Video Article

Psychophysiological Assessment of the Effectiveness of Emotion Regulation Strategies in Childhood

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Abstract

Effective regulation of emotion is one of the most important skills that develops in childhood. Research interest in this area is expanding, but empirical work has been limited by predominantly correlational investigations of children's skills. Relatedly, a key conceptual challenge for emotion scientists is to distinguish between emotion responding and emotion regulatory processes. This paper presents a novel method to address these conceptual and methodological issues in child samples. An experimental paradigm that assesses the effectiveness with which children regulate emotion is described. Children are randomly assigned to use specific emotion regulation strategies, negative emotions are elicited with film clips, and changes in subsequent psychophysiology index the extent to which emotion regulation is effective. Children are instructed to simply watch the emotion-eliciting film (control), distract themselves from negative emotions (cognitive distraction), or reframe the situation in a way that downplays the importance of the emotional event (cognitive reappraisal). Cardiac physiology, continuously acquired before and during the emotional task, serves as an objective measure of children's unfolding emotional responding while viewing evocative films. Key comparisons in patterns of obtained physiological reactivity are between the control and emotion regulation strategy conditions. Representative results from this approach are described, and discussion focuses on the contribution of this methodological approach to developmental science.

Video Link

The video component of this article can be found at https://www.jove.com/video/55200/

Introduction

Children experience negative emotions like sadness and fear every day. As they develop and mature, children learn regulatory strategies that allow them to manage a broad range of stressors and challenges to adapt to the world. Their emotion regulation repertoire expands, and shifts in composition from primarily behavioral strategies to include more cognitive strategies[1]. By the end of middle childhood, children regulate their emotions using both cognitive and behavioral strategies[2]. Understanding the effective regulation or management of unwanted negative feelings has become increasingly interesting to developmental scientists in recent years. This interest is driven, in part, by research linking emotion regulation processes to a host of social, emotional, and cognitive outcomes with substantial consequences for children's daily lives (*e.g.*, academic achievement[3], friendships[4], and psychopathology[5]).

The method described here focuses on two cognitive emotion regulation strategies that have received the lion's share of empirical attention to date: reappraisal and distraction. Studies done with adults have shown that reappraisal and distraction are effective methods for alleviating emotion[6,7,8,9,10,11]. Reappraisal, which involves changing or reframing *how* one interprets an emotion or problem, has been shown to be effective in reducing the intensity of negative emotions in school-aged children[12,13]. Distraction, in contrast, involves changing *what* one is thinking about, such as when a child about to receive a vaccine thinks instead of the ice cream they will enjoy with their parent afterwards. Children can also begin to use these cognitive strategies to regulate negative emotions effectively, from as young as 5 - 6 years of age[14].

The Theoretical and Practical Challenges of Studying Emotion Regulation

Emotional reactivity and regulatory processes are intertwined, bidirectional, and iterative[15,16]. Thus, a key conceptual challenge for developmental scientists is to identify and employ methods that meaningfully distinguish between emotion responding and regulatory processes. The approach described here takes the view of emotions as *regulated* (in contrast to emotions as *regulating*)[15]. Emotion regulation is defined as the process of changing an experienced emotion[17] in ways that alter the intensity, duration, and/or valence of the emotion[18].

Despite promising behavioral evidence that cognitive emotion regulation strategies like distraction and reappraisal reduce negative emotions[14], there are many limitations to the predominant self-report or observational methodologies that constrain the conclusions that can be drawn from existing empirical studies, especially with young children. For example, self-report of emotional experience is subject to inaccuracies and demand characteristics. Although behavioral observation (*e.g.*, of facial expressions) to index emotional responding is ostensibly more objective than self-report, observation is still subject to automatic and explicit regulatory processes that mask or hide the true experience of distress or negative emotion. To address these conceptual and methodological issues, this paper describes a method of examining the effects of emotion

regulation strategies on children's subsequent psychophysiology that allows researchers to more clearly distinguish between *reactivity* to and active *regulation* of negative emotions. This experimental paradigm for eliciting negative emotions and assessing the consequences of different instructed emotion regulation strategies provides an approach that can be used with children of a wide range of ages, adolescents, or adults.

