doi: 10.1111/j.1467-9507.2010.00576.x

Patterns of Attachment and Emotional Competence in Middle Childhood

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Abstract

The study investigated the relationship between patterns of attachment and emotional competence at the beginning of middle childhood in a sample of 122 seven-year-olds. A new battery of tasks was developed in order to assess two facets of emotional competence (emotion recognition and knowledge of regulation strategies). Attachment was related to the choice of emotion regulation strategies in hypothetical situations; secure children produced the highest frequency of cognitive engagement strategies (e.g., reappraisal), and disorganized children the lowest. Insecure children produced more behavioral engagement strategies and fewer behavioral diversion ones. There was a minor effect of attachment on emotion recognition, with disorganized children scoring lower in the discrimination of facial expression. Consistent sex differences were also apparent in the direction of a female advantage in emotional competence: Girls scored higher in emotion recognition than boys, and in the regulation knowledge task, they produced fewer helpless answers and more cognitive engagement strategies.

Keywords: Attachment; emotion regulation; facial expressions; middle childhood

Introduction

After receiving little attention in the psychological literature for many years, middle childhood (from about six to eleven years of age) is now recognized as a crucial phase in the development of human cognition, emotion, and social behavior. Masked by the lack of obvious physical changes (body and brain growth rates in middle childhood are the lowest from birth), the transition from early to middle childhood witnesses a dramatic transformation of the child's psychological world and is characterized by fascinating—and still incompletely understood—neurobiological processes (Campbell, 2006; Del Giudice, Angeleri, & Manera, 2009). Whereas parents and other kin are the child's primary relational partners during the first five or six years of life, in middle childhood peers begin to take center stage. Children start forming larger, organized groups, thus facing the need to manage their place in peer hierarchies and social networks; they also begin to form stable friendships and organize their behavior according to shared rules—in short, they begin to experience the complexity of human competition, co-operation, and social roles (Sroufe, Egeland, & Carlson, 1999). Various forms of play (including fight and parenting play) peak in middle childhood as does sex segregation (e.g., Geary, 1998; Smith, 2005); tellingly, children (especially girls) also

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begin to consistently adopt relational aggression tactics in addition to physical ones (Archer & Coyne, 2005; Pellegrini & Archer, 2005; Pellegrini & Roseth, 2006; Underwood, 2003). From the cognitive point of view, this phase is marked by a striking and rapid increase in self-regulation and self-control, focused attention, and strategic planning (known as the '5-to-7 years shift'); these abilities are essential in the context of organized group life (Collins, 1984; Sameroff & Haith, 1996; White, 1965). Finally, there is a dark side to the changes that occur in this developmental phase: several psychological syndromes including conduct disorders, anxiety-related disorders, and attention-deficit/hyperactivity disorder (ADHD) show a distinct onset peak in middle childhood (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Kessler et al., 2005).

All of the aforementioned points to middle childhood as a critical phase in the development of emotional competence in children. In particular, the ecology of middle childhood suggests that change should be especially pronounced in two areas: the understanding of complex social emotions (e.g., shame, pride, embarrassment) and the deliberate, self-aware employment of emotion regulation strategies. Indeed, normative studies have shown that sophisticated regulation strategies, such as cognitive reappraisal, first appear in middle childhood (e.g., Pons, Harris, & De Rosnay, 2004); self-regulation also increases markedly from early to middle childhood (Raffaelli, Crockett, & Shen, 2005), and seems to correlate with measures of executive functions (Simonds, Kieras, Rueda, & Rothbart, 2007). Moreover, children's ability to use specific facial features (e.g., eyes and mouth) in the recognition of emotional expressions shows rapid maturation across middle childhood, and by the age of 12, it closely approximates the pattern observed in adults (Karayanidis, Kelly, Chapman, Mayes, & Johnston, 2009).

Despite growing understanding of the development of emotional competence, little is known about the factors that determine *individual differences* in the relevant abilities: why are some children better than others at discriminating complex emotional displays (e.g., Del Giudice & Colle, 2007) and understanding the causes of people's emotions (e.g., Sutton, Smith, & Swettenham, 1999)? Why do children differ in the type and effectiveness of the regulation strategies they implement (e.g., Pons et al., 2004; Raffaelli et al., 2005)? According to attachment theory, early child–caregiver relationships affect children's emotional functioning at all levels (e.g., Cassidy & Shaver, 2008; De Rosnay & Harris, 2002), and individual differences in attachment patterns can influence the development of emotional competence from infancy to adulthood.

Attachment and Emotional Development

Close relationships with caregivers play a unique role in shaping children's affective and emotional life (Cassidy & Shaver, 2008), and many studies have focused on the connection between attachment patterns and the development of emotional competence. It is important to remark at the outset that emotional competence is not a monolithic entity; for example, the developmental model proposed by Saarni (1999) identifies eight basic 'emotional skills': awareness of one's emotions; ability to recognize others' emotions; use of emotional vocabulary; capacity for empathy and sympathy; distinction between internal feelings and external expressions; adaptive coping through self-regulatory strategies; awareness of the role of emotions in relationships; and emotional self-efficacy. At a more general level, these skills can be roughly grouped in three broad facets of emotional competence: emotion recognition,

understanding, and regulation. Most of the research carried out in the framework of attachment theory has been concerned with emotion regulation and to a lesser extent, emotion understanding; nearly all studies have only examined one specific facet of emotional competence at a time. Here, we will briefly review the main findings that concern emotion regulation and recognition.

Shaver and Mikulincer (2002) and Mikulincer, Shaver, & Pereg (2003) presented what is currently the most thoroughly articulated theoretical model of emotion regulation from an attachment perspective. In these authors' model, secure children develop a *primary strategy* of affect regulation, which is at first based on the open expression and co-regulation of emotional states with the caregiver; as development proceeds, effective regulation becomes internalized and results in autonomous coping, high self-efficacy, and a tendency to engage in active, instrumental problem solving. In insecure child–caregiver dyads, this default process is blocked and the child develops one of the two *secondary strategies*: the hyperactivating strategy typical of ambivalent children and the deactivating strategy associated with avoidance. Hyperactivating children constantly monitor the environment for potential threats and worry about the possibility of losing the caregiver's support; they are expected to develop a dependent and ineffective style of emotion regulation and a sense of helplessness/low self-efficacy. On the contrary, deactivating children divert attention from negative emotions, suppress the experience of distress and do not signal their negative states to their caregiver. This should lead to a coping style based on behavioral avoidance of potentially threatening situations; as development progresses, this strategy may generalize and lead to reduced awareness of one's own negative emotions and feelings.

