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An Evaluation of the Validity of a Script-Driven Imagery Procedure among Traumatic Event Exposed Adolescents

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An Evaluation of the Validity of a Script-Driven Imagery Procedure among Traumatic Event Exposed Adolescents

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Abstract

Extensive research suggests script-driven imagery procedures employed with traumatic event-exposed adults produce reliable reactions that map onto contemporary models of posttraumatic stress, including increased physiological (Carson et al., 2000; Orr et al., 1998; Ramón et al., 2006) and negative affective (Pitman et al., 1987) responses to trauma scripts. Therefore, such procedures can be utilized in a controlled, laboratory-based setting, supporting mechanism-oriented research designed to better understand the nature, correlates, and consequences of traumatization and posttraumatic stress symptoms (PTSS). Unfortunately, only one study has begun to evaluate the validity of script-driven imagery procedures for use with youth, making further investigation of this important methodology crucial for developmental psychopathologists seeking to use script-driven imagery procedures among youth. The current study examined responding to script-driven imagery in relation to PTSS within a sample of 60 traumatic event-exposed adolescents, ages 10 to 17 years. Results showed that PTSS predicted self-reported fear, disgust, and distress responses to the script, as well as re-experiencing and dissociation symptoms elicited. However, PTSS did not predict self-reported anxiety, avoidance or total PTSD symptoms elicited by the script, or any physiological variables, including heart rate, facial EMG, or skin conductance. As expected, adolescents' self-reported thought problems did not predict any affective, physiological, or PTSD symptom outcomes in response to the script-driven imagery procedure, suggesting a degree of divergent validity for PTSS as a predictor. Unexpectedly, there were no significant effects of gender on any affective, physiological, or PTSD symptom outcomes. Implications will be discussed in terms of the developmental stage of adolescence, the differences in using script-driven imagery with youth compared to adults, and the importance of this new methodology for youth PTSD research.

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Available evidence supports the utility of script-driven imagery procedures in the study of posttraumatic stress phenomena among adults (McTeague et al., 2010; Orr et al., 1998; Pitman, Orr, Forgue, de Jong, & Claiborn 1987; Ramón et al., 2006). For example, such procedures have allowed for the real-time assessment of the interplay between negative affectivity produced by memories of a traumatic experience and substance-related cravings (Beckham et al., 2007). Such research is critical for informing both prevention and treatment-oriented interventions for individuals experiencing traumatization, posttraumatic stress disorder (PTSD), and related conditions. Unfortunately, the validity of script-driven imagery procedures has not been thoroughly evaluated for use with adolescent populations despite evidence suggesting that more than 60% of youth experience a traumatic event by age 16 years (Copeland, Keeler, Angold, & Costello, 2007), and such exposure constitutes a risk factor for psychopathology (e.g., Buka, Stichick, Birdthistle, & Earls, 2001; Nader, 2008). Indeed, only one study (Kirsch, Wilhelm, & Goldbeck, 2015) has examined script-driven imagery use among youth. The overarching objective of the current study was, therefore, to empirically evaluate the validity of a script-driven imagery procedure for use with adolescents.

PTSD: Nature and Prevalence

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association [APA], 2000) enumerates five criteria necessary for the diagnosis of PTSD. Criterion A states that an individual must have been exposed to an event in which they experienced: significant threat to self or others (A1), as well as subjective feelings of horror, helplessness and/or fear (A2). Posttraumatic stress disorder is comprised of three groups of symptom clusters that can occur after experiencing a traumatic event. These are 1) re-experiencing (e.g., recurrent distressing dreams, memories, or flashbacks related to the trauma; Criterion B), 2) avoidance (e.g., avoiding thoughts, people, or places associated with the trauma; Criterion C), and 3) increased arousal (e.g., increased startle, hyperarousal, or difficulty concentrating or sleeping; Criterion D). Additionally, these symptoms must cause clinically significant distress or impairment for at least one month to meet the diagnosis of PTSD (Criterion E). Posttraumatic stress disorder is conceptualized as a chronic and debilitating condition (Kessler, Chiu, Demler, & Walters, 2005; World Health Organization, 2008), and available data converge to suggest that attendant disability is comparable to, or greater than, any other psychological problem (Kessler, 2000). It is, therefore, imperative that we obtain a sophisticated understanding of the etiology and maintenance of this condition, including among adolescents, who evidence particular vulnerability to anxiety-related psychopathology.

Adolescence is conceptualized as a "core risk" (Beesdo, Knappe, & Pine, 2009) period, during which anxiety-related vulnerability is transformed into clinically relevant psychopathology. Indeed, research suggests that understanding and modifying problems during this time is especially beneficial to preventing poor future outcomes (Dahl, 2004). In terms of traumatic event exposure, data from the Great Smoky Mountains Study, a representative sample of 1,420 adolescents, ages 9 to 16 years, suggest that traumatic events are relatively common in childhood and adolescence, with about two thirds of all adolescents experiencing one or more traumatic event of any kind by the age of 16 years (Copeland et al., 2007). As with other anxiety disorders, available evidence suggests that as youth move from childhood through adolescence, increases in traumatic event exposure, as well as posttraumatic stress symptom severity and impairment, can be observed (Copeland et al., 2007).

It warrants mention that traumatic event exposure is a risk factor that can precipitate multiple trajectories, depending on individual and/or contextual characteristics (i.e., multifinality; Cicchetti & Toth, 2009). Indeed, consistent with developmental theory, traumatization exemplifies the type of experience that can produce an array of developmental problems (e.g., altered functioning of the Hypothalamic Pituitary Adrenal Axis, which plays a role in stress reactivity; Yehuda & Ledoux, 2007) and contribute to a negative "developmental cascade" in which the effects can accumulate and disperse across developmental domains (Buka et al., 2001; Masten & Cicchetti, 2010). For instance, traumatic event exposure is associated with elevated risk for anxiety psychopathology (e.g., specific phobia, social phobia) and major depressive disorder, as well as difficulties with school and relationships, higher likelihood of substance abuse, and increased suicide attempts (Boney-McCoy & Finkelhor, 1996; Buka et al., 2001; Cortes et al., 2005; Nader, 2008). While these data underscore the idea that developmental trajectories following traumatic event exposure are varied, traumatic event exposure is typically studied in relation to PTSS or PTSD, as traumatization is a hallmark feature of PTSD (APA, 2000). Indeed, a substantial minority of trauma-exposed adolescents go on to develop subclinical or clinical symptoms of PTSD, with the characteristic symptomatology and functional impairment described above. Current 12-month prevalence estimates, based on epidemiological data from the adolescent supplement of the National Comorbidity Study Replication (NCS-A), suggest approximately 4% of youth, ages 13 to 17 years, meet diagnostic criteria for PTSD (Kessler et al., 2012). Collectively, the serious negative consequences that can follow traumatic event exposure among youth highlight the importance of having sophisticated methodologies designed to better understand the numerous pressing questions regarding the developmental sequelae of traumatic event exposure, including PTSS/PTSD. Next, we turn our attention to conceptual models of PTSD and the utility of script-driven imagery procedures for better understanding the consequences of traumatization.

Conceptual Models of PTSD

Posttraumatic stress disorder is a complex psychological condition that results from altered biopsychosocial functioning precluding recovery from a traumatic event (Feldner, Monson, & Friedman, 2007). Evidence exists for information processing (Ehlers & Clark, 2000), memory formation (McCleery & Harvey, 2004), and psychobiological (Friedman & McEwen, 2004) mechanisms, and such theories are not mutually exclusive. One of the most widely studied conceptual models of PTSD is derived from Mowrer's (1947) two-factor learning theory of fear and anxiety. Mowrer hypothesized that anxiety disorders are classically conditioned fear responses learned from the pairing of stimuli and negative outcomes, and these disorders are maintained via negative reinforcement afforded by avoiding anxiety-relevant cues. In particular, avoidance precludes the extinction of such conditioned fear responses. Keane, Zimering, and Caddell (1985) applied two-factor theory to posttraumatic stress disorder more specifically. They posited that, via classical conditioning, interoceptive and exteroceptive stimuli present during a traumatic event (e.g., an alleyway where an individual was assaulted) become associated with the event. Foa and Kozak (1986), drawing from Peter Lang's (1979) bioinformational theory, further suggest that stimuli associated with a traumatic event are connected within a mental information structure, referred to as a "fear network" that also contains affective, physiological, cognitive, and environmental phenomena related to the event. Associations are formed between traumatic event stimuli, fear responses, and negative emotions, as well as interpretations, including broader negative meanings regarding network components, which themselves become part of the fear network (Foa & Kozak, 1986). Subsequently, trauma-exposed individuals avoid circumstances, memories, and stimuli that remind them of the trauma. Additionally, stimulus generalization occurs such that new stimuli (not present during the traumatic event) come to elicit conditioned fear responding. Over time, a more consolidated fear network is formed and an increasing number of stimuli, emotions, and responses in the network can be interpreted as being dangerous (Foa & Kozak, 1986). Fear can even be increased after the initial traumatic event conditioning when feared stimuli are re-evaluated by the individual or when more threatening information about the danger of the feared stimulus is learned (Mineka & Sutton, 2006). Reminders of the trauma cause increased fear and anxiety because trauma memories have been avoided rather than processed (Keane et al., 1985). This increased fear and the physiological arousal that accompany it are central features of PTSD.

Learning-related theoretical models of PTSD highlight the importance of the fear network described above, which is activated in the presence of trauma-related behavioral, psychophysiological, or interpretative information (Foa & Kozak, 1986). Mentally imagining past experiences can activate this network, but to do so effectively, it is necessary to incorporate physiological reactions, behavioral responses, and vivid stimuli representations into scripts used to visualize during the procedure (Lang, 1979). Script-driven imagery procedures, therefore, represent a powerful, theoretically-relevant methodological tool pertinent to the study of traumatic event exposure and PTSS/PTSD.

Script-Driven Imagery Procedures

Script-driven imagery procedures, which involve the presentation of trauma-related cues, allow for the evaluation of trauma-related responding and “state” PTSS. The experience is akin to the naturalistic encounter of a trauma-related cue (e.g., brakes screeching for a motor vehicle accident survivor). A script-driven imagery procedure involves converting a written trauma script, based on the memory of the trauma, into a 30 second audio recording. This recording is then used in a four-segment imagery procedure in which each of the segments (i.e., baseline, playing of the audio script, silent rehearsal of the script, and recovery) is 30 seconds in length (see Procedure; Pitman et al., 1987). Although idiographic and standardized approaches to script-driven imagery procedures have been used, idiographic procedures are more common and well-accepted as they are consistent with assertions of the bioinformational theory suggesting specific physiological reactions, stimuli, and responses more effectively activate the mental fear network (Lang, 1979), as well as empirical evidence indicating processing of self-relevant information elicits stronger emotional and neurobiological reactions in the context of PTSD (Liberzon & Martis, 2006).