Psychophysiology Is a Non-Invasive Index of Emotion Regulation

Respiratory Sinus Arrhythmia (RSA) is a commonly used index of parasympathetic cardiac psychophysiology, and has emerged as a key correlate of children's emotion regulatory ability[19,20]. RSA is derived from the measurement of heart rate variation (controlled by efferent fibers of the vagus nerve) within the respiratory cycle[21,22]. High baseline RSA indicates better emotional regulation and socio-emotional competencies[21], whereas lower baseline RSA is linked to negative socio-emotional outcomes[23]. Baseline RSA reflects the system's regulatory capacity to respond to stress, whereas changes in RSA from baseline levels under conditions of challenge (RSA reactivity) enable greater sympathetic influence and resource mobilization. This process reflects a shift away from homeostatic demands to the facilitation of sustained attention, behavioral self-regulation, and the generation of coping strategies to control affective or behavioral arousal[20,26]. RSA reactivity to challenging lab tasks is associated with better emotion regulatory abilities and general adaptive functioning, including less negative emotionality and risk for behavior problems and better sustained attention[21,23,24,25,26,27]. RSA reactivity to challenge can be described as increasing (RSA augmentation) or decreasing (RSA suppression) parasympathetic influence. The flexibility with which parasympathetic influence over the heart is regulated across contexts is thought to underlie adaptive emotion regulation.

Indeed, changes in children's RSA amplitudes during a series of challenging tasks predict their emotional regulatory skill[28]. RSA is responsive in emotionally challenging contexts as well. For example, RSA suppression (a decrease from baseline level to task level) is linked to experiencing fear and sadness, but augmentation (increase from baseline to task) is linked to effective regulation of emotion when sadness and fear are evoked via film clips[29,30]. Previous work that has capitalized on the utility of this non-invasive method for assessing *in vivo* emotion regulation processes has demonstrated how children's use of specific cognitive emotion regulation strategies predicted RSA reactivity while they were watching emotion-eliciting videos[31]. This paper describes a novel experimental paradigm that uses the physiological patterns associated with active emotion regulation to index regulatory ability, providing an innovative method to parse the experience and regulation of negative emotions.

Protocol

NOTE: The university's institutional review board approved all procedures before recruitment or data collection with human subjects began. Parents provide informed consent for children's participation, and children provide verbal (or, verbal and written if older than 7 years) assent to participate in these activities.

1. Randomly Assign Participants to Experimental Conditions

1. Test the effects of two different emotions and two different emotion regulation strategy instructions against a control group that receives no emotion regulation instructions, using a 2 (discrete emotion condition: sad or scary) x 3 (emotion regulation condition: control, distraction, or reappraisal) between-subjects experimental design.
   NOTE: Other experimental designs may also be used, as long as a suitable control group is included against which the effects of interest may be compared. For example, a neutral film condition, in which no emotion is evoked, could be included, or a within-subjects design could be used. Regardless, an approximately equal number of children should be assigned to each experimental condition.
2. Randomly assign children to one of the six conditions before they arrive at the laboratory (with the constraint that an approximately equal number of boys and girls are assigned to each condition).

2. Establish Rapport with Child Participants

1. The following are procedures for the lead experimenter, E1 to follow. At the beginning of the visit, establish rapport with the child to ensure their compliance with study procedures.
2. Sit at a small table with the child, and introduce art supplies the child can use if desired (*e.g.*, crayons, paper). Ask 2 - 3 questions about the child's hobbies and interests to engage the child in friendly conversation.
3. Once the child appears to have acclimated to the laboratory context and is relaxed in his or her interaction (usually about 5 - 10 minutes), begin other procedures.

