The Pennsylvania State University

The Graduate School

College of the Liberal Arts

STRATEGY FLEXIBILITY: A NEW VIEW OF EARLY CHILDHOOD EMOTION REGULATION

A Dissertation in

Psychology

by

Patricia Z. Tan

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy
August 2011

The dissertation of Patricia Z. Tan was reviewed and approved* by the following:

Pamela M. Cole
Professor of Psychology
Dissertation Advisor
Chair of Committee

Clancy B. Blair
Professor of Applied Psychology

Kristin A. Buss
Associate Professor of Psychology

Jose A. Soto
Assistant Professor of Psychology

Mel Mark
Department Chair
Professor of Psychology
Director of Graduate Training

*Signatures are on file in the Graduate School.

ABSTRACT

Evidence has accumulated supporting the centrality of emotion regulation (ER) in mental health (for a review, see Eisenberg, Spinrad, & Eggum, 2010). However, researchers and clinicians have recognized that the clinical utility of ER research will remain limited without delineating the *specific* dimensions of ER that contribute to dysregulated emotion and psychopathology. This dissertation investigated an often-cited but rarely-studied dimension– strategy flexibility, or a person's ability to be able to vary the strategies used to regulate emotion across situational contexts and within a given situation. The present study tested the convergent and predictive validity of new strategy flexibility measures in children at ages 36 and 48 months. If strategy flexibility is important to mental health, children with greater strategy flexibility should show greater self-regulation (e.g., fewer externalizing symptoms, better social self-control, and better general emotion regulation skill). Convergent validity of two forms of strategy flexibility, specifically, children's flexible use of strategies (a) *across* different situations (*situational flexibility*) and (b) *within* a given situation (*momentary flexibility*), was tested by examining relations between these new flexibility measures and an observational measure of children's skill at ER. First, we compared the convergence of the variety of children's regulatory strategies (strategy variety) and (i) situational flexibility with independent ratings of children's overall quality of ER. This approach was intended to capture children's ability to use different but appropriate strategies as a function of task objectives. Second, we compared the convergence of strategy variety and (ii) two new momentary flexibility measures assessing the frequency (ratio-of-switches) and speed (latency-to-switch) with which children switch strategies when a first strategy is ineffective with independent ratings of children's ER quality. The two momentary measures were intended to capture children's ability to change strategies when a current one was ineffective. Second, we tested the predictive validity of strategy flexibility measures by relating strategy flexibility measures to indices of child socio-emotional competence at ages 36 and 48 months. Finally, relations between measures of strategy flexibility and cognitive flexibility, assessed by young children's ability to shifts sets in a cognitive task, were examined. Results provided support for the convergent validity of situational flexibility and one measure of momentary flexibility, latency-to-switch, as measures of young children's flexible strategy use. These two newly-developed strategy flexibility measures systematically predicted independent ratings of children's global quality of emotion regulation at ages 36 and 48 months. In contrast, strategy variety and momentary ratio-of-switches were not consistently related with children's global emotion regulation; moreover, when predictive, they were associated with *less* skill at emotion regulation. Finally, set-shifting was not associated with strategy flexibility at either 36 or 48 months of age.

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ACKNOWLEDGEMENTS

I would like to first thank Dr. Pamela Cole for her mentorship and support throughout my graduate studies, in particular, for encouraging me to pursue any intellectual interest, including the expansive area of flexibility. I would also like to thank Drs. Kristin Buss, Clancy Blair, and Jose Soto for serving on my committee and for their invaluable feedback throughout my dissertation. In addition, I would like to thank the graduate and undergraduate students who worked with me on the Development of Toddlers Study; they provided me with essential support from conception to completion of this study. I am especially indebted to Caitlin Maugher, Melissa Perri, and Melanie Klein for their careful and patient second-by-second observational coding. Finally, I could not have completed my doctoral studies without the love and support of my parents, Chia Kiang Tan and Lee Peng Chong, and husband-to-be, Chad Hazlett.

Introduction

"He is happy whose circumstances suit his temper; but he is more excellent who suits his temper to any circumstances." -- *David Hume*

Specific Aims

Given the varied situations that people encounter each day, the ability to flexibly adjust one's temper according to the specific circumstances of the immediate situation has long been touted as an integral component of both physical and psychosocial health (e.g., Compas, Worsham, & Ey, 1992; Friedman, 2007; Lazarus & Folkman, 1984; Kashdan & Rottenberg, 2010; Rozanski & Kubansky, 2005). Specifically, the ability to adjust or regulate one's emotion sacross varied circumstances is thought to be central for both socio-emotional health and well-being (e.g., Bonnano, Papa, Lalande, Westphal, & Coifman, 2004; Eisenberg & Fabes, 1992; Halberstadt, Denham, & Dunsmore, 2001; Saarni, 1999).

Although consensus regarding a definition of emotion has not been reached, most researchers agree that emotions are (1) multifaceted, (2) alert an individual to environmental challenges, and (3) support the capacity to rapidly respond to challenges (Campos, Campos, & Barrett, 1989; Keltner & Gross, 1999; Kleinginna & Kleinginna, 1981). In short, emotions are viewed as critical to a person's ability to maintain well-being as he or she contends with the diverse and ever-changing demands of daily life (Gross & Thompson, 2007). As such, it is not surprising that flexibility is emphasized in definitions of skill at emotion regulation (Cole, Michel, & Teti, 1994; Diamond & Aspinwall, 2003; Eisenberg, Spinrad, & Eggum, 2003; Kring & Werner, 2004; Lemerise & Arsenio, 2000).

Defined as "extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying" emotional reactions to accomplish one's goals (Thompson 1994, p. 27-28), individual differences in emotion regulation (ER) are predictive of individual differences in psychological and physical health (Cicchetti, Ackerman, & Izard, 1995; John & Gross, 2004; Moffitt, Arseneault, Belsky, Dickson, Hancox, et al., 2011; Saarni, 1999). Research has converged to underscore the role of early skill at regulation in healthy developmental trajectories. Early emotional development, especially in the capacity for the adept self-regulation of emotion, has been consistently linked to a myriad of psychosocial outcomes, ranging from academic achievement, social skills, and mental health (Eisenberg, Spinrad, & Eggum, 2010; Shonkoff & Phillips, 2000). Moreover, the early ability to delay, an aspect of self-regulation, predicts a child's college aptitude test scores, earned income, and emotional and physical health (Caspi, 2000; Moffitt et al., 2011; Shoda, Mischel, & Peake, 1990).

Given theory and evidence that normative improvements in children's ability to regulate emotions occur during the transition from the toddler to preschool years (Kochanska, Murray, & Harlan, 2000; Kopp, 1982; 1989; Sroufe, 1996), the promotion of early childhood ER may be especially important for altering maladaptive developmental trajectories and promoting healthy developmental outcomes (Calkins & Keane, 2009; Cicchetti et al., 1995; Rutter & Sroufe, 2000). That is, early childhood interventions can capitalize on significant developmental changes in the capacity to regulate emotion that occurs between ages 2 and 5 years (Cole, Tan, Hall, Zhang, Crnic, Blair 2011; Mangelsdorf, Shapiro, & Marzolf, 1995; Supplee, Skuban, Shaw, & Prout, 2009).

Successful early interventions depend, in part, on understanding risk. A significant challenge for translational researchers is the specification of early risk factors for psychopathology (Tolan & Dodge, 2005).Given the importance of early emotional development for mental health across the life span (Shonkoff & Phillips, 2000), it is important to identify the qualities of young children's ER that signal clinical risk (Cole & Hall, 2008). Individual differences in the flexibility with which a child regulates emotion may be an understudied indicator of regulatory difficulties. However, before the clinical implications of flexible ER can be investigated, valid measurement is needed. Thus, the overall goal of this dissertation was to develop and test different operational definitions of one aspect of flexible emotion regulation -- flexible strategy use, herein referred to as strategy flexibility.

The ability to flexibly use emotion regulation strategies is implicit in definitions of emotional competence and often refers to the use of coping strategies that are appropriate for the immediate situational context (Cole et al., 1994; Bonnano et al., 2004; Cheng, 2001; Eisenberg, Fabes, Guthrie, & Reiser, 2000). That is, flexible strategy use is important for emotion regulation because a person needs to (a) tailor strategies to the demands of a situation, requiring *situational strategy flexibility*, and (b) switch to a different strategy when a current one is ineffective, requiring *momentary strategy flexibility*.

By age 3-4 years, typically-developing children use a sufficiently broad range of regulatory strategies (e.g., Mangelsdorf, Shapiro, & Marzolf, 1995) to permit the study of flexible strategy use in young children. Therefore, this study examined children's flexible strategy use at ages 36 and 48 months, during a developmental period when children become able to self-initiate strategies that regulate emotion but are variable in their skill. We also chose this developmental period because of the significance of early intervention and prevention (Shonkoff & Phillips, 2000).

In addition, with valid measurement, it is possible to begin exploring the factors associated with individual differences in strategy flexibility. Because executive functions are important for switching among response sets, inhibiting predominant or maladaptive responses, and controlling attention (Rueda & Rothbart, 2004; Garon, Bryson, & Smith, 2008), there seems to be a logical link between it and flexible strategy use. Specifically, flexibility in ER strategies may involve executive functions that reflect flexibility in cognitive processes (Eisenberg, Smith, Sadovsky, & Sprinrad, 2004; Posner & Rothbart, 2000). Therefore, the current study examined relations between cognitive flexibility, defined as the ability to shift cognitive set, and the flexibility with which children use emotion regulation strategies.

In sum, the study had three aims:

1. To test the convergent validity of strategy flexibility measures with independent ratings of the overall quality of children's ER at ages 36 and 48 months. The convergent validity of two forms of strategy flexibility will be assessed:
   A) Situational flexibility defined as children's ability to flexibly vary their ER strategies *across situations*.
   B) Momentary flexibility defined as children's ability to flexibly tailor their ER strategies to *a given situation*, in accordance with moment-to-moment indicators of the effectiveness of a current strategy.
2. To test the predictive validity of the new strategy flexibility measures with an outcome that is indicative of regulatory ability, child socio-emotional competence. Again, the predictive validity of two forms of strategy flexibility will be assessed.
   A) Situational flexibility defined as children's ability to flexibly vary their ER strategies *across situations*.
   B) Momentary flexibility defined as children's ability to flexibly tailor their ER strategies *to a given situation*.
3. To explore a possible correlate of strategy flexibility, cognitive flexibility, defined as the ability to flexibly set-shift in tests of executive functioning. Individual differences in cognitive flexibility will be indexed by the number of preservative errors children exhibit in set-shifting tests.

Assessing Skill at Emotion Regulation in Early Childhood

Evidence has accrued indicating that emotion regulation (ER) is a central feature of mental health. The ability to regulate emotion is a critical developmental task of early childhood, unfolding with the continued maturation of biological systems and the integration of emotion, attention, and action systems (Bell & Deater-Deckard, 2007; Blair & Diamond, 2008; Calkins & Bell, 2010) into adolescence. During the transition from toddlerhood to the preschool years, advances in children's language and executive control are believed to support the growing ability to use self-reliant and complex regulatory strategies such as attentional control, information-seeking, and instrumental action; these strategies are thought to be particularly important for children's ability to appropriately modulate emotion in service of personal goals (Kopp et al., 1982; 1989).

Skill at ER provides young children with the foundation for a variety of positive developmental outcomes associated with adept self-regulation, notably, emotional well-being and mental health. Specifically, young children's ability to modulate negative emotion in emotionally-challenging challenges predicts school-readiness and academic performance (Blair, 2002; Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Graziano, Reavis, Keane, & Calkins, 2007), social skills (e.g., Eisenberg, Fabes, Bernzweig, Karbon, Poulin, & Hanish, 1993; Rubin, Coplan, Fox, & Calkins, 1995), and psychological adjustment (e.g., Eisenberg, Cumberland, Spinrad, Fabes, Shepard, Reiser, et al., 2001; Hill, Degnan, Calkins, Calkins, & Keane, 2006; Denham, 1998; El-Sheikh, Erath, Buckhalt, Granger, & Mize, 2008; Kochanska & Knaack 2003). Evidence from observational studies of young children's behavior during standardized laboratory tasks suggest that normative advances in ER entail (a) declines in the frequency and intensity with which children express negative emotions and (b) increased use of appropriate regulatory strategies during challenging situations (e.g., Calkins & Dedmon, 2000; Cole, Zahn-Waxler, & Smith, 1994; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Mangelsdorf et al., 1995; Stifter & Spinrad, 2002).

Negative emotion as an index of ER ability. Individual differences in young children's ability to regulate emotion have been traditionally defined by the degree to which children express negative emotion (see Cole et al., 2004, *for a review*). In fact, children's skill at ER is frequently measured by quantifying the frequency or intensity of children's negative emotions. Studies consistently document that children who express less negative emotion during challenging situations exhibit fewer behavior problems, more social skills, and less internalizing symptomatology (e.g., Crockenberg & Leerkes, 2006; Eisenberg et al., 2001; Hill et al., 2006). As a result, programs that are intended to prevent disorders by promoting emotional competencies include components aimed at improving regulatory skill (e.g., Domitrovich, Cortes, & Greenberg, 2007; Izard, King, Trentacosta, Morgan, Laurenceau, Krauthamer-Ewing, et al., 2008). Specifically, these programs teach regulatory strategies that putatively help children be able to down-regulate negative emotion (Ehrenreich, Goldstein, Wright, & Barlow, 2009; Kovacs, Sherrill, George, Pollock, Tumuluru, & Ho, 2006; Suveg, Kendall, Comer & Robin, 2006). However, given that emotions, even negative ones, are functional (Campos et al., 1989; Frijda, 1986), our ability to promote healthy child development would likely improve through a more sophisticated, clinically sensitive approach to conceptualizing and defining skill at ER (Cole & Hall, 2008).

Frequency of strategy use as an index of ER ability. Research across the lifespan has consistently suggested that regulatory strategies which reduce the amount (i.e., the frequency and intensity) of negative emotion are important for ER. These strategies are thought to allow people to capitalize on the functionality of negative emotions by harnessing them in the support of goal-oriented action (Izard, Fine, Mostow, Trentacosta, & Campbell, 2002; Thompson & Calkins, 1996), but the focus on reducing the amount of negative emotion does not give full justice to the equally important function of negative emotions for accomplishing goals (e.g., Campos, Campos, & Barrett, 1989; Cole et al., 1994). Nonetheless, research clearly indicates that the frequent and/or intense expression of negative emotion is detrimental to a person's social relationships, psychological health, and larger goals (for a review, see Eisenberg et al., 2010). Negative emotions are also associated with difficulty accomplishing immediate task objectives and information processing abilities (e.g., Dodge, 1991; Gilliom et al., 2002). Thus, emotion researchers suggest that although negative emotions can be functional, they can also be disruptive or dysfunctional. That is, if experienced as highly intense or arousing, negative emotions likely impair a person's ability to organize behaviors into socially-appropriate goal-oriented actions (e.g., Cole & Hall, 2008; Thompson & Gross, 2007). Regulatory behaviors (i.e., strategies) that modulate or harness negative emotions are therefore a critical aspect of skillful ER.

Strategy efficacy as an index of ER ability. To begin, it is important to briefly discuss differences in definitions of ER strategies. In general, the study of adult coping strictly defines ER strategies as responses that *directly* modify emotion (Folkman & Moskowitz, 2004). This contrasts with the definitions that prevail in early childhood research, which includes instrumental behaviors that change the emotion-eliciting situation and thereby the emotion, for example, unlocking a box to get a desired toy (e.g., Dennis, 2006; Eisenberg, Champion, & Ma, 2004). For the purposes of this study, ER strategies were defined as behaviors that either directly or indirectly are purported to modify emotion.

What characterizes skillful strategy use? Most studies of children's skill at using ER strategies have focused on the types and frequency with which children use putatively effective strategies during laboratory tasks that are designed to elicit emotion. Evidence suggests these strategies, particularly those involving attentional control, are important to psychological adjustment (e.g., Belsky, Friedman, & Hsieh, 2001; Eisenberg et al., 2001; Rueda, Posner, & Rothbart, 2005). Children who use strategies that are thought to be effective have fewer externalizing and internalizing symptoms, both concurrently (Cole, Zahn-Waxler, & Smith, 1994) and longitudinally (Hill et al., 2006). Specifically, the frequent use of "effective" strategies is associated with higher levels of externalizing behavior (Eisenberg, Guthrie, Fabes, Shepard, Losoya, Murphy et al., 2000), later oppositional-defiant behavior in preschool (Gilliom et al., 2002), and elevated internalizing and externalizing symptomatology among school-aged children, adolescents, and adults (Eisenberg & Fables, 1992; Garnefski, Kraaij, & Spinhoven, 2001; Lengua, 2002; Maughan & Cicchetti, 2002; Rubin, Coplan, Fox, & Calkins, 1995; Rydell, Berlin, & Bohlin, 2003; Silk, Morris, & Steinberg, 2003). In conclusion, the frequency with which a child deploys putatively effective ER strategies is considered indicative of his or her skill at ER.

Research has generally assumed that strategies are effective because they reduce negative emotion in a particular situation. For instance, self-distraction is widely considered to be an effective strategy, particularly in young children, because shifting attention away from an emotion-eliciting stimulus should reduce the experience of the emotion. Indirect evidence supporting distraction as an effective ER strategy has been reported, relating the frequency with which children initiate distraction (i.e., look away from emotion-eliciting stimuli) with the frequency and intensity of their expressions of negative emotion (e.g., Belsky et al., 2001;

Grolnick, Bridges, & Connell, 1996; Harman, Rothbart, & Posner, 1997; Rothbart, O'Boyle, & Ziaie, 1992).However, the validity of the assumption that distraction actually accounted for reduced negative emotion is rarely tested. A few studies provide supportive evidence, demonstrating that young children's strategies *actually* reduced their expression of negative emotion (Buss & Goldsmith, 1998; Gilliom et al., 2002; Stifter & Braungart, 1995), although the effectiveness of distraction may be temporary.

Moreover, this small body of research has mainly examined distraction in situations in which children's goals were *temporarily* blocked by an adult who restricted the child's access to a desired object (Mischel, Shoda, & Rodriguez, 1989; Gilliom et al., 2002; Vaughn, Kopp, & Krakow, 1984). In this context, distraction is a socially-appropriate strategy that helps a child to comply with adult instruction (Stifter, Spinrad, & Braungart-Reiker, 1999). However, there are anger-eliciting situations in which distraction may not be an optimal strategy. This possibility underscores the importance of considering how flexibly children use different strategies. In situations in which anger motivates persistence, and persisting helps an individual achieve a goal, distraction may be less effective because it reduces effort to regain the goal (Dennis, Cole, Wiggins, Cohen, & Zalewski, 2009).

Definitions of strategy effectiveness are also often predicated on whether or not a strategy aids in accomplishing the objectives of a particular situation (i.e., task objectives). In situations where children are told to wait for a desired object, persistent focus on obtaining that desired object is counter to the objectives of the situation. A more effective strategy, therefore, would be to shift attentional focus to another object in the room. Indeed, studies have found that children who are able to use self-distraction during delay or waiting tasks are also reported to be more socially competent by parents (e.g., Kochanska, Coy, & Murray, 2001; Stansbury & Sigman, 2000). In contrast, in contexts where children are told to persist in obtaining a desired object, shifting attentional focus away from the desired object would be counter to task demands, meaning that problem-focus would be an effective strategy (Dennis, 2006). Thus, skill at ER includes using the strategies that support a child's ability to not only achieve personal goals (e.g., opening the gift) but to also achieve task objectives (e.g., waiting until mother finishes her work to open the gift. Because children's school readiness and social competence include both of these (and other) behavioral skills (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Blair, 2002), it is logical that children be able to flexibly use ER strategies to modulate emotion in the service of goals in each of the varied situations they encounter (Kashdan & Rottenberg, 2010).

Other situational characteristics can also influence judgments of strategy effectiveness. For one, the emotions elicited by a particular situation influence whether or not a strategy is effective in a particular situational context. Buss and Goldsmith (1998) have demonstrated that although self-distraction is effective for reducing anger, it is less effective for reducing fear. In addition, the types of environmental supports or resources (e.g., maternal social support) available in a situation also influence the frequency and effectiveness of ER strategies (e.g., Grolnick et al., 1996; Mangelsdorf & Diener, 2000). Furthermore, the long-term impact of a regulatory strategy influences judgments of effectiveness. For example, avoidance is an effective ER strategy for reducing an anxious person's *immediate* negative emotion; however, avoidance also augments a child's negative emotions over time by limiting the effectiveness of treatment exposure that would likely attenuate his or her anxiety symptoms (Campbell-Sills, Barlow, Brown, & Hofmann, 2006). Finally, the standards for appropriate conduct in a child's socio-cultural context also influence judgments of strategy effectiveness. That is, effective strategies include only behaviors that are in line with social norms defining appropriate behavior (Saarni, 1999). For instance, when asked to wait for a desired object, distracting oneself by playing with an electrical outlet or ripping puzzle pieces would be considered ineffective because these behaviors are socially-inappropriate, even though they aid a child's ability to accomplish the objective of waiting.

In short, strategy effectiveness cannot be *simply* defined by whether or not a strategy reduces a child's immediate negative emotion. The ability to use ER strategies to reduce negative emotion is critical to mental health; however, the strategy that would be most effective for modulating negative emotion depends, in large part, on the particular characteristics of a situation. Skill at ER is also defined by the ability to modulate emotion in service of goals, which often include both the fulfillment of personal desires and the accomplishment of task objectives. Therefore, it seems problematic to universally categorize a particular ER strategy as effective or ineffective. This view contrasts with conventions in clinical psychology categorizing some strategies as always effective (e.g., cognitive appraisal or distraction) and others as ineffective or maladaptive (e.g., focus on the problem, suppression; Campbell-Sills et al., 2006; Gross & John, 2003). Consider, for example, a child in a physically maltreating context. He or she may have learned that it is maladaptive to express one's anger when feeling frustrated within the family context. Instead, in this specific context, it may be effective to suppress expressions of anger in order to diffuse the situation or to not be noticed. In sum, for ER strategies to be effective, they must be used in fluid, *flexible* ways that correspond to the needs of a given situation and that meet with socio-cultural expectations regarding appropriate behavior (e.g., Cole et al., 1994; Zeman, Cassano, Perry-Parrish, Stegall, 2006).

Flexible strategy use as an aspect of skill at ER. Flexible emotion regulation has been often described but rarely quantified. Despite the conclusions of several recent reviews on the role of ER in mental health (e.g., Cole & Hall, 2008; Eisenberg et al., 2010; Gross & Thompson, 2007; Trosper, Buzzella, Bennett, & Ehrenreich, 2009), empirical studies have traditionally focused on two aspects of ER, assessing the degree to which persons express negative emotions and the frequency with they use purportedly “effective” strategies.

In recent years, researchers have begun to assess ER with increasingly sophisticated approaches, for example, by using multiple measures of emotion (e.g., Degnan, Hane, Henderson, Moas, Reeb-Sutherland, & Fox, 2010; Hastings, Nuselovici, Utendale, Coutya, McShane, & Sullivan, 2008), assessing temporal characteristics of emotional expression (e.g., Calkins & Johnson, 1998; Cole et al., 2010), and focusing attention on positive emotion (Fredrickson, 2001). Yet, the flexibility with which children regulate emotions remains understudied, particularly among young children.

Flexibility is an especially critical component of ER to consider because the effectiveness of a particular strategy depends on situational characteristics such as the emotional context, task objectives, situational affordances, and socio-cultural norms for that situation (Cole & Hall, 2008; Trosper et al., 2009). For instance, definitions of skill at ER imply that without the flexibility to adjust regulatory strategies, children would have difficulty organizing their emotions and behaviors to pursue goals in a socially-acceptable manner (Chaplin & Cole, 2005; Gross & Thompson, 2007). However, assessments of children’s skill at ER which emphasize *how often* children use putatively “effective” strategies cannot fully capture a quality like flexibility. Instead, clinically-significant individual differences in children’s ability to regulate emotion could be better understood by assessing whether children are able to adjust their strategies according to situational characteristics.

Furthermore, many assessments of ER neglect consideration of the dynamic, ever-changing nature of emotions (Goldsmith, Pollak, & Davidson, 2008). The dynamic nature of emotion underscores the need for flexible regulation that supports a person's ability to make moment-to-moment adjustments in their ER strategies (Gross & Thompson, 2007). This particular aspect of flexibility could sustain a child's pursuit of goals by supporting his or ability to adapt to the moment-to-moment demands of the immediate situational context.

In conclusion, studies of flexible strategy use can deepen our understanding of how ER *processes*, rather than static measures of children's quantity of negative emotion and "effective" strategies, contribute to developmental trajectories. However, this endeavor first necessitates valid measurement of flexible strategy use. There is a paucity of empirical research on flexible ER, and in particular, flexible strategy use. This is particularly true of research on young children's emotional processes. Therefore, we draw from studies assessing flexible psychological functioning, in particular, flexibility in emotional expression, to inform our conceptualization and operational definitions of strategy flexibility. Although the majority of this research has been conducted with adolescents or adults, these studies provide a framework for understanding flexible ER in early childhood.

Studies of Flexibility in Psychological Health

Flexible psychological functioning generally refers to adaptability or how a person adapts to changing contexts or task objectives (Kashdan & Rottenberg, 2010). This capacity has often been conceptualized as a higher-order skill or personality trait that supports well-being (e.g., Rozanski & Kubzansky, 2005; Thayer & Lane, 2002).

Flexibility as a personality trait: Trait resiliency. A person who is able to adapt to varying situations is described as being high in trait resiliency. Trait resiliency is defined as a stable characteristic reflecting a person's ability to perceive his or her thoughts and feelings as they unfold in the present moment and to persist or change behavior in accordance with these perceptions (Genet & Siemer, 2011; Waugh, Fredrickson, & Taylor, 2008). A meta-analysis of 32 studies suggested that trait resiliency was moderately associated with healthy outcomes ranging from excellent job performance and satisfaction to mental health (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Results from questionnaire studies are consistent with experimental evidence showing that even when coping with *physical* stress (i.e., cold pressor task), people who are high in trait resiliency show greater pain tolerance, and a more rapid rate of recovery to baseline levels of negative emotion than people who are low in the trait (Feldner, Hekmat, Zvolensky, Vowles, Sechrist, & Leen-Feldner, 2006). Thus, although not directly assessed, studies of trait resiliency suggest that flexibility is important for a person's ability to adapt to varied or changing stressors.

