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Language and Internalizing and Externalizing Behavioral Adjustment: Developmental Pathways from Childhood to Adolescence

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Abstract

Two independent prospective longitudinal studies that cumulatively spanned the age interval from 4 years to 14 years used multi-wave designs to investigate developmental associations between language and behavioral adjustment (internalizing and externalizing behavior problems). Altogether 224 children, their mothers, and teachers provided data. Series of nested path analysis models were used to determine the most parsimonious and plausible paths among the three constructs over and above stability in each across age and their covariation at each age. In both studies, children with poorer language skills in early childhood had more internalizing behavior problems in later childhood and in early adolescence. These developmental paths between language and behavioral adjustment held after taking into consideration children's nonverbal intellectual functioning, maternal verbal intelligence, education, parenting knowledge, and social desirability bias, as well as family socioeconomic status, and they applied equally to girls and boys.

A unique longitudinal relation obtains when one intrapersonal characteristic influences another over time apart from temporal stability in each and their concurrent covariation. Such developmental paths are conservative and robust and imply that one characteristic shapes another in more than a transient way. Here, in two independent prospective longitudinal multimethod multi-informant converging analyses, we report such pathways between language and internalizing and externalizing behavior problems from early childhood to early adolescence. The primary questions addressed by our developmental analyses were: What are the adolescent language outcomes for young children with different levels of behavioral adjustment, and what are the adolescent behavioral adjustment outcomes for young children with different levels of language skills? Two secondary questions were presumptive to these primary questions. Are language and internalizing and externalizing behavioral adjustment stable individual-difference constructs from childhood to adolescence? What are the interconnections between language and these two forms of behavioral adjustment at different time points from childhood to adolescence?

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Language and Behavioral Adjustment in Childhood and Adolescence

Language is a fundamental skill and a cornerstone of multiple cognitive and socioemotional aspects of development (Gleason & Ratner, 2008; Hoff, 2008). It is also a necessary ingredient of successful social adjustment and functioning in society. Behavioral adjustment is likewise a basic ontogenetic functional adaptation. Extremes of maladjustment are commonly dichotomized into two empirically established distinctive syndromes of behavior problems (Achenbach, 2000; Campbell, 1995). Internalizing or overcontrolled behavior problems are reflected in withdrawal, anxiety, depression, and dysphoria as well as feelings of inferiority, self-consciousness, shyness, hypersensitivity, and somatic complaints. Externalizing or undercontrolled behavior problems are characterized by defiance, impulsivity, disruptiveness, aggression, antisociality, and overactivity as well as problems with attention, self-regulation, and noncompliance (Achenbach, Howell, Quay, & Conners, 1991; Allen & Prior, 1995; Bornstein, Hahn, & Haynes, 2010; Caspi, Henry, McGee, Moffitt, & Silva, 1995).

Studies from child psychiatry, developmental science, and psycholinguistics have historically hinted at comorbidity between language and behavioral maladjustment at various developmental periods from infancy through adolescence to adulthood (Beitchman et al., 2001; Fuijiki, Brinton, & Todd, 1996; Johnson et al., 1999; Mawhood, Howlin, & Rutter, 2000; Petrill, 2005; Rapin, 1998; Stattin & Klackenberg-Larsson, 1993; Stevenson, 1996; Williams & McGee, 1996). Moreover, these associations have obtained after controlling for ethnicity, socioeconomic status, academic attainment, and test motivation (Evans, 1996; Lynam, Moffitt, & Stouthamer-Loeber, 1993). Specific to the age range examined in the two present studies, approximately one-half of school-aged children who have psychosocial and emotional disorders exhibit problems with language and communication (Baker & Cantwell, 1977), and teachers and parents both rate 5-year-old speech/language-impaired children as having more behavioral problems than typically developing children (Beitchman, Nair, Clegg, Ferguson, & Patel, 1986). Rates of language impairment reach 24% to 65% in samples of children identified as exhibiting disruptive behaviors (Benasich, Curtiss, & Tallal, 1993), and 59% to 80% of children identified as exhibiting language delays also exhibit disruptive behaviors (Beitchman et al., 1996; Brinton & Fujiki, 1993).

The literature linking language proficiency and behavioral adjustment is consistent and convergent, but most research in the field has been cross-sectional and descriptive or correlational, and so is more suggestive than determinative because it has failed to institute proper or meaningful controls on method, design, or analysis to disentangle direction of effects, specificity of effects, or covarying effects. For example, longitudinal connections between language and behavioral adjustment could reflect their high initial association or their stability. One goal of the developmental path analyses undertaken here was to overcome these shortcomings and disambiguate mutually confounding considerations to expose potentially causative connections.

Modeling Possible Developmental Paths

What directional relations obtain between language and internalizing and externalizing forms of behavioral adjustment across childhood and into adolescence? Several possibilities present themselves (Hinshaw, 1992; Masten & Curtis, 2000). First, poor behavioral adjustment might limit language development, perhaps because children are too depressed, self-consumed, or occupied with acting out to acquire competent language. Anxiety (internalizing) or aggression (externalizing) during social interactions might undermine the use of language. Aggressive children tend to generate more action-oriented, and fewer verbal, solutions in response to social dilemmas (Lochman, Lampron, & Rabiner, 1989).

Alternatively, language might play a central role in the emergence and development of internalizing and externalizing behavior problems (Lynam & Henry, 2001). Achieving verbal competency constitutes a key criterion by which children are judged by others and by themselves. Language deficiencies could negatively influence children's perceptions or judgments of themselves or others and could lead over time to the development of behavioral adjustment problems. Limited verbal abilities may reduce the capacity for self-control and inhibit social problem-solving, and children who are less able to reason or assert themselves verbally may aggress to gain control in social exchanges. General failures to master cognitive tasks create vulnerabilities for future social and emotional failures (Cicchetti & Schneider-Rosen, 1986). Likewise, competency-based models of depression propose that feedback from others (parents, peers, teachers) across different domains of performance (including language) affects self-image and subsequently the development of depressive symptoms (Cole, 1990, 1991). Insofar as language helps to regulate both self-control and achievement, children with less optimal language skills might, out of frustration, become depressed/withdrawn or aggressive/disruptive. It is hardly surprising that, when children experience difficulty understanding others and expressing themselves, psychosocial and emotional adjustment problems ensue. Children who are poor communicators do not send clear messages and therefore may be difficult to understand and respond to appropriately, and they may have fewer positive interactions with others. In short, language failures might contribute to socioemotional symptomatology.

It is also possible that language and behavioral adjustment develop from common underlying endogenous or exogenous influences (Hill, 2001) so that they emerge simultaneously and unfold in tandem. Neurodevelopmental delay of basic attentional, perceptual, and motor functions could be linked to language deficits, inhibition, or aggression (Moffitt, 1990b; Moffitt & Silva, 1988). Parental rearing practices, maternal education, or family socioeconomic status constitute other possible shared generators. In a nutshell, language-behavioral adjustment associations could reflect third variables that have established histories of predictive significance for both.

The developmental paths design implemented in the present studies allowed us to examine temporal influences between language and internalizing and externalizing behavior problems. In addition, it allowed examination of how the two forms of behavioral adjustment influence one another. Internalizing behavior problems could constrain the development of externalizing behavior problems because behavioral inhibition diminishes

risk-taking and/or involvement with deviant peers (Mesman, Bongers, & Koot, 2001). Reciprocally, less inhibited children are more likely to increase in externalizing behavior problems. Alternatively, internalizing behavior problems may augment externalizing behavior problems (Bornstein et al., 2010; Burt, Obradović, Long, & Masten, 2008; Masten et al., 2005; Moffitt, Caspi, Harrington, & Milne, 2002; Pine, Cohen, Cohen, & Brook, 2000). There is also evidence that externalizing behavior problems generate internalizing behavior problems over time (Kiesner, 2002; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002). Children's externalizing behavior problems at age 3 predict both internalizing and externalizing behavior problems at age 12 (Pihlakoski et al., 2006).

Of course, other developmental paths between these two forms of behavioral adjustment -- even involving language -- are possible. For example, language might serve as an intervening link between internalizing and externalizing behavior problems (see Mesman et al., 2001, and Mesman & Koot, 2001, for an analogous three-term chain). Relevant data addressing this possibility are lacking.

Stability and Covariation of Language and Behavioral Adjustment across Childhood

Secondary to these principal pathways questions, the two studies presented here also provided data on the stabilities in language and internalizing and externalizing behavior problems as well as their concurrent covariations. Stability describes consistency in the relative ranks of individuals in a group with respect to some characteristic through time, and covariation describes the association of distinct constructs at any given time (Bornstein & Bornstein, 2008; Hartmann, Pelzel, & Abbott, 2011). Stability and covariation constitute important developmental issues in their own right. In addition, in the assessment of developmental paths among constructs, it is important to account for the stability and covariation of the constructs to rule out alternative explanations of longitudinal effects in terms of initial associations persisting or consistency in any one construct carrying lagged associations.

Stability of language in children

In the age range of the current study (including the important transition from preschool to school), across multiple tests at each age, and across multiple informants, children show moderate to strong stability in individual differences of language. For example, Bornstein, Hahn, and Haynes (2004) reported language stability in age-appropriate maternal questionnaires and interviews, teacher reports, experimenter assessments, and transcripts of children's own spontaneous speech. Furthermore, that stability does not normally differ for girls and boys (Bates, Bretherton, & Snyder 1988; Bornstein, Tamis-LeMonda, & Haynes, 1999; Feldman et al., 2000).

Stability of behavioral adjustment in children

Behavior problems that manifest early in life frequently endure (Rutter, 1989), and their stability is high from 3 to 4 years on and even increases with increasing age (Hemphill, 1996; McConaughy, Stanger, & Achenbach, 1992; Koot & Verhulst, 1992; Verhulst & vam

der Ende, 1995). Thus, relatively high stability is found for both internalizing and externalizing behavior problems (Achenbach, Howell, McConaughy, & Stanger, 1995; Hofstra, vam der Ende, & Verhulst, 2002; Kim-Cohen et al., 2003; Masten et al., 2005; Mesman & Koot, 2001; Moffitt & Caspi, 2001). In a review of longitudinal studies, Koot (1995) concluded that one-third to one-half of children with deviant behaviors remained deviant after 2 to 6 years. In general, somewhat higher stabilities are reported for externalizing behavior problems than internalizing behavior problems (Burt et al., 2008), although it could be that externalizing behavior problems are easier to observe and recognize than internalizing behavior problems.