3. Train Children to Self-report Their Emotions

1. Train children to self-report the intensity of their emotional reactions (*e.g.,* sadness, fear, happiness) on simple, four-point cartoon face scales to rate each discrete emotion of interest separately (see **Figure 1**). Each scale depicts a neutral face (*e.g.,* “not at all” Sad/Scared/Angry/Happy”) followed by three faces depicting increasingly exaggerated (*A Little*, *Pretty Much*, *Very*) target facial expressions for each emotion.
2. Present one scale to the child, and read the scale anchors aloud while pointing to each corresponding face.
   NOTE: Say, "Today we are going to play a lot of different games, and sometimes we will ask you to tell us what you are thinking and feeling. This scale shows some sad faces. You can use this to tell us how sad you are feeling at different times today."
3. Demonstrate use of the scale.
   NOTE: Say: "So, this face is where you would point if you feel 'Not at All' sad [*points to first face*]; This one is where you would point if you feel 'A Little' sad [*points to second face*]; This one is where you would point if you feel 'Pretty Much' sad [*points to third face]*; And this one is where you point if you feel 'Very' sad [*points to fourth face*]."
4. Repeat this training process for each emotion of interest (*e.g.*, sadness, fear, anger, happiness).
5. For each emotion scale, give the child two practice questions to ensure comprehension. If children point to an incorrect face, or express confusion about what to do, repeat the instructions (and practice trials) until children answer two practice items correctly.
   NOTE: Say (*e.g.*, "Which face would you point to if you felt *very* sad?" and, "Where would you point if you felt *not at all* sad?").

6. After the training trials, explain to the child that they will be asked to report feelings using the same scales a few more times during the study.

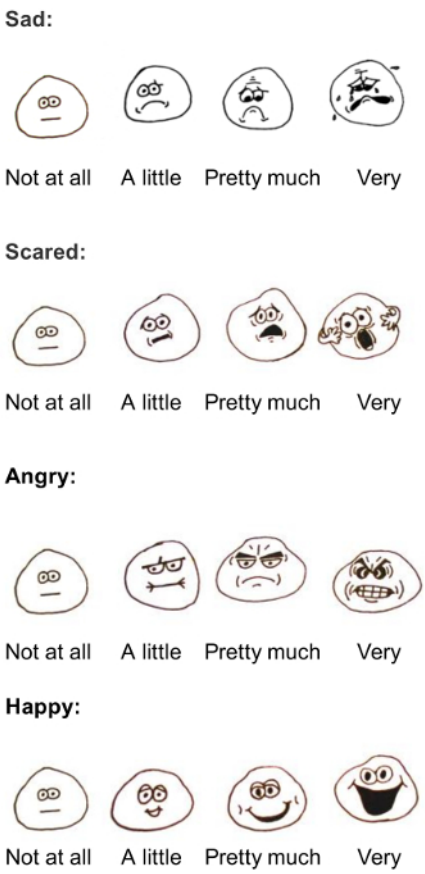

Figure 1. Emotion Rating Scale. This scale displays the picture scales that the researcher shows the children throughout the experiment to collect in-the-moment ratings of how sad, scared, and happy they are. Please click here to view a larger version of this figure.

4. Acquire a Baseline Report of Children's Emotions

1. Ask children to self-report how they are "really feeling, *right now,"* using the same 4-point emotion face scales before children receive emotion regulation instructions or view any film clips.
2. This self-report constitutes the baseline emotion assessment that is necessary to ensure that children do not feel pre-existing negative emotion that would influence their reaction to the experimental manipulation. Children additionally report their sad, scared, and happy feelings again using this same format after viewing the sad or scary film clip.

5. Acquire Cardiac Psychophysiology Data

1. Have the second adult experimenter (E2) enter to assist with electrode placement.
   NOTE: E2 explains that children wear sticky sensors on their torsos so that the experimenters can monitor their hearts during the study.
2. Frame electrode placement as a game to improve children's compliance with the procedure. As part of the "sticker game," the child chooses multiple stickers from a sheet and can keep them, place them on the experimenters, place them on their parent, or wear them on their own body.
3. Secure stickers (selected by the child) to three disposable, pre-gelled electrodes and place these over the child's distal right collarbone, lower left rib, and lower right rib to acquire the ECG signal.
   1. Ask parents if they are comfortable with E2 placing the electrodes on their children. If not, ask parents to help place the electrodes on their children's torsos, with guidance from E2.
4. After attaching the electrodes, give the children 5 min to acclimate to wearing the sensors, then acquire a resting parasympathetic baseline. Record baseline electrocardiogram (ECG) for five minutes. During this baseline phase, children sit quietly at a table with E1, coloring or reading a book.
5. Continue the ambulatory, wireless ECG recording for the rest of the visit with the ambulatory monitor secured in a child-sized backpack hung on the back of a chair to minimize movement artifacts. ECG signal for ambulatory acquisition is typically sampled at a rate of 500 ms and bandpass filtered at 40 and 250 Hz.
6. At the end of the study, gently remove and discard the electrodes
   NOTE: This is analogous to removing an adhesive bandage in terms of potential discomfort to the participant.