Ego-resiliency. Trait-level differences in the ability to flexibly vary behavior have also been revealed in children as young as age 3 years (Block & Block, 1980). Conceptualized as the personality trait underlying self-regulation, children classified as high in ego-resiliency show better flexibility, defined as the ability to adjust levels of behavioral control according to situational characteristics (Block & Block, 1980; Kerman & Block, 1998).A related trait, ego-control, refers only to a person's "*modal* threshold" for behavioral control (Kermen & Block, 1998). In terms of more recent emotion research, ego-control refers to a person's level of reactive control (Eisenberg, Valiente, Fables, Smith, Reiser, Shepard et al., 2003) whereas ego-resiliency refers to one's ability to show *variation* from his or her modal level of ego-control. That is, ego-resiliency allows for flexibility by supporting a person's ability to increase or decrease behavioral control *according to situational characteristics*. This emphasis on the ability to *flexibly* engage in effortful processes that may be counter to a child's biologically-driven response systems (i.e., temperamental negative affectivity) or learning history echoes recent discussions of temperamental effortful control as a cornerstone of self-regulation (Eisenberg, Hofer, & Vaughn, 2007; Posner & Rothbart, 2000; Rothbart & Bates, 2006).

Children who lack ego-resiliency have difficulty adjusting their modal level of behavioral control. Consequently, they may appear under- or over-controlled in relation to their immediate context. As noted by clinicians, rigid displays of under-controlled (e.g., aggression,) or over-controlled (e.g., avoidance, emotional suppression) behavior often portend maladjustment (e.g., Cole et al., 1994; Rothbart & Sheese, 2007). Indeed, results from a 30-year longitudinal study suggested that young children's level of ego-resiliency is predictive of developmental outcomes ranging from school-aged motor inhibition, adolescent substance use, and adult political orientation (Block & Block, 2006). According to parents and teachers, ego-resilient children are described as exhibiting adaptive characteristics associated with psychological well-being such as curiosity, self-reliance, creativity, quick recovery from stressful events, and social skill (Gjerde, Block, & Block, 1986; Klohnen, 1996). Moreover, ego-resiliency is generally stable across time, particularly among boys, and has shown convergent and divergent validity with independent laboratory-based assessments of self-regulatory ability and psychological adjustment (Block & Block, 2006).

In sum, ego-resiliency can be considered as one of the earliest measures of flexible functioning in young children. It is measured via parental or teacher report, relying on a q-sort approach in which caregivers sorted behavioral qualities as "like or "unlike" the target child. The profiles are then matched to a prototypical ego-resilient child, as defined by the researchers (Block & Block, 1980; Block, 1961). The advantages and disadvantages of parent report have been enumerated, particularly with regard to reports of the quality of children's behaviors (e.g., Glascoe & Dworkin, 1995; Seifer, Sameroff, Barrett, Krafchuk, 1994). Researchers critical of parental report highlight the biases associated with having parents give general impressions of children's behavior (e.g., Seifer, Sameroff, Barrett, & Krafchuk, 1994).

Nonetheless, the significance of the Blocks' contributions to current conceptualizations of skill at ER is reflected in the acknowledgment that skill at ER entails more than high levels of emotional control (e.g., Cole et al., 1994). As suggested in studies linking ego-resiliency to indices of adept self-regulation (Block & Block, 1980; Spinrad, Eisenberg, Cumberland, & Valiente, 2006), flexibility is thought to support peoples' ability to accomplish goals across fluctuating and varied situational contexts.

Although informative for definitions of flexible self-regulation, ego-resiliency is not a sufficient measure of flexibility in *specific* regulatory processes because it focuses on behavioral *qualities* across contexts. Broad measures of general behavioral quality preclude the investigation of moment-to-moment changes in behavior, thereby leaving questions regarding children's ability to flexibly adjust their behaviors within a situation unanswered.

Studies of Flexibility in Emotion-related Response Systems

Theories have recognized that emotions unfold across multiple response systems, noting the influence of specific physiological processes contribute to emotional responses, including ER (e.g., Barrett, Mesquita, Ochsner, & Gross; Gross & Thompson, 2007; Thompson et al., 2008). Multi-method measurement is important for assessing ER (Cole, Martin, & Dennis, 2004), particularly in situations when emotional expressions are too subtle to be observed. As such, physiological indices have been used and validated as indices of emotion functioning (e.g., Blair & Peters, 2003; Buss, Goldsmith, & Davidson, 2005; Porges, 2001).

Physiological flexibility. Researchers have recognized the significance of individual differences in cardiac responses, specifically, respiratory sinus arrhythmia (RSA), for assessing individual differences in ER. High vagal tone, or increased RSA variability, is thought to reflect a healthy autonomic nervous system capable of quickly recruiting internal resources for coping with negative situations. As such, high vagal tone is also thought to represent physiological flexibility (Beauchaine, 2001; Thayer & Lane, 2002), and psychologists have been interested in the relations among physiological flexibility, coping, and psychological adjustment health (e.g., Thayer, Friedman, & Borkovec, 1996; Eisenberg, Fabes, Karbon, Murphy, Wosinski, Polazzi, Carlo, & Juhnke, 1996).

Evidence is consistent with the view that individuals with high vagal tone show better ER. For example, high vagal tone has been associated with resiliency in the face of daily life stressors (Fabes & Eisenberg, 1997) and improved coping with interpersonal conflicts (Gyurak & Ayduk, 2008). Individual differences in vagal tone are also associated with individual differences in young children's ER. High vagal tone is associated with positive socio-emotional outcomes, including social skill, sympathy, and teacher-reported skill in ER among young boys (e.g., Fabes, Eisenberg, & Eisenbud, 1993). Preschoolers with low vagal tone show higher vulnerability to the development of internalizing symptoms (e.g., Calkins, Graziano, & Keane, 2005; Hinnant & El Sheikh, 2009). Research has also suggested individual differences in vagal tone are associated with how well children manage attention when confronted with an environmental challenge (e.g., Suess, Porges, & Plude, 1994).

Furthermore, vagal recovery, or the degree to which a child suppresses vagal tone during a challenging task may be especially predictive of how effectively children use ER strategies (e.g., Calkins & Keane, 2004). Indeed, in a sample of young children at high risk for depression, low vagal recovery predicted children's inability to shift attention away from a prohibited object during a delay task (Santucci, Silk, Shaw, Gentzler, Fox, & Kovacs, 2008). That is, children with inflexible physiological responding exhibited a regulatory pattern that was indicative of inflexible strategy use, notably an inability to use an ER strategy that was appropriate for achieving task objectives. In conclusion, flexibility in one emotion response system, RSA variability, appears to influence children's skill at ER.

Flexibility of Emotional Expression

Thus far, the discussion of flexibility has focused on more *general* regulatory processes thought to be associated with the regulation of emotion. Although the flexibility of ER strategies is rarely studied, researchers have increasingly investigated the flexibility (and rigidity) of emotional *expression*. In particular, there has been a resurgence of interest in understanding the effects of context on emotion (e.g., Davidson, Jackson, & Kalin, 2000). However coping research has examined the impact of context on behavior, delineating how adaptive coping is, in large part, predicated on the match between context and coping strategy.

Context-appropriate emotions. Of particular relevance to flexible ER is the ability to express emotions that are appropriate to situational characteristics (i.e., task objectives or social norms). This skill is thought to enhance a person's ability to successfully interact with his or environment (Bonanno, Pap, Lalande, Westpha, & Coifman, 2005). Moreover, an inability to adapt one's emotional expression to situational characteristics (i.e., showing context-inappropriate emotion) is considered to be clear sign of dysregulation. That is, context-inappropriate expression has been viewed as evidence of a person's diminished capacity to be responsive to environmental demands (e.g., Davidson et al., 2000; Kashdan & Rottenberg, 2010), and this type of emotional inflexibility has been implicated in a range of psychiatric disorders associated with deficits in ER (Cole et al., 1994; John & Gross, 2004; Kring, 2008). The expression of context-inappropriate emotion has also been predictive of a person's coping ability. For example, the success with which one grieves was not predicted by the ability to reduce negative emotion or enhance positive emotion but rather the ability to express emotions that are congruent with the situation (i.e., grief-related or unrelated discussion topics; Coifman & Bonanno, 2010).

Furthermore, context-inappropriate emotion has been viewed as a serious form of dysregulated ER, generating research on its role in psychopathology (Buss, 2011; Gehricke & Shapiro, 2000; Larson, Nitschke, & Davidson, 2007).Given that depression often involves inflexible responses, Rottenberg and colleagues (2005) have has argued that the central dysfunction in depression is context insensitivity. They contend that depression is essentially a syndrome in which a severe mood disturbance interrupts goal-oriented activity and responsive behavior, resulting in the frequent occurrence of behaviors that appear insensitive to the emotional context of a situation (ECI; Rottenberg, 2005; Rottenberg, Gross, & Gotlib, 2005). Consistent with the ECI model, a recent meta-analysis revealed that depressed individuals consistently exhibited less context-appropriate emotional reactivity to both positive and negative emotional stimuli (Bylsma, Morris, & Rottenberg, 2008).

Thus, the inability to change one's emotional expressions across situations that varied in emotional context (i.e., emotional valence) is thought to be indicative of problematic ER. The inability to express the emotion that is appropriate to another situational characteristic, social context has also been implicated in maladjustment.

Display rules. Definitions of emotional competence note the importance of social and cultural standards (Denham, 1999), suggesting that skill at ER includes the ability to flexibly express emotions that are congruent with socio-cultural norms of one's social context. Consider a situation in which a person receives a gift he or she does not desire. The culturally-accepted norm for emotional behavior, in this type of disappointing situation is to react in a positive manner even though the person is unhappy with the gift (Cole, 1986; Cole & Zahn-Waxler, 1992; Saarni, 1984). Consistent with the view that the ability to adjust emotional expression according to socio-cultural norms is important with psychological adjustment, Cole and colleagues (1994) found that boys with elevated behavior problem symptoms were more likely to show more negative emotions and for longer periods of time than low-risk boys; this suggested that at-risk boys had difficulty regulating their emotions according to the situational context. Research has also found that children who were more effective in following display rules were rated as more socially competent by both teachers and peers (e.g., Eisenberg, Fabes, Bernzweig, & Karbon, 1993; McDowell, O'Neil, & Parke, 2000).

In sum, display rules, defined as the expression of appropriate emotions in specific social situations (McDowell et al., 2000; Saarni, 1984), are likely pertinent to flexible ER. Specifically, the ability to flexibly regulate one's emotional expression according to interpersonal context is thought to be important for socio-emotional competence and likely depends on the ability to engage context-appropriate regulatory strategies. For instance, although it is considered to be adaptive for a child to show disappointment at receiving an undesired gift in front of his or her sympathetic mother, it is less adaptive for a child to show the same level of disappointment to an unfamiliar adult who gave the gift to him or her. Indeed, this flexibility (i.e., ability to vary emotional expressions across social context) is an important predictor of whether or not at-risk youngsters continue to show behavior problems (Cole et al., 1994; Liew, Eisenberg, Spinrad, Eggum, Haugen, & Kupfer, 2004).

Low emotional range: Emotional inertia. A restricted range of emotional expressions has also been defined by an absence of emotional expression or predominance of one emotional state across contexts. This phenomenon has been termed emotional inertia and refers to the degree with which previous emotional states predict current emotional states (Kuppens, Oravecz, & Tuerlincks, 2010). People who show high emotional inertia are thought to be more impervious to external or internal cues, thereby showing an inability to adapt to their immediate situation. Kuppens and colleagues (2010) have suggested that high emotional inertia is indicative of serious emotional dysfunction, specifically, a loss in the adaptive value of emotions as signals regarding task demands, personal goals, or overall well-being. Research examining the emotion dynamics of depressed individuals support assertions that high levels of emotional inertia, particularly in angry and dysphoric states, reflect disruptions in the ability to flexibly respond to environmental changes and result in psychiatric symptoms (Kuppens, Allen, & Sheeber, 2010).

Flexibility of Regulatory Behaviors

Although flexibility of emotional expressions, most notably demonstrated in studies examining context-inappropriate emotion, provide some guidelines for defining flexible strategy use, research has rarely addressed flexibility in regulatory behaviors. The few that have considered flexible behavior also focus on the impact of context on strategy effectiveness or overall adaptation.

Context and regulatory behaviors. Context not only influences emotional expression but also regulatory behavior. In animals, including humans, freezing is an automatic response characterized by the cessation of motor and vocal activity (Kalin & Shelton, 1989). Adaptive freezing helps an animal remain inconspicuous and escape predation; however, excessive freezing, or behavioral inhibition, is a risk factor for the development of anxiety disorders (e.g., Kagan, Snidman, & Arcus, 1998). Behavioral observations of monkeys in high- and low-threat contexts reveal individual differences in freezing that relate to anxious symptomatology. Specifically, freezing in low-threat conditions is interpreted as a dysregulated fear response reflecting not only insensitivity to situational characteristics but inflexible deployment of a regulatory behavior, freezing. Moreover, individual differences in freezing duration are stable over time and reflect individual levels of anxious behavior among primates (Kalin & Shelton, 1989). Primates who show differences in duration of freezing behaviors across the two threat contexts are thought to show adaptive regulation of anxiety-related behavior (Kalin, 2003).

Following the lead of animal researchers, temperament and emotion researchers have begun to define problematic ER, that is, dysregulated ER in relation to the appropriateness of the behavioral response for a situational context. By assessing children's emotional reactions in situations that vary in one characteristic, such as high vs. low threat or positive vs. negative emotional valence, researchers are better able to assess for behaviors that are incongruent to situational demands or task objectives (Davidson et al., 2000). For example, Buss (2011) has demonstrated that children who showed extremely high levels of fear reactivity in nonthreatening conditions were most at risk for developing anxiety-related behavioral problems. Thus, context-inappropriate behaviors are likely meaningful indications of a specific aspect of dysregulation, the rigid or inflexible use of an ER strategy. As suggested by Buss and colleagues (2004), measurements of ER across varied situational contexts may augment the clinical utility of ER, yielding information about maladaptive (i.e., inflexible) regulatory profiles that could not be gained by measures that quantify the amount of negative emotion or strategy use. In sum, there is substantive evidence that the effectiveness of a particular strategy depends on context; however, innovative experimental designs have begun to directly investigate whether individual differences in people's ability to *vary* strategies *across* context influences skill at ER.

Expressive flexibility: The ability to express *and* not express. Emotional expression is generally considered to be a more effective strategy than emotional suppression, at least in contemporary American culture. There is a large body of literature documenting the ill-effects of emotional suppression, notably, evidence linking suppression with heightened experiences of subjective distress and sympathetic nervous system activity (e.g., Gross & Levenson, 1997). On the other hand, there is also evidence that suppression is an effective strategy, particularly, in social contexts in which the expression of negative emotion would be inappropriate -- such as receiving a disappointing gift (e.g., Cole et al., 1996). Because individuals move through a multitude of social contexts, it is likely that the ability to use both expression and suppression to regulate emotion (i.e., expressive flexibility) is part of skill at ER. That is, expressive flexibility may be a subset of strategy flexibility.

Using a within-subject experimental design, participants were alternatively instructed to following three instructions while viewing positive or negative stimuli (e.g., emotion-eliciting photographs): (1) to enhance emotional expression; (2) to suppress expression and (3) no instruction ("behave as you normally would"), Bonanno and colleagues (2004) demonstrated that expressive flexibility predicted a person's adjustment to college. Specifically, students who were better at *both* enhancing and suppressing expressions in the relevant conditions also reported less distress by the end of their second year in college.

A follow-up study further supports the supposition that expressive flexibility is indicative of regulatory ability. Wesphal et al., (2010) demonstrated that expressive flexibility prospectively predicted resilient coping. Specifically, among people with low expressive flexibility, the presence of a high number of stressful life events was associated with higher levels of psychiatric symptoms. In contrast, people with high expressive flexibility showed greater resiliency (i.e., fewer psychiatric symptoms in the presence of a high number of stressful life events) (Westphal, Seivert, & Bonanno, 2010). As a whole, this line of research supports the hypothesis that the ability to flexibly enhance and suppress emotion according to task objectives reflects the skillful, flexible regulation of emotion.

Bonanno and colleagues' approach to the operationalization and measurement of expressive flexibility have important implications for the operationalization of flexible strategy use. Expressive flexibility was operationally defined as two difference scores, obtained by comparing behavior across conditions that systematically differed on one, targeted, dimension (i.e., task objective to enhance or suppress). These difference scores were then summed to create an overall flexibility measure where higher scores indicated a greater ability to enhance and suppress according to task objectives. Thus, a within-subject design which includes at least two situations with opposing task objectives appears suitable for capturing individual differences in children's ability to vary ER strategies according to situational characteristics, specifically, task objective. Children's flexible use of ER strategies could therefore be measured by assessing the frequency with which a child uses the situation-appropriate vs. situation-inappropriate ER strategy for accomplishing different task objectives.

Flexible coping: Strategy range. An assumption of flexible ER is that a person possesses a large enough repertoire of ER strategies from which he or she could (a) select one that is most appropriate for a particular situation or (b) turn to when one is not effective in the moment. That is, a person's range of ER strategies (i.e., strategy variety) may be a simple measure of flexible ER.

Indeed, strategy variety, defined as the number of different strategies a person attempts when coping with a negative situation, has been shown to be predictive of adaptive coping. For example, in a study with older adults, Blanchard-Fields (2007) found that participants who showed greater strategy variety were more effective at problem-solving than those who used a lesser variety of strategies. Healthy adults also reported greater variability in coping strategies in response to hypothetical vignettes depicting stressful events than adults coping with depression and chronic illnesses (Schwartz, Peng, Lester, Daltroy, & Goldberger, 1998).

These studies generally rely on coping questionnaires to measure strategy variety and most make the assumptions that (a) variability in one's coping styles is adaptive and (b) high variability supports more flexible coping (Cheng, 2001). Thus, a standard measure of flexibility in many coping studies is strategy variety, or the total number of different types of coping strategies endorsed.

However, a number of studies have also revealed that strategy variety is either unrelated or inversely adaptive functioning. In daily diary study of adults' coping strategies, researchers found that greater strategy variability is correlated more symptoms of psychopathology with more frequent and varied use of strategies (Decker, Turk, Hess, & Murray, 2008; Garnefski & Kraaji, 2006). Inconsistency has also been observed in studies of children's range of coping strategies. A study of high-risk urban youth suggests that greater strategy variety is associated with less adaptive ER (Tolan, Gorman-Smith, Henry, Chung, & Hunt, 2002) whereas a study of youth with ADHD suggests that it is associated with better skill at ER (Babb et al., 2009). Overall, strategy variety appears to be an inconsistent measure of flexibility in coping, perhaps because people may be using a diverse and large number of strategies because they lack the skill to regulate emotions (Cheng, 2001).

Coping Flexibility and Flexible Strategy Use

Even with a variety of available regulatory strategies, the hallmark of flexible strategy use is that the strategy fits with situational characteristics, for example, the emotional context or task objective of a situation. Studies from the coping literature support this view, emphasizing the importance of the match between one's coping responses and situational characteristics. Also referred as the goodness-of-fit hypothesis, the ability to use coping strategies in accordance with situational characteristics is referred to as coping flexibility (e.g., Lester et al., 1994) and is an important quality of adaptive (i.e., flexible) coping.

Research on the effectiveness of coping strategies has consistently demonstrated that a person's appraisal of how much control he or she has over a negative event influences the effectiveness of a given coping strategy. Therefore, effective coping depends, in part, on the match between a person's perception of controllability and a given strategy.

Goodness-of-fit. Definitions of the match, or goodness-of-fit, between a strategy and the controllability of a situation depends on the classification of coping strategies as primary control (e.g., problem-focused, strategies aimed at changing the negative situation) or secondary control (e.g., emotion-focused, strategies aimed at changing internal emotions and cognitions rather than the situation). Primary control strategies are thought to be effective in most stressful situations because they promote a sense of self-efficacy (Heckhausen & Schulz, 1995). However, when a situation is not easily changed (e.g., chronic illness) or when a person perceives low levels of control over the negative event, primary control strategies are thought to be maladaptive. That is, primary control coping strategies are not effective in situations that are perceived to be low in controllability because persistent attempt to control or change the situation leads to low self-efficacy (Bandura, 1982; Heckhausen & Schulz, 1995). Secondary control or emotion-focused strategies are instead thought to be effective for coping with uncontrollable situations because they facilitate emotional recovery from failure to attain a goal, helping to reserve self-efficacy for future coping attempts (Wrosch, Scheier, Carver, & Schulz, 2003). A third type of coping strategy consists of giving up or making no attempts to cope is referred to as relinquished control and is not considered to be effective for coping with stressors (Rothbaum, Weisz, & Snyder, 1982).

Studies examining the fit between one's appraisal of controllability and type of coping strategy have generally supported the perspective that coping flexibility is adaptive. For example, several studies have found support for benefits associated with higher levels of coping flexibility including decreased psychopathology (Williams, 2002), fewer somatic symptoms (Mino & Kanemitsu, 2005), lower burn-out rates among college students (Gan et al., 2007), and fewer stress-related symptoms (Katz, Kravetz, & Grynbaum, 2005). Overall, the evidence for primary control strategies as more effective in controllable situations (e.g., Cheng, 2001; 2003; Christensen, Benotsch, Wiebe, & Lawton, 1995) is more consistent than evidence supporting the adaptiveness of secondary control strategies in less-controllable situations. The inconsistency regarding evidence for goodness-of-fit between secondary control coping strategies and less controllable situations could stem from findings that *most* strategies are less effective for coping with less-controllable stressors.

A second factor, *flexibility of situational appraisals*, may also account for the inconsistent evidence for the fit between secondary control strategies and low-control situations. Cheng (2001; 2003) found that people who showed little variability in their designation of stressful situations as controllable also reported lower adjustment. This is consistent with research linking low explanatory flexibility (i.e., pervasive appraisals of stressful situations as low-control) with anxiety and depression (e.g., Moore & Fresco, 2007). However, it is important to note that a number of studies have supported the goodness-of-fit hypothesis for *both* problem-focused and emotion-focused coping (Forsythe & Compas, 1987; Park, Folkman, & Bostrom, 2001; Zakowski, Hall, Cousino Klein, & Baum, 2001).

Although the majority of studies have focused on adults, coping flexibility has also been linked to different indices of psychological adjustment *across the life span* (e.g., Altshuler & Ruble, 1984; Ayers et al., 1996; Babb, 2004; Bonanno et al., 2004; Connor-Smith et al., 2001; Compas et al., 1998; Halpern, 2006; Vitaliano et al., 1990). Coping flexibility has consistently predicted the socio-emotional health of chronically-ill children, highlighting the importance of the ability to use secondary control strategies to cope with a less-controllable stressors, hospitalization and physical health (e.g., Compas, Malcarne, & Fondacaro, 1998; Weisz et al., 1994).

In addition, studies have suggested in the context of another low-control situation, feeling homesick when at sleep-away camp, most children adaptively chose to cope in secondary controlling ways, regardless of their perceived control over homesickness (Thurber & Weisz, 1997). Finally, in social situations, school-aged children who scored low in social competence demonstrated more inappropriate persistence with primary control coping, as well as more repetitive use of the same ER strategies over time (D'Amico, 1995). That is, in the context of social interactions requiring cooperation, problems with coping flexibility may contribute to the problematic peer relations of rejected children.

In conclusion, flexible coping centers on the goodness-of-fit between a coping strategy and the (perceived) controllability of a situation. In fact, research has demonstrated that it is the flexible use of a situation-appropriate strategy that predicts how well a person copes rather than his or her *pattern* of coping strategies. Specifically, daily diary studies in which people recorded their daily stressors and coping strategies revealed that flexibility better predicted people's daily adjustment and later internalizing symptoms than measures of how rigidly people used particular coping strategies, regardless of whether they were primary or secondary control strategies (Cheng, 2003; Cheng & Cheung, 2005).

Measuring coping flexibility. Coping flexibility has been traditionally assessed with questionnaires that present a person with a range of hypothetical stressors (Schwartz & Daltroy, 1991; Westman & Shirom, 1995; Zeitlin, 1985). A flexibility score is calculated by summing the number of different coping strategies a person endorses across the different stressors. However, these questionnaires have limitations. Foremost, the flexibility score generated by these measures may simply reflect the variability in a person's coping, leaving a critical aspect of flexible coping -- goodness-of-fit-- unexplored. Thus, many questionnaire-based measures of coping flexibility do not allow researchers to understand whether high flexibility scores reflect the use of context-appropriate strategies or a random, but highly variable, pattern of strategy use. Second, self-report measures may not accurately assess people's coping behaviors. Questionnaires are susceptible to recall and social desirability biases that can lead to discrepancies between how people report coping and the strategies they actually use in the moment (Coyne & Racioppo, 2000; Schwartz, Neale, Marco, Shiffman, & Stone, 1999; Smith, Leffingwell, & Ptacek, 1999).

Studies of coping flexibility provide an excellent outline for understanding flexible ER. However, it yet unknown whether conclusions drawn from studies of flexible coping in adult and adolescent populations apply to our understanding of flexible strategy use among young children. Moreover, we know of only one study examining the flexibility of children's coping using methods that are similar to ER measures. Specifically, the study assessed children's coping in negative events that were designed to mimic typical situations.

To assess coping flexibility, children across two ages group (younger, ages 7-8 years; older, ages 10-11 years) were asked to imagine themselves as the protagonist in three hypothetical situations designed to elicit negative emotion; the children then reported on how they would respond to the negative event (Babb et al., 2009). Coping flexibility was defined as children's ability to choose different strategies when a situation changed, becoming less controllable. To assess children's ability to vary strategies according to changing circumstances, the vignettes were broken into two parts, controllable and uncontrollable. The second part emphasized the uncontrollability of the situation ("When the picture falls into the mud puddle, it gets completed ruined. The picture *has to be turned in right now* to enter the context, so you can't enter the contest because you don't have a picture." (Babb et al., 2009, p.14)). Flexible regulation was operationally defined as an increase in the number of secondary-control strategies endorsed during the second, uncontrollable part, of the situation as compared to the first, controllable part, of the situation.

Results revealed that older children without attention-deficit hyperactivity disorder showed greater coping flexibility than younger children (regardless of ADHD) and older children with ADHD (Babb et al., 2004). More specifically, results suggested that children younger than age 8 years and children with ADHD have difficulty adjusting their strategy use according to the controllability of a situation, in part, because they have difficulty accurately perceiving this particular situational characteristic. In conclusion, at least one from of psychopathology, ADHD was associated with less flexible coping in youth. Moreover, the study highlighted the importance of accurate and/or flexible situational appraisals in children's ability to show flexible coping across situations that vary in controllability.

Relating coping flexibility to flexible ER. There is considerable overlap between coping and ER, with some theorists including coping as a subset of ER behaviors (e.g., Compas 1998; Eisenberg et al., 1997; Lazarus & Folkman, 1984). Distinctions, nonetheless, can be made. Coping strategies often refer to voluntary efforts to change a stressor (e.g., Compas et al., 2001; Folkman & Moskowtiz, 2004; Lazarus, 1983) whereas ER strategies refer to both volitional and automatic actions that modulate emotion (e.g., Compas, 1988; Eisenberg et al., 1993). Given that flexible ER involves access to a range of voluntary and involuntary strategies, this study focuses on children's ER. Moreover, because the present study sought to improve our understanding of early childhood ER, it would be difficult to make distinctions between children's voluntary and involuntary strategies for modulating emotion. Despite this distinction, the approaches used in the coping literature inform our approach to studying flexible ER in early childhood.

