

The Functional Organization of Preschool-Age Children's Emotion Expressions and Actions in Challenging Situations

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Although functional links between emotion and action are implied in emotion regulation research, there is limited evidence that specific adaptive actions for coping with a challenge are more probable when certain negative emotions are expressed. The current study examined this question among 3- and 4-year-olds ($N = 113$; M age = 47.84 months, $SD = 6.19$). Emotion expressions and actions were observed during 2 challenging tasks: children waited for a gift while the mother worked, and children worked alone to retrieve a prize from a locked box with the wrong key. Angry and happy expressions, compared with sad expressions, were associated with more actions. These actions varied with the nature of the task, reflecting appreciation of situational appropriateness. In addition, when waiting with the mother, happiness was associated with the broadest range of actions, whereas when working alone on the locked box, anger was associated with the broadest range of actions. Results are discussed in terms of the adaptive function of negative emotions and in terms of functional and dimensional models of emotion. Findings have implications for the development of emotion regulation and social-emotional competence.

Keywords: functional emotion theory, emotion expression-action sequences, emotion regulation

A compelling body of research shows that children who express more negative emotion during laboratory challenge tasks are more poorly adjusted and less socially competent than children who express less negative emotion (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002; Cole, Martin, & Dennis, 2004; Eisenberg et al., 2001; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Saarni, 1999; Shoda, Mischel, & Peake, 1990; Silk, Shaw, Skuban, Oland, & Kovacs, 2006). Because much work in this area is aimed at addressing the role of emotion expression in the development of psychopathology, the adaptive functions of negative emotions, and the potential for emotions to have both adaptive or maladaptive aspects depending on the context, is less well documented (Campos, 2003; Campos, Campos, & Barrett, 1989; Cole, Michel, & Teti, 1994). When goals are blocked, competent behavior involves

socially appropriate action that achieves the goal despite the barriers (Cole & Hall, 2008; Saarni, 1999). Anger supports effort to persist and overcome obstacles to the goal. Sadness supports relinquishing the goal, which can serve recovery and the ability to shift attention to more attainable goals. Happiness in the context of a goal might involve various states: optimism about achieving the goal, disengagement from the goals, lack of concern for the goal, or potentially inappropriate positive affect. Although these emotion-action patterns are consistent with emotion theory, there is a dearth of empirical evidence demonstrating relations between children's emotion expressions and specific behaviors in emotionally challenging contexts.

These links between negative emotions and adaptive actions are articulated by the functional model of emotion (K. C. Barrett & Campos, 1987), which defines emotions as situational appraisals and concomitant preparedness to act accordingly (Frijda, 1986). The functional perspective provokes a question that is not commonly examined in research on emotion regulation: Are different emotions associated with different types and rates of regulatory actions when a person is faced with an emotionally challenging situation (Arnold, 1960; Campos, 2003; Frijda, 1986; Lazarus, 1991)? The functional perspective does not hold that emotions *cause* actions. Rather, it conceptualizes emotions as relational constructs defined by two coterminous aspects (appraisals and action readiness tendencies) that pose an individual to interact with the environment (Campos, Frankel, & Camras, 2004). That is,

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an emotional response reflects an organismic shift in orientation. When such shifts are potentiated, they should be reflected in behavior, including both expressive behaviors (e.g., facial expressions) and goal-directed actions (e.g., problem solving). From this perspective, it is not the valence of an emotional response but the constituent expression–action patterns, and their appropriateness given contextual demands, that make them adaptive or maladaptive and place individuals at risk for psychopathology (Cole & Hall, 2008; Cole et al., 2004).

The goal of the present study was to test the hypothesis that negative emotion expressions, particularly those associated with anger and sadness, are associated with distinct *context-appropriate* attempts to deal with the types of day-to-day challenges that typically developing preschool-age children encounter. In the present study, there were two contexts, each of which blocked a child's goal for a desired object differently and therefore involved different situational demands and behavioral standards.

Functional and Dimensional Models of Emotion

Understanding why children use specific types of actions to cope with emotional challenges is a critical goal of research on emotional competence and emotion regulation. Functional views of emotion highlight several characteristics of emotion that suggest predictable associations between emotion and action (K. C. Barrett & Campos, 1987; Frijda, 1986; Lazarus, 1991). Emotions rapidly signal potential harm or benefit in the context of environmental circumstances that are relevant to well-being. Although emotions such as anger and sadness are both negative, that is, reflect goals for well-being that are not yet achieved, they reflect adaptive responses to situations. They are advantageous because they support actions that help us behave in ways that regain our sense of well-being. For example, anger is defined by the appraisal of blocked goals and readiness to behave with increased effort or force to overcome the barrier and achieve the goal. Sadness, in contrast, is defined by the appraisal of loss of a goal or the means to achieve a goal and readiness to conserve resources, withdraw, and relinquish fruitless or harmful goals. This action tendency should be associated with temporarily reduced action (withdrawal), which ultimately may help the individual recover from loss. Happiness, in relative contrast to anger and sadness, is defined by the appraisal that goals for well-being are achieved and by actions that maintain those conditions (K. C. Barrett & Campos, 1987; Carver, 2004; Carver & Scheier, 1998). For example, happy expressions under challenging circumstances may reflect motivation to maintain or regain well-being in the face of frustration or disappointment. Hence, happiness can be accompanied both by situation-maintaining behaviors and by active efforts to deal with a problem situation. In contexts known to elicit negative emotions, happiness may therefore be associated with a broader range of actions in that some signal successful regulation and others signal efforts to regain well-being (Fredrickson, 2001; Lazarus, Kanner, & Folkman, 1980; Tomkins, 1962).

On the other hand, dimensional models of emotion (Lang, 1995) and core affect theory (L. F. Barrett, 2006a) also predict associations between emotion expressions and actions. From this perspective, however, emotional arousal and valence, rather than patterns of action readiness associated with discrete emotions such as anger or sadness, are associated with actions. That is, differences be-

tween two negatively valenced emotions such as anger and sadness would be due to differences in affective arousal, leading to differences in the amount rather than the nature of efforts to cope with affective challenges. Indeed, core affect theory proposes few systematic relations among purported components of emotion, such as expression and action (L. F. Barrett, 2006a, 2006b).