6. Provide Children with Emotion Regulation Instructions

1. Based on experimental condition assignment, provide each child with specific, scripted emotion regulation instructions before showing them a film clip designed to evoke negative emotion.
    1. For children assigned to the Control condition
        1. Show a short movie to the children and instruct them pay attention to all the things that happen in the movie. NOTE: Instructor says: "I'm going to show you a short movie now. Pay close attention to the movie because we will ask you some questions about it later. While you watch this movie, I want you to just try to pay attention to all the things that happen in the movie, ok? Can you try to do that? Ok, so what are you going to try to do while you watch the movie?"

    2. For children assigned to the Distraction condition
        1. Show a short movie to the children and instruct them pay attention to the movie. Instruct the children if they feel bad or upset, then to think about something happy instead. NOTE: Instructor says: "I'm going to show you a short movie now. Pay close attention to the movie because we will ask you some questions about it later. While you watch this movie, if you start to feel bad or upset, I want you to think about something happy instead. You could think about a time you had fun playing, or eating ice cream, or think about a TV show you like to watch. Anything that you can think of that is happy is ok to think about instead, ok? Can you try to do that? Ok, so what are you going to try to do while you watch the movie?"

    3. For children assigned to the Reappraisal condition
        1. Show a short movie to the children and instruct them pay attention to the movie. Instruct the children if they feel bad or upset, then to think that it's not really happening.
        NOTE: Instructor says: "I'm going to show you a short movie now. Pay close attention to the movie because we will ask you some questions about it later. While you watch this movie, if you start to feel bad or upset, I want you to think about how everything that is happening in the movie is not really happening, so it's not a big deal. Think about how it's just a movie, and isn't real, ok? Can you try to do that? Ok, so what are you going to try to do while you watch the movie?"

2. Provide follow-up questions at the end of the specific instructions to ensure that children understand what they should do. Repeat instructions for any child who expresses confusion about what to do.
NOTE: Follow up question such as, "what are you going to try to do?"

7. Elicit Negative Emotion

1. Show children standardized film clips to elicit negative emotions (*e.g.*, sadness or fear). Though a variety of film clips can be chosen, clips should be brief (about 3 - 5 min long), age-appropriate, and acceptable to parents (*e.g.*, films with a G or PG rating should be chosen).
NOTE: Before running the experiment, pilot test the film clips with the target age range to ensure that the expected discrete emotion or negative affective state is evoked with sufficient intensity and specificity.Though sadness and fear are examined in this protocol, other negative and positive emotions can be evoked as desired using other film clips.
    1. Elicit sadness by showing children a brief (~5 minutes) scene from *The Land Before Time*[32].
    NOTE:In the clip, a young dinosaur searches for his mother during a storm. She has been injured and shortly after he finds her and they have a conversation, she dies. The little dinosaur is left alone and lost and cries while he tries to find his way back to the main herd.
    2. Elicit fear by showing children a brief (~5 minutes) scene from *The Secret of NIMH*[33].
    NOTE: In the clip, a mouse navigates her way through a dark and eerie cave (an owl's lair) to seek help for her son, who is ill. Inside the cave, she trips over piles of bones, and is almost eaten by a giant spider before coming face-to-face with the owner of the cave, a giant scary owl who devours a moth in front of her, and crushes the spider. She has a brief conversation with the owl in which she asks for advice about how to help her son.

2. After watching the emotion-eliciting film, ask children to self-report their feelings again using the face scales. Later, compare this second self-report to the baseline emotion rating to ensure the emotion manipulation was effective.