Commonalities in Definitions of Flexible Emotion Regulation

A review of the literature on flexibility in psychological processes reveals that the inflexible regulation of emotion figures prominently in both the diagnostic guidelines and etiological models for a multitude of psychological disorders (Cole et al., 1994; Rottenberg & Gross, 2003; Izard et al., 2002). Research has further demonstrated that children who flexibly adjust their emotional expressions in accordance with situational characteristics and social standards are less likely to develop psychopathology (Cole et al., 1996; Spinrad et al., 2004). In short, the expression of context-appropriate emotion and use of context-appropriate regulatory behaviors have been widely-implicated in measures of flexible psychological functioning, especially, in emotional processes.

In fact, it is suggested that the frequent experience of context-inappropriate emotions (i.e., fear during a situation that normally elicits joy) may be a more robust predictor of emotional dysregulation and risk for psychopathology than intense but context-appropriate emotion (e.g., Buss et al., 2004; Davidson et al., 2000). Thus, measures of young children's flexible strategy use should *directly* assess their ability to flexibly vary their strategies according to the particular characteristics of a situation. Moreover, situational characteristics other than controllability may be more fruitful to examine given evidence that young children have difficulty in appraising the controllability of a situation (Babb et al., 2009).

Results from studies of coping flexibility also support the view that operational definitions of strategy flexibility need to consider behavior across context. Measures of coping flexibility often present people with a variety of *hypothetical* situations to assess the variety of their coping strategies. Flexibility is then determined by people's own reports of the variety (i.e., number of different strategies a person uses) or the context-appropriateness of strategies they would have used in the situation. Experimental studies of flexible coping (i.e., expressive flexibility) have also indicated that the crucial element for skilled ER is not *which* strategies are used but *if* people can effectively accomplish diverse task objectives (e.g., focus on a problem, distract from a problem) by flexibly using the strategy that is most appropriate to the situation (Bonnano et al., 2004). In all, it seems critical to compare children's strategy use across two situations that vastly differ on one characteristic. Given demonstrations of children's struggles in appraising the controllability of a situation (Babb et al., 2009), an important situational characteristic that is also understandable to young children (i.e., communicated through direct adult instruction) is the situation's task objective.

Although emotional range has been generally revealed to be adaptive (Rottenberg & Gross, 2005; Zeman et al., 1996); it is unclear if range in ER strategies, that is, the number of different coping or ER strategies a person uses in responses to a negative event (i.e., strategy variety) is adaptive. Results from studies of coping in children and adults have been mixed, with some finding positive associations between high strategy variety and psychological adjustment and others finding relations between high variability and maladjustment (e.g., Tolan et al., 2002). Thus, there needs to be further examination of whether individual differences in children's range of ER strategies constitute skilled, flexible ER.

Finally, emotions themselves are dynamic processes (Davidson, 2002; Gross & Thompson, 2007). Behaviors aimed at modulating emotion, that is, ER strategies must also be dynamic, that is, flexibly varying according to changing circumstances. For this reason, the ability to adapt to the demands of different and ever-changing situations should be reflected in assessments of children's skill at ER. Indeed, successful navigation of the ebb and flow inherent in emotional life requires the dynamic, flexible use of multiple regulatory strategies (Ehrenreich et al., 2007). Generally, studies of coping emphasize the ability to change strategies according to external circumstances, but it is also important to consider change related to internal circumstances (i.e. the internal state of the person). Evidence suggests the importance of monitoring one's own state for regulating emotion (Lewis et al., 2006; Compton et al., 2008). Therefore flexible strategy use must involve both changes in strategy as a function of internal states (e.g., emotion) and external conditions (e.g., situational characteristics).

In conclusion, findings on trait resiliency, RSA variability, context-appropriate behavior and coping flexibility inform our understanding of flexibility as an aspect of skill at ER. However, without moving towards specific, operationalized definitions of flexible strategy use, advances in understanding the clinical implications and correlates of flexible ER are not possible. As noted by Cole and colleagues (1994), emotion regulation is not equivalent to stopping or suppressing emotion. Skill at ER includes the ability to exaggerate and sustain emotional responses depending on the situational context and feedback regarding the effectiveness of particular strategy in the moment.

Clinical implications for studying flexible strategy use. Considerations of how flexibly people use ER strategies can also enrich our understanding of relations between strategy use and psychopathology. Specifically, it may clarify our understanding of how individuals sustain ER during challenging situations. Flexible shifts in ER strategies may be necessary to maintain emotional and behavioral organization. It is thought that children with behavior problems do not necessarily lack ER strategies, rather they persist in strategies that are demanding or socially-inappropriate (e.g., support-seeking in a negative manner). For example, consider a boy who cannot get his straw into his juice box. He asks his mother for help but she is on the phone. He persists in seeking support, and this behavior interferes with his mother's call. If this pattern is chronic, the mother would likely describe the child as problematic.

Diminished flexibility in ER early in development may also have long-term consequences on individuals' overall capacity for ER (i.e., affective style or ER pattern) and subsequent risk for psychopathology. Early experiences are thought to strengthen children's predispositions toward certain strategies (e.g., Davidson, Jackson, & Kalin, 2000; Mischel & Ayudek, 2001; Rothbart & Bates, 2006), resulting in ER patterns that, when emotionally aroused or stressed, impair functioning (e.g., Davidson et al., 2002 Malatesta & Wilson, 1988). Given evidence for the far-reaching influences of early regulatory skill, including the regulation of emotion, it seems especially pertinent to understand the characteristics of skilled ER in early childhood. That is, an understanding of young children's skill at matching regulatory strategies to varying situational demands could enrich assessments of the clinical significance of young children's overall ER capacity, thereby enhancing our ability to provide early interventions before chronic, severe psychopathologies develop

Strategy Flexibility as an Aspect of Skillful ER

Flexible ER has been rarely studied, possibly due to the challenges associated with constructing operational definitions that allow for its measurement. In order to operationalize flexible strategy use (i.e., strategy flexibility), the present study draws from research on context-appropriate behavior and coping flexibility.

While most research has defined strategy flexibility as the ability to effectively vary strategies across diverse contexts (e.g., Babb et al., 2009; Bonanno, 2004; Cheng, 2001), theoretical models of skillful ER highlight that strategy flexibility also includes the ability to switch regulatory strategies when a current one is ineffective (e.g., Cole et al., 1994). Given that both an ability to regulate emotion in diverse situations and an ability to persist in the face of distress figure prominently in definitions of skillful regulation, both forms of strategy flexibility (i.e., flexible strategy use *across* and *within* situations) seem pertinent to skillful ER. On the other hand, strategy flexibility may simply entail the ability to access a number of different strategies during challenging situations. Thus, the present study developed operational definitions for three strategy flexibility measures: (1) a child's range of ER strategies (i.e., strategy *variety*), (2) the flexible use of strategy across situations (i.e., *situational* strategy flexibility), and (3) the flexible use of strategies during a single, challenging situation (i.e., *momentary* strategy flexibility).

Methodological approaches for studying early childhood strategy flexibility. As previously noted, the lack of empirical research on flexible ER is surprising given its theoretical prominence. This may be due, in part, to the complexities of assessing emotion and ER (e.g., Cole et al., 2004). First, definitions of flexible ER often refer to context, including the fit between a purported regulatory strategy and the specific characteristics of a situation (i.e., situational appropriateness) or using a strategy that is most effective for accomplishing immediate task objectives. Although definitions of situational-appropriateness can be agreed on for specific cultural contexts (i.e., display rules, social norms), consensus regarding judgments of strategy effectiveness is a more complex issue. Strategy effectiveness often refers to the impact of a strategy on emotional distress (Cole & Hall, 2008; Stifter & Braungart, 1995). However, as highlighted by other researchers, emotions and regulatory attempts may not be readily observed or distinguished (e.g., Campos et al., 2004; Lewis et al., 2004). In addition, traditional methods for assessing emotion processes (e.g., questionnaires) do not capture temporal dynamics central to flexible strategy use. Finally, methods that can capture temporal dynamics often assume that ER is a linear process, where regulation is inferred by measuring emotions before and after a strategy occurs (e.g., Campos et al., 2004).

It is beyond the scope of this project to resolve these issues, but measures of strategy flexibility should be mindful of these challenges. We suggest a measurement approach that (1) defines appropriateness and strategy effectiveness according to a person's developmental level and socio-cultural context, (2) minimizes confounds between emotions and strategies and (3) targets strategies shown to have regulatory impact on negative emotions.

Strengths of an observational approach. An *observational* approach appears most appropriate for assessing strategy flexibility in early childhood. This approach is timeconsuming, usually limited to lab tasks and precludes assessments of cognitive strategies, but it can also permit distinctions between emotion and regulatory attempts (Cole et al., 2004). A number of studies have established the feasibility and reliability of observational measures for studying coping flexibility in children (e.g., Altshuler et al., 1996; Bachanas & Blunt, 1996; Manne et al., 1993). However, these observations were limited to medical settings, and may have constrained children's range of coping strategies. As demonstrated in developmental research, observations of behaviors in lab-based situations that are analogous to everyday challenges (e.g., not getting a desired toy) may provide a wider window for observing children's repertoires of ER strategies (e.g., Grolnick et al., 1996; Calkins et al., 2001).

An observational approach is also most suitable for studying the temporal *dynamics* of ER. Measures of momentary strategy flexibility require observations of individuals' moment-to-moment strategy use. Such micro-level observation allows researchers to specify the regulatory processes that reflect contingent changes in ER strategies thought to sustain ER and goal persistence in challenging situations.

There are several methods for assessing flexible behaviors or emotions via an observational approach. A dynamic systems measure, the state-space grid, has been used to assess flexibility, primarily investigating flexibility in dyad's emotions during interpersonal interactions (e.g., Granic et al., 2003; Hollenstein et al., 2007). However, flexibility as assessed in this system may reflect behavioral or emotional variability, which could be more related to lability than flexibility. Behavioral changes that are responsive to situational demands distinguish flexibility from variability (e.g., Werner, 1940). Observations of environment-behavior associations, specifically sequential analysis, may be better suited for detecting such contingencies in behavioral changes. However, because some response patterns occur at very low frequency, meaningful interpretations of sequential analyses can be difficult. In light of these considerations, contingent behavioral codes may therefore most accurately and efficiently capture strategy flexibility in real-time.

Operational Definitions of Strategy Flexibility

We now turn to our operational definitions of children's strategy flexibility. These definitions will be used to create observational measures of flexible strategy use across and within situations.

Range: Does variety reflect strategy flexibility? Strategy flexibility implies having a range of ER strategies from which one can choose from according to the demands of given situational context. Many coping studies have used range as a measure of coping flexibility. Consider the variety of challenges a child faces over the course of day: Standing still while in line, waiting for a turn during a Chutes & Ladders, turning away from a desired but prohibited sweet at the grocery store, complying with bed-time rules, or persisting to learn new skills like tying shoe laces. Each challenge elicits different emotions, presents different goals and obstacles, and involves different situational constraints and affordances. Based on research regarding context effects and strategy effectiveness, it is logical that children would need a variety of ER strategies in order to skillfully regulate emotion across diverse types of challenging situations. Thus, strategy flexibility may simply be defined as the variety (i.e., number of different) of ER strategies children use in an emotion-eliciting situation (e.g., Cohen, 2004; Hollenstein et al., 2004).

S**ituational strategy flexibility**. While strategy variety may be an important part of strategy flexibility, it may not be a *defining* characteristic of the ability to vary strategies across different situations. For example, the ER strategies that are best suited for persistence at a difficult puzzle may not be the ones that are best suited for patiently tolerating a delay or wait. Both theory and research suggest, then, that the ability to flexibly use strategies in different situations (herein referred to as *situational strategy flexibility*) would be demonstrated by children who are able to focus their attention during the difficult puzzle but shift their attention away during the delay.

Thus, even with a variety of available regulatory strategies, the hallmark of situational strategy flexibility is the more frequent use of context-appropriate strategies. Studies from the coping literature support this idea, emphasizing the importance of goodness-of-fit between one's coping responses and situational context (e.g., Cheng, 2001). As such, an assessment of situational flexibility should compare children's ability to use ER strategies that are effective in a given situation, defined as strategies that are appropriate for meeting task objectives. Specifically, children's ability to vary strategies across two tasks with differing task objectives should be observed.

Two commonly-used tasks, the wait and transparent box, have been successfully used to assess individual differences in young children's skill at ER (e.g., Cole et al., 2011). Moreover, developmental studies have demonstrated that different strategies are effective in regulating the anger elicited by the two tasks. This difference is likely due to differing task objectives. The wait task is a type of delay task in which children are prohibited from obtaining a blocked goal (i.e., gift) and the transparent box is a persistence task in which children are instructed to continue their attempts to overcome a blocked goal (i.e., locked box). Research has suggested that the task-appropriate strategy for the wait is self-distraction (e.g., Gilliom et al., 2002; Mischel et al., 1992; Vaughn et al., 1984). In contrast, the task-appropriate strategies for the transparent box are behaviors that focus one's attention on the blocked goal (i.e., attempts to open the box;

Dennis, 2006). It is logical then to define situational flexibility as the ability to focus attention on the blocked goal in the transparent box task *and* shift attention away from the blocked goal in the wait task.

Momentary strategy flexibility. As was true for situational strategy flexibility, strategy variety may also be important for momentary strategy flexibility but it is also unlikely to be the defining characteristic of flexible strategy use within a situation. Compare a child who continuously tries different strategies -- regardless of a strategy's impact on his or her negative emotion, ability to achieve task goals, or social relationships -- with a child who only switches strategies when one is associated with increases in negative emotion. This more selective pattern of strategy switches reflects *contingent* switches in ER strategies, that is, switches that occur in response to indications that a current strategy is ineffective. It is this ability to make *contingent* switches that likely enables a child to sustain ER in the face of distress and/or prolonged challenge. This ability captures a person's responsiveness to internal cues regarding his or her current behavior and is herein referred to as momentary strategy flexibility.

If children are able to switch strategies in response to increasing negative emotion, it is more likely that their negative emotion will not overwhelm their attempts to solve the problem. This form of flexibility in turn supports their ability to persist in goal-direction action. However, momentary strategy flexibility may not be defined simply by *whether* or even *how often* children are able to adjust their strategies according to changing external (changing situational demands) or internal conditions (emotional states), but it may also depend on how *quickly* they can adjust their behavior according to external or internal feedback.

We suggest that there are at least four approaches for operationalizing momentary strategy flexibility. All four assess children's ability to flexibly switch to a different strategy when a current one is ineffective and each is described below. However, only two are also designed to distinguish behavioral *variability* from flexibility.

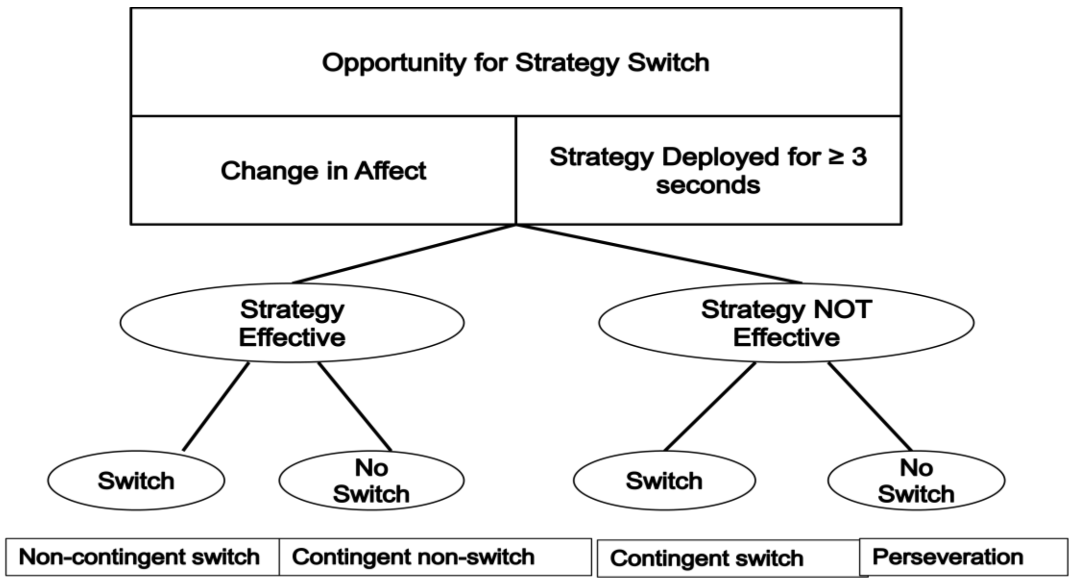
The first approach simply asks how often children switch strategies when one is ineffective. This can be defined as the probability that a child switches to an effective strategy when he or she is currently using an ineffective strategy. As noted earlier (see pp. 9-11), the effectiveness of a strategy is best defined by one or more of the following criteria (1) reduction of negative emotion (2) fit with task demands or goals and/or (3) adherence with socio-cultural norms. This first approach appears elegant but has two shortcomings. One, strategy flexibility does not necessitate the ability to switch to *effective* strategies, and two, high flexibility scores may reflect a propensity to (frequently) change strategies, regardless of feedback regarding the effectiveness of a strategy. As such, this type of indiscriminate flexibility may actually reflect difficulties with ER (Waugh et al., 2008).

The second approach accounts for these potential shortcomings by defining momentary strategy flexibility as a difference score representing a child's ability to switch strategies more frequently when one was effective than ineffective. It is obtained by subtracting (a) the probability that a child switches strategies when a current one was effective from (b) the probability that a child switches strategies a current strategy was ineffective. Because strategy switches that occur when a current strategy is effective may reflect a propensity for switching (i.e., behavioral variability), rather than responsiveness to situational needs (i.e., flexibility), subtraction corrects for influence of frequent switching on strategy flexibility scores. For example, if a child switches to a different strategy 40% of the time when a current one was ineffective and only 30% of the time when a current one was effective, then the child would have a flexibility score of .10. If another child switches strategies 30% of the time when a current one was ineffective and 40% of the time when one was effective, then the child would have a flexibility score of -.10. Thus, higher scores reflect greater capacity for contingent (i.e., flexible) strategy switches.

However, this (second) subtraction approach is still subject to inflated scores of momentary strategy flexibility. Specifically, children could still obtain high flexibility scores due to factors other than their ability to switch strategies in response to indicators of strategy ineffectiveness. Specifically, the likelihood that contingent strategy switches occur would be influenced by the number of opportunities a child has to demonstrate this capacity. As a result, a child who frequently uses ineffective strategies may receive a higher flexibility score than a child who rarely uses ineffective strategies simply due to individual differences in temperamental negative emotionality. Thus, flexibility scores should also consider whether children are able to *not switch strategies when one is effective*. In other words, momentary flexibility should consider whether children can make contingent non-switches, thereby sustaining effective strategies.

***Momentary flexibility: Ratio-of-switches*.** Although complex, the third approach to measuring momentary strategy flexibility is preferred because it entails a more precise assessment of a child's capacity for *contingent* strategy switches. To account for individual differences in negative emotionality and the propensity to change behavior, the third approach determines the ratio of all contingent switches and non-switches to the all possible switches and non-switches (see Figure 1 below). Simply, this ratio represents how often a child makes a *contingent* switch whenever there is an opportunity for a switch to occur, while accounting for his or her ability to not switch when a strategy was already effective. It does not require that a child switch to an effective strategy. It also accounts for the influence of a child's propensity to switch strategies and opportunity to demonstrate contingent switches on momentary flexibility scores. As such, this measure of momentary flexibility distinguishes between (a) children who have low flexibility scores because they frequently use effective strategies (and therefore do not need to switch strategies) from (b) those who have low scores because they cannot make switches when a strategy is ineffective (i.e., make *contingent* strategy switches).

Figure 1. Decision tree for momentary flexibility variables



As illustrated in Figure 1, ratio-of-switches first necessitates the determination of four classes of switches and non-switches: (a) switch when a current strategy is ineffective (contingent switch), (b) non-switch when a current one is effective (contingent non-switch), (c) switch when a current one is effective (non-contingent switch), and (d) non-switch when a current one is ineffective (perseveration). The sum of contingent switches, contingent non-switches, non-contingent switches, and perseverative non-switches represents the total number of opportunities a child had to engage in a strategy switch. Thus, this approach accounts for variations in flexibility scores that stem from individual differences in children's ability to use *effective* ER strategies and propensity to experience negative emotion. One aspect of momentary flexibility, ratio-of-switches, is therefore operationally defined as a high number of contingent switches and non-switches and a low number of non-contingent switches and perseveration (i.e., non-contingent non-switches).

***Momentary flexibility: Latency-to-switch*.** Finally, the study also defines momentary strategy flexibility by considering the *dynamics* of children's contingent and non-contingent strategy switches, referred to as latency-to-switch. We suggest that children with greater momentary flexibility should not only be able to make a high number of contingent switches *but also* be able to make this type of switches more quickly than a less flexible child. As was true for ratio-of-switch, the definition of latency-to-switch also necessitates the determination of strategy effectiveness.

This fourth approach for operationalizing momentary flexibility assesses children's ability to quickly switch strategies when one is ineffective and sustain a strategy when it is effective. In other words, high momentary flexibility involves a longer latency to switch during an effective strategy than an ineffective strategy. The present study therefore examined latency-to-switch, which compares the latency of children's strategy switches when one was ineffective versus effective. As was true for all other strategy flexibility measures, higher momentary latency indicated greater flexibility. In sum, because momentary flexibility necessitates quick switches when a strategy was ineffective, momentary flexibility can also defined as a longer latency to switch strategies when one was effective rather than ineffective.

Summary of the three new strategy flexibility definitions. The first form of strategy flexibility explored in the study was situational strategy flexibility, or the ability to selectively engage ER strategies that would be effective for a particular situational context. Judgments of strategy effectiveness, as previously noted, are complex. However, a review of the literature regarding the skillful use of ER strategies suggests that situational strategy flexibility entails the use of ER strategies that are (a) deemed socially-appropriate by members of a child's larger socio-cultural context and (b) associated with reductions in negative emotion *or* congruent with the task objects of the situation.

The second form of strategy flexibility refers to momentary flexibility or the ability to switch to another ER strategy when the current strategy is ineffective, as defined by the current strategy's influence on a child's negative emotion, achievement of task objectives, and adherence to social standards. It also likely reflects children's ability to respond on-line to internal feedback regarding their progress towards goal and momentary emotional state. The present study investigated two operational definitions of momentary strategy flexibility which were designed to differentiate flexible, contingent strategy switches from behavioral variability (i.e., a high propensity for switching ER strategies that is reflected by non-contingent switches). Specifically, the first, *ratio-of-switches* considered how *frequently* children were able to make *contingent* switches and non-switches and the second, *latency-to-switch* considered whether children were able to sustain effective strategies and quickly switch from ineffective ones.

A Cognitive Correlate of Strategy Flexibility

By age three to four years, children begin to show skill in executive functions that, on the basis of face validity, may be linked to strategy flexibility. Although a consensus definition of executive function has yet to be reached, scientists generally agree that it refers to a set of cognitive processes thought to underlie complex, goal-directed behaviors including ER (e.g., Blair et al., 2005; Zelazo & Mueller, 2002). Extant literature from developmental studies across disciplines has further linked executive function with ER, providing strong neurological and behavioral evidence of the interdependent nature of these multi-dimensional capacities (e.g., Bush et al., 2000; Espy, Kaufmann, McDiamod, & Glisky, 1999, 2004; MacDonald, Cohen, Stegner, & Carter, 2000; Martel et al., 2007; Miyake et al., 2000). Finally, there is also a body of evidence suggestive of relations between different components of executive function (i.e., working memory, set-shifting) and child outcomes thought to require skillful self-regulation, including social competence and academic achievement (e.g., Blair et al., 2005; Gerardi-Caulton, 2000; Hughes, 1998; Riggs et al., 2006; Rothbart et al., 2003; Spinrad et al., 2007).

With regards to mental health, it has been suggested that deficits in executive functioning may directly and indirectly contribute (e.g., by affecting ER capacity) to a number of developmental and psychological disorders (e.g., Barkley, 1997; Nigg, 2000; Pennington & Ozonoff, 1996; Rueda et al., 2004). Indeed, research has linked deficits in executive functioning with difficulties using putatively "effective" ER strategies, higher levels of negative emotion, and diminished behavioral control in early and middle childhood (e.g., Belsky et al., 2001; Rothbart et al., 1994). Although there are relatively few studies explicitly addressing relations between ER strategies and executive functioning, research supports the view that executive function plays an important role in children's ability to modulate negative emotion. However, relations between EF and other aspects of skilled ER, specifically, strategy flexibility, remain unexplored.

One aspect of executive function, cognitive flexibility, may be particularly relevant for the flexible deployment of ER strategies. Cognitive flexibility connotes an ability to shift response sets among different, sometimes conflicting, characteristics of an object/event (e.g., Espy, 1997; Kloo & Perner, 2005; Senn et al., 2004). In other words, cognitive flexibility refers to the ability to shift or switch between different responses (e.g., seek assistance or persist in a talk; focus attention on source of frustration or another object in the room) when attempting to solve a problem or obtain a goal.

Children's cognitive flexibility can be assessed by testing their ability to shift response sets (e.g., Diamond, 1988; Carlson et al., 2004; Marcovitch & Zelazo, 1999). Specifically, tests of early childhood executive function assess children's ability to switch between spatial locations during search tasks (i.e., A-not B-tests) or object characteristics during sorting tasks (i.e., Dimensional Change Card Sort). Inflexible cognitive processes, reflected in perseverative errors, occur when children do not change responses and instead, continue to search or sort incorrectly (Kirkham et al., 2000; Yerys & Munakata, 2006; Zelazo et al., 1996). This type of error may be akin to an inability to switch ER strategies when a current strategy is ineffective. As such, set-shifting may tap some of the cognitive processes that are important for strategy flexibility, such as children's ability to recognize the specific demands of the current situation and to switch ER strategies as needed. In contrast, perseverative responses on EF tests may reflect difficulty with such regulatory processes and therefore contribute to low strategy flexibility.

Relations between cognitive flexibility and socio-emotional health have also been investigated among adolescent and adult populations with mood disorders (e.g., Eysenck, Derakshan, Santos, & Calvo, 2007; Posner & Rothbart, 2000). Similar to executive function tests of set-shifting ability, reversal learning is a task in which children learn a stimulus/response relationship through trial-and-error learning. The learned stimulus/response relationship is then reversed without explicit warning and children must adapt their response. Success at this task requires cognitive flexibility, defined as the ability to adapt to adapt one's thinking and behavior in response to fluctuating situational demands (Clark, Cools, & Robbins, 2004; Stemme, Deco, & Busch, 2007). Evidence suggests that children with mood disorders have difficulty regulating the frustration associated with the sudden change in situational demands, which in turn, hinders their success at learning the new stimulus/response relationship (Dickstein, Finger, Brotman, Rich, Pine & Leibenluft, 2010). Indeed, children with mood disorders, notably bipolar disorder, show deficits in reversal learning. Moreover, it has been speculated that the irritability displayed by children with depression and bipolar disorder stems from the frustration they face in everyday life when they are unable to adapt to a change in situational demands (e.g., reward contingencies) (Blair & Cipolotti, 2000). By directly addressing the relationship between ER and the capacity to flexibly change behaviors in response to changing task demands, this line of research highlights the importance of examining children's ability to adapt behavior to changing situational characteristics for understanding the characteristics of skillful vs. problematic ER (Ghahremani, Monterosso, Jentsch, & Bilder, 2010; Gorrindo, Blair, Budhani, Dickstein, Pine & Leibenluft, 2005). It also provides further support for the hypothesis that set-shifting may be an important correlate of strategy flexibility.

