and R01 HD091047 from the National Institute of Child Health and Human Development to Grazyna Kochanska and by the research fund of Hanyang University (HY-2018) to Sanghag Kim. We thank many students, staff, and colleagues, especially Lea Boldt, for their contributions to this research and all the participating parents and children for their commitment to this study over the years.

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control (EC). Researchers broadly agree with regard to robust links between early self-regulatory processes, including EC, and future conscientiousness and have articulated those claims in multiple comprehensive reviews. EC and conscientiousness share many key dimensions, including persistence, self-discipline, inhibitory control, deliberation, will power, delay of gratification, planfulness, impulse control, or grit, to name a few. The commonalities between EC and conscientiousness links have been framed in various terms. Some researchers have posed that EC and conscientiousness have a shared substrate or substrates (genetic, psychophysiological, neural). Others have proposed that EC is a developmental precursor, antecedent, or an early form of the adult trait, or a developmentally evolving temperament system out of which conscientiousness emerges. Yet others have proposed those are overlapping traits or a family of conscientiousness constructs (Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Caspi & Shiner, 2006; De Pauw & Mervielde, 2010; Eisenberg et al., 2014; Hoyle, 2006; Hoyle & Gallagher, 2015; Jensen-Campbell et al., 2002; Nigg, 2017; Roberts et al., 2014; Rothbart, 2011; Rothbart & Bates, 2006; Shiner & Caspi, 2012; Tackman, Srivastava, Pfeifer, & Dapretto, 2017).

Much less is known about the role of early relationships and parenting in the origins of conscientiousness. This is a striking gap, because some of its dimensions reflect the degree to which an individual has embraced and internalized socialization standards of the family and society. Consequently, the child's experiences in early relationships with socializing agents must play a critical role. Roberts, Jackson, Berger, and Trautwein (2009), when discussing the development of conscientiousness, stated that most of the extant evidence had come from studies of adults and that very little was known about its early origins and developmental paths in childhood. They reported three studies of college students, with all measures based on self-reports, that examined links between conscientiousness, assessed with several personality inventories, and retrospective measures of parenting and home environment. Higher conscientiousness was associated with the participants' recall of lower family conflict, more positive parenting and better communication with parents, and warm, loving, affectionate, and involved parental care. Drake, Belsky, and Fearon (2014) supported the path from early (ages 1 through 3) secure attachment to future conscientiousness (Grade 5), using a combination of observations and informant ratings, drawn from the large prospective National Institute of Child Health and Human Development Study of Early Child Care and Youth Development.

Developmental literature on early compliance in the context of the parent-child relationship has a particular potential to inform research on conscientiousness. Specifically, one form of compliance—internalized, committed compliance—reflects the child's genuine embrace of the parent's socialization standards, values, and goals and represents an early form of conscience, a construct closely related to conscientiousness. Earlier research (Kochanska & Aksan, 1995; Kochanska, Aksan, & Koenig, 1995; Kochanska, Tjebkes, & Forman, 1998) has amply documented that committed compliance, assessed in control encounters, represents the young child's enthusiastic, genuine, positive embrace of the parent's standards of conduct and socialization goals, and correlates with and predicts future internalization of parental values, assessed when no parental surveillance was present. It therefore appears that viewing committed compliance as an early developmental precursor,

or perhaps motivational antecedent of future conscientiousness is legitimate.

Although committed compliance emerges, in part, as a result of a close, secure, warm, and mutually positive parent-child relationship, early child temperament also contributes to its development in important ways (Braungart-Rieker, Garwood, & Stifter, 1997; Lickenbrock et al., 2013). EC in particular is an important contributor, as it underlies the child's ability to follow commands and requests, redirect and sustain attention, stay on task, and more generally, to suppress a predominant action tendency and perform instead the action desired by the parent (Spinrad et al., 2012). Consequently, a developmental path from early EC to committed compliance to conscientiousness trait in adolescence appears very consistent with developmental literature.

The awareness of the gap in knowledge with regard to early origins of conscientiousness and appreciation of the need for longitudinal research have clearly begun to come into focus on the developmental stage. A special section of *Developmental Psychology*, devoted to conscientiousness, reflects its ascending visibility in the study of human development. In that section, Eisenberg et al. (2014) presented a comprehensive, integrative conceptual review, informed by the extant empirical studies. They proposed a forward-looking agenda for the study of emerging conscientiousness, its antecedents, and temperament and socialization mechanisms and pathways leading to its development. In synthesizing the extant literatures, they proposed—but had not yet tested—specific developmental paths from early emerging regulation (EC) to committed compliance and academic motivation in childhood to conscientiousness in adolescence and adulthood.

This work addresses a straightforward goal: Drawing from the data from our long-term longitudinal study that followed children and parents from infancy to adolescence, we aim to provide an initial empirical test of that model. Figure 1 is an adaptation of Eisenberg and her colleagues' (2014) figure that depicted their model of the relations among children's early EC, their committed compliance to parents, and conscientiousness. The shaded sections of the model represent the components tested in the present article. Because our study was focused on social-emotional development, we did not have robust data on children's cognitive measures; consequently, we did not test the paths that involved academic motivation (see the unshaded section in the center of our Figure 1).

We did, however, have rich and robust measures of EC, observed in multiple behavioral tasks when children were 2 years old and again when they were 3; we also obtained behavioral measures of their compliance with parents, observed in lengthy discipline contexts that encompassed "do" and "don't" paradigms at 4.5, 5.5, and 6.5 years. As well, we collected parents' ratings of conscientiousness, using an established Big Five Inventory (i.e., the NEO Five-Factor Inventory-3 [NEO-FFI-3]; Costa & McCrae, 2010).