8. Alleviate Intense or Lingering Negative Emotions

1. After completion of the task and removal of the electrodes, provide a positive affect emotion induction to ensure children do not leave the laboratory feeling upset.
NOTE: As with the previous film clips, choose a film that is brief (about 3 - 5 minutes long), age-appropriate, and acceptable to parents (*e.g.*, with a G or PG rating).
2. Elicit positive emotion in children by showing a short film (~4 minutes) called *For the Birds*[34].
NOTE:In the clip, a bird lands on a telephone wire, is joined by several other birds, and then by a big, awkward looking bird. A series of amusing interactions takes place, and the clip ends with all the birds laughing together.
NOTE: If a child becomes unduly upset at any point during the study, follow ethical guidelines for working with children. If a child seems overly distressed by any aspect of the protocol (*e.g.*, watching the sad or scary film), take a short break. After allowing the child to calm down for ~30 s, check to see if the child is ready to continue or if they need a longer break.
NOTE: If a child continues to be excessively distressed, call the parent in to the room to help comfort their child. If the distress persists for longer than a couple of minutes, the child cannot calm down, or the participants wish to discontinue participation (in the task or study altogether) the protocol should be stopped immediately, and the positive affect induction begun to conclude the visit.

9. Process and Code Physiology Data

1. Continuously record electrocardiogram (ECG) throughout the laboratory tasks and process these data offline (as described in 9.2 - 9.6).
   NOTE: Respiratory sinus arrhythmia (RSA), the measure of parasympathetic physiology of interest to index children's online emotion regulation, is derived from the ECG signal using a software program (*e.g.*, Mindware Heart Rate Variability). The Mindware software program allows for behavioral or procedural event markers to be inserted into the physiological data stream on- or off-line.
2. Use the heart-rate editing software's validated algorithm[35] to detect interbeat intervals (IBIs) and intervals that are physiologically improbable based on the overall distributions of collected data.
   1. After opening the software, select the correct participant file on the data file path. In the events and modes tab enter the correct start and end time of the episode and enter 30 s as the segment time.

3. In the calibration settings tab, select the high frequency range for the age of children in the study. For children between 3 and 12 years of age, respiratory sinus arrhythmia (RSA) is defined as the natural log integral of the .15 - 8 Hz power band[36,37]
   1. Then, click on the Analyze (ENTER) button on the lower right. Observe a segment of the data appear on the screen with the question "Is the EKG inverted?". Visually inspect the data and respond no if it looks normal or yes if it looks inverted.

4. Visually inspect data for artifacts and make corrections as needed. Blue dots indicate that there is no need to edit the data, yellow dots indicate that the data should be carefully inspected and edited.
   1. Click the green "Edit Rs" button at the top to inspect and edit a segment of data. Check the RSA value for each segment on the RSA section on the lower right of the screen. Values should be between 0 - 10.

5. Write the clean and edited data to a spread sheet file using the white "Write" button on the top of the page. When done writing out segments, click the red "Done" button at the top of the screen.
   1. Using the spread sheet file, calculate interrater reliability on ~25% of cases. To constitute a reliable match, final RSA values for any 30 s epoch from two scorers should fall within 0.1 of one another[31,38,39]. Raters should agree on at least 85% of the epochs.

6. In the spread sheet file, click on the "HRV stats" tab to retrieve RSA values for each coded segment. Calculate RSA scores for an episode by averaging all segments within the episode.

10. Calculate RSA Reactivity Scores

1. Calculate RSA reactivity using one of the methods described below.
   1. First, calculate RSA reactivity as the simple difference between the baseline (sitting quietly) and challenge (watching an emotion-eliciting film) tasks. Subtract the baseline value from the average task value for each participant (*e.g.*, RSA during sad movie = 7.20; RSA during baseline = 7.00; task minus baseline: 7.20 - 7.00 = .20).
      NOTE: In this approach, positive reactivity values indicate that RSA has increased (RSA augmentation) relative to baseline. Include baseline RSA values as a covariate in other analyses to account for individual variation in initial level when characterizing the pattern of change within the experimental context.

2. Calculate RSA reactivity as a residualized change score by predicting task RSA from baseline RSA in a linear regression. Save the standardized residuals from this analysis as a new variable. In this approach, positive reactivity values indicate that RSA increased more than sample average.