We know of only one study to examine the cognitive correlates of flexible strategy use (i.e., coping flexibility) in young children. In a study comparing the ability of ADHD and non-ADHD children to vary their self-reported coping strategies according to the controllability of a situation, researchers found no associations between cognitive flexibility, defined as children's performance on the Wisconsin Card Sort (WCST), and flexible coping strategies (Babb, Arsenault, & Levine, 2009). Instead, low scores on the WCST (total number of perseverative errors) predicted higher levels of a dysfunctional coping pattern, relinquished control. However, the authors note that younger children with ADHD had the lowest cognitive flexibility scores and reported the most goal forfeiture, suggesting that deficits in cognitive flexibility have some influence on the skillful use of ER strategies. Because strategy flexibility includes not only the ability to vary strategies according to varied or changing situational characteristics but also the ability to (quickly) change strategies when one is ineffective (i.e., momentary strategy flexibility), a measure of cognitive inflexibility may be associated with the flexible use of ER strategies. Thus, we propose to examine individual differences in sustained perseveration (i.e., longest run of perseverative errors) as correlate of strategy flexibility.

Overall, we suggest that strategy flexibility represents a higher-order regulatory capacity reflecting a child's ability to evaluate the demands, constraints, and affordances of a situation and selectively deploy an ER strategy that fits with immediate situational demands and social constraints. The flexibility to switch ER strategies according to situational context and in response to on-going demands likely involves the ability flexible switch between response sets (i.e., set-shifting). Like other researchers, we do not suggest that set-shifting is uniquely related to strategy flexibilty ER; rather, we suggest that along with other aspects of executive functioning, set-shifting is a fundamental skill for many aspects of self-regulation (e.g., Eisenberg et al., 2007; Garon et al., 2008; Raver et al., 1999; Rueda, Posner, & Rothbart, 2004; Ruff & Rothbart, 1994). Thus, if, in fact, executive processes are related to strategy flexibility, it would be important for future studies to clarify these relations (Nigg & Casey, 2005). In particular, it would be important to examine whether one aspect of executive functioning, set-shifting, may be a correlate of strategy flexibility.

In sum, because flexible switches in ER strategies likely involve executive functions like set-shifting, attentional control, and inhibitory control (e.g., Garon et al., 2008), we suggest that cognitive flexibility and strategy flexibility may be systematically related (e.g., Kaufman, 1989; Schouten et al., 2000). Specifically, we hypothesize that the better children's skill in executive functioning tasks requiring shifts among response sets, the more flexibly they use ER strategies.

The Present Study

The inclusion of strategy flexibility in definitions and assessments of children's ability to regulate emotion may be an important step in improving the clinical utility of ER. Therefore, the study tested the validity of three novel measures (i.e., situational, momentary ratio-of-switches, and momentary latency-to-switch flexibility) of early childhood strategy flexibility.

First, convergent validity is tested by examining relations between strategy flexibility measures and independent ratings of children's overall skill at emotion regulation. Studies of individual differences in children's ability to regulate emotion have frequently used parental report of children's general regulatory abilities (i.e., Emotion Regulation Checklist) and some have used independent, trained observers to assess children's overall, or general, quality of ER (e.g., Maughn & Cicchetti, 2002; Zahn-Waxler, Cole, Richardson, Friedman, Michel, & Belouad, 1994). The present study therefore utilizes a macro-level observational system to rate the quality of children's ER attempts during emotionally-evocative situations.

Second, predictive validity was tested by examining concurrent and longitudinal relations between the newly-developed flexibility measures and child adjustment outcomes that have been associated with skill at ER. Specifically, we reason that if strategy flexibility is important to mental health, it should relate systematically to children's socio-emotional competence. Research has revealed relations between young children's ER and their social skills and levels of behavioral control (e.g., Eisenberg, et al., 2003; see Howse & Calkins, for a review). Therefore, present study utilized measures of social self-control and behavior problems to assess individual differences in children's socio-emotional competence and skill at ER.

Furthermore, validation of the novel strategy flexibility measures will be strengthened if their convergent and predictive validity are established in comparison to indices of individual differences in children's ability to regulate emotion that are widely-used in developmental studies. That is, the frequency and intensity of children's negative emotion during challenging situations and child temperamental negative affectivity will be included in models testing relations between the three flexibility measures and children's socio-emotional competence. We also compare the validity of the novel measures to a typical measure of flexible ER, strategy variety.

Finally, we explored associations between cognitive and strategy flexibility. Relations between flexible processing across psychological domains are an important, but unstudied, research area (e.g., Hollenstein & Lewis, 2006; Nigg & Casey, 1995; Rozanski & Kubzansky, 2005). Because strategy flexibility may involve executive processes (i.e., set-shifting), better cognitive flexibility (i.e., lower perseveration) is thought to predict greater strategy flexibility. However, this link may not be apparent until age four years because studies have shown that typically-developing children who are younger than three year of age show difficult on executive functioning tasks, particularly those that require set-shifting (Carlson, 2005). Moreover, because children in the present study are seen within 2 weeks of their third and fourth birthdays, it is likely that relations between cognitive and strategy flexibility will not be observed in the young three-year-olds.

Considerations of gender. Little is known about gender effects on flexible functioning. Some developmental research suggests that girls show greater capacity for some aspects of EF (i.e., effortful control, inhibitory control) but firm conclusions regarding gender differences in this area are not yet possible (e.g., Diamond et al., 2007; Else-Quest et al., 2006). Gender differences in flexible ER have not been addressed; however, boys and girls differ in behavior problems in early childhood (e.g., Campbell, 1995), implying potential for gender effects in flexibility. Some ER research has also suggested that girls show a greater capacity for ER than boys (Cole, Zahn-Waxler, et al., 1994); however, other studies report null or contrary results (e.g., Suveg & Zeman, 2004). Thus, evidence regarding gender effects in ER remains inconclusive. Moreover, because strategy flexibility is a new construct, it seems premature to build a hypothesis regarding gender differences in children's strategy flexibility.

The specific study hypotheses were:

Hypothesis 1a: Situational strategy flexibility (i.e., using different ER strategies as a function of task objectives), but not strategy variety (i.e., number of different ER strategies used), will predict independent ratings of children's overall quality of ER in a anger-eliciting task at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.

Hypothesis 1b: Both measures of momentary strategy flexibility (i.e., ratio-of-switches and latency-to-switch), but not strategy variety, will predict independent ratings of children's overall quality of ER in a anger-eliciting task at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.

Hypothesis 2a: Situational strategy flexibility, but not strategy variety, will predict children's scores on a composite measure of socio-emotional adjustment at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.

Hypothesis 2b: Both measures of momentary strategy flexibility (i.e., ratio-of-switches and latency-to-switch), but not strategy variety, will predict child socio-emotional adjustment at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.

Hypothesis 3: Cognitive flexibility at age 48 months, but not at age 36 months, will concurrently predict child strategy flexibility. Specifically, less perseveration (i.e., fewer perseverative errors) will predict higher situational strategy flexibility, ratio-of-switches scores, and latency-to-switch scores, above and beyond the influence of child IQ.

METHOD

Participants

The participants are children from families who participated in a larger longitudinal study regarding the development of ER across the toddler and preschool years. Economically-strained families living in rural and semi-rural communities in central Pennsylvania were recruited at 18 months of age (± 2 weeks of age) and were seen 6 times in the course of 2.5 years, at ages 18, 24, 30, 36, 42, and 48 months of age.

Economic strain was defined as household income above the U.S. government defined poverty threshold but at or below the national median income for their family size. Additional exclusionary criteria included children who were known to have developmental delays or serious medical conditions that would compromise their ability to participate in the study. As a result, 124 children were recruited and seen for the first two visits at age 18 months (Time 1) and four more families withdrew from the study before age 36 months. Because this study was interested in children's strategy flexibility at age 36 and 48 months, 120 families with relatively complete data comprise the sample for this study.

The mean annual income of these families at Time 1was $40,655 (SD = $14,996). The children's racial/ethnic identity as reported by mothers indicated that children were primarily white (94.4%) with the remainder identified as biracial. At Time 1, the sample comprised of 69 (55.2%) boys and 55 (44.8%) girls. Most children (97.6%) came from a two-parent home. The majority of mothers (67.3%) had at least some college education and approximately half of fathers (44.8%) also had at least some college education. In terms of parental employment at Time 1, 28% of the mothers described themselves as unemployed or homemakers, 32% as working part-time, and 39% as working full-time. The majority of fathers (92%) of fathers were working full-time at Time 1.

Procedure

At child age 18, 24, 36, and 48 months of age, a parent (usually the mother) and child participated in a series of challenging and non-challenging tasks in the laboratory. Each visit scheduled within two weeks of the child's birthday (e.g., 24 months ± 2 weeks). Each laboratory visit took place in a small observation room, equipped with a one-way mirror running the full-length of one wall (for videotaping purposes). The room was furnished with a metal cabinet, an adult-sized card table, two adult chairs, a child-sized wooden table and two child-sized wooden chairs. Four posters of letters, animals, colors, and numbers were on one wall. Additional materials for each procedure were brought in and removed as needed.

The lab visits were videotaped. Visits included standard procedures for eliciting anger in young children, most of which were taken from a standard assessment battery for observing individual differences in emotion (LabTAB-locomotor version, Goldsmith & Reilly, 1993). These anger-eliciting tasks were designed to mimic the common challenges young children face each day, for example situations that placed demands on their patience (waiting) or persistence (continued engagement). The order of tasks was fixed, ensuring that anger-eliciting tasks were always followed by relief tasks. Lab visits were administered by trained research assistants (graduate and undergraduate students) who followed a standardized protocol.

Data for the current study is drawn from questionnaire measures at child age 30 and 42 months, child performance on intelligence and executive function tests at child age 36 and 48 months, and observational data from anger-eliciting tasks in laboratory visits at child age 36 and 48 months. Procedural details of each anger-eliciting task are outlined below.

Wait task (adapted from, Carmichael-Olson, Greenberg, & Slough, 1985). At the start of this task, the research assistant (RA) brought in a small, attractively wrapped gift ("surprise") for the child, a boring toy (e.g., horse with broken leg at age 36 months or car with no wheels at age 48 months) for the child, and a clipboard with questionnaires for the mother to complete. Mothers were briefed in advance as to the purpose of the task and what they would be asked to do. After indicating to the mother that it was time to begin the task, the RA placed the wrapped gift on a small table, telling the child that it was a "surprise" for him or her. The RA then handed the child the boring toy and left the room. As soon as the RA left, the mother indicated to the child that he or she had to wait until the mother "finished her work" (i.e., questionnaires) before opening the "surprise." The wait task lasted 8 minutes at both 36 and 48 months of age, timed from the point at which the mother issued the instruction to wait. At the end of 8 minutes, the RA returned to the room and the mother indicated that the child could open the gift. Often, upon the end of the task, the RA helped the child open it as the mother completed the last of the questionnaires.

The task-appropriate ER strategies for meeting the task objectives of this task are those that help a child shift attention away from the problem (i.e., gift) in a socially manner. Indeed, self-distraction has been a demonstrated strategy for effectively coping with delays (Cole et al., 2011; Gilliom et al., 2002; Vaughn et al., 1984). At age 36 months, the gift was magnet marbles; at age 48 months, it was a stamp and inkpad set.

Transparent box task (Goldsmith & Reilly, 1993). At the start of this task, the RA asks the child to choose a small figurine of a popular TV or movie character (e.g., Care-Bear figurine) from two possible choices. The RA then placed the chosen figurine inside a clear Plexiglas box, locking it inside with a small padlock. The RA showed the child how to open the box with keys until the child indicated that he or she understood how the box could be opened. The RA relocked the box, instructing the child to "work on opening the box" while the RA was out of the room doing something else. The child was also told that he or she could play with the figurine if he or she unlocked the box before the RA returned. However, before handing the child the keys and leaving, the RA switched key rings without the child's knowledge. That is, the child was given a key ring with a set of two "wrong" keys which would not open the padlock. Upon re-entering the room, the RA sees that the box is not open and, in a scripted fashion, discovers the mistake, retrieves the correct keys, and helps the child to unlock the box and get the toy, which the child later takes home. At age 36 months the RA returned after 2.5 minutes, timed from the moment the RA left the room. At age 48 months the RA returned after 3 minutes; the task was lengthened at age 48 months to ensure that it was equally challenging across the two ages.

The task-appropriate ER strategies for meeting the task objectives of this task are those that help a child sustain attention on the problem (i.e., figurine in the box) by persisting in his or attempts at opening the locked transparent box. Although this goal is technically unattainable because the child is given the wrong keys, he or she is unaware of the deception until the end of the task. Moreover, he or she was explicitly instructed to work on opening the box while the RA was out of the room. Indeed, attentional focus on the problem, referred to as problem-solving or attempts to fix, has been a demonstrated effective strategy for the transparent box (Dennis, 2006).

Perfect circles task (LabTAB; Goldsmith & Reilly, 1993). In this task, the child was asked to draw "the perfect green circle" on a sheet of plain white 8" x 11" paper. Each time the child finished drawing a circle, the RA criticized it in a neutral tone of voice (e.g., "That one's too flat, skinny, small, etc…") and asked the child to draw another one. This task lasted for 3 minutes at age 36 months and 3.5 minutes at age 48 months, beginning immediately after the first criticism by the RA. Judges regarded a child's being able to try again at drawing a perfect circle to be on task behavior. Upon completion the RA showed the child the best circle drawn and it was shown to the mother. In the present study, this task was included only in the observational measure of children's overall quality of ER (see pp. 66-67).

Measures

Parent report of child behavior and socio-emotional adjustment were obtained at each visit. The present study utilized questionnaires from ages 30, 36, 42, and 48 months to measure child temperamental negative reactivity and socio-emotional competence. Finally, all strategy flexibility, cognitive flexibility, and child IQ measures were obtained during the laboratory visits at ages 36 and 48 months.

The Toddler Behavior Assessment Questionnaire – Revised (TBAQ-R; Goldsmith, 1996; additional scales by Rothbart, 1996). Child temperamental negative affectivity was assessed at 30 months of age using a 90-item version of the TBAQ-R. In the TBAQ-R, mothers rate the frequency of their child's behaviors across a range of situations on a scale of 1 (never) to 7 (always). The TBAQ-R yields three higher-order dimensions, Effortful Control, Surgency/Extraversion, and Negative Affectivity. Negative affectivity is a measure of a child's predispositions towards negative emotional reactions (Rothbart & Bates, 2006). The TBAQ-R is a frequently used measure of young children's temperament and has consistently demonstrated adequate reliability and validity for this age group (e.g., Goldsmith, 1996; Hayden, Klein, & Durbin, 2005; Rothbart, Ellis, Rueda, & Posner, 2003). Examination of Cronbach's alpha suggested that the scale was reliable for the sample, $\alpha = .86$.

The Child Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001; CBQ). Child temperamental negative affectivity at age 42 months was assessed via maternal report on the 195-item CBQ questionnaire. Mothers rated on a 7-point Likert scale the likelihood of her child’s reactions in a variety of situations. Like the TBAQ-R, the CBQ yields three higher-order dimensions, Effortful Control, Extraversion/Surgency, and Negative Affectivity. The Negative Affectivity dimension in the CBQ is also thought to measure a child’s negative emotional reactivity. This measure has shown good validity (e.g., Davis et al., 1999) and reliability (e.g., Rothbart et al., 2001). The scale showed adequate reliability in the sample, $\alpha = .79$.

Relating temperamental negative affectivity to child outcomes. To determine that predictive relations between (a) strategy flexibility measures and (b) child adjustment outcomes associated with skillful self-regulation are attributable to children’s flexible use of ER strategies rather than individual differences in child emotional reactivity, the current study includes mother-reported TBAQ-R and CBQ child negative affectivity scores as covariates in analyses. Items on parental report measures of child temperament and behavior problem symptoms sometimes overlap (e.g., “easily angered” and “tantrums frequently”). Nonetheless, assessments of emotional reactivity and behavior problems necessitate substantial opportunity for observation of the child; consequently, the study relies on parental report. This creates a concern, specifically, shared method variance in understand relations between temperamental negative affectivity and behavior problem symptoms.

Although there is evidence each construct (i.e., temperamental negative affectivity and behavior problem symptoms) contributes uniquely to predictions, even when assessed by parental report (Lemery, Essex, & Smider, 2002; Lengua et al., 1998), we address this concern by using maternal temperamental ratings of children from an earlier age point than maternal ratings of child behavior problems. That is, when predicting child behavior problems at age 36 months, the proposed study utilizes TBAQ-R Negative Affectivity scores from age 30 months.

Likewise, when predicting child behavior problems at age 48 months, the study utilizes CBQ Negative Affectivity scores from age 36 months.

Child IQ: Wechsler Preschool and Primary Scale of Intelligence III (Wechsler, 2002; WPPSI-III). Scaled scores from two subtests on the WPPSI-III, Block Design and Vocabulary, will be used to estimate the child's intellectual functioning at 36 months of age. The short form was used given the demands of a long lab visit in a child who was just turning 3 years of age. The short form of the WPPSI-II has shown adequate validity and reliability (e.g., Sattler, 2001; Sattler & Dumont, 2004). Because previous studies have revealed associations between children's IQ and executive functions (Garon et al., 2007), the short form Full Scale IQ will be used as a covariate in tests of relations between cognitive flexibility and strategy flexibility at 36 months of age.

Child IQ: Stanford-Binet IV (Roid, 2003; Stanford-Binet Intelligence Scales IV, S-B IV). The Full Scale IQ based on the Abbreviated Battery from the SB-IV, which consists of the scaled scores for the Nonverbal Fluid Reasoning and Verbal Knowledge routing subtests, will be used to estimate intellectual functioning at 48 months of age. The Abbreviated IQ score has shown adequate validity and reliability (Becker, 2003). Again it was selected in consideration of the length of the visit for a young child (just turning 4 years). The Abbreviated Full Scale IQ will be used as a covariate in tests of relations between cognitive flexibility and strategy flexibility at 48 months of age.

Child ER strategies. Classification of children's emotion regulatory strategies was conducted by a trained team of undergraduates, who were trained to a criterion of 85% accuracy with a master coder. The coding system, developed for this project, was originally conducted in 15-second epochs (Cole et al., 2006). Team members coded independently and were blind to study hypotheses; in addition, weekly meeting were held to prevent observer drift. Reliability of this coding system has been calculated for fifteen to twenty percent of the cases at each age. At this level of observation, Cohen's κ ranges from .82 to .89 across the 18-, 24-, 36-, and 48-month lab visits (aggregated across the wait, transparent box, and perfect circles tasks), indicating reasonable reliability.

For the purposes of the present study, coders used the coding sheets from the 15s epoch coding to transfer, and specify, the observations of children's strategy use on a second-by-second basis 36 and 48 months of age (Cole et al., 2006). The ER strategies included in the coding system are drawn from the literature on early childhood emotion regulation and include self-distraction, self-soothing, escaping the situation, self-verbalization of strategy, and instrumental action. Examples of each are listed in Table 1. Strategy codes are not mutually exclusive and it is possible for two strategies to occur during the same second. In these cases, both strategies were coded as present. However, with the exception of self-soothing, strategies were generally observed to be mutually exclusive.

Insert Table 1 here

All coders were trained to a criterion of 85% accuracy of with a master coder and were blind to study hypotheses. Reliability of the second-by-second coding was calculated for 15% of the cases at each age. The systems showed adequate reliability with Cohen's κ ranging from .78 to .86 across the 36- and 48-month laboratory visits.

Strategy flexibility. Four measures of strategy flexibility were derived from second-by-second observations of children's emotions and putative ER strategies. All flexibility variables were created such that higher scores indicated greater strategy flexibility.

1. *Strategy variety* is defined as the total number of different strategies used in anger-eliciting situations. The variable used in analyses is the total number of different strategies children use across the wait and transparent box tasks. Thus, the number of different ER strategies used in the wait and transparent box tasks were summed, standardized, and averaged to create a composite score reflecting the range of a child's repertoire of ER strategies. The following variable is used in analyses:

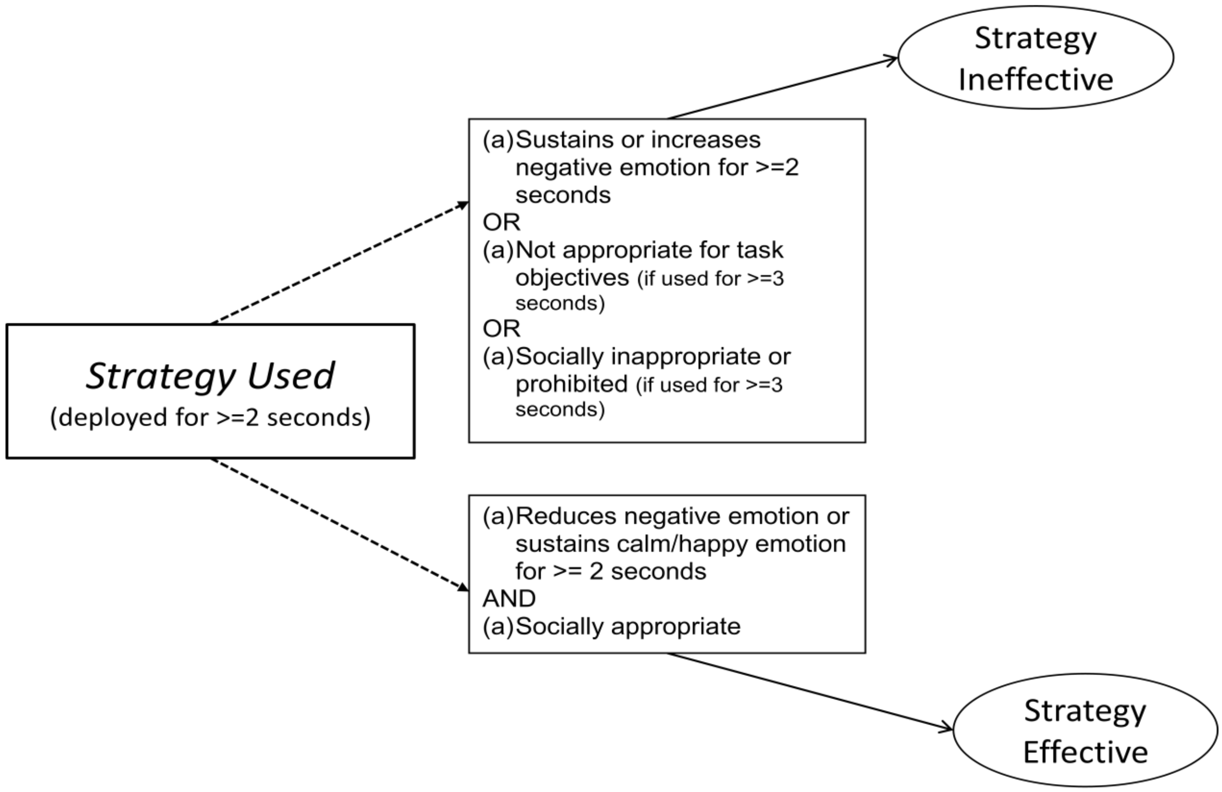
$$\Sigma \text{ (\# different strategies in wait)} + \Sigma \text{ (\# different strategies in transparent box)}$$

2. *Situational strategy flexibility* is defined as the more frequent use of situation-appropriate ER strategies. Because this study focuses on children's ER across anger-eliciting situations with varying task objectives, the appropriateness of ER strategies is judged in relation to their fit with task objectives -- tolerating a delay in the wait task and persistence in overcoming a blocked goal in the transparent box task. Based on the literature (e.g., Gilliom et al., 2002; Vaughn et al., 1984) the context-appropriate strategy is distraction for the wait task and problem-focus (i.e., attempt to fix) in the transparent box. The following variable will be used in analyses:

$$\varepsilon\left(\%\text{time distraction used in wait} + \%\text{ time problem focus used in transparent box}\right)$$

Second-by-second observations of ER strategies during the wait task are used to create momentary strategy flexibility variables because the wait task is longer than the other anger-eliciting tasks in the larger study, thereby affording more opportunity for switches to occur. Because momentary flexibility refers to children's ability to switch strategies when one is ineffective, strategy effectiveness must first be operationally defined. Figure 2 provides an overview of the study's definition of strategy effectiveness and non-effectiveness.

Figure 2. Defining strategy effectiveness for momentary strategy flexibility measures



Once used for at least 2 seconds, a strategy is defined as ineffective if it (a) involves focusing (i.e., staring or touching) on the desired surprise for ≥ 3 seconds, (b) sustains or increases child negative emotion, or (c) is judged to be socially-inappropriate (e.g., playing with the light switch) or occurs directly after being prohibited by child's mother (e.g., "don't bother me while I'm working"; "don't touch the surprise"). The 2 second period allows for a delay in observed associations between strategy deployment and changes in emotion; this period is informed by our experience coding young children's ER strategies and emotion. In addition, because interest in the prohibited object (i.e., gift) may be reflective of engagement in the task, a child's persistent attention (i.e., staring, touching) on the surprise will not be considered ineffective unless it last for ≥ 3 seconds. This duration is informed by our experience coding regulatory strategies and literature characterizing attentional control (e.g., Ruff & Lawson, 1994). As outlined in Figure 1, strategy effectiveness determined whether a strategy switch and non-switch was contingent (i.e., occurred for an ineffective strategy) or non-contingent (i.e., occurred for an effective strategy).

Once the effectiveness of each strategy was determined, two momentary flexibility measures were created.

a. *Ratio-of- switches* (i.e., momentary ratio flexibility). One definition of momentary strategy flexibility is the ability to more frequently switch strategies when one is effective than ineffective. This definition is operationalized by the momentary *ratio* variable which assesses the frequency of switches in strategies when one is ineffective.

However, because frequent strategy switches may simply reflect inefficient or unskilled ER, the momentary ratio variable accounted for both contingent switches *and* contingent non-switches (see Figure 1, p. 43). That is, the measure must account for inflated scores due to frequent switching (i.e., high numbers of non-contingent switches) and for individual differences in *opportunities* for contingent switches and non-switches to occur. The variable used in analyses is as follows:

$$\frac{(\text{Total \# Contingent Switches + Non-switches})}{(\text{Total \# Contingent Switches+Non-switches}) + (\text{Total \# Non-contingent switches + Non-switches})} =$$

$$\frac{(\text{Total \# Contingent Switches + Non-switches})}{(\text{Total \# Opportunities to Switch})}$$

Higher ratio scores indicated greater momentary flexibility, that is, a higher ratio of contingent switches and non-switches.

b. *Latency-to-switch* (i.e., momentary latency flexibility). The second definition of momentary flexibility is the ability to more quickly switch strategies when one is ineffective than when one is effective. For ease of interpretation, the momentary variable was constructed such that latency to switch from *effective* strategies is the numerator and switch from *ineffective* strategies is the denominator. Thus, higher momentary latency scores would indicate greater momentary flexibility.

