HOW COGNITIVE DEVELOPMENT MAY IMPACT COGNITIVE MODELS OF DEPRESSION IN YOUTH

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Attributional theories of depression, such as the reformulated helplessness model (Abramson, Seligman, & Teasdale, 1978) and the hopelessness model (Abramson, Metalsky, & Alloy, 1989), are two of the most influential cognitive models of depression, impacting both research and intervention efforts. Both are cognitive diathesis-stress models, insofar as they suggest that negative life events (NLE) are especially likely to generate depression in people who attribute these events to stable and global if not internal causes. As interest in childhood depression has increased, researchers have begun to test these attributional models in child and adolescent populations (Joiner & Wagner, 1995). Several researchers have suggested that a certain degree of cognitive maturity is necessary before the kinds of depressive attributions described by Abramson et al. are even possible (Nolen-Hoeksema, Girgus, & Seligman, 1992; Turner & Cole, 1994). Efforts to test this developmental hypothesis have generated somewhat inconsistent results (Joiner & Wagner, 1995; Nolen-Hoeksema et al., 1992; Turner & Cole, 1994). We hypothesize that these inconsistencies exist because this research has used age as a proxy for cognitive developmental level. Age is a poor proxy for developmental level (Siegler, 1996), and a relatively sophisticated level of cognitive development (not simply an advanced age) is necessary before youth can truly have the kind of depressive attributional style (AS) as described by Abramson et al. (1978, 1989). This study examines the degree to which cognitive level (not simply age) serves as a developmental prerequisite for the relevance of attributional style to depression in childhood. Thus my hypotheses focus on children's cognitive capacity to understand and judge the internality/externality (I/E), stability/instability (S/I), and globality/specificity (G/S) of hypothetical causes as a developmental moderator of the relation between attributional style and depressive symptoms.

We contend that children do not understand key dimensions of causal relation in the same way that adults do. Subsequently, we contend that the measures of children's causal attributional style may not tap the same construct as do adult measures. For example, a commonly used measure of children's depressive attributional style is the Children's Attributional Style Questionnaire (CASQ; Seligman, Peterson, Kaslow, Tanenbaum, Alloy, & Abramson, 1984). In order to distinguish internal from external attributional style, the CASQ asks, "You get very good grades. Is it because (a) School work is simple, or (b) You are a hard worker." This item (and many like it) assumes that the child understands ability as an internal and stable attribute. This assumption is contradicted by previous research. In previous work (Folmer, et al., 2008; Nicholls, 1978; Nicholls & Miller, 1984), young children are shown to conflate ability with effort, such that hard work implies *high* ability across all contexts. In contrast, adolescents and adults realize that the person who must work harder to obtain a given outcome must have *lower* ability. Therefore, items such as these will likely mean very different things to older and younger respondents.

This is not an instrument-specific problem; rather it is due to a cognitive level of development that does not allow a mature understanding of ability as an internal, stable, and trait-like entity (Folmer et al., 2008; Cole et al., 2008). Folmer et al. (2008) replicated and expanded upon Nicholls' (1978; Nicholls & Miller, 1984) work on children's conception of ability (an internal, stable attribute) and effort (an internal but unstable attribute) as causes of achievement-related outcomes. In this previous study, we assessed level of cognitive development and motivation to exert effort on tasks with (artificially determined) poor outcomes. Results indicated that the exertion of high effort was more strongly associated with higher motivation for older participants than for younger participants. Task motivation covaried with effort among older participants (who understand that failure after exerting high effort implies low ability), but not among younger participants (who still conflate ability with effort). This provides support for the relevance of cognitive development to motivation, a system that is often disrupted in depression. Additionally, age and cognitive level both correlated positively with children's capacity to differentiate ability and effort as causal factors. Collectively, these results suggest that attributional theories that rely upon a mature understanding of effort and ability (and consequently internality, stability, and globality of causes) may not be applicable to younger populations.

Cole et al. (2008) lend further support to the hypothesis that depressive attributional style in childhood is not the same thing as depressive attributional style in adolescence. In a three-cohort, four-year longitudinal investigation of over 800 youths (grade 2 through 9), they obtained measures of depressive attributional style, negative life events and depressive symptoms. Analyses revealed that the consistency of children's attributions across situations was moderately high at all ages. Nevertheless, confirmatory factor analysis showed that the cross-sectional structure of AS changed with age, as stability became a more salient aspect of AS than internality and globality. Perhaps the most intriguing finding was that the longitudinal structure of AS also changed, becoming more time-invariant (i.e., trait-like) as children grew older. That is, structural equation modeling revealed that depressive attributional *style* becomes increasingly *style-like* as children enter into adolescence. Longitudinal analyses further revealed that evidence of a cognitive diathesis x stress interaction did not emerge until grades 8 and 9, suggesting that AS may not serve as a diathesis for depression at younger ages. In conjunction with the results of Folmer et al. (2008), these results lend considerable credence to my contention that attributional models of depression may require serious modification before they are applied across developmental levels.

In preparation for the proposed project, we have designed the Peabody Causal Attribution Test (PCAT) to assess children's cognitive developmental level with respect to the conception of ability. The PCAT assesses children's ability to make accurate judgments about the causes of hypothetical events. The hypothetical events in the PCAT are similar to those used in the major attributional measures for children and adolescents: e.g., the Children's Attributional Style Questionnaire (CASQ; Seligman et al., 1984), the Children's Attributional Style Interview (CASI; Conley, Haines, Hilt, & Metalsky, 2001), and the Adolescent Cognitive Style Questionnaire (ACSQ; Hankin & Abramson, 2002). The PCAT assesses the degree to which children make erroneous judgments about the causes of events involving luck (external, unstable, uncontrollable), effort (internal, potentially unstable, controllable), and task difficulty (external, stable, uncontrollable). Adults should have little trouble answering these questions correctly, given their capacity for abstract reasoning and their adult-like conceptualization of trait-like characteristics. Children and some adolescents, however, are prone to make anticipatable errors when answering these questions – errors that are consistent with their cognitive level of development. A sample PCAT item is, “Jenny does not work very hard in school, but she gets very good grades anyway. Sarah works very hard in school. She gets very good grades too. Sarah and Jenny both get As all the time. Who is smarter?” (The item is accompanied by an illustration.) Response options are (a) Jenny is smarter, (b) Sarah is smarter, and (c) They are the same. Adolescents and adults understand the reciprocal relation between effort and ability and would be expected to answer the question correctly: Jenny must be smarter because she does not have to work as hard as Sarah. Younger children confound effort and ability, suggesting that they would claim that Sarah must be smarter because she works harder (and good students work hard). Still younger children only focus on the outcome and may proclaim that Jenny and Sarah are equally smart because they got the same grades. Containing 24 such items, the PCAT was designed to discriminate reliably among children according to the cognitive sophistication of their causal attributions.