11. Data Analysis

1. Conduct a manipulation check using children's self-reported emotions.
   NOTE: Preliminary analyses (*e.g.*, one-way ANOVA) should compare children's ratings of each emotion at baseline to ensure that there are no differences in emotion ratings by experimental condition before viewing the films.
   1. Determine whether the emotional films elicited the intended negative emotion by comparing children's baseline self-report ratings (before film) to ratings provided immediately after the film using paired samples t-tests or ANOVA.
      NOTE: Significant increases in target emotion suggest that the films evoked the target emotion. If multiple negative emotions are assessed via self-reports (*e.g.*, sadness and fear), an alternate way to ensure the effectiveness of the emotion elicitation is to compare the intensity of different emotion ratings provided immediately after the film. The target negative emotion (*e.g.* sadness) should be evoked significantly more strongly than other negative emotions (*e.g.*, anger, fear).

2. Examine the effect of emotion regulation instructions on children's physiological reactivity. Use ANOVA to compare children's baseline RSA levels across the different emotion regulation instruction conditions and ensure there were no differences in RSA before viewing the film (again serving as a check of the assumptions of random assignment).
   NOTE: RSA reactivity (change from baseline to task) that represents an increase from baseline levels (augmentation) is typical when emotions are evoked using film clips[29,30,31]. Examination of average baseline RSA and average task (film viewing) RSA should show a significant increase in RSA for all participants, regardless of experimental condition.
   1. Examine differences in RSA reactivity patterns among experimental conditions using ANOVA, with covariates included as needed.
      NOTE: RSA reactivity is the dependent variable of interest here, but similar procedures can be used to examine other indices of emotional processes (continuous coding of facial expressions, for example).

3. To probe ANOVA results, conduct pairwise comparisons to identify the significant differences in RSA reactivity scores between different experimental conditions.

NOTE: Recall that Control group participants are not instructed to use a specific emotion regulation strategy to manage sadness or fear. Thus, key contrasts in RSA reactivity are between the two experimental strategy conditions (Distraction and Reappraisal) and the Control condition.

Representative Results

As shown in **Figures 2** and **3**, a typical result is that instructing children to use cognitive emotion regulation strategies leads to a different pattern of RSA reactivity than simply viewing the emotional film (Control). This supports the idea that instructions to regulate negative emotion using distraction or reappraisal give rise to different patterns of physiological responding during an emotionally challenging task, given the difference in responding among children in the Control condition and the strategy conditions.

Different methods for quantifying RSA reactivity have distinct implications for the interpretation of the results. **Figure 2** presents RSA reactivity, computed as a difference score, as the dependent variable. This calculation provides information about the direction (*i.e.* a positive or negative change in RSA from baseline levels) and magnitude of the change. Positive difference scores indicate RSA augmentation and enhanced parasympathetic influence. In contrast, **Figure 3** depicts results of the same analysis with a different computation of RSA reactivity (standardized residuals) used as the dependent variable. These residualized change scores account for the initial level (baseline) of each participant, and quantify the extent to which RSA reactivity is greater than (positive change scores) or less than (negative change scores) the average change for the entire sample. Because reactivity with this second computation is relative to the sample average, interpretation must avoid describing reactivity in absolute terms. Instead, **Figure 3** suggests that children in the *Reappraisal* condition showed RSA reactivity comparable to the sample average ($M = 0$), children in the *Distraction* condition showed relatively less RSA augmentation than average, and the reactivity of children in the *Control* condition was greater than average for the sad film, but average for the scary film. Thus, researchers should select the desired statistical approach to quantifying RSA reactivity data that allows for a generalizable (**Figure 2**) or sample-specific (**Figure 3**) interpretation.