The research findings are in general agreement with Shaver and Mikulincer's hypotheses, although many of their specific predictions still need to be empirically tested. In an early study, Spangler and Grossmann (1993) observed heightened physiological stress responses to separation in avoidant one-year-olds, in striking contrast with their detached behavior. However, this result was not replicated in subsequent studies (see Spangler & Schieche, 1998). A physiological pattern suggesting active suppression of negative feelings was found in dismissing adults during the adult attachment interview (Main, Kaplan, & Cassidy, 1985) by Dozier and Kobak (1992), and Roisman, Tsai, and Chiang (2004). Dismissing participants showed a specific increase in electrodermal response during the interview, interpreted as affective suppression coupled with high arousal. Anxious romantic attachment predicted increased cortisol response to stress in a sample of women in a study by Quirin, Pruessner, and Kuhl (2008). Attachment security, in contrast, relates to more effective down regulation of negative emotions such as anxiety and anger (e.g., Diamond & Hicks, 2005).

In the longitudinal Minnesota study (see Sroufe, Egeland, Carlson, & Collins, 2005), children's attachment histories predicted later behavior in peer interactions. In accord with Shaver and Mikulincer's predictions, children that had been securely attached showed higher resiliency and more persistent and flexible coping strategies. Regulation in middle childhood was the focus of a study by Kerns, Abraham, Schlegelmilch, and Morgan (2007); in a sample of 11-year-olds, attachment security predicted constructive coping styles and increased tolerance to frustration as evaluated by parents and teachers.

Whereas disorganized attachment was not addressed in Shaver and Mikulincer's model, attachment theorists have argued convincingly that ineffective emotion regulation is a central feature of disorganization (e.g., Lyons-Ruth & Jacobvitz, 2008; Schore, 2000). A study on adolescent mothers by DeOliveira, Moran, and Pederson

(2005) showed that secure mothers scored highest in the ability to manage and regulate negative emotions; dismissing mothers had lower scores than secures, and unresolved mothers ranked lowest.

An important component of emotion regulation is the explicit knowledge of the cognitive and behavioral strategies that work best in dealing with negative affective states. Adults possess a rich repertoire of regulation strategies and a sophisticated knowledge of what can be performed to cope with negative emotions (Parkinson & Totterdell, 1999). As children grow up and engage in progressively more complex social interactions, the deliberate control of emotions can be expected to become increasingly crucial. The maturation of executive functions in middle childhood promotes the diversification of regulation strategies and an increasing sensitivity to context; for example, between six and 12 years, children become able to rank different strategies based on their probable effectiveness in a given situation (Saarni, 1997). Despite the theoretical importance of regulation-related knowledge, we are not aware of any study that investigates its relationship with attachment patterns.

Regulation of one's own emotional states is not the only facet of emotional competence that may be affected by a child's attachment history. It has been suggested that attachment patterns shape the perceptual and attentional mechanisms involved in the processing of other people's emotions as well. Consistent with this hypothesis, Magai, Distel, and Liker (1995) and Niedenthal, Brauer, Robin, and Innes-Ker (2002) reported subtle differences in the perceptual discrimination of emotional faces between adults with different attachment styles. Whereas these results are encouraging, no equivalent studies have been carried out with children; moreover, it is not clear whether the effects of attachment are limited to perceptual discrimination or generalize to other abilities, such as the verbal labeling of emotional states.

Attachment in Middle Childhood

The relation between attachment and emotional development is likely to become significantly more complex and nuanced as children enter middle childhood. First of all, emotional competence in this phase can be expected to depend increasingly on controlled, strategic processes in addition to automatic regulatory mechanisms (see earlier). In particular, emotion regulation becomes much less dependent on assistance and scaffolding from caregivers (Denham, von Salisch, Olthof, Kochanoff, & Caverty, 2002). Unfortunately, most of the available studies on the effects of insecure attachment styles on emotion regulation concern automatic, low-level processes or psychophysiological variables. Whereas attachment security has been related to increased self-control and constructive coping (Kerns et al., 2007; Sroufe et al., 2005), it is still unclear how (and if) attachment styles map on the larger and more sophisticated range of regulation strategies available to older children. However, there is more: the attachment system itself appears to undergo a phase of remarkable reorganization in middle childhood, and we are only beginning to understand the implications for attachment theory at large. Middle childhood is regarded as the period in which early, relationship-specific internal models are integrated into generalized representations; at the same time, friends start to become possible attachment figures in addition to parents and relatives, marking the beginning of the 'transfer' of attachment functions that will culminate with the formation of affective bonds to romantic partners reviewed in Kerns & Richardson, 2005).

Finally, sex differences in some facets of emotional competence (e.g., emotion recognition and labeling) are consistently found in adults (see Golan, Baron-Cohen, Hill, & Golan, 2006; Hall, 1984) and have sometimes been reported in children. Females are generally better in the recognition and labeling of emotional expression; in a large meta-analysis by McClure (2000), sex differences in emotion recognition showed a temporary peak in middle childhood, before rising again during late adolescence. Recently, it has been proposed that sex differences in attachment emerge at the beginning of middle childhood, with insecure males shifting toward increased avoidance and insecure females becoming more often ambivalent, especially in conditions of moderate environmental stress (Del Giudice, 2008, 2009). Thus, careful consideration of sex differences becomes especially important when doing research on attachment and emotional competence in middle childhood.

Aim and Hypotheses of the Study

In the present study, we set out to investigate the relationships between attachment, sex, and emotional competence at the beginning of middle childhood (seven years of age). We measured two different facets of competence: the recognition of emotional displays and the knowledge of emotion regulation strategies. The latter is perhaps the most original contribution of our study because we focused on *deliberate* strategies by asking children to describe what people can do in order to modify their negative emotional states. We are aware of no other studies in the attachment literature that examines this facet of emotional competence and correlates it to other facets such as emotion recognition. Given the dramatic increase in social and emotional sophistication observed in the transition from early to middle childhood, we designed our tasks to include a range of 'complex' emotions (shame, pride, and anxiety) in addition to the standard 'basic' ones (anger, fear, sadness, and joy).

Hypotheses

Our main prediction was that attachment patterns would relate to individual differences in emotional competence. With respect to emotion regulation, this general hypothesis can be further specified by formulating two competing predictions about the effect of attachment patterns. The first prediction is that attachment-related differences will map on a *security-disorganization continuum*. Under this hypothesis, attachment patterns relate to knowledge of regulation strategies in a linear fashion, with secure children scoring highest and disorganized children scoring lowest in the production of proactive, problem-oriented strategies. The second prediction is that specific regulation strategies will correlate with specific attachment patterns (*pattern-specific regulation strategies*). The model by Shaver and Mikulincer could be used to predict that insecure attachment patterns (avoidant or ambivalent) correlate with individual differences in the knowledge of specific strategies: for example, avoidant children may produce a larger number of diversion strategies, and ambivalent children may fail to produce a regulation strategy more often than other children because of a general perception of helplessness and passivity. Finally, we expected to detect generalized sex differences in emotional competence. Based on a consistent pattern of findings in emotion research, we anticipated that girls would score higher than boys in emotion recognition tasks; we also anticipated that they would display more sophisticated knowledge of regulation strategies compared with boys.