Consequently, we were able to test the moderated mediation model postulated by Eisenberg et al. (2014). Several originally anticipated paths (see Figure 1) were tested, as follows: (a) from toddler-age EC to conscientiousness in adolescence (Path 1); (b) from toddler-age EC to committed compliance in childhood, to conscientiousness in adolescence, with committed compliance modeled as the mediator of the EC-conscientiousness link (Paths 5 and 4); and (c) EC modeled additionally as a moderator of the link between committed compliance and conscientiousness (Path 7).

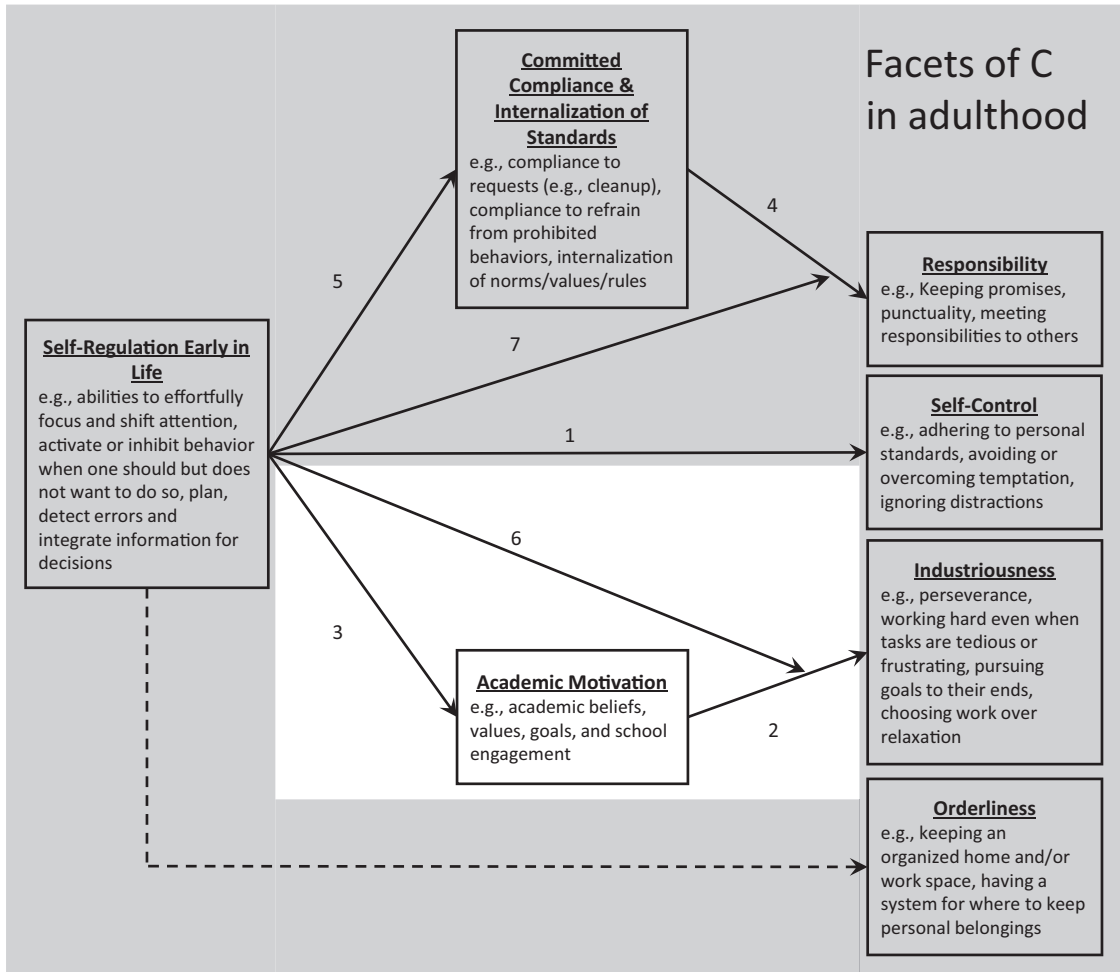


Figure 1. Conceptual model of relations among children’s early effortful control (EC), committed compliance in childhood, and conscientiousness in adulthood. The shaded area represents constructs (EC at ages 2 and 3, compliance at ages 4.5 through 6.5, and conscientiousness at age 14) and paths tested in the present study. The unshaded area represents constructs (academic motivation) and paths not measured and not tested in the present study. Adapted from “Conscientiousness: Origins in Childhood?” by N. Eisenberg, A. L. Duckworth, T. L. Spinrad, C. Valiente, 2014, *Developmental Psychology*, 50(5), p. 1333. Copyright 2014 by American Psychological Association. Adapted with permission.

Of note, Eisenberg et al. (2014) did not specify the expected form of the moderated mediation, or the interaction of EC and committed compliance (Path 7). To articulate our hypothesis, we drew from the rapidly growing literature on differential susceptibility and sensitivity to the environmental influences (Belsky & Pluess, 2009; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011). Consequently, we expected that for toddlers with relatively poor self-regulatory capacities, variation in socialization influences (as reflected in committed compliance) would be more consequential than for very highly self-regulated toddlers for whom the path to conscientiousness in adolescence may be more direct.

Notably, all measures were parallel for mother–child and father–child dyads. This addresses a dire gap in the literature. Eisenberg and colleagues (2014) commented on the pervasive lack of data on fathers’ contributions to children’s conscientiousness.