In summary, anger and happiness compared with sadness may be defined by action tendencies that ready the individual to engage in action. Therefore, expressions of these emotions are likely to be associated with particular actions that are less likely when sadness is expressed. In addition, anger and happiness may differ in regard to the amount of activity observed. Anger, when compared with happiness, should involve short-term sustained, focused efforts to achieve a blocked goal (Campos, Mumme, Kermoian, & Campos, 1994; Cannon, 1929; Frijda, 1986; Izard, 1993). As such, in contexts that emphasize blocked goals, anger will be linked to more behavioral attempts that are narrowly focused on goal-directed activity compared with positive emotions or sadness (Cole et al., 1994), whereas happiness is more likely to co-occur with a flexible range of actions rather than a specific type of action (Fredrickson, 2001; Fredrickson & Branigan, 2005). By assessing emotion expression and action independently and examining their co-occurrence in time, it is possible to test these predictions (Cole et al., 2004).

Such predictions may be even more consistent with a dimensional view of emotions, which characterizes emotions as systematic variations in valence and arousal (L. F. Barrett, 2006a; Lang, 1995). That is, whereas discrete emotions approach might predict that anger and sadness are associated with qualitatively distinct actions, from a dimensional perspective, these two negatively valenced emotions have similar valence but vary systematically in arousal, and thus will differ quantitatively in associated patterns of action dispositions.

Developmental Evidence for the Functional Organization of Emotions and Actions

There is emerging evidence in the early childhood developmental literature that is consistent with the functional perspective. For example, easily angered infants are more likely to engage in strategies such as scanning and orienting to mother compared with less easily angered infants (Calkins et al., 2002). For infants, these strategies are interpreted as approach-oriented, in that they involve becoming engaged with the environment, in contrast to inaction or avoidance. Thus, in this study, a specific emotional tendency was associated with a specific class of regulatory action. Another study with infants examined behaviors following expressions of distinct emotions and found that anger compared with fear preceded more instances of goal-relevant actions and distraction 5 to 10 s later in a number of negative emotion-eliciting tasks and, interestingly, resulted in a decrease in anger intensity (Buss & Goldsmith, 1998). This suggests that, in very young children, not only is anger associated with adaptive attempts to engage a challenge, but it is linked to specific action patterns. The question has not been addressed in preschool-age children, who are of an age when they have acquired some basic social competencies. In the present study, we asked whether anger and sadness tend to co-occur with similar or distinct types of actions, and whether sadness compared with anger, because sadness involves withdrawal from a challenge,

is associated with fewer actions in typically developing preschool-age children.

The emergence of functional associations between specific emotions and actions used to cope appropriately with emotion-eliciting events may be particularly salient in the preschool years (Hill, Degnan, Calkins, & Keane, 2006; Kopp, 1989). During this time, children's emotion regulation repertoire, which already includes more elementary actions such as self-soothing and seeking comfort from caregivers, is expanding to include more independent and cognitively mature actions such as problem solving and seeking information about a distressing situation (Gilliom et al., 2002; Kopp, 1989). It is interesting that elementary strategies such as self-soothing are becoming less frequent, perhaps due to the recognition that other strategies are more effective and are at their disposal. In fact, this period marks a shift during which children's distress can be linked to more clearly identifiable, effective, and socially acceptable regulatory actions. For example, between ages 24 and 36 months, there is a notable change in children's behavior when frustrated; 24-month-olds tend to become aggressive and disruptive when frustrated, whereas 36-month-olds engage in goal-directed actions that are context appropriate even when frustrated (Cole et al., 2009). Three- and 4-year-olds are also able to shift attention and redirect behavior away from a tempting but prohibited item; youngsters who distract rather than focus on the desired object show better concurrent ability to persist, wait, and resist temptation (Cole, 1986; Gilliom et al., 2002; Putnam, Spritz, & Stifter, 2002), as well as better ability to manage negative emotions as adolescents (Shoda et al., 1990).

Context

Because the functional approach states that there are adaptive features embedded within emotion-action patterns, it is imperative to understand the context in which emotions and actions occur. In the present study, we focused on emotional expressions—as signals of changes in emotions—in relation to actions. Context not only influences the types of emotions individuals express, but also affords or constrains what actions one can take. That is, an action is deemed adaptive or socially appropriate only if it fits with the demands of the context. For instance, in the context of wanting a desired object but having the goal blocked, contextual constraints are likely to influence whether anger is associated with persistent effort to get the object (e.g., an adult tells you to try your best at this hard task) or with shifting attention away from the object (e.g., an adult says you must wait). In the second context, persistent efforts to obtain the object are less socially desirable and we hope children learn to divert their attention away from the object, whereas in the first context, sustained attention on and effort to get the object are socially desirable, showing an ability to persist in the face of difficulty. Therefore, given that context dictates which actions are most socially acceptable and developmentally desirable, anger and sadness may differ, not in the type but in the frequency of actions: "Activating" anger episodes may be associated with a greater proportion of goal-directed and effortful attempts to meet the demands of a situation.

Another important aspect of context is interpersonal context. The presence of a parent is likely to increase social pressure for acceptable behavior and provide a source of emotional support and instrumental aid. Moreover, when a young child has a parent

present, not only does this influence task demands (e.g., behaving in a socially desired way with one's parent), but also shapes which strategies are effective (complying with parent directives, seeking social support).