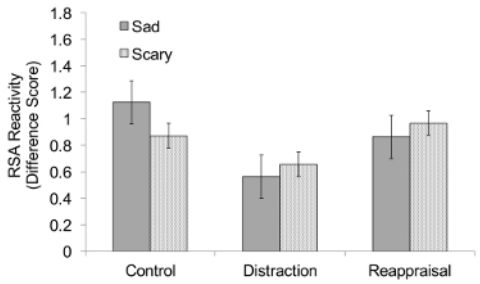

Figure 2. RSA Reactivity to the Sad and Scary Films (Calculated as a Difference Score) by Emotion Regulation Condition. This bar graph displays children's RSA reactivity to the sad and scary films in each of the three between-subject instruction conditions (Control, Distraction, Reappraisal). Error bars represent standard error. Please click here to view a larger version of this figure.

Figure 3. RSA Reactivity to the Sad and Scary Films (Calculated as Residualized Change Scores) by Emotion Regulation Condition. This bar graph displays children's RSA reactivity to the sad and scary films in each of the three between-subject instruction conditions (Control, Distraction, Reappraisal) using the same dataset as **Figure 2**. Error bars represent standard error. Please click here to view a larger version of this figure.

Discussion

Critical Steps within the Protocol

Effectively eliciting negative emotion and instructing children to use specific emotion regulation strategies are the critical steps within the protocol.

Modifications and Troubleshooting

Film clips must be selected (and pilot tested) to be age-appropriate given the age range in question to ensure they evoke the target emotions of interest for the specified age ranges. Researchers should also take care to make sure that children understand the emotion regulation

instructions. After providing regulatory instructions, researchers should ask children what they will do if they start to feel the target negative emotion (*e.g.*, sad, scared) and ensure that children can repeat the instructions before the film task begins.

Limitations of the Technique

Limitations to this technique include the generalizability of physiological regulation from a brief lab-based evocation to real world contexts. For example, film clips are brief in duration and the negative emotions they evoke are often short-lived. People's emotional engagement during a brief clip may be very different from their engagement in real world events, and as such, individual motivation to engage in regulatory strategies and their subsequent performance on lab-based versus real-world emotional challenges may vary widely as well. To the extent that the cognitive emotion regulation strategies examined here impose cognitive load, they could influence RSA differently than other emotion regulation strategies. In addition, alternative baseline tasks and conditions (*e.g.*, watching a neutral film) should be considered in conjunction with the goals of the researcher. Future work should combine physiological assessments of emotion regulation with experiential and behavioral assessments to gain a more comprehensive picture of effective regulation.

Significance of the Technique with Respect to Existing/Alternative Methods

Given the difficulty in separating the experience of emotion from active regulatory attempts, this approach answers the call for techniques that parse reactive and regulatory processes to provide conceptual and methodological clarity[15]. The experimental paradigm demonstrates that engagement in purposeful, active emotion regulation can be quantified by examination of RSA reactivity, and separated from the experience of negative emotions. Findings from this paradigm represent a first step towards understanding how emotion regulation strategies relate to changes in children's emotional responding. This is noteworthy because this work focuses on strategies that are cognitive (such as distraction and reappraisal), making them harder to assess through traditional approaches to examining children's emotional responding in the laboratory (*e.g.*, observations, self-report, parent report). The advantage of this approach is particularly evident early in development when children are less able to articulate or explain their regulatory choices. This psychophysiological method of assessing emotion regulation in children gives the opportunity to acquire information about children's active regulatory processes as they unfold that cannot be acquired through observations and self-reports.

Future Applications or Directions after Mastering the Technique

The use of film clips to elicit negative emotions has multiple benefits. Not only does this approach allow for greater levels of experimental control and minimize movement artifacts by having children sit during the tasks, but may also minimize measurement invariance issues, given that films have successfully been used to evoke discrete emotions in child participants across a wide range of ages[12,31]. Future research can take advantage of this type of paradigm to examine how individual differences (*e.g.*, pre-existing emotional regulatory skill, cognitive functioning, exposure to trauma, personality) can influence people's physiological reactivity in emotional contexts. Such an approach would shed light on the important psychological questions of *which individuals*, or *under which conditions* an individual may benefit more or less from specific emotion regulation strategies.

In sum, this novel lab-based paradigm advances understanding of the interrelation of emotional reactivity and regulation, by providing a controlled technique for eliciting negative emotions and measuring subsequent physiological responding that corresponds to the use of different emotion regulation strategies.

Disclosures

The authors have nothing to disclose.

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