This is a common and continuing issue in developmental psychology, and scholars persuasively argue that future agenda should include efforts to gather data from mother- and father–child relationships (Cabrera, Volling, & Barr, 2018).

We approached the analyses of the path from child EC to committed compliance to conscientiousness at two levels. At the “family level,” we examined the child’s committed compliance using (highly intercorrelated) compliance scores averaged across mother–child and father–child dyads, and the child’s conscientiousness using (also highly intercorrelated) mothers’ and fathers’ reports. In this approach, committed compliance is conceived as the child’s generalized receptiveness to and embrace of the family’s socialization influence and conscientiousness as a dispositional trait, perceived by two informants. We followed up those analyses by testing two separate models of the proposed developmental path, for mother–child and for father–child dyads, using

committed compliance scores and conscientiousness scores unique to the given relationship.

Method

Participants

Participants were 102 two-parent, intact families of infants, who were born mostly in 2001; who lived in a Midwestern college town, a nearby small city, and surrounding rural areas; who volunteered for a longitudinal study in response to advertisements and fliers distributed in the community. A family was accepted if the parents were living together, with both willing to participate and speak English during sessions; the infant was a typically developing, biological child; and the family had no plans to move in the next 5 years. Education and income varied: 25% of mothers and 30% of fathers had no more than a high school education, 54% of mothers and 51% of fathers had an associate or college degree, and 21% of mothers and 20% of fathers had a postgraduate education. In terms of income, 8% of families made less than \$20,000 per year, 17% made between \$20,000 and \$40,000, 26% made between \$40,000 and \$60,000, and 49% made over \$60,000. In terms of ethnic background, 90% of mothers and 84% of fathers were White, 3% of mothers and 8% of fathers Hispanic, 2% of mothers and 3% of fathers African American, 1% of mothers and 3% of fathers Asian, 1% of mothers Pacific Islander, and 2% of mothers and fathers reported other. In 20% of families, at least one parent was not White.

Overview

We report data collected at 25 months, age 2 ($n = 100$, 50 girls), 38 months, age 3 ($n = 100$, 50 girls), 52 months, age 4.5 ($n = 99$, 49 girls), 67 months, age 5.5 ($n = 92$, 45 girls), 80 months, age 6.5 ($n = 90$, 43 girls), and 170 months, age 14 ($n = 73$, 34 girls). Additionally, one covariate, committed compliance, was collected at 15 months ($n = 101$, 51 girls). All assessments from ages 2 to 6.5 entailed observational mother-child and father-child sessions, which were 2 to 4 hr long, conducted by female experimenters, typically both within 2 to 3 weeks, and video recorded for future coding. They took place in a university laboratory (at 38 months, sessions were at home and in the laboratory). At age 14, we collected questionnaires from parents. There were no significant differences on any of the studied constructs between families that did and did not return. The University of Iowa Institutional Review Board approved the study (200107049, titled "Developmental Pathways to Antisocial Behavior: A Translational Research Program").

All behavioral data were coded from videos. Reliability was typically established on 15% to 20% of cases, followed by frequent realignments to prevent observer drift. We used kappas, weighted kappas, and alphas or intraclass correlations (ICCs; note that the best practices have evolved over the course of the study). Because many of the constructs have been published, descriptions are abbreviated and appropriate references provided.

Measures

Effortful control (EC), ages 2 and 3.

Observed tasks. Details of the tasks and coding are in prior articles and available on request (e.g., Jonas & Kochanska, 2018;

Kim & Kochanska, 2012; Kochanska, Murray, & Harlan, 2000; Kochanska, Philibert, & Barry, 2009). At age 2, the tasks included snack delay (the same task was administered in both sessions), waiting to unwrap a gift, waiting to retrieve a gift from a bag, and tower. Snack delay required waiting to reach for an M&M candy placed under a cup; each produced one score. Waiting to unwrap a gift produced two scores: behavior while the experimenter was wrapping it (gift wrap) and behavior while waiting for the experimenter to bring a bow (gift bow). Waiting to retrieve a gift from a bag (gift bag) produced one score. Tower required taking turns with the experimenter while building a tower from blocks; it produced one score.

At age 3, the tasks included snack delay (same as at age 2), waiting to unwrap a gift (gift wrap and gift bow, same as at age 2), tower (same as at age 2), dinky toys, turtle and rabbit, walk-a-line, day-night, snow-grass, and whisper. Dinky toys required deliberately choosing a prize from a box filled with small toys, and it produced one score. Turtle and rabbit and walk-a-line called for slowing down motor activity, and each produced one score. Day-night and snow-grass were effortful attention Stroop-like tasks (Carlson & Moses, 2001), with each producing one score. Whisper called for lowering voice and produced one score. Note that in some tasks, the one final score represented a composite of several (standardized) coded behaviors that cohered (e.g., peeking, staying in seat, touching/opening the gift, as well as latencies to peek, to open, to leave seat, and so forth). In some tasks, the final score was a result of aggregation across trials.

Coding and reliability. The codes were strongly behaviorally based and required little inference. Reliability was high. Across coding teams, at age 2, kappas ranged from .77 to 1.00 and alphas ranged from .88 to 1.00; at age 3, kappas ranged from .71 to 1.00 and alphas ranged from .81 to 1.00.