The Present Study

The present study examined predicted associations between preschool-age children's expressions of anger, sadness, and happiness and the nature of their attempts to cope with two different situations involving blocked goals. The use of two different situations permitted a test of the predictions across contexts: one in which the mother tells her child to wait to open a present while she finishes her work (the Waiting Task), and one in which an adult tells a child to try to open a locked box on his or her own, but the child has the wrong key (the Transparent Box Task). In the Waiting Task, distraction is the most appropriate action because it is functionally consistent with needing to wait and with the mother being busy with work and therefore unavailable. Persistent effort to get the desired object (the surprise) despite the mother's instructions to wait is less socially appropriate. During the Transparent Box Task, on the other hand, persistent effort to get the desired object (the figurine) is an appropriate problem-solving action because it is functionally consistent with the task instructions (try to open the box while I am gone) and theoretically consistent with trying to overcome obstacles to well-being.

The hypothesized co-organization of emotion expression and action is not intended to imply causation; rather, it highlights the functional perspective that emotions are, in part, action readiness tendencies. Indeed, the issue of whether an appraisal of events and readiness to act according to the appraisal are temporally linked or concomitant has not been resolved in basic emotion research (Cole et al., 2004). The preschool age was targeted given the rapid emergence of emotion regulatory skills during this period, including clearly identifiable and adaptive actions to cope with emotional challenges. The presence of a mother may increase both the behavioral expectations placed on the child and the availability of social support. In keeping with the functional perspective, we examined relations between emotion expressions (as behavior that signals emotion) and action. We focused on expression-action patterns in which emotional expression temporally preceded actions. Although either expression or action could be used as a starting point in ongoing behavioral sequences, we used expressions as the starting point because they have been empirically related to the experience of discrete emotions (Ekman, 1993) and have been both implicitly and explicitly used as a sequential starting point in the research cited above (e.g., Buss & Goldsmith, 1998; Calkins et al., 2002).

In the present study, three emotions were assessed in each of the two tasks: anger, sadness, and happiness. Six actions were also assessed: problem solving, attentional distraction, behavioral distraction, soothing (self-soothing and seeking social support), focusing on the desired object, and disruptive behavior. This is one of few studies that has examined emotional expressions in relation to subsequent actions, an analytic strategy that may shed light on how emotions are functionally organized along with goal-directed or disorganized actions (Cole et al., 2004). Again, temporal order was used to show co-organization and not to infer that the expression of a particular emotion causes a particular action. Instead,

temporal order allowed us to test specific associations between two sets of behaviors: different emotional expressions and their theoretically associated actions. There were two hypotheses:

Hypothesis 1: Anger and happiness expressions in contrast to sadness expressions will be followed by a greater number of context-appropriate actions, specifically those that (a) engage the problem (i.e., problem solving) during the Transparent Box Task to obtain the desired toy and (b) comply with parental directives during the Waiting Task to distract from the present and from the mother who is unavailable because she is busy with work (i.e., behavioral and attentional distraction). Qualitative differences in emotion expression–action patterns—that is, each emotion being associated with unique actions—may reflect that discrete emotions have distinct functions, whereas quantitative differences in these patterns may instead reflect dimensional variations in the arousal and valence properties of a given emotion.

Hypothesis 2: Although both anger and happiness are activating emotions, happiness expressions will be associated with greater behavioral flexibility (i.e., a broader range of actions) compared with anger.

Method

Participants

A sample of 113 predominantly White (83%) 3- and 4-year-olds (58 boys and 55 girls; M age = 47.84 months, SD = 6.19, range = 36–59 months) and their mothers participated in a larger study of emotion regulation. There were approximately equal numbers of 3- and 4-year-olds. Mean family income was \$58,494 (SD = 28,277), and ranged between \$20,000 and \$200,000. All mothers were college graduates.

Children and their mothers were recruited through letters sent to families with preschool-age children based on a birth announcement database, local newspaper advertisements, and fliers distributed on day care and preschool bulletin boards in a small city in central Pennsylvania. Interested parents contacted a special phone number, received details of the study, and then scheduled a visit. The assistants who administered the procedures were female graduate or undergraduate students. Another group of eight coders, unaware of study hypotheses and never having interacted with the families prior to rating child actions, reviewed videotaped recordings of the sessions to generate data for analyses. Six of these research assistants coded child emotion and the remaining two coded child action.

Each preschooler and mother spent approximately 90 min in a laboratory room designed for young children. Following introduction to the novel laboratory room and experimenter, the child participated in a series of tasks designed to measure emotions and actions related to emotion regulation and temperament, two of which were used in the present study.

Observations of Child Emotion Expression–Action Sequences

Waiting Task. The 8-min Waiting Task was designed to elicit child distress to blocked goals and delay of gratification (Cole,

Teti, & Zahn-Waxler, 2003; Vaughn, Kopp, & Krakow, 1984). Before the Waiting Task began, the experimenter handed the mother papers to complete, gave the child a broken toy, and left an attractively wrapped surprise on the table. The mother, who had been previously instructed, told the child, “This is a surprise for you but you must wait until I finish my work to open it.” During this task, therefore, social demands were for the child to wait and to not pursue the goal (the present). The mother was then free to interact with her child as she wished. After 8 min, the Waiting Task concluded with the child opening and playing with the prize (magnetic marbles).

Transparent Box Task. The Transparent Box Task was designed to elicit distress to blocked goals (Laboratory Temperament Assessment Battery; Goldsmith & Rothbart, 1996). Children were able to see a desired toy through a transparent plastic box and were left alone to work on opening the box with a ring of incorrect keys. During this task, therefore, social demands were for the child to pursue the goal independently (opening the box) while the experimenter was gone. After 3 min, the experimenter returned with the correct key and explained, “I guess I gave you the wrong keys. Let’s try this one.” The box was then opened, and the child was encouraged to play with the toy for 1 min.

Data Coding and Reduction

Child emotional expressions and actions were each coded by separate teams of coders. The coding was time-synchronized in that each team identified which behaviors occurred in the same 10-s epoch as an emotional expression. Subsequently, independent coders generated the expression–action sequence codes. Because expressions and actions unfold over time, coding in 10-s epochs is common in research on young children’s emotional development (Buss & Goldsmith, 1998; Stifter & Braungart, 1995). Unlike previous research, however, we coded only those expression–action sequences in which the *ongoing* emotion expression preceded the action within 10 s or in which the expression ended within 1 s before the subsequent action began. Although we do not assume causal relations between expressions and actions, these coding criteria were adopted because we reasoned that observable emotional expressions that occur concurrently or immediately prior to an action are more likely to be functionally related to that action. In addition, these criteria may reduce the likelihood that a different unexpressed affective experience would intervene between an expressed emotion and action. If the emotion expression was ongoing for more than 10 s, a given emotion expression could be associated with multiple actions both within an epoch and across epochs.