This project has three key aims. Our first aim is to validate the PCAT. We hypothesize that the PCAT will relate to other cognitive developmental measures and age. Second, we anticipate that the PCAT will be related significantly to measures of attributional style, suggesting that measures of AS may be confounded by cognitive development when applied to child and adolescent populations. Our third aim is to clarify the potential moderating effect of cognitive development on the relations among attributional style, negative life events, and depression. We hypothesize that when AS is measured at early levels of cognitive development (as operationalized by low scores on the PCAT), it will not relate to depression in the manner anticipated by attributional models of depression (Abramson et al., 1989). That is, it will not interact with negative life events to predict level of depression symptoms. Conversely, we also hypothesize that individuals at later levels of cognitive development (operationalized by higher scores on the PCAT and supporting measures) do have the cognitive capacity for true depressive attributional style, and that measures of AS will interact with NLEs to predict level of depressive symptoms.

CHAPTER II

METHOD

Participants

Participants included 94 male and female participants from grades 3-10 in over 35 public and private elementary, middle, and high schools in the Nashville area. This age range is optimal because (a) depression in youth is rare prior to grade 3, (b) the age range includes early adolescence when incidence of depression increases – especially among females, (c) the age range spans periods of cognitive development when the capacity for abstract reasoning (presumably necessary for understanding the reciprocal relation between effort and ability) comes online, and (d) all of the study measures have been developed for and/or piloted for use with children throughout this age range.

Table 1
Demographic characteristics by grade level

Grade	N	% Female	Mean Age (SD)
3	16	75%	8.43 (.64)
4	8	75%	9.38 (.52)
5	18	39%	10.33 (.48)
6	11	64%	11.27 (.47)
7	9	56%	12.67 (.70)
8	10	40%	13.33 (.70)
9	16	38%	14.31 (.60)
10	6	17%	15.33 (.52)
Total	94	51%	11.62 (2.31)

Our sample was racially heterogeneous (45% White, 45% African American, 7% Multiple races/ethnicities, 2% Hispanic, 1% Asian). It was also socioeconomically diverse, with annual family incomes ranging from less than $10,000 to over $180,000 (median = $40,000); over 20% of our sample reported an annual income of $10,000.00 or less. Participants were screened and excluded based on special needs (such as a diagnosed learning disability) or a limited command of English that would interfere with their ability to complete the required tasks.[1]

Measures

Cognitive Development. We administered six measures to assess level of cognitive development and obtain an estimated IQ score. The assessment strategy involved multiple methods designed to evaluate several areas of cognitive functioning, including: 1) the general capacity to understand the reciprocal relation between effort and ability (the Nicholls' Effort-Ability task); 2) verbal short-term and working memory tasks (WISC-IV Digit Span Forward and Backward); 3) perceptual organization (WISC-IV Picture Concepts); 4) estimated intelligence (comprised of WISC-IV Block design and WISC-IV Vocabulary), and 5) the specific capacity to understand what is meant by the internality, stability, and globality of causes (the PCAT). As the PCAT is of our own construction, we will use the other two measures as part of its validation.

The Digit Span Task, Picture Concepts, Block Design and Vocabulary tasks were taken from the WISC-IV (Wechsler Intelligence Scale for Children, Fourth Edition; Wechsler, 2003). WISC-IV scores show evidence of validity in children 6 to 16 years of

[1] Our sample included 19 groups of siblings for a total of thirty-nine participants related to another child in the study.

age and have good internal consistency reliability (.85) and test-retest stability (.83; Wechsler, 2003). This sample yielded subscale-specific internal consistency reliabilities ranging from .58 (Digit Span Backward) to .93 (Vocabulary). Children's scores on these tasks show age-related differences and typically, WISC-IV scores are scaled according to age-appropriate norms. However, we will use the raw scores on the individual subtests to compare performance across age groups. We will use the scaled scores to calculate IQ, as intelligence is measured relative to same-age peers. These measures are discussed in more detail below.

1. Nicholls' Effort-Ability Level (EA). Based on Nicholls' (1978; Nicholls & Miller, 1984) studies of effort and ability, we developed materials necessary to assess children's level of understanding the reciprocal relation between effort and ability as potential causes of achievement outcomes (see Folmer et al., 2008, described above). This method is a one-on-one interview focused on a set of questions that follow the presentation of a set of video clips. From previous work, we have constructed video clips depicting two actors sitting side-by-side at a table. The actors match each other on sex, ethnicity, and apparent age. In these video clips, both actors work on a math worksheet. One actor works hard on a set of math problems for the entire 2-minute time span, exhibiting high effort. The other actor, taking cues from an off-screen research assistant, spends approximately half the time fiddling with objects on the desk, hence exhibiting low effort. Before and after viewing the video clip, participants are told (a) that one actor (e.g., Harry) works hard for the entire time whereas the other actor (e.g., Luke) goofs off a lot, and (b) that both of the actors get 2 out of 10 problems correct on the worksheet.

All video clips are installed on a Dell Inspiron 1200 laptop computers for presentation to participants.

The follow-up Nicholls' Effort-Ability questions assess the participants' perceptions of the actors' relative levels of ability. Two of the questions require fixed responses: (1) "Who do you think is smarter?" and (2) "Who do you think is better at math?" Response options are "Harry is smarter than Luke," "Luke is smarter than Harry," and "They are the same." Still images from these videos serve as photographs for participants to use as references while answering questions. The next 3 questions are in a free-response format: (3) "How come both of them got the same score when one worked hard and the other didn't work hard?" (4) "What would happen if both of them worked really hard? Would one of them do better than the other, or would they do the same as each other?" and (5) "How can you tell?" Finally, the first two questions are re-administered as a reliability probe. All responses are videotaped for later scoring using Nicholls' (1978; Nicholls & Miller, 1984) criteria.