As such, the momentary *latency* in the present study is operationally defined as a *longer* onset to switch strategies when one is *effective* than when one is ineffective. Momentary flexibility is thought to entail the ability sustain an effective strategy *and* quickly switch away from an effective one. The variable used in analyses is as follows:

$$\frac{\text{Avg. latency to switch strategy}|\textit{effective}\text{ current strategy}}{\text{Avg latency to switch strategy}|\textit{Ineffective}\text{ current strategy}}$$

Higher latency scores indicated greater momentary flexibility, that is, a longer latency to switch from effective strategies than ineffective ones.

A summary of the strategy flexibility examined in the present study can be found in Table 2 below.

Table 2.

Summary of strategy flexibility variables

Flexibility Measure	Variable
Strategy Variety	Σ (# different strategies in wait) + Σ (# different strategies in transparent box) ∴ flexibility = higher # different strategies *N.B. Because the two tasks differ in length, strategy sums were standardized*
Situational strategy flexibility	Σ (% of self-distraction wait task + % of focused on problem solving in transparent box task) ∴ flexibility = higher % of distract in wait and problem-focus in transparent box

Ratio-of-switches (Momentary Flexibility)	$\frac{\text{(Total \# Contingent Switches + Non-switches)}}{\text{(Total \# Opportunities to Switch)}}$ ∴ flexibility = higher ratio of contingent switches and non-switches
Latency to-switch (Momentary Flexibility)	$\frac{\text{Avg. latency to switch } \vert \text{effective current strategy}}{\text{Avg latency to switch } \vert \text{Ineffective current strategy}}$ ∴ flexibility = longer latency to switch from effective strategy than ineffective strategy *N.B. In other words, flexibility = faster switches when one is ineffective versus effective*

Child Overall ER Quality (adapted from Zahn-Waxler et al., 1994).In contrast to micro-analytic observational systems, the global emotion regulation system (GER) provided an objective rating of the overall quality of child ER during three different anger-eliciting tasks (wait, transparent box, and perfect circles). Trained coders judged the predominant quality of each child's (a) emotional tone (calm or negative) and (b) behavior (on-task, off-task, or disruptive). In prior work (Hall, 2008) the off-task and disruptive codes were combined and were therefore combined in this study. The system makes separate judgments about emotion and behavior to allow for any possible combination (e.g., calm/off-task) and does not conflate negative emotion and disruptive behavior as has been done in past studies.

To judge a child's predominant emotional tone, the coder used facial and vocal expressions in order to determine whether the predominant tone was positive (happy, joyful, content), negative (angry, sad, anxious, generally distressed), mixed (equal positive and negative emotion), or neutral. This judgment does not exclude the experience of other emotions during the task (e.g., displaying some negative emotion but being predominantly positive or displaying some positive emotion but being predominantly distressed); instead, emotional tone codes capture the child's primary overall or dominant emotional tone during each task. In addition, the emotion data was aggregated to create two composite codes: *calm* (positive or neutral) and *negative* (negative or mixed) because of the slightly lower reliability in distinguishing between positive and neutral emotion and the rare occurrence of mixed emotion.

Detailed descriptions of the three behavior ratings are outlined below:

1. *On-task*: the child worked toward a pre-determined task goal, specifically tolerating waiting and allowing mother to complete work (wait task) or persisting at a difficult task (perfect circles, locked box).
2. *Off-task*: the child did not work toward a pre-determined goal but did not engage in disruptive behavior.
3. *Disruptive*: the child engaged in behavior that was disruptive, defined as behavior that the average adult would try to stop or change.

For the present study, emotion and behavior codes were combined to produce an overall global ER rating of the child's behavior during each task (e.g., calm/on-task or negative/disruptive). The wait task was divided into two 4 minute segments as judges found it difficult to assign a single rating to an 8 minute task. The joint codes were summed at each age, creating a continuous variable, ranging from 0 to 4, indicating the total number of tasks in which a child was observed to exhibit a specific type of global ER quality (i.e., calm/on-task and negative/off-task or disruptive). Table 3 provides examples for each of the joint codes during the wait task. Higher scores on the calm/on-task code or lower scores on the negative/off-task or disruptive code indicated that the child was perceived as well-regulated on more tasks.

Insert Table 3 here

Coders were trained to an accuracy level of 80% with the master coder; once criterion was reached, the coding team met weekly in order to prevent observer drift. Coders were trained to first rate a child's dominant emotional tone during a task and then to rate the quality of the child's behavior. Using Cohen's κ (1960), inter-rater reliability was calculated for ratings of children's emotional tone and behavioral organization. To determine inter-rater reliability, 15-20% of cases at each age point were double coded; κs for emotion ratings ranged from .58 to .79 and for behavior from .71 to .76.

Child emotion. An independent coding team classified child emotion expression. Coders indicated the presence and intensity of expression of each of four emotions (i.e., anger, sadness, anxiety, and happiness) on a second-by-second basis. Classification of emotions is based on facial expressions, vocal quality (not verbal content) and, to a limited degree, postural and gestural cues that are known to be associated with the target emotions. This coding system has been used extensively in studies of young children (e.g., Cole et al., 1996). Emotion codes are not mutually exclusive and children can express "blends," or multiple simultaneous emotions. Peak intensity of expression for the overall emotional expression is rated as 1 (minimal intensity), 2 (moderate intensity), or 3 (high intensity).

For the purposes of this study, the frequency and intensity with which the child expresses any negative emotion in the transparent box and wait tasks at age 36 and 48 months will be used in two ways. First, emotion codes were used to determine strategy effectiveness, an important judgment for our operational definitions of strategy flexibility within a challenging situation (i.e., momentary strategy flexibility). Second, the total amount of negative emotion expressed) in the wait task (i.e., number of seconds, weighted by emotional intensity) will be used as a covariate in analysis testing relations between strategy flexibility measures and (a) independent ratings of children's overall ER quality and (b) parent-report of outcome variables measuring children's socio-emotional competence.

Child cognitive flexibility. Executive function tests assessing children's set-shifting ability were used as measures of cognitive flexibility.

1. ***A-not-B*** (Espy et al., 1999). This adaptation of an A-not-B task has been used frequently among children in the toddler and preschool years to index skill of executive processes, particularly working memory and ability to shift between response sets. It is reliable over a period of 2 years and has shown good validity in early childhood (e.g., Espy et al., 1999; Carlson, 2005; Carlson, Mandell, & Williams, 2004).

In A-not-B, the child watches the research assistant hide a small sticker in one of two shallow wells on the long wooden board. The assistant then hides the sticker by covering the wells with two identical beige cups. After 10 seconds, the child is asked to "find the sticker" by touching one of the cups. If the child picks the right location, he or she gets to keep the sticker. If, however, the child does not pick the right location, the assistant says "Oops, try again!" and removes the sticker for use in the next trial. The next trial begins with the assistant hiding a small sticker in one of two shallow wells and asking the child to "find the sticker." After 10 seconds, the child is asked to find the sticker again.

For each trial, the hiding locations of the sticker switches between the two shallow wells after 2 consecutive correct searches by the child or 5 searches regardless of correctness. That is, hiding locations change if the child finds the sticker in 2 consecutive trials or after 5 trials.

To measure low cognitive flexibility, a perseverative error score was created. This score was calculated by first summing the number of consecutive trials in which an incorrect search occurs. This score was then standardized and combined with a standardized perseverative error score from Delayed Alternation (see below) to create an age 36-month variable assessing the longest run of perseverative errors. This score measured the longest string of consecutive errors that a child made on the set-shifting task.

2. ***Delayed Alternation*** (DA; Espy et al., 1999). This is a more advanced version of an A-not-B task that involves reversals, which requires a child to discern a pattern of hiding locations. Specifically, the child does not get to watch the assistant hide the reward; to correctly find it, the child must notice that the hiding location of the reward reverses after a correct search. As in the A-not-B task described above, this test is has been used to index skill of executive processes, particularly working memory and the ability to shift between response sets. Although it used less frequently than A-not-B, studies have reported adequate reliability and validity among children between 2.5 and 5 years of age (e.g., Espy et al., 1999; Espy & Kaufman, 2002).

The procedure for DA is very similar to A-not-B. The task begins with a pre-trial where the assistant pretends to hide a small foam shape in one of the two shallow wells on the testing board. This is accomplished by placing the board out of the child's sight (i.e., underneath the testing table); the assistant then proceeds to "hide" a while the testing board is out of sight. After a ten second delay, the assistant places the board on the table and says "The shape is under one of these cups. Let's see if you can find it. Go ahead--take a guess!" Because there was no shape hidden, the child cannot search correctly. The child's search on the pre-trial determines the first hiding location of the testing trials.

The test trials begin with the assistant showing the child a shape, stating "Now I will hide this shape." The assistant then hides the shape while the testing board is out of the child's sight. The shape is hidden in the location opposite from the one that the child searched on the pre-trial. After a 10 second delay, the assistant asks the child to search for the shape by touching one of the cups. If the child searches correctly, the assistant gives the shape to the child and asks the child "to play again!" After a correct search, the hiding location reverses to the opposite side. If the child searches correctly, the assistant says "Oops it wasn't there! Let's try again!" The assistant removes the shape before hiding it again in the same location. The shape will be hidden in the same location for as long as the child incorrectly searches for it.

To estimate low cognitive flexibility, a longest run of perseverative errors score was created in a parallel fashion to A-not-B. The number of consecutive trials in which an incorrect search occurs is summed. In sum, the cognitive flexibility variable used in analysis at 36 months of age was a standardized score of the longest run of perseverative errors made across the A-not-B and DA tasks.

3. ***Dimensional Change Card Sort*** (DCCS; Zelazo et al., 1996). This version of the DCCS been used frequently among young children (ages 2 to 5 years) to index skill of executive processes, particularly working memory and ability to shift between response sets. It is reasonably reliable over a period of 3 years and has shown good validity in early childhood (e.g., Carlson, 2005; Carlson & Wang, 2007; Zelazo et al., 2003)

In DCCS, the child sorts cards that vary in two dimensions (i.e., shape and color). During pre-trials, the child learns the rules “of the card game” by sorting training cards according to the dimensions of target cards (i.e., blue boats & red rabbits). That is, the child can either sort the cards by the shape dimension (i.e., boats or rabbits) or by the color dimension (i.e., blue or red).

Before each test trial, the child is reminded of the correct sorting rules. During the pre-switch trials, the child sort target cards by one dimension. If the child does not correctly sort on 6 consecutive trials, the test ends. If the child passes the pre-switch trials, he or she is reminded of the rules of the “sorting game.” The child has to demonstrate understanding of the sorting game (i.e., blue goes with blue in the color game but boat goes with boat in the shape game) before continuing to the post-switch trials.

During the post-switch trials, the child sorts the target cards according to the second dimension. One measure of (low) cognitive flexibility was created based on children’s performance on the DCCS. The longest run of perseverative errors score was calculated by counting the longest string of consecutive trials in which an error occurred.

Child socio-emotional competence. Children’s socio-emotional competence was assessed with measures of questionnaire measures of outcome variables thought to be associated with skilled ER. Specifically, parental ratings of child behavior problems and social skills were used to measure child socio-emotional competence.

1. ***Child Behavior Checklist*** (CBCL; Achenbach & Edelbrock, 1991): Child behavior problem symptoms were assessed via parental report on the CBCL. It is a 100-item questionnaire asking parents to rate the frequency with which a child

engages in a specific problem behavior and the significance of that behavior to the parent on a 3-point scale. It yields a number of outcomes scores, including a Total Problems score. The Total Behavior Problem raw score will be used as an index of child behavior problems at ages 36 months, 48 months, and 5 years. Only maternal reports were available at age 36 months but paternal reports were included at age 48 months and 5 years. The preschool version of the CBCL has shown good reliability (alpha = .84; Lengua, 2002) and validity (Achenbach, 1991). Reliability analysis for the study sample suggested that the total behavior problems scale was reliable at all ages, $\alpha = .94$ for mother-report at age 36 months, and $\alpha = .95$ for mother-report at age 48 months, $\alpha = .94$ for father-report at age 48 months.

2. ***Social Skills Rating Scale*** (SSRS; Gresham & Elliot, 1990): Children's social self-control were assessed via maternal report on the SRSS. The SRSS is a 52-item questionnaire that asks a parent to rate the frequency with which a child engages in a specific social behavior on a 2-point Liker scale. The measure yields four subscales indexing child social skill, and raw scores from the Self-Control and Responsibility subscales will be used to measure child self-regulation at ages 36 months, 48 months, and 5 years. These scales measure child self-regulation during peer conflict and compliance with socio-cultural norms respectively. This measure has also shown good psychometric properties and is identified as one of the most effective parent-rating scales of child social competence (Demaray et al., 1995). Both scales showed modest to acceptable reliable; $\alpha = .70$ for social responsibility and $\alpha = .79$ for self-control at age 48 months.

Composite index of child self-regulation. At age 36 months, scores from two measures assessing child adjustment outcomes that have been associated with individual differences self-regulatory ability (i.e., maternal report of child CBCL behavior problem symptoms and SSRS responsibility and self-control scores) were standardized and averaged to create a composite score representing child self-regulation. The composite was scaled such that higher scores are indicative of better self-regulation. A similar approach was used to create a composite score representing child self-regulation at age 48 months. Specifically, scores three parental report measures were standardized and averaged, specifically, maternal report of child behavior problem symptoms, paternal report of child behavior problem symptoms, and maternal report of child social responsibility and self-control. Scores from the age 36 and 48 month self-regulation composites were used to examine the concurrent predictive validity of strategy flexibility measures at ages 36 and 48 months.

RESULTS

Overview of Results

First, the descriptive statistics for all study variables are presented. Second, steps taken to address missing and skewed data are presented. Third, age differences on strategy flexibility and child outcome variables are presented. Fourth, correlations among all variables relevant to study hypotheses are provided. Fifth and finally, results from a series of hierarchical regressions that tested study hypotheses are presented

Descriptive Statistics and Missing Data

Descriptive statistics. The means, standard deviations, minimums, and maximums for all study variables are presented in Table 4. Descriptive data revealed that by age 36 months all children attempted regulatory strategies and there was variability in the strategy variety scores at both ages. The lowest strategy variety score was 1 in the transparent box and 3 in the wait task. Finally, there also was variability in the total number and longest run of children's perseverative errors, particularly at age 48 months where the range of scores was 0 to 5.

Insert Table 4 here

Descriptive statistics of the number of tasks in which the child was calm/on-task or negative/off-task or disruptive indicated that, at 36 and 48 months of age, these codes were used to explain the majority of children in the three tasks. As shown in Table 5, the GER codes included in the present study occurred most frequently but do not represent the entire range of children's GER scores. Specifically, children could be judged as calm/off-task or negative/on-task during one or more of the anger-eliciting situations. As such, child scores on calm/on-task codes were not simply the reciprocal of negative/off-task or disruptive; thus, both were included in testing the study hypotheses regarding child skill at ER. Paired sample t-tests revealed a decrease in the number of children classified as negative/off-task or disruptive between ages 36 and 48 months, $t = 2.56$, $p < .05$ (see Table 5 for *M*s and *SD*s of global ER codes) but no difference for calm and on task ($t = -1.39$, *ns*).

Insert Table 5 here

Missing data. There were multiple ways in which data was missing. The first way was that a family withdrew from the study. The attrition rate in this study was low, however. Of the 124 eligible cases at Time 1 (child age 18 months), four cases withdrew prior to the time points used in the present study. Of the 120 participants who completed the age 36 month visit, two families (1.7%) withdrew by the time the child reached age 48 months. Of the 118 families who completed the age 48 month visit, 96 (81.4%) returned for an age 5 visit. Using EM methods to estimate missing data (see below), an N of 120 was used in most analyses, unless otherwise noted.

Some sources of data were missing for an entire visit of a continuing participant due to family circumstances (e.g., death of a relative). In other cases, partial data was missing for some participants (e.g., questionnaires were returned too late). Of the 120 participants, who completed laboratory visits at ages 36 and 48 months, four (3.3% of cases) were missing all questionnaire measures (parental report data) at both ages, and five cases (4.2%) were missing the age 30 month temperament questionnaire. In some cases, only one parent completed questionnaires; for these cases the score was based on data from that parent. In addition, some children lacked scores for cognitive flexibility because the test was not administered (n = 6 at 36 months), the child refused to complete the task (n = 10 at 36 months, n = 3 at 48 months), or the child failed the 48 month task pre-test (n = 16).

Expectation maximization (EM) was used to estimate values to replace missing data points. EM is a single imputation method in which missing values are iteratively estimated through a maximum likelihood approach given the observed relationships among observed variables in the dataset (Graham, 2009). Some EM procedures also add a degree of random error to parameter estimates in order to reflect the uncertainty (i.e., error) associated with all imputation methods (Acock, 2005). Prior to imputation, Little's MCAR test was performed to determine whether missing data were missing completely at random (MCAR), a requirement for use of data estimation methods such as EM (Schafer & Graham, 2002). Results suggested there was no detectable pattern in the missing values, $\chi^2 = 898.75$, df = 760, $p<.001$. EM was therefore a suitable approach for approximating missing data.

Skewed data. The distributions of all variables presented in Table 4 were examined for normality. The age 36 and 48 month observed negative emotion variables (total amount of negative emotion expressed), the age 36 month perseverative error scores, and the 48 month and 5 year child socio-emotional adjustment composite scores had skewed and kurtotic distributions. To normalize these distributions, log transformations were performed on the total amount of negative emotion expressed variables and the perseverative errors variables, and square root transformation was performed on the socio-emotional adjustment variables. Examination of the distributions for all transformed data indicated successful transformation.

Age differences. Although age differences were not a focus of the present study, these were examined to aid in interpretation of the tests of the study hypotheses. To this end, one repeated-measures MANOVA (GLM; SPSS 18.0) was conducted to identify age differences in all study variables (36 and 48 month *Ms, SDs, minimums* and *maximums* are also presented in Table 4). As different tests were used at each age to measure cognitive flexibility, standardized (*z*) scores were used for this analysis. The MANOVA yielded only one significant age difference. Specifically, 48-month-olds had higher momentary flexibility ratio scores than 36-month-olds, $F(1,119) = 5.71$, $p < .05$.

Bivariate Relations among Study Variables

Before conducting regression analyses, correlation tables were examined for several purposes. First the correlations were examined for potential multicollinearity. No pair of predictor variables was correlated $r > .70$. The full correlation matrix (Table 6) also indicated associations relevant to the aims of the study. First, correlations among parent report scores that were intended to create a child socio-emotional adjustment composite were examined (see Table 7). As all of these variables were significantly associated in expected directions at each age, the data supported the creation of the composite variables.

Insert Tables 6 and 7 here

Next, the correlations among the strategy flexibility variables were examined (see Table 8). In terms of consistency across ages, the relations were mixed. First, 36-month strategy variety was associated with 48-month strategy variety, $r = .77$, $p < .001$. However, 36-month situational flexibility was not related to 48-month situational flexibility, $r = .01$. Similarly, 36 and 48 month scores were not related for latency scores, $r = .10$. However, 36-month ratio scores were associated with 48-month scores, $r = .22$, $p < .05$.

In terms of relations among the different flexibility measures within age, there was little evidence of relatedness. 36-month strategy variety was positively associated with 36-month situational flexibility, $r = .48$, $p < .001$, and 48-month variety was positively associated with 48-month ratio scores, $r = .15$, $p < .05$, but inversely related to 48-month latency, $r = -.18$, $p < .05$. Most of the significant relations found between the situational and momentary flexibility scores were in the expected direction, with exception of the pairwise relations involving momentary ratio scores. This unexpected pattern of relations, along with the associated multiple regression results, is addressed in the discussion.

Insert Table 8 here

Hypothesis Testing

If, as hypothesized, strategy flexibility is an aspect of skillful ER, then it should be associated with an independent measure of children's overall quality of ER. In addition, individual differences in strategy flexibility should also predict individual differences in behavior associated with ER—socio-emotional adjustment and cognitive flexibility. The present study therefore investigated the validity new measures for quantifying flexible strategy use in predicting socio-emotional adjustment and cognitive flexibility, controlling for two typical approaches for inferring skill at ER—total amount of negative emotion expressed and total number of different strategies attempted (i.e., strategy variety) in an anger-eliciting task. The convergent validity of three novel strategy flexibility variables (one for situational flexibility and two for momentary flexibility) was tested using hierarchical regressions to predict independent ratings of children's overall ER quality. That is, we tested the degree to which strategy flexibility variables predicted variance in independent coders' judgments about the overall organizational quality of children's emotion regulation during three anger-eliciting tasks. Next, the predictive validity of the strategy flexibility variables was tested using hierarchical regressions to predict children's scores on socio-emotional adjustment variables that are putatively associated with ER. Finally, a regression approach was also used to test relations between the number of preservative errors and strategy flexibility measures.

Hypothesis 1a. *Situational strategy flexibility (i.e., using different ER strategies as a function of task objectives), but not strategy variety, at ages 36 and 48 months will predict the number of tasks in which children were (a) calm and on task or (b) negative and off task or disruptive at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed.*

Two hierarchical regressions (one for each age—36 and 48 months) were conducted for each of two global ER types: calm/on-task and negative/off-task or disruptive. The hierarchical regressions were constructed identically to those previously described. Specifically, Step 1 comprised two covariates (child gender and temperamental negative affectivity) and the total amount of expressed negative emotion. Step 2 comprised strategy variety and situational strategy flexibility. Regression statistics for these analyses are summarized in Tables 9 and 10.

At age 36 months, situational flexibility scores predicted the number of tasks in which children were calm and on-task, $\beta = .39$, $t = 4.59$, $p < .001$, in the expected direction. Specifically, children who were more flexible across situations were more often judged as calm and on task at age 36 months. In contrast, children who used a broader range of strategies (i.e., strategy variety variable) were less often judged as calm and on task, $\beta = -.18$, $t = -2.13$, $p < .05$. The total amount of negative emotion expressed and the covariates (child gender and temperamental negative affectivity) did not contribute significant variance (see Table 9).

At age 48 months, the same pattern of results was found. As expected, higher situational flexibility scores at age 48 months predicted that children were judged as calm and on-task during more tasks, $\beta = .41$, $t = 4.99$, $p < .001$. However, higher variety scores predicted that children were *less* often judged as calm and on task, $\beta = -.18$, t -2.14, $p < .05$. Again, the total amount of negative emotion expressed and covariates (child gender and temperamental negative affectivity) did not contribute significant variance (see Table 9).

Insert Table 9 here

In sum, even in the presence of covariates and control variables, situational strategy flexibility predicted independent ratings of children in predicted directions. Specifically, the more flexibly children used strategies across situations, the more often they were judged to be well-regulated.

In regard to negative/off task or disruptive, a similar pattern of results was found at both ages, although at age 36 months, one covariate and one control variable also accounted for significant variance. Specifically, at age 36 months, boys were more often coded as negative/off-task or disruptive than girls, $\beta = -.29$, $t = -4.02$, $p < .001$, and, as would be expected, a higher amount of expressed negative emotion scores predicted more tasks in which a child was coded as negative/off-task or disruptive, $\beta = .49$, $t = 6.82$, $p < .001$ The inclusion of 36-month situational flexibility in the second step accounted for additional significant variance, $F(2,114)_{change} = 6.13$, $p < .01$, above the effects of gender and negative expressed emotion. That is, higher situational flexibility predicted being judged as negative and off-task/disruptive in *fewer* tasks, $\beta = -.22$, $t = -3.00$, $p < .01$. In contrast, higher strategy variety at 36 months predicted that children were judged as negative/off-task or disruptive in *more* tasks, $\beta = .17$, $t = 2.30$, $p < .01$. Child temperamental negative affectivity did not contribute significant variance (see Table 10).

At age 48 months, total amount of expressed negative emotion and situational strategy flexibility were the only significant predictors of the number of tasks in which children were coded as negative/off-task or disruptive. That is, a higher amount of expressed negative emotion predicted that children were judged as negative and off-task/disruptive more often, $\beta = .35$, $t =$

4.22, $p < .001$. However, over and above this effect, $F(2,114)_{change} = 7.72$, $p < .01$, higher situational flexibility scores predicted being judged as negative and off-task/disruptive *less* often, $\beta = -.30$, $t = -3.68$, $p < .001$ (see Table 10).

Insert Table 10 here

Hypothesis 1b. *Both types of momentary strategy flexibility (i.e., momentary ratio and latency scores), but not strategy variety, at ages 36 and 48 months will predict child scores on global emotion regulation codes at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.*

Eight hierarchical regressions were conducted (for ratio and latency score at each age for each type of global ER). These regressions were constructed similarly to those examining situational flexibility. Step 1 comprised two covariates (child gender and temperamental negative affectivity) and the total amount of expressed negative emotion. Step 2 comprised strategy variety and either momentary *ratio* or momentary *latency* flexibility scores.

As previously detailed, momentary *ratio* scores represent the frequency with which children made contingent switches and non-switches. On the other hand, momentary *latency* scores compare the average latency of strategy switches when one was effective to latency when one was ineffective. As such, a *higher* latency score indicated greater momentary flexibility because a child was slower to switch from an effective strategy than an ineffective strategy. Tables 11 and 12 summarize regression results for momentary ratio scores; Tables 13 and 14 summarize regression results for momentary latency scores.

Momentary ratio flexibility. Contrary to hypothesis, at age 36 months, momentary ratio did *not* account for significant variation in the number of tasks in which children were calm and on-task. As expected, however, strategy variety was also a non-significant predictor. A control variable, total amount of expressed negative emotion accounted for marginal variance, suggesting that children who expressed more negative emotion were marginally less often judged to be calm and on-task, $\beta = -.18$, $t = -2.12$, $p < .10$. Covariates did not contribute significant variance (see Table 11).

A similar pattern of results was found at age 48 months. No flexibility measure significantly predicted the number of tasks in which children were judged to be calm and on-task. However, children who expressed more negative emotion were less often judged to be calm and on-task, $\beta = -.20$, $t = -2.20$, $p < .05$. Covariates were not significant (see Table 11).

Insert Table 11 here

The findings were somewhat different for predicting the number of tasks in which children were judged negative/off-task or disruptive. One covariate and one control variable accounted for significant variance at age 36 months. Specifically, boys were more likely than girls to be judged as negative/off-task or disruptive, $\beta = -.27$, $t = -2.80$, $p < .001$. Also, higher expressed negative emotion scores predicted being judged as negative/off-task or disruptive more often, $\beta = .42$, $t = 5.30$, $p < .001$. In addition, 36-month ratio momentary scores predicted significant variance, $F(2,114)_{change} = 6.15$, $p < .001$, over and above the effects of gender and expressed negative emotion. Contrary to expectations, higher 36-month ratio scores predicted that children were judged as negative/off-task or disruptive in *more* tasks, $\beta = .24$, $t = 2.98$, $p < .01$. Child temperamental negative affectivity and strategy variety variables were not significant (see Table 12).