Script-driven imagery has proven to be a very useful tool in research on PTSD. Adults with PTSD, as compared to individuals without PTSD who have or have not experienced a traumatic event, show increased physiological reactivity and negative affect in response to trauma scripts (McTeague et al., 2010; Orr et al., 1998; Pitman et al., 1987). Facial electromyography (EMG), which is used to measure emotional reactivity (e.g., fear and anxiety) to trauma scripts, is one method of measuring increased physiological responding in individuals with PTSD. For instance, individuals with PTSD, compared to trauma-exposed individuals without PTSD, have shown increased facial EMG responses to trauma scripts (Carson et al., 2000; Orr et al., 1998). This effect has also been shown with PTSD resulting from various types of trauma compared with individuals without PTSD who have and have not been exposed to a trauma (McTeague et al., 2010). Similarly, individuals with PTSD show increased skin conductance (i.e., galvanic skin response; Carson et al., 2000; Pitman et al., 1987) and heart rate (Orr et al., 1998; Ramón et al., 2006) reactivity in response to trauma scripts in studies with several types of trauma exposure. Finally, individuals with PTSD show increased negative affect, such as self-reported fear, anxiety, and disgust, following script-driven trauma imagery as compared to trauma-exposed individuals without PTSD (Orr et al., 1998; Pitman et al., 1987; Ramón et al., 2006). Collectively, these findings are consistent with conceptual models and diagnostic criteria for PTSD and suggest script-driven imagery procedures are effective in producing trauma-related physiological and psychological reactivity.

Given the usefulness of the procedure, adult researchers have been able to evaluate numerous correlates and consequences of traumatic event reminders and PTSS induction (Hopper, Frewen, van der Kolk, & Lanius, 2007b; Lanius et al., 2010). For instance, a script-driven imagery procedure was used to examine real-time, substance-related cravings during trauma reminders in a laboratory setting (Beckham et al., 2007). This study found that presentation of trauma-related cues enhanced drug use cravings. Such data are critical in terms of understanding maladaptive strategies for managing PTSS (e.g., substance use to reduce distress; Stewart, 1996), as well as more complex clinical presentations (e.g., amelioration of co-morbid PTSD and substance use disorder).

Only one study by Kirsch and colleagues (2015) has examined the use of a script-driven imagery procedure in youth, 6-17 years of age. This study obtained measures of anxiety and physiological arousal before and after neutral and trauma scripts. Results suggested that adolescents who met criteria for PTSD had significantly higher anxiety responses and facial EMG responses to the trauma script compared to trauma-exposed youth without PTSD. However, contrary to hypotheses, heart rate, skin conductance, and respiratory sinus arrhythmia response levels did not differ between groups, in contrast with previous adult research (Kirsch et al., 2015). While this research began to address the notable gap in the literature, there are important limitations of the study that should be addressed by additional research. First, Kirsch and colleagues (2015) used a modified script-driven imagery procedure, which did not include rehearsal of the scripts, recovery, or pre-script baseline periods, making it difficult to make comparisons with adult research or baseline responding for each individual script. Second, self-reported anxiety was the only affective variable measured in the study; however, research suggests that several affective states (e.g., fear, disgust, anger, shame) are often associated with traumatic events (Hathaway, Boals, & Banks, 2010; Lee, Scragg, & Turner, 2001). Therefore, additional research examining script-driven imagery in youth is needed.

Developmental Considerations

Given the profound biopsychosocial changes that characterize adolescence, findings observed in adult script-driven imagery research cannot be assumed to hold for youth (Dahl, 2004). Indeed, consistent with the basic tenants of science, empirical evidence is necessary to draw developmentally sensitive conclusions. For instance, the prefrontal cortex, which continues to develop beyond adolescence (Casey, Tottenham, Liston, & Durston, 2005), has been shown to play a key role in the ability to label and manage emotions (Lieberman et al., 2007). Therefore adolescents' ability to identify, label, and regulate emotions is still developing, a factor that needs to be taken into consideration when interpreting self-reported affectivity elicited by the script-driven imagery procedure (Pynoos et al., 2009; Zeman, Cassano, Perry-Parrish, & Stegall, 2006).

It is, therefore, necessary to obtain empirical data regarding the validity of script-driven imagery procedures for use with youth. The availability of such procedures in the "toolbox" of developmental psychopathologists will allow for greater methodological rigor in the study of trauma and PTSS/PTSD among youth including the ability to 1) test causally-oriented hypotheses in a controlled, laboratory setting, 2) reduce biases associated with retrospective self-report by utilizing “real-time” assessment, and 3) obtain data across multiple modalities (e.g., psychophysiological, psychological; Olatunji, Leen-Feldner, Feldner, & Forsyth, 2008; Zvolensky, Lejuez, Stuart, & Curtin, 2001). In addition, laboratory-based study of trauma and PTSS among youth stands to enhance extant theories of PTSD. For example, as compared to adults, adolescents have underdeveloped abilities in terms of emotion regulation (Garnefski & Kraaij, 2006; Zeman et al., 2006). Pynoos and colleagues (2009) propose that children may take longer to return to baseline emotional states following exposure to a trauma cue. Empirical evidence for this assertion, afforded by the use of script-driven imagery procedures, would be conceptually important, given basic learning studies suggesting that the formation and consolidation of fear networks may be affected by such elongated affective states (Wagner & Brandon, 1989). Taken together, our understanding of the developmental psychopathology of traumatization and PTSS/PTSD would clearly benefit from an ability to elicit trauma-related responding and PTSS in the laboratory.

Current Research

The overarching goal of the current study was to evaluate the validity of an idiographic script-driven imagery procedure for use with traumatic event exposed adolescents. Importantly, despite the developmental differences between trauma-exposed adolescents and adults, developmental trauma literature suggests that adolescents are likely to show similar patterns of responding to trauma as adults (Pynoos et al., 2009). Similarly, developmental psychopathologists assert that, given appropriate acknowledgement of relevant parameters (e.g., reading comprehension; developmental task; neurodevelopment), it is acceptable to use adult research to guide hypotheses in the context of adolescent research (Cicchetti & Rogosch, 2002).

Drawing from published work, several hypotheses guided the investigation.

First, to address the convergent validity of the procedure, it was hypothesized that PTSD symptom severity (as indexed by a clinician-administered interview) would correlate positively with responding to an idiographic script-driven imagery procedure. It was expected that symptoms of posttraumatic stress would predict:

- psychophysiological reactivity to the procedure, as indexed via facial EMG, skin conductance, and heart rate,
- affective reactivity to the procedure, measured via self-report ratings of fear, anxiety, disgust, and general distress, and
- level of self-reported posttraumatic stress symptoms elicited by the script-driven imagery procedure.

Second, to evaluate divergent validity, adolescent thought problem symptoms, as indexed by the Youth Self Report (YSR; Achenbach & Rescorla, 2001; Yasick et al., 2001), were not expected to relate to psychophysiological or affective reactivity elicited by the script driven imagery procedure.

Finally, to address known-groups validity, it was hypothesized that girls would evidence increased affective and physiological reactivity to idiographic trauma scripts as compared to boys. Research on gender differences in response to script-driven imagery procedures is lacking. However, available work suggests that stress reactivity increases across the course of puberty (Edwards, Rose, Kaprio, & Dick, 2011; Ladouceur, 2012; Susman, Dorn, & Chrousos, 1991), and that this effect is more pronounced among girls, as compared to boys (Sanborn & Hayward, 2003; Stroud, Papandonatos, Williamson, & Dahl, 2004).

Method

Participants

Descriptive statistics of sample characteristics are presented in Table 1. Forty-three traumatic event exposed adolescents between the ages of 10 and 17 years, with an average age of approximately 14 years (*M* = 14.12, *SD* = 2.36), were recruited from the Northwest Arkansas region. Participants included 21 girls (48.8%) and were enrolled in 4^{th} through 11^{th} grade at the time of participation (*M* = 7.86, *SD* = 2.31). Racial composition of participants represented the local community: 72.1% Caucasian, 16.3% Biracial or "Other", 7.0% African American, 2.3% Native American, and 2.3% declined to answer. The sample was relatively well-educated, with the majority of parents (79.2%) reporting at least some higher education.

Recruitment procedures included posting flyers in the community (including school-based flyering), assembling information booths at community functions (e.g., farmer's market), and advertising in local bulletins (e.g., University of Arkansas Newswire), on internet websites (e.g. Facebook), and at local organizations (e.g., Boys and Girls Club). Although there is no evidence to suggest that traumatic cue presentation following recent trauma exposure has negative effects for youth, we took a conservative approach in the current study by screening out potential participants with traumatic event exposure within the past month.

Measures

Posttraumatic stress symptoms and traumatic event exposure. Participants were administered the *Clinician-Administered PTSD Scale, Child and Adolescent Version* (CAPS-CA; Nader et al., 1996) in order to assess traumatic event exposure and PTSS. For those participants with multiple traumatic event exposures, the most distressing and impairing traumatic event was selected as the index event for that participant. The CAPS-CA is a structured clinical interview, designed for use with children and adolescents ages 8 to 18 years old. It includes 33 questions, which address traumatic event exposure, as well as three posttraumatic stress symptom clusters of re-experiencing, numbing or avoidance, and arousal (Ohan, Myers, & Collett, 2002). These symptoms align with DSM-IV-TR criteria for the diagnosis of PTSD (APA, 2000), and scores from the CAPS-CA were used as a continuous measure of PTSS severity (Kassam-Adams, Garcia-España, Fein, & Winston, 2005; Nugent, Christopher, & Delahanty, 2006). The CAPS-CA was derived from the adult version of the scale (the Clinician-Administered PTSD Scale; [CAPS]), which evidences excellent validity and reliability (Weathers, Keane, & Davidson, 2001). The CAPS-CA was modified from the adult version to be developmentally appropriate, and it includes practice examples, pictorial rating scales, and other age-appropriate modifications (Ohan et al., 2002). There is limited research on the psychometric properties of the CAPS-CA; however, preliminary studies of reliability and validity are promising (Nadar, 1997; Ohan et al., 2002), including high inter-rater reliability (r = 0.95- 0.99), high internal consistency (α = 0.90), and good convergent validity with the Children's PTSD Inventory (CPTSDI; r = .74) and the Child PTSD Symptom Scale (CPSS; r = .84), similar interview and questionnaire-based measures of PTSS in youth (Harrington, 2008).

