



Published in final edited form as:

Dev Psychol. 2014 May ; 50(5): 1331–1349. doi:10.1037/a0030977.

Conscientiousness: Origins in Childhood?

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Abstract

In this review, we evaluate developmental and personality research with the aim of determining if the personality trait of conscientiousness can be identified in children and adolescents. After concluding that conscientiousness does emerge in childhood, we discuss the developmental origins of conscientiousness with a specific focus on self-regulation, academic motivation, and internalized compliance/internalization of standards. Based on the accumulated body of evidence, we conclude that self-regulation fosters conscientiousness later in life, both directly and via academic motivation and internalized compliance with norms. We argue that elements of conscientiousness are evident by early childhood, self-regulation skills are likely a core developmental component of conscientiousness, and despite the contribution of heredity to the aforementioned aspects of functioning, environmental factors likely contribute to conscientiousness.

Conscientiousness, one of five domains in the Big Five taxonomy of personality, has been defined as “the tendency to be organized, responsible, and hardworking” (American Psychological Association, 2007, p. 218) and as “the propensity to follow socially prescribed norms for impulse control, to be goal directed, to plan, and to be able to delay gratification and to follow norms and rules” (Roberts, Jackson, Fayard, Edmonds, & Meints, 2009, p. 369). Although definitions of conscientiousness tend to be similar, there remains disagreement regarding the hierarchical organization of its component traits. Several unique factor structures for conscientiousness have been published. Commonalities across factor structures point to features of conscientiousness that are prototypic of the domain; four facets have reliably (though not universally) been identified in prior empirical work (see Table 1). The facet of *self-control* refers to the regulation of attentional, emotional, and behavioral impulses in the service of valued goals and standards. The facet of *industriousness* describes the tendency to work hard to achieve goals and to be purposeful

and diligent. The facet of *responsibility* refers to reliably fulfilling duties and obligations toward other people. The facet of *orderliness* describes the tendency to be neat and tidy, to keep personal belongings organized, and to take a methodical approach to work tasks. In addition to these reliably extracted facets, two published studies have identified the facets of *traditionalism/conventionality* and *decisiveness/consistency* (see Table 1).

The major goal of this paper is to consider theory and research relevant to the developmental origins of conscientiousness as manifest by late adolescence and in adulthood. We focus primarily on three domains of functioning in childhood—self-regulation, academic motivation, and committed compliance and internalization of standards of behavior—that we believe are relevant to the development of full-blown conscientiousness. As is depicted in Figure 1 (Path 1), we argue that self-regulatory processes have a direct effect on the self-control component of conscientiousness and also affect children’s committed compliance/internalization of norms/standards (henceforth often labeled committed compliance/internalization for brevity) and academic motivation. We further suggest that compliance/internalization of norms/standards has a direct effect on the responsibility facet (Path 2), and that academic motivation has a direct relation to the industriousness facet (Path 4), of conscientiousness. In addition, we discuss the possibility that self-regulation interacts with both academic motivation and compliance/internalization to predict facets of adult conscientiousness (Paths 6 and 7). This framework organizes much of our review.

Prior to discussing research relevant to the figure, we consider if investigators have identified the trait of conscientiousness in children and if it is similar to what has been found in studies of adults. Next, we review literature related to the development and origins of three facets of conscientiousness in adulthood: self-control, industriousness, and responsibility. We summarize work on their development in childhood and relations to functioning in adolescence and adulthood (if evidence exists); then we provide an overview of findings on the origins of these three aspects of functioning. In the section on origins, we acknowledge that much of the work is essentially correlational, not genetically-informed, and does not prove a causal role of the environment. We also briefly mention work with a behavioral or molecular genetics focus because of evidence that conscientiousness has a hereditary basis (Jang, Livesley, & Vernon, 1996; Luciano, Wainwright, Wright, & Martin, 2006). We do not examine orderliness in any depth given the relative lack of relevant developmental work on this topic. Throughout we suggest that individual differences in effortful regulatory processes contribute broadly to the trait of conscientiousness, in part through their effects on industriousness and compliance/internalization with norms (see Figure 1).

Is there a Trait of Conscientiousness in Children?

A set of characteristics similar to those encompassed by conscientiousness in adulthood also has been identified in children. In some studies, investigators have factor analyzed preselected sets of descriptors of children in a manner similar to most studies of the Big Five in adult samples. For example, John, Caspi, Robins, Moffitt, and Stouthamer-Loeber (1994) asked mothers to sort a set of descriptors to describe their 12- to 13-year-old sons’ personality and found support for the existence of the Big Five personality traits, including

conscientiousness (“He finds ways to make things happen and get things done”, “He is determined in what he does; he does not give up easily,” “He has high standards for himself. He needs to do very well in the things he does”). Consistent with theoretical expectations, conscientiousness was negatively related to delinquency and internalizing and externalizing symptoms, and positively related to high school performance across subject areas. Abe and Izard (1999) used John et al.’s (1994) conscientious items and found that mothers’ reliable ratings of 3.5 year olds’ conscientiousness were related to ego undercontrol (e.g., insufficient modulation of impulses, the inability to delay gratification, immediate and direct expression of motivations and affects, and vulnerability to environmental distractors; Block & Block, 1980). In other work, teachers’ ratings of children’s personality also produced a conscientiousness factor (see Kohnstamm, Zhang, Slotboom, & Elphick, 1998).

Support for the construct of conscientiousness also has been found in research in Europe. Lamb, Chuang Wessels, Broberg, and Hwang (2002) essentially replicated the factors found by John et al. (1994) in a sample of Swedish children 2 to 15 years of age, and conscientiousness was positively related to academic performance and to teachers’, but not mothers’, reports of adaptation to the school context. In the Netherlands, van Lieshout and Haselager (1994) also obtained a conscientiousness factor similar to that obtained by John et al. (1994), although it included intellectual capacity and curiosity/exploring; moreover, reports from parents, teachers, and early adolescents were interrelated (friends’ reports of early adolescents were somewhat less consistently related to others’ reports). Mervielde, Buyst, and De Fruyt (1995) asked teachers to rate 4- to 12-year-olds’ characteristics using bi-polar scales for descriptors of the Big Five dimensions (e.g., lazy vs. industrious) and obtained a factor for conscientiousness; however, at some ages, markers of conscientiousness loaded with items tapping intelligence or openness to experience (e.g., creativity).

The trait of conscientiousness in children also has been identified using parents’ descriptions of their children when asked to freely describe their children (rather than responding to predetermined items/scales). Kohnstamm et al. (1998) reported finding a factor for conscientiousness (carefulness, faithfulness, diligence) in several countries, with conscientiousness being mentioned more in China than in the U.S. or European countries. Across the countries, parental mention of conscientiousness or the lack thereof increased from 3 to 6 years as children entered formal schooling, and continued to increase until age 9, and then leveled off between 9 and 12 years of age (Slotboom, Havill, Pavlopoulos, & de Fruyt, 1994). Using a scale partially constructed from these parents’ descriptors of child personality, Halverson et al. (2003) obtained clear relations of components of parent-described conscientiousness (including academic motivation, low distractibility, and organization) with low levels of parent-reported problem behaviors and several aspects of temperament, including positive affectivity, high effortful attentional focusing and high inhibitory control, and low impulsivity, as well as the children’s self-reports of conscientiousness in adulthood. Furthermore, Measelle, John, Ablow, Cowan, and Cowan (2005) found that 5- to 7-year olds’ reports of characteristics of conscientiousness were significantly correlated across one and two years and were related to adults’ reports of behaviors that are generally part of conscientiousness (children’s mastery motivation and low distractibility).

Thus, in general, the construct of conscientiousness emerges from adults' ratings and descriptions of children's characteristics, as well as from children's reports. In addition, in factor analyses of ratings of children's temperament, a factor including task persistence, attentiveness, and/or behavioral control has often been obtained (Martin, Wisenbaker, & Huttunen, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001). Therefore, there is little question that characteristics typically viewed as part of the construct of conscientiousness are evident in children. Moreover, adults' reports of children's conscientiousness appear to be at least somewhat valid because they predict not only quality of children's functioning in childhood, but also mortality and other health outcomes in adulthood (e.g., Friedman et al., 1993; Hampson, Goldberg, Vogt, & Dubanoski, 2007; see Kern, Hampson, Goldberg, & Friedman, this issue).

Children's Self-regulation: The Construct and Its Conceptual Links to Later Conscientiousness

Investigators frequently have suggested that conscientiousness has a strong basis in temperamentally based self-regulation (see Figure 1). Given its primacy in our model, we consider the construct of self-regulation first.