Emotion expressions. Expressions of anger, sadness, and happiness were coded on the basis of facial, vocal, or postural cues. Expressions were coded if either one or more cues were present. Fear/anxiety was also coded, but was so infrequent that we did not include it in the current study. Table 1 summarizes facial, vocal, and postural cues used to code anger, sadness, and happiness.

Actions. In the Waiting Task and Transparent Box Task, coders discerned whether any of six actions occurred in each 10-s epoch. The child could employ more than one action per epoch.

1. *Problem solving:* statements and questions that are aimed at understanding the situation, its constraints, and solutions (e.g., asking, “How much longer do we have to wait?” in the Waiting

Table 1
Facial, Vocal, and Postural Cues for Coding Emotional Expressions

Emotion	Cue		
	Facial	Vocal	Postural
Anger	Furrowed brow, lips pressed or tightened, and a clenched jaw	A harsh vocal quality conveying protest and vocalizations with a loud and deep pitch	Arms akimbo (fists placed on each hip) and finger wagging or jabbing
Sadness	Lip corners turned downward, drooping eyes, and a brow forming an oblique shape	Lowered or whiny vocalizations but without protest	The head dropped down and to the side, shoulder and/or body slumping, and eye-rubbing to mask tears
Happiness	Smiling, corners of mouth turning upwards, and eyes crinkled	A light and lilting voice (e.g., laughing, giggling, etc.)	Jumping or raising arms in glee, puffing out the chest, and clapping hands with delight

Task), or enacting possible solutions to the task (e.g., trying different ways to open the transparent box with the key or asking the experimenter once she returns, "How does this lock work?").

2. *Behavioral distraction*: doing something other than focusing on the task at hand, including chatting with the mother during the Waiting Task, engaging in imaginary play, dancing, or singing.

3. *Attentional distraction*: turning attention away from the task at hand by shifting gaze, staring into space, laying his or her head on the table.

4. *Focus on desired object*: looking at or touching the desired but unavailable/prohibited object (i.e., the wrapped gift in the Waiting Task and the toy locked inside the box in the Transparent Box Task) without seeking information about it.

5. *Soothing*: self-soothing (e.g., thumb sucking, hugging self) and comfort seeking (during the Waiting Task, climbing on mother's lap or requesting soothing from mother; during the Transparent Box Task, telling the experimenter, "Help me, the box won't open," rather than seeking information about how to open the box independently).

6. *Disruptive behavior*: socially inappropriate actions or words directed toward the mother, experimenter, or objects in the room (e.g., defiant or aggressive, such as saying, "I want the present now, stupid!" in the Waiting Task; throwing the keys on the floor or trying to break the box in the Transparent Box Task).

Because of differences in the base rate of emotions (e.g., the Waiting Task was longer, both tasks elicited fewer episodes of expressed sadness), expression-action sequences were converted into percentage scores, calculated as the number of epochs in which each ongoing emotion (anger, sadness, and happiness) was followed within 10 s or less by each of the six codable actions divided by the total number of episodes for that specific emotion (number of expression-action sequences/total number of emotion expression episodes). If one emotion was expressed but then stopped before an action was expressed, this expression-action sequence was *not* recorded. Therefore, two emotions could not be associated with the same action. Because some ongoing emotions were not followed by any actions within a 10-s range, or because some were followed by unobservable or uncodable actions, the percentages for each expression-action sequence did not add up to 100%.

In addition to expression-action sequences, the *range of actions* in which each child engaged after each emotion was computed separately for each task. This score was calculated by assigning 1 point to each action performed at least once. All behaviors were included except disruptive behaviors because the aim was to

measure behavioral flexibility. Arguably disruptive behaviors reflect perseveration on a goal rather than flexibility. In addition, disruptive behaviors had a low base rate (see Table 2). The minimum and maximum for range of actions in the Waiting Task was 0 to 5; in the Transparent Box Task, it was 0 to 4 for anger and happiness and 0 to 5 for sadness.

Interrater agreement. Emotion and action coding was done by two independent teams. For each team, coders were trained to an accuracy criterion of 80% based on agreement with a master coder. Interrater reliability was estimated on the basis of 15% of the cases, randomly chosen and judged using kappa coefficients. The average Cohen's kappa coefficient for emotion coding was .72 (ranging from .65 to .84); the average Cohen's kappa coefficient for actions was .82 (ranging from .68 to .92), reflecting moderate to excellent agreement.

Results

Table 2 shows means, standard deviations, and ranges for the frequency and percentage of observed expressions, actions, and expression-action sequences. The top portion of Table 2 shows frequencies and proportions (of total emotions expressed) for anger, sadness, and happiness. Some emotions were not codable, co-occurred, or were expressed infrequently (<1%); therefore, percentage scores may not sum to 100%.