The Principal Investigator (PI) administered all CAPS-CA interviews in the current study. The PI completed a CAPS training presented by a certified trainer (Dr. Jennifer Price) at the Laureate Institute for Brain Research in Tulsa, Oklahoma. Dr. Leen-Feldner provided additional training in the CAPS-CA, including: 1) an overview of the interview (e.g., development, psychometrics), 2) general considerations in conducting structured interview assessments with adolescents (e.g., rapport building, human subjects considerations), 3) specific instruction in the interview items and scoring, and 4) role play and practice in administering and scoring the interview. Training continued until the PI evidenced mastery. Further, all interviews were audiotaped, and reliability ratings were made on a random selection of 10% of the protocols, which resulted in 100% agreement on PTSD diagnosis, as well as number of symptoms endorsed.

Physiological Reactivity. All physiological data were gathered using a BIOPAC MP 150 data acquisition system (BIOPAC Systems Inc., Goleta, CA, USA). This system uses Acq*Knowledge* 4 software, which is compatible with the Mac operating system. BIOPAC allows data to be collected for several physiological measures, including a single-channel biopotential electrocardiogram amplifier (ECG100C) to measure heart rate, two channels of biopotential electromyogram amplifiers (EMG100C) to measure facial EMG, and a single channel electrodermal activity amplifier (GSR100C) to measure skin conductance (BIOPAC Systems Inc., n.d.).

In order to measure facial EMG, disposable Ag/AgCl electrodes were placed on the levator labii and lateral frontalis, which are areas of the face associated with fear and disgust responsivity (Orr & Roth, 2000; Fridlund & Cacioppo, 1986). Heart rate was also measured in a method consistent with previous research and recommended guidelines (Berntson, Quigley, & Lozano, 2007; Segerstrom & Nes, 2007) using disposable Ag/AgCl electrodes, which were placed in a Lead II configuration on the chest. Finally, skin conductance was measured by attaching Ag/AgCl electrodes to the participant's non-dominant hand on the palmar surface of the medial phalanges of the index and middle fingers (Khalfa, Isabelle, John-Pierre, & Manon, 2002; Khambam, Naidu, Rani, & Rao, 2012). Heart rate, facial EMG, and skin conductance were measured throughout all phases of the script-driven imagery procedure.

Affective Reactivity. Subjective Units of Distress Scales (SUDs; Wolpe, 1958) were used to index self-reported changes in affect before and after each script-driven imagery procedure. Participants reported levels of fear, anxiety, disgust, and distress on a scale from 0 (*no fear, no anxiety, no disgust*, or *no distress*) to 100 (*extreme fear, extreme anxiety, extreme disgust,* or *extreme distress*). This approach has been utilized in multiple laboratory-based studies of anxiety-relevant responding among youth (e.g., Leen-Feldner, Feldner, Bernstein, McCormick, & Zvolensky, 2005; Ollendick, Lewis, Cowart, & Davis, 2012) and has also been used in the context of previous script-driven imagery research to measure emotional responses (Orr et al., 1998; Pitman et al., 1987).

Post-script Level of PTSS. The Reponses to Script-Driven Imagery Scale (RSDI; Hopper, Frewen, Sack, Lanius, & van der Kolk, 2007a) has been commonly used in adult research on PTSD as a self-report measure of PTSS evoked by a trauma script during a script-driven imagery procedure (e.g., "state-like" PTSS; Hopper et al., 2007a). Participants report the extent to which they experienced PTSD symptoms on a scale from 0 (*not at all*) to 6 (*a great deal*). The RSDI includes 11 questions, which address PTSD symptom clusters of re-experiencing, avoidance, and dissociation. A confirmatory factor analysis showed strong support for the predicted three-factor model, and the RSDI has shown strong construct validity and adequate to high internal reliability (α = 0.69- 0.93; Hopper et al., 2007a). The RSDI was adapted for use with youth in the current study; words were adapted for age appropriateness (e.g., "re-experiencing" was changed to "happening again"), and the revised measure (RSDI-A) was submitted to the Flesch-Ease Reading Index, which suggested it was comprehensible by a 4.6 grade-level reader (please see Appendix).

The RSDI-A evidenced good reliability in the current study (α = .89). On average, adolescents reported approximately 32 total posttraumatic stress symptoms in response to the script-driven imagery procedure (*M* = 32.10, *SD* = 13.79), including re-experiencing (*M* = 12.07, *SD* = 5.62), avoidance (*M* = 8.10, *SD* = 5.16), and dissociation (*M* = 11.93, *SD* = 5.62) symptoms. Scores on the RSDI-A in the current sample were comparable to RSDI scores among adults with clinical and subthreshold levels of PTSD (Hopper et al., 2007a).

Trait Vividness of Imagery. The Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) is a 16 item scale commonly used in adult imagery research to measure individual differences in vividness of visual imagery. Participants visualize several images and rate the vividness of those images on a scale from 0 (*perfectly clear and as vivid as normal vision*) to 5 (*no image at all, you only "know" that you are thinking of the object*). The VVIQ was originally completed twice (with eyes open and with eyes closed); however, these conditions have not shown significant differences in scores (McKelvie, 1995), so the questionnaire was completed once with participants' eyes closed in the current study (Allbutt, Ling, Rowley, & Shafiullah, 2011). The VVIQ evidences good test-retest reliability (*r* = 0.74) and split-half reliability (*r* = 0.85). In the current study, the wording of the VVIQ was modified for use with youth, and the revised measure (VVIQ-A) was submitted to the Flesch-Ease Reading Index, which suggested it was comprehensible by 3.7 grade-level readers.

In the current study, the VVIQ-A evidenced good reliability (α = .86), and participants reported that their visualization abilities allowed them to imagine "clear and quite vivid" imagery on average (*M* = 2.01, *SD* = .62). The VVIQ-A was used as a covariate when examining the relations between PTSS and psychophysiological and affective reactivity to a trauma-script in order to examine these associations above and beyond individual differences in imagery vividness.

Thought Problems. The Youth Self-Report form for ages 11-18 (YSR; Achenbach & Rescorla, 2001) measures clinically relevant symptomotology and was employed in the current study to index child-reported thought problems. Adolescents rate 112 items (e.g., "I hear sounds or voices that other people think aren't there") on a three-point Likert-type scale (0 = *not true*, 1 = *somewhat or sometimes true*, and 2 = *very true or often true*). The YSR is made up of eight syndrome or problem scales (i.e., Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-breaking Behavior, Aggressive Behavior) and an optional Competence Scale. In addition, two overarching scales index psychopathology (i.e., the Internalizing and Externalizing Scales). The YSR evidences good psychometric properties, with good test-retest reliabilities ($r \geq .72$) and good concurrent validity (Achenbach & Rescorla, 2001; Grisso, Barnum, Fletcher, Cauffman, & Peuschold, 2001).

Procedure

A visual depiction of the study procedures is presented in Figure 1. First, a telephone screener (please see Appendix) was administered to prospective adolescent participants to determine whether they had experienced a traumatic event. Eligible adolescent participants (and a parental guardian) were invited to the Arkansas Interdisciplinary Sciences Laboratory for a single session lasting approximately 3 hours. Upon arrival, adolescents completed written, informed assent, and their parental guardian provided written, informed consent for personal and adolescent participation. Aspects of consent and assent forms, such as limits of confidentiality and voluntary participation, were explained and reviewed. Next, adolescents were administered the CAPS-CA by the PI. Following the interview, participants completed a battery of questionnaires, including those described above. The battery was randomized to limit order effects. Next, adolescents performed a computerized puzzle Tetris game online for 5 minutes. While multiple distractor tasks have been utilized in the literature (e.g., word searches; Baldwin & Main, 2001), Tetris was selected for the current study because it provides a relatively pleasant task for youth. The game involves mentally rotating objects to fit together and then pressing computer keys to rotate and fit the objects. This game has been used in previous literature as a cognitive distraction task (Kang, McDermott, & Cohen, 2008). This task was introduced as a break from the research study and served as a distraction task to minimize priming of the traumatic event between the CAPS-CA and the script-driven imagery procedure. Two brief training sessions were then completed, including a) the experimenter explaining emotional awareness and labeling of emotions and b) an audio recording of response to imagery training to increase vividness of imagining during the scripts.

Emotional Awareness Training. During the emotional awareness training, the participant worked together with the PI to identify and understand meanings of 9 emotions (i.e., fear, anxiety, disgust, anger, sadness, excitement, relaxation, happiness, and surprise). Both positive and negative emotions were included in the training to avoid priming for a negative emotional response bias. Emotion training included adolescents matching emotions with the appropriate definition, hearing and giving examples of each emotion, and taking a brief emotional understanding post-test to ensure that emotion training was effective (see Appendix for a copy of the training protocol and post-test).

Response to Imagery Training. All participants received standardized imagery training, the goal of which was to enhance the vividness of scenes imagined during the script-driven imagery procedure. Lang (1979) contends that increased imagery vividness leads to increased physiological responses (e.g. muscle tension, eye movement, EMG activity) when remembering an event. He theorized that this increased physiological response is due to sensory organs and muscles reproducing the original responses to the event during imagery and a network (e.g., fear network; Foa & Kazak, 1986) that controls behavior and links behavior to context. The effectiveness of the script-driven imagery procedure, therefore, should increase with more vivid imagery, which is associated with stronger physiological responses to the script and greater participation in the context of the memory. Indeed, adult research suggests that this is the case (Bauer & Craighead, 1979; Miller et al., 1987). In the context of the current study, the response to imagery training was used to guide participants through imagining and reacting to three separate imagery scenes, in which they were encouraged to be an active participant. The training involved using physiological reactions to increase participation in and vividness of participants' imagery (see Appendix for a copy of the training protocol).

Script-Driven Imagery Procedure. All participants completed a neutral script-driven imagery procedure, followed by a trauma-related script-driven imagery procedure. The neutral script-driven imagery procedure allowed for comparison to the trauma script, and data from neutral imagery procedures indicated reactivity patterns to non-emotional scripts. For both the neutral and trauma-related procedures, the PI worked with the adolescent to generate a script based on a traumatic event or an event that the participant considered to be neutral (e.g., did not elicit positive or negative affect, such as riding in the car or eating lunch). Participants selected neutral script topics from a standardized list, and only topics rated less than 10 on a 100-point

SUDs arousal scale were used. Scripts were written to include sensory information, bodily sensations, and action responses in order to increase vividness of imagery, as suggested in the emotional imagery literature (Foa & Kozak, 1986; Lang, 1979). The experimenter then used the written scripts to create two 30-second audio recordings for the neutral and trauma-related script-driven imagery tasks, respectively.