Temperament often is viewed as "constitutionally based individual differences in reactivity and self-regulation, in the domains of affect, activity, and attention" (Rothbart & Bates, 2006, p. 100). It generally is seen as having a biological and genetic basis, although temperament is believed also to be influenced by experience. Rothbart and Bates (2006) argued that temperament is the "affective, activational and attentional core of personality, whereas personality includes much more than temperament, particularly the content of thoughts, skills, habits, values, defenses, morals, beliefs, and social cognition" (p.100). Similarly, Caspi and Shiner (2006, p. 363) argued that personality traits likely reflect "a wider range of individual differences in feeling, thinking, and behaving" than temperament—for example, a cognitive self-concept, values that are learned, goals, coping styles, and motives.

According to Rothbart (e.g., Rothbart & Bates, 2006), the two major components of temperament are self-regulation and reactivity. Self-regulation refers to "processes such as effortful control and orienting that function to modulate reactivity" whereas reactivity refers to "responsiveness to change in the external and internal environment" (p.100), including emotional responses and physiological reactivity. The self-regulatory part of temperament has been labeled as *effortful control*, defined as "the efficiency of executive attention--including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors" (Rothbart & Bates, 2006, p. 129). As well as planning and the integration of information, effortful control includes the following: (a) attention focusing (the tendency to maintain an attentional focus upon task-related channels), (b) attention shifting (the capacity to intentionally shift attentional focus to desired channels, thereby avoiding unintentional focusing on particular channels), (c) inhibitory control (i.e., the capacity to suppress positively toned impulses and resist the execution of inappropriate approach tendencies), and (d) activation control (i.e., the capacity to perform an action when there is a strong tendency to avoid; see Evans & Rothbart, 2007;

Rothbart, Ahadi, & Hershey, 1994). Effortful control appears to be grounded in components of executive functioning, especially executive attention, and, neurologically, is believed to be centered in the anterior cingulate gyrus with involvement of the prefrontal areas (Posner, Rothbart, & Sheese, 2007; Rothbart & Bates, 2006). Executive functioning skills may be seen as tools for implementing self-regulation of attention, emotion, and behavior, which also may include motivational elements (e.g., the desire to restrain oneself or initiate a dreaded activity).

A number of personality theorists and developmental scientists have hypothesized specific links between temperament and the development of conscientiousness. Ahadi and Rothbart (1994) suggested that early self-control is virtually synonymous with elements of conscientiousness such as persistence, being organized, and self-discipline, and that one's ability to control attention facilitates internalization of societal values. Caspi (1998) hypothesized that temperamental persistence (i.e., attention span, low distractibility, interest) is linked to the adult personality of conscientiousness. Caspi and Shiner (2006) further suggested that the lower-order traits of attention and self-control contribute to conscientiousness. Similarly, Hagekull (1994) hypothesized that infant manageability (e.g., persistence, low irritability and negative emotionality, the ability to adapt) predicts low impulsivity in childhood, which in turn predicts conscientiousness.

Some aspects of conscientiousness (e.g., self-control, industriousness, responsibility) more clearly overlap with early emerging aspects of temperament than others (e.g., orderliness). Most temperament scales have factors assessing attention span, distractibility, and/or task persistence (especially after infancy) whereas components of conscientiousness such as orderliness generally are not found or reported (see Martin et al., 1994; Rothbart & Bates, 2006). Nonetheless, in a study in which mothers reported on 3- to 12-year-olds' temperament and also described their children's personalities, dimensions of temperamental effortful control (inhibitory control, attention focusing, and distractibility/attention shifting) and mothers' descriptions of children's personality-based order, diligence, and self-discipline grouped together in an exploratory factor analyses of numerous dimensions of personality and temperament (work by Victor et al. reported in Rothbart, 2011). Similarly, DePauw and Mervielde (2009) found that parents' reports of children's conscientiousness, including orderliness, loaded on the same factor with temperamental attention focusing and persistence (but not inhibitory control). These findings are consistent with the notion that temperamental self-regulation may contribute to orderliness, as well as industriousness and self-control (although causal relations could not be determined).

The Development of Self-Regulation in Childhood

Precursors of effortful control emerge in infancy. Even in the first year of life children begin to modulate their attention and actions (see Eisenberg, Spinrad, & Eggum, 2010, for a review). By the second year of life, children often have some ability to control the speed of their motor behavior (Kochanska, Murray, & Harlan, 2000). The development of effortful control is typically rapid in the third year of life, and children are fairly skilled in their efforts to manage their attention and inhibit behavior by five years of age (e.g., Carlson, 2005; Li-Grining, 2007). However, the skills involved in effortful control and self-regulation

continue to develop across childhood, with substantial development occurring in adolescence (Albert & Steinberg, 2011; Lengua, 2006; Leon-Carrion, Garcia-Orza, & Pérez-Santamaría, 2004).

If the self-regulatory capacities we see early in life are relevant to later conscientiousness, we would expect to see some stability in self-regulation across development. In fact, individual differences in effortful control exhibit considerable inter-individual consistency across time. For example, observers' ratings of infants' attention have shown stability across infancy and the early toddler years (e.g., Heinicke, Diskin, Ramsey-Klee, & Oates, 1986; Lawson & Ruff, 2004), as have parents' ratings of their children's attentional focusing across 6-, 12-, and 18-month spans during toddlerhood (Putnam, Gartstein, & Rothbart, 2006).

Inter-individual stability also has been found after infancy. For example, Gaertner, Spinrad, Eisenberg, and Greving (2007) found modest to substantial stability for adult-reported and behavioral measures of attention between 18 and 30 months of age. Putnam, Rothbart, and Gartstein (2008) reported stability in mothers' reports of orienting/regulatory capacity in the first year of life to age 1–2 years, as well as in reported effortful control from age 1–2 to age 2–4 years (but not from infancy to age 3–4). Similarly, Kochanska and Knaack (2003) found considerable and increasing stability in a behavioral battery of effortful control from 22 to 45 months; effortful control was highly stable from 33 to 45 months ($r = .80$) and highly coherent in terms of interrelations of measures comprising the composite index (also see Li-Grining, 2007). Spinrad and Eisenberg (e.g., Spinrad et al., 2007, 2012) reported stability of parent- and caregiver-rated effortful control, combined with a behavioral measure, over one to two years of time between 18 and 54 months of age. In multiple samples, individual differences in parent- and/or teacher-reported effortful control have been found to be stable across the late preschool to mid-elementary school years and from elementary school into early adolescence (e.g., Eisenberg et al., 2005, 2008; Murphy et al., 1999; Valiente et al., 2006; Vazsonyi & Huang, 2010).

There is also evidence that earlier age-appropriate measures of self-regulation relate to other, somewhat different measures of regulation later in childhood. Some of the indices of self-regulation at older ages in these studies are a good match for characteristics typically used to classify individuals as conscientious. In regard to the early years, it appears that duration of attentional orienting and manageability in infancy relate to indices of self-regulation in the toddler and preschool years. For example, Kochanska et al. (2000) found that focused attention at 9 months predicted future effortful control, assessed with diverse behavioral indices, at 22 months (but not 33 months), and effortful control at 22 months predicted more restraint when a child was expected not to touch a toy at 33 months. Friedman, Miyake, Robinson, and Hewitt (2011) found that self-restraint when told not to touch an attractive toy across 14 to 36 months of age predicted executive functioning 14 years later. Moreover, Feldman (2009) found that neonatal physiological regulation (sleep-wake cyclicality and especially vagal tone) at 8–9 months of age predicted observed emotion regulation in stressful contexts at 3, 6, and 12 months, which in turn predicted observed focused attention and the ability to delay responding on a challenging cognitive tasks in the second year of life. These capacities in the second year then predicted observed executive functioning skills

(the ability to inhibit impulsive responding, selectively attend to auditory and visual information, and to plan, adapt, and maintain and change set; behavioral regulation; and self-restraint in terms of opening an attractive gift in a package) at age 5. Correlations across time also were found for most of these measures.

Finally, measures of self-regulation in early childhood that sometimes also include impulsivity and management of negative emotionality (De Pauw & Mervielde, 2011) have been associated with outcomes in later childhood indicative of self-regulation, such as low aggression and externalizing problems (Caspi, 1998; see Eisenberg et al., 2010, for other studies of the relation of self-regulation to problem behaviors). Of particular note, some of this research involved longitudinal data with panel models, thus controlling for prior levels of regulation and the outcome behaviors when predicting across time—a methodological approach that is a step closer to ascertaining causality than in most research (e.g., Belsky, Fearon, & Bell, 2007; Eisenberg et al., 2004; Spinrad et al., 2007; Valiente et al., 2006; see Lengua, 2006, for findings using the growth curve of self-regulation). Thus, these findings are consistent with the view that there is some continuity in self-regulated behavior across development.

