Child Development, March/April 2007, Volume 78, Number 2, Pages 430–447

I Like to Do It, I'm Able, and I Know I Am: Longitudinal Couplings Between Domain-Specific Achievement, Self-Concept, and Interest

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The longitudinal development of the intraindividual coupling between academic achievement, interest, and self-concept of ability (SCA) was analyzed in a sample of approximately 1,000 children between grades 1 and 12 (ages 6–17). Across all calculated indexes, the average level of coupling was positive. Individuals generally felt competent and interested in domains where they achieve well, and were interested in domains where they perceive their personal strengths. The degree of coupling was the highest between interest and SCA and the lowest between interest and achievement. For all indexes, evidence for an increase in coupling across time was found. Female gender was related to a lower level of coupling. There was evidence for a positive effect of conscientiousness on the amount of coupling.

One of the basic goals of most current school systems is to promote students' skill development in different academic domains. Because children are in school to learn, their level of *academic achievement* is closely and regularly monitored by grades, report cards, and achievement tests. Accordingly, it is no surprise that children start to develop representations about their level of skill in the attainment of educational goals from a very early age onwards (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Harter, 1990); Eccles and her colleagues refer to these representations as domain-specific self-concepts of ability (SCAs). Research has found that children's SCAs develop from generalized notions to increasingly domain-specific self-views (Eccles et al., 1993; Harter, 1990; Marsh & Ayotte, 2003; Shavelson, Hubner, & Stanton, 1976).

Children also differ with regard to what academic subjects they like and dislike from an early age (Eccles et al., 1993). Several researchers have been interested in the link between liking a subject, doing well in the subject, and having a high domain-specific ability self-concept (see Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Renninger, 2000, for examples). The current study focuses on the *coupling* of these three components of school-related achievement perceptions and performance. We define coupling as the intraindividual association between domain-specific academic achievement, domain-specific SCA, and domain-specific interests.

Almost by definition, achievement, interest, and SCA are not static constructs but reflect the investment of intellectual and motivational resources. For example, investment theory (Horn, 1982) suggests that interest guides the investment of intellectual resources, and cross-sectional research suggests that both constructs are indeed coupled by adulthood (e.g., Ackerman & Heggestad, 1997). Similarly, Eccles-Parsons' et al. (1983) Expectancy-Value (E-V) theory of achievement behavior stresses the emerging synergistic relations among actual achievement, domain-specific SCA, and domain specific interests and enjoyment. Eccles et al. predicted that these beliefs and behavior will begin fairly distinct from one another and then become more highly related as the children mature cognitively and become better at regulating their behavioral investments according to their interests (e.g., Eccles et al., 1993; Eccles, Wigfield, & Schiefele, 1998; Wigfield & Eccles, 1992, 2002). However, little previous research has looked at

This research was supported by Grant HD17553 from NICHD and by grants from the MacArthur Network on Successful Pathways through Middle Childhood. Additional support for international travel and boarding for the first author was provided by the International Max Planck Research School on the Life Course: Evolutionary and Ontogenetic Dynamics (LIFE). We thank Jens Asendorpf, Lars Penke, Gabriel Nagy, and Kai Cortina for helpful comments on earlier versions of this article.

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developmental changes in this coupling—most have focused instead on developmental changes in individual constructs (e.g., Jacobs et al., 2002; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005; Wigfield et al., 1997).

In this study, we focus on the associations within individuals across domains (i.e., a person-centered approach) rather than correlating across individuals' beliefs within one domain. Such a perspective allows for an assessment of stability of individual differences in the extent of coupling across domains. Furthermore, using person-centered statistical techniques, this perspective allows us to model intra-individual trajectories of coupling across domains and investigate whether there are person-level characteristics, particularly gender and aspects of children's personality, that are associated with differences in the shape of within-individual coupling trajectories.

Associations Between Achievement and SCA

A number of theoretical frameworks predict associations between domain-specific SCA and domain-specific achievement. For example, Eccles-Parsons et al. (1983) developed a comprehensive E-V model of achievement-related choices that focuses on the relation of self-competency beliefs and interest to task choice and future achievement while taking into account previous and current achievement (and other important factors such as the influence of socializers; e.g., Jacobs et al., 2002; Wigfield et al., 1997). This research has contributed to our understanding of the reciprocal nature of the impact of these subsystems of beliefs and performance (interest, SCA, achievement) as well as the developmental process of differentiation between SCA, interests, and achievements that occur within domains over time. According to this model, individuals who have high expectations for succeeding at a task (i.e., who have a high SCA) should show ambitious goal setting, a high level of persistence and effort, and, subsequently, a high level of achievement (see Eccles et al., 1993; Eccles-Parsons, Adler, & Meece, 1984; Fredricks & Eccles, 2002; Wigfield, 1994; Wigfield & Eccles, 2002 for empirical support for this model). Researchers in the tradition of Social cognitive theory (Bandura, 1982, 1997; see also Covington, 1984; Weiner, 1985) also predict and have shown that children do better and are more motivated to seek challenging tasks when they believe that they are capable of accomplishing such tasks.

Many empirical studies have documented the positive relations of SCA to subsequent achievement (Guay, Marsh, & Boivin, 2003; Marsh, Byrne, & Yeung, 1999). Valentine, DuBois, and Cooper (2004) meta-analyzed results from 60 independent samples and found small but systematic effects of SCA on later achievement, controlling for initial achievement. Moreover, a recent study by Marsh et al. (2005) investigated associations between SCA and achievement in two large German samples and found significant cross-lagged paths from SCA in the seventh grade to academic achievement a year later.

The Marsh et al. (2005) study also documented the impact of initial achievement on subsequent SCAs. Several theorists, including Bandura (1997), Eccles and her colleagues (e.g., Eccles et al., 1983, 1998), and Marsh and his colleagues (e.g., Marsh et al., 2005), have argued that the relation between SCA and achievement should be reciprocal across time, with high SCAs leading to increased investment and performance in the related domains, which, in turn, should lead to further increases in the SCAs most directly related to the high-performance domains. Empirical studies have supported the significance of these bidirectional influences between SCA and achievement (see Marsh et al., 1999; Wigfield & Karpathian, 1991). This perspective and the related evidence are particularly important for predictions related to the developmental changes in coupling we are studying in this paper. Consistent with Marsh's Internal–External Comparison Theory of the development of self-concept (Marsh, 1986), we believe that individuals compare their own performance across different domains in an effort to assess their relative abilities and to refine their hierarchy of domain-specific ability self-concepts. Developmentally, we know that the between-individual correlations between performance and domain-specific SCA increase from early elementary school on, reaching an asymptotic level by about the fifth grade (Eccles et al., 1993; Fredricks & Eccles, 2002; Wigfield et al., 1997). Extending this evidence to a within-individual perspective, we predict that an individual's coupling between performance and SCA across domains should increase with age over the elementary and middle school years.

Associations Between Achievement and Interest

According to Eccles and colleagues' E-V Theory, achievement-related experiences (through their impact on children's affective memories and their SCAs) should affect the subjective task value that the children come to attach to different achievement-related tasks. One critical feature of subjective task value likely to be subject to such an influence is

interest (see Eccles-Parsons, 1983, 1985; Jacobs et al., 2002; Renninger, 2000). In turn, according to the Eccles et al. E-V Model, interest should influence task choice and task investment, which in turn should influence achievement.