Data aggregation. All the scores were aggregated across the assessments at ages 2 and 3 (six scores at age 2, and 10 scores at age 3; 16 scores total) to produce the overall EC composite for ages 2 and 3. Cronbach's alpha was .74, indicating satisfactory coherence across tasks and ages. Girls' scores were higher than those of boys: girls ($M = .13$, $SD = .46$), boys ($M = -.15$, $SD = .50$), $t(98) = 2.97$, $p < .005$.

Committed compliance, ages 4.5, 5.5, and 6.5.

Observed contexts. At each age, the child was observed, with each parent, in two discipline contexts, "do" (toy cleanup) and "don't" (prohibition to touch attractive toys displayed in the laboratory, which were designated as off limits at the outset by the parent; these contexts included multiple interactions that took place in the room with easy access to the toys). The coded times were as follows, with each parent (toy cleanup first, prohibition next): age 4.5 (10 min, 65 min); age 5.5 (10 min, 60 min); age 6.5 (10 min, 60 min; total 215 min with each parent).

Coding, reliability, and data aggregation. The child's behavior was coded for every 30-s segment throughout the toy cleanups and for every 30-s segment during the episodes of control that revolved around the prohibition (an episode began when the child's attention shifted toward the toys and lasted until he or she reoriented; the onset and offset of the episodes were coded during an earlier pass). *Committed compliance* was defined as the instances when the child complied enthusiastically and appeared self-regulated and embracing the parent's agenda. In toy cleanups, those behaviors included eagerly picking up toys, spontaneously

moving from one pile of toys to the next, clapping hands. In prohibition contexts, the behaviors included looking at the toys without touching, shaking head, or articulating the prohibition.

Reliability of coding child behavior, kappas across multiple teams, were .77 to .88 for “do” and .73 for “don’t.” Reliability of identifying episodes in the prohibition contexts, alphas, were .83 to .94 and ICCs were .80 to .90 (more details about the coding are in Kochanska & Aksan, 1995; Kochanska, Aksan, & Koenig, 1995).

Data aggregation. At each age, and with each parent, the instances of the child’s committed compliance were tallied, divided by the number of coded segments, standardized, and aggregated across the “do” context, toy cleanup, and “don’t” context, prohibition, into the overall score of committed compliance. Then, those scores were each aggregated across ages 4.5, 5.5, and 6.5, into the final composites of committed compliance, with each parent, as well as across both parents and all ages, for the “family level” score ($M = -.00$, $SD = .58$). All composites had satisfactory coherence: Cronbach’s alphas were .74, .78, and .81, for mother–child dyads, father–child dyads, and family, respectively. Compared with boys, girls were more compliant with mothers: girls ($M = .17$, $SD = .51$), boys ($M = -.14$, $SD = .68$), $t(96) = 2.56$; with fathers: girls ($M = .15$, $SD = .50$), boys ($M = -.16$, $SD = .74$), $t(96) = 2.42$; and with both parents: girls ($M = .16$, $SD = .46$), boys ($M = -.16$, $SD = .65$), $t(97) = 2.76$ (all $ps < .025$).

Conscientiousness, age 14. Mothers and fathers described the adolescent by completing NEO-FFI-3 for adolescents (Costa & McCrae, 2010), rating each item on a scale ranging from 0

(*strongly disagree*) to 4 (*strongly agree*). We examined the 11-item Conscientiousness scale (Cronbach $\alpha_s = .94$ and $.93$ for mothers and fathers, respectively). Examples of items include the following: “Tries to perform all the tasks assigned to him/her conscientiously,” “Works hard to accomplish his/her goals,” and “Wastes a lot of time before settling down to work?” (reverse-coded). We also created an average score across parents ($M = 35.75$, $SD = 8.46$) to capture conscientiousness as a dispositional construct for the analyses at the family level.

Covariates

Demographic data obtained at entry to the study on children’s gender and family income (scored from 1, under \$10,000, to 8, over \$70,000), and committed compliance score, obtained when children were 15 months in the manner analogous to later measures (10 min “do” and 32 min “don’t”), were the covariates. Table 1 presents descriptive data for all constructs.

Results

Preliminary Analyses

We examined correlations among all the constructs. Those are presented in Table 2. As anticipated, and for both mother–child and father–child dyads, children’s EC at ages 2 and 3 was positively associated with their committed compliance to the parent

Table 1
Descriptive Data for All Measures

Age and measure	<i>M</i>	<i>SD</i>	Range	<i>n</i>	<i>M</i>	<i>SD</i>	Range	<i>n</i>
Measures of child effortful control								
Age 2								
Effortful control (EC) ^a	-.01	.66	-1.90–1.36	100				
Age 3								
EC ^b	-.01	.52	-1.35–1.30	100				
Ages 2 and 3								
Overall EC ^c	-.01	.50	-1.50–1.01	100				
Parallel measures for mother–child (M–C) and father–child (F–C) dyads								
Age 4.5								
Committed compliance (CC) do	.14	.17	.00–.95	98	.17	.20	.00–.89	98
CC don’t	.89	.16	.20–1.00	98	.93	.14	.30–1.00	98
Overall (do/don’t) ^d	.00	.75	-2.50–2.62	98	.00	.73	-2.68–2.00	98
Age 5.5								
CC do	.34	.26	.00–.95	90	.36	.26	.00–.93	88
CC don’t	.93	.16	.00–1.00	90	.94	.12	.40–1.00	88
Overall (do/ don’t) ^d	.00	.74	-2.91–1.28	90	.00	.78	-2.72–1.35	88
Age 6.5								
CC do	.34	.28	.00–1.00	87	.56	.28	.00–1.00	85
CC don’t	.94	.13	.21–1.00	87	.96	.10	.26–1.00	84
Overall (do/don’t) ^d	.00	.75	-3.35–1.41	87	.01	.79	-4.45–.98	85
Ages 4.5 through 6.5								
Overall CC ^d	.01	.62	-2.92–1.77	98	-.00	.64	-3.14–1.06	98
Age 14								
NEO–FFI–3, Conscientiousness subscale	35.79	9.26	8.00–50.00	70	35.65	8.69	14.00–51.00	65

Note. Family–level scores were also created for CC and conscientiousness by aggregating across mother–child and father–child scores. NEO–FFI–3 = NEO Five–Factor Inventory–3.