Covariation of language and behavioral adjustment in children

As indicated earlier, correlations between externalizing behavior problems and internalizing behavior problems are moderate to high (Achenbach & Edelbrock, 1983; Caspi et al,, 1995), and studies of community and clinical samples alike have shown associations of childhood antisocial behaviors with symptoms of anxiety and depression (Burt et al. 2008). The two also have been found to be comorbid with deficits in language skills (Lynam & Henry, 2001). Thus, the distinct domains of language and behavioral adjustment appear to relate meaningfully to one another through the course of development (Burt et al., 2008; Masten, Burt, & Coatsworth, 2006; Masten et al., 2005).

Overview of the Two Studies

A step in investigating developmental pathways among children's language and their internalizing behavior problems and externalizing behavior problems is to untangle direction, specificity, and sources of mutual effects over and above their temporal stability and concurrent covariation. We attempted to do this in two longitudinal designs that cumulatively spanned the ages from 4 to 14 years. In Study 1, we investigated developmental pathways in a 2-wave 2½-year study of children across the transition from preschool to grade school. Findings of Study 1 were cross-validated in Study 2 on a second independent sample. We expanded the scope of our investigation in Study 2 to a 3-wave 10-year span from early childhood to late childhood to early adolescence. Data were gathered from the principal stakeholders in children's development--child, mother, and school teacher. Constructs were assessed by multiple measures. We used path analysis to conduct long-term, longitudinal, robust tests of developmental pathways involving three domains: language, internalizing behavior problems, and externalizing behavior problems. This approach allowed for examination of longitudinal cross-domain paths while controlling for both within-domain cross-time stabilities and cross-domain within-time covariation.

Few studies collect measures of at least three constructs across at least three time intervals; fewer assess longitudinal effects over and above stability and covariation in the constructs; and fewer still attempt cross-validation with independent samples. Guided by extant research, we developed three main hypotheses. First, we expected to find stability of language and behavioral adjustment from childhood to adolescence as well as their covariation at each time point. Second, we hypothesized cross-domain cross-time predictions between language and internalizing behavior problems, and perhaps between language and externalizing behavior problems, between adjacent time points even after

controlling for stability and covariation. Third, we hypothesized that internalizing behavior problems and externalizing paths would be correlated across time after controlling for stability, covariation, and cross-domain cross-time correlations of language with internalizing and externalizing behavior problems. Finally, in follow-up analyses we hypothesized that the final path model would hold controlling for key variables and third-variable causes.

General Methods

Certain features of the participants, procedures, preliminary data analyses, and analytic plans were common to the two longitudinal studies. They are reported here.

Participants

Each sample consisted of normal, healthy, firstborn girls and boys. Families were mostly European American (Study 1: 96.5% and Study 2: 100%) and monolingual English-speaking, but drawn from a broad range of socioeconomic class (Hollingshead, 1975, Four-Factor Index of Social Status assessed at the first data collection wave, Study 1: $M = 58.29$, $SD = 7.20$, *range* = 35–66, and Study 2: $M = 55.99$, $SD = 9.20$, *range* = 29 to 66; see Bornstein, Hahn, Suwalsky, & Haynes, 2003). Families were recruited in a U.S. East coast metropolitan area through announcements in local newspapers, contacts with local nursery schools and childcare centers, and mass mailings. The two community samples were therefore socioeconomically heterogeneous in terms of maternal education and family SES, although they over-represented families with higher SES. We recruited an ethnically homogenous European American sample because they are currently the majority cultural group in the United States (the vast majority of the population of the United States self-identifies as European American in descent; Humes, Jones, & Ramirez, 2011; Tilton-Weaver & Kakihara, 2008; U.S. Census Bureau, 2008) and because we wanted to understand the matrix of associations surrounding language and behavioral adjustment in one group before embarking on more complex studies and analyses with ethnically diverse samples (by including only European Americans, we intentionally avoided an ethnicity confound that might cloud our findings if ethnic groups were combined; Jager, 2011; Twenge & Crocker, 2002).

Procedures

Children, their mothers, and teachers all provided data. Prior to data collection, mothers were informed of the nature of the study including the fact that the child's teacher would be asked to provide information about the child in the school setting. For both studies, mothers completed questionnaires that supplied demographic information about the child's health status, their own education history, marital status, family language, and the like. Each mother also received a packet to give to the child's teacher that contained a letter explaining the study and requesting the teacher's assistance in providing information, a postage-paid return envelope, and questionnaire(s). Informed consent/assent was obtained from mothers, teachers, and adolescents. Participants were modestly compensated for their time, and these studies were approved and monitored by our Institutional Review Board.

Preliminary Analyses and Analytic Strategy

At each wave, we examined concurrent correlations of child age with any scale scores that were not age-standardized to determine if age adjustment were warranted. In neither study did child age correlate with any concurrent outcome measures; child age was therefore excluded as a covariate. Based on a path analytic approach, we computed language and behavioral composite scores at each wave relative to their indicators for that developmental period. Prior to data analysis, distributions of language and behavior adjustment measures were examined for normality and outliers (Tabachnick & Fidell, 2007). Transformed variables were used in analyses (as indicated); for clarity, untransformed data are presented in reports of descriptive statistics.

We fit path models using maximum likelihood functions and followed the mathematical models of Bentler and Weeks (1980) as implemented in EQS 6.1 (Bentler, 1995; Bentler & Wu, 1995). Prior to fitting path models, we inspected bivariate plots to confirm that variables in the models were linearly related and that no curvilinear effects obtained between pairs of variables. Influential cases were evaluated by scatter plot inspection and numeric statistics from preliminary regressions (Cook's D, the studentized deleted residual, and the leverage). In the course of fitting path models, we evaluated Mardia (1970) coefficients of multivariate kurtosis, case(s) that contributed disproportionately to parameter estimates, and the stability of parameter estimates. To evaluate the significance of parameter estimates in the final models, we report the standardized coefficients but evaluated their probabilities using robust standard errors for the unstandardized coefficients.

Results in each study are discussed in the following order. First, descriptive statistics for all language and internalizing and externalizing behavior problem measures are reported. Second, zero-order concurrent and predictive relations between language and internalizing and externalizing behavior problems are evaluated (where $r \approx .10$ is interpreted as a small effect, $r \approx .25$ as a medium effect, and $r \approx .40$ as a large effect; Cohen, 1988). Finally, analytic models were tested to establish the direction and timing of developmental pathways.

In preliminary analyses, we assessed child gender as a moderating variable. However, inspection of the correlations and multi-sample analysis of the path models indicated no significant differences between girls and boys in either study; therefore, gender was not considered further. All analyses are based on each study's full sample.

Study 1: Pathways from 4.5 Years to 7 Years

Participants

The first study sample consisted of 85 children, (45 girls and 40 boys), their mothers, and teachers who provided data at two ages. On average, children were 4.52 years old (*SD* = 0.25, range = 4.08 to 4.92) at the first assessment wave when all were attending preschool, and they were 6.83 years old (*SD* = 0.35, range = 5.75 to 7.58) at the second assessment wave when all were in grade 1. At the first assessment, mothers averaged 34.63 years of age (*SD* = 3.73, range = 25.20 to 45.00); 3 mothers had completed high school, 11 had partial college, 26 had completed college, and 45 had graduate professional training or had completed graduate degrees. Initially, 113 children were recruited, so 28 were lost to follow

up. These 28 children and the 85 in the final study sample did not differ in any of the child language, internalizing behavior problem, or externalizing behavior problem measures (see below), except children who were lost to follow up scored higher on the PBQ Hostile-Aggressive subscale than did those who were followed up at grade 1.

Procedures

At 4.5 years, data on child language were derived from experimenter assessments and maternal and teacher reports. At 7 years, data on child language were derived from experimenter assessments. The child's preschool and grade-1 teachers were independently queried about the child's internalizing and externalizing behavior problems using a standardized instrument.

Language—At 4.5 years the Test of Language Development-Primary (TOLD-P; Newcomer & Hammill, 1982) and the Verbal Scale of the McCarthy Scales of Children's Abilities (MSCA; McCarthy, 1972) were administered to the child, and mothers and teachers completed the Vineland Adaptive Behavior Scales, Communication Domain (VABS; Sparrow, Balla, & Cicchetti, 1984, 1985) via interview and questionnaire, respectively. At 7 years the Wide Range Achievement Test-Revised Edition (WRAT-R; Jastak & Wilkinson, 1984) was administered to the child during a laboratory visit. The TOLD-P is a standardized instrument for assessing language comprehension and production in children 4 years through 8 years, 11 months. The Spoken Language Quotient (M = 100, SD = 15), a measure of general language that reflects the child's ability in semantics, syntax, speaking, and listening, is derived from 5 subtests. The TOLD-P standardization sample consisted of 1836 children; split-half reliability coefficients for the subtests range from .71 to .95 for children at 4 years. The MCSA was used to assess children's ability to express themselves verbally and the maturity of their verbal concepts. The Verbal Scale (M = 50, SD = 10) had a split-half reliability coefficient of .88 for a standardization sample of 104 children at 4 years, 6 months. The VABS: Interview Edition -- Survey Form, Communication Domain was used to obtain mothers' estimates of their children's communication skills. The standard score (M = 100, SD = 15) for the Communication Domain is the converted sum of raw scores for the Receptive, Expressive, and Written subdomains and had a split-half reliability coefficient of .93 for a standardization sample of 200 children at 4 years. The VABS-Classroom Edition provides a teacher's assessment of the child's communication skills in the classroom. The standard score (M = 100, SD = 15) for the Communication Domain is the converted sum of raw scores for the Receptive, Expressive, and Written subdomains. The WRAT-R was administered at 7 years to measure multiple language capacities, including basic knowledge of Reading (word recognition and pronunciation) and written Spelling. Standard score (M = 100, SD = 15) norms are based on a sample of over 5000 individuals ranging in age from 5 years to adulthood. The reliability coefficients for 6- and 7-year-old children vary from .96 to .97 for Reading and .91 to .94 for Spelling.

Internalizing and externalizing behavior problems—Children's teachers completed the Preschool Behavior Questionnaire (PBQ; Behar & Stringfield, 1974), a standardized screening instrument for early detection of behavioral adjustment in children 3 to 6 years.

The Total Disturbed Behavior (TDB) score is the sum of 3 subscale scores and 6 additional "behavior problem" items. The PBQ has high interrater r = .84 and test-retest (3 to 4 months apart) r = .87 reliabilities in a sample of 89 preschool children (Behar, 1977). The mean TDB score from standardization samples of 496 preschool children in a "normal" group was 8.01 (SD = 7.72) and of 102 children in a "deviant" group was 21.32 (SD = 6.80); mean TDB scores differentiated beyond the .001 level of significance between the two groups (Behar & Stringfield, 1974). To better characterize behavioral variables from teacher reports, based on previous research on the factor structure of the PBQ (Fowler & Parke, 1979), we created an aggregated standardized score from each questionnaire representing internalizing and externalizing behavior problems. The child's grade-1 teacher completed the Revised Behavior Problem Checklist (RBPC; Quay & Peterson, 1983) which provides reliable and valid information about dimensions of behavior deviance in children (Short, 1991). Norms are based on both normal and clinical samples, and inter-rater reliabilities range from .52 to .85. Two aggregated standardized scores representing internalizing and externalizing behavior problems were computed based on the Manual for the RBPC (Quay & Peterson, 1987). The grade-1 internalizing behavior problems score was derived from the RBPC Anxiety-Withdrawal and Psychotic Behavior scales. The grade-1 externalizing behavior problems score was derived from the RBPC Conduct Disorder, Socialized Aggression, Attention Problems-Immaturity, and Motor Excess scales.