Disruptive behaviors and self-soothing were uncommon among the participants: Fewer than 20% of children engaged in one of these behaviors. As a result, these variables were highly skewed and could not be transformed because of a high number of zero scores. We therefore omitted them from parametric analyses. However, because these behaviors are less common in typically developing children of preschool age during mild emotional challenges and may be of clinical interest, we examined them separately. Specifically, we examined whether disruption and soothing were more likely to co-occur with anger compared with sadness, and whether these patterns varied by task. These actions never occurred following happiness, and therefore could not be examined in relation to happy expressions. Dependent variables were percentage scores for emotion expression-action sequences only for those children who showed disruption and self-soothing during one of the tasks (15 children). Analyses were paired-sample *t* tests and a 2 (expression: anger and sadness) \times 2 (action: disruption and soothing) \times 2 (task: Waiting Task, Transparent Box Task) repeated measures analysis of variance (ANOVA). Logarithmic

Table 2
Observed Emotion Episodes, Actions, and Expression–Action Sequences

Observation	Waiting Task				Transparent Box Task			
	<i>M</i> frequency	<i>M</i> range	%	% range	<i>M</i> frequency	<i>M</i> range	%	% range
Emotion expression episodes								
Anger	6.83 (5.57)	0–33	19 (14)	0–63	4.36 (4.91)	0–26	54 (33)	0–100
Sadness	4.26 (4.16)	0–22	12 (11)	0–59	1.78 (3.56)	0–22	17 (24)	0–100
Happy	26.27 (14.09)	0–60	69 (21)	21–100	2.57 (3.30)	0–20	32 (32)	0–100
Actions								
Problem solve	6.56 (4.86)	0–24	9 (7)	0–34	18.35 (7.12)	0–36	70 (19)	15–100
Behavioral distract	44.33 (17.32)	0–98	58 (19)	0–91	2.25 (3.61)	0–20	7 (12)	0–56
Attentional distract	3.98 (7.20)	0–39	5 (8)	0–38	2.58 (2.71)	0–13	8 (9)	0–35
Focus on desired object	17.63 (13.20)	0–69	23 (13)	0–53	3.24 (3.31)	0–13	9 (11)	0–50
Soothing	1.27 (2.94)	0–19	2 (4)	0–21	0.08 (0.33)	0–2	0 (1)	0–8
Disruption	1.77 (4.65)	0–37	3 (7)	0–49	1.04 (2.06)	0–10	5 (13)	0–89
Expression–action sequences								
Anger–problem solve	0.71 (1.17)	0–8	10 (16)	0–100	2.73 (2.92)	0–15	57 (38)	0–100
Anger–behavioral distract	4.27 (3.41)	0–23	63 (31)	0–100	0.64 (1.69)	0–11	10 (21)	0–100
Anger–attentional distract	0.29 (0.69)	0–3	5 (13)	0–75	0.46 (0.97)	0–6	10 (22)	0–100
Anger–focus on object	1.51 (2.56)	0–19	18 (24)	0–100	0.56 (1.02)	0–6	10 (18)	0–100
Anger–soothing	0.17 (0.52)	0–4	2 (4)	0–25	0.02 (0.19)	0–2	0 (3)	0–29
Sad–problem solve	0.43 (0.73)	0–3	11 (22)	0–100	0.78 (1.43)	0–8	25 (39)	0–100
Sad–behavioral distract	2.51 (2.65)	0–12	48 (38)	0–100	0.39 (1.33)	0–11	9 (24)	0–100
Sad–attentional distract	0.22 (0.61)	0–3	4 (12)	0–75	0.19 (0.59)	0–4	6 (21)	0–100
Sad–focus on object	0.94 (1.89)	0–13	16 (24)	0–100	0.33 (1.07)	0–7	6 (20)	0–100
Sad–soothing	0.11 (0.39)	0–2	1 (6)	0–40	0.03 (0.21)	0–2	0 (2)	0–17
Happy–problem solve	1.97 (1.92)	0–8	9 (9)	0–33	1.83 (2.16)	0–9	53 (43)	0–100
Happy–behavioral distract	17.12 (10.31)	0–48	63 (20)	0–100	0.22 (0.68)	0–5	5 (14)	0–100
Happy–attentional distract	1.03 (2.20)	0–14	4 (8)	0–54	0.21 (0.73)	0–6	5 (14)	0–75
Happy–focus on object	5.67 (5.41)	0–29	20 (14)	0–56	0.32 (1.10)	0–9	7 (20)	0–100
Happy–soothing	0.35 (0.78)	0–4	2 (5)	0–40	0.00 (0.00)	0	0 (0)	0

Note. Values are means and standard deviations (in parentheses). Emotion percentages are out of all expressed emotions; action percentages are out of all observed actions; and emotion–action percentages are the percentages of instances in which the emotion was followed by a given action. Fear/anxiety emotional expressions and noncodable emotions and actions are not included.

transformations were applied to correct for positively skewed distributions of variables. All analyses were conducted with both transformed and untransformed values, but did not differ. Neither of these analyses yielded significant effects, that is, soothing and disruption were equally likely to occur following anger and sadness. Disruption and soothing were dropped from subsequent analyses.

To test study hypotheses with the entire sample, we conducted a 3 (expression: anger, sadness, happiness) \times 4 (action: problem solving, focus on desired object, attentional distraction, behavioral distraction) \times 2 (task: Waiting Task, Transparent Box Task) repeated measures ANOVA.¹ Dependent variables were percentage scores for each expression–action sequence. Follow-up tests were LSD, Bonferroni, or paired *t* tests. Logarithmic transformations were applied to correct for positively skewed distributions of all other variables. All analyses were conducted with both transformed and untransformed values. Because results did not differ, untransformed values are reported for ease of interpretation.

Task Effects on Emotional Expression

Before testing the hypotheses, the significant Expression \times Task interaction, $F(2, 111) = 7.02, p < .001, \eta^2 = .11$, suggested that each task was characterized by unique patterns of emotion expression. As seen in the top portion of Table 2, happiness was the predominant emotion in the Waiting Task: Sixty-nine percent

of the episodes of emotion involved happiness (i.e., involved only happiness or happiness co-occurred in the time frame with other emotions) compared with anger (19%) and sadness (12%), both $ps < .001$. In contrast, the Transparent Box Task elicited more expressions of anger (54%) compared with happiness (32%) and sadness (17%), both $ps < .001$. There was a significantly greater proportion of anger and sadness expressed in the Transparent Box Task versus Waiting Task, $t(112) = 5.39, p < .001$, and $t(112) = 2.21, p < .05$, respectively, and a greater proportion of happiness expressed during the Waiting Task versus Transparent Box Task, $t(112) = 10.00, p < .001$. The majority of children displayed negative emotions in these tasks designed to elicit frustration: Ninety-three percent of children in the Waiting Task and 85% in the Transparent Box Task displayed anger, and 81% in the Waiting Task and 48% in the Transparent Box Task displayed sadness.