Two independent raters scored the free-response questions using a scoring rubric based upon Nicholls' descriptions of the four effort-ability differentiation levels (Nicholls & Miller, 1984). Because these questions build upon one another, the raters considered them jointly when making their judgments. Responses were transcribed and raters were naïve to the participants' ages, sex, and grade levels during the rating process. Each participant's effort-ability question set was scored from 1 to 4 to yield a Nicholls' Effort-Ability Level, with 4 indicating the most mature understanding and 1 indicating the least. Inter-rater reliability in this study was good (r = .85) and resembled that of previous studies (*r* = .87; Folmer et al., 2008). Disagreements were resolved by inter-rater conferences.

2. Digit Span Task (DS). The Digit Span Task (as taken from the WISC-IV; Wechsler, 2003) asks respondents to remember and repeat a series of numbers that systematically increases in length. For the first task, respondents are asked to repeat the numbers exactly as heard (Digit Span Forward). For the next task, they are asked to repeat the numbers in reverse order (Digit Span Backward). Each task has 16 trials that form 8 items. Other studies (Alloway, Gathercole, & Pickering, 2006) have demonstrated that Digit Span Forward comprises a measure of verbal short-term memory and Digit Span Backward measures verbal working memory. Both verbal short-term and working memory capacities should play important roles in children's ability to understand hypothetical scenarios, consider multiple causes/outcomes/alternatives, and draw a conclusion. Working memory skills have also been linked to false-belief understanding, a developmentally-linked theory of mind task, in young children (Mutter, Alcorn, & Welsh, 2006). Therefore, given the age-related differences in Digit Span performance, its approximation of verbal short-term and working memory, and the relevance of such memory to the ability to consider simultaneously multiple hypothetical causes and scenarios, the Digit Span Task is an appropriate validation tool for the PCAT.

3. Picture Concepts (PC). Picture Concepts (as taken from the WISC-IV; Wechsler, 2003) asks respondents to look at several rows of pictures and pick one picture from each row that best fits with the other pictures selected. It assesses a child's ability to use abstract and perceptual reasoning skills to group items together (Sattler & Dumont, 2004). We used PC raw scores to examine how children's ability to discern sometimes

subtle relationships may relate to their understanding of the reciprocal relations between effort/task difficulty/luck and ability.

4. Estimated IQ Score. We estimated IQ by summing Block Design and Vocabulary scaled scores (see descriptions below) and using this sum to obtain IQ estimates from Sattler and Dumont's (2004) tables. This method, based on work by Cyr and Brooker's (1984) work, has shown good reliability (r_{xx} = .92) and validity (r = .87) and has been used successfully in other studies as a brief IQ screener (Biederman, Carter, Ball, Fried, Doyle, Cohen, et al., 2009; Campbell, 1998; Seidman, Buka, Goldstein, & Tsuang, 2006). This IQ score provided us with an estimate of each participant's cognitive functioning relative to other children at the same age level. We included an estimate of IQ to distinguish between overall cognitive skill level, which we expect to remain relatively stable at all age levels (Hoekstra, Bartels, & Boomsma, 2007; Juan-Espinosa, Garcia, Colom, & Abad, 2000; Mortensen, Andresen, Kruuse, Sanders, & Reinisch, 2003) and the emergence of more developmentally-linked factors such as Nicholls' Effort-Ability Level.

Vocabulary (VC). Vocabulary (as taken from the WISC-IV; Wechsler, 2003) asks respondents to name pictured objects (Items 1-4) and define words presented visually and verbally (Items 5-36). It assesses language development, verbal comprehension, and verbal skills (Sattler & Dumont, 2004).

Block Design (BD). Block Design (as taken from the WISC-IV; Wechsler, 2003) is a timed subtest that asks respondents to reproduce printed designs using 2, 4, or 9 blocks within a given time limit. Block Design consists of 14 items and includes a time bonus when designs are completed within certain time intervals. It is thought to assess nonverbal reasoning ability, visual-motor integration, and the ability to synthesize visual information (Sattler & Dumont, 2004), which may relate to a child's ability to respond to illustrated questionnaires.

5. Peabody Causal Attribution Test (PCAT). The PCAT assesses children's cognitive capacity to understand key features of causal attributions, especially those features used to define a depressive attributional style (i.e., internality/externality, stability/instability, globality/specificity). The PCAT accomplishes this with a series of questions that children will only get "right" if they understand the relation between ability and effort, ability and luck, and ability and task difficulty. This instrument consists of 24 items describing hypothetical, developmentally appropriate scenarios. Each item is illustrated. These items can be broken down into three separate 8-item subscales: Effort, Task Difficulty, and Luck. The PCAT was administered individually (one-on-one) at all grade levels to avoid confounding method with developmental level.

Depressive Symptoms. We obtained measures of depressive symptoms in participants by asking participants about themselves and parents about the participants. Trained research assistants verbally administered child questionnaires in a private, one-on-one setting. Participants were instructed to read along and mark their own answers.

Children's Depression Inventory (CDI). The CDI (Kovacs, 1985) is a 27-item self-report measure that assesses cognitive, affective, and behavioral symptoms of depression in children. Each item consists of three statements graded in order of increasing severity from 0 to 2. Children select one sentence from each group that best describes themselves for the past two weeks (e.g., "I am sad once in a while," "I am sad many times," or "I am sad all the time"). In nonclinic populations, the CDI has relatively high levels of internal consistency, test-retest reliability, predictive, convergent, discriminant, and construct validity, and has been validated for use with children as young as 3rd grade (Cole & Jordan, 1995; Craighead, Smucker, Craighead & Ilardi, 1998; Smucker, Craighead, Craighead & Green, 1986; Timbremont, Braet, & Dreessen, 2004). In this sample, scores on the CDI showed good internal consistency reliability (Cronbach's alpha = .83).

Life Events and Attributional Style. The following measures of negative life events and depressive attributional style have been validated for use with children at least as young as 8 years old.