Method

Participants

Participants were 122 children (71 girls and 51 boys) aged 81–90 months (M = 7.2 years, SD = 3.1 months). The children were recruited from three public schools in northern Italy. The parents signed a consent form for testing and videotaping; all data were recorded anonymously using a numerical coding scheme. The initial sample was composed of 130 children; eight children were selected out before testing because either they had a history of cognitive impairment (based on teachers' report) or they had experienced divorce or death of a parent during the last six months. The latter criterion was decided to avoid overly distressing the child during the attachment assessment procedure. The sample can be regarded as a low-risk one because the majority of children in the three schools came from middle-class families.

Material and Procedure

Administration. Administration was carried out in three sessions, two to seven days apart from one another, each lasting about 30 min; the child was individually placed in a quiet room in the school and tested by a trained experimenter. Attachment patterns were assessed in the first session; in the second session, the first half of each emotion task was presented, and the second half was administered in the third session. This administration scheme was devised to keep the interest of children by presenting them with varied tasks in every session.

Assessment of Attachment Patterns. Attachment patterns were assessed with the Manchester child attachment story task (MCAST; Goldwyn, Stanley, Smith, & Green, 2000; Green, Stanley, Smith, & Goldwyn, 2000). The MCAST is a story-completion task composed of one warm-up vignette and four test vignettes representing situations of separation and distress. The task took about 15–45 min to administer, and videotape was used for scoring. Material was composed of a doll's house and two dolls, representing the child and the mother. The administrator introduced each vignette and began to represent the story, which was then completed freely by the child. Scores were attributed to represented doll behavior, child behavior, expressed and described emotions, and narrative coherence. An overall attachment category was then assigned to the child based on the predominant behavioral strategy represented in the four vignettes.

Secure attachment (B). Secure stories show an effective interpersonal transaction between child and caregiver. The child asks for help and comfort, and the caregiver responds quickly and appropriately to the child's needs. The result is a prompt resolution of distress, with the child returning to exploratory activities (e.g., relaxed play). The caregiver is represented as warm and sensitive but not overly controlling. The narrative is coherent.

Avoidant attachment (A). Avoidant stories show non-interpersonal ways of resolving distress, either by self-care (e.g., going to the hospital alone) or by displacement (e.g., watching television; denying the distressing event). The caregiver is not represented, or represented as cold and rejecting. Interaction can be minimal and is ineffective in resolving distress.

Ambivalent attachment (C). Ambivalent stories represent interpersonal transactions with the caregiver that are *not* effective in resolving distress, actually increasing or maintaining it, and typically involve high levels of anger and reciprocal control. The child often introduces new elements of distress, and the story may never reach a clear ending.

Disorganized attachment (D). In disorganized stories, the attachment strategy is incoherent and ineffective in calming distress. There may be a complete lack of a recognizable strategy or the rapid alternation of incompatible strategies. Most of the time, stories are characterized by narrative/behavioral 'lapses' (e.g., freezing, trance-like states, interrupted sequences) and intrusion of bizarre, frightening, or overly aggressive content.

All videotaped session were scored by one of the authors (MDG), who is a certified MCAST coder. Seventeen randomly chosen videos (14 percent) were cross-rated by one of three reliable coders: Dr. Jonathan Green (University of Manchester, developer of the MCAST), Barbara Actis (University of Turin), and Dr. Francesca Manaresi (ARPAS, Rome). The raw inter-rater agreement on four-way attachment categories was 88 percent (Cohen's $\kappa = .81$).

Emotion Recognition. We developed two emotion recognition tasks: a non-verbal *discrimination* task and a *labeling* task. Each task was composed of 14 items, two for each of the seven target emotions. The target stimuli depicted five negative emotions (*sadness, fear, anger, anxiety*, and *shame*—10 items) and two positive ones (*joy* and *pride*—four items). The logic was to obtain items of varying difficulty, from emotional expressions that can be expected to be easy to recognize and label (e.g., joy and anger) to subtler and more complex ones (e.g., shame and anxiety). The items were based on 40 movie clips from the Mind Reading DVD (Baron-Cohen, Golan, Wheelwright, & Hill, 2004). Research has shown that using dynamic instead of static displays can increase accuracy of emotion identification (e.g., Wehrle, Kaiser, Schmidt, & Scherer, 2000); most importantly, using movies allows for depiction of complex emotional displays (e.g., shame, embarrassment, excitement), which are extremely difficult to render in static pictures or drawings (Golan et al., 2006). Complete scoring criteria for all the emotion-related tasks are available from the authors.

The movie clips were selected on the basis of a preliminary study. First, the authors pre-selected 167 clips; the clips were divided into three blocks, and each block was shown to 15 adults who were asked to provide a free label for the emotion shown in each clip, then choose the most appropriate labels from a list. The clips that were judged as depicting 'mixed' emotions or emotions outside the intended list were excluded from the set, leaving a total of 56 clips. These were divided into two blocks, and each block was shown to 50 adults. The participants rated the presence and intensity of the listed emotions in each clip on a 0–5 scale. The items were retained in the final set if they received an average score of at least 3 on their 'primary' (i.e., most intense) emotion (in most cases, the average score exceeded 3.5), and if they only showed weaker traces of other emotions as indicated by average scores at least one point below that of the primary emotion and in any event, below the cutoff value of 3 (in most cases, the average scores for other emotions were less than 2 and at least two points below the primary score).