^a Composite of 6 standardized scores for all the tasks in EC battery. ^b Composite of 10 standardized scores for all the tasks in EC battery. ^c Composite of standardized 16 scores. ^d Composite of standardized constituent scores (“do”, toy cleanup; and “don’t”, prohibition).

Table 2
Correlations Among All Measures

Age and measure	1	2	3
1. Ages 2 and 3, effortful control	—	.45***	.31**
2. Ages 4.5 through 6.5, committed compliance	.38***	.71***	.19
3. Age 14, conscientiousness	.09	.20	.79***

Note. Correlations for mother–child dyads are above the diagonal; correlations for father–child dyads are below the diagonal; and correlations across the dyads are on the diagonal.

** $p < .01$. *** $p < .001$.

from age 4.5 to 6.5. EC was also positively associated with mother-rated child conscientiousness at age 14.

Main Analyses: Testing the Moderated Mediation Model

In the main analyses, we tested the proposed moderated mediation model (Eisenberg et al., 2014), first for the family level (with committed compliance and conscientiousness scores averaged across mother–child and father–child dyads) and then separately for mother–child and father–child dyads. To test the moderated mediation effect, we used the Mplus code provided by Stride, Gardner, Catley, and Thomas (2015). By converting the original syntax into the Mplus program (Muthén & Muthén, 2012), this method allows for the use of the full information maximum likelihood (FIML) missing data treatment within the framework of PROCESS (Hayes, 2013). We estimated the mediation effect by performing the nonparametric resampling method (bias-corrected bootstrap) with 10,000 resamples drawn to derive the 95% confidence intervals (CI) for the mediation effect. This bootstrap approach is particularly advantageous when the sample size is not large, because (a) the sampling distribution is not assumed to be normal, (b) no particular formula for the standard error is required, and (c) power is maximized while minimizing Type I error rate (MacKinnon, Lockwood, & Williams, 2004; Preacher, Rucker, & Hayes, 2007; Shrout & Bolger, 2002). To probe significant moderation effects, we conducted the follow-up analyses of simple slopes (Aiken & West, 1991).

Consistent with Figure 1, we modeled children’s EC at ages 2 and 3 as the predictor, their committed compliance at ages 4.5 through 6.5 as the mediator, and their conscientiousness at age 14 as the outcome variable. Additionally, children’s EC was modeled as a moderator of the link between their committed compliance and conscientiousness. Child gender, family income, and child committed compliance at 15 months served as the covariates.¹

We tested three models. First, we examined the studied relations at the family level, averaging committed compliance scores across the child’s behavior with both parents (note those were highly correlated). In this model, the child’s conscientiousness scores were also averaged across both parents’ ratings. The findings are presented in Figure 2. Second, we examined separate models for mother–child and father–child dyads, using the child’s committed compliance score with the given parent and that parent’s rating of the child’s conscientiousness (see Figure 3A [mother–child dyads] and Figure 3B [father–child dyads]).

In the family-level analyses (see Figure 2), children’s EC at ages 2 and 3 was associated with greater committed compliance to

parental influence; an increase in committed compliance, in turn, was associated with an increase in child conscientiousness at age 14, as rated by both parents. The moderation effect of children’s EC on the link between committed compliance and conscientiousness was not significant. The indirect effect from EC to committed compliance to conscientiousness, without considering the nonsignificant moderation path, was present ($B = .20$, $SE = .11$; bias-corrected bootstrap 95% CI [.04, .51]). Children’s EC did not have a significant direct effect on their conscientiousness. Figure 3 represents the results for models for children and mothers (see Figure 3 A) and children and fathers (see Figure 3 B), in which committed compliance to the given parent was the mediator and the parent-rated conscientiousness was the outcome.

In mother–child dyads, children’s higher EC at ages 2 and 3 was associated with greater committed compliance and an increase in committed compliance, with an increase in mother-rated child conscientiousness at age 14. Further, the moderation effect of children’s EC on the link between committed compliance and conscientiousness was significant. This is graphed in Figure 4. This pattern of results suggests that the indirect effect from EC to committed compliance to conscientiousness varied depending on the level of the child’s EC. When the EC score was low ($-1 SD$) or average ($0 SD$), the indirect effect was present ($B = .27$, $SE = .13$, bias-corrected bootstrap 95% CI [.07, .57] and $B = .17$, $SE = .09$, 95% CI [.03, .42], respectively). By contrast, when the EC score was high ($+1 SD$), the indirect effect was not present ($B = .07$, $SE = .10$, 95% CI [−.07, .33]). In other words, the variation in children’s committed compliance to mothers at ages 4.5 through 6.5 was associated with mother-rated child conscientiousness at age 14 for children who had relatively low EC at ages 2 and 3 but not for those who had high EC at ages 2 and 3. Children’s EC did not have a significant direct effect on their mother-rated conscientiousness.