Prior to script administration, participants were fitted with BIOPAC physiological measurement equipment in order to measure heart rate, facial EMG, and skin conductance during the imagery procedure. During an initial baseline period, participants were asked to relax for five minutes in order to obtain accurate baseline physiological readings. Although baseline periods with adult script-driven imagery have ranged from three (Carson et al., 2000; Orr et al., 1998, & Pitman et al, 1987) to ten (Badour & Feldner, 2013; Olatunji, Babson, Smith, Feldner & Connolly, 2009) minutes, a five-minute baseline was chosen for the current study to allow for accurate physiological readings while reducing artifact related to participant boredom (e.g., limb movement). This period was followed by a baseline SUDs measurement of anxiety, fear, disgust, and distress. Consistent with previous research, each script-driven imagery procedure included four periods (Pitman et al., 1987). The pre-script baseline period lasted 30 seconds and was used to obtain physiological measurements prior to each script. The script period was 30 seconds long, and participants were asked to listen carefully to the audio recording of the script. Next, participants engaged in a rehearsal period, during which they were asked to vividly imagine the scenario for an additional 30 second period of silence. Finally, there was a 30 second period at the end of the script for recovery and continued physiological data collection. A two-minute between-script interval separated the neutral and trauma script, and SUDs ratings were measured prior to the trauma script. After participants completed both scripts, they completed additional measurements of affective reactivity (SUDs) and PTSS elicited (RSDI-A; trauma script only), as well as a measure of task engagement for use as a manipulation check.

Neutral and trauma scripts were not counterbalanced; each adolescent completed the neutral script prior to the trauma script. Due to time constraints, an additional distraction task was not added between scripts. Therefore, it was expected that, had adolescents completed the trauma script first, the subsequent neutral script would have been contaminated by continuing negative affect from the trauma script.

After completing the scripts, BIOPAC physiological equipment was detached from the adolescent. Next, to ensure participants did not leave the laboratory in a negative affective state, adolescents engaged in a positive affect induction, consisting of 18 positive slides from the International Affective Picture System (Lang, Bradley, & Cuthbert, 1999) with an average valence rating of above 7.5 on a 9 point scale. Slides included positive images such as cute animals and babies. Positively valenced music ("Brandenberg Concertos 2 and 3" by Bach) was played during the viewing of the slides (Conklin & Perkins, 2005; Goodwin & Sher, 1993). Following the positive affect induction, participants and their parent or guardian were thoroughly debriefed, and adolescents were compensated $40 for their participation.

Results

Data Analytic Approach

To address the first hypothesis, hierarchical linear model regression analyses were performed to examine the relation between PTSS and physiological (heart rate, skin conductance, and facial EMG) and affective (fear, anxiety, disgust, and distress) reactivity, as well as state-like PTSS elicited by the script-driven imagery procedure. At step 1, age, gender, trait vividness of imagery, and, when appropriate, relevant baseline responding (e.g., baseline affective and physiological variables) were entered in order to evaluate the incremental validity of PTSS in predicting script response (Sechrest, 1963). At step 2, PTSS, as indexed via the CAPS-CA, was entered. A similar procedure was undertaken to address the second hypothesis, except that the broad-based dimension of thought problems served as the primary predictor, entered at step 2. The unique variance explained by child-reported thought problems, after controlling for age, gender, and VVIQ-A scores was evaluated. Divergent validity was evaluated by examining differences in magnitude between convergent and divergent validity analyses. Finally, in terms of the third hypothesis, ANCOVAs were performed to compare each physiological and affective variable between genders, with age and VVIQ scores as covariates.

Prior to analyses, all data were checked for outliers and assumptions of linearity, normality, and homoscedasticity. In order to correct for positive skewness and kurtosis of affective responding variables (i.e., SUDs anxiety, fear, disgust, and distress), a square root transformation was employed for all affective responding variables throughout analyses. All assumptions were otherwise met.

Also prior to analyses, all physiological data were visually inspected for problematic signals (e.g., poor signal due to excessive movement, recording noise, electrode connectivity problems), and problematic data were filtered. A few recordings were removed from analyses completely, including 4 heart rate, 3 skin conductance, 4 EMG Frontalis, and 2 EMG Levator recordings. Otherwise, only small sections (e.g., 1.5 seconds or less) of data were removed from recordings. As recommended (Reaz, Hussain, & Mohd-Yasin, 2006; Tassinary, Cacioppo, & Vanman, 2007), facial EMG data was rectified via a Fast Fourier Transformation, and average volts across the neutral and trauma script intervals were calculated. Also as recommended (Berntson et al., 2007; Porges & Byrne, 1992), raw electrocardiogram data was used to calculate average heart rate across script intervals. Finally, raw skin conductance data was used to calculate average levels across script intervals after subtracting the relevant baseline interval (i.e., neutral script minus neutral script baseline, trauma script minus trauma script baseline) in order to control for baseline drift (Boucsein et al., 2012; Figner & Murphy, 2011).

Descriptive Statistics

Means and standard deviations of predictor and outcome variables are presented in Table 1. Adolescents in the current sample displayed low to moderate PTSS, with an average PTSS level (i.e., number of symptoms meeting both frequency and severity criteria) of 5-6 symptoms ($M = 5.63$). Additionally, 10 participants met diagnostic criteria for PTSD (23.3%). In addition, adolescents in the current sample reported YSR-assessed thought problems significantly below clinical levels and only slightly higher than findings from other normative samples (Abad, Forns & Gomez, 2002; Broberg et al., 2001). No significant differences were found between boys and girls on any covariates or demographic or predictor variables, including PTSS level or thought problems; means are reported in Table 1.

On all SUDs scales, participants reported higher levels of affective arousal following the trauma script compared to the neutral script. Regardless of PTSS level, paired-samples comparisons showed that trauma script SUDs ratings were significantly greater than neutral script SUDs ratings for all affective states, including anxiety, $t(42) = -3.35$, $p = .002$, fear, $t(42) = -4.09$, $p < .001$, disgust, $t(42) = -3.92$, $p < .001$, and distress, $t(42) = -4.40$, $p < .001$. In addition, participants had increased physiological responding following the trauma script compared to the neutral script on all measurements. However, pair-samples comparisons revealed that only heart rate responding to the script-driven imagery procedure was significantly higher following the trauma script compared to the neutral script, $t(38) = -4.61$, $p < .001$. While means were in the expected direction, differences between trauma script and neutral script responding were not significant for EMG Frontalis, $t(38) = -1.67$, $p = .10$, EMG Levator, $t(40) = -1.74$, $p = .09$, or skin conductance, $t(40) = -1.72$, $p = .09$, measurements.

Zero-Order Correlations. Zero-order correlations among covariates, predictor variables, and outcome variables are displayed in Table 2. All subscales within measures (i.e., RSDI-A, SUDs) were significantly correlated with one another. As expected, thought problems were not associated with any other variables. Also as expected, PTSS level was positively associated with self-reported disgust and number of total, re-experiencing, and dissociation symptoms experienced in response to the script-driven imagery procedure. However, contrary to expectations, PTSS level was not significantly correlated with any other outcome variable (e.g., other affective, physiological, or PTSS variables). Not surprisingly, given that responding across different modes of measurement (physiological, self-report) tends to be desynchronous (Lang, Levin, Miller, & Kozak, 1983; Meier, 2013), some outcome variables were significantly positively correlated (e.g., re-experiencing symptoms elicited and all affective scales) while others were not significantly correlated or were negatively correlated (e.g., VVIQ-A scores negatively correlated with self-reported disgust).

Convergent Validity

Regression analyses examining the effect of PTSS level on affective responding are summarized in Table 3. Imagery vividness ability significantly predicted self-reported changes in anxiety, but not fear, disgust, or distress, to the script-driven imagery procedure, and no other step 1 variables (age, gender, baseline responding) were significant predictors. As hypothesized, higher levels of PTSS significantly predicted greater fear, $t\ (32) = 2.52$, $p = .02$, disgust, $t\ (32) = 3.08$, $p = .004$, and distress, $t\ (32) = 2.38$, $p = .02$, responding to the trauma scripts. However, PTSS levels did not significantly predict SUDs anxiety, *t* (32) = 1.46, *p* = .16, in response to the script-driven imagery procedure (see Table 3).

Hierarchical regressions examining the effect of PTSS level on psychophysiological responding are summarized in Table 4. Baseline psychophysiological responding significantly predicted all psychophysiological responding to the trauma script. No other step 1 variables were significant predictors. Contrary to expectations, PTSS level did not significantly predict any psychophysiological outcomes, including EMG Frontalis, t (28) = -0.49, p = .63, EMG Levator, t (30) = -0.34, p = .73, heart rate, t (28) = 1.15, p = .26, or skin conductance, *t* (29) = 0.99, *p* = .33.

Regression analyses examining the effect of PTSS level on PTSD symptom responding are summarized in Table 5. No step 1 variables significantly predicted PTSS elicited by the trauma script. As expected, increased levels of PTSS were significantly associated with higher self-reported re-experiencing, *t* (32) = 2.24, *p* = .03, and dissociation, *t* (32) = 2.28, *p* = .03, symptoms in response to the trauma script. PTSS level did not significantly predict the number of overall PTSD, *t* (32) = 1.92, *p* = .06, or avoidance, *t* (32) = 0.33, *p* = .74, symptoms elicited.

Divergent Validity

Similar to tests of convergent validity, regression analyses examining the effects of YSR thought problems on affective, physiological, and PTSD symptom responding to the script-driven imagery procedure were conducted for divergent validity hypotheses. As expected, self-reported youth thought problems did not significantly predict affective responses to the script, including anxiety, *t* (30) = -0.80, *p* = .43, fear, *t* (30) = 0.29, *p* = .78, *p* = .81, disgust, *t* (30) = -1.33, *p* = .20, or distress, *t* (30) = -0.35, *p* = .73, responses. Also as hypothesized, thought problems did not predict psychophysiological responding to the script-driven imagery procedure, including changes in EMG Frontalis, *t* (26) = 0.04, *p* = .97, EMG Levator, *t* (28) = -0.25, *p* = .81, heart rate, t (27) = -0.28, p = .78, or skin conductance, t (27) = 0.96, p = .35, in response to the scripts. Finally, YSR thought problems did not significantly predict overall PTSS, t (30) = 0.19, p = .85, re-experiencing symptoms, t (30) = 0.03, p = .98, avoidance symptoms, t (30) = -0.89, p = .38, or dissociation symptoms, t (30) = 1.27, p = .21, experienced in response to the trauma script.

Convergent and Divergent Validity Differences in Magnitude

The magnitude of difference between convergent (PTSS level) and divergent (YSR thought problems) factors and reactivity to the script-driven imagery procedure was evaluated by comparing indices of effect size. Please see Table 6 for comparison statistics. PTSS level, but not thought problems, significantly predicted self-reported changes in fear, disgust, and distress responding, accounting for 16%, 12%, and 13% more variance in affective responses, respectively, than thought problems. In addition, PTSS level, but not thought problems, significantly predicted re-experiencing and dissociation symptoms elicited by the trauma script, both accounting for 13% more variance in PTSS responses than thought problems.

