Longitudinal Pathways of Emotion Regulation, Maternal Depression and Early Childhood Psychopathology

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Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Overview

Emotion regulation (ER) is complex and can implicate numerous outcomes within a child's environment. It is a valuable framework in conceptualising adaptive and maladaptive functioning in children (Cicchetti, Ackerman, & Izard, 1995). The current thesis provides a developmental account of ER and addresses a number of critical questions in three parts.

Part one is a meta-analysis of 17 studies. It investigated the effectiveness of ER interventions for children which was found to improve regulatory abilities as well as behavioural and clinical outcomes, compared to having no treatment or an alternative treatment. Factors such as age, duration and sample origin did not differentiate treatment gains. The majority of the included studies had interventions that were group-based and informed by CBT principles.

Part two describes an empirical study utilising prospective observational data to examine preschoolers' ER, over time, and its interaction with maternal depression on subsequent externalising and internalising behaviours. ER was represented by emotion reactivity, social regulation and redirected attention. It was assessed at age 15, 26 and 37 months. The three ER indices were not significant precursors of later emotional and behavioural symptoms. However, lower emotion reactivity at 15 months was found to intensify the direct influence of maternal depression on externalising but not internalising problems. Coding of the ER variables was jointly completed with another trainee.

Part three presents a critical appraisal of the dissertation process. A discussion on the choice of research topic, learning points and challenges encountered was included. It concludes with a consideration of childhood ER from the perspective of culture.

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Part 1: Literature Review

A meta-analysis of the effectiveness of emotion regulation interventions for children and adolescents

Abstract

Many emotion regulation (ER) programmes have been developed but there has been no known study that systemically integrates and evaluates the overall efficacy of ER interventions for children. *Aim:* The objective of this meta-analysis was to establish whether ER interventions led to improvements in regulation among children and adolescents, in comparison to having no treatment or receiving an alternative treatment. *Method:* A systematic search was conducted for articles published before 22nd November, 2015, on electronic databases. Standardised mean effects (Cohen's *d*) were calculated from the data of the identified studies using a random-effects model. The primary dependent variable was overall improvement in ER. *Results:* An overall mean effect size of $d = .30$ was generated from the 17 studies included. This represented a small to medium gain in ER following a course of treatment. Age, duration, sample origin and types of control groups were not significant moderators. Sub-analysis of therapeutic improvements using behavioural and clinical outcomes yielded a large effect size of $d = .54$ and a small effect size of $d = .25$ respectively. Most of the ER interventions were group-based and adopted a CBT framework. *Conclusions:* The findings provided evidence in support of ER-based interventions for improving abilities to regulate affect in children and adolescents. Treatment gains were also observed in clinical and behavioural outcomes. Clinical implications, methodological limitations and future directions are considered.

Keywords: emotion regulation, meta-analysis, intervention, children, adolescents

1. Introduction

The construct of emotion regulation (ER) has received substantial empirical attention in the last two decades. ER refers to the "extrinsic and intrinsic processes responsible for monitoring, evaluating and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (Thompson, 1994, p. 27-28). It emphasises the dynamic ways in which an individual can influence the intensity of an affective experience in addition to when and how these experiences are expressed across a variety of situations (Gross, 2002; 2014).

There is continuing debate on the theoretical and methodological specificity of ER processes, and in particular, the degree to which emotions is encapsulated as a dimension within the ER framework interacting with regulatory behaviours (e.g. Cole, Martin, & Dennis, 2004; Kappas, 2011). Emotions can be experienced in differing intensity, frequency and duration (i.e. reactivity), and can have a regulating function. An individual's affective states modulate how s/he feels (e.g. generating and maintaining positive emotions to up-regulate mood) as well as how others feel (e.g. a child expressing sadness through crying regulates parental responses) (Gross, 2013).

In addition, Gross (1998) proposes the process model of ER to facilitate an understanding of the multiple ways emotions can be regulated. Regulatory behaviours are classified into five main clusters; namely: (i) situation selection (e.g. a teenager avoids school because it makes him anxious), (ii) situation modification (e.g. a child apologises to a parent to avoid punishment), (iii) attentional deployment (e.g. a toddler focusses on a toy instead when a stranger approaches him), (iv) cognitive reappraisal (e.g. an individual regulates his

anxiety by thinking that a presentation is a positive challenge rather than a nerve-wrecking one), and lastly (v) response modulation (e.g. a student with a fear of public speaking suppresses his distress). The first four categories are deemed to be antecedent-focussed strategies, i.e. activated before the generation of an emotion while the final category represents response-focussed strategies, i.e. activated after the generation of an emotion. Importantly, none of these ER strategies are dichotomously better than the other; the adaptivity of a regulatory behaviour is dependent on the situational context and outcome (Gross & Thompson, 2007). For example, an individual may manage his worries successfully by avoiding anxiety-provoking situations. However, the avoidance may also bring about difficulties coping with healthy challenges.