Discrimination task. Five pictures were presented on screen, with the target picture in the center; the other four pictures were labeled A to D (Fig. 1a,b). Clicking on the

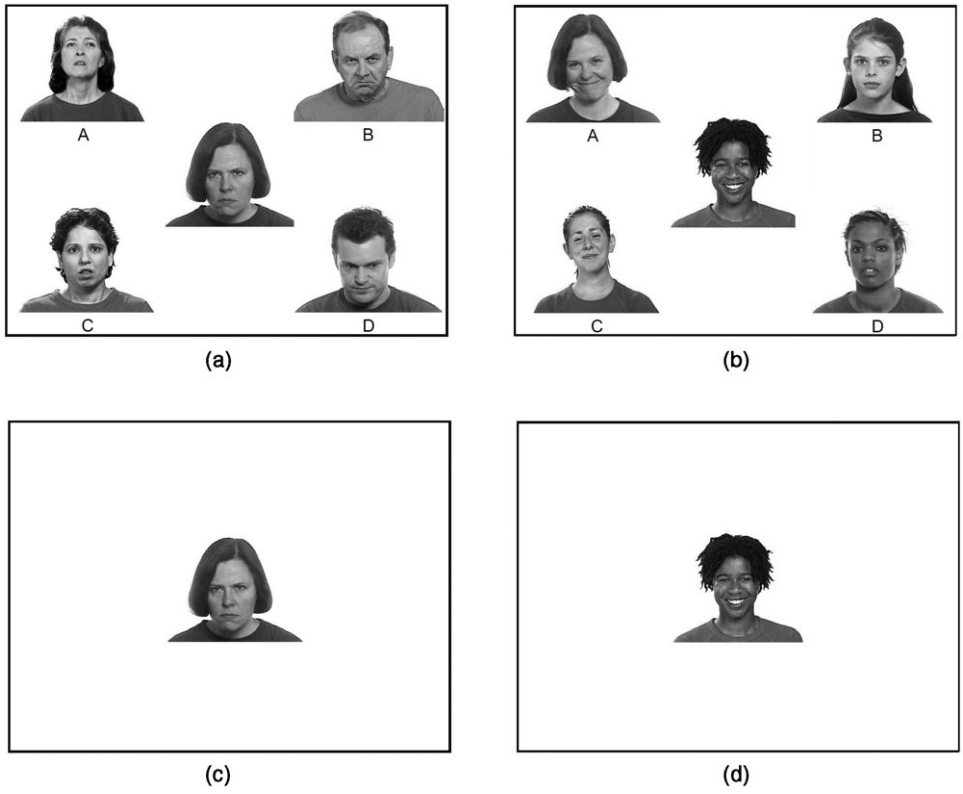

Figure 1. Sample items from the discrimination task (a, b) and from the labeling/knowledge of regulation strategies task (c, d).

pictures started brief movie clips (duration: 2–4 seconds) of emotional expressions. The child was shown the target movie and then asked to 'find the person who feels the same' as the one in the center. The child was instructed to click on all the movies and in order to minimize working memory requirements, could watch them several times if he or she wanted to. This task required matching the target emotion with the correct one among the four, without the need to produce or comprehend verbal labels. Two of the distractors had the same valence (positive or negative) as the correct one, and one had opposite valence. Expressions of surprise and disgust were included as distractors in some items but never figured as target emotions. The target emotions that proved easiest to discriminate non-verbally were anger (mean proportion of correct answers per item: .61), joy (.51), pride (.50), and shame (.47), followed by anxiety (.39), fear (.35), and sadness (.28). Discrimination scores ranged from zero to 14. The average score was 6.1 (see Table 1), indicating that the task was neither too simple not too difficult for our sample of children. Inter-item consistency was moderate, a = .51. It should be noted that moderate inter-item correlation is a positive characteristic of a test when the test is designed to assess a wide range of participants' ability and minimize redundancy between items as in the present case; see Embretson (1996) for an in-depth discussion of this topic.

Labeling task. In the labeling task, the child was presented again with the target movies seen in the discrimination task (Fig. 1c,d), and asked: 'How do you think this

Table 1. Descriptive Statistics and Bivariate Correlations between Dependent Variables

	1.	2.	*M* (%)	*SD*
Recognition				
1. Discrimination	1.00	—	6.1	2.1
2. Labeling	.20	1.00	22.6	4.8
Regulation knowledge				
3. Helpless answers[a]	−.13	−.02	(17.9)	26.8
4. Cognitive engagement[a]	−.11	.19	(9.6)	18.6
5. Behavioral engagement[a]	.08	−.06	(64.5)	33.7
6. Cognitive diversion[a]	.06	−.04	(6.0)	17.5
7. Behavioral diversion[a]	.05	−.08	(15.0)	24.4

Note: Correlations between different types of regulation strategies are not meaningful and have thus been omitted (see text).
[a] These variables were arcsin-transformed before computing correlations.

person is feeling?' Prompts were given if the child did not know how to answer or if he or she only gave generic descriptions. The entire interview was audiotaped and transcribed; the children's answers were then scored on a scale ranging from 0 to 3 points according to the precision of the labels they provided: *0 points* means no answer, wrong valence, or physical/mental states unrelated to the target emotion; *1 point* means vague answer (good/bad) or wrong emotion with correct valence; *2 points* means a description of physical/mental states consistent with the target emotion; and *3 points* means correct, accurate label. Labeling scores thus ranged from 0 to 42. The average score was 22.6 (see Table 1), again indicating that the overall task difficulty was appropriate for children of this age group. The easiest items were those that depicted 'basic' emotions—joy (average score per item: 2.7), fear (2.1), sadness (2.0), and anger (1.8)—followed by pride (1.0), shame (.9), and anxiety (.8). Interestingly, some of the emotions that proved hard to label correctly (e.g., pride and shame) were rather easy to discriminate (see earlier), supporting our distinction between the non-verbal discrimination and the verbal labeling of emotional expressions. Inter-item consistency was a = .57. Inter-rater reliability for the labeling task was assessed by cross-coding 40 protocols (33 percent); the intra-class correlation coefficient was .97.

Knowledge of Regulation Strategies. In the second half of the recognition task, knowledge about emotion regulation was assessed. At the end of the labeling phase, the experimenter asked: 'and why do you think this person is feeling [emotion label]?' The child was prompted to imagine a possible explanation for the corresponding emotional state then asked to think of appropriate regulation strategies. After each of the five negative emotion items, the experimenter asked: 'Now imagine that this person doesn't want to feel [emotion label] anymore. Do you think he/she can do anything to feel better?', then 'What can he/she do?', and 'How do you think he/she would feel after [child's answer]?' The answers were classified in one of three categories: *invalid*, when the child failed to acknowledge the negative emotion or mistook it for an unrelated physical state (e.g., 'sleepy'); *helpless*, when the child stated that the person could do nothing to feel better; and *strategic*, when the child provided a valid regulation strategy.