Covariates

Child nonverbal intelligence—The Perceptual-Performance Scale of the MSCA was administered at 4.5 years to evaluate children's reasoning abilities through imitation, logical classification, and visual organization in a variety of spatial, visual-perceptual, and conceptual tasks.

Maternal education—Maternal education was measured using the Hollingshead (1975) Index 7-point education scale when the child was 4.5 years of age.

Maternal parenting knowledge—The Concepts of Development Questionnaire (Sameroff & Feil, 1985) was used to evaluate mothers' understanding of child growth and development on a scale ranging from categorical to compensating to perspectivistic. At the Categorical level, child development is seen as determined by a single cause. Compensating level items assess a parent's awareness of the interaction between the child and his or her environment in producing developmental outcomes. At the Perspectivistic level, child behavior is seen as the outcome of complex, transactional processes. The total score, which combined the amount of agreement to the Compensating-Perspectivistic items and the amount of disagreement to the Categorical items, was used in analysis. Sameroff and Seifer (1983) reported significant concurrent correlations between mothers' concepts of development scores and measures of their 4-year-olds' cognitive and social competence.

Family SES—Family SES was assessed using the Hollingshead (1975) Index when the child was 4.5 years old.

Statistical Analyses

A series of nested path analysis models was examined to test the 3 hypotheses of the present study involving the interconnections between language and internalizing and externalizing behavior problems at different time points from early to middle childhood. Figure 1 presents the 3 hypothesized path models we tested. Model 1 tested our first hypothesis about stability of each domain between adjacent time points as well as within-time covariation among domains. Model 2 added 4 cross-domain paths to test our second hypothesis about cross-domain cross-time predictions between language and internalizing behavior problems, and between language and externalizing behavior problems, between adjacent time points. Model 3 added two paths to test our final hypothesis about cross-domain cross-time predictions between internalizing and externalizing behavior problems between adjacent time points.

Choice of the final model was based on the robust Satorra-Bentler scaled chi-square statistic (S-B χ^2; Satorra & Bentler, 1988, 1994) and the robust comparative fit index (CFI; Bentler, 1990). The standardized root mean squared residual (SRMR; Browne & Cudeck, 1993) is reported because of the relatively small sample sizes ($N \leq 250$; Hu & Bentler, 1999). Cutoff values close to .95 for CFI and close to .09 for SRMR are indicative of a relatively good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). In addition, the chi-square difference test for nested models was computed with each more parsimonious model compared to the next more complex model. A significant chi-square difference test implied that the successive complex model fit the data significantly better than the previously more parsimonious one. To enhance the cross-validation adequacy of models, the Akaike Information Criterion (AIC; Akaike, 1987; Kaplan, 2000) was monitored for its decreasing value in all nested models.

Last, the final path model was evaluated controlling for key variables and third-variable causes. We considered child nonverbal abilities, maternal education and parenting knowledge, and family SES as potential covariates. To qualify as a covariate in the path model, a candidate variable had to correlate significantly ($p < .05$) with the composite scores in the expected direction. We postulated within-time correlations between covariates and child outcomes (e.g., wave-1 covariates with wave-1 outcomes) and direct paths from covariates at an earlier time to child outcomes at a later time (i.e., from wave-1 covariates to wave-2 outcomes) in the path models. Covariates were allowed to correlate within ages.

Results

Descriptive statistics—Table 1 shows the *M*s and *SD*s for all child measures and potential covariates for the total study sample. At 4.5 and 7 years, all child language and internalizing and externalizing behavior problem scores fell within or around 1 *SD* of means reported in standardization samples.

Language and behavior problem composite scores—Summary scores representing language and externalizing behavior problems at ages 4.5 and 7 years and for internalizing behavior problems at age 7 years were each computed as the mean standard scores of all relevant scale scores obtained at each respective age and were used in path analysis models.

The Anxious-Fearful subscale of the PBQ was the sole indicator of age 4.5-year internalizing behavior problems; it was used as an observed variable in the models, and no mean standard score was computed for age 4.5-year internalizing behavior problems.

Correlations among scale scores for language, externalizing behavior problems, and internalizing behavior problems at each of the two ages were all positive and, in most cases, significant. The correlation between the two indicators of language at age 7 years was $r(83) = .87$, $p < .001$. Correlations between the two indicators of externalizing behavior problems at age 4.5 years was Spearman $\rho(83) = .61$, $p < .001$, and between the two indicators of internalizing behavior problems at age 7 years was $\rho(83) = .16$, $p = .14$. Before testing our hypotheses, measurement models of language and behavior problem constructs that consisted of more than two indicators were evaluated for the fit of the observed scale scores as indicators of the composites. Excellent model fits were achieved for both language at age 4.5 years and externalizing behavior problems at age 7 years: For 4.5-year language, S-B $\chi^2(2) = 3.96$, $p = .14$, Robust CFI = .95, SRMR = .05, AIC = −.04, with factor loadings ranging from .42 to .85; for externalizing behavior problems at age 7 years, S-B $\chi^2(2) = 4.55$, $p = .10$, Robust CFI = .95, SRMR = .05, AIC = .55, with factor loadings ranging from .38 to .80. Factor loadings were all significant at the .05 level or better. Cronbach's alpha reliability coefficients = .67 and .74 for 4.5-year language and 7-year externalizing behavior problem composite variables, respectively.

All four 4.5- and 7-year internalizing and externalizing behavior problem aggregate scores required $\log_{10}$ transformations to approximate normality and resolve problems of outliers (Tabachnick & Fidell, 2007). In the path models, univariate measures of kurtosis and normalized estimates of Mardia's multivariate coefficient indicated no significant problems of nonnormality, and no single case contributed disproportionately to parameter estimates.

Zero-order Correlations

Stability of language and behavioral adjustment—Children's language and their externalizing behavior problems showed strong stability from ages 4.5 to 7 years, rs(83) = .50 and .51, respectively, ps < .001. Children's internalizing behavior problems were positively, but nonsignificantly, stable, $r(83) = .17$, *ns*.

Concurrent and predictive relations between language and behavioral adjustment—Table 2 presents concurrent and predictive relations between language and the two behavioral adjustment measures. The diagonal sections of Table 2 provide evidence for concurrent associations between language and behavioral adjustment problems in 4.5- and in 7-year-old children. No significant concurrent relations emerged between language and internalizing behavior problems at either age. However, children with lower language skills exhibited more externalizing behavior problems at 4.5 years and 7 years, and vice versa. Internalizing and externalizing behavior problems were marginally related at 4.5 years, $r(83) = .20$, $p = .07$, and significantly so at 7 years, $r(83) = .35$, $p = .001$.

The lagged zero-order correlations of language-to-behavior adjustment (Table 2, top right) suggest that inferior language ability at 4.5 years predicts more internalizing and externalizing behavior problems at 7 years, whereas the behavior problems-to-language

correlations (Table 2, bottom left) indicate only that more externalizing behavior problems at age 4.5 years predict inferior language skills at age 7 years. For internalizing behavior problems at age 4.5 years to externalizing behavior problems at age 7 years, and vice versa, both $r(83)$s = .17, *ns*.

Path Analysis Models

Comparison of the nested models—Table 3 shows model fit indices and comparisons of the nested path models. Both Models 1 and 2 demonstrated good fit to the data. Inspection of the chi-square difference test indicated that Model 3 did not fit the data significantly better than Model 2. Although the chi-square difference test suggested Model 2 fit the data only marginally better than did Model 1, evaluations of the robust S-B χ^2 statistic, robust CFI, and SRMR indicated substantial improvement of Model 2 over Model 1. An examination of AIC supported this conclusion; Model 2 had the optimal balance of fit and parsimony and was the final model of Study 1. Figure 2 presents the standardized solution of Model 2. Appendix 1 presents the pair-wise covariance matrix of all variables in the final model.

Hypothesis 1: Stability and covariation: Language and externalizing behavior problems showed strong stability from 4.5 to 7 years; internalizing behavior problems were not stable. At 4.5 years, language and externalizing behavior problems were negatively correlated. There were no other within-time correlations at 4.5 years. At 7 years, the error variances of internalizing and externalizing behavior problems were positively correlated. There were no other within-time correlations at 7 years.

Hypothesis 2: Cross-domain cross-time predictions between language and internalizing behavior problems, and between language and externalizing behavior problems: Controlling for its relations with 4.5-year internalizing and externalizing behavior problems, 4.5-year language predicted 7-year internalizing behavior problems above and beyond age 4.5-year internalizing behavior problems: Children with poorer language skills at 4.5 years had more internalizing behavior problems at 7 years.

Hypothesis 3: Cross-domain cross-time predictions between internalizing and externalizing behavior problems: The path model did not provide evidence for these expectations.

Covariate analyses—Four potential common cause covariates considered in this analysis were child nonverbal intelligence, maternal education and parenting knowledge, and family SES. We asked whether longitudinal stabilities, concurrent relations, and the longitudinal cross-domain effect persisted when they were controlled. At the zero-order level, maternal education and parenting knowledge and family SES were not significantly correlated with any child outcomes; they were therefore excluded as covariates. Child nonverbal intelligence assessed at age 4.5 years correlated with 4.5-year language, $r(83) = .35$, $p = .001$, and predicted 7-year language, $r(83) = .22$, $p < .05$, as well as internalizing behavior problems, $r(83) = -.22$, $p < .05$, and externalizing behavior problems, $r(83) = -.33$, $p < .01$. We therefore added child nonverbal intelligence to the final path model (Figure 2) and re-

evaluated the longitudinal cross-domain effect. Two out of the four significant correlations between child nonverbal intelligence and child outcomes at the zero-order level attenuated to non-significance with longitudinal stability, within-time covariation, and the path in the model. Figure 3 presents the standardized solution to the final covariate model, S-B $\chi^2(6) = 4.73$, $p = .58$, robust CFI = 1.00, SRMR = .05, AIC = −7.27. The significant longitudinal cross-domain path between 4.5-year language and 7-year internalizing behavior problems remained significant controlling for child nonverbal intelligence in the model.