Empirical Relations of Self-regulation to Later Conscientiousness

Similarly, measures including self-regulatory components of functioning in childhood tend to predict conscientiousness as well as other measures of self-regulation in adulthood. In regard to conscientiousness, Deal, Halverson, Havill, and Martin (2005) assessed temperamental impulsivity—a temperamental construct that typically is negatively related to effortful control—using a composite of teacher-reported high negative emotionality, activity level, and low task persistence. Impulsivity, assessed in early to mid-childhood, predicted parent-reported distractibility, lack of achievement orientation, and disorganization at a mean age of 18, and was negatively related to the larger personality construct of conscientiousness. Caspi et al. (2003) found that ratings (based on observations) of an undercontrolled personality at age 3 predicted self-reported low conscientiousness at 26.

Moreover, there is evidence that childhood self-regulation predicts regulated behavior in adulthood and, thus, likely the self-control facet of conscientiousness. In the Caspi et al. (2001) study just mentioned, undercontrolled young children, compared to peers in other personality groups, were generally less controlled (self-reported reflective, cautious, careful, rational, planful, not impulsive) at age 18 (but not 26). In this study, the undercontrolled group included children who were impulsive, restless, negativistic, distractible, and labile in their emotional responses; thus, undercontrol was operationalized as including measures of emotion as well as regulation.

Shoda, Mischel, and Peake (1990) found that the ability to delay gratification in the late preschool years (i.e., to wait for a larger treat versus not wait for a lesser treat)—another index of self-regulation—predicted characteristics in adolescence such as parent-reported coping (including self-control, persistent and effective goal pursuit, attentional control, being sidetracked by minor problems, and maintaining friendships). Early observed delay of gratification also was positively associated with efficiency (greater speed without reduced accuracy) during a go/no-go task (requiring pressing a button when a target stimulus was

present and not responding to an infrequently presented nontarget stimulus or a different stimulus) more than 10 years later (Eigsti et al., 2006) and 40 years later (Casey, Somerville, Gotlib, Ayduk, Franklin et al., 2011).

Finally, in longitudinal work, measures of behaviors in childhood (ages 3, 5, 7, 9, and 11 years) that reflect self-regulation (including low negative emotionality, and high impulsivity and aggression) predicted behaviors that likely involve regulation, such as low criminal offending, financial planfulness, and substance dependence, in adulthood. Those children who became more self-controlled from childhood to early adulthood generally had better outcomes at age 32. Moreover, prediction by self-regulation over time held even when controlling for differences in intelligence and social class. Moreover, in the same study, siblings with lower self-regulation had poorer outcomes in adulthood despite their shared environment (Moffitt et al., 2011; also see Pulkkinen, Lyyra, & Kokko, 2011, for relations between childhood self-regulation and adult socioemotional functioning).

The Origins of Self-Regulation

Behavioral genetics studies have established that heritability estimates for conscientiousness and its facets typically range from about 40 to 50% (e.g., Jang et al., 1996; Luciano et al., 2006). Substantial heritability estimates also have been established for children's effortful control/self-regulation (Goldsmith, Pollak, & Davidson, 2008), although it should be kept in mind that environmental factors, including parenting and socioeconomic status, can moderate heritability (Krueger, South, Johnson, & Iacono, 2008; Turkheimer et al., 2003).

Twin and sibling studies generally find minimal evidence for shared environmental influence (e.g., parenting behaviors commonly experienced by children in the same family) on conscientiousness (e.g., Luciano et al., 2006). However, the effects of parenting may be mostly unique for each child. Indeed, there is a growing body of work identifying socialization correlates and predictors of individual differences in self-regulation. Of course, individual differences in children's regulatory capacities undoubtedly also affect socializers' behavior with children (e.g., Eisenberg, Vidar, et al., 2010; Lengua, 2006), and it is likely that there are bi-directional relations between the two, as well as gene by environment interactions predicting self-regulation (e.g., Kochanska, Kim, Barry, & Philibert, 2011; see below).

In fact, in research on infants, toddlers, and young children, a secure parent-child attachment relationship has been linked to children's optimal self-regulation (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Kochanska, 2001; Kochanska, Philibert, & Barry, 2009). In addition, responsive parenting (sometimes combined with warmth; Karreman, van Tuijl, van Aken, & Dekovic, 2008; Li-Grining, 2007; Spinrad et al., 2007) and mother-infant synchrony in terms of gaze, vocalizing, and affect (Feldman, Greenbaum, & Yirmiya, 1999) or connectedness (Li-Grining, 2007) predict relatively high effortful control/delay skills. Conversely, power assertion (Houck & Lecuyer-Maus, 2004; Kochanska, Coy, & Murray, 2001) and intrusive parenting (e.g., Calkins & Johnson, 1998) appear to undermine young children's regulation of emotion and behavior.

Parental responses may need to be age-appropriate to have an optimal effect. Spinrad, Stifter, Donelan-McCall, and Turner (2004) found that soothing and acceptance of children's unregulated behavior at 18 months was predictive of children's use of distraction as a strategy at 5 years of age, but similar maternal behavior at 30 months predicted children's unregulated facial responses at age 5 to a disappointing gift.

In the late preschool and elementary school years, sometimes in longitudinal research controlling for levels of earlier regulation and parenting, investigators have found that children's attentional and behavioral regulation is positively related to the quality of mothers' behavior, including their warmth and sensitivity and/or low negativity in the family (e.g., Belsky et al., 2007; Colman, Hardy, Albert, Raffaelli, & Crockett, 2006; Gilliom et al., 2002; Hofer, Eisenberg, & Reiser, 2010; Morris et al., 2002; Valiente et al., 2006; see Eisenberg, Spinrad, & Eggum, 2010, for a review). Moreover, parental coaching and acceptance of emotion (e.g., Gottman, Katz, & Hooven, 1997) and a variety of general strategies by which parents try to help children understand or appropriately modulate their emotions have been linked to outcomes that likely partially tap regulation (e.g., problem behaviors, unregulated emotion, coping; Eisenberg, Spinrad, & Eggum, 2010; Morris, Silk, Steinberg, Myers, & Robinson, 2007).

Parents' specific methods of dealing with children's emotion and behavior in contexts where children must self-regulate also have been associated with children's greater regulation. For example, Houck and Lecuyer-Maus (2004) found that mothers' use of power assertive techniques (commands and physical directs, little empathic reasoning or sensitive support, often delivered with a negative tone) during a prohibition task at age 1, 2 and 3 years was inversely associated with the ability to delay (i.e., waiting for a larger number of food items) at age 5. In contrast, *teaching-based* limit-setting pattern (firm control accompanied by sensitive and empathic support for the child's developing self-control, accompanied by the provision of reasons and explanations about the prohibition) was associated with better ability to delay at age 5 and better outcomes more generally (i.e., mother-reported social competence and self-related processes such as self-evaluation, self-recognition, emotional response to wrongdoing, and autonomy). Maternal indirect control (i.e., rare assertion of a limit about the prohibited object but the use of distraction) was associated with the greatest ability to delay but also was associated with non-optimal self and social outcomes at 36 months. Other work suggests that that maternal scaffolding, which would appear to reflect parents' responsiveness to the child's need and respect for their autonomy, has also been related to regulation and executive functioning in children (Hammond et al., 2012; Lengua et al. 2007), although children's level of regulation also may affect mothers' use of scaffolding (Eisenberg, Vidar, et al., 2010).

In a study of somewhat older children, Morris, Silk, Morris, Steinberg, Aucoin, and Keyes (2011) found that when preschoolers to second graders were presented with a disappointing prize, parents' attempts to help them cognitively reframe the situation so that it was no longer negative or to redirect attention away from the prize were related to less expressed sadness and anger. Surprisingly, however, Spinrad et al. (2004) found that maternal attempts to use distraction to help their children at 18 months were negatively related children's use of distraction at 30 months; moreover, they found no relations between mothers' specific

strategies at 30 months and children's self-regulation during a disappointment task at 5 years of age.

It is not surprising that some findings on the socialization correlates of regulation are not consistent. Sometimes children's emotionality or difficult temperament moderates the relation of socialization to indices of regulation (Feldman et al., 1999; also see Kochanska & Aksan, 2006); sometimes age may moderate findings (e.g., Eisenberg, Spinrad, Eggum, et al., 2010). Moreover, the relations of parental responsiveness, positive control, and negative control with regulation vary with the definition of regulation (e.g., Karreman et al., 2006, found few relations, especially for inhibition and emotion regulation, but their definition of inhibition included shyness and they had few studies measuring effortful control/executive functioning).

It should be noted that maternal income and education, as well as risk factors such as maternal depression and history of mental health or legal problems, are associated with children's effortful control in the predicted direction (e.g., Lengua, Bush, Long, Kovacs, & Trancik, 2008). Although such risks may be partly hereditary, these findings suggest that familial risks can affect the development of self-regulation skills and, hence, conscientiousness.