In father–child dyads (see Figure 3 B), children’s EC at ages 2 and 3 was associated with greater committed compliance. An increase in committed compliance, in turn, was related to an increase in father-rated child conscientiousness at age 14, although that path was marginally significant. The moderation effect of children’s EC on the link between committed compliance and conscientiousness was not significant. The indirect effect from EC to committed compliance to conscientiousness, without considering the nonsignificant moderation path, was present ($B = .14$, $SE = .10$; bias-corrected bootstrap 95% CI [.001, .436]). Note that the bootstrap approach can reveal the presence of an indirect effect even if the path from the mediator to outcome is marginal, as in this case. This is particularly true for smaller samples, which is why it is a recommended approach (Bollen & Stine, 1990). Children’s EC did not have a significant direct effect on their father-rated conscientiousness.

Discussion

The aim of this work was straightforward: To test the model of development of conscientiousness proposed by Eisenberg and colleagues (Eisenberg et al., 2014), drawing from our data from a

¹ We also conducted all analyses, controlling additionally for EC assessed at age 5.5 (see Figures 1S, 2AS, and 2BS in the online supplemental material). The findings were essentially unchanged.

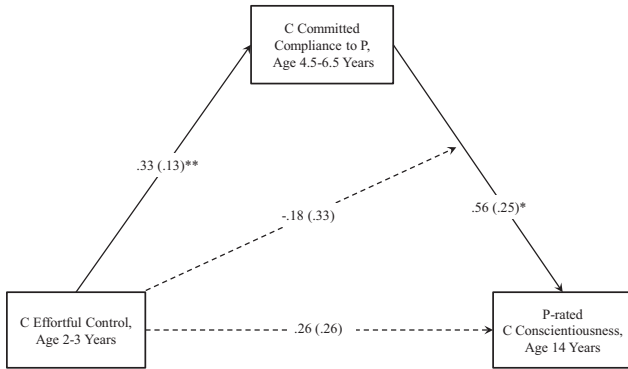


Figure 2. The moderated mediation model of the path from the predictor, the child's effortful control (EC) at ages 2 and 3 to the mediator, committed compliance to the parents at ages 4.5 to 6.5, to the outcome, and conscientiousness at age 14. EC is additionally modeled as a moderator of the path from committed compliance to conscientiousness. Although not depicted, the child's gender and family income are included as covariates for both of the mediator and the outcome. Committed compliance to the parents at 15 months is also included as a covariate for the mediator. Solid lines represent significant effects, and dashed lines represent nonsignificant effects. Reported are unstandardized coefficients and standard errors (in parentheses). P = parents; C = child. * $p < .05$. ** $p < .01$.

long-term longitudinal study. Eisenberg and colleagues (2014) framed their title regarding childhood origins of conscientiousness as a question. Given our findings, the answer to this question appears to be "yes." They also proposed a developmental path to future conscientiousness. Again, our findings suggest that this postulated path is empirically accurate.

The path to conscientiousness, proposed by Eisenberg et al. (2014), integrated two sets of key developmental influences: A temperamentally based system, EC, and child committed compliance, an important aspect of the parent-child socialization that reflects the child's embrace of parental standards. Committed compliance was modeled as a mediator of the link between EC and conscientiousness in adolescence (Paths 4 and 5 in Eisenberg et al., 2014).

Our approach to the analyses encompassed modeling this path at two levels. At a family level, we examined the path leading from early EC to the composite of the child's committed compliance to both parents to conscientiousness assessed as a dispositional trait, rated by both parents. In this approach, the child's committed compliance from ages 4.5 to 6.5 is viewed as a generalized receptiveness to parental influence and readiness to embrace the family's standards of conduct (indeed, committed compliance was remarkably coherent across parents and ages). Of note, internalization of rules and values is a salient developmental issue at preschool and early school ages (Sroufe, 2016). We followed with the analyses that modeled the path for each parent-child dyad: From early EC to child committed compliance with the given parent to conscientiousness rated by the same parent.

All models—for the family level and for mother-child and father-child dyads—produced support for that path. Children's EC assessed at toddler age had an indirect effect on conscientiousness, mediated by the child's committed compliance. Of note, for mother-child dyads, the results further revealed an additional

moderation effect (also proposed, but not extensively articulated, by Eisenberg et al., 2014, as Path 7), such that the path was present for children with relatively poorer ($-1 SD$ and $0 SD$) early EC skills. This finding is consistent with the broadly accepted perspectives that emphasize generally a greater importance of socialization factors for children with more difficult temperament characteristics, including low EC (Belsky & Pluess, 2009; Ellis et al., 2011; Kochanska & Kim, 2013). It appears that for children with relatively lower EC skills, an embrace of the mother's standards of conduct provided an important motivational mechanism promoting their progress toward conscientiousness.