1. <u>Perceived Events Schedule (PES)</u>. The PES (Compas, Davis, Forsythe, & Wagner, 1987) consists of 89 items that assess both daily ("Not spending enough time with friends") and major ("Death of a family member") life events. Respondents identify each event that has happened in the preceding four months. They then rate the desirability of each event on a 9-point Likert scale, with 1 being "extremely bad" and 9 being "extremely good." A ruler illustrating the 1-9 scale provides visual support for respondents and separate instructions are provided for children under the age of 10. Desirability ratings are then converted to a -4 to 4 valence score scale, with lower scores indicating more negativity. All positively rated events are summed to form an overall Positive Event valence total and all negatively rated events are summed to form a Negative Event valence total. For the purposes of this study, we examined only the Negative Event valence total. Scores on this measure have been shown to have good test-retest reliability (*r*s ranging from .77-.89) in adolescents (Compas et al., 1987). The PES was completed by participants about themselves and by parents about the participants.

Due to discrepancies between parent- and child-reported events, we created a composite Negative Life Event (NLE) variable. If only a child or parent reported a negative event, we used that single valence score. However, if both parents and children reported the event, we took the average valence rating.

2. Attributional Style. We assessed participants' AS using one of two measures, depending upon participant age. For younger children (grades 3-6), we used the Children's Attributional Style Interview (CASI; Conley et al., 2001). Each of the 16 items (8 positive, 8 negative) presents a hypothetical situation and accompanying picture. Children are asked to imagine themselves in the situation and provide the one main reason that the situation happened to them. Children then rate their causal attribution on three 7-point scales: internality (how much their causal reason was "because of you"), stability (if their reason "would be true again?"), and globality (if their reason would "make other bad things happen?"). A validation study of this measure in a group of children (age range 5-10) revealed good subscale internal consistency (Cronbach's alphas range from .72-.82; Conley et al., 2001). In this sample, alphas ranged from .51 (internal subscale) to .80 (global subscale).

For older children and adolescents (grades 6-10), we used the Adolescent Cognitive Style Questionnaire (ACSQ; Hankin & Abramson, 2002). The ACSQ presents respondents with 12 negative hypothetical events (six interpersonal, six achievement). Respondents think of one reason why the event may have happened. They then rate the internality, stability, and globality of the cause, as well as negative inferences about consequences and implications for the self, along a 7-point Likert scale, with higher scores indicating a more depressotypic response. Past studies have shown that we can obtain high reliability in the use of this measure (alphas range from .74-.88, Cole et al., 2008; see also Hankin & Abramson, 2002). This sample yielded alphas of .70 for internality, .82 for stability, and .78 for globality.

Previous work from our lab on a sample of 120 7th graders revealed that the CASI and ACSQ are congenerically equivalent (Cole et al., 2008). More specifically, multitrait-multimethod confirmatory factor analysis revealed that comparable CASI and ACSQ subscales tap the same three underlying constructs: internality/externality, stability/instability, globality/specificity. Factor loadings were large and significant for all subscales. Means and standard deviations for the two measures are also quite comparable. Because of these measures' congeneric equivalence, we created a composite Attributional Style variable (AS) by summing the total scores for each CASI and ACSQ subscale (Internality, Stability, Globality) and creating total scores for both measures. We then standardized the scores due to the differing lengths of the measures. For participants who completed *either* the CASI or the ACSQ (n = 82), we used the single standardized score from the administered instrument. However, for participants who completed both (n = 11), we took the mean of the two scores and used that averaged value. We used this composite AS variable in our analyses.

Demographic Information. We administered a brief questionnaire to parents to gather demographic information. This information included the child's age, grade, and school, parents' marital status, ages, and educational achievements, relation of the respondent to the participant, family size (including number of children and adults currently living in the home), and annual income.

Procedure

Doctoral psychology students and advanced undergraduates were extensively trained on all measures prior to data collection. Data collection took place in our laboratory on the Vanderbilt campus. Sessions were scheduled with the participant's parents. We provided vouchers for taxi cabs to transport participants to and from our laboratory, if necessary. This ensured that lack of available transportation did not prohibit participation. Of 94 participants, 10 required assistance with transportation.

We administered the following measures to participants in a single session:

1. *Cognitive development*: To assess level of developmentally-linked cognitive abilities, we administered the Nicholls' Task, Digit Span, Block Design, Picture Concepts, Vocabulary, and the PCAT.
2. *Depressive symptoms*: To assess symptoms of depression, we administered the CDI to participants.
3. *Attributional style*: To assess this cognitive diathesis for depression, we administered either the CASI or the ACSQ (depending on the child's age).
4. *Life stress*: To measure life stress over the preceding four months, we administered the PES to participants about themselves and to parents about participants.
5. *Demographic Information*. To obtain information on demographic characteristics, we administered a brief questionnaire to parents.

We administered measures to participants in two different orders to reduce the effect of fatigue or sequence on any particular instrument. In both sequences, the PCAT and CDI were administered first to reduce the likelihood of previous measures (such as attributional style questionnaires or the Nicholls Effort-Ability task) influencing reported depression levels or effort-ability understanding. We then alternated the administration order of the measures of cognitive development, attributional questionnaires, and PES. Finally, we concluded each time with the Nicholls' task. The entire session took approximately 90 minutes. Participants and their parents were offered a snack break approximately 45 minutes into the session. After completing the measures, participants received $50 compensation as well as a candy bar.

CHAPTER III

RESULTS

Descriptive Statistics. Descriptive statistics for key study variables are presented in Table 2. CASI and ACSQ means and standard deviations are similar to scores reported in other samples (Conley et al., 2001; Hankin & Abramson, 2002; LaGrange et al., 2008). CDI scores are generally consistent with previous work (Cole, Hoffman, Tram, & Maxwell, 2000; Tram & Cole, 2006), aside from slight elevations (+.5 sd) at ages 8-, 13-, and 14-years. We found similar elevations in another sample of youth at risk for depression from this community (Cole et al., 2008). These results are consistent with research on other lower socioeconomic status, community samples of youth that show elevated CDI scores (e.g., Edelsohn, Ialongo, Werthamer-Larsson, Crockett, & Kallam, 1992; Fitzpatrick, 1993). In the current project, 7 participants (7.5%) obtained CDI scores of 19 or above.