The strategic answers were then coded following the taxonomy developed by Parkinson and Totterdell (1999) by cluster-analyzing a large number of emotion regulation strategies from questionnaires, interviews, and diaries in an adult sample. In Parkinson and Totterdell's model, the strategies are classified along two axes: *strategic intention* (engagement vs. diversion) and *implementation medium* (cognitive vs. behavioral). Engagement strategies include active problem solving and any coping strategy in which the person acknowledges the negative emotion and tries to modify the situation (behavioral engagement) and/or his or her own appraisal (cognitive engagement). Diversion strategies, on the contrary, displace attention and/or behavior away from the triggering situation, or involve active denial/suppression of the emotion itself. The proportions of helpless answers, behavioral engagement, cognitive engagement, behavioral diversion, and cognitive diversion were calculated for each child.

Inter-rater reliability for the regulation task was assessed by cross-coding 30 protocols (25 percent). For the four strategy types, Cohen's κ was .89 (raw agreement: 93.2 percent).

Data Analysis

Analytic Approach. In the present study, we avoided the use of null hypothesis statistical testing (NHST) in favor of a more sophisticated inference method based on Akaike's information criterion (AIC). In this section, we explain our choice in some detail and provide a basic outline of the methods we used (for a more technical treatment, see Anderson, Burnham, & Thompson, 2000; Burnham & Anderson, 2002).

Methodologists have been criticizing routine null hypothesis testing for decades (for reviews and discussion see Cohen, 1994; Gigerenzer, Krauss, & Vitouch, 2004; Loftus, 1993; Meehl, 1978), but NHST is still ubiquitous in research despite the severe limitations that burden it. Among the problems of NHST are the arbitrariness of alpha levels, the strong dependence of *p* values on sample size, the need for alpha corrections when multiple tests are performed, and the general uninformativeness of *p* values with respect to the size and replicability of effects. In an attempt to advance methodology in psychological research, the American Psychological Association (APA) appointed a statistical task force whose goal was to issue a set of guidelines for data analysis informed by modern statistical theory (Wilkinson and the Task Force on Statistical Inference 1999). Among other recommendations, the APA task force urged researchers to greatly reduce the use of NHST, increase the reporting of descriptive statistics and use of graphical displays, and focus on effect sizes and practical significance instead of statistical significance.

In this article, we employed AIC-based methods (Akaike, 1973; Anderson et al., 2000; Burnham & Anderson, 2002) to evaluate models and hypotheses against the data. AIC is a classical model selection criterion and has the advantage of being theoretically sophisticated, yet easy to compute and apply in practice. Here, we introduce AIC in a non-technical way in order to enable the reader unfamiliar with this approach to critically appraise our results. A short explanation of how to compute AIC and related statistics—together with some technical remarks on their interpretation—can be found at the website of one of the present authors (http://www.psych.unito.it/csc/pers/delgiudice/pdf/AIC_stats.pdf).

The AIC (Akaike, 1973) is a model selection criterion that can be computed when fitting a statistical model to a dataset. In essence, it provides an estimate of the relative information distance between a given model and the 'true' model (i.e., the process that

actually generated the data). While the *absolute* distance between a model and truth is in principle, not knowable, the *relative* distance is—and it can be used to compare two or more models and determine which one provides a closer approximation to the truth. The model with the lowest AIC value is the one that loses the least information compared with the hypothetical true model given the data at hand. The key issue in model selection is that a good model needs to fit the data reasonably well while retaining parsimony (simplicity) and avoiding overfitting the data by having too many parameters to estimate. AIC provides an elegant and practical way to assess performance in balancing between fit and parsimony and select the best among a set of competing models.

Typically, researchers who follow NHST procedures use null hypothesis testing to select between models, for example, by adding (or removing) one independent variable at a time and testing for statistical significance. Unfortunately, this method has no sound theoretical justification as a model-selection procedure (i.e., it is not designed to optimize parsimony and fit), and it only allows comparison between nested models: if two models are not nested, they cannot be compared by NHST. Moreover, null hypothesis testing can only be used to compare two models at a time, and it reduces model selection to 'yes/no' decisions without the possibility of weighing the evidence in support of each model. In contrast, AIC can be used to compare multiple non-nested models simultaneously, does not depend as much as NHST on sample size, and provides ways to properly weigh the evidence supporting each model in the set.

Interpreting AIC Statistics. In the following section, we will evaluate models by reporting and comparing two main statistics: Δ_i and w_i. Δ_i is the difference in AIC between a given model and the best model in the set. By definition, the best model has $\Delta_i = 0$; the higher the Δ_i, the poorer a model's relative performance. Also, $\Delta_I \leq 2$ usually indicates that a model's performance is comparable with that of the best one, whereas $\Delta_I \geq 7$ suggests that there is little support for the model; models with $\Delta_I \geq 10$ enjoy virtually no support from the data (note that these are only approximate rules of thumb). Of course, selection of the best model is itself subject to uncertainty because of sampling error (model selection uncertainty); thus, the model with the lowest AIC value may not *actually* be the best model in the set. To take account of model selection uncertainty, the statistic w_i ('Akaike weight') can be computed (see Wagenmakers & Farrell, 2004). The Akaike weight w_i quantifies the evidence supporting a given model and can be interpreted as an estimate of the probability of that model being the best in the set.

Analytic Procedure. Each dependent variable was analyzed separately by fitting a set of linear models, each representing a different hypothesis about the data. The models were fitted with SPSS 17 (SPSS, Inc., Chicago, IL); the residual sum of squares was used to compute AIC statistics with an Excel utility (Microsoft Corp., Redmond, WA) written by one of the authors (MDG). The utility can be downloaded at the author's website (http://www.psych.unito.it/csc/pers/delgiudice/pdf/AIC.zip). Because our sample is relatively small compared with the number of parameters in the models, the small sample AIC_c was used instead of AIC (for details, see Burnham & Anderson, 2002).

Results

Descriptive statistics and bivariate correlations among dependent variables are shown in Table 1. To help reduce the skewness of proportion variables, arcsin transformations

Table 2. Frequency Distribution of Four-way Attachment Patterns by Sex

	Attachment patterns				
	A (%)	B (%)	C (%)	D (%)	Total
Males	14 (27)	28 (55)	1 (2)	8 (16)	51
Females	3 (4)	38 (54)	18 (25)	12 (17)	71
Total	17 (14)	66 (54)	19 (16)	20 (16)	122

were applied to children's scores in the regulation knowledge task (helpless answers, cognitive engagement, cognitive diversion, behavioral engagement and behavioral diversion) before general linear model (GLM) fitting. Discrimination and labeling were only weakly correlated with one another (.20). Because the proportions of the four strategy types necessarily add up to 100 percent, correlations among them are not meaningful and were thus omitted from the table.