Although our results seem relatively straightforward, a developmentally advanced and more complete understanding of the mediated path—from EC to committed compliance to conscientiousness—is a complex task, yet to be accomplished. In particular, the emerging committed compliance almost certainly reflects the contribution of the child's biologically based temperament and those of the parent-child relationship. In terms of temperament,

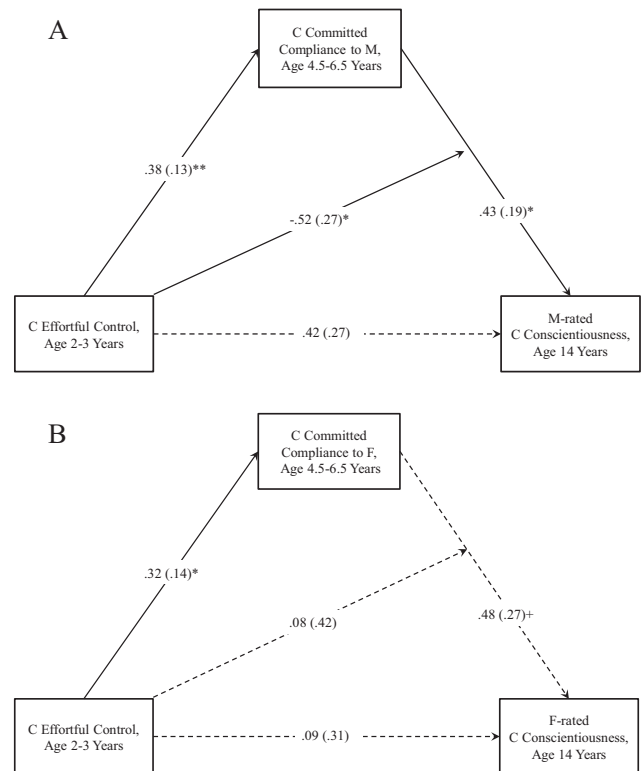


Figure 3. The moderated mediation model of the path from the predictor, the child's effortful control (EC) at ages 2 and 3 to the mediator, committed compliance to the parent at age 4.5 through 6.5, to the outcome, and conscientiousness at age 14. EC is additionally modeled as a moderator of the path from committed compliance to conscientiousness. Although not depicted, the child's gender and family income are included as covariates for both of the mediator and the outcome. Committed compliance to the parent at 15 months is also included as a covariate for the mediator. Solid lines represent significant effects and dashed lines represent nonsignificant effects. Reported are unstandardized coefficients and standard errors (in parentheses). Panel A: mother-child relationship. Panel B: father-child relationship. M = mother; F = father; C = child. + $p < .10$. * $p \leq .05$. ** $p < .01$.

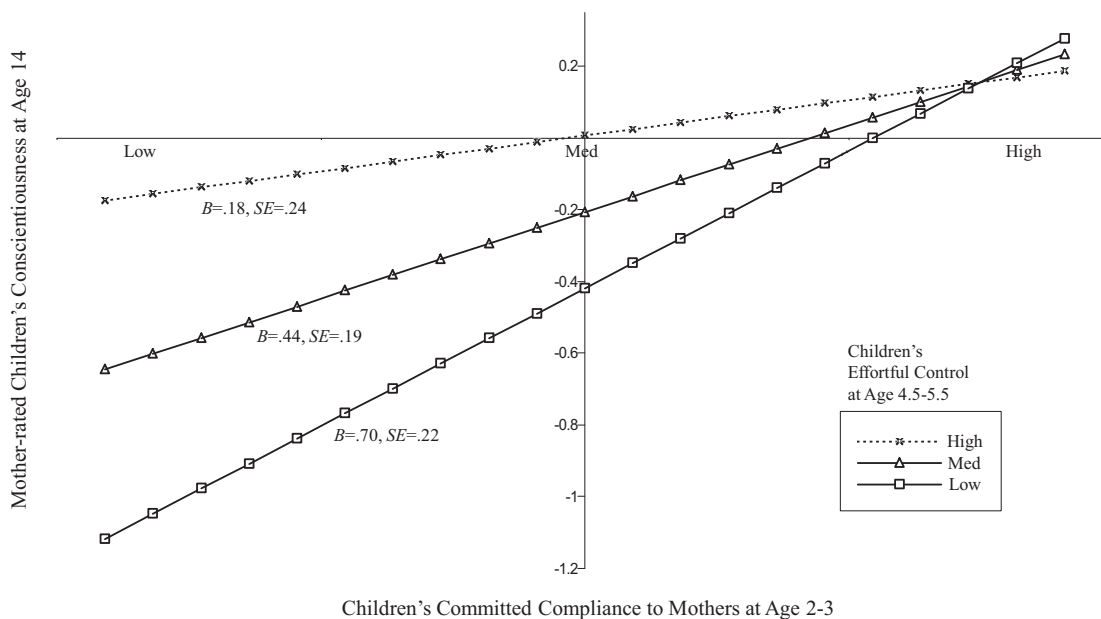


Figure 4. The child's effortful control (EC) at ages 2 and 3 moderates the effect of committed compliance with the mother at ages 4.5 through 6.5 on conscientiousness at age 14. The child's gender and family income are covaried. Solid lines represent significant simple slopes, and the dashed line represents a nonsignificant simple slope.

EC, the characteristic studied here, clearly undergirds the child's ability to follow commands and requests, and to sustain or redirect attention in service of suppressing a predominant action tendency and performing instead the action desired by the parent. A reasonably large literature on children's compliance and emerging self-regulation has emphasized this contribution; in fact, EC and committed compliance share many common definitional features (Spinrad et al., 2012). Indeed, in all our models, the path from EC to committed compliance was significant.

But the qualities of the specific parent-child relationship certainly matter as well, as compliance evolves as part of a "mutually responsive orientation" between the parent and the child. That process has been extensively studied. To complicate things further, EC itself is influenced by the parent-child relationship (Bernier, Carlson, Deschenes, & Matte-Gagne, 2012; Kochanska & Knaack, 2003; Pallini et al., 2018). A more complete developmental understanding of the exquisite interplay of temperament and parent-child relationships in emerging compliance, internalization, and conscientiousness is a compelling task for future long-term longitudinal studies.