PCAT Psychometrics. We scored the PCAT using a dichotomous system in which a 1 represents the most adult-like answer (e.g., "We don't know why he won the game of dice; it was because of luck") and a 0 represents the two less adult-like answers (e.g., "He won the game of dice because he worked hard;" "[Loser] is better at the game, he just let [Winner] win"). We created a total score to examine overall PCAT understanding as well as three subscale scores that encompassed the three question types: Effort, Task Difficulty, and Luck. We next examined the PCAT factor structure. To conduct a factor analysis on dichotomous data, we created a smoothed tetrachoric correlation matrix using

Table 2

Means and standard deviations of key measures by age

	8 (N = 8)	9 (N = 12)	10 (N = 16)	11 (N = 14)	12 (N = 8)	13 (N = 8)	14 (N = 16)	15 (N = 9)	16 (N = 3)
CDI	11.00 (6.72)	7.42 (7.49)	6.69 (5.77)	8.07 (6.04)	6.38 (3.02)	2.63 (2.92)	9.00 (5.53)	9.78 (6.38)	6.00 (5.57)
NLE	-29.00 (15.89)	-23.17 (19.58)	-21.00 (13.13)	-28.29 (17.70)	-25.00 (18.52)	-14.75 (9.57)	-24.06 (14.81)	-32.11 (18.60)	-35.83 (15.97)
CASI	90.63 (28.85)	87.50 (23.57)	87.44 (18.62)	92.92 (16.92)	109.67 (19.04)	--	--	--	--
ACSQ	--	--	--	137.75 (16.02)	117.24 (23.46)	135.88 (25.90)	143.50 (29.40)	139.00 (31.10)	137.33 (48.01)
VC	28.75 (7.36)	30.92 (11.21)	37.31 (11.93)	36.57 (9.76)	40.25 (7.72)	43.00 (11.49)	42.50 (14.90)	45.67 (11.46)	34.00 (14.53)
BD	27.63 (14.66)	24.75 (11.56)	35.88 (13.79)	35.71 (14.69)	36.13 (15.70)	30.38 (13.50)	38.25 (15.94)	46.67 (7.26)	31.00 (4.35)
DS	15.75 (2.66)	13.67 (4.72)	16.75 (3.75)	15.64 (2.44)	14.00 (3.02)	16.75 (3.12)	16.94 (2.95)	18.22 (3.38)	14.00 (1.00)
PC	16.50 (3.21)	16.91 (3.58)	18.81 (4.32)	17.43 (2.90)	16.63 (3.81)	18.63 (4.47)	18.69 (4.51)	17.11 (4.37)	19.00 (4.36)
IQ	103.25 (18.63)	98.58 (21.59)	106.69 (19.72)	100.36 (19.87)	99.25 (17.75)	93.50 (19.00)	95.44 (22.30)	99.22 (14.25)	74.67 (13.01)
PCATT	13.88 (6.10)	14.50 (5.82)	14.44 (5.62)	15.50 (5.50)	14.63 (5.01)	17.25 (5.78)	17.56 (4.15)	17.11 (5.35)	14.33 (9.87)
PCATE	2.25 (3.28)	3.67 (2.57)	2.43 (2.53)	2.43 (2.59)	1.75 (2.38)	3.50 (3.70)	3.69 (2.68)	3.56 (2.96)	4.67 (4.16)
PCATD	6.50 (2.27)	6.25 (1.96)	5.44 (2.76)	6.79 (1.37)	5.87 (2.64)	6.38 (2.45)	6.50 (2.25)	6.33 (1.80)	5.33 (2.08)
PCATL	5.13 (2.69)	4.58 (2.75)	6.56 (2.44)	6.29 (3.12)	7.00 (2.07)	7.38 (.92)	7.38 (1.54)	7.22 (1.30)	4.33 (3.79)
EA	1.75 (1.16)	1.75 (1.14)	1.94 (1.06)	2.21 (1.19)	2.75 (1.04)	2.88 (1.25)	2.94 (.85)	3.00 (1.31)	2.33 (1.53)

Note. CDI = Children's Depression Inventory; NLE = Composite Negative Life Events Valence Score (Lower score = More stress reported); CASI = Children's Attributional Style Interview; ACSQ = Adolescent Cognitive Style Questionnaire; VC = Vocabulary Comprehension, unstandardized raw score; BD = Block Design, unstandardized raw score; DS = Digit Span, unstandardized raw score; PC = Picture concepts, unstandardized raw score; IQ = Intelligence Quotient, estimated using Block Design and Vocabulary Comprehension; PCATT = Peabody Causal Attribution Test, Total score; PCATE = Peabody Causal Attribution Test, Effort subscale; PCATD = Peabody Causal Attribution Test, Task Difficulty subscale; PCATL = Peabody Causal Attribution Test, Luck subscale; EA = Nicholls' Effort Ability level.

the TetCorr correlation program (Fleming, J. S., 2005). Previous work (Knol & ten Berge, 1989; Uebersax, 2006) has demonstrated that “smoothing,” or removing negative eigenvalues, should be performed before conducting a factor analysis on a tetrachoric correlation matrix. We conducted three separate principle axis factor analyses. As seen in Table 3, each analysis yielded a single factor that accounted for most of the variance within each PCAT subscale.

Table 3
Factor structure of the PCAT

	Effort	Task Difficulty	Luck
Eigenvalue 1	5.74	6.39	6.99
Eigenvalue 2	.93	.42	.29
Eigenvalue 3	.36	.32	.27
Eigenvalue 4	.34	.26	.15
Eigenvalue 5	.25	.21	.11
Eigenvalue 6	.20	.19	.09
Eigenvalue 7	.11	.13	.06
Eigenvalue 8	.07	.09	.03

Primary factor loadings ranged from .78 to .98 with the exception of one item, which loaded only .41 (see Table 4). This item asks a question about popularity, which may explain why it did not load as strongly as others onto the Effort subscale. Overall, PCAT items loaded very well onto their a priori subscale factors. Each of the subscales showed good reliability (see Table 4) with alphas ranging from .81 to .90. Discriminant validity was also good, with no subscale correlating with another more than .40 (see Table 5).