Study 2: Pathways from 4 Years to 10 Years to 14 Years

Participants

The second study sample consisted of 139 children (55 girls and 84 boys), their mothers, and their teachers who provided data at 3 ages. On average, children were 4.05 (*SD* = 0.09, range = 3.87 to 4.62), 10.24 (*SD* = 0.14, range = 9.99 to 10.81), and 13.83 (*SD* = 0.25, range = 13.48 to 14.82) years old at the first, second, and third assessment waves. At the first assessment, mothers averaged 35.31 years of age (*SD* = 5.30, range = 20.59 to 49.63); two mothers had not completed high school, 6 had completed high school, 25 had partial college, 48 had completed college, and 58 had graduate professional training or had completed graduate degrees. Initially, 267 children were recruited, so 128 children were lost to follow up. These 128 children and the 139 in the final study sample did not differ on any child language, externalizing behavior problem, or internalizing behavior problem measures except that children lost to follow-up scored lower on the 10-year WISC-III information and vocabulary subtests (see below). In the course of fitting path models, 1 additional case was identified as a multivariate outlier, contributing disproportionately to parameter estimates; this case was also removed from the final analyses.

Procedures

Children and their mothers provided data at all 3 waves; at 10 years, children's teachers also provided data. At all 3 waves, a laboratory visit was scheduled for the mothers and children; in addition, two home visits were scheduled at 10 years. (In the case of a small number of families living at significant distances from the laboratory, only home visits were made.) At 4 years, the child completed a variety of activities with an experimenter. Prior to the 10- and 14-year visits, packets of questionnaires for child, mother, and father were mailed to the family, with the request that they be completed in time for the visit. During each visit, children and mothers completed questionnaires and were interviewed, and children were tested. About 1.5 months after in-person data collection, mothers were interviewed by telephone. At 10 years, mothers were asked to recruit their children's teachers into the study. Teachers who agreed to participate were given a packet of questionnaires to complete and mail directly back to study personnel.

Language—At 4 years, language was assessed using two verbal subtests of the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989) and the Vineland Adaptive Behavior Scales-Interview Edition, Survey Form, Communication domain (VABS; Sparrow et al., 1984). At 10 years, 3 verbal subtests on the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991) were administered. At 10 and 14

years, language was assessed by subtests of the Woodcock–Johnson Psycho-Educational Battery–Revised Test of Achievement (WJ–R; Woodcock & Mather, 1989) and the VABS, Communication domain. The WPPSI-R is an individually administered intelligence test for children aged 3 years to 7 years, 3 months. Scaled scores (M = 10, SD = 3) of two verbal subtests were used. In a standardization sample of 2004-year-old children, split-half reliability coefficients ranged from .88 to .89. The VABS: Interview Edition Survey Form, Communication Domain was used to obtain mothers' estimates of their children's communication skills at 4, 10, and 14 years. The same procedures were followed as in Study 1 at 4.5 years. The WISC-III is an individually administered intelligence test for children from ages 6 to 16 years. Scaled scores (M = 10, SD = 3) of three verbal subtests were used. The WISC-III was standardized on a sample of 2200 children who matched census data and were representative of the U.S. population on ethnicity, geographic region, gender, age, and parent education. Reliability coefficients were .81 to .87. Two subtests from the WJ-R were administered at 10 and 14 years to assess children's achievement in language skills. The WJ-R was standardized on a nationally representative sample from 24 months to 95 years of age. Raw scores were converted to standard scores (M = 100, SD = 15).

Internalizing and externalizing behavior problems—Two forms of behavioral adjustment were assessed by parent and teacher reports on symptom checklists. At 4 years, internalizing behavior problems were assessed using the Anxious-Fearful subscale of the Preschool Behavior Questionnaire (PBQ; Behar & Stringfield, 1974). At 10 years, internalizing behavior problems were assessed using the Anxious-Depressed, Somatic Complaints, and Withdrawal scales of the Child Behavior Checklist/4-18 (CBCL/4-18; Achenbach, 1991a) and Teacher Report Form (TRF; Achenbach, 1991b). At 14 years, internalizing behavior problems were assessed using the Anxious-Depressed, Somatic Complaints, and Withdrawal scales of the CBCL and Youth Self-Report (YSR; Achenbach, 1991c). At 4 years, externalizing behavior problems were assessed using the Hostile-Aggressive and Hyperactive-Distractible subscales on the PBQ. At 10 years, externalizing behavior problems were assessed using the Aggressive Behavior and Delinquent Behavior scales of the CBCL/4-18 and TRF. At 14 years, externalizing behavior problems were assessed using the Aggressive Behavior and Delinquent Behavior scales of the CBCL/4-18 and YSR. The PBQ, a standardized screening instrument for detection of emotional problems in children ages 3 to 6 years, is described in Study 1. The CBCL/4-18 consists of a social competence section and a behavior/emotional problems section. The focus of Study 2 is on the 118 items that make up the behavior/emotional problems section. Internalizing behavior problem scale scores were computed as the sum of the Anxious-Depressed, Somatic Complaints, and Withdrawal scores. Externalizing behavior problem scale scores were the sum of the Aggressive Behavior and Delinquent Behavior scores. The raw summary scores of internalizing and externalizing scale scores were used. The TRF, the teacher version of the CBCL, includes 118 items of which 93 are in common with the CBCL. Teachers based their ratings on observation of the child during the previous 2 months. The YSR includes 103 items describing a broad range of problem behaviors. Children completed the YSR as an assessment of their behavioral and emotional problems over the last 6 months. The YSR yields two broad-based factors, Internalizing Problems and Externalizing Problems, both of which were used. Internal consistencies for younger

children (n = 46) were excellent for internalizing (α = .90) and externalizing behavior problems (α = .88). The Achenbach System of Empirically Based Assessment, which includes the YSR, has strong test-retest reliability (r = .79 to .95). Criterion related validity has also been established (Achenbach & Rescorla, 2001). The alpha coefficients for the current sample were .89 and .88 for internalizing and externalizing behavior problems, respectively.

Covariates

Child nonverbal intelligence—Child nonverbal intelligence was measured by the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989) at age 4 years and by the WISC-III (Wechsler, 1991) at age 10 years.

Maternal verbal intelligence—Maternal verbal intelligence was estimated using the Peabody Picture Vocabulary Test-Revised (PPVT-R Form L; Dunn & Dunn, 1981).

Maternal education—Maternal education was measured on the Hollingshead (1975) Index 7-point education scale at all 3 ages.

Maternal parenting knowledge—The Knowledge of Infant Development Inventory (KIDI; MacPhee, 1981; Bornstein, Cote, Haynes, Hahn, & Park, 2010) is a 75-item criteria-referenced questionnaire that assesses evidence-based knowledge of parental practices, developmental processes, health and safety guidelines, and norms and milestones relevant to children's growth. Proportion correct of total items was used.

Maternal social desirability—The short form of the Social Desirability Scale (SDS-SF; Reynolds, 1982) uses 13 items in Crowne and Marlowe's (1960) Social Desirability Scale to assess a respondent's tendency to reply to questions in a socially desirable fashion. Reliability of the SDS-SF is .76, and the correlation with the full SDS is .93 (Reynolds, 1982). The SDS-SF was assessed for mothers at child ages 10 and 14 years and was explored as a potential covariate for maternal reports of children's language and internalizing and externalizing behavior problems.

Family SES—Family SES was assessed using the Hollingshead (1975) Four-Factor Index of Social Status at all 3 ages.

Results

Preliminary analyses and analytic strategy—Prior to analysis, missing data points (8.20% of the total data points) were imputed using the Expectation-Maximization algorithm (Dempster, Laird, & Rubin, 1977); data were missing completely at random, Little's MCAR test $\chi^2(683) = 708.12$, p = .25.

Several variables required transformation to approximate normality and resolve problems of outliers. Age 10-year internalizing and externalizing behavior problem scores were re-expressed using square roots of their reciprocals. (The transformed variables were multiplied by −1 to keep the sign of the correlation coefficients the same as if the untransformed

variables were used.) Age 14-year internalizing behavior problem scores were re-expressed using a $\log_{10}$ transformation, and age 14-year externalizing behavior problem scores were re-expressed using a cube-root transformation.

Four nested path analysis models were examined to test the interconnections between language and behavioral adjustment at different time points from early to late childhood to early adolescence. Model 1 tested our first hypothesis about stability of each domain between adjacent time points as well as within-time correlations among domains. Model 2 tested the negative longitudinal cross-domain path between wave-1 language and wave-2 internalizing behavior problems that was identified in Study 1. Model 3 added 4 cross-domain paths from late childhood to early adolescence to test our second hypothesis about cross-domain cross-time prediction between language and internalizing behavior problems, and between language and externalizing behavior problems. Model 4 added two paths from late childhood to early adolescence to test our third hypothesis about cross-domain cross-time predictions between internalizing and externalizing behavior problems. As in Study 1, the last goal was to determine whether significant longitudinal cross-domain paths of the final model would persist when meaningful covariates were taken into consideration. We considered child nonverbal intelligence, maternal verbal intelligence, education, parenting knowledge, and social desirability bias, and family SES as potential covariates.

Descriptive statistics—Table 4 presents *M*s and *SD*s of outcome measures and potential covariates for all participants. All mean scores fell within or around 1 *SD* of means reported in normal or standardization samples of children and adolescents of similar ages.

Language and behavior problem composite scores—Summary scores representing 4-, 10-, and 14-year language, internalizing behavior problems, and externalizing behavior problems were each computed as the mean standard scores of all relevant scale scores obtained at each respective age. The Anxious-Fearful subscale of the PBQ was the sole indicator of 4-year internalizing behavior problems; it was used as an observed variable in the path models, and no mean standard score was computed for 4-year internalizing behavior problems.

Correlations among scale scores for language, internalizing behavior problems, and externalizing behavior problems, respectively, at all 3 ages were positive and significant. Correlations between the two indicators of internalizing behavior problems at 10 and 14 years were *r*s(137) = .38 and .38, respectively, *p*s < .001. Correlations between the two indicators of externalizing behavior problems at 4, 10, and 14 years were *r*s(137) = .36, .38, and .27, *p*s < .001, .001, and .01, respectively. Before testing our hypotheses, measurement models were evaluated for language at all 3 ages to evaluate the fit of the observed scale scores as indicators of the composites. Excellent model fits were achieved for all 3 models: For 4-year language, S-B $\chi^2(1) = 0.00$, $p = .97$, Robust CFI = 1.00, SRMR = .00, AIC = −2.00, with factor loadings ranging from .57 to .73; for 10-year language, S-B $\chi^2(9) = 18.37$, $p = .03$, Robust CFI = .97, SRMR = .05, AIC = 4.16, with factor loadings ranging from .45 to .88; and for 14-year language, S-B $\chi^2(1) = 0.53$, $p = .47$, Robust CFI = 1.00, SRMR = .02, AIC = −1.51, with factor loadings ranging from .38 to 1.00. Factor loadings were all

significant at the .001 level or better. Cronbach's alpha reliability coefficients = .68, .85, and .65, for the 4-, 10-, and 14-year language composites, respectively.