By and large, evidence has supported these predictions as well as the bidirectional relation between achievement and interest (see Eccles et al., 1993; Eccles-Parsons et al., 1983; Renninger, 2000; Updegraff, Eccles, Barber, & O'Brien, 1996; Yoon, 1996). For example, a meta-analysis by Schiefele, Krapp, and Schreyer (1993) showed that interest is related to academic achievement, with the correlation between both constructs estimated to be .30. Similarly, Harackiewicz and Sansone, (2000) and Harackiewicz, Sansone, and Manderlink, (1985) also found that positive competence feedback reflecting a person's level of achievement increases intrinsic motivation, a construct that is related to individual interest.

More recently, Marsh et al. (2005) found some evidence for bidirectional links between interest and achievement. Specifically, using bivariate longitudinal modeling, the paths from initial interests to later grades and achievement test scores were statistically significant (although relatively small), whereas the opposite path from initial grades to later interests was significant in one of the two samples studied (although again, its strength was relatively small). In addition, Wigfield et al. (1997) found that parents' and teachers' ratings of children's academic competence are significantly related to children's self-reported interest, although this association was weaker than the one between SCA and academic competence. Similarly, work by Eccles and colleagues has shown that interests predict increases in subsequent achievement as well as course enrollments (Eccles et al., 1998; Eccles-Parsons et al., 1983, 1984; Updegraff et al., 1996; Yoon, 1996).

Finally, using a person-centered approach, Reeve and Hakel (2000) studied the coupling between domain-specific knowledge and interest across 12 content domains, such as physical science, biological science, farming, and art. The results indicated a moderate level of coupling between interest and knowledge, with intraindividual profile correlations ranging between .25 and .35). We set out to replicate and extend this finding using a similar person-centered approach by (a) using a broad range of academic and nonacademic domains, (b) comparing the role of mean-level versus profile similarity in coupling, (c) studying the shape of intraindividual trajectories of coupling across the entire primary and secondary schooling period, and (d) including personality (conscientiousness) as a moderator of coupling. Based on the increasing correlations between interest and achievement across the elementary school years documented by Wigfield et al. (1997) and Fredricks and Eccles (2002), we predicted that the coupling of interest and achievement would increase across the elementary and middle school years.

Associations Between Interest and SCA

Several theorists have posited links between SCA and interest. Hidi, Berndorff, and Ainley (2002) noted a number of similarities in the outcomes of both constructs. Social cognitive theory predicts that interests are essentially a function of the perceived likelihood to succeed on a specific group of tasks and the value of the consequences of doing well (Bandura, 1982; Lent, Brown, & Hackett, 1994). Thus, an ''interest'' in mathematics could be the result of the belief that one is able to understand mathematical problems (at least in the long run) and the consequences that follow such an understanding (Deci & Ryan, 2000; Harter, 1992). Similarly, Eccles-Parsons et al. (1983) posited a relation between SCA and subjective task value and argued that the direction of causality was likely to be bidirectional.

Ample empirical evidence supports the conceptual link between interest and SCA. A meta-analysis by Lent et al. (1994) found an average correlation of .53 between the two constructs (e.g., Hidi et al., 2002; Tracey, 1997). Research by Eccles and her colleagues has documented a positive relation between the two constructs as early as in the first grade (Eccles et al., 1993; Wigfield et al., 1997). Even so, this association is not perfect, indicating that individuals can be interested in something despite lack of confidence in one's ability and vice versa (Renninger, Ewen, & Lasher, 2002). Additional analyses by Eccles and her colleagues have shown that the association between SCA and interests increases over the primary and secondary school years (Fredricks & Eccles, 2002; Jacobs et al., 2002; Wigfield et al., 1997). Using hierarchical linear modeling (HLM), Jacobs et al. (2002) added competency beliefs as an explanatory variable to the model of task values and found that perceptions of competence explained between 38% and 71% of the variance in stable individual differences in task value in the domains of mathematics, language arts, and sports. They also showed that changes in competence beliefs accounted for much of the age-related declines they found in task values for mathematics, language arts, and sports. Finally, recent findings by Marsh et al. (2005) support a reciprocal effects model in which interest has a

significant influence on SCA and vice versa, although the path from SCA to interest seems to be stronger than the other way around. On this basis, we predict that the coupling between both variables will increase with age across the elementary and secondary school years. However, Marsh's conclusions were limited to the domain of math. Because it has been argued that specific social forces have historically influenced school-related outcomes in this domain (Eccles & Jacobs, 1987), it is unknown to what extent these findings can be generalized to other domains, something that is examined in this study.

Variable Versus Person-Centered Approaches to Study Associations Between SCA, Interest, and Achievement

The current study uses a person-centered approach to examine the level of *coupling* between SCA, achievement, and interest *within* individuals across domains (see Figure 1). This is an important extension of the extant literature because it addresses the question of whether a person who has a higher level of coupling in one domain (e.g., a high level of achievement, SCA, and interest in math) also has a high level of coupling in others (e.g., English). If the degree of coupling between SCA, interest, and achievement generalizes across domains, it can be regarded as an individual difference variable that may be related to meaningful outcomes. For example, people with high levels of coupling across domains are likely to be motivated to work the hardest in exactly those domains in which they are most able to succeed and for which they hold the highest subjective task values. This motivational system should lead to both high levels of positive affect and high levels of competence and success. In contrast, people with low levels of coupling may spend a lot of time engaged in tasks for which they have limited probabilities of success, leading to frustration and less than optimal distribution of time and effort (Wigfield & Eccles, 2002).

Scattered evidence regarding the coupling between SCA, interest, and achievement in single domains suggests that coupling may indeed be related to important outcomes. For example, Harackiewicz, Barron, Tauer, and Elliot (2002) found that college students whose high level of academic achievement was backed by a similarly high level of interest in the domain of psychology were particularly likely to take classes and major in that domain. In addition, Harter (1986) found that children who are unable to discount the importance of domains where they have a lower SCA have lowered general self-esteem.