Table 4

PCAT item loadings

	Effort		Task Difficulty		Luck	
	Item #22	.92	Item #18	.95	Item #11	.98
	Item #16	.92	Item #6	.92	Item #5	.96
	Item #10	.88	Item #24	.90	Item #8	.94
	Item #13	.87	Item #12	.88	Item #17	.93
	Item #7	.86	Item #9	.87	Item #20	.92
	Item #4	.85	Item #21	.87	Item #2	.91
	Item #1	.81	Item #3	.84	Item #14	.90
	Item #19	.41	Item #15	.79	Item #23	.87
Cronbach's α	.87		.81		.90	

Table 5

PCAT Discriminant Evidence Coefficients

	Effort	Task Difficulty	Luck
Effort	1.00	$.40^{**}$	$.22^{*}$
Task Difficulty	$.40^{**}$	1.00	$.31^{**}$
Luck	$.22^{*}$	$.31^{**}$	1.00

* $p < .05$. ** $p < .01$.

Because we conducted three separate factor analyses and were unable to examine cross-loadings, we investigated the possibility that the subscales significantly overlapped to the point of redundancy. If the true subscale correlation was 1.0, then the maximum observed correlation after attenuation due to measurement error would equal the product of the square root of the reliabilities, or approximately .85. Observed subscale correlations were .22, .31, and .40 – all substantially less than .85, providing evidence of discriminant validity.

Aim 1: PCAT scores, age, and cognitive-developmental variables. To examine the relation of the PCAT to other variables, we conducted a series of bivariate correlational analyses (see Table 6). We discovered that although overall PCAT performance (PCAT-Total) did not correlate with Age (r = .20, p = ns), it showed moderately strong relations with other measures of cognitive development. PCAT-Total showed a positive relation to IQ, with higher PCAT scores indicating higher IQ scores (r = .52, p < .01). Because IQ is corrected for age, we also examined the relation of PCAT-Total to raw scores on WISC-IV subtests. We found significant positive correlations with Block Design (.44, p < .01) and Vocabulary (.61, p < .01), used for estimating IQ, as well as Picture Concepts (r = .35, p< .01) and Digit Span (r = .33, p < .01). Although the PCAT was not related to chronological age, it was significantly correlated with cognitive skills (such as working memory and abstract reasoning). Additional support for this hypothesis emerged from examinations of PCAT-Total and EA, which showed a moderate positive correlation (r = .45, p < .01). This provides evidence of convergent validity for the PCAT by demonstrating that it correlates in the anticipated direction with a previously established measure of the understanding of attributional dimensions.

Table 6

Correlations between key measures

	AGE	CDI	AS	IQ	PC	DS	BD	VC	PCATT	PCATE	PCATD	PCATL	EA	NLE
AGE	1.00													
CDI	-.00	1.00												
AS	.10	.32**	1.00											
IQ	-.18	-.13	.29**	1.00										
PC	.08	-.05	.35**	.41**	1.00									
DS	.19	-.14	.21*	.38**	.32**	1.00								
BD	.29**	-.09	.18	.76**	.33**	.37**	1.00							
VC	.37**	-.11	.40**	.74**	.47**	.45**	.61**	1.00						
PCATT	.20	-.07	.39**	.52**	.35**	.33**	.44**	.61**	1.00					
PCATE	.13	-.01	.23*	.26*	.13	.18	.27**	.28**	.77**	1.00				
PCATD	.04	.05	.28*	.39**	.35**	.14	.27**	.41**	.74**	.40**	1.00			
PCATL	.26*	-.18	.35**	.52**	.32**	.42**	.43**	.68**	.69**	.22*	.31**	1.00		
EA	.39**	.04	.35**	.31**	.24*	.30**	.41**	.49**	.45**	.38**	.24*	.35**	1.00	
NLE	-.08	-.53**	-.19	.16	.19	.11	.06	.11	.16	.14	.04	.16	.11	1.00

$^{*}p < .05$. $^{**}p < .01$.

Note. Age = Child's age; CDI = Children's Depression Inventory; AS = Attributional Style Composite; VC = Vocabulary Comprehension, unstandardized raw score; BD = Block Design, unstandardized raw score; DS = Digit Span, unstandardized raw score; PC = Picture concepts, unstandardized raw score; IQ = Intelligence Quotient, estimated using Block Design and Vocabulary Comprehension; PCATT = Peabody Causal Attribution Test, Total score; PCATE = Peabody Causal Attribution Test, Effort subscale; PCATD = Peabody Causal Attribution Test, Task Difficulty subscale; PCATL = Peabody Causal Attribution Test, Luck subscale; EA =Nicholls' Effort Ability level; NLE = Composite Negative Life Events Valence Score (Lower score = More stress reported).

After examining the relation between PCAT-Total and other cognitive variables, we next looked at the PCAT subscales of Effort, Task Difficulty, and Luck. We discovered similar patterns of subscales correlating with other cognitive developmental variables. With regard to Age, Luck showed a modest, significant, positive correlation ($r = .26$, $p < .05$), indicating that older children were slightly more likely to answer a Luck item correctly. None of the other subscales showed a consistent relation with Age. Effort showed a modest correlation with IQ ($r = .26$, $p < .05$) whereas Task Difficulty ($r = .39$, $p < .01$) and Luck ($r = .52$, $p < .01$) showed stronger relations. This suggests that the positive relation between IQ and overall PCAT score is not due to one particular subscale bur rather to performance on all three. All three subscales also showed significant positive correlations with raw scores on Block Design (*r*s = .27-.43, *p*s < .05) and Vocabulary (*r*s = .28-.68, *p*s < .05). However, when examining relations with Picture Concepts and Digit Span, differences between subscales emerged. Task Difficulty ($r = .35$, $p < .01$) and Luck ($r = .23$, $p < .01$) showed significant relations with Picture Concepts, but Effort ($r = .13$, $p <$ ns) did not. Digit Span showed more marked differences, correlating only with Luck ($r = .42$, $p < .01$). Finally, all three subscales also showed positive, significant relations with Nicholls' Effort-Ability Level, suggesting that better effort/ability differentiation skills are associated with an understanding of the luck/ability and task difficulty/ability differentiation as well. Overall, PCAT subscales behaved much in the same way as PCAT-Total, with higher PCAT subscale scores correlating with better participant performance on cognitive developmental measures.