Several variables required transformation to approximate normality and resolve problems of outliers. Age 10-year internalizing behavior problem scores were re-expressed using square roots of their reciprocals, and age 10-year externalizing behavior problem scores were re-expressed using their reciprocals. (These two transformed variables were multiplied by −1 to keep the sign of the correlation coefficients the same as if the untransformed variables were used.) Age 14-year internalizing behavior problem and externalizing behavior problem scores were re-expressed using a $\log_{10}$ transformation.

Zero-order Correlations

Stability of language and behavioral problems—Across the 6-year span of the first two waves, children's language, $r(137) = .64$, $p < .001$, internalizing behavior problems, $r(137) = .22$, $p < .01$, and externalizing behavior problems, $r(137) = .44$, $p < .001$, showed moderate to strong stability. Across the 4-year span of the second to third waves, children's language, $r(137) = .83$, $p < .001$, internalizing behavior problems, $r(137) = .41$, $p < .001$, and externalizing behavior problems, $r(137) = .63$, $p < .001$, showed strong stability. Across the 10-year span of the first to third waves, children's language, $r(137) = .60$, $p < .001$, internalizing behavior problems, $r(137) = .26$, $p < .01$, and externalizing behavior problems, $r(137) = .27$, $p = .001$, showed moderate to strong stability.

Concurrent and predictive relations between language and behavior problems—Table 5 presents concurrent and predictive relations between language and internalizing and externalizing behavior problems. The diagonal sections of Table 5 provide evidence for concurrent associations between language and behavioral adjustment at the 3 ages. Children who scored lower on language had more internalizing and externalizing behavior problems at ages 4 years and 10 years, and vice versa. At 14 years, poorer language skills related to more externalizing behavior problems; the concurrent relation between language skills and internalizing behavior problems was negative, but not significant. The correlations between internalizing and externalizing behavior problems at 4, 10, and 14 years were $r(137)$s = .51, .51, and .42, respectively, all ps < .001.

The zero-order correlations of language-to-behavior adjustment (Table 5, top right above the diagonal) suggest that inferior language skills at 4 years predict more internalizing behavior problems at both 10 and 14 years, whereas language skills at 10 years were not related to internalizing behavior problems at 14 years. Across the 4-year span from 10 to 14 years, inferior language skills predict more externalizing behavior problems; the predictive relations were negative, but not significant, across the 6-year span from 4 to 10 years and the 10-year span from 4 to 14 years.

The zero-order correlations of behavior adjustment-to-language (Table 5, bottom left below the diagonal) indicate that more internalizing behavior problems predict inferior language skills from 10 to 14 years, and more externalizing behavior problems predict inferior language skills from 4 to 10 and 14 years as well as from 10 to 14 years. The predictive relations from 4-year internalizing behavior problems to language skills at later years were

both negative, but not significant. Relations between earlier and later internalizing and externalizing behavior problems were mostly significant: 4-year internalizing behavior problems to 10-year externalizing behavior problems, $r(137) = .05$, *ns;* 10-year internalizing behavior problems to 14-year externalizing behavior problems, $r(137) = .34$, $p < .001$; 4-year externalizing behavior problems to 10-year internalizing behavior problems, $r(137) = .33$, $p < .001$; and 10-year externalizing behavior problems to 14-year internalizing behavior problems, $r(137) = .19$, $p < .05$.

Path Analysis Models

Comparison of the nested models—Table 6 shows model fit indices and comparisons of the nested path models. The chi-square difference test indicated that each successive model fit the data significantly better, except for the final comparison: Model 4 did not fit the data significantly better than did Model 3 despite the added two paths between externalizing behavior problems and internalizing behavior problems. Evaluations of the robust S-B scaled χ^2, robust CFI, and SRMR also suggested Model 3 as the overall most plausible model, and the model AIC supported this conclusion. Figure 4 presents the standardized solution of Model 3. Appendix 2 presents the pair-wise covariance matrix of all variables in the final model.

Hypothesis 1: Stability and covariation: Unsurprisingly and as has been found in the past, longitudinal stability paths for language skills and for internalizing and externalizing behavior problems were all positive and significant. At 4 years, internalizing and externalizing behavior problems were, also as expected, positively correlated, and both were negatively correlated with language skills. At both 10 and 14 years, the error variances of externalizing behavior problems were correlated with the error variances of internalizing behavior problems (positive). The error variances of language skills and internalizing behavior problems or externalizing behavior problems were not related at 10 or 14 years. On the whole, internalizing and externalizing behavior problems related positively to each other at all 3 ages, and the two related negatively to language skills during early childhood. Removing the variances that were related to other variables specified in the final model (Figure 4), the error variances between internalizing behavior problems and language skills, and between externalizing behavior problems and language skills, were not related at 10 or 14 years.

Hypothesis 2: Cross-domain cross-time predictions between language and internalizing behavior problems, and between language and externalizing behavior problems: Two cross-domain cross-time paths emerged as significant: The negative longitudinal cross-domain path from wave-1 language to wave-2 internalizing behavior problems identified in Study 1 was cross-validated in the Study 2 sample. Controlling for its relation with 4-year internalizing and externalizing behavior problems, 4-year language skills predicted 10-year internalizing behavior problems above and beyond 4-year internalizing behavior problems: Children with poorer language skills at 4 years had more internalizing problems at 10 years. One significant longitudinal cross-domain path emerged from late childhood to early adolescence: Controlling for its relation with 10-year language and externalizing behavior problems, 10-year internalizing behavior problems predicted 14-year language skills above

and beyond 10-year language, internalizing behavior problems, and externalizing behavior problems: Children with more internalizing behavior problems at 10 years had poorer language skills at 14 years.

Two significant 3-wave cross-domain effects emerged from the final model. Age 14-year internalizing behavior problems were predicted by 4-year language skills, standardized indirect effect = −.12, $p < .05$, with the effect mediated by 10-year internalizing behavior problems. Age 14-year language skills were predicted by age 4-year language skills, standardized indirect effect = .53, $p < .001$, with the effect mediated by age 10-year internalizing behavior problems, standardized indirect effect = .02, and language, standardized indirect effect = .51.

Hypothesis 3: Cross-domain cross-time predictions between internalizing and externalizing behavior problems: The path model did not provide evidence for these predictions.

Covariate analyses—Potential covariates and common causes considered in this covariate model included child nonverbal intelligence, maternal verbal intelligence, education, parenting knowledge, and social desirability bias, and family SES. Maternal social desirability was not related to any child outcome measures reported by mothers; it was therefore excluded as a covariate. At the zero-order level, concurrent correlations of child nonverbal intelligence assessed at age 4 years with language skills, internalizing behavior problems, and externalizing behavior problems at 4 years were all significant, *r*s(137) = .42, −.23, and −.20, *p*s < .001, .01, and .05, respectively. Child nonverbal intelligence assessed at 4 and 10 years were correlated with language skills at 10 years, *r*s(137) = .32 and .40, respectively, both *p*s < .001. Child nonverbal intelligence assessed at 4 and 10 years was correlated with language skills at 14 years, *r*s(137) = .34 and .35, respectively, both *p*s < .001.

Maternal parenting knowledge was positively related to child language skills at 10 years, $r(137) = .22$, $p < .01$. Maternal verbal intelligence, was positively related to child language skills at 4, 10, and 14 years: *r*s(137) = .20, .37, and .32, *p*s < .05, .001, and .001, respectively. Maternal education assessed at 4 years was positively correlated with child language skills at 10 and 14 years, *r*s(137) = .22 and .17, *p*s < .01 and .05, respectively. Maternal education assessed at 10 years was positively correlated with child language skills at 10 and 14 years, *r*s(137) = .23 and .19, *p*s < .01 and .05, respectively. Maternal education assessed at 14 years was positively correlated with child language skills at 14 years, $r(137) = .20$, $p < .05$. Family SES assessed at 4 and 10 years was positively related to child language skills at 10 years, *r*s(137) = .29, $p \leq .001$, and .25, $p < .01$, respectively, and at 14 years for family SES assessed at 4, 10, and 14 years, *r*s(137) = .24, $p < .01$, .22, $p < .05$, and .19, $p < .05$, respectively. Family SES assessed at 4 and 10 years was negatively related to child externalizing behavior problems at 10 years, *r*s(137) = −.18 and −.19, respectively, *p*s < .05, and at 14 years for family SES assessed at 4, 10, and 14 years, *r*s(137) = −.20, $p < .05$, −.27, $p \leq .001$, and −.30, $p < .001$, respectively.

In two separate path models (maternal education was a component of family SES, and they are linearly related and so could not be evaluated in the same model), we added child nonverbal intelligence at ages 4 and 10 years, maternal verbal intelligence, parenting knowledge, and in one model maternal education assessed at all 3 ages, and in the other model family SES assessed at all 3 ages, as exogenous variables to the final model (Figure 4) and reevaluated developmental cross-domain effects. Many of the significant zero-order correlations of child nonverbal intelligence, maternal verbal intelligence, education, and parenting knowledge, and family SES with child outcomes attenuated to non-significance with longitudinal stability, within-time covariation, and the cross-domain paths in the model. Maternal parenting knowledge and education and family SES assessed at all 3 ages were removed from the covariate analysis because they did not correlate or predict any child outcomes in the path model with all other variables in the model.

Figure 5 presents the standardized solution to the final covariate model controlling for maternal verbal intelligence and child nonverbal intelligence, S-B $\chi^2(41) = 55.09$, $p = .07$, robust CFI = .98, SRMR = .08, AIC = −26.91.

Similar results were obtained controlling for significant control variables and third-variable causes: The significant longitudinal cross-domain paths between 4-year language skills and 10-year internalizing behavior problems, and between 10-year internalizing behavior problems and 14-year language skills remained significant controlling for maternal verbal intelligence and child nonverbal intelligence. The two significant 3-wave cross-domain effects of 4-year language skills on 14-year internalizing behavior problems mediated by 10-year internalizing behavior problems, standardized indirect effect = −.11, $p < .05$, and 4-year language skills on 14-year language skills mediated by 10-year language and internalizing behavior problems, standardized indirect effect = .48, $p < .001$, remained significant controlling for maternal verbal intelligence and child nonverbal intelligence.