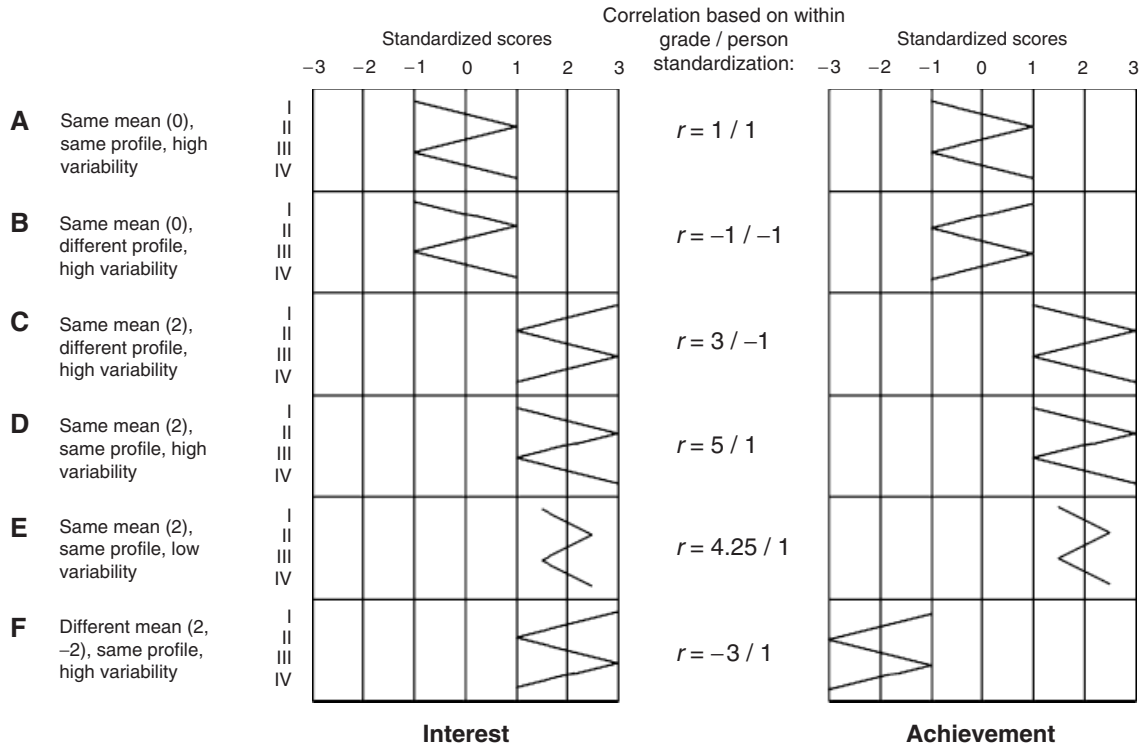

Figure 1. Differences and similarities of coupling indexes based on within-person versus within-grade standardized profiles.

Ontogeny of the Coupling of SCA, Interest, and Achievement

In this study, we investigate longitudinal changes in the strength of the coupling between interest, SCA, and achievement across domains using a person-centered approach. The purpose of the Eccles et al. E-V Model of Achievement-Related Choices is to predict the choices people make about how to distribute their time and energy across various achievement-related activities. According to this perspective, under optimal conditions, individuals will select those tasks for which they have the highest expectations for success and to which they attach the greatest subjective task value. Such decision making should be optimized when there is strong coupling between performance, SCA, and subjective task value both within and across activity domains. Such coupling will make it relatively easy for an individual to form a stable, hierarchical ordering of task preferences on which to base behavioral goals and choices. As developmentalists, we are interested in the ontogeny of such coupling. We assume that coupling increases with age due to the impact of cumulative experiences, increasing cognitive maturity, and social pressures to make more autonomous choices about how to spend one's time (cf. Eccles et al., 1998; Higgins & Eccles-Parsons, 1983; Parsons & Ruble, 1977; Ruble, Eisenberg, & Higgins, 1994) According to other researchers (Schiefele et al., 1993; Wigfield & Karpathian, 1991), the level of coupling may increase if reciprocal effects between variables give rise to stable within-person configurations.

Alternatively, an increase in coupling can be the result of one variable becoming more stable, allowing for the accumulation of unidirectional influences. The level of coupling may also increase due to so-called ''niche picking'' (Scarr, 1996). For example, an individual may decide to select a certain college major (e.g., cell biology) because of a high level of interest. Over time, this intellectual environment may lead to an increase in domain-specific knowledge (e.g., about cell biology; see Renninger, 2000) and the positivity of one's SCA (e.g., feeling competent as a cell biologist).

Scattered evidence suggests that the level of coupling between interest, SCA, and achievement indeed increases across time. For example, the previously mentioned study by Reeve and Hakel (2000) found that the coupling between interest and achievement was higher in senior high school students than in freshmen. Similarly, Wigfield et al. (1997) reported increases in the correlation between SCA and interest as children moved from first to sixth grade. In their meta-analysis, Schiefele et al. (1993) reported a (nonsignificant) trend for the association between interest and achievement to increase with time. Finally, Marsh and Ayotte (2003) showed that the correlation between the cognitive and affective components (including interests) of reading and math SCA increased between grades 2 and 6. These results are limited, however, because they were based on comparisons of product–moment correlations across different age groups or specifically focused on a particular domain. In contrast, the current study uses a longitudinal sample of over 900 Ss, holding enough power to model the *trajectory* of intra-individual coupling over time.

Personality and Gender as Moderators of the Coupling Between SCA, Interest, and Achievement

Another objective of the current study was to identify potential moderators of the shape of the longitudinal trajectories of coupling. Examining these moderators will help to generate hypotheses regarding the processes behind the establishment of coupling. In the present study, we chose to focus on two possible moderators: gender and one aspect of personality likely to influence motivation for coupling, conscientiousness.

Gender as a Moderator

Gender-stereotypic differences exist from quite young in both SCAs and interest, with girls reporting lower scores than boys for math and sports but higher levels for reading/language arts and instrumental music (Eccles et al., 1989, 1993; Eccles & Harold, 1992; Fredricks & Eccles, 2002; Huston, 1983; Marsh & Yeung, 1998; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991; Wigfield et al., 1997). Interestingly, these gender differences are not mirrored in measures of actual achievement at any age. Accordingly, mean gender differences in self-perceptions and values are not likely to be the consequence of gender differences in coupling across all three constructs.

Some evidence suggests that there may be gender differences in the extent of within-person coupling. For example, Reeve and Hakel (2000) found that boys had a consistently higher level of cross-sectional coupling than girls. Similarly, Eccles-Parsons et al. (1984) found stronger correlations between math grades and both math SCA and math-subjective task value for high school males than for females; however, this gender pattern did not replicate for English. In addition, in their meta-analysis,

Schiefele et al. (1993) found a significantly higher correlation between interest and achievement for boys (.24) than for girls (.16), although this difference was only significant for published studies. As an explanation for this finding, they speculated that girls may be more likely to put greater effort into academic subjects because they are expected to and less because they are interested. This would lead to a greater disconnect of one's SCA and subjective task value for girls than for boys. Also, boys have been found to be more single-minded about their interests, concentrating their energy in a few key domains, whereas girls were found to have a more diverse array of interests, distributing their cognitive resources across multiple domains simultaneously (Knox, Funk, Elliott, & Bush, 1998). Such a pattern would lead to more differentiated pattern of performance across achievement domains for males than for females—making it easier for males to carry out within-person comparisons of their performances across domains. If this is true, then males would be expected to have higher coupling than females. Because of this we hypothesize that older males will have higher levels of coupling than their female peers.

It is less clear exactly when gender differences in coupling might emerge. We could find no relevant empirical studies. Girls do mature cognitively, on average, slightly sooner than boys. Given that successful coupling requires sophisticated social comparison and internal comparison skills, one might expect such differentiation across domains to begin earlier in girls than in boys. However, if girls' achievements across domains are more consistent than males, their higher levels of cognitive skills are unlikely to provide them with any particular advantage with regard to coupling.

Conscientiousness as a Moderator

According to recent meta-analytic work by Ackerman and Heggestad (1997), there exist reliable associations between the personality traits and indexes of domain-specific interest and achievement (knowledge). In the current study, we focus on the trait of conscientiousness, which taps into individual differences in being disciplined and goal-oriented, because it has been shown to promote persistence in the face of difficulties (Sansone, Wiebe, & Morgan, 1999). Indeed, this feature of conscientiousness may be invoked to explain its positive association with academic achievement (Lüdtke, Trautwein, Nagy, & Koller, 2004; Paunonen & Ashton, 2001). In spite of the existence of positive variable-centered evidence, little is known about the moderating role of conscientiousness in person-centered indexes of the coupling between SCA, interest, and achievement. We predict that the greater self-monitoring skills of conscientious individuals are associated with a heightened sensitivity to information about one's competencies and a desire to focus attention on what one is good at, leading to a higher level of coupling.