Aim 2: PCAT Scores and Attributional Style. Because we hypothesized that high PCAT scores would relate to children's (internal, stable, global) attributional style, we next examined the relations between the PCAT and AS. As seen in Table 6, higher PCAT-Total scores were associated with higher AS scores (r = .39, p < .01). Similarly, higher scores on the Effort (r = .23, p < .05), Task Difficulty (r = .28, p < .05), and Luck (r = .35, p < .01) subscales also related significantly to the endorsement of internal, stable, and global attributions. Children who endorsed a more sophisticated causal attribution understanding responded to attributional style questionnaires in a more adult-like, depressotypic fashion.

Aim 3: Moderation Analyses. We hypothesized that the relation between attributional style, negative life event valence scores, and depression will be different at early levels of cognitive development (as operationalized by PCAT-Total scores) than later levels. To test this hypothesis, we conducted multiple regression analyses using NLE, AS, PCAT-Total, and their interactions to predict depression as measured by the CDI. As seen in Table 7, the NLE x AS x PCAT interaction significantly predicted depression scores (β = .22, p < .05), and the addition of the three-way interaction to the regression explained a significant portion of the variance beyond the two-way interactions and main effects (R^2 = .03, p < .05). This is equivalent to a small effect size according to Cohen's (1988) standards for testing a three-way interaction. We next plotted the interaction to examine its direction. As seen in Figure 1, AS x NLE related to higher depression scores for children with low (-1 sd below the mean) but not high (+1 sd above the mean) PCAT scores.

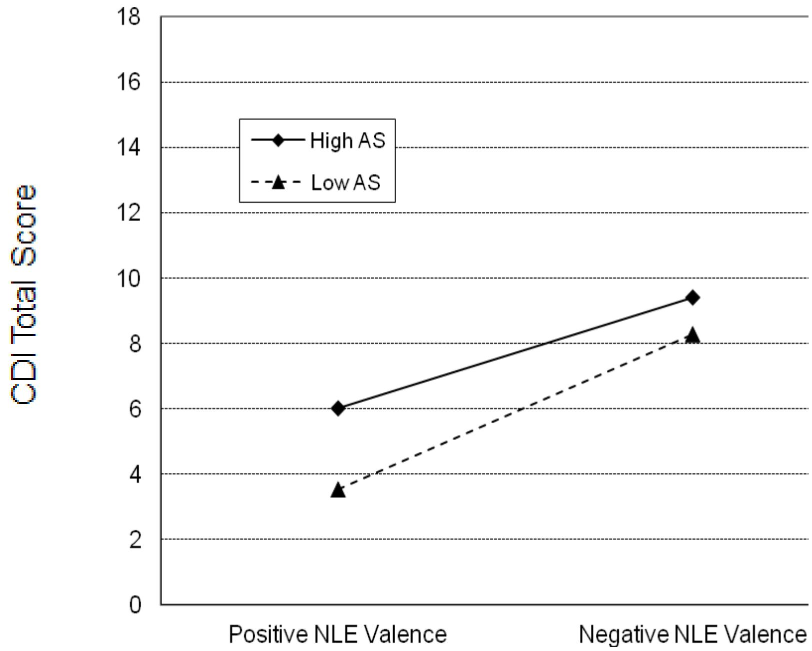
Table 7

PCAT-Total, Attributional Style, and Negative Life Events predicting CDI Score

	Predictor	*B*	SE(*B*)	β	Δ R^2
Step 1	NLE	-2.71	.54	$-.46^{***}$	
	AS	1.66	.57	$.28^{**}$	
	PCAT	-.64	.67	-.11	$.34^{***}$
Step 2	NLE	-2.58	.55	$-.44^{***}$	
	AS	1.75	.57	$.30^{**}$	
	PCAT	-.97	.59	-.16	
	NLExAS	-1.18	.60	-.19	
	NLExPCAT	.71	.58	.12	
	PCATxAS	-.70	.57	-.11	.05
Step 3	NLE	-3.02	.58	$-.51^{***}$	
	AS	1.52	.57	$.26^{**}$	
	PCAT	-.84	.58	-.14	
	NLExAS	-.78	.61	-.13	
	NLExPCAT	.99	.59	-.17	
	PCATxAS	-.62	.56	-.10	
	NLExPCATxAS	1.12	.52	$.22^{*}$	$.03^{*}$

$^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$.

High PCAT Score



Low PCAT Score

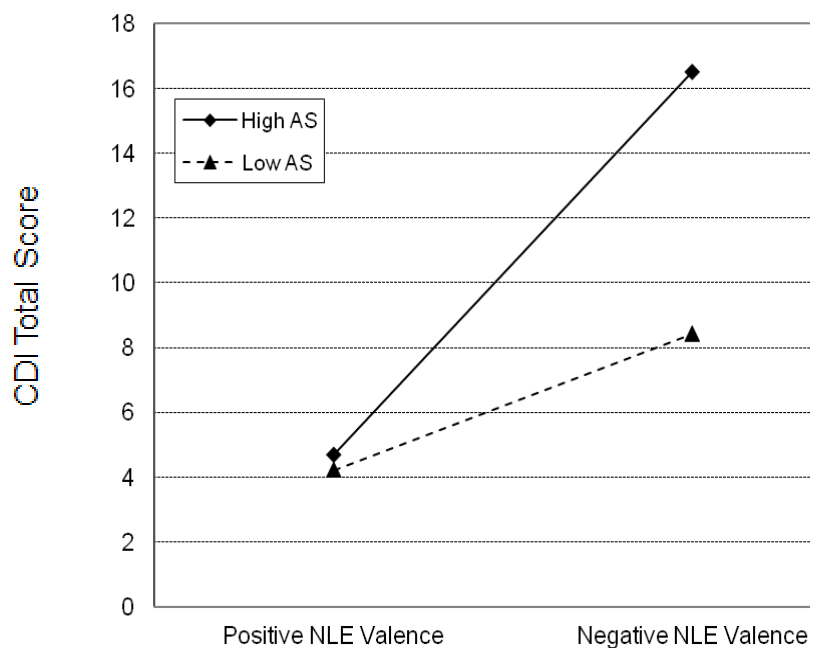


Figure 1. CDI scores as a function of Attributional Style and Negative Life Event Valence Score: High PCAT vs. Low PCAT scores

CHAPTER IV

DISCUSSION

Four major findings emerged from this study. We first demonstrated that our new measure, the PCAT, has a solid factor structure that corresponds with its a priori design. Second, like Nicholls (1984), we found that children's capacity to understand causal attributional dimensions is tied to cognitive level of development. Third, we discovered that measures of attributional style are related to (or cofounded with) cognitive level of development. Finally, we found evidence of a diathesis-stress interaction between attributional style and negative life events to predict depression for children with low, but not high, PCAT scores. We elaborate on these findings and discuss their implications below.