General Discussion

In two independent longitudinal cohorts we evaluated developmental pathways between children's language skills and their behavioral adjustment in terms of internalizing and externalizing behavior problems. Across the ages of 4.5 to 7 years (Study 1) and 4 to 10 to 14 years (Study 2), respectively, we twice found that children with inferior language skills at age 4 years had more internalizing behavior problems at age 7 years (Study 1) and 10 years (Study 2) and more internalizing behavior problems at age 14 years (Study 2). These developmental paths obtained over and above the temporal stability of language and behavioral adjustment across age and covariation between these characteristics at each age. These results are consistent with a concept of "developmental cascades" in which functioning in one intrapsychic domain is thought to influence other domains both directly and indirectly from one period of life going forward (Masten & Cicchetti, 2010). At most ages in the two studies, language was inversely related to externalizing behavior problems, and internalizing and externalizing behavior problems tended to relate positively to one another. The nature of our path analyses also permitted conservative replies to two secondary questions on stability and concurrent covariation among the constituent constructs, that is when other relations are controlled. Finally, these paths, stabilities, and

covariances obtained separate and apart from child nonverbal intellectual functioning, maternal intelligence, education, parenting knowledge, and social desirability bias, as well as family SES.

Language and Internalizing Behavior Problems

The general cascading pattern observed in both cohorts indicated that language proficiency in early childhood affected behavioral adjustment in late childhood, which in turn contributed to behavioral adjustment in early adolescence. Framed in the positive, young children who are more competent verbally have fewer internalizing behavior problems later. Reciprocally, over and above whatever developmental paths and bidirectional influences may have already occurred prior to the start of this study, inferior language skills in early childhood forecast internalizing adjustment problems into adolescence.

Language is multidimensional, with receptive and expressive phonological, semantic, syntactic, and pragmatic components. We do not know exactly which language competencies or what about language competencies in early childhood keep behavioral adjustment problems at bay. This is a question for future research. Nonetheless, the two studies together employed multiple language measures; the fact that similar paths obtain between language and internalizing behavior problems, even when language is variously operationalized, further enhances the results. Children's language used during social interactions has been employed to quantify how they socialize with others, and children who are language delayed tend to score low on measures of social development (Eckerman, Davis, & Didow, 1989; Howes & Matheson, 1992). Moreover, competency-based models of child development generally suggest the lack of language in early childhood contributes to later internalizing behavior problems (Cole, 1990, 1991). It could be, for example, that children deficient in language have difficulty connecting with peers and, as a result, experience loneliness and have less opportunity to learn and practice the social skills they need for successful peer interaction.

Our analyses rule out some process explanations. With respect to possible developmental models, language and internalizing and externalizing behavior problems in children could be generated and influenced by the same (genetic or environmental) factors, emerge at the same time, and develop in tandem. Alternatively, children's early language development may be jeopardized because they are withdrawn or aggressive. Or, perhaps instead, language facility protects against behavior problems. Applying a developmental path analytic approach, we found strong and consistent evidence for the third possibility, that poorer early childhood language skills predict later internalizing behavior problems. Internalizing and externalizing behavior problems never predicted language. Although we cannot refute alternative explanations concerning the direction of cause and effect, the temporal designs of these studies and their independent concordant findings strongly suggest that poorer early language skills predict later internalizing behavior problems. Moreover, our common cause analyses explored whether inclusion of childhood nonverbal intelligence and diverse factors in mothers and children's general environments might affect observed cross-domain effects. Overall, links between language skills and internalizing behavior problems obtained over and above the inclusion of these broad individual and family resource factors.

By the time children in Study 2 were 4 years of age, their language skills already linked to their internalizing behavior problems. Children as young as 2 years have been reported to exhibit similar relations. Kaler and Kopp (1990) found that toddlers' compliance with adult commands related to how well they understood language. And comparing groups of expressive-language delayed children with language-normal children of the same age for developmental and behavioral difficulties Carson, Klee, Perry, Muskina, and Donaghy (1998) found that children with language delay scored higher than typically developing children on a total internalizing scale (anxious/depressed and withdrawn scales, sleep problems), but scores for the two groups did not differ on a total externalizing scale. In accord with our findings, these investigations imply that children as young as 2 years with language delay might be more vulnerable to internalizing emotional distress or behavioral difficulties than language-normal children.

Why should early language competency be developmentally linked to one type of behavioral adjustment (internalizing) but not to another (externalizing) even as the two types of adjustment are correlated? Perhaps the advantages bestowed by greater language skills (e.g., facilitating a child's social relationships with both peers and adults) are undermined by the abrasive nature of negative behavioral outbursts. Or, perhaps the mechanisms underlying the development of language are more closely linked to or set the stage for the development of internalizing strategies for dealing with negative behavioral tendencies. It is not surprising that unhappy children with anxiety and depression also exhibit some degree of behavioral acting out and vice versa (hence, the correlation between internalizing and externalizing). Perhaps children with the tendency to develop externalizing behavior problems react so impulsively that their access to language and its organizing effects is pre-empted. It is noteworthy that externalizing children are often coached to "Use your words" in place of acting out, an impulse that does not come naturally to them. Thus, we suspect that factors other than or in addition to language may be implicated in behavioral cascades involving externalizing behavior problems, and it may prove productive to examine the role of temperament in that mix.

Stability and Covariation

In these two studies, we measured stability in language and internalizing and externalizing behavior problems, both at the zero-order level and in the context of path models that exposed unique stabilities of these variables. Stability has many variations and interpretations (see Bornstein & Bornstein, 2008; Hartmann et al., 2011). Kagan (1971) distinguished and defined two central kinds of stability. Homotypic stability is the maintenance of rank order in individuals in the same manifest behavior through time (e.g., vocabulary size in language). Heterotypic stability is the maintenance of rank order in individuals on different manifest behaviors through time where the different behaviors are theoretically related and presumably share the same stable latent construct or process (e.g., vocabulary size and grammatical correctness in language). Our stability estimates included homotypic stabilities in language and behavioral adjustment measured in the same ways at different ages as well as heterotypic stabilities in different and age-appropriate assessments of constructs and processes underlying both language and behavioral adjustment. Consistent with one of the main principles of developmental task theory (Sroufe, 1979), our results

demonstrate moderate to strong stabilities within the domains of language and behavioral adjustment as assessed by developmentally appropriate indexes across time. The longitudinal stabilities of language and internalizing and externalizing behavior problems support the notion that these constructs, broadly construed, exhibit developmental consistency independent of measurement variability across the study time points.

Our stability assessments also provide insight into individual variation and how it maintains in development. Stable characteristics in ontogeny are informative as to the nature of those characteristics per se as well as the individuals they describe. Insofar as a characteristic is ontogenetically stable, we know that individuals who do well or do more at one time are likely to do well or do more later. Looked at another way, a major predictor of developmental status at a given age is competence at an earlier age. In addition, consistent child ability or performance likely affects the child's environment and thereby his or her own development. For example, adults adjust their language to match the language of children: Mothers fine-tune the semantic and syntactic contents of their utterances to match their children's level of understanding (e.g., Bellinger, 1980; McLaughlin, White, McDevitt, & Raskin, 1983).

As mentioned earlier, the linkages between internalizing and externalizing behavior problems are complex. These behavior problem domains were concurrently and positively associated with one another from the outset of this study and rather consistently from early childhood to early adolescence. However, over and above stability in each across waves, as well as their intercorrelation at each wave, internalizing and externalizing behavior problems never uniquely influenced one another.

Two Studies with Limitations and Strengths

These two studies have a number of limitations but also display notable strengths. Our sample sizes were modest for the complex analyses undertaken. Sample size may also have affected our ability to detect nonzero paths; replication with larger samples might reveal additional significant paths. Our community samples were relatively advantaged and high functioning. Although a wide range of SES was represented, the means for both SES and maternal education were elevated. Furthermore, child functioning was generally above average. The samples were also ethnically homogeneous and normal with respect to language and internalizing and externalizing behavior problems. All these considerations define the population to which the developmental pathways we found can be generalized. It could be, for example, that language affects internalizing behavior problems only in the normal range of functioning and not for samples with more severe clinical disorders.

To focus this analysis, we limited the scope of our studies to only one major developmental task domain and two major symptom domains. Other domains of developmental task competence (like adaptive behavior and social competence) have been implicated in the cascade literature as also linking to these symptoms (Bornstein, Hahn, et al., 2010; Masten, 2005). Another limitation of the present study design is the unequal and widely spaced longitudinal relations among broad constructs that prevent firm conclusions about precisely when or how cross-domain links developed.

That said, the operationalization and assessment of developmental pathways in these studies are both stringent and conservative, and the replication in two independent cohorts is rare. Study 2 extended Study 1 from 2 to 3 waves, added dependent variables, and took into consideration more covariates. The first assessment for this study took place in early childhood, before children had begun school, which allowed a test of the early onset of pathways. Children were evaluated across particularly critical transitions in their development, namely their entry into formal schooling and into adolescence. However, due to concerns of model complexity, additional common cause third variables and interacting constructs, such as academic achievement and social competence, were not included. Likewise, examination of additional child characteristics (e.g., temperament) might have made for a more definitive study. The inclusion of these constructs in the future is warranted and may extend our understanding of the cross-domain linkages uncovered in this set of studies.

The path analysis modeling approach we took made it possible to reduce the influence of key confounds and initial covariances between domains; it allowed us to control for spurious effects related to covariance with child age and nonverbal intelligence, maternal intelligence, education, and parenting knowledge, as well as family SES, important markers of general psychosocial advantage; and it afforded tests of alternative theoretical or antecedent-consequent models. Moreover, shared source and method variance, potential biases due to single reporters and single instruments, were avoided in our multi-informant, multimethod designs. An additional advantage of the path approach is revealed in comparison with the zero-order relations. If we had suspended our analyses at the point of correlations, we would have concluded that language is concurrently (negatively) related to externalizing behavior problems, not internalizing behavior problems, and even that early externalizing behavior problems relate to later language. The path analyses showed, however, that unique longitudinal relations obtained from language to internalizing behavior problems only. Importantly, the cascade approach was also able to discriminate between alternative temporal models.

Implications for Prevention, Intervention, Education, and Policy

According to epidemiological studies, rates of language impairment or delay in the general population range from 3% to 15% depending on severity (Cummings, Iannotti, & Zahn-Waxler, 1989; Silva, 1987). In this set of studies, language skills in early childhood emerged as a key domain in children's later development due to effects that spread to their behavioral adjustment over time, suggesting that programs aimed at improving child language may also promote their psychological well-being. An early focus on language may therefore yield a high return on investment in strategically timed and targeted interventions designed to ameliorate or obviate behavioral problems (Heckman, 2006; Masten et al., 2006). By identifying the processes, timing, and conditions of spreading effects it is possible to learn *when* to do *what* to interrupt negative spirals. Our research suggests that one way to prevent problems in *one* domain (internalizing) is to intervene earlier in *another* domain (language). One implication of our results is, therefore, that promotion of language early in development is warranted and not only to facilitate language development per se. What gives rise to individual variation in language? Perhaps unsurprisingly, positive parenting in infancy

enriches language in early childhood. Language skills in the younger child have origins in relationships in the family, and on this argument parent-child language interaction is therefore a significant indirect factor in wholesome child socioemotional development (e.g., Bornstein, Haynes, & Painter, 1998; van IJzendoorn, Dijkstra, & Bus, 1995).