Goals and Predictions of the Present Study

The current study has two broad objectives: (1) to explore whether mean levels of intraindividual coupling change across time and (2) to explore whether these trajectories are modified by gender and conscientiousness. We predict that coupling will increase as children grow older. We expect this increase to apply for the coupling between achievement and interest (AIC), achievement and SCA (ASC), and interest and SCA (ISC). We also predict that conscientiousness and gender will moderate individual differences in the longitudinal trajectories of coupling, with boys and conscientious children showing steeper trajectories and higher final levels of coupling.

Method

Participants

We used data from the Childhood and Beyond longitudinal study of the development and socialization of children's achievement motivation and behavior (for more information, see http://www.rcgd.isr.umich.edu/cab/research.htm). The first wave of data was collected in 1986 from three cohorts of children and their parents and teachers, beginning when the children were in kindergarten, first, and third grades. These children were followed for 4 consecutive years. After a 3-year gap, additional information was collected from children for 4 more consecutive years (see Table 1 for sample sizes across cohorts and grade levels). The interest and SCA measures were collected each spring, whereas the measure of academic achievement represents the average of all school marks of a particular year.

Approximately, 1,000 children and two thirds of their parents agreed to participate. Participants lived in four small- to medium-sized cities in southeastern Michigan. The sample was primarily European American, with a very small minority of African Americans and Asians, Indians, and Hispanics. Gender was almost perfectly balanced across all waves of data collection, with 51% of the overall

Table 1
Sample Sizes Across Cohorts and Grade Levels

Grade	Cohort 1	Cohort 2	Cohort 3	Total *n*
1	243/289			243/289
2	219/273	271/314		490/587
3	203/241	245/286		448/527
4		220/250	233/261	453/511
5			378/396	378/396
6			344/366	344/366
7	136–139/187			136–139/187
8	52/131	142–145/194		194–197/325
9	82–88/154	81/129		163–169/283
10		83–86/155	217–222/278	300–308/433
11			106/187	106/187
12		63–66/116	87–99/199	150–165/315

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); ISC = coupling between interest and SCA.
Sample sizes for AIC and ASC (different in some cases) are on the left, and those for ISC are on the right of the slash.

sample being female. In general, the families were middle or working class, two parent intact families (90% two parent). Family income in 1986 ranged from $10,000 to over $80,000, with an average income between $40,000 and $50,000.

Measures

The current study assessed interest, SCA, and achievement in three academic domains of (English, math, science), and two skill-based nonacademic domains (sports and instrumental music). Sampling these five domains provides a broad base over which both academically and non-academically-oriented children can achieve a high level of coupling.

Interest. Interest was assessed with two items that asked participants to rate their interest and enjoyment for each domain on a 1–7 Likert scale. Items consisted of ''I find (domain X) very boring–very interesting'' and ''I like (domain X) a little–a lot.'' Interest in science was not assessed until grade 6. Across the entire 12-year study period, the average α reliability of this two-item scale was .84. As usually found in personality assessment (Roberts & DelVecchio, 2000), reliabilities were lower for younger ages, ranging from .68 in grade 1 to .91 in grade 12 (average reliabilities were .85, .86, .76, .84, and .90 for math, English, instrumental music, sports, and science, respectively).

SCA. Domain-specific SCA was assessed with a subset of the following five items for each of the five domains: ''How good at (domain X) are you?,'' ''If you were to list all the students from best to worst in (domain X), where are you?,'' ''How well do you expect to do in (domain X) this year?,'' ''How good would you be at learning something new in (domain X)?,'' and ''How good do you think you would be in a career requiring (domain X) skills?.'' Not all items were used at every wave and for every domain. Most importantly, items assessing science SCA were only assessed from Wave 4 onwards, and items tapping into English and instrumental music SCA were not assessed in Wave 6. Additionally, some items were only available in certain waves (e.g. the item ''How good do you think you would be in a career requiring sports skills?'' was only available between Waves 5 and 8). To account for this scale heterogeneity, all items were standardized before they were averaged. Across all available grades, the α reliabilities for these aggregated scales ranged from .60 to .94, with an average value of .84.

Academic achievement. Domain-specific achievement was operationalized as the average yearly school mark for each subject. For instrumental music, marks were only available from grade 7 onwards. Because school grades constitute a direct form of performance feedback for both children and parents, they were deemed the best achievement indicator to use in the current study. To check for the relation of school marks to another indicator of academic ability, we correlated them with the results of standardized achievement tests, which were available in a number of grades. The mean correlation was .36 for English (range .10–.57), .34 for mathematics (range .05–.64), and .29 for science (range .20–.44). Following Flammer & Wiegand (1973), it can be assumed that the degree of interrater agreement among teachers in grading assignments equals .60. Because children were graded (at minimum) in the fall and in the spring, the reliability of the year average can be estimated at .75 (using the Spearman–Brown formula).

Conscientiousness

Because of the limited self-reflective abilities of the youngest children in the current sample, personality was assessed by means of parental ratings. In Waves 2, 3, and 4, parents had to rate how often their children exhibit a list of 28 characteristics using a 7-point Likert scale (1 = *rarely*, 7 = *most of the time*). Preliminary factor analyses of separate mother and father ratings indicated a clear conscientiousness factor across all waves. Based on the pattern of factor loadings ($\geq .60$) and item content, four child descriptors were deemed especially characteristic of

this factor: ''well-organized,'' ''perfectionist,'' ''persistent,'' and ''impulsive/makes errors'' (reverse coded). Accordingly, these items were combined into a single conscientiousness scale, with an average reliability of .71 (range .62–.75) across waves and raters. If possible, data were aggregated across time to conform to the multilevel framework. More specifically, by including the time-specific indexes in level 1, it is assumed that level 2 constitutes stable individual characteristics. By summing the personality indicators, this stable ''core'' is better captured than by using just one indicator gathered at the beginning of the study. Indeed, correlations between mother and father ratings across different waves ranged from .59 to .78. Aggregating the ratings of different waves into a single parent-specific index of conscientiousness resulted in highly reliable scales of .88 for both mother and father ratings.

Analysis Strategy

Assessment of coupling. To assess coupling, we calculated intraindividual correlations between children's domain-specific SCA, interest, and achievement profiles (Cronbach & Gleser, 1953), a procedure that was also used in previous studies (Pelham, 1995; Reeve & Hakel, 2000; Roberts & Robins, 2004). Specifically, interests, SCAs, and/or school marks were first standardized (in two different ways) and then used to calculate the average of the domain-specific cross-products (this is the formula for the well-known Pearson correlation). Figure 1 shows a range of possible interest and achievement profiles across four domains (I–IV). For example, in case D, the interest and achievement profile both have a high *elevation* and the same *form* (a *Z* shape), resulting in highly positive coupling indexes. Note that a pure within-person correlation is only dependent on the similarity of the form of a person's SCA, interest, and achievement profiles, as information about profile elevation is removed by standardizing each variable within persons. This is related to some methodological difficulties, most notably with ignoring differences in profile variability or *differentiation* (e.g., example D vs. E) and elevation (e.g., example D vs. F). Because of this, we also investigated an alternative index of profile similarity based on variables that are standardized within school grades, thus retaining information regarding profile elevation as compared with other children. As can be seen in Figure 1, if the mean elevation of both profiles is zero, these two indexes do not differ from each other (examples A and B). However, to the extent that profile means drift away from zero, the coupling index based on within-grade standardized components can be at odds with the similarity of the profiles based on within-person standardized components (examples C and F). In the following, we include the suffixes ''/p'' and ''/g'' in the coupling indexes to indicate these respective standardization procedures (e.g., AIC/g refers to the coupling coefficient between achievement and interest based on within-grade standardized profiles, whereas AIC/p refers to the coupling based on within-person standardized profiles).