¹ Because there were no specific hypotheses concerning gender and age and because effects were limited, analyses with gender and age are not reported here. There were two significant effects. First, the Gender \times Action effect, $F(3, 109) = 3.33, p < .05, \eta = .08$, showed that boys versus girls used behavioral distraction more frequently, $t(112) = 2.43, p < .05$. The Age \times Action effect, $F(3, 109) = 3.42, p < .04, \eta = .11$, showed that 4- versus 3-year-olds used more attentional distraction, $t(112) = -2.23, p < .05$.

Associations Between Emotion Expressions and Actions

The first hypothesis was that anger and happiness, compared with sadness, would be followed more frequently by actions that fit with the demands of the context during the two challenging tasks—distraction during the Waiting Task and problem solving during the Transparent Box Task. First, without taking context into account, anger and happiness compared with sadness were followed more frequently by actions: Expression \times Action interaction, $F(6, 107) = 3.82, p < .01$, partial $\eta^2 = .18$. Follow-up tests showed that anger versus sadness was more often followed by focus on solving the problem, $t(112) = 6.50, p < .001$, focus on wanting the desired object, $t(112) = 3.29, p < .001$, behavioral distraction, $t(112) = 4.24, p < .001$, and attentional distraction, $t(112) = 2.63, p < .01$. Happiness versus sadness was more often followed by problem solving, $t(112) = 4.40, p < .001$, and behavioral distraction, $t(112) = 2.50, p < .05$.

As predicted, these expression–action patterns differed between tasks: Expression \times Action \times Task effect, $F(6, 107) =$

8.32, $p < .001, \eta^2 = .32$. As seen in Figure 1, within the Waiting Task, anger versus sadness was more often followed by behavioral distraction, $t(112) = 4.08, p < .001$. Within the Transparent Box Task, anger versus sadness was more often followed by problem solving, $t(112) = 7.70, p < .001$, focus on the desired object, $t(112) = 3.25, p < .01$, and attentional distraction, $t(112) = 2.49, p < .05$. In addition, in the Transparent Box Task only, anger compared with happiness was more often followed by behavioral distraction, $t(112) = 2.37, p < .05$. Anger and happiness did not otherwise differ in their temporal associations with actions.

Comparing happiness with sadness, results were similar to those for anger versus sadness, but reached significance only for those actions hypothesized to be most context appropriate: Happiness versus sadness was more often followed by behavioral distraction in the Waiting Task, $t(112) = 4.09, p < .001$, and by problem solving in the Transparent Box Task, $t(112) = 5.20, p < .001$.

Although sadness was associated with relatively fewer actions, within the Waiting Task sadness was most often followed by

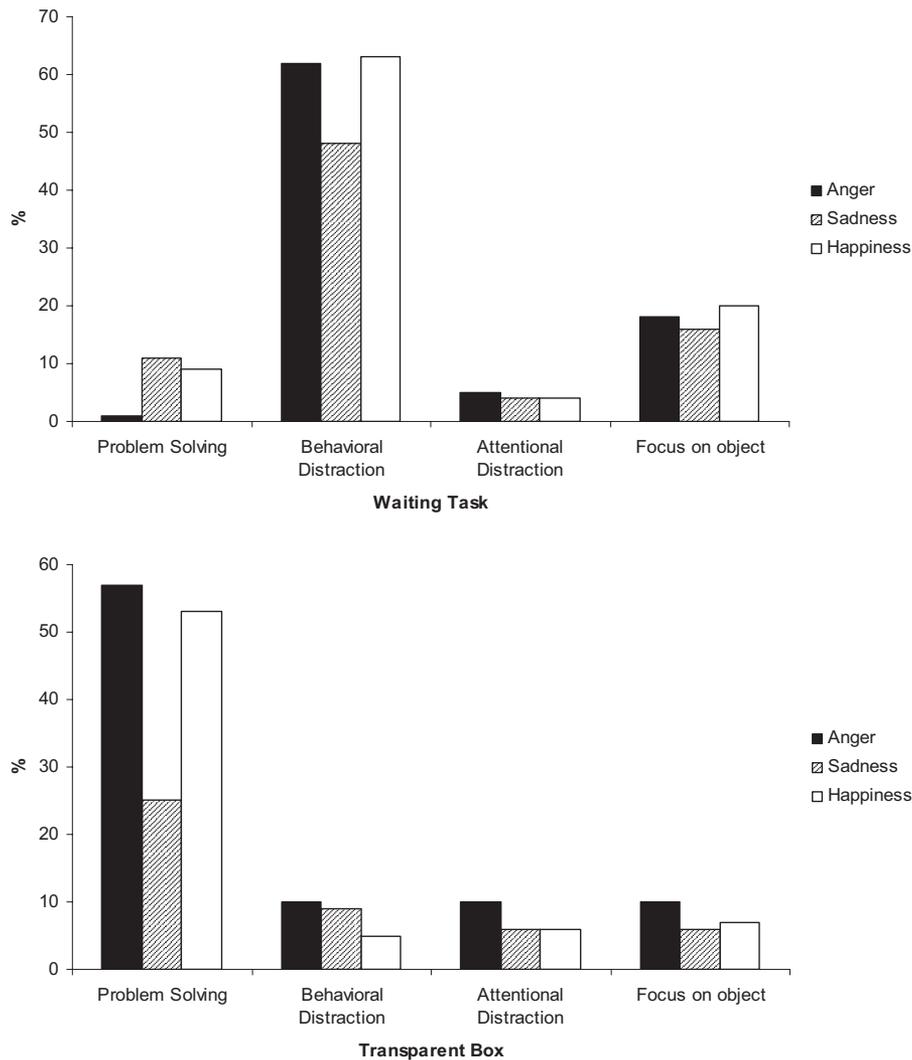


Figure 1. Expression \times Action effects varied between the Waiting Task and Transparent Box Task.

behavioral distraction compared with all other actions, ($ps < .001$); in the Transparent Box Task, sadness was most often followed by problem solving compared with all other actions ($ps < .001$). Therefore, sadness may reduce the amount of effortful actions but may not fundamentally affect the types of actions (e.g., distraction) that are used to cope with distinct emotional challenges compared with happiness and anger.