In summary, the relatively stable individual differences observed in self-regulation capacities appear to be due to genetic factors, sociodemographic risk, and socialization experiences. Although most studies are correlational, in some of the aforementioned studies, children's self-regulation was predicted by parenting when controlling for earlier levels of self-regulation (e.g., Eisenberg et al., 2005; Valiente et al., 2006). Moreover, in experimental studies that provide a strong test of causality, interventions have affected individual differences in self-regulation (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Diamond, Barnett, Thomas, & Munro, 2007; Raver et al., 2011). However, there is little work on the degree to which early environmental factors affect conscientiousness across the life span.

Academic Motivation and the Conscientiousness Facet of Industriousness

As shown in Table 1, the facet of industriousness (sometimes called perseverance) is reliably identified as a component of Big Five conscientiousness. Defined as the capacity to work diligently on productive, goal-directed activities, this aspect of conscientiousness suggests a straightforward explanation – cumulative effort -- for meta-analytic findings that conscientiousness predicts job performance in adulthood (Barrick, Mount, & Judge, 2001) and academic course grades from elementary school through college (Poropat, 2009) better than does any other Big Five factor.

The Development of Industriousness and Academic Motivation in Childhood

As noted by Caspi and Shiner (2006), very little research has explicitly examined the developmental origins of industriousness. However, as discussed above, several studies have found individual differences in children's tendencies to persist on tasks despite distractions and diversions. In addition, attempts to factor analyze questionnaire measures based on the

Thomas-Chess Nine-Dimensional model of temperament reliably yield a dimension called *task persistence* (Presley & Martin, 1994). Parent-report items from this factor reflected preschoolers' persistence and attention to tasks (e.g., "When my child starts a project such as a puzzle, he/she works at it without stopping until completion") and teacher-report items also included items about resisting classroom distractions (e.g., "If another child is talking or making noise while teacher is explaining a lesson, this child remains attentive to the teacher").

It seems obvious that motivation has an important role in determining individual differences in industriousness. Indeed, Roberts et al. (2005) found that the industriousness facet of conscientiousness encompasses both the NEO-PI-R *achievement striving* and *self-discipline* subscales, the former exemplified by individuals who "have high aspiration levels and work hard to achieve their goals" and "are diligent and purposeful..." (Costa & McCrae, 1992, p. 18) and the latter exemplified by individuals who "have the ability to motivate themselves to get the job done" (Costa & McCrae, 1992, p. 18). Likewise, Emmons and McAdams (1991) found that more industrious individuals hold personal goals with more achievement-oriented themes. Roberts, Jackson, Fayard, Edmonds, and Meints (2009) have argued, however, that the modest size of such associations suggests conscientiousness and motivation are "relatively independent but related constructs that have a complex and as yet not fully elaborated relationship" (p. 374). We agree that there is a conceptual difference between behavior and motivation and that these likely interact in complex ways. However, the empirical task of parsing engagement in productive activities (a behavioral construct) from value and interest in such activities (a motivational construct) is difficult, particularly in children too young to query directly.

Individual differences in industriousness become most noticeable when children begin formal schooling (Kohnstamm, 1998). Thus, motivation and engagement in the academic domain are useful starting points to understand the development of industriousness. According to Wigfield, Eccles, Schiefele, Roeser, and Davis-Kean (2006), academic motivation involves the beliefs, values, and goals that are associated with performance on academic tasks that require excellence. As shown in Figure 1, we also situate academic engagement under the larger rubric of academic motivation because, despite their conceptual distinction, empirical research on academic motivation often involves both motivational inclinations *and* behavioral efforts to succeed. Mean levels of academic motivation are often high at the beginning of schooling and remain elevated for several years before steadily declining during late elementary school through high school (National Research Council/Institute of Medicine, 2004). Although mean levels of child- or adult-reported academic interest and motivation decrease as children age, rank-ordering on these characteristics remains fairly consistent overtime (Ladd & Dinella, 2009; Simpkins, Davis-Kean, & Eccles, 2006).

Empirical Relations of Academic Motivation to Later Conscientiousness

Very few researchers have examined relations of academic engagement and motivation to industriousness later in life (Path 2 in Figure 1). Nonetheless, at least one study has documented the very long-term predictive validity of industriousness observed earlier in life

for much later outcomes: Vaillant and Vaillant (1981) found that industriousness in early adolescence, based on school records, teacher evaluations, and child and parent interviews, predicted employment, income, and mental health in middle age better than did either childhood socioeconomic status or IQ. Similarly, Oliver, Guerin and Gottfried (2007) found that task persistence and low distractibility at age 16 years predicted grades in high school and college and educational attainment at age 24.

The most direct investigation of academic motivation and later conscientiousness has been undertaken by Shiner and colleagues, who have followed a community sample of 205 children from ages 8–12 years longitudinally, assessing them again 10 and 20 years later. Childhood ratings of personality were derived from semi-structured interviews with parent and children as well as a questionnaire about classroom behaviors completed by teachers (Shiner, 2000). Mastery motivation encompassed zestful engagement in activities, achievement motivation (including tendencies to strive for mastery in intellectual pursuits, to be competitive, confident, and curious), and lack of performance anxiety in academic situations. Academic conscientiousness entailed academic engagement, including careful, thorough, and serious completion of schoolwork. Whereas mastery motivation in childhood predicted self-reported ratings of the tendency to work hard and thrive on challenges at age 30, achievement orientation did not (Shiner, Masten, & Roberts, 2003). In contrast, academic conscientiousness in childhood predicted the self-reported tendencies to plan ahead, avoid risk, and endorse moralistic, traditional values at age 30, but mastery motivation did not. Both mastery motivation and academic conscientiousness predicted academic attainment (e.g., years of education) and work competence (e.g., paid employment) at age 30, even when controlling for IQ.

In later work, Shiner and Masten (2012) identified their childhood ratings of academic conscientiousness as essentially equivalent to Big Five conscientiousness but suggested that without the performance anxiety component, mastery motivation more closely resembled Big Five openness to experience. Their conceptualization of mastery motivation as distinct from the construct of conscientiousness underscores the distinction between academic engagement on the one hand, and academic motivation, on the other. Regardless, it would seem that particularly when measured using informant ratings or behavioral observations, these two constructs are difficult to tease apart.

The Role of Self-Regulation in Academic Motivation

There is some longitudinal evidence that earlier self-control/regulation predicts later academic motivation (Path 3 in Figure 1), which in turn predicts industrious and persistent behavior (Path 2 in Figure 1). In particular, early childhood individual differences in the ability to inhibit inappropriate behaviors and resist distraction predict both achievement orientation and (lack of) distractibility in late adolescence/early adulthood (Deal et al., 2005). Likewise, the ability to delay gratification as a preschooler predicts parents' ratings during adolescence on items such as "How likely is your child to be sidetracked by minor setbacks?", "How able is your child to pursue his or her goals when motivated," "When trying to concentrate, how distractible is your son or daughter?" (Shoda et al., 1990). Notably, performance on the delay of gratification task depends in large part on the ability to

deploy attention adaptively (e.g., by distracting themselves from temptation; Rodriguez, Mischel, & Shoda, 1989), as does performance on boring work tasks (Peake, Hebl, & Mischel, 2002).

In addition, there is a growing body of work linking measures of self-regulation/effortful control to a range of academic outcomes (see Eisenberg, Valiente, & Eggum, 2010, for a review). In two separate cross-sectional studies, Valiente and colleagues found positive relations between adults' reports of elementary school students' self-regulation and students' participation and school liking (Valiente, Lemery-Chalfant, & Castro, 2007; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). In a short-term longitudinal study, Silva et al. (2011) reported positive relations between preschoolers' effortful control assessed in the fall and school attitudes assessed in the spring. Similarly, in a sample of Chinese elementary school students, the ability to delay was negatively related to learning problems involving underachievement and poor motivation (Chen, Zhang, Chen, & Li, 2012). In perhaps the strongest test to date, Stormshak, Fosco, and Dishion (2010) found that 7th graders' self-regulation was positively related to their school engagement one year later, even when controlling for prior levels of school engagement. Self-regulated students are likely to function well in peer groups and to receive support from teachers and these assets are believed to foster a sense of belonging and desire to engage in educational activities (Rothbart & Bates, 2006; Valiente et al., 2008). Thus, collectively, longitudinal and cross-sectional data are consistent with the hypothesis that the abilities to persist on difficult or tedious tasks and to deploy attention flexibly and adaptively early in life predict subsequent industriousness.

The Origins of Academic Motivation

Given the importance of academic motivation to taking advanced courses in high-school, earning high grades, reducing student boredom, and subsequent graduation (National Research Council/Institute of Medicine, 2004; Simpkins et al., 2006; Wigfield et al., 2006), scholars have devoted considerable resources to understanding the roles of parenting, peers, and the school context in academic motivation. Less attention has been directed to the heritability of academic motivation per se, but it is worth noting that scales tapping industriousness demonstrate heritability estimates comparable to other facets of conscientiousness (Jang, 2005).