Modeling longitudinal trajectories. We used HLM (Bryk & Raudenbush, 1992) as a tool to model the development of the coupling between SCA, interest, and achievement over time. Both the within-person and within-grade standardized AIC, ASC, and ISC indexes were inserted as the dependent variables of the level 1 model, with linear and quadratic time (centered at grade 6) as independent variables. Because these indexes are based on a slightly different mix of academic subjects across time (see Table 2), we included both the total number of academic subjects and the availability of sports, instrumental music, and science components (coded as dummy variables) as covariates (as sports was included in 99.5% of all ISC couplings, no corresponding dummy was included in this case). After first testing the full saturated model, nonsignificant covariates

Table 2
Number and Percentage of Coupling Indexes Including Information From Different Academic Subjects

	EN		MA		SC		SP		MU		
Index	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	Total
AIC	3,149	92.8	3,358	99.0	1,275	37.6	2,099	61.9	287	8.5	3,393
ASC	3,151	92.9	3,354	98.9	1,278	37.7	2,099	61.9	305	9.0	3,393
ISC	3,957	89.8	4,402	99.9	2,042	46.3	4,386	99.5	3,594	81.6	4,406

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); EN = English; ISC = coupling between interest and SCA; MA = math; SC = science; SP = sports; MU = instrumental music.

($p > .10$) were removed from the model, until only predictors that were at least marginally significant were left. Nonsignificant growth parameters ($p > .05$) were then removed (when this resulted in some covariates becoming nonsignificant, these were excluded as well). In addition to providing model parameters and their significance level, HLM also gives an estimate of the level 1 variability in these parameters. When this estimate was significant, the current study examined the moderating effect of gender and personality on the individual-specific growth parameters. In addition, we tested for the influence of cohort membership by including it as a set of dummy variables (Miyazaki & Raudenbush, 2000).

Results

Mean Levels and Stabilities

Table 3 presents the means and standard deviations of the different coupling indexes across grades. From these results, a number of general conclusions can be drawn. First, there is a general convergence of the indexes based on within-person and within-grade standardized components. To investigate this association more closely, we calculated the correlation between the two indexes for each content domain across all 12 grades. The results showed that the association was moderate for AIC ($r = .52$, $p = .09$), and high for both ASC ($r = .81$, $p < .01$) and ISC ($r = .92$, $p < .01$). Moreover, in the latter case, the person-standardized level of coupling was lower than the grade-standardized level, with a mean difference of .18 points.

Table 4 presents the 1-year retest stability correlations of the different indexes sorted by grade. For ISC/g, stability was consistently significant and reached moderate levels (.41). In addition, the levels of stability seemed to increase with grade, ranging from .20 between grades 1 and 2 to .63 between grades 11 and 12 (correlation with grade level = .79, $p < .01$). For AIC/g and ASC/g, however, periods of substantial stability (e.g., grades 4–6, 8–10) alternated with periods of instability (grades 1–2, 10–12). Subsequent analysis showed that this was likely caused by a parallel change in the 1-year stability of school marks, with the average stability correlation being .43 for grades 1–4 and 10–12 versus .82 for grades 5–10.

For the within-person standardized indexes, stabilities were quite low and generally insignificant for AIC and ASC. However, it should be noted that stabilities are not only impaired by a lack of

Table 3
Reliabilities, Mean Levels, and Standard Deviations of Coupling, Reported Separated by Grade Level and Component Standardization Procedure

	AIC							ASC							ISC						
		/g			/p				/g			/p				/g			/p		
Grade	α	*M*	*M′*	*SD*	*M*	*M′*	*SD*	α	*M*	*M′*	*SD*	*M*	*M′*	*SD*	α	*M*	*M′*	*SD*	*M*	*M′*	*SD*
1	.71	.01	.01	0.76	.06	.08	.51	.72	.08	.11	0.76	.06	.09	.49	.69	.35	.51	.64	.21	.30	.43
2	.77	.11	.14	0.67	.08	.10	.50	.74	.22	.30	0.71	.11	.15	.52	.75	.43	.57	.68	.30	.40	.39
3	.80	.12	.15	0.63	.08	.11	.51	.74	.22	.30	0.63	.14	.19	.51	.79	.48	.61	.73	.35	.45	.38
4	.80	.05	.07	0.60	.11	.14	.46	.78	.18	.24	0.66	.18	.23	.46	.84	.54	.65	.71	.36	.43	.37
5	.81	.08	.10	0.61	.07	.09	.51	.78	.26	.33	0.67	.15	.19	.52	.84	.60	.71	.67	.40	.47	.37
6	.83	.05	.06	0.59	.10	.12	.43	.79	.12	.15	0.57	.12	.15	.43	.88	.59	.68	.56	.45	.52	.33
7	.81	.17	.22	0.50	.11	.13	.41	.81	.29	.35	0.63	.20	.25	.38	.87	.71	.81	.59	.52	.59	.26
8	.82	.20	.24	0.50	.12	.15	.43	.82	.30	.37	0.48	.21	.25	.44	.89	.72	.80	.65	.51	.57	.31
9	.82	.20	.25	0.54	.16	.19	.43	.82	.33	.40	0.60	.22	.27	.42	.90	.70	.77	.69	.46	.51	.34
10	.82	.24	.30	0.60	.17	.20	.42	.82	.35	.42	0.55	.22	.27	.40	.90	.70	.78	.57	.56	.62	.25
11	.83	.06	.08	1.10	.16	.19	.47	.84	.12	.15	1.11	.11	.13	.49	.93	.77	.83	.71	.43	.47	.33
12	.83	.15	.18	0.46	.06	.07	.50	.82	.22	.27	0.45	.11	.13	.49	.91	.74	.82	.61	.55	.60	.28
Mean	.80	.12	.15	0.63	.11	.13	.47	.79	.22	.28	0.65	.15	.19	.46	.79	.85	.61	.71	.65	.43	.50

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and SCA; ISC = coupling between interest and SCA; /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons; *M* = mean; *M′* = mean corrected for attenuation; *SD* = standard deviation.
The reliability of the coupling indices was calculated by taking the square root of the product of the reliabilities of each pair of coupling components. Owing to the mixed cohort design of the present study, mean levels do not necessarily refer to the same sets of individuals (see Table 1 for sample sizes per cohort/grade).