Emotion Expressions and Range of Actions

The second hypothesis was that anger versus happiness would be followed by a greater number of context-appropriate actions, but that happiness compared with anger and sadness would be associated with a broader range of actions. To test this hypothesis, a 3 (Expression) \times 2 (Task) \times 2 (Gender) \times 2 (Age) repeated measures ANOVA was conducted. There was a significant Expression \times Task effect, $F(2, 111) = 47.29$, $p < .001$, $\eta^2 = .47$, suggesting that range of actions varied by emotion and task. No significant age or gender differences emerged. In the Waiting Task, as predicted, happiness was followed by a broader range of actions compared with anger, $t(112) = 8.49$, $p < .001$, and sadness, $t(112) = 12.31$, $p < .001$, and anger was associated with a broader range of actions compared with sadness, $t(112) = 4.19$, $p < .001$: Average range of action scores in the Waiting Task were happiness, $M = 3.19$, $SD = 1.08$; anger, $M = 2.16$, $SD = 1.12$; and sadness, $M = 1.65$, $SD = 1.17$. In the Transparent Box Task, however, anger was associated with the broadest range of actions compared with happiness and sadness, $t(112) = 4.00$, $p < .001$, and $t(112) = 7.10$, $p < .001$, respectively; happiness was associated with a broader range of actions compared with sadness, $t(112) = 2.45$, $p < .05$: Average range of action scores in the Transparent Box Task were anger, $M = 1.66$, $SD = 1.14$; sadness, $M = 0.78$, $SD = 1.09$; and happiness, $M = 1.16$, $SD = 0.98$.

Discussion

Young children use an array of actions to cope with distress and frustration, such as making active attempts to solve problems, trying alternative solutions, and shifting attention away from unattainable goals (Cole, 1986; Grolnick, Bridges, & Connell, 1996; Putnam et al., 2002; Rothbart, Ziaie, & O'Boyle, 1992; Shoda et al., 1990). The present study demonstrates that young children's negative emotional expressions are associated with *appropriate* rather than *inappropriate* action, and that those actions are functionally linked to specific situational contexts. However, contrary to prediction, specific emotions—anger, sadness, and happiness—were not associated uniquely with different actions; rather, they were associated with differences in the degree to which actions occurred. Thus, this first attempt to examine functional relations between young children's emotion expressions and actions revealed quantitative rather than qualitative differences in action, which are more consistent with dimensional than discrete views of emotion (L. F. Barrett, 2006a; Lang, 1995). This first step in examining these relations between emotion expressions and actions, therefore, yields some interesting findings and raises additional questions concerning dimensional versus discrete views of emotion, as well as the adaptive role of negative emotions and their implications for emotion regulatory competencies across contexts.

Although negative emotions are often thought of in the context of destructive or socially inappropriate actions in response to a challenge, the present study shows that the anger and sadness expressions of typically developing preschool-age children are often associated with appropriate actions. Specifically, anger compared with sadness was associated with a greater number of actions (both self-distraction and problem solving) to meet task demands, and happiness compared with negative emotions was associated with a greater range of actions in the Waiting Task, suggesting increased flexibility. Children's expression-action associations also varied as a function of situational context, revealing an important aspect of emotion regulation: Children often persisted at their goals when that was appropriate (they were instructed to try to open the box) and did not when it was not appropriate (they were instructed to wait).

In both tasks, anger was associated with a greater number of active attempts to deal with the situation within the social constraints and affordances of the situation. In the Waiting Task, the pairing of anger expressions and behavioral or attentional distraction may reflect children's ability to regulate frustration and distress by shifting attention away from the object they must wait to have (Calkins & Johnson, 1998; Grolnick et al., 1996; Shoda et al., 1990). In the Transparent Box Task, anger expressions were, as predicted, associated with problem-solving attempts to obtain the figurine, but also were more likely than sadness or happiness to precede distraction. Although persistence is desirable in this context, occasional shifts of attention away from the frustrating box may also reflect adaptive attempts to regulate distress in order to continue persisting or to disengage from the impossible task. Using tasks that elicit more immature or inappropriate behaviors or including participants with greater variability in behavioral and emotional disruptions may allow us to explore nonadaptive emotion expression-action associations, an important direction for future research. In the present study, the typically developing children appeared to cope well with the challenges. As a result, they might not have expressed the full range of emotion and action.

Although the findings for anger support the functionalist perspective, which asserts that specific classes of emotion are associated with specific action tendencies in relation to specific goals, sadness was not more likely to coincide with "giving up" or distinct types of actions compared with anger. Instead, the most frequent actions following sadness were consistent with patterns for anger and happiness, albeit at a significantly lower frequency: greater behavioral distraction during the Waiting Task and greater problem solving during the Transparent Box Task.

Therefore, the findings appear to be more consistent with dimensional views of emotion, which also predict associations between emotion expressions and actions (L. F. Barrett, 2006a; Lang, 1995). That is, the *relative* frequency of actions following anger and sadness was similar. Systematic variations in arousal or valence could account for this. Because anger is typically more arousing than sadness (Lang, 1995), anger would be associated with a relatively greater number of context-appropriate actions that serve to accomplish goals and modulate arousal.

On the other hand, because the situations studied were designed to elicit anger, sadness for that reason may have played a secondary role. Indeed, sadness was expressed by about half the children during the Transparent Box Task, even though the presence of an unattainable prize is likely to prompt hopelessness and sadness.