The role of parenting in the development of academic motivation is clearly evident within Self-Determination Theory (Deci & Ryan, 1985) and the Expectancy-Value Model (see Wigfield et al., 2006, for a review). Although there are differences between these orientations, both provide relatively detailed predictions of why parental behaviors and beliefs, as well as child characteristics (e.g., locus of control, aptitude), are expected to foster academic motivation. For example, Deci and Ryan (1985) suggested that parental involvement can foster motivation by fulfilling students' need for relatedness. Further, reasonable parental rules, guidelines, and expectations are hypothesized to give students a sense of control and competence that is necessary for their motivation to succeed.

There is also some prospective evidence that the development of a secure parent-child attachment relates to observational measures of school engagement via indirect effects on

children's teacher-reported self-control (Drake, Belsky, & Fearon, this issue). Similarly, Wigfield et al. (2006) posited that parents' encouragement of their children's pursuit of a variety of educational activities, efficacy beliefs, and perceptions of the child's temperament fosters academic motivation. Such posited influences in their detailed heuristic model, which involves specific mediational and moderated pathways, have been supported empirically in elementary and middle-school samples. For example, beginning with more distal predictors, there is evidence that family structure (e.g., married vs. single parent), being from a majority group, and financial resources are associated with high motivation and subsequent achievement (Amato, 2010; Crosnoe, 2006; Evans, 2004; Yeung, Linver, & Brooks-Gunn, 2002). It is not always clear why these relations exist, but when children are reared in single-parent families or by parents low in education or income, their academic motivation may be reduced via decreases in parental energy or time to invest in children's education, increased parental stress, low parental expectations for success, and low belief in the importance of achievement (Conger et al., 2002; Wigfield et al., 2006). Parents may also foster motivation and achievement through their involvement in school, provision and use of learning materials at home, and selection of educationally rich child care settings and after school activities (Grolnick & Slowiaczek, 1994; Simpkins, Fredricks, Davis-Kean, & Eccles, 2006). In addition, there is evidence that parents' autonomy support (e.g., including the child in decisions and providing encouragement) and involvement are positively related to children's internalized academic motivation and performance (Grolnick & Ryan, 1989). It will be important to document how more distal parenting constructs (e.g., socializers' beliefs) and proximal child characteristics (e.g., expectation of success) cumulatively foster academic motivation (Wigfield et al., 2006).

There are a number of ways peers might foster or inhibit academic motivation. It is well-documented that working in a social context is more enjoyable and interesting than working in isolation (Slavin, 1995). When peer interactions foster group discussion and higher-order thinking about the topic, motivation for learning also may be enhanced via increased expectations for success (Wigfield et al., 2006). There is also evidence that competence in the peer domain is instrumental in fostering academic motivation and related processes. For example, peer acceptance has been positively related to the pursuit of goals to learn (Ladd, Herald, & Kochel, 2006). Moreover, relatedness with peers and teachers should enhance a sense of belonging, motivation, and participation in the classroom (Ladd et al., 2006). Interestingly, students' reports of their relatedness with peers and a sense of belonging have been associated with high teacher- and student-reported emotional and behavioral engagement at school (Furrer & Skinner, 2003). Similarly, peer competence in the early school years is related to concurrent and subsequent work habits, math, and language/reading, negative school attitudes, academic engagement, and achievement during the first year or two of schooling (Ladd et al., 2006). In contrast to supportive peer relations, difficulties in the peer domain, especially when chronic, are implicated as precursors to school-related difficulties, including emotional disengagement, even when relations are examined across multiple informants (Ladd, Herald-Brown, & Reiser, 2008).

Schools and school personnel also have the potential to foster academic motivation through many mechanisms. In this review, we focus on the student-teacher relationship and the

classroom climate. Reviews covering other topics, such as teacher qualifications, teachers' beliefs, and school safety are also available (Eccles & Roeser, 2011).

There is strong evidence linking the quality of the student-teacher relationship to students' motivation. In particular, supportive teachers offer students experiences that likely foster motivation, school engagement, and positive academic attitudes (Furrer & Skinner, 2003; Silva et al., 2011). Students who have sensitive and responsive teachers appear to feel more secure in exploring the learning environment and, especially for younger children, the teacher may serve as an attachment figure who fosters emotional support and opportunities that, in turn, advance positive school attitudes and motivation for academic-related tasks (Connell & Wellborn, 1991; Howes, Hamilton, & Matheson, 1994; Valeski & Stipek, 2001). Students who form a close, supportive relationship with their teacher tend to pursue academic goals, exhibit mastery orientations toward learning, and are high in academic interest and emotional engagement (Hamre & Pianta, 2005; Pianta, Cox, & Snow, 2007; Silva et al., 2011). Informed by the premise that relationships can function as a resilience mechanism, Osher, Sandler, and Nelson's (2002) school-based prevention program for at risk students places much importance on the student-teacher relationship as a means to affect motivation.

In addition to the student-teacher relationship, there is evidence that teachers' practices are relevant to students' motivation (see Stipek, 2002). Deci and Ryan (2002) suggested that academic motivation is most likely when students' autonomy, competence, and emotional needs are fostered. Providing students with opportunities to influence how the classroom operates, and helping to ensure that all students have opportunities for success and receive emotional, as well as academic support, are key ways to meet such needs. Correlational data indicate that kindergartners were observed to be more on-task and engaged in learning when teachers fostered child-centered classrooms (Pianta, La Paro, Payne, Cox, & Bradley, 2002), perhaps partly because of the negative association of a punitive school environment with children's executive function (Talwar, Carlson, & Lee, 2011). Stipek and colleagues (1998) provided experimental evidence demonstrating that teachers can be trained to focus on improving students' motivation, and that such changes are positively related to students' mastery orientation. The effect of the intervention on students' mastery orientation only approached significance ($p < .08$), likely due to a small sample size (N for teachers = 24) and short training (1 week); however, the study suggests that teachers' strategies for improving motivation have the potential to be successful, particularly in larger samples and when training is more extensive.

Beyond emotional support, teachers' choice of curriculum can either enhance motivation for academic tasks or, conversely, lead to boredom, disengagement, and lack of motivation. When the work is meaningful and culturally relevant, adolescents report high levels of concurrent and prospective motivation and affiliation with their peers and the school context (Burchinal, Roberts, Zeisel, & Rowley, 2008; Roeser, Eccles, & Sameroff, 2000). Minority students' interest and motivation for learning seems to be especially linked to the presentation of culturally relevant material that includes the experiences of under-represented groups (Graham & Taylor, 2002). The selection of instructional materials that challenge students and that require an array of cognitive activities is also critical for

motivating students (Fredricks, Blumenfeld, & Paris, 2004). Providing students with interesting academic tasks that are structured to build upon one another and that are well scaffolded (e.g., encourage students to ask themselves if they understand the key issues) appear key for building intrinsic motivation and identity as a dedicated student (Deci & Ryan, 2002). It is also clear that schools and teachers need to place great emphasis on the developmental change in students. What works in elementary school is not necessary going to work in middle or high school (NRC/IOM, 2004).

In summary, there is robust correlational evidence linking academic motivation to the family environment and parents' behaviors/beliefs, the peer context, and the school environment. Although it is widely acknowledged that the same parenting behavior, experiences, or expectations may not exert uniform effects across all children, an overreliance on methods useful for detecting main effects limits the understanding of how the reviewed processes operate for children living in different environments or for children who have different assets or risks. Therefore, we know relatively little about how variables in these domains cumulatively foster academic motivation. For example, scant data are available on the goodness of fit between familial expectations and the school environment. In addition, despite clear possibilities for reciprocal relations between parenting (or peer and student-teacher functioning) and children's motivational tendencies, there is little research on this topic.

Committed Compliance and Internalization of Norms and Standards and the Conscientiousness Facet of Responsibility/Dutifulness

The domain of responsibility/dutifulness involves fulfilling duties and obligations towards other people. The developmental underpinnings of this trait probably can be traced to behaviors observed in early childhood, particularly in young children's compliance with adults' demands. Indeed, certain forms of compliance have been conceptualized as precursors to internalization of appropriate standards of conduct. Thus, compliance, although not directly equated to dutifulness, has important parallels to internalization and the development of responsibility.