Table 4
One-Year Stability of Different Coupling Indexes

	AIC			ASC			ISC		
Stability	n[a]	/g	/p	n	/g	/p	n	/g	/p
1 – 2	188	– .09	.04	188	.08	– .02	245	.16**	.02
2 – 3	409	.15**	.06	409	.16**	– .02	508	.26**	.11**
3 – 4	207	.12	.06	207	.04	.02	245	.46**	.15*
4 – 5	219	.35**	.02	219	.53**	.13	239	.34**	.17**
5 – 6	341	.28**	.08	341	.54**	.12*	361	.28**	.27**
7 – 8	51	.07	.04	51.5	.42**	.13	125	.40**	.11
8 – 9	115	.22*	.17	117	.27**	.14	239	.36**	.02
9 – 10	64	.59**	.07	64.5	.66**	– .10	114	.62**	.15
10 – 11	100	.11	– .16	101	.12	– .05	173	.45**	.17*
11 – 12	69	.02	– .12	71	.03	.05	151	.60**	.14
Mean		.19	.03		.29	.04		.41	.14

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); ISC = coupling between interest and SCA; /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons.
Mean correlation after Fisher *r*-to-*Z* transformation. Between grades 6 and 7, no stability coefficient could be calculated.
[a]In some cases, sample sizes differed slightly for /g and /p standardized indices; hence, statistical power to detect significant results varied across correlations. Reported sample sizes were averaged across standardization procedure.
*$p < .05$, **$p < .01$.

reliability. They can also be reduced because of differential growth patterns, which might depend on personality indicators. Finally, stabilities for ISC/p were mostly significant, although generally smaller than the stabilities for the within-grade standardized index. The latter finding is probably due to the fact that the /g indexes include information about profile elevation, whereas the /p indexes only include information about profile form. Accordingly, the substantial mean-level stability observed in the present data (average 1-year $r = .47$ for interest, $r = .60$ for SCA) could only act as a stabilizing force in the case of the /g indexes but not in the case of the /p indexes.

Multilevel Analyses

In the following, the results of the HLM growth curve analyses are presented for each coupling index and standardization method separately (see Figure 2 for a graphical depiction of the different growth curves).

AIC. In the final model for AIC/g, the intercept was significantly different from zero and the linear trend was significant (see Table 5). For both coefficients, individual level variability was highly significant ($ps < .01$). Further analysis showed that there were no cohort differences in the growth parameters, and there was no effect of either the content or the number of coupling components, $ps > .10$).

For the within-person standardized AIC/p index, the intercept was significantly different from zero. The time parameters indicated that its longitudinal trajectory was characterized by a significant linear increase. The individual-specific variability in these parameters was not significant and there were no

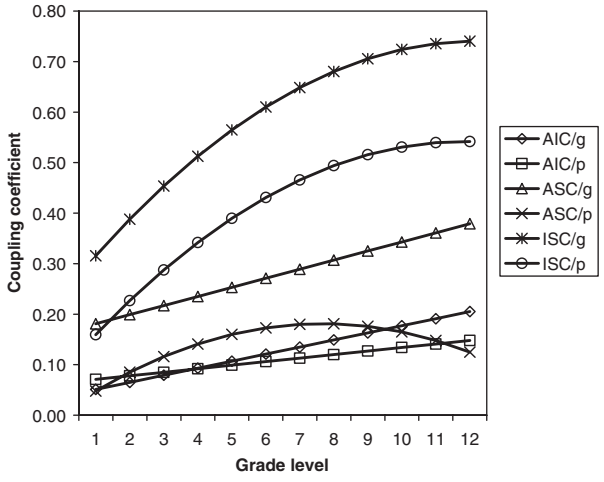

Figure 2. Growth trajectories of different coupling indexes between grades 1 and 12. AIC = coupling between achievement and interest, ASC = coupling between achievement and self-concept of ability (SCA), ISC = coupling between interest and SCA, /g = index of profile form and mean-level similarity, based on components standardized within grades, /p = index of profile form similarity, based on components standardized within persons.

Table 5
Hierarchical Linear Modeling (HLM) Regression Weights Indicating the Intercept and Growth Parameters of the Trajectory of Achievement × Interest Coupling

Index	Parameter	*b*	*p*	*SD*	*p*
AIC/g	Intercept	.121	.00	.173	.00
	Linear slope	.014	.00	.052	.00
	Residual			.584	
	Deviance	6,476			
AIC/p	Intercept	.106	.00	.076	.15
	Linear slope	.007	.01	.024	.12
	Residual			.461	
	Deviance	4,585			

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons.
Number of level 1 units: 971.

Table 7
Hierarchical Linear Modeling (HLM) Regression Weights Indicating the Intercept and Growth Parameters of the Trajectory of Interest × Self-Concept

Index	Parameter	*b*	*p*	*SD*	*p*
ISC/g	Intercept	.610	.00	.346	.00
	Linear slope	.042	.00	.060	.00
	Curvilinear slope	− .003	.00	.005	.01
	Residual			.533	
	Deviance	8,288			
ISC/p	Intercept	.431	.00	.141	.00
	Linear slope	.038	.00	.025	.00
	Curvilinear slope	− .003	.00	.005	.10
	Residual			.327	
	Deviance	3,386			

Note. ISC = coupling between interest and SCA; /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons.
Number of level 1 units: 1,069.

differences between cohorts. As for the AIC/g index, there were no effects of the content or the number of coupling components.

ASC. The intercept for ASC/g was significantly different from zero (see Table 6). There was a significant linear increase across time ($p < .01$). Individual-level variation in these parameters was highly significant. In addition, there was a significant association between the level of coupling and both the number of included academic domains and the inclusion of science ($b = .068$, $p < .01$ and $b = -.105$, $p < .01$, respectively). Thus, the level of coupling was higher if profiles included a large number of domains in general and lower if it included science education. Accordingly, both variables were retained as covariates in subsequent analyses.

Table 6
Hierarchical Linear Modeling (HLM) Regression Weights Indicating the Intercept and Growth Parameters of the Trajectory of Achievement × Self-Concept

Index	Parameter	*b*	*p*	*SD*	*p*
ASC/g	Intercept	.271	.00	.233	.00
	Linear slope	.018	.00	.055	.00
	Residual			.589	
	Deviance	6,718			
ASC/p	Intercept	.173	.00	.087	> .50
	Linear slope	.010	.00	.022	> .50
	Curvilinear slope	− .003	.00	.003	> .50
	Residual			.460	
	Deviance	4,567			

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons.
Number of level 1 units: 971.

The intercept of the ASC/p model was significant and positive. There was a significantly positive linear and negative curvilinear (decelerating) increase across time. In addition, individuals from Cohort 2 had a significantly higher intercept ($b = .058$, $p < .01$). When this effect was controlled for, individual-level variation was not significant for any of the parameters.

ISC. In the case of ISC/g, the intercept was quite large and highly significant (see Table 7). Also, the parameters for the linear and curvilinear trends were significant, describing a pattern of decelerated growth. All parameters had significant variation at the individual level. Cohort effects were not significant.

For ISC/p, parameters were similar, with a significantly positive intercept and linear and quadratic slopes. Likewise, individual variation in parameters was significant. In addition, the ISC/p index was significantly predicted by the number of components included in the calculation ($b = .074$, $p < .00$) and marginally significantly by the inclusion of science education in the profile ($b = -.042$, $p = .07$). Paralleling the results for ASC/g, the level of ISC/p coupling was higher if profiles included a large number of domains in general but lower if it included science education. In addition, individuals

from Cohort 1 had a higher coupling intercept ($b = .033$, $p = .03$).

Possible Artifacts

Because the interest and SCA measures used in the present study were less reliable in younger ages (they increased from approximately .70 in grade 1 to around .90 in grade 12), it could be argued that the increase in coupling is due to a methodological artifact due to an attenuation of correlations. To test this possibility, reliabilities of the coupling indexes were estimated by calculating the square root of the product of the reliabilities of their constituting variables. As can be seen in Table 3, these reliabilities indeed increase with age. Accordingly, the mean coupling levels were corrected by dividing the raw mean by the corresponding reliability estimate for each grade level (columns M'). As can be seen, this correction did not remove the time trends observed for the different coupling indexes.