Gender Differences in Script Responsivity

Several ANCOVAs were conducted to examine the effect of gender on affective, physiological, and PTSD symptom responding to the script-driven imagery procedure and are summarized in Table 7. Age and vividness of visual imagery ability were entered as covariates for all analyses. Contrary to expectations, there was no significant effect of gender on any affective, physiological, or PTSD symptom responding.

Discussion

The current study was the first among youth to examine the validity of the standard script-driven imagery procedure used with adults. In addition, it is one of only two studies evaluating the use of any script-driven imagery procedure with youth. Results suggest the script driven imagery procedure is a promising tool for use in the elicitation of PTSS among youth.

First, a series of convergent validity hypotheses were addressed. Findings were partially consistent with hypotheses. Youth displayed significantly greater levels of anxiety, fear, disgust, and distress following a trauma script, compared to a neutral script, regardless of their PTSS level. As expected, greater PTSS levels significantly predicted higher levels of fear, disgust, and distress responses to the trauma script. However, PTSS level did not predict anxiety levels. Kirsch and colleagues (2015) used self-reported anxiety as their single affective measure of script reactivity [i.e., rate “anxiety” from 0 (*not at all*) to 10 (*extremely*)]. Contrary to current results, youth with PTSD in the Kirsch study evidenced significantly higher anxiety levels following the trauma script compared to youth without PTSD. One possible explanation for this unexpected finding in the current study is that adolescents differentiated between fear and anxiety temporally during the script-driven imagery procedure. When listening to the scripts, it is possible that children felt fear in the moment as they remembered the traumatic event but did not feel anxiety about the future, knowing that the traumatic event had already occurred and the script-driven imagery procedure would soon be over. In fact, the emotion training completed by participants may have contributed to this finding as the temporal distinction between fear and anxiety had been discussed just prior to the scripts. Notably, Kirsch and colleagues did not conduct an emotion training.

Surprisingly, PTSS levels among youth were not significantly correlated with any physiological outcomes (heart rate, skin conductance, facial EMG), nor did PTSS level significantly predict any physiological outcomes. Adolescents’ did have higher heart rate following the trauma script, compared to the neutral script, regardless of PTSS level. Although means for skin conductance and facial EMG were also in the expected direction, there were no other significant differences between trauma and neutral script physiological outcomes. One factor that may have contributed to this unexpected finding is that physiological responses of youth may differ somewhat from adults. Research suggests that youth display increased heart rate, skin conductance, and cortisol levels in response to fear or stress, similar to adults; however, slight differences such as different heart rate patterns have been observed in youth (Beidel, 1989; McManis, Bradley, Berg, Curthbert & Lang, 2001; Silvetti, Drago, & Ragonese, 2001). However, it does not seem that these minor differences would fully account for the findings of the current study. Alternatively, it is possible that youth have greater difficulty clearly visualizing the scripts. Although youth in the current study had VVIQ-A scores comparable to adult scores (Kozhevnikov, Kosslyn, & Shephard, 2005), these self-reported scores likely also represent other factors, such as participants' beliefs about their imagery abilities and how vivid a specific image is for someone in comparison to others images they have had. In fact, research suggests that youth have greater difficulty generating imagery, particularly complex imagery, compared to adults, and that this ability may continue to develop through adolescence (Kosslyn, Margolis, Barrett, Goldknopf & Daly, 1990). In addition, research shows that it takes longer for youth to generate and process imagery than adults (Kosslyn et al., 1990); therefore, it may be useful to have longer visualization time periods in youth than in adults, and future studies should examine this possibility. These differences in imagery ability may contribute to less vivid remembering of the trauma during the script and less associated physiological responsivity, consistent with previous PTSD theory and research, including Lang's bioinformational theory (Bryant & Harvey, 2006; Lang, 1979). Finally, differing presentations of PTSS between adults and youth may have contributed to the divergent physiological findings. Many experts contend that DSM criteria for PTSD poorly captures posttraumatic reactions of youth and many youth with subthreshold PTSD experience equivalent distress and impairment to those meeting criteria (Copeland et al., 2007; Pynoos et al., 2009; Smith et al., 2013). Therefore, PTSS may not correlate with physiological responses due to the adult PTSS symptom structure not clearly representing youth PTSS severity. In addition, PTSD severity level may have impacted physiological results of the current study. Kirsch and colleagues (2015) found significantly higher facial EMG and skin conductance reactivity to the trauma script among youth with PTSD than without PTSD. Greater severity of symptoms may be necessary to yield higher levels of physiological script responsivity.

Next, the current study found that PTSS levels were significantly positively correlated with total PTSD symptoms, re-experiencing symptoms, and dissociation symptoms elicited by the trauma script, although avoidance symptoms experienced were not associated with PTSS level. Similarly, PTSS level significantly predicted re-experiencing and dissociation symptoms elicited by the trauma script but not avoidance or total symptoms. Interestingly, of the three PTSD symptom clusters included in the RSDI-A measure, avoidance symptoms are the only cluster that the script-driven imagery directions specifically asked youth not to engage in during the scripts. For instance, the RSDI-A questions ask whether the participant tried not to have pictures, thoughts, or feelings about the event, which is in direct opposition to the script-driven imagery directions of imagining the event and the related emotions and sensations as clearly as possible. One interpretation of these results is that adolescents were carefully following directions and therefore did not engage in avoidance behaviors during the script-driven imagery. It is also possible that, while participants did engage in avoidance behaviors, they also engaged in desirable reporting biases, making it seem as if they were following directions. Importantly, Kirsch and colleagues (2015) did not include an index of PTSD symptom responding in their study, and the current study is the first to examine PTSD symptom responsivity to a script-driven imagery procedure among youth.

In regards to divergent validity of the script-driven imagery procedure, adolescent thought problems were not correlated with and did not significantly predict any outcome variables, including affective, physiological, or PTSD symptom responses to the scripts. This difference between PTSS level and thought problems as a predictor for script responding suggests some specificity of PTSS as a useful predictor of script-driven imagery outcomes. In addition, of those outcomes that were significantly predicted by PTSS, PTSS level accounted for 12-16% more variance than thought problems, again suggesting a level of specificity for PTSS as a predictor.

Unexpectedly, there were no significant gender differences for any affective, physiological, or PTSD symptom script response outcomes. It is possible that the current study was underpowered to test for such gender effects, particularly after including age and VVIQ-A scores as covariates. Future studies should enroll a greater number of adolescents to examine possible gender differences in script-driven imagery responding. It is also possible that boys and girls within this age range respond similarly to script-driven imagery procedures, even though stress reactivity increases more among girls than boys during this developmental period (Sanborn & Hayward, 2003; Stroud et al., 2004). There is a lack of research on gender differences in script-driven imagery, even among adults, making it difficult to draw conclusions about the lack of gender differences in the current study. While many gender differences are emerging during this period, and women go on to have significantly higher rates of PTSD following a traumatic event than men (Breslau, 2001; Breslau 2009), the adolescents in the current study may have been too young to see the effects of the ongoing biopsychosocial developmental changes.

Some important limitations of the current study should be considered. First, the study included a relatively small sample size. It is possible that some analyses, such as gender differences, were underpowered due to this limitation. A second limitation is that the current adolescent sample displayed low to moderate levels of PTSS, and only 10 individuals met criteria for PTSD. While subthreshold PTSS causes significant distress and impairment for many youth, it is possible that adolescents with and without PTSD may display markedly different responses to the script-driven imagery procedure. A majority of adult script-driven imagery procedure studies compare trauma-exposed participants with and without PTSD (Carson et al., 2000; Orr et al., 1998; Pitman et al., 1987; Ramón et al., 2006), which may explain some divergence in results of the current study. Future research should examine differences in responding to a script-driven imagery procedure among youth with and without full PTSD diagnoses. A third limitation is that, while every effort is made to include many types of information (e.g., emotions, thoughts, senses) and make the script-driven imagery procedure as realistic as possible, there are obvious differences between a trauma script and a naturalistic trauma cue. Trauma cues in an individual's day-to-day life are often unpredictable and uncontrollable, which are important factors in how a person responds; unpredictable and uncontrollable cues are known to elicit more fear than predictable, controllable cues, for instance (Hartley, Gorun, Reddan, Ramirez, & Phelps, 2014; Rosellini, Warren, & DeCola, 1987; Wood et al., 2015). A final limitation is that many measures and procedures associated with the script-driven imagery have not been validated for use with youth. For instance, the RSDI and VVIQ measures and the imagery vividness training were developed for use with adults. Measures and methods associated with the script-driven imagery procedure must also be validated for use with youth in order to fully understand the similarities and differences between adult and adolescent responding to the procedure. Given the developmental differences, findings may be influenced by factors such as wording of measure items or amount of time given to process imagery.

Despite these limitations, the current study provides preliminary evidence for the utility of a script-driven imagery procedure among adolescents. As discussed above, script-driven imagery allows for testing of causally-oriented hypotheses in a controlled laboratory setting, as well as reducing biases of retrospective reporting with real-time assessment of reactivity. This procedure has been valuable in understanding correlates and consequences of PTSS and PTSD among adults and could greatly add to the available tools for researching PTSD among youth. For instance, research using a script-driven imagery procedure among youth could test the effects of different regulatory strategies on script responsivity to help understand the impact of trauma exposure and regulatory strategies within the context of child and adolescent emotional development. Importantly, although PTSD treatment in youth has begun to receive considerably more research and attention, youth treatment continues to lag behind treatment for adults, and adult treatments are often adapted for use with youth rather than developed with youth in mind (Schneider, Grilli, & Schneider, 2013; Silverman et al., 2008). The script-driven imagery procedure is a promising tool that may aid in our understanding of how specific treatment practices impact youth with PTSD. Overall, the addition of this tool to the “toolbox” of youth PTSD researchers would likely greatly contribute to innovative, impactful research in this area.

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Figure 1.