In contrast, 48-month momentary ratio scores did *not* predict variance in the number of tasks in which children were rated as negative/off-task or disruptive (see Table 12). Indeed, only the total amount of expressed negative emotion variable was significant such that higher scores predicted being judged as negative and off-task or disruptive in more tasks, β = .40, t = 4.70, p < .001.

Insert Table 12 here

Momentary latency flexibility. As hypothesized, both 36- and 48-month momentary latency scores accounted for significant variation in the number of tasks in which children were rated as calm and on-task. Specifically, children with higher momentary latency scores at age 36 months, β = .24, t = 2.41, p < .05, and 48 months, β = .44, t = 5.17, p < .001, were more often judged as calm and on-task. That is, children who were slower to switch from an effective versus ineffective strategy were also more often judged as calm and on-task in an anger-eliciting task. Moreover, momentary latency scores were the only significant predictors at each age; no covariates or control variables accounted for significant variance.

Hypotheses regarding relations between momentary latency and the number of tasks in which a child was judged to be negative and off-task or disruptive scores were also supported. At age 36 months, boys were more often judged as negative/off-task or disruptive than girls, β = -.29, t = -3.98, p < .001, and more expressed negative emotion predicted being more often judged as negative/off-task or disruptive, β = .47, t = 6.07, p < .001. Furthermore, 36-month momentary latency predicted additional variance, $F(2,114)_{change}$ = 3.41, p < .001. That is, a longer latency to switch during an effective versus ineffective strategy (i.e., higher momentary latency scores) predicted that children were judged as negative/off-task or disruptive less often, β = -.15, t = -1.96, p < .05, over and above the effects of child gender or total amount of negative emotion. Strategy variety and temperamental negative affectivity did contribute significant variance (see Table 13).

Insert Table 13 here

Similarly, at 48 months of age, higher expressed negative emotion predicted being judged as negative and off-task or disruptive more often, $\beta = .32$, $t = 3.78$, $p < .001$. Moreover, 48-month latency accounted for additional variance, $F(52,114)_{change} = 4.49$, $p < .01$. That is, children who were slower to switch when a strategy was effective than ineffective were judged as negative/off-task or disruptive less often, $\beta = -.25$, $t = -2.86$, $p < .01$, over and above the effects of expressed negative emotion.

Insert Table 14 here

In sum, hierarchical regressions revealed that one measure of momentary strategy flexibility, latency-to-switch, systematically predicted variation in the number of tasks in which children were calm/on-task and negative/off-task or disruptive. Higher latency scores predicted higher calm/on-task scores and lower negative/off-task, disruptive scores at both ages, over and above a control variable (total amount of expressed negative emotion) and covariates. This pattern of results suggested that a longer latency to switch strategies when one effective rather than ineffective, that is, higher latency-to-switch is indicative of skill at ER. However, contrary to hypothesis, a second measure of momentary flexibility, ratio-of-switches, did not systematically predict variation in children's GER scores.

Combining situational and momentary flexibility to predict children's quality of ER. Because both situational and momentary flexibility predicted the number of tasks in which children were judged as calm/on-task and negative/off-task or disruptive, a follow-up analysis investigated whether each measure predicted *unique* variance in GER scores. Four hierarchical regressions (one for each age—36 and 48 months—and for each type of global ER quality—calm/on-task and negative/off-task, disruptive) were conducted. Step 1 comprised two covariates (child gender and temperamental negative affectivity) and the total amount of expressed negative emotion. Step 2 comprised strategy variety, situational flexibility, and momentary latency flexibility scores.

In regard to calm and on-task scores, results suggested that situational and momentary latency scores predicted unique variance only at age 48 months. In addition, there was a finding for strategy variety at age 36 months. Specifically, at age 36 months, higher strategy variety scores predicted being judged as calm and on-task less often, β = -.18, t = 2.13, p < .05. In contrast, higher situational flexibility scores predicted being judged as calm and on-task *more* often, β = .38, t = 4.06, p < .001. In terms of momentary latency, at 36 months latency scores did not account for significant variance and no control variable or covariate did (see Table 15 for summary of regression statistics). However, at age 48 months, *both* situational and momentary latency scores predicted variance in the number of tasks in which children were judged to be calm and on-task. Specifically, higher scores in *both* situational flexibility, β = .27, t = 3.05, p < .01, and momentary latency, β = .31, t = 3.31, p < .001, predicted being judged as calm and on-task in more tasks. Strategy variety, the total amount of expressed negative emotion, and covariates did not predict significant variance (see Table 15).

Insert Table 15 here

The results differed somewhat for the number of tasks in which children were judged to be negative/off task or disruptive. At age 36 months, a covariate and control variable were significant predictors. That is, boys were more likely than girls to be judged as negative and off-task or disruptive, β =.-.29, t = -4.04, p <.001; higher expressed negative emotion scores were also significant, β = .48, t = 6.22, p < .001. In addition, 36-month strategy variety and situational flexibility accounted for unique variance, $F(3,113)_{change}$ = 4.28, p < .01. Specifically, over and above the effects of gender and expressed negative emotion, higher strategy variety scores predicted being judged as negative/off-task or disruptive in *more* tasks, $\beta = .18$, $t = 2.30$, $p < .05$, whereas higher situational flexibility scores predicted being judged as negative/off-task or disruptive in *fewer* tasks, $\beta = -.19$, $t = -2.40$, $p < .05$. At age 48 months, a higher amount of expressed negative emotion again predicted being judged as negative/off-task or disruptive in more tasks, $\beta = .32$, $t = 3.82$, $p < .001$. However, higher situational flexibility scores predicted being judged as negative/off-task or disruptive in *fewer* tasks, $\beta = -.24$, $t = -2.63$, $p < .01$, over and above the effects of expressed negative emotion, $F(3,113)_{change} = 5.80$, $p < .001$. No other covariate or flexibility measure contributed significant variance (see Table 16 for summary of regression statistics).

Insert Table 16 here

Longitudinal relations between strategy flexibility and children's overall ER quality. Results thus far indicate that age 36 and 48 month strategy flexibility measures converge with concurrent measures of children's overall ER quality. However, does early strategy flexibility predict later ER quality? We hypothesized that earlier (36 month) situational and momentary strategy flexibility, but not strategy variety, will predict later (48 month) global emotion regulation, over and above the amount of negative emotion expressed at age 48 months. Six regressions (three strategy flexibility variables at age 36 months as predictors of 48 month global ER) were conducted.

Separate regressions were used in order to conserve statistical power and to understand the influence of each novel strategy flexibility measure on global ER quality. Step 1 comprised two covariates (gender and temperamental negative affectivity). Step 2 comprised strategy variety and one of the three novel strategy flexibility variables—situational flexibility, momentary ratio, or momentary latency scores—at age 36 months. Table 17 summarizes regression results for calm and on-task variables and Table 18 summarizes results for negative/off-task, disruptive data.

Contrary to prediction, 36-month strategy flexibility scores did not account for significant variance in the number of tasks in which children were calm and on-task at age 48 months. The only significant predictor was the total amount of expressed negative emotion. Specifically, in each regression model, a *higher* amount of expressed negative emotion predicted that children were judged as calm and on-task during fewer of the anger-eliciting situations (see Table 17).

Insert Table 17 here

The hypothesis that age 36-month strategy flexibility scores would account for significant variation in the number of tasks in which children were later judged as negative/off-task or disruptive was, however, supported. Again, children who expressed more negative emotion were judged as being negative/off-task or disruptive in more tasks (see Table 18 for a summary of regression statistics). Furthermore, all three 36-month strategy flexibility variables accounted for significant variance in 48-month negative/off-task or disruptive GER scores, over and above 48-month expressed negative emotion (Table 18). Specifically, lower situational flexibility scores, $\beta = -.22$, $t = -2.56$, $p < .05$, *higher* momentary ratio scores, $\beta = .20$, $t = -2.36$, $p < .05$, and lower momentary latency scores, $\beta = -.23$, $t = -2.70$, $p < .05$, prospectively predicted higher scores negative/off-task or disruptive scores. That is, children who (a) used fewer task-appropriate strategies, or (b) made more frequent contingent switches and non-switches, or (c) were slower to switch strategies when one was ineffective versus effective at age 36 months were more often judged as negative and off-task at age 48 months. Covariates, strategy variety and temperamental negative affectivity were not significant (see Table 18). In sum, the added value of strategy flexibility measures in predicting children's later skill at ER was supported, at least in the context of identifying children who had difficulty regulating anger.

Insert Table 18 here

Hypothesis 2a. *Situational strategy flexibility (i.e., using different ER strategies as a function of task), but not strategy variety, at ages 36 and 48 months will predict child socio-emotional adjustment at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.*

Two hierarchical regressions (one for age 36 months, one for 48 months) predicting children's socio-emotional adjustment tested the variance accounted for by situational flexibility and strategy variety. In each regression, Step 1 comprised two covariates (child gender and level of temperamental negative affectivity) and the total amount of negative emotion. Step 2 comprised strategy variety and strategy flexibility scores. The dependent variable for each was the socio-emotional composite score from the standardized raw scores of the CBCL and SSRS.

The two covariates – child gender and temperamental negative affectivity – were the only significant predictors of child socio-emotional composite scores at either age (see Table 19 for summary of regression statistics). Specifically, girls were described as more socio-emotionally adjusted by their parents than boys; higher levels of temperamental negative emotionality predicted lower levels of socio-emotional adjustment at both ages. Contrary to prediction, neither total amount of negative emotion expressed nor strategy flexibility variable (strategy variety and situational flexibility variables) contributed significant variance.

Insert Table 19 here

Hypothesis 2b. *Both momentary strategy flexibility variables (i.e., ratio and latency scores) , but not strategy variety, at ages 36 and 48 months will predict child socio-emotional* *adjustment at 36 and 48 months of age respectively, over and above the amount of negative emotion expressed by the child.*

Four hierarchical regressions were conducted (for ratio and latency score at each age). Momentary *ratio* scores represent the frequency with which children made contingent switches and non-switches; momentary *latency* scores compare the average latency of strategy switches when one was effective to latency when one was ineffective. Thus, higher latency score indicated greater momentary flexibility because a child was slower to switch from an effective strategy than an ineffective strategy.

The four regressions were constructed similarly to those examining situational flexibility. Step 1 comprised two covariates (child gender and temperamental negative affectivity) and the total amount of expressed negative emotion. Step 2 comprised strategy variety and either momentary *ratio* or momentary *latency* flexibility scores. The dependent variable for each was the socio-emotional composite score from the standardized raw scores of the CBCL and SSRS. Table 20 summarizes the regression statistics for ratio-of-switches and Table 21 summarizes regression statistics for latency-to-switch.

Momentary ratio flexibility and child socio-emotional competence. Momentary ratio scores did not predict variation in child socio-emotional composite scores at ages 36 or 48 months. As was true for situational flexibility, only the two covariates – child gender and temperamental negative affectivity – significantly predicted children's socio-emotional scores at either age (see Table 20). Specifically, at both ages, girls were described as more socio-emotionally adjusted by their parents than boys. In addition, higher levels of temperamental negative emotionality predicted lower levels of socio-emotional adjustment at ages 36 and 48 months. Contrary to prediction, neither total amount of negative emotion expressed nor strategy flexibility variables (strategy variety and momentary ratio scores) contributed significant variance.

Insert Table 20 here

Momentary latency flexibility and child socio-emotional competence. A similar pattern was observed regarding momentary latency scores at ages 36 and 48 months. Contrary to prediction, neither total amount of negative emotion expressed nor strategy flexibility variables (strategy variety or momentary latency scores) predicted variation in children's socio-emotional competence at both ages. Instead, only the two covariates – child gender and temperamental negative affectivity – significantly predicted children's socio-emotional scores at either age (see Table 21). That is, at both 36 and 48 months of age, girls were described as more socio-emotionally adjusted by their parents than boys and children with lower levels of temperamental negative emotionality predicted higher levels of socio-emotional adjustment.

Insert Table 21 here

It was surprising that strategy flexibility scores predicted independent ratings of children's overall ER quality but not parental report of children's socio-emotional competence, particularly because of evidence linking ER to social skills and emotional development in early childhood (cite Eisenberg, Denham others). However, examination of the components of the socio-emotional composite—children's raw CBCL and SSRS scores—suggested that these scores lacked sufficient variability (see Table 22 for *Ms*, *SDs*, *minimums* and *maximums* of child socio-emotional competence variables). To verify this impression, we examined the distribution of children's CBCL and SSRS scores. The low variability in children's CBCL scores was highlighted by the lack of clinical variability in parental report of children's behavior problem. Specifically, the average T-scores for child behavior problem symptoms ranged from the mid-to-high 40’s, well below the clinical cut-off of 70. Moreover, at age 36 month, less than 4.5% of children were described as exhibiting clinically-significant behavior problem symptoms and this percentage drops to 2% by age 5 years. There was relatively more variability in children’s SSRS scores. Nonetheless, a large percentage of the sample (50-55% of cases) had scores that were within ±1 SD of the sample mean at each age point, suggesting that there was not a meaningful distribution of scores that differentiated children with low social skill scores.

Insert Table 22 here

Furthermore, bivariate correlations between children’s scores on socio-emotional adjustment and strategy flexibility variables revealed few relations (Table 23). This may have been due, at least in part, to the restricted range of the child socio-emotional adjustment scores (see Table 22). As seen in Table 23, only four of 56 possible correlations were significant. Moreover, most (3 of 4) of these correlations were in unexpected directions. Only one correlation was significant in the expected direction; age 36-month momentary latency scores were positively associated with higher 36-month mother-reported social responsibility.

Insert Table 23 here

Nonetheless, parental reports of child behavior problems were modestly associated with observer ratings of global ER quality (see Table 24). Specifically, higher CBCL scores were positively associated with the number of tasks in which children were rated as negative/off-task, disruptive and inversely associated with the number of tasks in which children were rated as well regulated. These results further support the validity of strategy flexibility measures. There may not have been sufficient variability in parental report measures to adequately test strategy flexibility but bivariate correlations nevertheless suggest that observer ratings of global ER quality were systematically related to parental reports of behavior problems.

Insert Table 24 here

Hypothesis 3. *Cognitive flexibility at age 48 months, but not at age 36 months, will concurrently predict child strategy flexibility. Specifically, less perseveration (shorter run of perseverative errors) will predict higher situational and momentary strategy (latency to switch) flexibility scores, above and beyond the influence of child IQ, at age 48 months but not 36 months.*

Four regressions (one for each age and strategy flexibility measure) tested the hypothesis that cognitive flexibility—defined as less perseveration—was a correlate of situational and momentary latency flexibility. Regressions were constructed identically at each age. Specifically, Step 1 comprised the control variable, WPPSI Full Scale IQ, and Step 2 the cognitive flexibility variable, longest run of perseverative errors.

Situational flexibility. As expected, 36 month longest run of perseverative errors did not account for significant variation in 36-month situational flexibility scores (see Table 25). Higher 36-month IQ predicted higher situational flexibility scores, $\beta = .27$, $t = 2.89$, $p < .05$. In terms of 48-month situational flexibility, neither longest run of perseverative errors or child IQ were significant models. Indeed the overall model was not significant (see Table 25).

Momentary latency flexibility. Hypothesis regarding relations between perseverative error and strategy flexibility scores at age 48 months were not supported. Neither child IQ nor longest run of perseverative errors accounted for significant variation in 48-month situational flexibility scores. This was also true for the model predicting 48-month momentary latency flexibility scores. Table 25 summarizes the regression statistics for models predicting flexibility variables from child IQ and longest run of perseverative errors.

Insert Table 25 here

We utilized a measure of cognitive inflexibility rather than flexible set-shifting. We therefore examined whether children's successful completion of set-shifting tasks predicted strategy flexibility. Results were no different from regression models using perseverative errors as a predictor. Moreover, measures of success (i.e., % correct, longest run of correct responses) were highly correlated with perseverative errors in the expected direction. It was therefore unsurprising that there were few bivariate relations between children's correct responses and strategy flexibility measures at either age (see Table 26).

Summary. Two of the three novel strategy flexibility measures, specifically, situational and momentary latency (to switch from an effective versus ineffective strategy), systematically predicted the number of tasks in which children were calm/on-task and negative/off-task or disruptive. This was true at both ages 36 and 48 months. Moreover, the effects of situational and latency flexibility were apparent even after controlling for the total amount of negative emotion expressed, child gender, and temperamental negative emotionality. In addition, at age 48 months situational and momentary latency flexibility accounted for unique variance in the number of tasks in which children were judged as calm and on-task during anger-eliciting situations. Finally, both higher situational and momentary latency scores at age 36 months predicted that children were less likely to be judged as negative and off-task or disruptive at a later age.

It was surprising that momentary ratio flexibility was not systematically predictive of children's overall quality of ER. Moreover, it was unexpected that higher 36-month ratio scores would predict being judged as negative and off-task or disruptive during more of the 36-month anger-eliciting tasks. Finally, higher momentary ratio scores at age 36 months predicted that children were more likely to be judged as negative/off-task or disruptive at a later age. The implications of these unexpected results are reviewed in the discussion.

It was also noteworthy that a typical measure of flexible ER, strategy variety, was generally not predictive of variation in the number of tasks in which children were rated as calm/on-task or negative/off-task or disruptive. Moreover, when significant, strategy variety predicted of being judged as calm and on-task less often; strategy variety was a significant predictor only in the presence of strategy variety.

Finally, contrary to hypothesis, the longest run of perseverative errors was not concurrently predictive of either situational or momentary latency flexibility at age 48 months. Perseverative errors were also not predictive of latency flexibility at age 36 months; however, contrary to expectations, higher perseveration predicted lower 36-month situational flexibility. It appears that cognitive flexibility, at least as defined as perseverative errors, was unrelated to strategy flexibility in this sample.

DISCUSSION

The primary aim of the present study was to test the validity of newly-developed masures for studying the flexibility of young children's strategy use. Three strategy flexibility measures, capturing two forms of strategy flexibility, were investigated. Situational flexibility captured a child's ability to use different strategies when tasks demands differed whereas momentary flexibility captured the degree to which a child was able to switch strategies when a strategy was ineffective but sustain one when it was effective strategy. Momentary flexibility was assessed in terms of the (a) frequency of contingent switches and non-switches (i.e., ratio-of-switches) and (b) latency to a contingent switch or non-switch (latency-to-switch). All new strategy flexibility measures were compared to a more typical measure of flexible ER, strategy variety or the number of different strategies a child used.

Taken together, results yielded support for the new measures, although with some qualifications. First, children who were better able to match their ER strategies to task objectives (i.e., situational flexibility) showed greater skill at ER as predicted. Second, also as predicted, children who were able to sustain an effective strategy and quickly switch to another strategy when one was ineffective (i.e., momentary latency-to-switch flexibility) showed greater skill at ER. However, the third index of flexibility, momentary ratio-of-switches was not supported. In terms of the prospective prediction, strategy flexibility at age 36 months predicted children's ability to remain calm and focused on task objectives at ages 48 months. Finally, contrary to prediction, cognitive flexibility did not predict strategy flexibility at age 48 months.

Situational strategy flexibility

The findings are the first to document a commonly-held belief that being able to use strategies that are well-suited to the context of a situation reflects skill at emotion regulation in early childhood (Cole & Hall, 2008). The evidence supporting this view is that situational flexibility accounted for skill at ER, over and above a more typical index of flexibility -- the number of different strategies used (i.e., strategy variety) or the total amount of expressed negative emotion. There is growing interest in the context-appropriateness of children's emotion regulation, including research suggesting that emotions and strategies in certain contexts are indicative of dysregulated emotion (e.g., Buss et al., 2004) and psychiatric disorder (e.g., Rottenberg et al., 2005).

Consistent with evidence from research on coping flexibility (e.g., Cheng, 2001), the ability to vary strategies according to situational context appears to be important for children's skill at ER. The present study added to evidence from the coping literature revealing the importance of goodness-of-fit between a child's coping strategy and situational characteristics (e.g., Compas, Malcarne, & Fondacaro, 1988; Rudolph, Dennig, & Wesiz, 1995) by (a) providing an observational method for assessing young children's strategy flexibility and (b) showing its importance in the related context of early childhood *emotion regulation*.

Moreover, the present findings revealed that children as young as age 36 months had the ability to vary their strategies according to situational characteristics. Babb and colleagues (2009) reported that children under age 7 years did *not* vary their strategies across situations. The difference in findings is likely due to methodological differences, particularly in how the two studies quantified strategy flexibility. In line with coping literature, Babb and colleagues focused on one aspect of context -- the controllability of a situation -- and relied on child self report. It may be that an observational approach revealed more about younger children's abilities than a self-report approach. Possibly, younger children have more difficulty perceiving and/or reporting on the controllability of different situations, which would then influence their ability to select situation specific strategies. The present study demonstrated, however, that children as young as 36 months of age could flexibly vary their strategies as a function of task-objectives. That is, young children were observed to use distraction in the situation where they were instructed to “wait” for the blocked goal (i.e., prohibited “surprise”) but to remain focused on the on the blocked goal (i.e., locked box) in the situation in which they were instructed to “work on” opening the transparent box. Moreover, the ability to vary strategy use at 36 months not only predicted children’s concurrent skill at ER but also predicted their skill at ER one year later.

In sum, observing emotion across contexts has been regarded as an important advance in understanding children’s emotion regulation (e.g., Buss et al., 2004; Cole, 1986; Cole et al., 2004). The present study adds to this perspective by showing that young children’s ability to vary ER strategies across context is an important dimension of how well they are able to regulate emotion in situations designed to elicit anger.

Momentary strategy flexibility

Another way to conceptualize strategy flexibility is as the ability to switch strategies during a task. Although the ability to flexibly switch strategies across situations has been examined, particularly within the coping literature, few studies have investigated this aspect of flexibility. This measure necessitated a somewhat complex approach that yielded some support for it as an index of strategy flexibility. Imagine that a child who is struggling to open the transparent box to get a desired toy is becoming more and more frustrated. The child momentarily shifts attention away from the box, looking away at the posters in the room, before returning to trying to open the box. That is, persistent focus on the blocked goal (i.e., transparent box) may have contributed to increasing frustration, but a moment’s distraction helped the child regain calm, goal-oriented effort to open the box. This example (Cole, 2008) highlights the importance of another aspect of strategy flexibility, the ability to flexibly switch strategies *within* a situation. To our knowledge, the present study is the first to have developed measures for examining a child's ability to switch strategies in a single task, in response to external (e.g., adult directives).

Studies of action monitoring have revealed the importance of responding to momentary feedback in accomplishing cognitive tasks and have even linked action monitoring individual differences stress regulation among adults (e.g., Compton, Robinson, Ode, Quandt, Fineman, et al., 2008). Momentary flexibility is likely similar to action monitoring in that it necessitates the ability to respond to internal emotional cues regarding the effectiveness of one's immediate strategy. To our knowledge, the present findings are the first to investigate how moment-to-moment changes in young children's putative regulatory strategies may reflect flexibility of on-line emotion regulation efforts.

Two indices of this momentary flexibility were developed and used to predict children's skill at ER. Both momentary flexibility measures were designed to assess children's ability to contingently change ER strategies. That is, they took into account the ability to switch to another strategy when one is ineffective. It was surprising that only one of these two indices predicted independent ratings of child skill at ER. The first measure, the ratio-of-switches, assessed the *frequency* with which children made *contingent* switches and non-switches. The second was a latency variable that assessed how *quickly* children were able to make contingent switches as compared to non-contingent switches. Evidence indicated that at both 36 and 48 months of age, children who quickly switched strategies in a contingent manner were rated as exhibiting an overall higher quality of ER across more anger-eliciting tasks than children who were slower to switch. On the other hand, momentary ratio scores were either unassociated with regulatory skill or predictive of lower quality ER. In all, results from investigations of momentary flexibility measures suggest that latency, and not ratio, flexibility is a valid measure of one aspect of skill at ER -- flexible strategy use.

It is difficult to differentiate "effective" and "ineffective" (Calkins, 2010; Cole et al., 2004). For example, a strategy may be effective because it increases a negative emotion ("psyches" a person to continue despite a blocked goal) although research more often regards a strategy as effective if it reduces negative emotion (Campos et al., 1989; Izard, 2009). However, given evidence that heightened negative emotion interferes with children's appropriate behavior and is associated with poorer ratings by adults of child competencies (Calkins & Johnson, 2008; for a review, see Eisenberg et al., 2010; Cole & Hall, 2008), the present study used changes in negative emotion as one indicator of strategy effectiveness. In support of this approach, follow-up analyses that distinguished mild and moderate/high intensity displays of negative emotion yielded similar findings.

Evidence garnered from tests of momentary latency flexibility is consistent with the view that flexibility is a *dynamic* process, entailing moment-to-moment adjustments in behavior (Davidson, 1998; Gross & Thompson, 2007; Kashdan & Rottenberg, 2010). As illustrated in a previous example, it is sometimes effective to switch away from a task-appropriate strategy. Nonetheless, it could also be problematic if the child never switched back to the strategy that was effective for meeting task objectives. In short, a dynamic measure reflecting how quickly a strategy switched occurred in relation to its momentary effectiveness may be a more sensitive measure of momentary flexibility than a static measure of whether or not a switch occurred. It seems logical, then, that in comparison to momentary ratio scores, *latency* scores was predictive of children's skill at ER because the operational definition of momentary latency flexibility emphasizes the dynamics of children's strategy switches.

Finally, by capturing a child's ability to quickly switch when strategies are effective and ineffective, the impact of behavioral variability (i.e., non-contingent switches) on flexibility scores is minimized. Thus, momentary ratio flexibility may have been more indicative of behavioral variability than flexible switches in strategy. This may have been particularly true at age 36 months when children appeared to engage in more contingent and non-contingent switches than at age 48 months, $F(1,119) = 5.71$ $p < .05$. Post-hoc analysis supports this interpretation of momentary ratio flexibility. Specifically, ratio scores were positively correlated with both contingent ($r = .81$ at age 36 months and $r = .77$ at age 48 months) and non-contingent ($r = .83$ at age 36 months and $r = .61$ at age 48 months) switches. However, given evidence that momentary ratio scores decline between the ages 36 and 48 months, the implications of high ratio scores among older age groups or in different situational contexts (e.g., situations that necessitate sustained attentional focus) require further investigation.

Furthermore, the validity of the novel momentary latency measure in predicting both concurrent and later skill at ER is consistent with Trull and colleagues' (Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009; Solhan, Trull, Seungmin, & Wood, 2009) supposition that micro-level studies of behavioral dynamics provide critical information about a person's emotional functioning. More specifically, information about the dynamics of a person's behavior seems critical for future studies that necessitate disentangling behavioral variability (e.g., emotional lability, behavioral dysregulation, non-contingent switches) from flexible behavior.