HLM Analyses With Conscientiousness and Gender as Level 2 Moderators of Coupling

In a second set of analyses, gender and conscientiousness were used as level 2 predictors of the time parameters in the level 1 equation that were characterized by a significant level of person-specific variability. Thus, we tried to use information about participants' stable characteristics to predict the average level of coupling and linear and/or quadratic changes across time. The level 2 equations for predicting the intercept and the linear and quadratic time trends included a random person-specific coefficient, but for reasons of model economy, we used only fixed effects to account for the covariates. To maximize sample sizes, we conducted separate analyses for each set of moderator variables (conscientiousness as rated by fathers and mothers, gender). The results of the HLM moderator analyses are presented in Table 8 and are discussed individually for each coupling index in the following section.

AIC/g. At a significance level of $p < .01$, female gender emerged as a negative predictor of the AIC/g intercept. Moreover, conscientiousness as rated by the child's father was positively related to the overall level of coupling between achievement and interest. Accordingly, male and highly conscientious individuals had a higher degree of coupling between their achievement and interest profiles.

ASC/g. For the coupling between achievement and SCA, a number of moderator effects were significant at the .01 level. Again, female gender was related to a lower level of coupling. Moreover, mother ratings of their children's conscientiousness were significantly positively related to the intercept. Thus, males and highly conscientious children had a higher level of correspondence between achievement and SCA.

ISC/g and ISC/p. No significant moderator effects were found for these indexes of the amount of coupling between interest and SCA.

Discussion

We analyzed the longitudinal development of the intraindividual coupling between academic achievement, interest, and SCA. The significantly positive level of intraindividual coupling found between these constructs supports earlier variable-centered research findings, such as Ackerman and Heggestad's (1997) in which ability and interest were found

Table 8
Hierarchical Linear Modeling (HLM) Regression Weights of (Marginally) Significant Moderators of Gender and Conscientiousness on the Average Level of Coupling

		AIC/g		ASC/g		ISC/g		ISC/p	
	Rater	*b*	*p*	*b*	*p*	*b*	*p*	*b*	*p*
Gender[a]		−.058	.02	−.085	.00				
Conscientiousness	Mother			.036	.04				
	Father	.049	.00						

Note. AIC = coupling between achievement and interest; ASC = coupling between achievement and self-concept of ability (SCA); ISC = coupling between interest and SCA; /g = index of profile form and mean-level similarity, based on components standardized within grades; /p = index of profile form similarity, based on components standardized within persons.
Final HLM models included all significant Level 1 and Level 2 covariates as well as gender. $N = 971–1{,}069$ for gender, $n = 541–579$ for mother ratings, $n = 389–413$ for father ratings). Because of fluctuating sample sizes, statistical power to detect significant results varied across analyses.
[a]Dummy coded as 0 for boys and 1 for girls.

to correlate in trait/ability/interest complexes in adulthood. Moreover, this study showed the generality of this process of coupling between different combinations of achievement-related constructs (i.e., interest, SCA, achievement), thus expanding previous analyses that focused on only the coupling between two of these constructs at a time (e.g., Reeve & Hakel, 2000; Schiefele, Krapp, & Winteler, 1992) and narrowly on a specific domain (e.g., Marsh et al., 2005).

Another extension of previous research is the comparison of two different coupling indexes that used different ways to standardize interest, SCA, and achievement scores. Whereas the index based on within-grade standardized information takes into account similarities in both profile elevation and form, the index based on within-person standardized information only takes into account similarities in form. As it ignores differences between individuals, this latter index is purely person-centered in nature. The fact that the level of coupling found with this index was substantially different from zero and increased across age indicates that children showed a high degree of ''specialization'' whereby, compared with other domains of the same person, the domain in which he or she felt most interested was generally the same domain in which he or she felt most competent. This source of variance is completely missed in traditional variable-centered research.

Although the level of coupling was positive for all calculated indexes, clear differences in the magnitude of coupling emerged. Of our three indexes, the coupling between interest and SCA was the greatest in magnitude. This could be due to the relatively intrapsychic nature of these variables, which are more malleable than behavioral indexes, such as school marks. Consistent with this, Roberts and Robins (2004) found that it is easier for individuals to establish a fit between their own personalities and their perceived versus their objective environments, because perceptions are often easier to change than environmental circumstances.

Furthermore, the high degree of coupling between interest and SCA makes conceptual sense and supports earlier theoretical and empirical work. For example, the Eccles' et al. (1983) E-V model highlights links between expectancies and values and between SCA and interest. Finally, the higher degree of coupling between SCA and achievement compared with interest and achievement is consistent with the theoretical predictions by Bandura (1986; see also Lent et al., 1994), who hypothesized that the link between achievement and interest is mediated by SCA, and by Eccles and her colleagues (see Eccles et al., 1998; Jacobs et al., 2002), who have argued that the valuing of an activity is influenced by many factors other than performance, such as those factors linked to the internalization of various social roles. The modest coupling between interest and achievement is also consistent with the previously mentioned study by Renninger et al. (2002), who found that not all students who perform well in a certain domain develop a corresponding interest.

Whereas the /g coupling between achievement and SCA reached a moderate level and increased across time, the corresponding /p coupling was quite low and did not show a linear increase. Because the within-person *SD* for school marks was lower than for interest and achievement (.51 vs. 82), restriction of range offers a likely, although incomplete, explanation for the low level of /p coupling (the average within-person *SD* was positively correlated with the corresponding ASC/p index, $r = .14$, $p < .01$). Second, the curvilinear pattern found for the ASC/p index was mainly caused by a sharp decline in coupling after the 10th grade, which may reflect peculiar features of the grading system during that period. In spite of this, the current findings are inconsistent with Marsh's (1986) Internal–External Comparison Theory of the development of SCA, which predicts an increasing SCA profile differentiation over time based on *within-person* contrast processes across academic domains. Of course, it should be noted that this theory was developed to explain the low correlation between math and English SCA, whereas the current study used information across a wider range of academic and nonacademic domains. Although we had school-based information on the children's competence in each of these domains, this information may have differed in its salience and perceived diagnosticity of actual competence. If so, then these indicators may not have been equally informative to individuals' own internal achievement-related performance comparisons (e.g., instrumental music vs. math). Nevertheless, the fact that such comparisons apparently were not very influential in the current study points out the need for further empirical tests of Marsh's (1986) theory. Because his theory has thus far been supported mainly with variable-centered data (with the exception of Bong, 1998; Dickhäuser, 2005), multilevel analyses would be ideally suited for such an endeavor.

With the exception of the ASC/p index (but including the ASC/g index), there was a clear increase in the level of coupling across age, which took place regardless of which profiles were correlated or how these profiles were standardized. This result is in line with our hypothesis and replicates previous findings

by Reeve and Hakel (2000) using the person-centered approach and by Eccles-Parsons et al. (1983), Schiefele et al. (1993), Wigfield et al. (1997), Fredricks and Eccles (2002), and Jacobs et al. (2002) using variable-centered approaches. According to Schiefele et al. (1993), such an increase can take place because of accumulating reciprocal influences between achievement, SCA, and interest. For example, a high level of interest in a domain may lead to an increased level of effort and persistence, resulting in higher achievement levels that may in turn reinforce the already high level of interest, and so forth. As the current design focused on concurrent levels of coupling, it was not possible to test cross-lagged associations between variables, although previous research (e.g., Eccles-Parsons et al., 1983; Marsh et al., 2005) suggests they indeed exist.