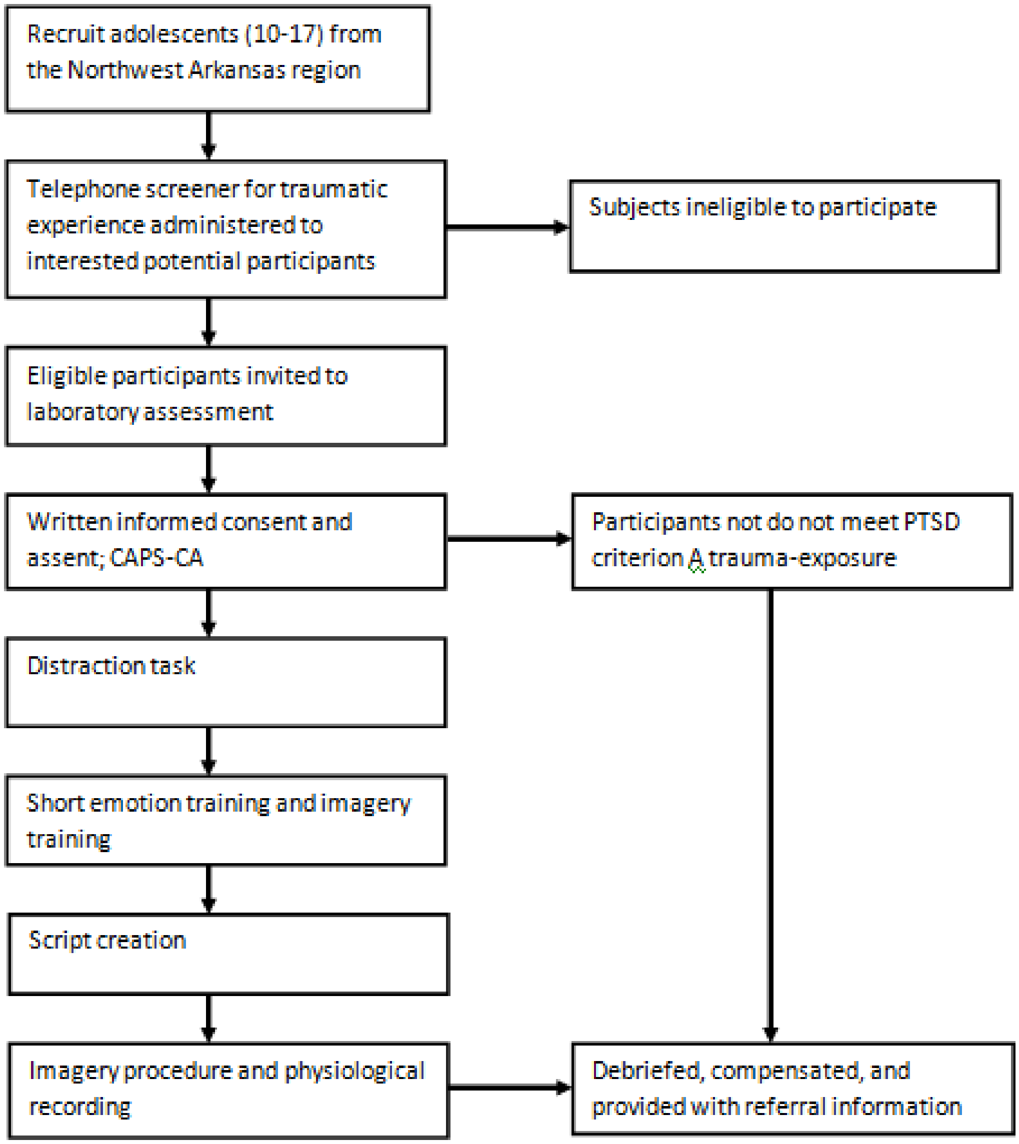

Recruit adolescents (10-17) from the Northwest Arkansas region
Telephone screener for traumatic experience administered to interested potential participants
Subjects ineligible to participate
Eligible participants invited to laboratory assessment
Written informed consent and assent; CAPS-CA
Participants not do not meet PTSD criterion A trauma-exposure
Distraction task
Short emotion training and imagery training
Script creation
Imagery procedure and physiological recording
Debriefed, compensated, and provided with referral information

Table 1.

Descriptive statistics of covariates, predictor variables, and outcome variables.

Covariates	***M (SD)***	**Girls *M (SD)***	**Boys *M(SD)***				
Age	14.12 (2.36)	14.38 (2.11)	13.86 (2.61)				
VVIQ-A	2.01 (0.62)	2.17 (0.58)	1.86 (0.62)				
Predictor Variables	***M (SD)***	**Girls *M (SD)***	**Boys *M(SD)***				
PTSS Level	5.63 (3.97)	6.43 (4.42)	4.86 (3.41)				
Thought Problems	3.15 (2.72)	3.26 (2.47)	3.05 (2.99)				
Outcome Variables	**Neutral Script *M (SD)***	**Trauma Script *M(SD)***	***Δ M (SD)***	**Girls Neutral Script *M (SD)***	**Boys Neutral Script *M(SD)***	**Girls Trauma Script *M (SD)***	**Boys Trauma Script *M(SD)***
SUDs Anxiety	17.44 (17.57)	29.63 (21.47)	12.19 (23.83)	19.00 (20.50)	15.95 (14.57)	34.57 (25.38)	24.91 (16.15)
SUDs Fear	10.74 (20.06)	29.09 (29.20)	18.35 (29.46)	10.19 (19.98)	11.27 (20.59)	29.71 (30.34)	28.50 (28.77)
SUDs Disgust	5.28 (13.26)	19.40 (26.15)	14.12 (23.61)	4.14 (11.33)	6.36 (15.07)	17.33 (22.18)	21.36 (29.85)
SUDs Distress	11.70 (17.50)	31.02 (28.60)	19.33 (28.78)	11.86 (15.83)	11.55 (19.33)	32.81 (26.20)	29.32 (31.25)
RSDI-A Total		32.10 (13.79)				34.57 (13.14)	29.62 (14.30)
RSDI-A Reexperiencing		12.07 (5.62)				12.71 (5.08)	11.43 (6.16)
RSDI-A Avoidance		8.10 (5.16)				8.76 (5.50)	7.43 (4.84)
RSDI-A Dissociation		11.93 (5.62)				13.10 (5.20)	10.76 (5.90)
EMG Frontalis (μV)	1.06 (1.38)	1.70 (3.97)	0.81 (3.01)	1.33 (1.76)	0.81 (0.84)	2.61 (5.49)	0.82 (1.05)
EMG Levator (μV)	0.40 (0.25)	0.45 (0.32)	0.08 (0.28)	0.41 (0.29)	0.39 (0.21)	0.42 (0.18)	0.48 (0.43)
Heart Rate (bpm)	74.28 (11.55)	78.18 (13.30)	3.90 (5.29)	77.29 (8.86)	71.11 (13.34)	81.00 (10.67)	75.22 (15.34)
Skin Conductance (μS)	0.16 (0.88)	0.43 (0.88)	0.59 (2.20)	0.32 (0.79)	-0.005 (0.95)	0.47 (0.91)	0.39 (0.87)

Note: 10 participants (23.3%) met diagnostic criteria for PTSD.

Table 2.

Zero-order correlations.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	-	.21	.07	.13	-.01	-.01	-.13	-.05	-.15	-.06	-.20	-.12	.09	.14	.06	-.20
2. VVIQ-A	-	-	-.13	.04	-.26	-.07	-.34*	-.26	-.08	-.18	-.14	.11	.32	-.37*	-.28	-.08
3. PTSS Level	-	-	-	.15	.13	.26	.43**	.20	.37*	.43**	.14	.35*	-.09	-.01	.23	.19
4. Thought Problems	-	-	-	-	-.15	.01	.21	-.13	-.02	-.06	-.20	.19	-.06	-.07	-.02	-.12
5. Δ SUDs Anxiety	-	-	-	-	-	.64**	.45**	.69**	.30	.47**	.21	.09	-.14	-.08	.32*	.07
6. Δ SUDs Fear	-	-	-	-	-	-	.52**	.55**	.28	.42**	.18	.10	-.20	-.21	.40*	-.05
7. Δ SUDs Disgust	-	-	-	-	-	-	-	.45**	.34*	.55**	.13	.16	-.07	.12	.31	-.09
8. Δ SUDs Distress	-	-	-	-	-	-	-	-	.23	.32*	.22	.05	-.12	.13	.33*	.13
9. RSDI-A Total	-	-	-	-	-	-	-	-	-	.85**	.82**	.86**	-.21	-.23	.09	.07
10. RSDI-A Reexperiencing	-	-	-	-	-	-	-	-	-	-	.54**	.60**	-.28	-.13	.28	.02
11. RSDI-A Avoidance	-	-	-	-	-	-	-	-	-	-	-	.55**	-.09	-.01	-.00	.12
12. RSDI-A Dissociation	-	-	-	-	-	-	-	-	-	-	-	-	-.15	-.44**	-.07	.05
13. Δ EMG Frontalis	-	-	-	-	-	-	-	-	-	-	-	-	-	.09	.08	-.16
14. Δ EMG Levator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.22	.03
15. Δ Heart Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.06
16. Δ Skin Conductance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: *p < .05, **p < .01; VVIQ-A: Vividness of Visual Imagery Questionnaire-Adolescent Version; PTSS: Posttraumatic Stress Symptom; Δ Change in neutral script responding subtracted from trauma script responding; SUDs: Subjective Units of Distress scales; RSDI-A: Responses to Script-Driven Imagery Scale- Adolescent Version; EMG: Electromyography.

Table 3.

Summary of hierarchical regression analyses for PTSS level predicting affective responding.

Variable		R^2	β	t	sr^2	p
DV: **SUDs Anxiety**	Step 1	.25				
Age			.03	0.18	.00	.86
Gender			.25	1.56	.05	.13
Trait Imagery Vividness			-.36	-2.25	.11	.03*
Baseline Anxiety			.17	1.13	.03	.27
	Step 2	.29				
PTSS Level			.23	1.46	.05	.16
DV: **SUDs Fear**	Step 1	.05				
Age			-.03	-0.16	.00	.87
Gender			-.05	-0.27	.00	.79
Trait Imagery Vividness			-.08	-0.47	.01	.64
Baseline Fear			.05	0.33	.00	.74
	Step 2	.21				
PTSS Level			.43	2.52	.16	.02*
DV: **SUDs Disgust**	Step 1	.29				
Age			-.11	-0.78	.01	.44
Gender			-.05	-0.37	.00	.71
Trait Imagery Vividness			-.15	-1.06	.02	.30
Baseline Disgust			.30	2.03	.07	.06
	Step 2	.45				
PTSS Level			.47	3.08	.16	.004**
DV: **SUDs Distress**	Step 1	.12				
Age			-.09	-0.55	.01	.59
Gender			.10	0.61	.01	.55
Trait Imagery Vividness			-.17	-1.00	.02	.33
Baseline Distress			.02	0.12	.00	.91
	Step 2	.25				
PTSS Level			.42	2.38	.13	.02*

Note: *p < .05, **p < .01

Table 4.

Summary of hierarchical regression analyses for PTSS level predicting psychophysiological responding.