Situational and momentary flexibility: Related but distinct

On the one hand, situational and momentary flexibility were conceptualized as distinct aspects of flexible ER. Yet each was regarded as a dimension of overall skill at ER and therefore it might be expected that they would be related. The evidence indicated that they are indeed associated. First, situational flexibility was related to both momentary latency and ratio scores, albeit in opposite directions. Consistent with the view that quickly switching when a strategy is not working is an aspect of skill at ER, momentary latency and situational flexibility scores were positively correlated (r = .42, p < .001 at age 36 months and r = .46, p <.001) at age 48 months. This modest association suggested that the two strategy flexibility measures are related but distinct indices of skill at ER. Indeed, when examined simultaneously each contributed uniquely to accounting for the general quality of children's ER. Furthermore, although higher scores in each measure predicted independent ratings of how well children regulated emotion, it was possible that children could have differed in the degree to which they were flexible within and across situations. The implications of being relatively flexible within situations but inflexible across situations could be an important future research area. For example, children who have difficulty sustaining task-appropriate strategies may nevertheless show high momentary latency flexibility because they quickly switch strategies when one is ineffective. It is possible that these children may show lower situational flexibility and therefore show greater regulatory difficulties over time.

Relations between situational and momentary flexibility also have implications for the debate in personality research regarding behavioral consistency and inconsistency across situations (Mischel, 2004). Specifically, an expectation for behavior consistency across situations would suggest that individual differences such as personality traits are detectable regardless of situation; however, this view ignores or minimizes that influence that situations have on behavior. Flexibility integrates the views regarding behavioral consistency and inconsistency across situations, allowing us to understand how situation-specific behaviors may actually reflect a consistent characteristic such as egg-resiliency or skill at ER (Block, 2002).

In addition, there is a push for multi-method measurement in studies of ER (Calkins & Bell, 2010). Advances in our understanding of ER necessitate that researchers heed this call. As such, greater consideration of the implications of observed behavioral variability across contexts *and* within a given situational context is needed. As highlighted by the present findings, both the ability to show a high frequency of one type of ER strategy and to switch between different ER strategies is important for emotional competence. Thus, further study of methods for validly measuring flexibility is needed, particularly with regards to different situational characteristics and different developmental periods.

Strategy variety

Situational flexibility and certain aspects of momentary flexibility appear to be indicative of better skill at ER. In contrast, there is little evidence supporting assertions that children who use a lot of different ER strategies in a given situation are more skilled at anger regulation. Although coping studies have typically used strategy variety as an index of flexible ER, recent studies have noted that the evidence linking high variety to better ER is mixed (e.g., Coplan & Hess, 1995; Donaldson, Prinstein, Danovsky, & Spirito, 2000; Tolan et al., 2002). Indeed, results from the present study revealed that high variety is predictive of lower quality ER. Perhaps children attempt a high number of ER strategies in a given situation because they have difficulty sustaining strategies that are task-appropriate and/or effective for reducing negative emotion. Or perhaps children attempt a number of different strategies because they are unable to make flexible, that is, contingent switches based on feedback about strategy effectiveness. Regardless, strategy variety appears to be a measure of ER difficulty rather than skill at ER.

It was somewhat surprising; however, that strategy variety was predictive of independent ratings of ER quality at age 36 but not 48 months. Developmental studies of children's self-regulation have noted significant improvements in children's ability to regulate behavior during this developmental period (Cole et al., 2011 Vaughn et al., 1984). As such, strategy variety may be predictive of poorer ER only at age 36 months because children are still developing effective strategy use. In other words, there may be more variability in children's strategy use at age 36 months, and that variability could be indicative of children's attempts to "find" an effective strategy rather than flexible strategy use. This interpretation is consistent with the finding that between ages 36 and 48 months, children declined in (a) the number of tasks in which they were judged as negative/disruptive and (b) the frequency with which they engaged in contingent and non-contingent switches.

It is also important to note that the findings regarding strategy variety do not necessarily denote that a wide-ranging repertoire of *available* strategies is not important for ER. That is, the availability of a large number of ER strategies from which a person could choose may be important for skill at ER, as long as a person is not exhaustively using many strategies because he or she is having difficulty using any one strategy effectively.

Age Considerations

There were surprisingly few age differences in this study of young children over one year. In terms of strategy flexibility, the only age difference revealed that 48-month-olds had lower momentary ratio scores than 36-month-olds, suggesting that with age, young children decrease in the frequency with which they switch strategies. Results suggested that ratio-of-switches was not an index of strategy flexibility but was associated with the behavioral variability (i.e., frequent changes in regulatory strategies). As suggested by results revealing that momentary ratio flexibility is predictive of lower global ER quality, the decline in the frequency of children's strategy switches may be related to improved skill at ER between ages 36 and 48 months. This suggestion is consistent with evidence demonstrating age-related improvements in children's regulatory ability during this developmental period (e.g., Cole et al., 2008; Gilliom et al., 2002). Combined with findings from the present study revealing that higher strategy variety is predictive of lower global ER quality, evidence of age-related decreases in momentary ratio scores suggests that young children's ability to skillfully regulate emotion may improve, at least in part, because of decreases in non-contingent switches and increases in contingent strategy switches.

Closer examination of the second index of momentary flexibility, latency, suggested that there may have also been age-related changes in children's momentary latency flexibility. As detailed earlier, momentary latency is comprised of two variables: (1) latency to switch from an effective strategy and (2) latency to switch from an ineffective strategy. At age 36 months, the average latency to switch from an effective strategy was positively associated higher quality regulation (r = .28, p<.01) and inversely related with problematic or lower quality, ER (r = -.27, p<.001). That is, 36-month-olds who were slow to switch strategies when one is effective (i.e., sustain effective strategies) in the wait task also demonstrated better overall ER across a series of anger-eliciting tasks. Latency to switch from *ineffective* strategies was not associated with independent ratings of children's skill at ER at age 36 months. Thus, the difference in patterns of relations between children's global ER quality and how quickly they were able to switch ER strategy may suggest that improved ER is associated with improved capacity to switch strategies when one is not effective. This inference, however, needs validation. Specifically, future work should investigate if children do indeed become more capable of making contingent strategy switches over time.

At age 48 months, both types of latency measures were associated with global ER ratings. Latency to switch strategies when one is effective was again positively associated with calm/on-task scores and inversely associated with negative/off-task, disruptive scores. Latency to switch when a strategy is *ineffective* was, however, associated with variation in the number of tasks in which children were judged to be well-regulated at age 48 months. Findings suggest that the ability to sustain an effective strategy is an important part of flexible strategy in younger children; however, by 48 months, young children's ability to switch strategies in response to cues that a strategy is ineffective contributes to skill at ER.

An age-related improvement in children's ability to switch away from ineffective strategies could also be related to demonstrated improvements in children's cognitive abilities, particularly in their executive functions (e.g., Calkins & Bell, 2010; Carlson, 2003). In addition, research on the development of children's emotional competence has noted that children's emotion understanding increases throughout the school-aged years (Denham, Blair, DeMulder, Levitas, Sawyer, & Auerbach et al., 2003: Saarni, 1999). Studies have shown that children's ability to discern the demands of particular situations or problems increases with age (e.g., Babb et al., 2009; Brown, 1996), likely in concert with the burgeoning maturation of the prefrontal cortex (e.g., Blair & Diamond, 2008; Casey, Giedd, & Thomas, 2000). It would be interesting for future studies to explore whether advances in verbal ability enhance children's emotion understanding and, in turn, ability to switch strategies when one is ineffective.

Finally, results from repeated measures MANOVA revealed that children are less likely to be judged as disruptive at age 48 than 36 months. Consistent with evidence that children decrease in their rates of strategy switches and become better able to switch strategies when a strategy is ineffective, it therefore appears that momentary flexibility may be an important factor in children's ability to *sustain* ER in order to minimize disruptive behaviors during anger-eliciting tasks.

Relations between Cognitive and Strategy Flexibility

The hypothesis that cognitive flexibility at age 48 months was a correlate of strategy flexibility was not supported. There was also no evidence that cognitive flexibility predicted variation in situational or momentary latency flexibility at age 36 months.

The inherent difficulties in defining, and measuring, a multi-dimensional capacity that is also developing through late adolescence complicates our ability to understand relations between cognitive flexibility and the flexible use of ER strategies. As such, it is premature to rule out cognitive flexibility as a correlate of strategy flexibility. Because many of the children in this sample struggled to pass the set-shifting tasks, the present study may not provide an adequate test of relations between cognitive and strategy flexibility. Specifically, at age 36 months, 73% of the sample gave incorrect responses on half of the Delayed Alternation trials, suggesting that they performed at or below chance. In addition, at age 48 months, only 40% of the sample passed the DCCS, defined as giving correct responses on 4 out 6 trials (Zelazo, 2006). It is important to note that set-shifting ability is one a later-developing executive function and children younger than age 4 years often show difficulty on these types of tasks (e.g., Carlson, 2005; Garon et al., 2008). Moreover, many developmental studies of executive function have generally focused on middleclass families; thus, the developmental timing of set-shifting in children from this economically-strained sample may differ from other studies.

Nevertheless, the nature of the relationship between cognitive flexibility and perseveration should not be assumed and may shed light on individual differences among different strategy flexibility measures. For instance, because perseverative errors also reflects an inability to update based on external cues, cognitive inflexibility may be indicative of low momentary strategy flexibility. These types of answers may be best answered by studying children at later ages, when the executive attention network shows greater maturity and children are more able to flexibly shift response sets (Best & Miller, 2010).

Limitations

The study had originally proposed to validate strategy flexibility measures by examining predictive relations between children's strategy flexibility scores and parental reports of child socio-emotional adjustment. However, there was insufficient variability in parental report measures for testing the validity of strategy flexibility measures. We therefore used ratings of children's global ER quality, conducted by an independent team of coders, to validate strategy flexibility measures. Although situational and momentary latency scores each systematically predicted the global quality of children's ER, there is still concern that shared method variance accounts for the relations, particularly for the measure of situational flexibility. Given that limitation, we still believe that situational and latency momentary scores measure children's flexible ER because (1) different coding teams rated children's emotional expressions and ER strategies at a micro, second-by-second level and the quality of children's ER at a global, task-by-task level, (2) strategy flexibility measures predicted children ER over and above more typical measures of ER, specifically, the total amount of negative emotion, and (3) strategy flexibility measures at age 36 months prospectively predicted individual differences in children's global ER quality at age 48 months.

Moreover, studies have often found low concordance rates between parental reports and observer ratings (e.g., Achenbach, McConaughy, & Howell, 1987; Seifer, Sameroff, Barrett, Krafchuk, 1994). Low concordance rates have been attributed to parental biases and differences in reporters' opportunities to view child behavior. Anecdotal evidence from the study suggests that parents in this sample may have under-reported problematic behavior, believing that these problematic behaviors were relatively normal for young children and that their particular child would "grow out" of it. Thus, it is unsurprising that there was little meaningful variability in parental reports of child behavior problems.

Difficulties inherent in the measurement of ER also have direct bearing on the limitations of the present study. First, our definition of strategy effectiveness assumes that adult standards for child behavior can be used to determine the optimal strategies are for meeting situational demands. Second, there have been cautions regarding the measurement of strategies that occur in the absence of observed emotion. Given advances in ER capacity, children are likely capable of regulating emotion well enough that observers cannot detect its' occurrence (e.g., Bridges et al., 2004). Moreover children likely use anticipatory ER strategies to regulate emotion before it manifests (e.g., Gross, 1998). Hence, for the purposes of this study, ER strategies are assessed in the absence of observed emotion. Third, we only measure the behavioral expressions of emotion and ER strategies. Future projects would benefit from neuro-physiological measures of ER. Including measures of ER from different levels of analyses could also questions regarding the occurrence of regulatory strategies in the absence of observed emotion. Finally, the present study includes only two situations for assessing children's flexible strategy use in different situations.

Future work would benefit from an inclusion of more situational contexts, including situations designed to elicit different emotions or those in which task demands unexpectedly change.

Conclusions

In sum, findings from the present study represent an important first step for studying flexibility as an indicator of children's skill at ER. The study highlights the value of incorporating micro-analytic, dynamic measures of emotional processes as opposed to global, static measures for understanding individual differences in ER. Overall, findings support the convergent validity of two of the flexibility measures—being able to use different strategies in different asks and the quickness with which a child switches from an ineffective strategy—at least in terms of concurrent ratings by independent observers of a child's skill at ER. It is also notable that strategy flexibility measures systematically predicted the global quality of children's ER in comparison to more typical measures such as total quantity of negative emotion and strategy variety. Given the systematic pattern of predictive relations between strategy flexibility and the global quality of children's ER, situational and momentary latency flexibility measures may provide important, additional information on individual differences in young children's skill at ER. We therefore suggest that the strategy flexibility measures used in the present study represent a preliminary method for studying flexible ER in early childhood.

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APPENDIX

Table 1.

Description and Examples of Putative ER Strategies

Purported ER Strategy	Description	Example(s)
Support-seeking (ODD)	Bidding to an adult for assistance in solving the problem	Asking Mom if he or she can open the prize during the Wait task; asking E to return to the room during the Transparent box task
Attentional bids (ODO)	Bidding/chatting to an adult for attention	Talking to Mom about the posters in the room during the Wait task
Transient self-distraction (D1)	Shifting one's attention away from the problem (i.e., transparent box, prohibited surprise, boring toy) in a transient manner	Looking around the room; brief attempts to play with the boring toy
Focused self-distraction (D2)	Shifting one's attention away from the problem (i.e., transparent box, prohibited surprise, boring toy) in a an absorbed, focused manner	Naming objects pictured on the posters in the room; playing with the boring toy; making faces in the mirror
Attempt to Fix (AF) (Transparent box only)	Attempts to open the transparent box as demonstrated by the E	Putting a key into the lock & turning the key
Attempt to Fix – Alternative (AFA) (Transparent box only)	Attempts to open the transparent box in manner not demonstrated by the E	Trying to open the box at the hinges; trying to open the box from the sides
Self-soothing (S)	Gentle rhythmic motions with the body, generally enacted in a soothing manner	Thumb sucking; gently rubbing against Mom's leg
Escaping the problem (L)	Attempts to physically escape the problem or distressing situation	Leaving the room
Verbalization of a strategy (V)	Verbalizing a regulatory strategy for coping with the problem	Stating that he or she wants to leave the room to "get help from friends"

Table 2.

Summary of Strategy Flexibility Variables

Flexibility Measure	Variable
Strategy Variety	Σ (# different strategies in wait) + Σ (# different strategies in transparent box) ∴ flexibility = higher # different strategies *N.B. Because the two tasks differ in length, strategy sums were standardized*
Situational strategy flexibility	Σ (% of self-distraction wait task + % of focused on problem solving in transparent box task) ∴ flexibility = higher % of distract in wait and problem-focus in transparent box
Ratio-of-switches (Momentary Flexibilty)	$\frac{\text{(Total \# Contingent Switches + Non-switches)}}{\text{(Total \# Opportunities to Switch)}}$ ∴ flexibility = higher ratio of contingent switches and non-switches
Latency to-switch (Momentary Flexibilty)	$\frac{\text{Avg. latency to switch |effective current strategy}}{\text{Avg latency to switch |Ineffective current strategy}}$ ∴ flexibility = longer latency to switch from effective strategy than ineffective strategy *N.B. In other words, flexibility = faster switches when one is ineffective versus effective*

Table 3.

Examples of Joint Codes from Global Quality of Emotion Regulation Codes

Joint Code	**Example (from the Wait task)**
Calm/On-task	Child appears emotionally content or neutral and spends most of the Wait task engaged in self-distraction or quickly asking Mom if she is finished with "her work."
Negative/Off-task	Child appears emotionally negative and spends most of the task asking Mom to help him or her open the prize. However, he or she asks Mom in a socially-appropriate manner.
Negative/Disruptive	Child appears emotionally negative and spends most of the task demanding to open the prize. His or her insistence on the opening the prize may escalate into hitting the toy against the table or hitting Mom when she refuses to help him or her opens it.

Table 4.

Minimums, Maximums, Means, and Standard Deviations of Study Variables

Study Variable	Min	Max	Mean	SD
30m Temperamental Negative Affectivity	2.27	4.96	3.57	.53
42m Temperamental Negative Affectivity	2.76	5.48	4.01	.61
36m Amount of Negative Emotion	0	896	117.22	151.28
48m Amount of Negative Emotion	8.00	631	114.55	120.90
36m Strategy Variety *(z)*	-2.06	1.60	.03	.72
48m Strategy Variety*(z)*	-2.05	1.43	.01	.69
36m Situational Flexibility	-2.39	1.16	.01	.69
48m Situational Flexibility	-2.49	1.19	-.02	.71
36m Ratio-of-Switches	.08	.50	.29	.09
48m Ratio-of-Switches	.10	.54	.32	.09
36m Latency-to-Switch	.23	6.37	2.19	1.19
48m Latency-to-Switch	.38	8.20	2.18	1.33
36m Calm/On-task (# of tasks)	.00	4.00	1.28	.99
48m Calm/On-task (# of tasks)	.00	4.00	1.45	1.18
36m Neg/Off-task or disruptive (# of tasks)	.00	4.00	1.06	1.03
48m Neg/Off-task or disruptive (# of tasks)	.00	4.00	.78	1.01
36m Socio-emotional Adj. Composite *(z)*	-2.06	1.69	.01	.76
48m Socio-emotional Adj. Composite*(z)*	-2.78	1.82	.01	.75
5y Socio-emotional Adj. Composite*(z)*	-3.08	1.29	.05	.703
36m full scale IQ	53	135	98.98	15.75
48m full scale IQ	61	138	97.43	13.57
36m Longest Run of Perseverative Errors*(z)*	-1.89	5.65	.02	1.434
48m Longest Run of Perseverative Errors*(z)*	0	5.00	2.43	2.21

Notes. Amount of negative emotion created by summing the weighted intensity of children's negative emotions in the wait task. Socio-emotional adjustment composite comprised of child behavior problem symptoms (CBCL), social responsibility and self-control (SSRS), and emotion regulation ability (ERC, at age 5yr only). At 36m, longest run of perseverative errors created by summing the standardized perseverative error scores from the A-not-B and Delayed Alternation tasks. At age 48m, longest run of perseverative errors obtained from the DCCS. N = 120

Table 5.

Minimums, Maximums, Means, and Standard Deviations of Quality of Global Emotion Regulation Variables

Global Emotion Regulation Variables	Min	Max	Mean	SD
36m Calm/On-task	.00	4.00	1.28	.99
36m Calm/Off-task	.00	3.00	1.07	.96
36m Calm/Disruptive	.00	4.00	.50	.75
36m Negative/On-task	.00	1.00	.086	.28
36m Negative/Off-task	.00	3.00	.41	.63
36m Negative/Disruptive	.00	4.00	.65	.93
48m Calm/On-task	.00	4.00	1.45	1.18
48m Calm/Off-task	.00	3.00	1.11	.98
48m Calm/Disruptive	.00	4.00	.36	.72
48m Negative/On-task	.00	3.00	.28	.58
48m Negative/Off-task	.00	2.00	.38	.63
48m Negative/Disruptive	.00	3.00	.41	.78

Notes. Global emotion regulation variables represent the number tasks (range = 0 - 4 tasks).

N = 120

Table 6.

Intercorrelations between Study Variables

	Study Variables																							
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
1. gender	1																							
2.30mNA	.13	1																						
3. 42mNA	.01	.57***	1																					
4. 36m Amt Neg Emo	.03	.040	-.08	1																				
5. 48m Amt Neg Emo	-.07	-.16*	.03	.15	1																			
6. 36m Variety	.04	.06	.06	.08	.04	1																		
7. 48m Variety	-.02	-.04	-.09	.08	.09	.48**	1																	
8. 36m Sit. Flex	-.01	.06	.08	-.12	-.07	.15*	-.05	1																
9. 48m Sit. Flex	.01	.01	.02	-.14	-.14	.07	.05	.02	1															
10. 36m Latency	-.04	.09	.14	-.33**	.01	.05	-.07	.43**	.07	1														
11. 48m Latency	.02	.05	.04	-.15	-.28**	-.07	-.17*	.10	.47**	.10	1													
12. 36m Ratio	-.04	.01	.04	.43**	.23**	-.02	.16*	-.31**	-.05	-.49**	-.28**	1												
13. 48m Ratio	-.13	.01	-.02	-.03	.26**	-.04	-.06	-.04	-.07	-.04	-.34**	.22**	1											

Notes. N = 120. ***p<.001, **p<.01, *p<.05, †p<.10

Table 6 continued.

Intercorrelations between Study Variables

	Study Variables																							
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
14. 36m SocioEmo	.19*	-.45**	-.31**	-.10	.02	-.13	.01	.02	.07	.02	.05	-.12	-.06	1										
15. 48m SocioEmo	.25**	-.56**	-.42**	-.04	.01	-.01	.05	.01	.06	-.03	-.02	-.12	-.02	.74**	1									
16. 5y SocioEmo	.18*	-.38**	-.37**	.02	.01	.00	-.04	.10	.12	-.15*	.08	-.08	.02	.58**	.74**	1								
17. 36m Calm/On	.12	-.06	-.05	-.18*	-.02	-.13	-.27**	.37**	.09	.20*	.07	-.19*	.10	.18*	.21*	.21*	1							
18. 36m Neg/Off or Disrp	-.26**	.01	.04	.53**	.21*	.16*	.13	-.25**	-.10	-.28**	-.13	.42**	-.04	-.24**	-.14	-.13*	-.46**	1						
19. 48m Calm/On	.12	.01	-.11	-.28**	-.21*	-.09	-.15*	.15	.42**	.03	.47**	-.23**	-.11	.06	.10	.16*	.25**	-.30**	1					
20. 48m Neg/Off or Disrp	.04	-.03	.08	.20*	.40**	-.05	.14	-.24**	-.34**	-.21*	-.34**	.28**	.21*	.00	.08	-.02	-.23**	.34**	-.48**	1				
21. 36m IQ	.04	.12	-.09	.00	-.04	.12	-.05	.14	-.04	-.13	-.08	-.07	.08	-.08	-.13	.09	-.01	.00	-.02	-.02	1			
22. 48m IQ	.14	-.10	-.10	.02	.10	-.01	-.20*	.31**	-.01	.19*	.10	-.15	-.05	.25**	.23**	.36**	.32**	-.22**	.20*	-.23**	.07	1		
23. 36m Persv	.03	-.02	.05	.07	.03	.06	.21*	-.22**	.00	-.12	-.01	.15	-.04	.05	.02	.06	-.12	.05	-.15	.17*	.03	-.24**	1	
24. 48m Persv	-.02	.11	.17*	-.05	-.18*	-.09	.10	.17*	.09	.06	.10	-.10	-.22**	-.21*	-.11	-.14	-.03	.12	.10	-.07	-.08	-.16*	.05	1

Notes. N = 120. ***p<.001, **p<.01, *p<.05, †p<.10

Table 7.

Intercorrelations between Child Socio-Emotional Adjustment Variables

	Socio-Emotional Adjustment Variables										
	36m CBCL Beh Px (mother report)	36m SSRS Resp.	36m SSRS Self-control	48m CBCL Beh Px (mother report)	48m CBCL Beh Px (father report)	48m SSRS Resp.	48m SSRS Self-control	5y CBCL Beh Px (mother report)	5y CBCL Beh Px (father report)	5y SSRS Resp.	5y SSRS Self-control
36m CBCL Beh Px (mother report)	1										
36m SSRS Responsibility	-.27**	1									
36m SSRS Self-control	-.36**	.59**	1								
48m CBCL Beh Px (mother report)	.79**	-.24**	-.39**	1							
48m CBCL Beh Px (father report)	.41**	-.08	-.31**	.48**	1						
48m SSRS Responsibility	-.28**	.64**	.60**	-.31**	-.26**	1					
48m SSRS Self-control	-.40**	.36**	.68**	-.48**	-.36**	.57**	1				
5y CBCL Beh Px (mother report)	.70**	-.15	-.40**	.74**	.43**	-.24*	-.37**	1			
5y CBCL Beh Px (father report)	.41**	-.11	-.27**	.50**	.63**	-.18*	-.30**	.59**	1		
5y SSRS Responsibility	-.17	.15	.26**	-.18*	-.35**	.34**	.18*	-.20*	-.324**	1	
5y SSRS Self-control	-.28**	.38**	.43**	-.37**	-.24*	.53**	.48**	-.39**	-.36**	.39**	1

Notes. N = 116. ***p<.001, **p<.01, *p<.05, †p<.10

Table 8.

Intercorrelations between Strategy Flexibility Variables

	Strategy Flexibility Measures							
	36m Strategy Variety	48m Strategy Variety	36m Situational Flexibility	48m Situational Flexibility	36m Ratio-of-switches	48m Ratio-of-switches	36m Latency-to-Switch	48m Latency-to-Switch
36m Strategy Variety	1.0							
48m Strategy Variety	.48***	1.0						
36m Situational Flexibility	.15	-.02	1.0					
48m Situational Flexibility	.07	.05	.01	1.0				
36m Ratio-of-switches	-.00	.15*	-.28***	-..03	1.0			
48m Ratio-of-switches	-.05	-.06	-.05	-.07	.22***	1.0		
36m Latency-to-Switch	.06	-.07	.42***	.07	-.50***	-.04	1.0	
48m Latency-to-Switch	-.06	-.18*	.12	.46***	-.27***	-.35***	.11	1.0

Notes. N = 120. ***p<.001, **p<.01, *p<.05, †p<.10

Table 9.

Summary of Hierarchical Regression Analysis for Situational Flexibility Predicting the Number of Tasks in which a Child was Calm/On-task (N = 120)

Variable	β	t
36m Calm/On-task		
1. Gender	.13	1.46
Temperamental Negative Affectivity	-.07	-.81
Amount of Negative Emotion (Wait Task)	-.18	-1.95
2. Gender	.15	$1.74^{‡}$
Temperamental Negative Affectivity	-.09	$-1.07^{‡}$
Amount of Negative Emotion (Wait Task)	-.12	-1.37
Strategy Variety	-.18	-2.13^{*}
Situational Flexibility	.39	4.59^{***}
48m Calm/On-task		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20
2. Gender	.11	1.33
Temperamental Negative Affectivity	-.14	$-.17^{‡}$
Amount of Negative Emotion (Wait Task)	-.12	-1.5
Strategy Variety	-.18	-2.14^{*}
Situational Flexibility	.41	4.99^{***}

Notes. Unless otherwise noted, statistics are reported from Step 2. 36m Calm/On-task: $F(2, 114) = 6.10$, $p < .001$, Adj $R^2 = .18$, $\Delta R^2 = .16$, $F\Delta = 11.52$, $p < .001$. 48m Calm/On-task: $F(2, 114) = 7.68$, $p < .001$, Adj $R^2 = .22$, $\Delta R^2 = .19$, $F\Delta = 14.07$. $^{***}p<.001$, $^{**}p<.01$, $^{*}p<.05$, $^{†}p<.10$

Table 10.