Second, coupling can increase because one or both of its constituting variables become more stable across time, allowing for an accumulation of unidirectional effects. Additional analyses suggested that this is also a likely explanation for the current results. Specifically, the 1-year stabilities of interest and SCA showed a marked increase with time (*r*s with grade level = .79 and .89, respectively, *p*s < .01), although no such increase was found in the case of achievement (due to the previously mentioned decline in stability in later school years). Accordingly, the greatest increase in coupling was indeed found between the two variables that were characterized by increasing stability (i.e., interest and SCA).

Third, the increase can represent increases in cognitive abilities as the children mature. Many developmental psychologists have documented increases in the association of beliefs and experience within an activity domain as children move through elementary school (see Eccles et al., 1998; Wigfield, Eccles, Schiefele, Roeser & Davis-Kean, 2006, for reviews). Similar processes likely underlie the coupling of beliefs across domains.

Moderators of the Coupling Between Achievement and Interest/SCA: Gender

Sex differences in these coupling indexes are important to study further because this study, along with past research (Bandura, 1997, 1986; Eccles et al., 1983; Meece, Wigfield, & Eccles, 1990), indicates that both competence-related beliefs and interests are strongly related to achievement and choices. In the current study, female gender had a negative effect on the coupling between achievement and interest and achievement and SCA (based on grade-centered profiles). This finding is in line with previous findings by Reeve and Hakel (2000) and Schiefele et al. (1993). There are several possible reasons for this gender difference. Reeve and Hakel (2000), Schiefele et al. (1993), and Eccles and her colleagues (e.g., Eccles, 1994; Eccles-Parsons, 1985) have all proposed that gender differences in coupling between interest and knowledge may be due to sociocultural norms that encourage males to concentrate their achievement-related efforts on the domains they are most interested in and most competent at. In addition, it has been suggested that girls are socialized to do well across domains, whereas boys are socialized to be good at particular domains (Eccles-Parsons, 1985; Edwards & Wilson, 1958). As a result, girls may show high achievement in all domains, regardless of what their interests are. Supplementary analysis supported this interpretation, in that the girls' achievement profiles were characterized by a significantly smaller standard deviation than boys' profiles.

In addition, across academic domains and school years, girls had somewhat better school marks than boys, although the difference was small and only marginally significant. Girls' tendency to focus at doing well in all domains may result in a lower likelihood of their becoming exceptionally proficient in any one domain (e.g., in the domain they enjoy most and feel most competent in) because their time and resources (energy) are so broadly distributed across a range of domains. Of course, this conclusion is limited to the academic and nonacademic domains that were studied in the current report. It is important to carry out further studies that include other domains, such as social or artistic skills.

Of course, it is not clear from the current set of analyses whether women will or will not be at a disadvantage because of their lower levels of coupling. On the one hand, lower coupling could be detrimental to girls in fields like mathematics, physical science, and information technology that require individuals to specialize early in their academic careers (taking required courses and following a particular academic and occupational pathway). On the other hand, it may be that the lower coupling for girls, combined with their higher, more uniform level of achievement, better prepare them for entering and succeeding in college, for lifelong learning in a broad array of domains, and for success in occupational settings that require breadth of knowledge and flexibility. Such skills and motivational orientations may be particularly adaptive in the 21st century when people may well be expected to change careers several times over their lifetime. In any case, future research should investigate the

possible processes involved in gender differences in the coupling between interest, SCA, achievement, and how the coupling between these constructs is related to subsequent educational and occupational choice and achievement.

Moderators of the Coupling Between Achievement, Interest, and SCA: Conscientiousness

As predicted, conscientiousness was positively related to the level of coupling, and this effect was consistent across multiple indexes (AIC and ASC) and raters. We believe that this effect results from highly conscientious individuals being more tightly focused on achievement and performance feedback. This could cause them to adjust their SCAs and interests to performance information across domains so that they can best focus their efforts on what they are both good at and value. Thus, conscientiousness could lead students to work harder on the subjects they both feel most competent in and find most interesting. Interestingly, Sansone et al. (1999) also found a positive association of conscientiousness with persisting at a task, regardless of the direct benefits of doing so. This persisting attitude may be one of the reasons for the positive association between conscientiousness and academic achievement (Chamorro-Premuzic & Furnham, 2003), which was replicated in the current study ($r = .28$ and .29 between achievement and conscientiousness rated by mothers and fathers, respectively, $ps < .01$).

Pathways to Coupling: Recommendations for Future Research

As stated in the introduction, a high degree of coupling between interest, SCA, and achievement, when based on profiles that are standardized between persons (e.g., the current/g index), is dependent on three elements. First of all, mean level congruence can be achieved by bidirectional influences between variables or because one highly stable variable exerts a cumulative influence on the other. Another possibility is that coupling is fostered by occupying achievement-related niches that nurture interest, SCA, and achievement simultaneously (Scarr, 1996). Third, coupling is constrained by the degree of profile differentiation. Indeed, subsequent analyses (not reported) showed that profiles with a reduced standard deviation were indeed associated with a lower level of coupling, and are a likely cause for girls' lower levels' of AIC and ASC coupling. Interestingly, a negative association between profile mean level and variability was found for interest and SCA. Apparently, then, thinking one is good at everything across the board and liking all academic subjects indiscriminately leads to less coupling between these two beliefs. Future research should investigate the short- and long-term consequences of these different sources of coupling between interest, SCA, and achievement. As we have speculated, high levels of coupling are likely to have two benefits: (a) it functions to increase proficiency in those activities one values the most because it directs a person's resources toward domains that are self-congruent, and (b) a stable constellation of interest, SCA, and achievement may contribute to a person's sense of consistency and coherence. But too high of a coupling may serve to harm one's skill acquisition and decrease flexibility. This may be especially costly if it occurs at too young an age or in future labor market situations where people will be expected to change careers and jobs fairly often and to ''re-invent'' themselves for new jobs. It may also be detrimental if life circumstances or life events require one to change directions and develop new skills. Under these circumstances, a looser coupling may be more adaptive.

Strengths and Limitations

The current study has a number of strengths. First, it used a large, longitudinal, cohort-sequential sample that allowed for the modeling of intraindividual trajectories and the disentangling of maturational and cohort effects. Second, it used a larger number of academic domains than previous studies, such as the one by Marsh et al. (2005). Third, the current study systematically investigated the impact of different kinds of profile information (i.e., elevation, differentiation, and form), which allowed for a more precise discussion of the processes behind the development of coupling.

The current study also has a number of weaknesses that limit the generalizability of its results. First, the studied age span does not provide a comprehensive picture of the development of the coupling between SCA, interest, and achievement across the life span. Second, our sample was quite homogeneous with regard to race and socioeconomic status. Third, generalizability is limited by the large amount of missing data for the parental personality ratings, as well by the fact that parental judgments may be confounded with halo biases related to some of the current outcomes (e.g., basing perceptions of children's conscientiousness on their grade level). Finally, the design was restricted with regard to the scope of the measures and domains that were

studied. For example, the current measurement of interest was mainly concentrated on affective reactions to academic subjects while ignoring other aspects such as having a substantial level of domain-specific knowledge (Renninger, 2000). Furthermore, it may be that the inclusion of even more domains (e.g., SCA in social relationships) may have allowed more individuals to achieve a high level of coupling. It should be noted, however, that this restriction in the number of domains examined made the identification of significant associations more difficult. The fact that the present study uncovered significant cross-sectional and longitudinal trends adds credence to the validity of our findings.

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