Kochanska and colleagues (Kochanska & Aksan, 1995; Kochanska et al., 1995) have differentiated between compliance that is internally motivated (i.e., committed compliance) and that which is externally motivated (i.e., situational compliance). Children who eagerly accept adults' requests/agenda, such as cleaning up toys or refraining from touching attractive objects, even when left alone, demonstrate committed compliance. On the other hand, when children lack interest in the task and need frequent prompting from adults to comply, they are exhibiting situational, or externally-motivated, compliance. Only committed (also known as internalized) compliance is thought to be an early form of internalization of sense of responsibility (Kochanska & Aksan, 1995). In a similar vein, Deci and Ryan (1985) suggested a continuum from externally-regulated compliance to integrated values in which the individual identifies with and accepts full responsibility for compliance with values.

Internalized, committed compliance has been shown to reflect internalization of values and standards (Kochanska & Aksan, 2006), even in very young children. Kochanska, Aksan and Koenig (1995) reported that toddlers' committed compliance (particularly in contexts in which the toddler was asked to refrain from touching attractive objects) was positively related to internalization of standards at preschool age (i.e., not cheating on tasks, compliance without being asked by parents). Given the evidence on the central role of committed compliance to the development of internalization, Kochanska and Aksan (1995) concluded that "committed compliance *is*, in fact, a form of early internalization" (p. 250). Kochanska and colleagues (2010) further argued that early internalized conscience serves as an important antecedent for adaptive developmental functioning, including rule-abiding behavior. In support of this argument, they found that a history of internalization of the parents' rules from ages 25 to 53 months was related to children's views of themselves as good, moral individuals, which in turn, predicted school-aged adaptive competence (e.g., prosocial and rule-abiding behaviors).

Children's compliance has been theorized to be linked to the broader trait of conscientiousness. For example, Caspi (2006) suggested that conscientiousness is reflected in individuals' compliance with authorities' rules and expectations. In adulthood, conscientiousness has been linked with valuing conformity (Roccas, Sagiv, Schwartz & Knafo, 2002). Although Halverson et al. (2003) did not find that the construct of compliance loaded on a parent-reported conscientiousness personality factor for children ages 3 to 12 years, similar constructs have loaded on the conscientiousness factor in other work with similarly aged children (Kohnstamm et al., 1998).

Similar to the construct of internalization, a component of the dutifulness/responsibility aspect of conscientiousness may be having moral values. Zahn-Waxler and Robinson (1995) suggested that children's empathy and guilt may be early precursors to feelings of responsibility. Moreover, empirical work has demonstrated relations between morality and conscientiousness. For example, in one study, adult participants were asked to provide descriptions of people who were described as moral exemplars (those adults who demonstrate a sense of moral responsibility to others); results showed that moral exemplars were described using trait terms categorized as highly conscientious and agreeable (Walker, 1999). In a study of 15- and 21-year-olds living in Switzerland, Malti and Buchmann (2010) found that conscientiousness was positively related to 15-year-olds' moral motivation in response to hypothetical situations and to adolescents' and adults' self-reported values of social justice. Moreover, Carlo and colleagues (2005) found a positive correlation between college students' trait conscientiousness and their prosocial reasons for volunteering (i.e., feeling compassion for others) and volunteerism.

The Development of Early Committed Compliance and Internalization in Childhood

Toddlerhood and early childhood years have been viewed as the period in which compliance and internalization develops. Kopp (1982) outlined the early development of self-regulation and proposed that children move from externally imposed control to gradually becoming more self-regulated and developing the ability to follow internalized rules in the absence of external monitoring. During the second and third years of life, toddlers become capable of

self-control in response to demands (Kopp, 1982; Vaughn, Kopp, & Krakow, 1984), and this time period also appears to mark the emergence of early conscience and the moral self (Kochanska et al., 2001). Indeed, the ability to delay and comply with maternal demands during cleanup tasks has been observed in children as young as 12–18 months (Kochanska et al., 2001; Stifter, Spinrad & Braungart-Rieker, 1999; Vaughn et al., 1984), and young children's ability to comply improves with age (Spinrad et al., 2012; Vaughn et al., 1984), perhaps because it relates to their cognitive and language abilities (Vaughn et al., 1984; Kopp, 1982).

There is evidence that children's compliance is relatively stable; thus, early compliance may be relevant to later conscientiousness-related constructs. Stability in observed compliance over time has been demonstrated from toddlerhood into the preschool years (Kochanska et al., 2001; Smith, Calkins, Keane, Anastopoulos & Shelton, 2004). In addition, researchers have found stability in compliance across contexts (Feldman & Klein, 2003), and coherence among compliance/delay tasks measures appears to increase with age (Vaughn et al., 1984).

Empirical Relations of Committed Compliance and Internalization to Later Conscientiousness

Although children's compliance with external standards has been equated with adults' diligence and responsibility (Caspi & Shiner, 2006), we argue that only internalized/committed compliance (and not externalizing motivated compliance—see Deci & Ryan, 1987) should be linked to adult conscientiousness (see Path 4, Figure 1). Unfortunately, there are no longitudinal studies to directly test this claim. However, Pulkkinen, Kokko & Rantanen (2012) showed that well-controlled behavior at age 14 (which included a compliance subscale) was related to higher adult conscientiousness at age 42 for females, but not for males. Research examining whether internally-motivated compliance in childhood predicts adult conscientiousness is needed.

The Role of Self-Regulation in Children's Committed Compliance and Internalization

Kochanska (1993) developed a conceptual model of children's conscience/ internalization and proposed two components of this construct, an affective component that includes anxiety and guilt associated with wrongdoing, and a behavioral component that allows the individual to suppress impulses and comply with standards. It is generally thought that children's self-regulation is most closely related to this second component of internalization; well-regulated children are likely to exercise restraint, think about the consequences for their actions, and perhaps consider the parental socialization messages to abide by rules. In addition, it is likely that an interaction between the affective component (guilt) and the behavioral component (effortful control) predicts later adaptive functioning (see Kochanska et al., 2012).

Consistent with Kochanska's thinking, a number of researchers focus on the role of temperament in children's compliance and sense of responsibility. In particular, self-regulation (or effortful control) has been viewed as an antecedent of committed compliance (see Path 5, Figure 1). Indeed, Hill and Braungart-Rieker (2002) found that 4-month-old infants who demonstrated more attentional regulation during an infant-mother still face

procedure showed higher levels of committed compliance during a clean-up task at age 3 than did less regulated infants. Similarly, Kochanska, Murray and Coy (1997) found that toddlers who exhibited less committed compliance at 22, 33, and 45 months of age had lower effortful control on a battery of tasks that included slowing down motor activity, suppressing a dominant response, cognitive reflectivity, and effortful attention than did more compliant toddlers. Spinrad et al. (2012) found mixed support for the finding that effortful control at 30 and 42 months of age predicted higher committed compliance a year later, even after controlling for earlier levels of committed compliance (the finding held except in the most conservation time-invariant model). Moreover, regulation may predict compliance into the school years; research has shown that using less-effective regulation strategies (i.e., focusing on a delay object) at age 3 was related to boys' lower teacher-reported cooperation at age 6 (Gilliom et al., 2002). Lack of regulation also predicts children's defiance and problem behaviors (Eisenberg, Spinrad, Eggum, 2010; Spinrad et al., 2007; Stifter et al., 1999).

In addition to compliance and noncompliance, regulation has been linked to children's conscience or internalization of rules of conduct (i.e., the ability to embrace authorities' agendas as their own). Kochanska et al. (1997) found that observed effortful control was related to high levels of conscience (e.g., internalized compliance, moral solutions to hypothetical dilemmas, resistance to cheating on games) both concurrently during the toddler and preschool years and also across time. Similarly, children's effortful control from 22–45 months predicted their internalized conduct at 56 months (Kochanska & Knaack, 2003). There is also evidence that effortful control is linked to other aspects of moral conduct, including guilt (which is likely a component of children's internalization and conscience; Rothbart et al., 1994). As previously noted, Ahadi and Rothbart (1994) suggested that the ability to control attention (a facet of effortful control) may lead to internalization of societal values.

Moreover, the degree to which children react to emotion-eliciting stimuli in combination with their early emotion regulation skills has been found to predict children's noncompliance. For example, Stifter et al. (1999) found that infants who exhibited high levels of both negative emotional reactivity and regulation during frustrating tasks were less defiant during a clean-up task at 30 months of age than were those who expressed similar levels of reactivity but who lacked regulation. These findings suggest that it is important to consider both levels of emotionality and regulation to understand individual difference in children's ability to cooperate and comply with requests.

The Origins of Committed Compliance and Internalization

As for self-regulation, there is evidence that dutifulness, and probably compliance, are heritable. For example, Jang, Livesley and Vernon (1996) and Jang et al. (1998) found significant genetic influence on Dutifulness (44% and 26%, respectively) and on the compliance subscale of Agreeableness (34% and 26%, respectively). Nonetheless, it is likely that socialization plays a major role in children's compliance and moral internalization. Due to space constraints, only two socialization factors are discussed: (1) parental responsiveness

and warmth, including the quality of the parent-child relationship, and (2) parental disciplinary style and patterns of control.