Distribution of Attachment Patterns

Table 2 shows the distribution of four-way attachment patterns and their association with sex. Whereas secure and disorganized attachment were distributed evenly with respect to sex, insecure-organized patterns showed a highly sex-biased distribution, with most insecure females classified as ambivalent and all but one insecure male classified as avoidant. Similar sex-related biases in middle childhood samples have been reported by other investigators (Corby, 2006; Finnegan et al., 1996; Granot & Mayseless, 2001; Karavasilis et al., 2003;). See Del Giudice, (2008) for a brief overview[1], and Del Giudice 2009) for extensive discussion of this phenomenon from an evolutionary perspective. When considering the entire sample, the distribution of attachment patterns was consistent with norms of Western countries (van IJzendoorn & Sagi, 1999).

Because of the extremely unbalanced distribution of avoidant and ambivalent patterns in boys and girls, the attachment was treated as a three-level factor (B = secure, A + C = insecure, D = disorganized); this ensured balanced frequencies of males and females in the three attachment groups.

Emotion Recognition

Model Set Generation

A set of five models was generated for discrimination and labeling scores. The set included a 'no effect' INTERCEPT model, a model that included only sex (labeled SEX), one that included only attachment (labeled ATT), and a model that included the main effects of both (labeled ATT + SEX). Finally, a model that contained the attachment-by-sex interaction in addition to main effects (ATT * SEX) was generated: this model could indirectly reveal differences between A and C patterns because the insecure (A + C) group is almost only composed of avoidant boys and ambivalent girls. The differences between the A and C attachment patterns would then show up as attachment-by-sex interactions involving the insecure group.

Model Selection

Discrimination. Model selection statistics are reported in Table 3. In the discrimination task, the selected model was the one that included the main effects of attachment and sex (ATT + SEX). The model that included only sex (SEX) ranked a very close second. As shown in Fig. 2a, the girls were better than the boys at discriminating between emotion expressions; disorganized attachment was associated to slightly worse performance in emotion discrimination. In the selected model, sex and attachment together accounted for 11 percent of sample variance in discrimination performance, with sex and attachment accounting for 8 percent and 3 percent of variance, respectively. The standardized difference between males and females (Cohen's *d*) was

Table 3. Model Selection Statistics for the Emotion Recognition Task

Dependent variable	Model	K	Δ_i	w_i	R^2
Discrimination	ATT + SEX	5	.00	.45	.11
	SEX	3	.12	.42	.08
	ATT * SEX	7	2.86	.11	.12
	INTERCEPT	2	7.58	.01	—
	ATT	4	7.85	.01	.03
Labeling	SEX	3	.00	.64	.05
	ATT + SEX	5	2.11	.22	.07
	INTERCEPT	2	4.10	.08	—
	ATT * SEX	7	6.08	.03	.07
	ATT	4	6.34	.03	.02

Note: Models are ranked from best to worst (smallest to largest Δ_i). K = number of fitted parameters.

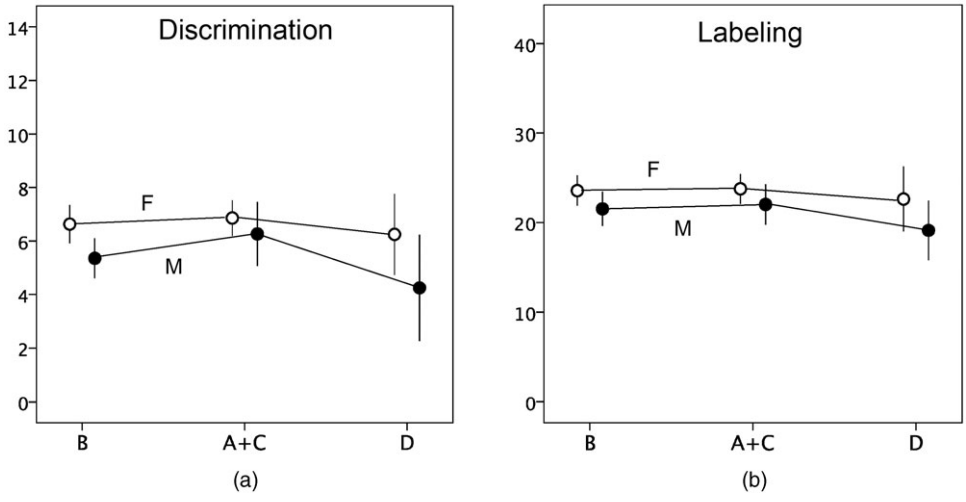

Figure 2. Means and 95% confidence intervals of emotion discrimination and labeling scores by sex and attachment pattern.

d = .58; the difference between disorganized and non-disorganized children was d = .12.

Labeling. In the labeling task, the SEX model was selected. The model accounted for 5 percent of variance in emotion labeling, with girls scoring higher than boys (Fig. 2b). The standardized difference between the males and the females was d = .46.

Knowledge of Regulation Strategies

Model Set Generation

For cognitive and behavioral diversion strategies, five models were generated: INTERCEPT, SEX, ATT, ATT + SEX, and ATT * SEX. The ATT * SEX model allows for indirect testing of differences between the A and C groups as predicted by the hypothesis of pattern-specific attachment patterns. In contrast, the hypothesis of a security-disorganization continuum predicts that insecurely attached children should rank lower than secures on the engagement dimension and that disorganized children should rank lowest; the opposite trend is expected in the number of helpless answers. This hypothesis can be captured by applying linear contrast weights to the attachment factor, representing a linear trend in group means such as B > A + C > D or B < A + C < D. Thus, two models including this contrast ($ATT_{[LIN]}$ and $ATT_{[LIN]}$ + SEX) were added to the model set for cognitive engagement, behavioral engagement, and helpless answers. Pre-specified contrasts such as this are more parsimonious than the original factors and can have lower Δ_i if they succeed in capturing the pattern of group means.

Model Selection

Helpless Answers. Model selection statistics are reported in Table 4. For helpless answers, the selected model was the INTERCEPT one, with virtually equivalent support for SEX. Boys produced slightly more helpless responses than girls (Fig. 3e), even if the effect was relatively small (2 percent of variance). The standardized difference between the males and the females was d = .30 (calculated on raw proportions). The models that included a linear effect of attachment ($ATT_{[LIN]}$ and $ATT_{[LIN]}$ + SEX) received some tentative support, although the effect sizes approaching zero invite considerable caution in interpreting this result.

Engagement Strategies. In engagement strategies, a consistent effect of attachment was apparent: the $ATT_{[LIN]}$ + SEX model was selected for cognitive engagement and the ATT model for behavioral engagement. Figure 3a shows that secure children produced more cognitive engagement answers than insecure children, and disorganized children had the lowest proportions. In addition, females produced more cognitive engagement answers than males. Together, attachment and sex accounted for 9 percent of variance in this type of strategic answers. The standardized difference between males and females was d = .39, and the difference between secure and disorganized children (the two extremes of the continuum) was d = .43. The situation was different for behavioral engagement, where the highest proportions were shown by insecure children (Fig. 3b). Attachment explained 8 percent of variance in this model; the standardized difference between the insecure group and the other children was d = .70.