1.1. ER and Developmental Psychology

Childhood, which is associated with numerous developmental processes as well as increased emotional and psychological demands, is a pivotal period where ER is particularly relevant (e.g., Cole, Martin, & Dennis, 2004). Emergent evidence has shown ER to be integral to the general well-being of children (e.g., Jacob, Thomassin, Morelen, & Suveg, 2011). It also contributes substantially to the development and maintenance of various childhood clinical difficulties (e.g., Dillon, Deveney, & Pizzagalli, 2011; Gross & Munoz, 1995).

1.1.1. Role of adaptive ER. Children with adaptive ER resources are considered to be more able to manage their feelings in a socially appropriate manner and when in an emotionally charged situation, can utilise more contextually effective strategies to regulate their emotions (e.g., Eisenberg, Fabes, Guthrie, & Reiser, 2000). For instance, a child redirects his attention to positive cues to distract himself from an anger-eliciting stimulus (instead of

being immediately argumentative) and in doing so, successfully reduces his anger to a level that allows him to continue with the task in hand. In contrast, children with maladaptive ER may be less able to control their emotions, are more labile and hence respond in a less adaptive manner (e.g., Fabes, Leonard, Kupanoff, & Martin, 2001). Here, a child in a fearful situation is likely to demonstrate persistent crying or marked passivity ("frozen in fear") and a slower return to baseline state, as a result of unhelpful regulation such as over-suppression of fear reactivity.

Extensive literature has documented the critical role of adaptive regulation in the socioemotional, academic and psychological functioning of children (e.g., Saarni, 1999; Thompson & Calkins, 1996). Proficiencies in ER among young individuals predicted better social resilience, competency (e.g., Blair, Denham, Kochanoff, & Whipple, 2004; Spinard et al., 2006), and better peer relations (e.g., Eisenberg et al., 2000) relative to those with poorer regulatory abilities. Adaptive ER in preschool children was positively associated with better classroom productivity (Graziano, Reavis, Keane, & Calkins, 2007). Children in kindergarten with contextually better abilities to regulate emotions achieved better results in scholastic domains such as vocabulary, mathematics and reading (Ponitz, McClelland, Matthews, & Morrison, 2009).

1.1.2. ER and childhood psychopathology. While ER is not categorically regarded as good or bad, certain reactivity and regulatory behaviours are more likely to jeopardise childhood functioning and in the longer term contribute towards psychopathology (Cicchetti, Ackerman, & Izard, 1995). For instance, recent studies suggest that children with an autism spectrum disorder (ASD) demonstrate a higher frequency of temper tantrums, self-harm

and aggression, as they have poorer ER capacities and engage in less constructive regulatory strategies such as avoidance and suppression (e.g., Mazefsky et al., 2013; Samson et al., 2014).

The ER construct is also linked to childhood internalising (e.g. anxiety and mood disorders) and externalising (e.g. behavioural problems) difficulties (e.g., McLaughlin, Hatzenbuehler, Mennin & Nolen-Hoeksema, 2011; Eisenberg et al., 2001) and are often associated with the core features of such disorders. Children with internalising behaviours have poor emotion recognition and low tolerance to negative feeling states (e.g. significant fear arousal despite non-threatening situation) (Weems & Silverman, 2006). Suveg and Zeman (2004) found that children with anxiety symptoms engaged in more maladaptive, response-focussed forms of regulation such as inhibition and avoidance to significantly dampen negative affects and mask distress, compared to those without. ER difficulties, often problems with the control of affective states, have also been observed in children with externalising symptomology (e.g., Eisenberg et al., 2001). Cole et al. (1996) demonstrated that maladaptive regulation is associated with behavioural difficulties among preschool children; where there is a tendency to act out in more confrontational and/or argumentative manners as means to regulate emotion states. Difficulties in ER have similarly been established in boys with attention-deficit hyperactivity disorder (ADHD) (Melnick & Hinshaw, 2000; Walcott & Landau, 2004).

1.2. ER Interventions

The theoretical principles and the supportive evidence base for ER have ensured continued research attention and generated considerable interest for clinical interventions that address problems commonly associated with

maladaptive ER amongst children. Established psychological interventions, such as dialectical behaviour therapy for adolescents (DBT; Linehan, 1993), which has a core ER component, lend further support to the potential of ER treatments. As a result, an assortment of ER programmes focussing on affective education in conjunction with teaching and/or enhancing specific regulatory behaviours have been developed, and applied in a variety of childhood populations to improve outcomes (Southam-Gerow & Kendall, 2002).

To foster consensus within the variability of ER treatment approaches, Berking and his associates (2008) proposed a useful framework for defining an ER-based treatment. They suggest that an ER intervention should typically integrate the following components: (a) awareness and identification of emotions, (b) recognition and interpretation of emotions, (c) management of difficult emotions, (d) regulation of emotions to improve overall mood and/or functioning, (e) acceptance of emotions, (f) development of coping and tolerance towards unhelpful emotions, and lastly, (g) addressing distressing emotional situation(s) to attain desired outcome(s). This framework, as noted in the method section, was used to inform the inclusion of studies.