Variable		R^2	β	t	sr^2	p
DV: **EMG Frontalis**	Step 1	.81				
Age			.09	1.08	.01	.29
Gender			.07	0.80	.00	.43
Trait Imagery Vividness			.14	1.54	.02	.14
Baseline EMG Frontalis			.85	10.03	.70	<.001**
	Step 2	.81				
PTSS Level			-.04	-0.49	.00	.63
DV: **EMG Levator**	Step 1	.45				
Age			.15	1.06	.02	.30
Gender			-.15	-1.03	.02	.31
Trait Imagery Vividness			-.31	-2.08	.08	.05*
Baseline EMG Levator			.62	4.42	.35	<.001**
	Step 2	.46				
PTSS Level			-.05	-0.34	.00	.73
DV: **Heart Rate**	Step 1	.85				
Age			.05	0.63	.00	.54
Gender			-.01	-0.13	.00	.90
Trait Imagery Vividness			-.12	-1.46	.01	.16
Baseline Heart Rate			.90	11.79	.72	<.001**
	Step 2	.85				
PTSS Level			.09	1.15	.01	.26
DV: **Skin Conductance**	Step 1	.67				
Age			-.24	-1.74	.06	.09
Gender			-.07	-0.46	.00	.65
Trait Imagery Vividness			-.07	-0.47	.00	.64
Baseline Skin Conductance			.64	4.61	.39	<.001**
	Step 2	.69				
PTSS Level			.14	0.99	.02	.33

Note: $^*p < .05$, $^{**}p < .01$

Table 5.

Summary of hierarchical regression analyses for PTSS level predicting PTSD symptom responding.

Variable		R^2	β	*t*	sr^2	*p*
DV: **RSDI-A Total**	Step 1	.07				
Age			-.14	-0.84	.02	.41
Gender			.17	0.98	.02	.34
Trait Imagery Vividness			-.05	-0.31	.00	.76
	Step 2	.17				
PTSS Level			.33	1.92	.10	.06
DV: **RSDI-A Reexperiencing**	Step 1	.06				
Age			-.02	-1.79	.00	.86
Gender			.08	0.48	.01	.63
Trait Imagery Vividness			-.15	-0.85	.02	.40
	Step 2	.19				
PTSS Level			.36	2.24	.13	.03*
DV: **RSDI-A Avoidance**	Step 1	.07				
Age			-.14	-0.82	.02	.42
Gender			.19	1.04	.03	.31
Trait Imagery Vividness			-.15	-0.84	.02	.41
	Step 2	.08				
PTSS Level			.06	0.33	.00	.74
DV: **RSDI-A Dissociation**	Step 1	.08				
Age			-.18	-1.12	.03	.27
Gender			.16	0.95	.02	.35
Trait Imagery Vividness			.15	0.90	.02	.37
	Step 2	.21				
PTSS Level			.38	2.28	.13	.03*

Note: *$p < .05$

Table 6.

Quantification of convergent and divergent validity tests.

Outcome Variable	**Convergent sr^2**	**Divergent sr^2**
SUDs Anxiety	.05	.01
SUDs Fear	.16*	.00
SUDs Disgust	.16*	.04
SUDs Distress	.13*	.00
RSDI-A Total	.10	.00
RSDI-A Reexperiencing	.13*	.00
RSDI-A Avoidance	.00	.02
RSDI-A Dissociation	.13*	.05
EMG Frontalis	.00	.00
EMG Levator	.00	.00
Heart Rate	.01	.00
Skin Conductance	.02	.02

Note: *$p < .05$; PTSS was the predictor variable for all convergent validity hypotheses. Thought problems was the predictor for all divergent validity hypotheses.

Table 7.

Gender differences in affective, physiological, and PTSD symptom responding.

Outcome Variable	***F***	***p***
SUDs Anxiety	1.74	.20
SUDs Fear	0.10	.76
SUDs Disgust	0.05	.83
SUDs Distress	0.34	.56
RSDI-A Total	2.10	.16
RSDI-A Reexperiencing	1.04	.32
RSDI-A Avoidance	1.38	.25
RSDI-A Dissociation	2.19	.15
EMG Frontalis	1.24	.28
EMG Levator	1.66	.21
Heart Rate	0.10	.75
Skin Conductance	0.44	.51

Appendix

Phone Screener

Thanks for your interest in this study. I'm going to start by explaining the study procedures to you. Then, if you're interested in participating, I'll ask you a few questions. Okay?

The purpose of this study is to understand adolescents' reactions to stressful events. You and your parent/guardian will be asked to come to the laboratory to take part in a research study. Here, we will first ask you and your parent/guardian to complete some questionnaires. Next, you will be asked to remember and write down memories or things that have happened to you, including a past stressful event. Then, you will listen to and think about recordings of these memories. We will also take measurements of your heart rate, skin responses, and face muscle movements. In total, this study will take three hours to complete; for your participation, you will be compensated $40.

Do you have any questions? (*Address all questions*). Does this sound like a study in which you and your child would be interested in taking part?

*If **no***: Okay. Thank you kindly for your time and have a nice day.

*If **yes***: continue

I'd like to continue now by asking you a few questions that will determine your eligibility for the study.

First, are you between the ages of 8 and 16 years?

*If **no:*** okay. Unfortunately, this is a requirement for the study so we are not able to invite you to participate at this time. I thank you very much for your time and look forward to working with you in future studies.

*If **yes:*** continue

Next, will your parent/parental guardian be able to come with you to the laboratory to sign a permission form for you to participate? We will also ask that s/he fill out a few questionnaires; it will take approximately 15 minutes.

*If **no:*** okay. Unfortunately, this is a requirement for the study so we are not able to invite you to participate at this time. I thank you very much for your time and look forward to working with you in future studies.

*If **yes:*** continue

Now, can you tell me if anything particularly stressful or traumatic has happened to you? I'm talking about something that was really frightening or upsetting and you felt like there was nothing you could do to stop it from happening (for example: serious accident, fire, or explosion, natural disaster, getting beat up, life threatening illness…things like that).

*If **no:*** okay. Unfortunately, this is a requirement for the study so we are not able to invite you to participate at this time. I thank you very much for your time and look forward to working with you in future studies.

*If **yes:*** continue

Y **N** Were you physically injured?

Y **N** Was someone else physically injured?

Y **N** Did you think that your life was in danger?

Y **N** Did you think that someone else's life was in danger?

Y **N** Did you feel helpless?

Y **N** Did you feel terrified?

Y **N** Did you feel horrified?

Obtain information related to the experience of 1) subjective threat, 2) helplessness, 3) horror, and 4) fear. If all are present, the participant has experienced a traumatic event. Continue. Otherwise inform the participant that she is not eligible and thank her for her time using the script above.

Thanks so much for answering these questions. What I'd like to do now if you're still interested is schedule a time that would be convenient for you and your parental guardian to come to the lab for the session.

Responses to Script-Driven Imagery Scale- Adolescent Version (RSDI-A)

This form asks about your feelings while you listened to and imagined the script.

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

Don't worry if you have trouble remembering. Just make the best guess you can based on what you remember now.

1. Did you feel like the event was happening again?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

2. Were you worried or unhappy?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

3. Did you feel upset?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

4. Did you have reactions in your body? (Examples: sweaty, racing heart, short of breath)

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

5. Did you try not to have (avoid) pictures in your head, sounds, or smells that had to do with the event?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

6. Did you try not to have thoughts about the event?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

7. Did you try not to have feelings about the event?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

8. Did what you feel like things were not real, like you were in a dream or watching a movie?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

9. Did you feel like you were watching what was happening to you from outside your body?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

10. Did you feel separate or apart from your body?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

11. Did you feel like you were in a fog?

Not at all A lot
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6

Response Vividness Training

Remember how I talked about vivid pictures of memories and things that have happened to you are going to be part of our study? We will start this part of the study now. I'd like you to imagine some events. I'll be reading descriptions of the events to help you imagine them. It is just like daydreaming but I want you to have more control over the things you think about, to imagine specific events, for a certain amount of time. It will be easier to do this if you are relaxed first.

As you sit there, relaxed and calm, try to imagine the situations as clearly and with as much detail as you can. By this I mean to try to involve yourself fully in the picture as if you were there and actually doing the things in the situation. For example, the first scene I will ask you to imagine involves lying on a beach watching people play in the water; I want you to try to move your eyes while you imagine, just like if you were really looking at all the people in the water and all the way down the beach. The idea of a clear and detailed image is that you get the feeling of a real, actual experience.

Now I'll set up the image. As I describe the situation, create the image in your mind, and act just like you would in the real situation. When I finish the description, keep imagining the scene until I tell you to stop. Close your eyes and focus on relaxing your muscles. We're ready for the first image.

You are lying on a sandy beach on a warm summer day. People in bright colored swimsuits splash around in the water, and closer by, two children are throwing a beach ball. You feel relaxed and happy, enjoying the warmth of the sun and the wet, squishy sand under your hands. You can hear sounds of people laughing and playing, and the steady sound of waves washing up on the shore.

(30 sec. imagine) Please continue to imagine this scene…

Relax and release these images (30 sec. relax)

Now open your eyes and see yourself back in the lab here today.

What did you do while you were imagining?

Did you move your eyes while you were imagining?

Could you feel the warm sun on your skin or the wet sand in your hands?

Could you hear the sounds of the people or the waves?

Did your breathing change or did your heart beat faster or slower?

It's very important to do as part of your image what you would do in the real situation.

This means things like actually tensing your muscles, moving your eyes, and breathing deeply as part of the imagining process. Many of us aren't used to this way of imagining things clearly and in detail, and the point of these sessions is for you to learn and practice how to feel like you are in the scene that you are imagining. As part of imagining, you need to do what you would do in the real situation. This can make the image feel more real to you.

All right, now that we've reviewed the idea of imagining more clearly, let's practice the same scene again. Don't worry if you didn't feel all the changes and actions, like your eyes moving or your breathing slowing down before. Some people are better than others at this at first, but practice will help you imagine events, feeling as if they were really happening.

Close your eyes and focus on relaxing your body. We're ready for the next image.

You are lying on a sandy beach on a warm summer day. People in bright colored swimsuits splash around in the water, and closer by, two children are throwing a beach ball. You feel relaxed and content, enjoying the warmth of the sun and the wet, squishy sand under your hands.

You can hear sounds of people laughing and playing, and the steady sound of waves washing up on the shore.

(30 sec. imagine) Please continue to imagine this scene…

Relax and release these images (30 sec. relax)

Now open your eyes and see yourself back in the lab here today.

What did you do while you were imagining?

Did you move your eyes while you were imagining?

Could you feel the warm sun on your skin or the wet sand in your hands?