Our first finding was that the PCAT appears to be a psychometrically sound measure of children's understanding of causal outcomes related to effort, task difficulty, luck, and ability. Scores on the PCAT demonstrated good internal consistency and factor analyses revealed evidence of construct validity; the PCAT yielded three moderately correlated factors that fit our a priori determinations of subscale content. The first factor, Effort, consists of questions that assessed children's correct understanding of effort as a causal parameter. Children with low scores on Effort fail to understand that working harder than another person to achieve the same outcome implies something negative about one's ability, when one's effort is controlled. The second factor, Task Difficulty, consists of questions that vary the difficulty of a task while holding outcome constant.

Children with low Task Difficulty scores fail to recognize that the difficulty of a task, not just the outcome, has implications for a person's ability. The third and final factor, Luck, presents situations in which the outcome is determined by chance. Children with low Luck scores erroneously attribute greater ability to the person with the positive outcome instead of understanding that outcome is not necessarily related to ability or effort. The importance of these three measurable factors – Effort, Task Difficulty, and Luck – becomes clear when one considers the dimensions of attributional style. Effort, task difficulty, and luck are distinguished by the degree to which they imply something about the internality, globality, stability, and controllability of the cause of events. The observed developmental differences on the PCAT would seem to reflect cognitive differences in children's fundamental understanding of causation and causal attribution dimensions.

Our second finding derived from our examination of convergent validity between the PCAT and cognitive measures of cognitive development. Nicholls and others (1984; Nicholls & Miller, 1985, 1984) demonstrated that children conceive of luck, task difficulty, and effort in characteristic ways that change with age. We replicated these findings with our measure of Effort-Ability, which in this study and previous work (Folmer et al., 2008) showed significant positive correlations with age. However, this project goes one step further by describing some of the mechanisms responsible for developmental changes in a child's capacity for attributional understanding. Cognitive abilities such as working memory, intelligence, and abstract reasoning relate to children's ability to judge the causes of situations and may explain part of the age-related changes seen. The PCAT provides evidence that children's understanding of ability, effort, and luck as causal factors is tied to level of cognitive development.

Our third finding was that PCAT scores showed significant, positive relations with measures of attributional style. If younger children do not understand major causal parameters like effort, task difficulty, and luck (or the underlying dimensions of internality, stability, globality, and controllability), they may respond to attributional style measures in ways that are difficult to interpret. If children conflate ability and effort by indicating on the PCAT that hard workers are more talented, what does it mean when they say, "I failed the test because I am stupid?" What attributional style questionnaires assess would seem to vary with the respondent's level of cognitive development. Other authors have documented a variety of problems with measures of attributional style. When administered to children, attributional questionnaires have demonstrated low internal consistency (Conley et al., 2001; Thompson, Kaslow, Weiss, & Nolen-Hoeksema, 1998), predictive validity (Bell, McCallum, & Doucette, 2004; Conley et al., 2001; Reijntjes, Dekovic, Vermande, & Telch, 2007), and stability (Cole et al., 2008). These inconsistencies suggest that something is amiss with how we measure attributional style, if not with the very concept of attributional style in younger groups. The downward extension of adult theories of psychopathology to children has yielded inconsistent results in the past (Joiner & Wagner, 1995; Nolen-Hoeksema et al., 1992; Turner & Cole, 1994). Our results lend further support to what previous studies have suggested (Cole et al, 2008; Nicholls & Miller, 1985; Rholes, Blackwell, Jordan, & Walters, 1980), that children's understanding of causal parameters may differ fundamentally from adults'.

Our fourth finding was that attributional style and negative life events interacted to predict depression in children with low, but not high, PCAT scores. Although contrary to our initial hypothesis, this finding makes intuitive sense upon reflection. Multiple studies (Gale, Hatch, Batty, & Deary, 1989; Koenen et al., 2009; Leech, Larkby, Day, & Day, 2005; Weisz, 1979) have found that lower intellectual abilities place a child at risk for helplessness and depression in adolescence and adulthood. Perhaps an immature understanding of causal relations leaves children vulnerable to depression, especially when they have a negative attributional style. If children who attribute negative events to something internal, stable and global also lack the cognitive capacity to consider alternative attributions (such as task difficulty or luck), they may be especially likely to experience an increase in depressive symptoms. The mixed evidence for the attributional style x negative life events interaction in children (Abela, 2001; Cole et al., 2008; Joiner & Wagner, 1994; Nolen-Hoeksema et al., 1992; Turner & Cole, 1994) suggests that developmental shifts occur in the strength of the relation between children's self-reported depression and attributions for negative events. Perhaps the cognitive-developmental factors assessed by the PCAT should be considered in future studies of the relations between attributional style, life stress, and depression in young children.

Several shortcomings of the current study suggest avenues for future investigation. First, the project was cross-sectional in nature, which limited our ability to explore longitudinal relations between variables. Perhaps assessing depression at two time points and negative life events over the interim may have strengthened our test of the diathesis-stress interaction. Second, although we found many significant results despite our modest sample size, a larger sample across a greater age range may have allowed us to test more effectively for age effects. Finally, this sample was drawn from the community and did not compare high-risk to low-risk populations. Repeating this project with a sample with greater diagnostic-risk diversity could strengthen our ability to test our hypotheses related to depression and will be an important next step.

In spite of these limitations, we succeeded in measuring a very specific set of cognitive developmental skills. Our findings suggest that children's cognitive developmental level of understanding effort, task difficulty, luck, and ability is clearly linked to performance on measures of attributional style, if not attributional style itself. What children mean when they make an attribution may be qualitatively different from what adults mean; this calls into question just what, exactly, we are measuring when we administer attributional questionnaires to young samples. The PCAT takes us closer to answering this question by providing a window into the cognitive developmental differences that may account for inconsistencies in the literature.

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