However, children may not have perceived that the prize was unattainable. It would be valuable in such tasks to examine patterns of longer sequences as many of the children did not succumb to sadness but instead may have rebounded from the sadness with renewed effort. Also, exploring a range of tasks designed to directly elicit sadness may clarify associations between sadness and adaptive attempts to cope with emotional challenges. The present study's coding scheme may also have compromised our ability to detect signature expression–action sequences for sadness. For example, passive waiting, a form of behavioral withdrawal, was not coded in the present study, but might reflect an important way in which inhibited or sad children regulate emotions and behavior (Asendorpf, 1991; Silk, Shaw, Forbes, Lane, & Kovacs, 2006; Silk, Shaw, Skuban, et al., 2006). More evidence is needed to disentangle the influences of anger and sadness on actions. In particular, emotion expressions would need to be measured during tasks that afford a wider range of actions, such that anger, sadness, and happiness expressions could be followed by qualitatively distinct behaviors.

Despite these limitations, the findings highlight the potential complementary roles of sadness and anger in challenging circumstances, consistent with the view that sadness may drive initial withdrawal and recovery responses to stress, whereas anger may reflect greater effort directed toward actively coping (M. Lewis, Sullivan, Ramsay, & Alessandri, 1992). The functionalist principle of equipotentiality is important to consider when interpreting results; this principle suggests that emotion expressive behavior and instrumental actions represent alternative means of achieving a goal and therefore are not always associated with one another (Camras & Witherington, 2005; Witherington, Campos, Anderson, Lejeune, & Seah, 2005). Future research should more carefully consider conditions under which emotions or actions are functionally linked to goals although they may not be associated with one another.

Happiness was predicted to occur along with a broader range of behaviors than anger, given the view of positive emotions as broadening behavior and anger as focusing behavior (Fredrickson, 2001). In fact, in the Transparent Box Task, anger was significantly associated with a broader range of actions compared with happiness and sadness, whereas in the Waiting Task, as predicted, happiness was significantly associated with a broader range of actions compared with both anger and sadness. These results suggest that both anger and happiness are “activating” emotions (Fredrickson & Branigan, 2005), but that in contexts for which behavioral persistence is appropriate, such as the Transparent Box Task, anger might promote greater flexibility than sadness, and in contexts for which waiting and social communication with mother are appropriate, such as the Waiting Task, positive emotions promote relatively greater flexibility than negative emotions.

It is important to recognize that there are not clear-cut measures of strategy flexibility. In the present study, flexibility was scored by giving a single point for an action category if it was performed at least once rather than assigning points each time an action was observed. This scoring technique allowed us to reduce overestimates of flexibility if a participant tended to enact an action category with a higher base rate (i.e., no matter how many times an action is enacted, a single flexibility point is assigned for each action type) as well as reduce underestimates of flexibility if a

participant tended to enact an action category with a lower base rate.

The present study's use of expression–action sequences suggests additional approaches that could also be fruitful to pursue, including examining variability in the lag time between an expression and specific types of behaviors and longer behavioral chains (e.g., action–expression–action). Expression–expression sequences might also be of interest in future research. For example, being happy initially and then becoming frustrated might be linked to distinct regulatory actions compared with being frustrated initially and then being happy while engaging in alternative actions. In addition, tasks such as the Waiting Task, in which caregivers might support child regulatory attempts or enhance the child's positive affect with their own positive emotion, provide the opportunity to explore the socialization of emotion and regulatory actions (Dennis, 2006; Diener & Manglesdorf, 1999; Grolnick, Kurowski, McMenemy, Rivkin, & Bridges, 1998; Kopp, 1989). Indeed, matching the unique demands of an emotional challenge with appropriate expression–action patterns may be a marker for social–emotional competence in children.

At the same time, the use of sequences of behaviors risks implying that emotion and its regulation of other processes, or its regulation by other processes, involve a linear, causal, temporal progression (first emotion happens, then an action is organized, which might in turn serve to regulate that emotion). Yet, given that emotion integrates and coordinates affect, behavior, cognition, and physiology, emotion regulation might be best conceived of as a dynamic, nonlinear phenomenon (Campos et al., 1994, 2004; M. D. Lewis, Lamm, Segalowitz, Stieben, & Zelazo, 2006). The present analytic approach also prevents causal attributions about emotions and actions. Indeed, given the temporal characteristics of emotions, which can vary over both brief and extended periods of time, future research is faced with the challenge of accurately representing the affective chronometry of multiple and at times co-occurring emotional experience and how they are related to various aspects and streams of action.

It is important to note that we coded only those expression–action sequences in which the ongoing emotion expression preceded the action within 10 s or in which the expression ended within 1 s before the subsequent action began. Other research has examined the sequential associations between expressions and actions with a longer time lag in between (e.g., Calkins et al., 2002). We chose to constrain coding in this way in order to increase the probability that an action is functionally related to an action, while reducing the likelihood that a different unexpressed affective experience would intervene between an expressed emotion and action. Future research should compare a range of coding strategies to examine the time course of expression–action sequences. These types of methodological issues are among the fundamental challenges in the study of emotion regulation: the artificial deconstruction of the ebb and flow of a child's emotional responses from the continuous regulatory processes that occur (Cole et al., 2004). Although it will be important for future research to use sequential analyses to examine the relations between emotions and actions, the analysis of temporal sequences is only one way to assess the co-organization of emotion and action during emotionally evocative and challenging circumstances.

In summary, the present findings document functional links between negative and positive emotions in preschoolers and adap-

tive actions to cope with emotional challenges. In addition, this study underscores the importance of context in understanding how emotion and action are related. Expression–action sequences may signal both adaptive and maladaptive functioning depending on the situation in which it occurred and can be further linked with competencies or problems. To pursue translational research goals, future studies should focus on how expression–action sequences relate to a range of problems and how these relations persist or change over time. For example, behavioral versus attentional distraction may be differentially linked to risk for internalizing versus externalizing problems. Such findings have implications for understanding of the role of emotion regulation in adjustment and maladjustment and could inform and constrain the development of intervention approaches for problems related to distinct aspects of emotional dysregulation.

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