Our findings specifically suggest a number of implications for different stakeholders in young children's healthy development. For parents, the promotion of early positive development in terms of language may foster verbal development and protect against the later emergence of internalizing behavior problems. For practitioners, the positive focus on language offers a valuable guideline for facilitating a child's developmental status. Furthermore, because behavior problems in the early years are seldom transient (that is, the stability of behavior problems is high), the identification of early formative potent preventatives or countermeasures is vital to children's healthy psychological development.

Conclusions

Cross-domain effects appear to reflect processes with significance for understanding the etiology of mental health problems and for intervening to promote competence and prevent or remediate symptoms (Masten et al., 2006; Rutter, Kim-Cohen, & Maughan, 2006). Here, we found that language skills in early childhood have implications for positive behavioral adjustment in terms of diminished internalizing behavior problems in future periods of development. Delineation of the directions, timing, and processes involved in such developmental paths has implications for developmental theory and for programs of intervention. These studies extend the evidence for developmental paths from successes (or failures) in one domain during one period of development to successes (or failures) in another domain across subsequent developmental periods.

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Appendix 1

Study 1: Pair-wise variance covariance matrix of variables in the final model

	1	2	3	4	5	6
1. Language, 4.5 years	1.00					
2. Internalizing behavior problems, 4.5 years	.08	1.00				

	1	2	3	4	5	6
3. Externalizing behavior problems, 4.5 years	−.30	.20	1.00			
4. Language, 7 years	.50	.00	−.22	1.00		
5. Internalizing behavior problems, 7 years	−.27	.17	.17	.01	1.00	
6. Externalizing behavior problems, 7 years	−.26	.17	..51	−.19	.35	1.00

Note. All variables were scaled by constants so that variable variances are all ≈ 1.

Appendix 2

Study 2: Pair-wise variance covariance matrix of variables in the final model

	1	2	3	4	5	6	7	8	9
1. Language, 4 years	.93								
2. Internalizing behavior problems, 4 years	−.18	.97							
3. Externalizing behavior problems, 4 years	−.30	.50	1.00						
4. Language, 10 years	.62	−.12	−.18	1.00					
5. Internalizing behavior problems, 10 years	−.29	.22	.33	−.19	1.00				
6. Externalizing behavior problems, 10 years	−.14	.05	.44	−.19	.51	1.01			
7. Language, 14 years	.58	−.10	−.20	.83	−.29	−.27	1.00		
8. Internalizing behavior problems, 14 years	−.23	.25	.17	−.11	.40	.19	−.10	.97	
9. Externalizing behavior problems, 14 years	−.11	.14	.27	−.21	.34	.63	−.25	.41	1.00

Note. All variables were scaled by constants so that variable variances are all ≈ 1.

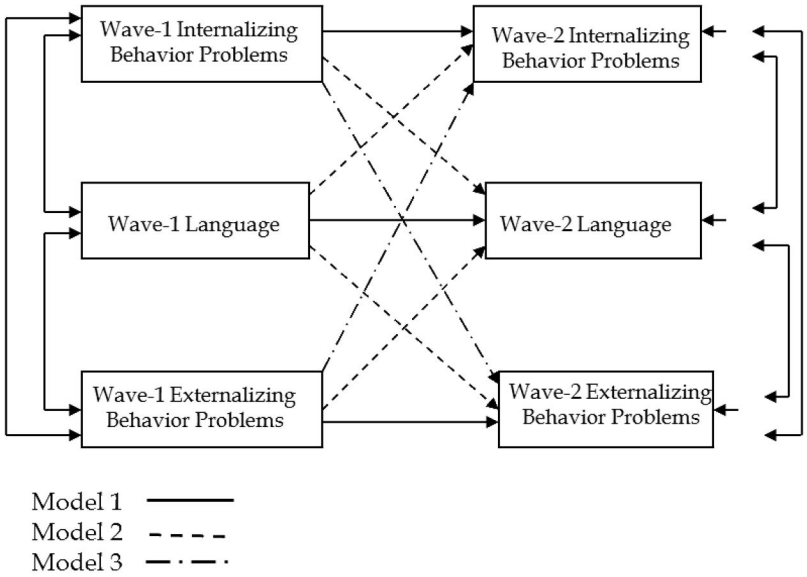


Figure 1.
Summary of the free parameters estimated for nested path models.

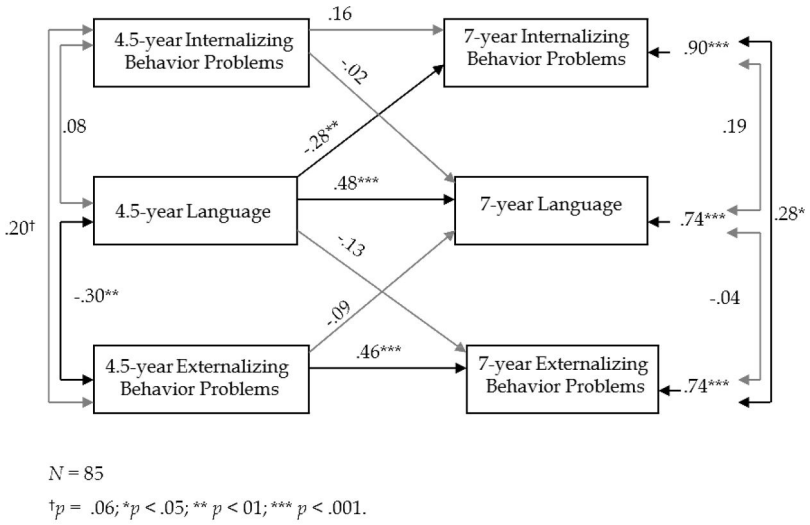
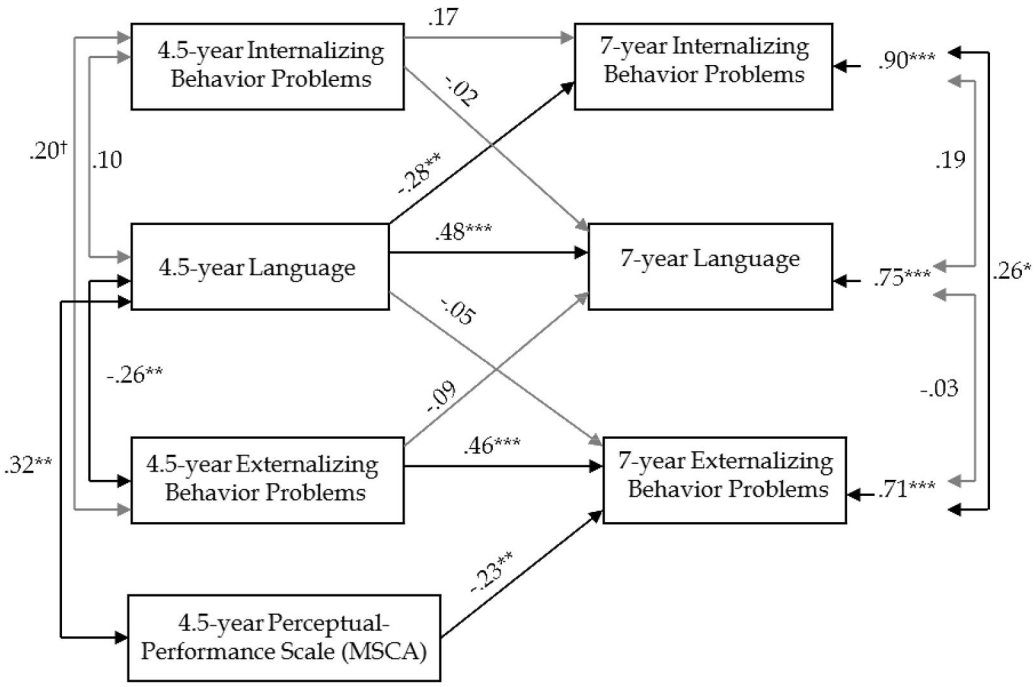


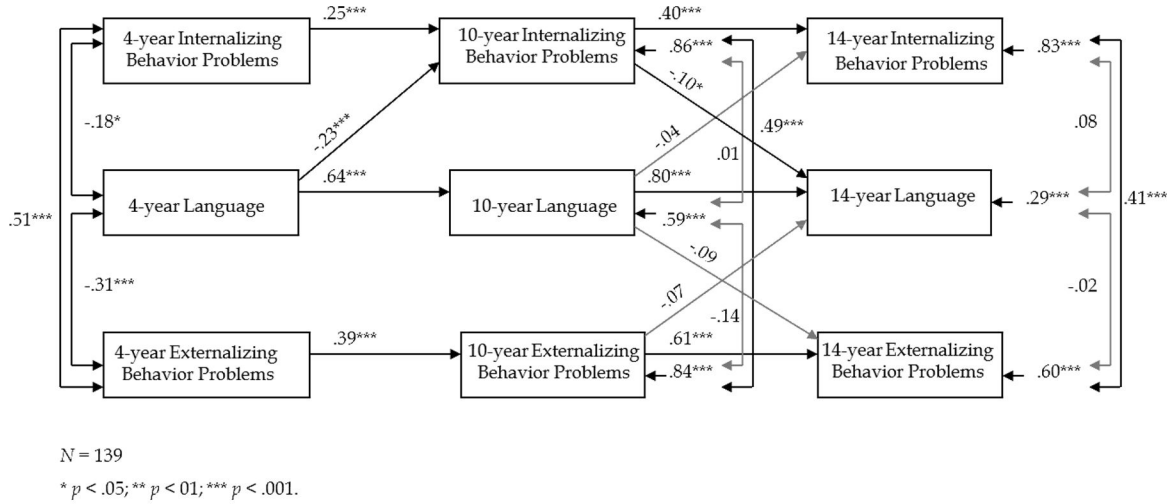
Figure 2.

Study 1: Standardized solution for the final model on the total sample. In this and all subsequent figures, numbers associated with single-headed arrows are standardized path coefficients; numbers associated with double-headed arrows are standardized covariance estimates. Arrows associated with dependent variables are error variances and represent the amount of variance not accounted for by paths in the model.



N = 85
†*p* = .06; * *p* < .05; ** *p* < 01; *** *p* < .001.

Figure 3.
Study 1: Standardized solution for the final model with covariate analyses on the total sample.