Could you hear the sounds of the people or the waves?

Did your breathing change or did your heart beat faster or slower?

Remember, what we're trying to learn is clearly imagining by being a part of the image or scene that you are imaging. Just like with the last scene, this means doing what you would normally do in the real situation. I want to try imagining something else this time but adding in the way your body would feel in the real situation. The first thing is that I want you to use the clear and detailed imagining you have practiced to help you experience situations as real. Things like facial expressions, heart changes, sweating, and breathing changes are a part of how you would react in the real situation, and doing these things during your imagery can help you to really experience situations as real. So, as we practice the images today, I want you to have the same kind of changes in your body as the last image, and to let this help you really be a part of the image, as much as you can.

Let's try an image now. Try to involve yourself in the image as much as you can, as if it were really happening. Close your eyes and focus on relaxing your body. We're ready for the next image.

You have decided to give a speech to a class that you really need a better grade in. You have never spoken in front of such a big group before. Your palms become sweaty, and you scrunch up the muscles of your forehead. It is almost time for the class to start and your heart starts beating faster as the buzzer in the hall rings for the start of class. As you walk to the front of the room, you start breathing quickly, and you look around at the faces of the people waiting for you to give your speech. The whole group looks at you quietly, moving around in their seats while they wait for you to start.

Relax and release these images (30 sec. relax)

Now open your eyes and see yourself back in the lab here today.

How did you react during the image? What did you do while you were imagining?

Did you breathe faster and scrunch up your muscles?

Did you feel heart beat faster or slower or did you start to feel sweaty?

Close your eyes again and relax for a few seconds. Before we do the next image, I want to remind you again of why we're practicing imagining; so that you let yourself act like you are really in the situation while you are imagining and your body is reacting and changing like it would in the real situation. Okay, let's try the next image.

On a clear Saturday morning, you are riding your bicycle on a quiet country road. You breathe heavily and sweat runs down your face while you peddle quickly over the road. Ahead of you is a steep hill, and you scrunch up your face and neck muscles, working hard to peddle up the hill. Your eyes look to the right at several chickens run away when you pass a big, red barn. A rooster crows loudly from inside the barn. Your heart beats fast as you get close to the top of the hill.

Relax and release these images (30 sec. relax)

Now open your eyes and see yourself back in the lab here today.

How did you react during the image? What did you do while you were imagining?

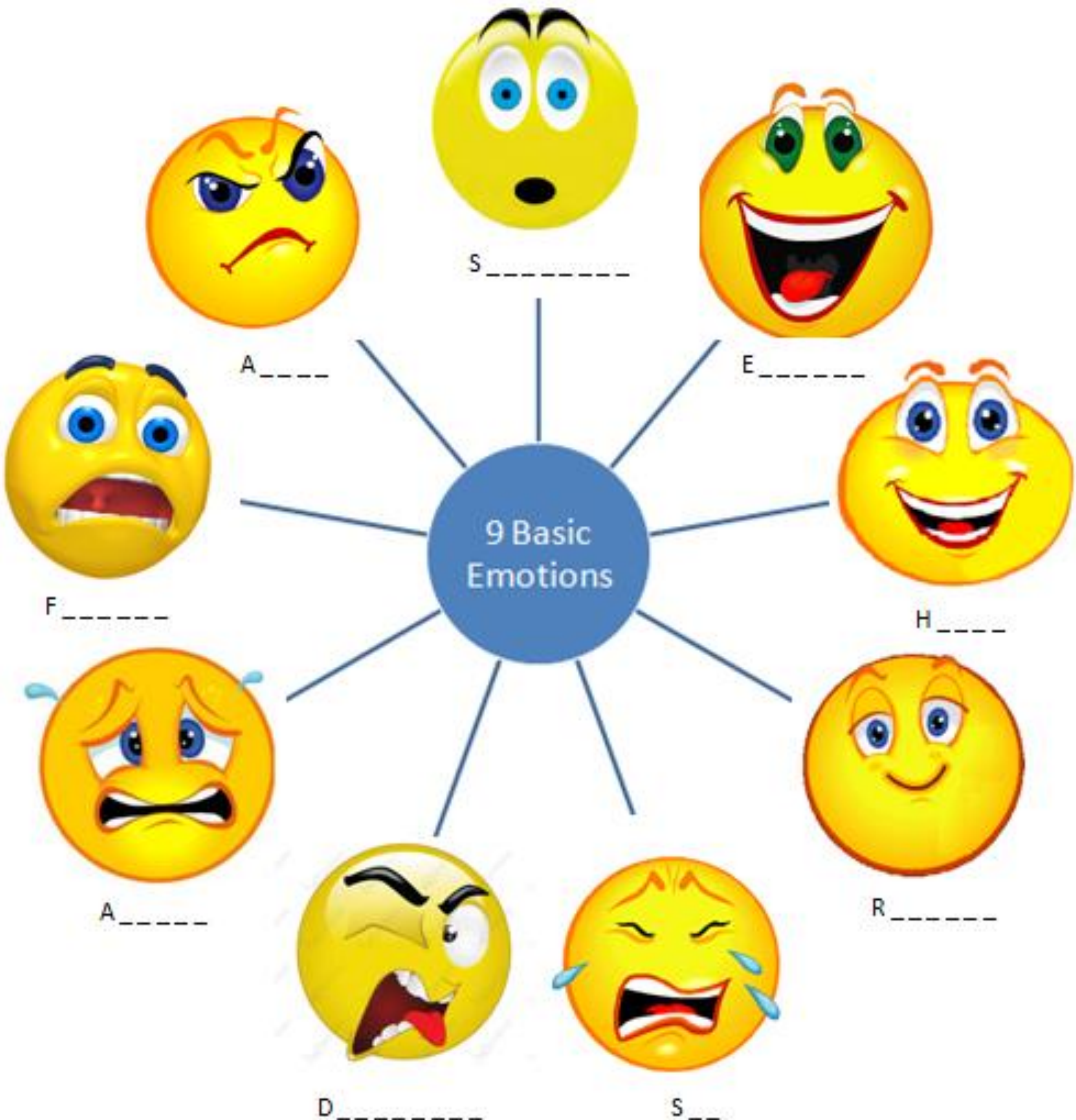
Did you scrunch up your muscles in your body or move your eyes?

What about breathing get faster or slower or did your heart beat faster or slower?

Did you feel any change in sweating?

You've practiced how to imagine a clear and detailed situation by feeling and acting as if you are in the situation yourself. In a little while you will be imagining another situation. I'd like you to remember the things that you learned during this training and how to be a part of the scene that you are imagining when you imagine the next time.

Emotion Training



1. Introduce emotion words in the order below, and have the participant write the words in the appropriate blank.
   - Angry
   - Disgusted
   - Sad
   - Excited
   - Relaxed
   - Happy
   - Surprised
   - Fearful
   - Anxious

2. Have a discussion about the definition of each emotion in the following order (starting with relaxed, moving clockwise):
   - Angry

     Angry is how you feel when something happens that you do not like and you get mad. You might scrunch up your fists and your eyebrows, and your heart might beat a little faster when you are angry. [Can you think of a time when you have felt angry?] **If another student at school says something mean to you or your little brother or sister breaks one of your favorite things, you might feel angry.**
   - Surprised

     Surprised is when something happens that you were not expecting. You might jump or yell or put your hand over your mouth like this [demonstrate]. [Can you think of a time when you have felt surprised?] **You might feel surprised if your friend throws you a birthday party that you did not know about or if you get a present that you did not expect.**
   - Excited

     Excited is when you are waiting for something good to happen and you are really looking forward to it or when something really good just happened. When you are excited, you might yell or smile or jump up and down. [Can you think of a time when you have felt excited?] **If you just found out that you won a new bike or you know that you are going on a fun vacation soon, you might feel excited.**
   - Happy

     Happy is a good feeling you have when something is how you wanted it to be or you are feeling glad about something. You smile and feel good when you are happy. [Can you think of a time when you have felt happy?] **You might feel happy if you just got an ice cream cone from your mom or dad or you got a good grade on a test.**

- Relaxed

  Relaxed is a good feeling you have when you are calm and not worried or busy. When you are relaxed, your muscles will feel loose and you might even close your eyes or lean back in your chair. [Can you think of a time when you have felt relaxed?] **If you are sitting on a beach enjoying the sunshine or going for a slow walk outside, you might feel relaxed.**
- Sad

  Sad is how you feel when something is not how you wanted it to be or you wish something was different. You might frown or even cry if you are feeling sad. [Can you think of a time when you have felt sad?] **If your dog runs away or your friend moves to a new school, you might feel sad.**
- Disgusted

  Disgusted is how you feel when something gross or yucky happens. You might scrunch up your nose or feel your stomach flip-flop if you are disgusted. [Can you think of a time when you have felt disgusted?] **If you see someone digging in the mud and playing with worms or if you smell a skunk, you might feel disgusted.**
- Anxious

  Anxious is how you feel when you are worried about something that is going to happen later. If you are anxious, your hands might feel sweaty or you might feel nervous, like you have butterflies in your stomach. [Can you think of a time when you have felt anxious?] **If you have to give a speech in front of your class or you get in trouble and have to tell your parents later, you might feel anxious. You get anxious when you are worried that something scary will happen later.**
- Fearful

  Fearful is how you feel when something scary happens. Your heart might beat faster or you might scream if you are fearful. You might even feel like hiding or running away. [Can you think of a time when you have felt fearful?] **If you are in the woods and see a mean-looking dog, or you are outside away from your house and a big storm starts, you might feel fearful. You get fearful when something scary is happening right now.**

3. Administer emotional understanding test.

Understanding Emotions

1. Which emotion do you feel when you are waiting for something good to happen and you are really looking forward to it?
    a. Surprised
    b. Excited
    c. Scared

2. Which emotion do you feel when you are worried that something scary is going to happen later?
    a. Anxious
    b. Relaxed
    c. Excited

3. Which emotion do you feel when something gross or yucky happens?
    a. Happy
    b. Angry
    c. Disgusted

4. Which emotion do you feel when you are calm and not worried or busy?
    a. Relaxed
    b. Disgusted
    c. Fearful

5. Which emotion do you feel when something scary is happening right now?
    a. Anxious
    b. Happy
    c. Fearful

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

April 17, 2013

MEMORANDUM

TO:	Emily Mischel Ellen Leen-Feldner
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	13-04-641
Protocol Title:	*An Evaluation of the Validity of a Script-Driven Imagery Procedure Among Adolescents*
Review Type:	☐ EXEMPT ☐ EXPEDITED ☒ FULL IRB
Approved Project Period:	Start Date: 04/17/2013 Expiration Date: 04/11/2014

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 200 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

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