Table 4. Model Selection Statistics for the Knowledge of Regulation Strategies Task

Dependent variable	Model	K	Δ_i	w_i	R^2
Helpless answers	INTERCEPT	2	.00	.29	—
	SEX	3	.05	.29	.02
	$ATT_{[LIN]}$	3	1.60	.13	.00
	$ATT_{[LIN]}$ + SEX	4	1.65	.13	.02
	ATT	4	2.74	.08	.01
	ATT + SEX	5	2.78	.07	.03
	ATT * SEX	7	6.61	.01	.03
Cognitive engagement	$ATT_{[LIN]}$ + SEX	4	.00	.55	.09
	ATT + SEX	5	1.85	.22	.09
	SEX	3	3.71	.09	.05
	$ATT_{[LIN]}$	3	3.96	.08	.04
	ATT * SEX	7	5.68	.03	.10
	ATT	4	5.78	.03	.05
	INTERCEPT	2	7.24	.02	—
Behavioral engagement	ATT	4	.00	.65	.08
	ATT + SEX	5	2.07	.23	.09
	$ATT_{[LIN]}$	3	5.58	.04	.03
	ATT * SEX	7	6.17	.03	.09
	INTERCEPT	2	6.51	.03	—
	$ATT_{[LIN]}$ + SEX	4	7.63	.01	.03
	SEX	3	8.51	.01	.00
Cognitive diversion	INTERCEPT	2	.00	.44	—
	SEX	3	.11	.42	.02
	ATT	4	3.90	.06	.00
	ATT + SEX	5	4.06	.06	.02
	ATT * SEX	7	5.57	.03	.04
Behavioral diversion	ATT	4	.00	.48	.05
	ATT + SEX	5	1.49	.23	.06
	INTERCEPT	2	2.06	.17	—
	SEX	3	3.51	.08	.01
	ATT * SEX	7	5.17	.04	.06

Note: Models are ranked from best to worst (smallest to largest Δ_i). K = number of fitted parameters.

Diversion Strategies. In diversion strategies, smaller effects of sex and attachment were found compared with engagement strategies. For behavioral diversion, ATT was selected as the best model and explained 5 percent of variance in this strategy type: here, insecure children produced *fewer* such answers than the secure or disorganized ones (see Fig. 3d). The standardized difference between the insecure group and the other children was $d = .50$.

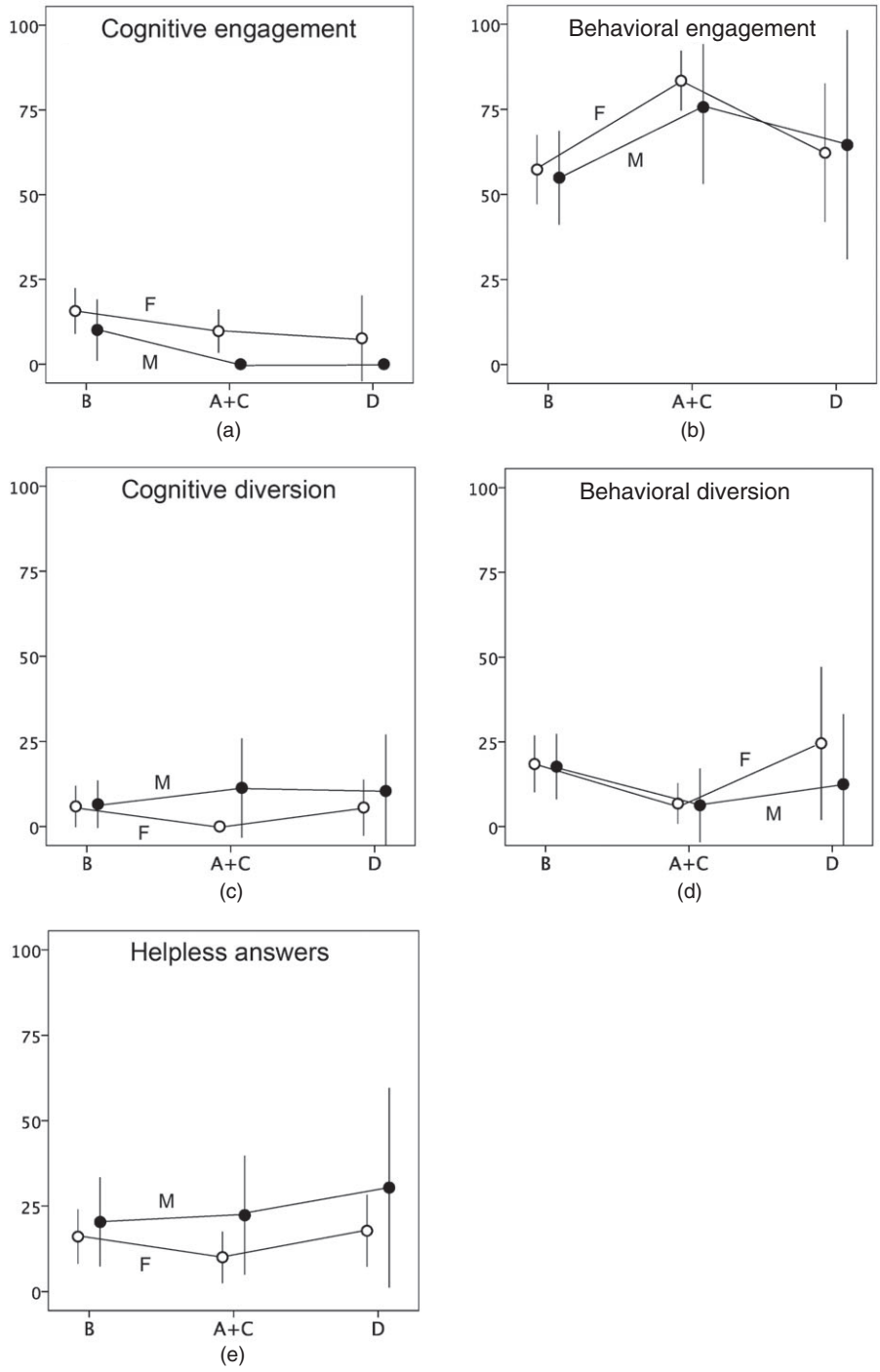

Figure 3. Means and 95% confidence intervals of regulation strategies by sex and attachment pattern (raw percentages).