Summary of Hierarchical Regression Analysis for Situational Flexibility Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive (N = 120)

Variable	β	t
36m Negative/Off-task or disruptive		
1. Gender	-.28	-3.72***
Temperamental Negative Affectivity	.02	.32
Amount of Negative Emotion (Wait Task)	.53	7.13***
2. Gender	-.29	-4.02***
Temperamental Negative Affectivity	.03	.41
Amount of Negative Emotion (Wait Task)	.49	6.82***
Strategy Variety	.17	.30**
Situational Flexibility	-.22	-3.00***
48m Negative/ Disorganized		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.84
Amount of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.07	.86
Temperamental Negative Affectivity	.09	1.12
Quantity of Negative Emotion (Wait Task)	.35	4.22***
Strategy Variety	.13	1.63
Situational Flexibility	-.30	-3.68***

Notes. Unless otherwise noted, statistics are reported from Step 2. 36m Negative/Off-task or disruptive: $F(2, 114) = 16.32$, $p < .001$, Adj $R^2 = .39$, $\Delta R^2 = .39$, $F\Delta = 6.13$, $p < .001$. 48m Negative/Off-task or disruptive: $F(2, 114) = 8.28$, $p < .001$, Adj $R^2 = .23$, $\Delta R^2 = .10$, $F\Delta = 7.72$.
***p<.001, **p<.01, *p<.05, †p<.10

Table 11.

Summary of Hierarchical Regression Analysis for Momentary Ratio-of-Switches Flexibility Predicting the Number of Tasks in which a Child was Calm/On-task (N = 120)

Variable	*β*	*t*
36m Calm/On-task		
1. Gender	.13	1.46
Temperamental Negative Affectivity	-.07	-.81
Amount of Negative Emotion (Wait Task)	-.18	-1.95ǂ
2. Gender	.13	1.45
Temperamental Negative Affectivity	-.07	-.74
Amount of Negative Emotion (Wait Task)	-.11	-1.08
Strategy Variety	-.13	.-1.39
Ratio-of- Switches	-.14	-1.40
48m Calm/On-task		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20*
2. Gender	.10	1.13
Temperamental Negative Affectivity	-.13	-1.40
Amount of Negative Emotion (Wait Task)	-.17	1.80ǂ
Strategy Variety	-.15	-1.69ǂ
Ratio-of- Switches	-.07	-.71

Notes. Models were not significant with the addition of Step 2; therefore statistics from Step 1 are reported. 36m Calm/On-task: $F(3, 116) = 2.11$, $p<.05$, Adj $R^2 = .04$. 48m Calm/On-task: $F(3,116) = 2.79$, $p<.05$, Adj $R^2 = .05$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 12.

Summary of Hierarchical Regression Analysis for Momentary Ratio-of-Switches Flexibility Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive (N = 120)

Variable	*β*	*t*
36m Negative /Off-task or disruptive		
1. Gender	-.28	-3.74***
Temperamental Negative Affectivity	.02	.32
Amount of Negative Emotion (Wait Task)	.53	7.13
2. Gender	-.27	-2.80**
Temperamental Negative Affectivity	.02	.22
Amount of Negative Emotion (Wait Task)	.42	5.30***
Strategy Variety	.15	2.02
Ratio-of-Switches	.24	2.98
48m Negative /Off-task or disruptive		
1. Gender	.07	-.43
Temperamental Negative Affectivity	.07	.80
Amount of Negative Emotion (Wait Task)	.40	.84
2. Gender	.08	.99
Temperamental Negative Affectivity	.09	1.01
Amount of Negative Emotion (Wait Task)	.36	4.04***
Strategy Variety	.12	1.44
Ratio-of-Switches	.13	1.48

Notes. Unless otherwise noted, statistics are reported from Step 2. 36m Negative/Off-task or disruptive: $F(2, 114) = 16.32$, $p<.001$, Adj $R^2 = .39$, $\Delta R^2 = .39$, $F\Delta = 6.15$, $p<.001$. 48m Negative/Off-task or disruptive: Step 1 $F(3,116) = 7.75$, $p<.001$, Adj $R^2 = .14$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 13.

Summary of Hierarchical Regression Analysis for Momentary Latency-to-Switch Flexibility Predicting the Number of Tasks in which a Child was Calm/On-task (N = 120)

Variable	*β*	*t*
36m Calm/On-task		
1. Gender	.11	1.17ǂ
Temperamental Negative Affectivity	-.08	-.77
Amount of Negative Emotion (Wait Task)	-.18	-1.88
2. Gender	.14	1.46
Temperamental Negative Affectivity	-.09	-.96
Amount of Negative Emotion (Wait Task)	-.10	-.96
Strategy Variety	-.09	-.97
Latency-to-Switch	.24	2.41*
48m Calm/On-task		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.2*
2. Gender	.11	1.34
Temperamental Negative Affectivity	-.14	-1.70ǂ
Amount of Negative Emotion (Wait Task)	-.07	-.82
Strategy Variety	-.09	-1.04
Latency-to-Switch	.44	5.17***

Notes. Unless otherwise noted, statistics are reported from Step 2. 36m Calm/On-task: $F(2, 114) = 2.36$, $p<.001$, Adj $R^2 = .06$, $\Delta R^2 = .06$, $F\Delta = 3.17$, $p<.05$. 48m Calm/On-task: $F(2, 114) = 8.08$, $p<.001$, Adj $R^2 = .23$, $\Delta R^2 = .19$, $F\Delta = 15.01$, $p<.001$. ***$p<.001$, **$p<.01$, *$p<.05$, †$p<.10$

Table 14.

Summary of Hierarchical Regression Analysis for Momentary Latency-to-Switch Flexibility Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive (N = 120)

Variable	*β*	*t*
36m Negative /Off-task or disruptive		
1. Gender	-.28	-3.72***
Temperamental Negative Affectivity	.02	.32
Amount of Negative Emotion (Wait Task)	.53	7.13***
2. Gender	-.29	-3.98***
Temperamental Negative Affectivity	.03	.44***
Amount of Negative Emotion (Wait Task)	.47	6.07***
Strategy Variety	.14	1.94**
Latency-to- Switch	-.15	-1.96**
48m Negative /Off-task or disruptive		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.83
Amount of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.07	.84
Temperamental Negative Affectivity	.09	1.08
Amount of Negative Emotion (Wait Task)	.32	3.78***
Strategy Variety	.08	.91
Latency-to- Switch	-.25	-2.86***

*Note*s. Unless otherwise noted, statistics are reported from Step 2. 36m Negative/Off-task or disruptive: $F(2, 114) = 14.63$, $p < .001$, Adj $R^2 = .37$, $\Delta R^2 = .04$, $F\Delta = 3.41$, $p < .001$. 48m Negative/Off-task or disruptive: $F(2, 114) = 6.97$, $p < .001$, Adj $R^2 = .20$, $\Delta R^2 = .07$, $F\Delta = 4.99$, $p < .01$. ***$p < .001$, **$p < .01$, *$p < .05$, $^{\dagger}p < .10$

Table 15.

Summary of Hierarchical Regression Analysis for Situational and Momentary Latency Predicting the Number of Tasks in which a Child was Calm/On-task (N = 120)

Variable	β	*t*
36m Calm/On-task		
1. Gender	.13	1.46
Temperamental Negative Affectivity	-.07	-.81
Amount of Negative Emotion (Wait Task)	-.18	-1.95*
2. Gender	.15	1.75
Temperamental Negative Affectivity	-.09	-1.09
Amount of Negative Emotion (Wait Task)	-.11	-1.20
Strategy Variety	-.18	-2.13*
Situational Flexibility	.38	4.01***
Latency-to- Switch	.03	.311
48m Calm/On-task		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20*
2. Gender	.11	1.39
Temperamental Negative Affectivity	-.14	-1.80‡
Amount of Negative Emotion (Wait Task)	-.06	-.78
Strategy Variety	-.12	-1.63
Situational Flexibility	.27	3.05**
Latency-to-Switch	.31	3.31***

Notes. Unless otherwise noted, statistics are reported from Step 2. 36m Calm/On-task: $F(3, 113) = 5.06$, $p<.001$, Adj $R^2 = .17$, $\Delta R^2 = .16$, $F\Delta = 7.65$, $p<.001$. 48m Calm/On-task: $F(3, 113) = 8.78$, $p<.001$, Adj $R^2 = .28$, $\Delta R^2 = .25$, $F\Delta = 13.86$, $p<.001$. $^{***}p<.001$, $^{**}p<.01$, $^{*}p<.05$, $^{\dagger}p<.10$

Table 16.

Summary of Hierarchical Regression Analysis for Situational and Momentary Latency Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive (N = 120)

Variable	β	t
36m Negative/Off-task or disruptive		
1. Gender	-.28	-3.72***
Temperamental Negative Affectivity	.02	-.32
Amount of Negative Emotion (Wait Task)	.53	7.13***
2. Gender	-.29	-4.04***
Temperamental Negative Affectivity	-.09	.48
Amount of Negative Emotion (Wait Task)	.48	6.13***
Strategy Variety	.18	2.30**
Situational Flexibility	-.19	-2.40**
Latency-to switch	-.07	-.79
48m Negative/Off-task or disruptive		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.84
Amount of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.07	.87
Temperamental Negative Affectivity	.09	1.15
Amount of Negative Emotion (Wait Task)	.32	3.82***
Strategy Variety	.11	1.33
Situational Flexibility	-.24	-2.63***
Latency-to switch	-.13	-1.36

*Note*s. Unless otherwise noted, statistics are reported from Step 2. 36m Negative/Off-task or disruptive: $F(3, 113) = 13.66$, $p<.001$, Adj $R^2 = .39$, $\Delta R^2 = .07$, $F\Delta = 4.28$, $p<.01$. 48m Negative/Off-task or disruptive:: $F(3, 113) = 7.26$, $p<.001$, Adj $R^2 = .24$, $\Delta R^2 = .11$, $F\Delta = 5.80$, ***$p<.001$, **$p<.01$, *$p<.05$, †$p<.10$

Table 17.

Summary of Hierarchical Regression Analysis for36-month Strategy Flexibility Variables Predicting the Number of Tasks in which a Child was Calm/on-task at age 48 months (N = 120)

Variable	*β*	*t*
Situational Flexibility		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20*
2. Gender	.12	1.32
Temperamental Negative Affectivity	-.12	-1.32
Amount of Negative Emotion (Wait Task)	-.18	-2.03*
Strategy Variety	-.11	-1.16
Situational Flexibility	.16	1.77ǂ
Momentary Flexibility: Ratio-of-switches		
1. Gender	.11	1.22
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20
2. Gender	.11	.22
Temperamental Negative Affectivity	-.11	.24
Amount of Negative Emotion (Wait Task)	-.15	.10
Strategy Variety	-.09	.33
Ratio-of-contingent Switches	-.20	.03
Momentary Flexibility: Latency-to-switch		
1. Gender	.11	1.23
Temperamental Negative Affectivity	-.11	-1.22
Amount of Negative Emotion (Wait Task)	-.20	-2.20*
2. Gender	.12	1.30
Temperamental Negative Affectivity	-.11	-1.25
Amount of Negative Emotion (Wait Task)	-.20	-2.16*
Strategy Variety	-.08	-.92
Latency-to-contingent Switches	.06	.63

Table 17 continues.

Table 17 continued.

Summary of Hierarchical Regression Analysis for36-month Strategy Flexibility Variables Predicting the Number of Tasks in which a Child was Calm/on-task at age 48 months (N = 120)

*Note*s. Unless otherwise noted, statistics are reported from Step 2. Situational Flexibility: Step 1 $F(3,116) = 2.78$, $p<.05$, Adj. $R^2 = .04$. Momentary ratio-of-switches: Step 1 $F(3,116) = 2.79$, $p<.05$, Adj. $R^2 = .04$. Momentary latency-to-switch: Step 1 $F(3,116) = 2.79$, $p<.05$, Adj. $R^2 = .04$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 18.

Summary of Hierarchical Regression Analysis for36-month Strategy Flexibility Variables Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive at age 48 months (N = 120)

Variable	β	*t*
Situational Flexibility		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.83
Quantity of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.07	.79
Temperamental Negative Affectivity	.09	1.11
Amount of Negative Emotion (Wait Task)	.38	4.61***
Strategy Variety	-.04	-.49
Situational Flexibility	-.22	-2.56*
Momentary Flexibility: Ratio-of-switches		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.84
Amount of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.08	.90
Temperamental Negative Affectivity	.08	.90
Amount of Negative Emotion (Wait Task)	.36	4.14***
Strategy Variety	-.07	-.18
Ratio-of-contingent Switches	.20	2.36*
Momentary Flexibility: Latency-to-switches		
1. Gender	.07	.80
Temperamental Negative Affectivity	.07	.84
Amount of Negative Emotion (Wait Task)	.40	4.70***
2. Gender	.06	.73
Temperamental Negative Affectivity	.11	1.28

Table 18 continues.

Table 18 continued.

Summary of Hierarchical Regression Analysis for36-month Strategy Flexibility Variables Predicting the Number of Tasks in which a Child was Negative/Off-task or Disruptive at age 48 months (N = 120)

Variable	*β*	*t*
Quantity of Negative Emotion (Wait Task)	.40	4.87***
Strategy Variety	-.07	-.78
Latency-to-contingent Switches	-.23	-2.70**

Notes. Unless otherwise noted, statistics are reported from Step 2. Situational Flexibility: F(2, 114) = 6.34, $p<.001$, Adj R^2 = .18, ΔR^2 = .05, $F\Delta$ = 3.68, $p<.05$. Momentary Ratio-of-switches: *F(2, 114)* = 6.10, $p<.001$, Adj R^2 = .18, ΔR^2 = .04, $F\Delta$ = 3.19, $p<.05$. Momentary Latency-to-switch: *F(2,114)* = 6.51, $p<.001$, Adj R^2 = .19, ΔR^2 = .06, $F\Delta$ = 4.03, $p<.05$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 19.

Summary of Hierarchical Regression Analysis for Situational Flexibility Predicting the Child Socio-emotional Adjustment (N = 120)

Variable	*β*	*t*
36m Socio-emotional Adjustment Composite		
1. Gender	.26	3.18**
Temperamental Negative Affectivity	-.48	-5.93***
Amount of Negative Emotion (Wait Task)	-.08	-1.05
2. Gender	.26	3.23**
Temperamental Negative Affectivity	-.47	-5.87***
Total Amount of Negative Emotion (Wait Task)	-.07	-.82
Strategy Variety	-.11	-1.36
Situational Flexibility	.07	.82
48m Socio-emotional Adjustment Composite		
1. Gender	.25	3.12**
Temperamental Negative Affectivity	-.42	-5.17***
Amount of Negative Emotion (Wait Task)	.04	.45
2. Gender	.25	3.10**
Temperamental Negative Affectivity	-.42	-5.13***
Total Amount of Negative Emotion (Wait Task)	.05	.55
Strategy Variety	.01	.08
Situational Flexibility	.07	.81

Notes. Because only Step 1 predictors were significant, statistics from Step 1 are reported. 36m Socio-emotional Adjustment: $F(3,116) = 14.21$, $p<.001$, Adj $R^2 = .25$, $\Delta R^2 = .27$. 48m Socio-emotional Adjustment: $F(3,116) = 12.02$, $p<.001$, Adj $R^2 = .22$, $\Delta R^2 = .24$***$p<.001$, **$p<.01$, *$p<.05$, †$p<.10$

Table 20.

Summary of Hierarchical Regression Analysis for Momentary Ratio-of-Switches Flexibility Predicting the Child Socio-emotional Adjustment (N = 120)

Variable	*β*	*t*
36m Socio-emotional Adjustment Composite		
1. Gender	.26	3.34***
Temperamental Negative Affectivity	-.48	-6.28***
Amount of Negative Emotion (Wait Task)	-.09	-1.15
2. Gender	.26	3.34***
Temperamental Negative Affectivity	-.48	-6.21***
Total Amount of Negative Emotion (Wait Task)	-.04	-.46
Strategy Variety	-.11	-1.42
Ratio-of-switches	-.10	-1.15
48m Socio-emotional Adjustment Composite		
1. Gender	.25	3.15***
Temperamental Negative Affectivity	-.42	-5.27***
Amount of Negative Emotion (Wait Task)	.04	.49
2. Gender	.25	3.15***
Temperamental Negative Affectivity	-.41	-5.19***
Total Amount of Negative Emotion (Wait Task)	.04	.49
Strategy Variety	.02	.22
Ratio-of-switches	-.01	-.14

Notes. Because only Step 1 predictors were significant, statistics from Step 1 are reported. 36m Socio-emotional Adjustment: $F(3,116) = 16.04$, $p<.001$, Adj $R^2 = .26$, $\Delta R^2 = .28$. 48m Socio-emotional Adjustment: $F(3,116) = 12.46$, $p<.001$, Adj $R^2 = .21$, $\Delta R^2 = .23$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 21.

Summary of Hierarchical Regression Analysis for Momentary Latency-to-switch Flexibility Predicting the Child Socio-emotional Adjustment (N = 120)

Variable	*β*	*t*
36m Socio-emotional Adjustment Composite		
1. Gender	.26	3.34***
Temperamental Negative Affectivity	-.48	-6.28***
Amount of Negative Emotion (Wait Task)	-.09	-1.15
2. Gender	.26	3.42***
Temperamental Negative Affectivity	-.48	-6.23***
Total Amount of Negative Emotion (Wait Task)	-.06	-.76
Strategy Variety	-.11	-1.38
Latency-to-switch	-.06	.71
48m Socio-emotional Adjustment Composite		
1. Gender	.25	3.22***
Temperamental Negative Affectivity	-.42	-5.22***
Amount of Negative Emotion (Wait Task)	.04	.49
2. Gender	.25	3.19***
Temperamental Negative Affectivity	-.41	-5.19***
Total Amount of Negative Emotion (Wait Task)	.04	.49
Strategy Variety	.02	.25
Latency-to-switch	.01	.14

Notes. Because only Step 1 predictors were significant, statistics from Step 1 are reported. 36m Socio-emotional Adjustment: $F(3,116) = 16.00$, $p<.001$, Adj $R^2 = .26$, $\Delta R^2 = .28$. 48m Socio-emotional Adjustment: $F(3,116) = 12.46$, $p<.001$, Adj $R^2 = .21$, $\Delta R^2 = .23$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 22.

Minimums, Maximums, Means, and Standard Deviations of Raw Scores from Parent Report of Child Socio-emotional Adjustment

Child Socio-emotional Adjustment Variable	Min	Max	Mean	SD
36m Behavior Problem Symptoms (mother-report)	2	88	31.17	18.65
36m Social Responsibility	0	15	7.21	3.41
36m Self-control	3	21	12.94	3.27
48m Behavior Problem Symptoms (mother-report)	2	121	32.24	19.50
48m Behavior Problem Symptoms (father-report)	0	9	2.32	1.70
48m Social Responsibility	5	22	13.76	3.16
48m Self-control	4.00	19.00	11.70	2.81
5y Behavior Problem Symptoms (mother-report)	1	105	26.48	18.54
5y Behavior Problem Symptoms (father-report)	0	113	23.90	20.18
5y Social Responsibility	8.50	19.00	13.59	1.96
5y Self-control	33.00	72.00	54.67	7.57
5y Emotion Regulation	46	91.00	77.51	7.38

Notes. *N* = 116 at ages 36 and 48 months; N = 96 at age 5 years. Behavior Problem Symptoms obtained from the Child Behavior Checklist (CBCL); Social Responsibility and self-control obtained from the Social Skills Rating Scale (SSRS); Emotion Regulation obtained from the Emotion Regulation Checklist.

Table 23.

Bivariate Correlations between Child Strategy Flexibility and Socio-emotional Variables

	Child Socio-emotional Adjustment											
Type of Strategy Flexibility	36m CBCL Beh Px (mother report)	36m SSRS Resp.	36m SSRS Self-control	48m CBCL Beh Px (mother report)	48m CBCL Beh Px (father report)	48m SSRS Resp.	48m SSRS Self-control	5y CBCL Beh Px (mother report)	5y CBCL Beh Px (father report)	5y SSRS Resp.	5y SSRS Self-control	5y Emo Reg. Checklist
36m Variety	-.15*	-.11	-.10	-.08	.01	.13	-.02	.16	-.10	.06	-.12	-.04
36m Sit. Flex	.08	.06	.09	.15	-.01	.07	.05	.15	-.05	.26**	.12	-.09
36m Ratio	.09	-.08	-.16*	.06	.10	-.07	-.14	.09	.02	-.06	-.02	-.02
36m Latency	.15	.07	.14	.23**	.11	.15*	.11	.18*	.17*	-.04	-.05	-.07
48m Variety	-.11	.02	.01	-.08	0	.08	.03	-.02	-.11	.03	.10	-.04
48m Sit. Flex	-.05	.01	.05	.06	-.14	.08	-.01	-.05	-.09	.18*	-.03	.03
48m Ratio	.04	-.03	-.09	-.01	.10	-.02	.00	.03	.07	-.12	.14	-.02
48m Latency	.00	.01	.07	-.01	-.07	-.01	-.13	-.16	-.08	.12	-.10	-.01

Notes. $N = 120$. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Table 24.

Intercorrelations between child socio-emotional composite and global ER quality variables at 36 and 48 months of age

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. 36m Mother-report behavior problem symptoms	1.0										
2. 36m Social responsibility	-.27*	1.0									
3. 36m Self-control	-.36***	.58***	1.0								
4. 48m Mother-report behavior problem symptoms	.79***	-.24*	-.39*	1.0							
5. 48m Social responsibility	-.28*	.64***	.60***	-.31*	1.0						
6. 48m Self-control	-.40***	.36*	.68***	-.48***	.56***	1.0					
7. 48m Father-report behavior problem symptoms	.41***	-.08	-.31*	.48***	-.26*	-.36*	1.0				
8. 36m Calm/On-task (# of tasks)	-.19*	.06	.17*	-.12	.07	.24*	-.09	1.0			
9. 36m Neg/Off-task or disruptive (# of tasks)	.24*	-.17*	-.15	.16*	-.01	-.20*	-.04	-.46***	1.0		
10. 48m Calm/On-task (# of tasks)	0	.02	.07	-.05	0	.11	-.10	.25*	-.30*	1.0	
11. 48m Neg/Off-task or disruptive (# of tasks)	.05	.03	.07	-.07	.20*	.08	0.04	-.23*	.34*	-.48***	1.0

Notes. N=116, Behavior problem symptoms obtained from Child Behavior Checklist; Social responsibility and self-control obtained from Social Skills Rating Survey; ER regulatory patterns obtained from independent global emotion regulation observational ratings.

****p < .001. **p<.01, *p<.05, †p<.10*

Table 25.

Summary of Hierarchical Regression Analysis for Perseverative Error Variables Predicting Situational and Momentary Latency-to-Switch Flexibility (N = 120)

Variable	β	t
36m Situational Flexibility		
1. Full scale IQ	.27	2.89*
2. Full Scale IQ	.22	2.37*
36m Longest Run of Perseverative Errors	-.17	-1.82†
48m Situational Flexibility		
1. Full scale IQ	-.01	-.05
2. Full Scale IQ	.01	.10
48m Longest Run of Perseverative Errors	.09	.97
36m Momentary Latency-to-Switch		
1. Full scale IQ	-.04	-.41
2. Full Scale IQ	-.04	-.44
36m Momentary Latency-to-Switch	-.02	-.18
48m Situational Flexibility		
1. Full scale IQ	.10	1.09
2. Full Scale IQ	.12	1.27
48m Momentary Latency-to-Switch	.12	1.26

Notes. Because perseverative errors were not significant, all regression statistics are reported from Step 1. 36m Situational Flexibility: $F(1,118) = 8.36$, $p<.05$, Adj $R^2 = .06$, $\Delta R^2 = .07$. 36m Latency: $F(1,118) = .17$, *ns*, Adj $R^2 = .01$, $\Delta R^2 = .02$. 48m Situational Flexibility: $F(1,118) = .47$, *ns*, Adj $R^2 = .01$, $\Delta R^2 = .01$, $F\Delta = .94$, *ns*. 48m Latency: $F(1,118) = .28$, *ns*, Adj $R^2 = .02$, $\Delta R^2 = .01$. ***$p<.001$, **$p<.01$, *$p<.05$, †$p<.10$

Table 26.

Correlations between Strategy Flexibility and Cognitive Flexibility Variables

	Perseverative Error & Total Correct Variables (Cognitive Flexibility)				
Strategy Flexibility Variables	36m Longest Run Perseverative Error	48m Longest Run Perseverative Error	36m Total # Correct	48m Total # Correct	48m Pass/Fail
36m Situational Flexibility	-.22*	.18*	.24**	-.12	-.13
48m Situational Flexibility	-.03	.12	-.02	-.12	-.04
36m Latency-to-Switch	.19*	-.13	.23*	.04	.04
48m Latency-to-Switch	-.03	-.21*	.03	-.03	-.01

Notes. N = 103 for age 36m cognitive flexibility variables and 110 for age 48m cognitive flexibility variables. At age 36m, perseverative error and total correct numbers created by summing standardized variables from the A-not-B and Delayed Alternation tasks. At age 48m, perseverative, total correct, and Pass/Fail variables obtained from the DCCS; to pass the DCCS, children needed to answer at least 4/6 trials correctly. ***$p<.001$, **$p<.01$, *$p<.05$, $^{\dagger}p<.10$

Patricia Z. Tan

CURRICULUM VITAE

EDUCATION

Ph.D. Clinical Psychology, The Pennsylvania State University, August 2011
M.S. Clinical Psychology, the Pennsylvania State University, August, 2007
B.S. Psychology, Duke University, May 2002

GRADUATE EXPERIENCE

Teaching: Graduate Instructor, Developmental Psychology, Summer 2009

Research: Research Assistant, Development of Toddlers Study, 2003-2008
Research Assistant, Early Growth and Development Study, 2008-2009
Primary Investigator, Strategy Flexibility Study, 2009; 2010-2011, *R36 N.I.M.H. Dissertation Award, MH084409-01A1*

Clinical: Staff Therapist, Pennsylvania State University Psychological Clinic, 2004-2009
Pre-doctoral Clinical Intern, Western Psychiatric Institute & Clinic, 2009-2010

PUBLICATIONS

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Tan, P.Z. Cole, P.M., & Armstrong, L.M. (revise and submit). Relations between Temperament and Anger Regulation over Early Childhood.

Pemberton, C.K., Bass, A.J., Moore, G.A., Murray-Kolb, L., Tan, P.Z., Gilmore, R.O., Cole, P.M. & Teti, L.O. (revise and resubmit). Let Me Go: The Influences of Crawling Experience and Temperament on the Development of Anger Expression.

Cole, P.M., LeDonne, E.N., & Tan, P.Z. (revise and resubmit). Predicting Maternal Emotion as a Function of Child Behavior Concurrently and Over Time.