Parental supportiveness, warmth, and responsivity have been thought to foster children's compliance and internalization by creating an environment in which the child is motivated to internalize adults' standards. That is, when children are raised in supportive environments, they develop a sense of reciprocity in their relationships, and they are eager to embrace their parents' goals and standards. In fact, maternal responsivity has been linked with higher compliance in children (Crockenberg & Litman, 1990; Spinrad et al., 2012).

There is also support for the notion that the quality of the parent-child relationship is associated with children's future compliance and internalization. In a classic study, Matas, Arend, and Sroufe (1978) found that children identified as securely attached were especially cooperative. In later studies in which committed compliance was differentiated from situational compliance, attachment security was related to children's committed compliance (Kochanska, Aksan, & Carlson, 2005) and internalization of parental rules (Kochanska & Aksan, 2006).

In regard to disciplinary style, Hoffman (2000) posited that parental power assertion may interfere with children's internalization because power-assertive strategies overly arouse children, which is likely to interfere with their ability to process information and self-regulate. On the other hand, more gentle control strategies are thought to maintain optimal levels of arousal so that children can effectively regulate their behavior. In support of Hoffman's theory, power assertive parenting has been linked with children's noncompliance and defiance (Grolnick, 2003; Kochanska & Aksan, 1995), whereas strategies that are low in power assertion (i.e., reasoning) have been associated with committed compliance and internalization (Kochanska et al., 2008). Importantly, although power assertive parenting (such as corporal punishment) may induce immediate compliance, it is thought to prevent internalization of values (Hoffman, 2000). At an extreme level, findings show that maltreated children exhibit more moral transgressions (i.e., cheating, stealing) than comparison children (Koenig, Cicchetti, & Rogosch, 2004).

Although most of the research to date has focused on the role of maternal socialization factors, fathers' parenting and family dynamics also play an important role in children's behavior. For example, fathers' power assertion during discipline contexts when children were 38 months, like mothers', was related to lower observed internalization of the parent's prohibition at 52 months of age (Kochanska, Aksan, Prisco & Adams, 2008). In addition, marital conflict has been related to lower compliance by sons aged 41 to 82 months with fathers (girls did not participate in the study; Jouriles & Farris, 1992). Further, coparenting among mothers and fathers (i.e., the support for each others' parenting) has been linked to parents' reports of children's early conscience development (Groenendyk & Volling, 2007). However, the literature on fathers and family dynamics in relation to children's sense of responsibility is very limited.

Children's temperament appears to moderate the relation of parenting to children's compliance/internalization. That is, gentle discipline appears to be effective for relatively

fearful children. On the other hand, for fearless children, conscience was predicted by attachment and maternal responsiveness (Kochanska, 1995).

Heredity also has been found to moderate the relation of socialization to compliance. Using a relatively small sample ($n = 88$), Kochanska and colleagues (2011) found that when exposed to low maternal responsiveness, children with a short 5-HTTLPR allele (ss/sl) of the serotonin transporter gene were lower on moral internalization (including prosocial reasoning, moral cognitions, and moral self [including internalization of rules, guilt, and apology]) than were children with two long alleles (ll). When children had more responsive mothers, the ss/sl children were higher than the ll children on moral internalization. These findings add to the growing literature suggesting that particular genes are only “risky” under conditions of low-quality parenting. Under conditions of high-quality parenting, children with susceptible or reactive genes are actually better off. Identifying these complex interactions is an important step to understanding the underpinnings of conscientiousness.

Finally, models of socialization have shifted away from the notion that parents influence their children to a more bidirectional or transactional view. For example, Smith et al. (2004) found that increases in children’s observed noncompliance from age 2 to age 4 predicted increases in parental controlling behavior. Greater delineation of the role of child’s internalization/compliance on parenting is needed.

Integration

We have argued that the development of several capacities in childhood—self-regulation, compliance/internalization with norms/standards, and academic motivation/persistence on tasks—provide the foundation for the full emergence of the personality trait of conscientiousness. As is indicated in Figure 1, we suggest that these three abilities may differentially relate to the various facets of conscientiousness. However, we do not think that the additive effects of these three capacities tell the whole story.

We view self-regulatory skills as involving basic abilities such as the capacities to inhibit behavior, manage attention, and plan. These abilities provide tools for acting in regulated ways and for behaving in a conscientious manner. However, some widely used measures of self-regulation such as delay of gratification and persistence tasks likely include motivational components as well because these tasks involve compliance with adults’ instructions or expectations and/or the desire to adhere to internalized goals.

In comparison to self-regulation (especially “purer” tasks of executive functioning regulatory skills), compliance/internalization and academic motivation both include very strong elements of motivation—the motivation to conform with standards of conduct as well as the motivation to do well on tasks considered relevant to success or accomplishment in a culture. Often self-regulation may provide the tools to accomplish goals that stem from the internalization of standards or the motivation to do well. Thus, we suggest that there might be multiplicative effects when predicting conscientiousness of individual differences in childhood (and adulthood) self-regulation with individual differences in compliance/internalization of norms/standards or academic motivation (Paths 6 and 7 in Figure 1).

Conclusion and Future Directions

In summary, it is clear that self-regulation, industriousness, and dutifulness/responsibility--three important facets of conscientiousness--can be seen in fairly young children. Individual differences in these constructs exhibit considerable inter-individual consistency.

Developmental maturity in self-regulation likely contributes to concomitant growth in industriousness and dutifulness/responsibility. Although other factors no doubt contribute to success in achieving goals, adhering to norms and personal standards, and acting responsibly toward others, the abilities to control attention, integrate information, plan, and willfully inhibit or activate behavior play a central, enabling role. Thus, regulatory skills likely are necessary but not sufficient to the development of industrious, dutiful, and responsible behavior; for example, individual differences in regulation might relate to industriousness and dutifulness/responsibility only if children have also developed the motivation to achieve or to act in responsible/dutiful ways. Further research is necessary to document the joint role of self-regulation and factors that affect relevant motivation and internalized goals in conscientiousness across the lifespan.

Many questions regarding the development and prediction of conscientiousness in adulthood remain unaddressed or unanswered. One potentially fruitful avenue for investigation is the additive or interactive effects of various aspects of childhood temperament/personality with those we targeted in this paper when predicting conscientiousness in adolescence and adulthood. For example, personality agreeableness may combine with self-regulation or internalized compliance/internalization of standards to predict conscientiousness in adulthood (Caspi & Shiner, 2006). Moreover, emotion likely plays a multi-faceted role in the motivation to behave in norm- or rule-abiding ways and to be industrious. Self-regulation and emotionality interact when predicting developmental outcomes such as externalizing and social competence (see Eisenberg, Fabes, Guthrie, & Reiser, 2000); thus, self-regulation might interact with individual differences in emotionality (both positive and negative) when predicting the emergence of conscientiousness. Emotionality might also moderate relations of conscientiousness tendencies to actual conscientious behavior or directly enhance or undermine conscientious behavior. Consistent with the latter possibility, dependability in adulthood is related not only to Big Five conscientiousness but also to Big Five emotional stability, as well as agreeableness (Roberts et al., 2005).

Another issue for future work is considering how other aspects of childhood personality do or do not contribute to the development of conscientiousness. For example, it could be argued that personality agreeableness contributes to the development of conscientiousness. For example, Caspi and Shiner (2006) suggested that responsibility is based on both agreeableness and conscientiousness. If this is true, the development of prosocial values and behaviors in childhood might be relevant to the emergence of adult conscientiousness. In addition, agreeableness, which Rothbart and Bates (2006) argued might be a neglected aspect of temperament, might contribute to some degree to compliance, especially compliance that is based on the desire to please others or on adherence to internalized norms related to prosocial values. In future work, it would be desirable to determine if prosocial responding or values in childhood are predictors of adult conscientiousness and if its prediction of conscientiousness is unique from that of self-regulation and committed

compliance/internalized standards. Moreover, it would be informative to determine the degree to which self-regulation and committed compliance/internalization predict conscientiousness versus agreeableness in adulthood.

An issue of obvious import is the degree to which socialization experiences, exposure to demographic risk factors, and interventions—all of which appear to affect children's self-regulation, industriousness/academic motivation, and committed compliance/internalization—have an enduring effect on conscientiousness across the life-span. It is possible that experiences later in life may dilute, nullify, or, conversely, amplify the effects of environmental influences on what we have argued are some of the origins of conscientiousness. Studies linking early socialization experiences to adults' conscientiousness are clearly needed. Moreover, perhaps certain aspects of the familial environment (e.g., coming from an orderly environment) are important for the emergence of a stable trait of conscientiousness. Research is also needed to determine the effectiveness of interventions for changing the developmental trajectory of conscientiousness and for modifying conscientiousness after childhood. Given the strong relation of conscientiousness to a host of positive outcomes in adulthood (see Roberts et al., this issue), it is important to determine aspects of the environment that are modifiable and affect the early emergence of behaviors and motivation relevant to conscientiousness. Even if genetics plays a large role in conscientiousness and its precursors, change in socializers' behaviors elicited by child characteristics or due to the adult's own genetic makeup often are modifiable by the environmental interventions.