INTERCEPT was the selected model for cognitive diversion, with virtually equivalent support for SEX (2 percent of variance). Males tended to produce more of these strategies, and the standardized sex difference was $d = .26$. Note that the low values of w_i (all below .50) indicate substantial uncertainty in model selection for both cognitive and behavioral diversion strategies.

Discussion

The aim of the present study was to investigate the relationship between attachment, sex, and two facets of emotional competence (emotion recognition and knowledge of regulation strategies) at the beginning of middle childhood.

Analysis of the recognition tasks showed that non-verbal discrimination and verbal labeling scores were only weakly correlated with one another and virtually uncorrelated with emotion regulation knowledge. In these tasks, the most apparent effect was that of the children's sex, with girls outperforming boys in both discrimination and labeling ($d = .58$ and .46, respectively). In line with the studies by Magai et al. (1995) and Niedenthal et al. (2002), we found support for a smaller effect of attachment on non-verbal discrimination, with disorganized children receiving slightly lower scores than the other groups ($d = .12$). In contrast, we found no support for an effect of attachment on verbal labeling, although an inspection of Fig. 2b suggests a small tendency for disorganization to predict lower labeling scores—a tendency that might become statistically detectable in larger samples.

In line with previous research, our results showed a consistent relation between attachment and the regulation strategies produced by children. The analysis of *cognitive engagement* strategies showed support for a security-disorganization continuum, with secure children producing the highest proportion of these strategies and disorganized children reporting the lowest. The distance between secure and disorganized children was almost half a standard deviation ($d = .43$). This result is especially interesting because cognitive engagement strategies (e.g., reappraisal) are among the most sophisticated forms of regulation and appear relatively late in development (Harris & Lipian, 1989; Pons et al., 2004). Our data are consistent with previous studies showing that secure children are capable of maintaining organized behavior in the context of emotional arousal (Crittenden, 1992) and display higher tolerance to frustration, higher resiliency, and more constructive coping strategies (Kerns et al., 2007; Sroufe et al., 2005); they suggest that the higher competence of secure children extends to the domain of explicit knowledge (Meins, Fernyhough, Russell, & Clark-Carter, 1998) and that the emotional dysregulation and lack of metacognitive abilities associated with disorganized attachment in infancy and early childhood (Fonagy, Redfern, & Charman, 1997) may translate into less sophisticated knowledge of cognitive regulation by the age of seven. A different pattern of results was observed for *behavioral engagement* and *behavioral diversion*. Insecure children (both avoidant and ambivalent) produced consistently more behavioral engagement and fewer behavioral diversion answers. This effect was rather strong, with differences between the insecure group and the other children in the range of .5–.7 standard deviations. No support for a sex-by-attachment interaction was found, indicating that this result was not specific to either the avoidant or the ambivalent children. No clear effect of attachment was found on the proportion of helpless answers (those in which the child was unable to produce even a single regulation strategy).

These findings have interesting implications for Shaver and Mikulincer's (2002) model of emotion regulation. The original prediction of the model was that secure children would engage in active, instrumental problem solving. In our data, security was associated with the production of *cognitive* problem-solving strategies in addition to behavioral ones. These strategies reflect an active coping style, but one that is psychologically oriented and reflective rather than focused exclusively on the external environment. By the beginning of middle childhood, the management of negative emotions in social contexts may benefit from such a reflective and self-directed attitude. In contrast, insecure children produced a large number of behavioral engagement strategies but relatively few strategies of any other kind. In a developmental perspective, this result suggests that as children grow up, the role of instrumental problem solving is taken up—at least in part—by its cognitive counterpart and that exclusive knowledge of behavioral means of regulation is a sign of lower emotional competence. Of course, the present study cannot settle the matter because of its cross-sectional nature and the lack of data on children's regulation abilities in real-life situations; however, it does indicate that future studies should focus on cognitive means of regulation in addition to overt behavioral strategies.

In contrast to what Shaver and Mikulincer's model would have led us to expect, we found no support for pattern-specific differences in regulation knowledge. Ambivalent children were no more likely to produce helpless answers than avoidant or secure ones nor was avoidance specifically associated with diversion strategies. The relevance of this finding is presently limited by the focus of our task on explicit knowledge rather than on children's regulatory behavior. In future research, it will be important to correlate regulation knowledge with actual regulation strategies and evaluate their respective relations with attachment patterns. Another interesting question is why behavioral diversion appears to be frequently reported both by secure and disorganized children (Fig. 3d), a finding for which present theoretical models offer no ready explanation. Future studies with larger samples and improved assessment procedures could attempt to discriminate more finely between subtypes of diversion strategies; this may reveal subtler differences between children with different attachment styles.

Sex differences were also observed in the knowledge of regulation strategies: girls displayed higher competence than boys by producing more cognitive engagement strategies ($d = .39$) and fewer helpless strategies ($d = .30$). We found tentative support for a sex difference in cognitive diversion (males > females), but more data will be needed to properly evaluate this hypothesis as model-selection parameters indicated substantial uncertainty with the present dataset.

In general, we documented an overall female advantage in all of our emotional competence tasks. Girls performed better than boys in emotion discrimination and labeling, produced a larger number of cognitive engagement strategies, and gave fewer helpless answers. The largest sex difference was observed in non-verbal discrimination (see earlier), strongly indicating that the higher scores of girls are not merely due to sex differences in vocabulary and linguistic skills. Our results replicate and extend previous findings in the emotion recognition literature, where females typically score better than males in various kinds of emotion recognition tasks (e.g., Golan et al., 2006; Hall, 1984; McClure, 2000). In addition, our results suggest that males and females may differ in their preferred emotion regulation strategies; further investigation will be required to extend our results on regulation-related knowledge to actual coping behavior.

In conclusion, we found evidence that attachment patterns in middle childhood correlate with individual differences in the knowledge of regulation strategies and (to

a lesser degree) with the ability to discriminate facial expressions of emotions. Middle childhood is a phase of emerging self-regulation and intense social and cognitive changes; nevertheless, patterns of attachment maintain their ability to predict individual differences in emotional competence. Of course, the cross-sectional data obtained in the present study only give a snapshot of the developmental processes leading through the middle childhood transition. Future longitudinal studies should investigate the developmental precursors of cognitive engagement strategies and test the hypothesis of pattern-specific emotion regulation styles by measuring actual behavior in addition to explicit knowledge. We believe that middle childhood will prove an especially promising arena in which to test and refine our theories about the development of social and emotional competence.

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Note

1. Del Giudice (2008) contains a more detailed analysis of sex differences in this dataset, including differences in disorganization scores and secure sub-classifications.