Somewhat surprisingly, we did not find a significant direct path from EC to either mother- or father-rated conscientiousness. This is in contrast with the fact that mother-rated conscientiousness significantly correlated with EC (see Table 2). We can think of two possible reasons. One, we reasoned that the direct effect of EC on conscientiousness in the mother-child model would be present if the paths associated with committed compliance were not considered at the same time. In fact, a simple regression without committed compliance, covarying child gender and family income, revealed an effect of EC on mother-rated conscientiousness ($B = .66$, $SE = .24$, $p < .01$). Two, in this study, we used relatively

broad-band measures of EC and conscientiousness. A more nuanced approach to both constructs may reveal more specific direct effects. For example, a subset of EC tasks that capture "hot EC" may directly predict the self-regulatory component of conscientiousness, whereas "cool EC" may predict the orderliness component. Eisenberg et al. (2014) did, in fact, point out that the relations between EC and conscientiousness reported in the literature often depend on the specific component of conscientiousness considered in a given study.

In addition to providing support for several key elements of Eisenberg et al. (2014) model, this work complements and expands that model in several ways. Most importantly, we examine all the processes in mother-child and father-child relationships. Given the growing engagement of fathers in young children's lives in contemporary society, the need to collect parallel data for both parents has been increasingly stressed (Cabrera et al., 2018). Consequently, having parallel data is certainly useful. The dearth of knowledge about commonalities and differences in socialization process in the two relationships, however, makes the interpretation of findings a challenge. Our findings reveal both similar and distinct processes.

The key postulated path from EC to committed compliance to conscientiousness was present in both relationships. The one difference between the two relationships pertained to the moderation effect: That effect was found only in mother-child relationships. For children with average or relatively lower EC skills, committed compliance with mothers was particularly important as a mechanism promoting conscientiousness. For children with the highest EC skills, compliance was not as critically important as a mechanism leading to conscientiousness—perhaps, their high self-regulation was sufficient for conscientiousness to develop. It is

unclear why we did not find a parallel effect for father–child relationships, although we note that we had occasionally obtained similar findings before, indicating interactions of temperament and socialization for mothers and children only (Kim & Kochanska, 2012). Perhaps mothers are more perceptive than fathers with regard to their children’s early temperament characteristics, and more likely to recognize that more difficult children might particularly benefit from a close, warm relationship (Leerkes, Parade, & Burney, 2010).

Although we believe the current findings make a useful contribution to the field, we also acknowledge that the model is incomplete. In particular, future exploration of qualities of early parent–child relationships, including attachment security in infancy and toddler age, in the context of origins of conscientiousness will be critical. Early security has been shown to have subtle, often indirect, but powerful effects on future committed compliance and internalization, and other personality qualities encompassed by conscientiousness (Drake et al., 2014; Kochanska, Kim, & Boldt, 2015; Kochanska et al., 2010).

This research has limitations that are a source of caution. A small sample size at age 14 is the most obvious one. Note that at the point of recruitment, the parents agreed to remain in the study for the first 5-year funding period (from infancy to preschool age). Although many remained committed through the next two funding periods until adolescence, inevitably, some families moved out of the area and became unavailable. We used a robust missing data treatment to address this issue; however, a replication with another large sample will be imperative, as this will allow for testing paths for the mother–child and father–child dyads in one model and deploying a full auto-regressive design. Such models may well reveal complexities that are only seen when dynamics of the entire family system are considered. As well, those community families were largely well functioning and children were typically developing and generally compliant and well socialized. Nevertheless, our key constructs—children’s EC, compliance, and conscientiousness—were normally distributed. However, given the shared etiology for externalizing problems and low conscientiousness (Roberts et al., 2009), studies that include children with elevated regulatory problems and antisocial behavioral patterns will be particularly informative.

Further, although our sample included a range of parental education and income, and 20% of our families included a non-White parent, nevertheless, the ethnic diversity was relatively limited. Ethnic and cultural differences in children’s temperament and social development, including the interplay among EC, parenting, compliance, and personality have been often documented (Rubin, 1998; Chen, Yang, & Fu, 2012; Wang, Hartl, Laursen, Booth-LaForce, & Rubin, 2016). Understanding developmental paths to conscientiousness in culturally and ethnically diverse samples is an important objective for future research. Despite those limitations, given the significant implications of conscientiousness for lives of individuals and for the society, we believe that the current work makes a useful contribution to the rapidly emerging research on origins of this key trait.

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Received February 14, 2018

Revision received July 2, 2018

Accepted July 18, 2018 ■

Correction to Kim and Kochanska (2019)

In the article “Evidence for Childhood Origins of Conscientiousness: Testing a Developmental Path From Toddler Age to Adolescence,” by Sanghag Kim and Grazyna Kochanska (*Developmental Psychology*, 2019, Vol. 55, No. 1 pp. 196–206. <http://dx.doi.org/10.1037/dev0000608>), due to a minor syntax error, the descriptive data for the 12-item child Conscientiousness variables (each item rated 0–4) were reported incorrectly. The correct values are as follows: Mother-rated scores, $M = 30.41$, $SD = 10.09$, range 0–46; father-rated scores, $M = 30.42$, $SD = 9.43$, range 7–47 (Table 1, p. 200); family-level (average across parents) scores, $M = 30.45$, $SD = 9.16$, range 7–46 (text, p. 200). In the analyses conducted with the corrected variables, all the findings reported in the article and in the supplemental materials were unchanged.

<http://dx.doi.org/10.1037/dev0000816>