In fact, there likely is a complicated interplay of genetic and environmental factors in predicting conscientiousness from childhood functioning. There is little doubt that genetics play a role in individual differences in both self-regulation and conscientiousness; some of this effect may be on variables such as executive functioning and the need for social stimulation/ interaction (e.g., extraversion) and perhaps the desire for social contact and approval. Moreover, heritable characteristics such as temperamental irritability and intelligence no doubt shape parenting behavior. However, parental values and goals, which are not entirely genetic, undoubtedly affect their socialization of behaviors such as conforming to norms, behaving in regulated and hence acceptable ways, and achieving success, and cannot be ignored.

Indeed, initial research (e.g., Kochanska et al., 2011) supports the plausible assumption that genes and environmental experiences interact to affect components of conscientiousness. Several genetic polymorphisms have been associated with conscientiousness and its facets; however, the variance explained by such polymorphisms is typically extremely modest and subsequent studies often fail to replicate earlier findings (Roberts, Jackson, Duckworth, & Von Culin, 2011; South & Krueger, this issue). Genes involved in the regulation of dopamine and serotonin activity may be especially important for conscientiousness and have been related to performance on tasks assessing alerting, orienting, and executive function aspects of attention (e.g., Posner et al., 2007). Research identifying combinations of genes or their components may provide better prediction of conscientiousness. Moreover, aspects of the environment probably even activate the expression of genes relevant to

conscientiousness but, to our knowledge, this issue has not been tested. Very little of the relevant research is genetically informed.

To accomplish the above goals, there is a need to identify in a more systematic way empirical links between childhood temperament and adult conscientiousness. Such work seems timely given recent progress in identifying facets of conscientiousness and growing interest in how individual differences unfold across the life course. One straightforward next step would be to examine how measures assessing the constructs discussed in this article vary across the life course. For instance, by comparing items on validated questionnaires of effortful control in early childhood, self-control in middle childhood and adolescence, and conscientiousness in adulthood, one might identify specific behavioral tendencies that are consistently identified across developmental epochs (e.g., concentrating on a task and ignoring non-task distractions, planning ahead for tasks, delaying gratification) despite distinct behavioral manifestations (e.g., concentrating when drawing in a coloring book vs. paying careful attention during lectures). (See Shiner & DeYoung, in press, for an important first step in this direction.)

The National Institute of Health has taken on the formidable challenge of developing computer-based performance tasks assessing functions relevant to conscientiousness (and other constructs) for individuals aged 3 to 85 years (see <http://www.nihtoolbox.org>). Of course, the validity of such task measures, and in particular their convergence with more ecologically valid measures of conscientiousness (e.g., informant report ratings), should be tested rather than assumed. Executive function, delay of gratification, and questionnaire measures of self-regulation tend to be only modestly interrelated (Duckworth & Kern, 2011). It is quite possible that some measures of self-regulatory capacities are more predictive of conscientiousness than others; for example, measures of regulation that include a motivational component might be more closely aligned with conscientiousness than measures that are more purely attentional and/or cognitive. Moreover, multi-task batteries of self-regulation (or compliance, internalization, or academic motivation) measures would probably increase reliability and validity of relevant measures and provide better prediction of the various facets of conscientiousness across time.

Further, in an effort to understand how the dutifulness component manifests in both childhood and adulthood, it is important to develop ways of measuring internalized compliance in adults. One method may be to consider measures of guilt after transgressions, which is likely related to internalization and the facet of responsibility. Similar measures with children have been used to assess children's moral selves (Kochanska et al., 2010). In addition, aspects of adults' adherence to normative standards may be available in existing scales, such as Gough's (1994) socialization scale, a subscale of the California Personality Inventory thought to tap individuals' internalization and compliance with positive values and norm-observing behavior (i.e., compliance with standards). In fact, this scale had been positively associated with ratings of adults' conscientiousness (Gough, 1994). Thus, Gough's scale and other existing adult personality measures with relevant items (e.g., items on Block's, 1961, Q-sort; see Gough, 1994) could be examined in relation to childhood measures of internalized compliance and norm-abiding behavior, perhaps even in existing longitudinal data sets (especially those in the Bay Area where Gough and Block worked).

Creative efforts to construct indices of conscientiousness and its likely childhood precursors from measures in existing studies would leverage those data while efforts are collect longitudinal data on the origins of conscientiousness are underway.

Acknowledgments

Writing of this article and some of the research discussed were partially supported by a grant from the National Institute of Mental Health to the first and third authors and by a grant from the National Institute of Child Health and Development to the first, third, and fourth authors. Valiente and Duckworth were also supported by the National Science Foundation and National Institute of Aging, respectively. We thank Kelly Allred for her assistance with this manuscript.

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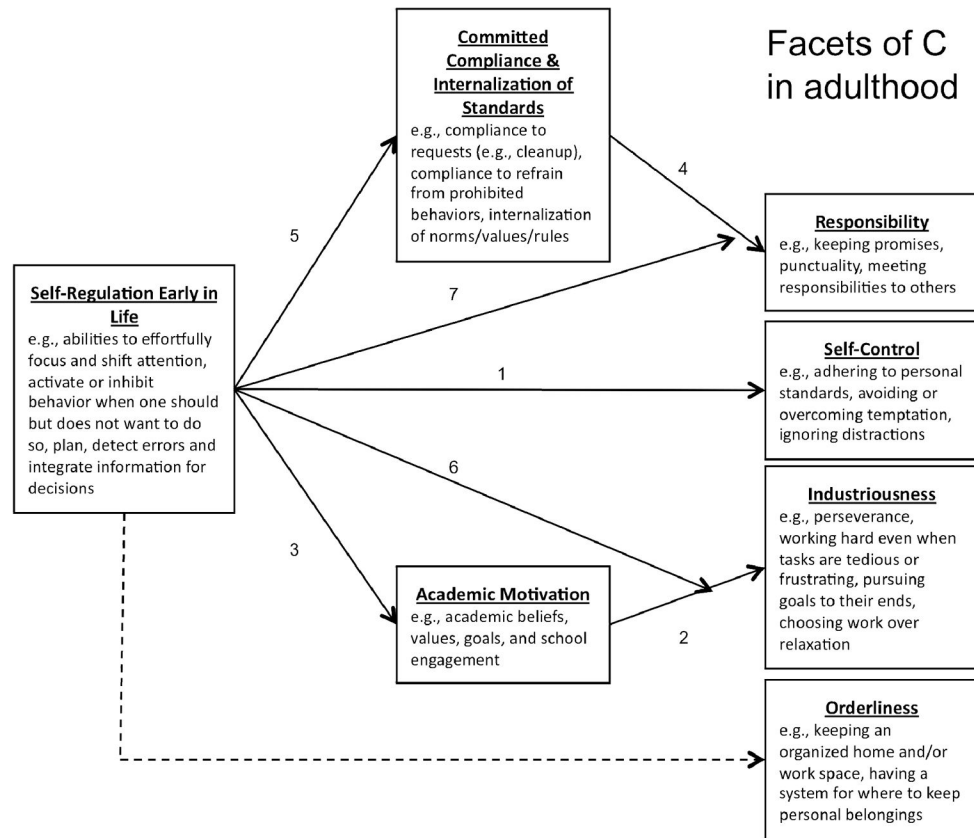
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**Figure 1.**

A heuristic model of the developmental origins of four reliably identified facets of conscientiousness (C).

Table 1
Dimensions of Conscientiousness Identified in Five Recent Studies of Personality

Factor	Costa & McCrae (1992)	Saucier & Ostendorf (1999)	Peabody & de Raad (2002)	Roberts et al. (2004)	Roberts et al. (2005)	MacCann, Duckworth, & Roberts (2009)
Self-Control	Deliberation	--	Impulse control	Impulse control	Self-Control	Control + Caution
Industriousness	Achievement Striving + Self-Discipline	Industriousness	Work + Persistence ¹	Industriousness	Industriousness	Industriousness + Perseverance + Procrastination refrainment + Perfectionism
Responsibility	Dutifulness	Reliability	Responsibility	Reliability + Punctuality	Responsibility	--
Orderliness	Order	Orderliness	Orderliness	Orderliness	Order	Tidiness+ Task Planning
Other identified factors	Competence	Decisiveness-consistency		Decisiveness + Formalness + Conventionality	Traditionalism + Virtue	

Note.

¹The facet of Persistence also loads on Big Five Extraversion in this study.