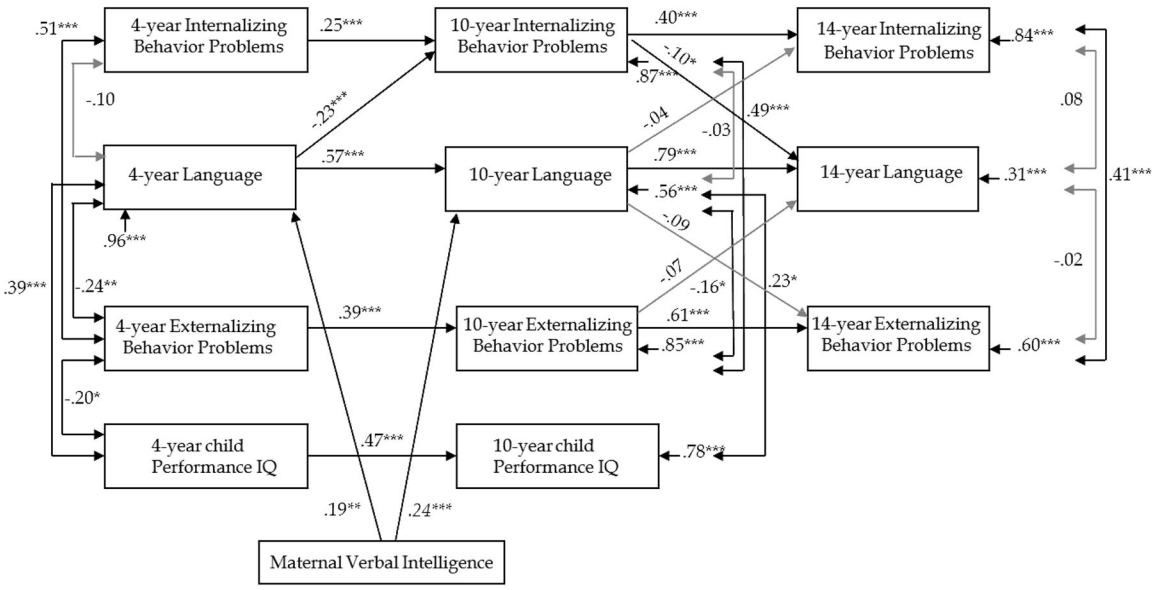


N = 139

* $p < .05$; ** $p < 01$; *** $p < .001$.

Figure 4.

Study 2: Standardized solution for the final model on the total sample.



$N = 139$

* $p < .05$; ** $p < 01$; *** $p < .001$.

Figure 5.

Study 2: Standardized solution for the final model with covariate analyses on the total sample.

Table 1

Study 1: Descriptive Statistics of Language, Behavioral Adjustment Measures, and Potential Covariates

Measurement	*M*	*SD*
Language		
4.5 years		
TOLD-P: Spoken Language Quotient	109.67	11.51
MSCA: Verbal	61.65	8.17
VABS: Communication (Mother)	112.67	7.40
VABS: Communication (Teacher)	110.01	12.10
7 years		
WRAT-R: Reading	115.20	16.91
WRAT-R: Spelling	113.62	19.53
Internalizing Behavior Problems		
4.5 years		
PBQ		
Anxious-Fearful	2.18	2.35
7 years		
RBPC		
Anxiety Withdrawal	2.03	2.77
Psychotic Behavior	0.24	0.84
Externalizing Behavior Problems		
4.5 years		
PBQ		
Hostile-Aggressive	2.18	3.46
Hyperactive-Distractible	1.52	1.90
7 years		
RBPC		
Socialized Aggression	0.44	1.01
Conduct Disorder	2.64	5.22
Attention Problems	2.80	3.95
Motor Excess	1.43	2.08
Covariates		
MSCA: Perceptual-Performance scale	55.76	6.19
Maternal Education on the HI 7-point Education scale	6.33	0.84
Concepts of Development Questionnaire	43.12	4.69
Family SES	58.29	7.20

Note. TOLD-P: Test of Language Development - Primary (Newcomer & Hammill, 1982); MSCA: McCarthy Scales of Children's Abilities (McCarthy, 1972); VABS-Mother: Vineland Adaptive Behavior Scales: Interview Edition Survey Form (Sparrow et al., 1984); VABS-Teacher: Vineland Adaptive Behavior Scales-Classroom Edition (Sparrow et al., 1985); WRAT-R: the Wide Range Achievement Test-Revised Edition (Jastak & Wilkinson, 1984); PBQ: Preschool Behavior Questionnaire (Behar & Stringfield, 1974); RBPC: Revised Behavior Problem Checklist (Quay & Peterson, 1983).

Table 2

Study 1: Concurrent and Predictive Relations Between Language and Behavioral Adjustment Measures at 4.5 and 7 Years

	4.5-Year Preschool Behavior Questionnaire		7-Year Revised Behavior Problem Checklist	
	Internalizing Behavior Problems	**Externalizing Behavior Problems**	**Internalizing Behavior Problems**	**Externalizing Behavior Problems**
	Concurrent Relations		Language-to-Behavior Relations	
4.5-year language aggregate score	.08	−.30**	−.27*	−.27*
	Behavior-to-Language Relations		Concurrent Relations	
7-year language aggregate score	.00	−.22*	.01	−.27*[a]

[a] One case emerged as an influential case (Cook's D = .33) and was removed from this analysis; before removing this case, $r(83) = -.19$, $p = .075$.

Table 3

Study 1: Model Fit Indices and Comparisons for Nested Path Models

Model	Satorra-Bentler Chi-square statistic	Robust CFI	SRMR	AIC	Model comparison	Chi-square difference test[a]
1	S-B $\chi^2(6) = 9.46$, $p = .15$	.95	.09	−2.54	2 vs. 1	$\chi^2(4) = 8.14$, $p = .087$
2	S-B $\chi^2(2) = 1.27$, $p = .53$	1.00	.03	−2.73	3 vs. 2	$\chi^2(2) = 1.13$, $p = .57$
3	--	--	--	--	--	--

Note. Model 3 was a just-identified model.

[a]Chi-square difference test was computed using chi-square statistics, not the Satorra-Bentler scaled chi-square statistics.

Table 4

Study 2: Descriptive Statistics of Language, Behavioral Adjustment Measures, and Potential Covariates

Measure	*M*[a]	*SD*
Language		
4 years		
Wechsler Preschool and Primary Scale of Intelligence-Revised, Verbal subtest		
Information	12.21	2.71
Similarity	10.97	2.40
Vineland Adaptive Behavior Scales, Interview Edition, Survey Form, Communication domain	107.07	8.87
10 years		
Wechsler Intelligence Scale for Children, Verbal subtest		
Information	14.28	2.95
Similarity	13.81	2.57
Vocabulary	14.03	3.16
Woodcock–Johnson Psycho-Educational Battery–Revised, Test of Achievement		
Letter-Word Identification	115.54	13.52
Passage Comprehension	116.56	10.78
Vineland Adaptive Behavior Scales, Interview Edition, Survey Form, Communication domain	107.59	12.10
14 years		
Woodcock–Johnson Psycho-Educational Battery–Revised, Test of Achievement		
Letter-Word Identification	114.73	13.83
Passage Comprehension	119.24	16.13
Vineland Adaptive Behavior Scales, Interview Edition, Survey Form, Communication domain	99.98	11.56
Internalizing Behavior Problems		
4 years		
Preschool Behavior Questionnaire, Anxious-Fearful subscale	3.72	2.28
10 years		
Child Behavior Checklist, Internalizing scale	6.24	5.65
Teacher Report Form, Internalizing scale	6.26	5.70
14 years		
Child Behavior Checklist, Internalizing scale	6.93	5.62
Youth Self-Report, Internalizing scale	10.56	7.52
Externalizing Behavior Problems		
4 years		
Preschool Behavior Questionnaire		
Hostile-Aggressive subscale	5.60	2.86
Hyperactive-Distractible subscale	2.97	1.73
10 years		
Child Behavior Checklist - Externalizing scale	7.72	6.49

Measure	***M*[a]**	***SD***
Teacher Report Form - Externalizing scales	6.26	8.49
14 years		
Child Behavior Checklist - Externalizing scale	8.37	6.94
Youth Self-Report - Externalizing scale	11.53	6.07
Covariates		
Child nonverbal intelligence		
4-year Wechsler Preschool and Primary Scale of Intelligence-Revised	113.93	16.26
10-year Wechsler Intelligence Scale for Children	112.01	14.47
Maternal verbal intelligence		
Peabody Picture Vocabulary Test-Revised	111.49	15.22
Maternal education on the HI 7-point education scale		
First assessment, child age 4 years	6.11	0.94
Second assessment, child age 10 years	6.14	0.95
Third assessment, child age 14 years	6.16	0.95
Maternal parenting knowledge		
Knowledge of Infant Development Inventory	.82	.06
Maternal social desirability		
Second assessment, child age 10 years	6.58	2.90
Third assessment, child age 14 years	6.77	2.72
Family SES		
First assessment, child age 4 years	55.99	9.20
Second assessment, child age 10 years	56.05	9.01
Third assessment, child age 14 years	55.93	8.94

[a] All scale scores were coded so that higher scores represent greater language or more internalizing or externalizing behavior problems.

Table 5

: Concurrent and Predictive Relations Between Language and Behavioral Adjustment Measures at 4, 10, and 14 Years

	4 Years		10 Years		14 Years	
	Internalizing Behavior Problems	**Externalizing Behavior Problems**	**Internalizing Behavior Problems**	**Externalizing Behavior Problems**	**Internalizing Behavior Problems**	**Externalizing Behavior Problems**
	Concurrent Relations		Language-to-Behavior Relations		Language-to-Behavior Relations	
nguage	−.18*	−.31***	−.30***	−.15	−.24**	−.12
	Behavior-to-Language Relations		Concurrent Relations		Language-to-Behavior Relations	
anguage	−.12	−.18*	−.19*	−.19*	−.11	−.21*
	Behavior-to-Language Relations		Behavior-to-Language Relations		Concurrent Relations	
anguage	−.10	−.20*	−.29***	−.27***	−.10	−.25**

1.

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Table 6

Study 2: Model Fit Indices and Comparisons for Nested Path Models

Model	Satorra-Bentler Chi-square statistic	Robust CFI	SRMR	AIC	Model comparison	Chi-square difference test[a]
1	S-B $\chi^2$21) = 46.91, p = .001	.95	.09	4.91	2 vs. 1	$\chi^2(1) = 10.05$, $p < .001$
2	S-B $\chi^2(20) = 37.02$, p = .01	.97	.06	−2.98	3 vs. 2	$\chi^2(4) = 11.75$, $p < .05$
3	S-B $\chi^2(16) = 25.58$, p = .06	.98	.05	−6.42	4 vs. 3	$\chi^2(2) = 0.11$, $p = .95$
4	S-B $\chi^2(14) = 25.86$, p = .03	.98	.05	−2.14	--	--

Note.

[a]Chi-square difference test was computed using chi-square statistics, not the Satorra-Bentler scaled chi-square statistics.