To date, one systematic review has evaluated the overall benefits of ER-based interventions. It assessed mostly adult-based programmes applied in health and clinical settings, with a brief focus on childrens programmes (Smyth & Arigo, 2009). In the qualitative review, diverse families of ER treatments were identified ranging from family-oriented programmes to group-based therapies for clinical populations and school-based resilience approaches, which suggested the broad applicability of interventions with an emphasis on emotions and its regulation. The researchers concluded that ER interventions are, in general,

beneficial and improve a variety of outcomes, including better adjustment to chronic health conditions and alleviation of psychiatric symptoms in adults, as well as increased emotional competence for children.

1.2.1. ER programmes for children. A proportion of ER treatments for children address the symptomology associated with regulatory deficits in clinical populations, while others target the promotion of adaptive regulation in normative populations. Given that adaptive emotion functioning and regulation have been implicated in studies of resilience, school- and community- based preventive ER programmes are increasingly implemented among typically developing children and/or at-risk populations, to foster overall functioning across various domains (e.g., Pat-Horenczyk, Shi, Schramm-Yavin, Bar-Halpern, & Tan, 2015). Expressive writing, where a young person writes about his/her emotional experiences, has been explored an alternative approach to facilitate affect regulation (Lepore & Smyth, 2002).

Cognitive behavioural therapy (CBT) approaches have been employed most widely across the world in the treatment of childhood disorders. Numerous studies have outlined favourable efficacy outcomes for CBT coupled with moderate effect sizes (e.g., Ishikawa, Okajima, Matsuoka, & Sakano, 2007; Kendall, 1994). Some of the CBT interventions to date have incorporated elements that serve to help children with emotion identification, understanding and regulation. However, these have been predominantly centred on negative feelings of anger and/or anxiety and linked to a specific disorder (e.g. depression). There has been less attention to how children experience other common emotions (e.g. joy, frustration). The process of ER is not limited to only the adaptive management of certain negative affective states but also

encompasses the sustenance of positive emotion states (Eisner, Johnson, & Carver, 2009). Hence, many ER interventions have utilised established CBT techniques and additionally, focussed on how a range of emotions can be adaptively regulated in differing contexts. Furthermore, ER programmes have been adapted and incorporated into other disorder-specific therapies to address the common pathway of regulatory deficits (e.g., Suveg, Sood, Comer, & Kendall, 2009).

Parents and caregivers, through modelling and socialisation of emotions, are significant contributors to the acquisition of ER skills in children from a young age (e.g., Goodman & Gotlib, 1999; Thompson, 2008). Treatments have incorporated family therapy principles with the goal of enhancing ER in families (e.g. carer), as well as equipping them with skills to foster the regulatory capacities of another family member (e.g. identified patient). For instance, in a recent trial, parents who received ER training reported better regulatory capacities and were both more empathic and engaged in more frequent emotion coaching with their children compared to those in the waitlist control condition (Havighurst et al., 2013). The children of these parents had fewer behavioural difficulties as observed by their teachers. As such, many ER interventions for children have incorporated an added component designed to equip parents with adaptive practices and strategies with the expectation that it would augment improvements in children's emotionality and regulation, effecting better outcomes.

1.3. The Current Study

The present review sought to integrate the evidence regarding the effectiveness of ER-based treatments for children and adolescents through a

meta-analysis, and to identify the specificity of the interventions on regulatory abilities as well as clinical and behavioural outcomes, in order to inform future clinical and research practices. The study addressed a number of important and novel questions – First, only a handful of reviews so far have attempted to summarise significant trends within the research area of ER. Two meta-analytic reviews have been published in this field and both investigated the types of ER strategies as well as their associations with psychopathology but did not evaluate the efficacy of ER-based treatments (Webb, Miles & Sheeran, 2012; Aldao, Nolen-Hoeksema & Schweizer, 2010). Smyth et al. (2009), whose findings were discussed in the preceding paragraphs, examined the applicability of ER-based interventions but did so across a variety of contexts in a qualitative review.

Despite the proliferation of ER-based programmes, there has been no study to date that systemically integrates and evaluates the overall efficacy of these interventions and none with a specialised childhood and adolescence focus. Meta-analysis allows for the systematic evaluation of treatment effects across a range of studies, and makes it possible to examine whether certain child (e.g. age) and/or intervention characteristics (e.g. duration) moderate treatment effects. These analyses are important for addressing not only whether the accumulated evidence suggests that ER-treatments can be effective, but also under what circumstances, or for whom, they are effective. The current review attempted to bridge these gaps.

Moreover, ER interventions work on the assumption that improved regulation alleviates clinical symptoms in many developmental disorders and promotes better functioning in typically developing children (Berking et al., 2008). Because of the intended, broad applicability of ER treatments, an

assortment of outcomes, including regulatory skills, behavioural changes and clinical indicators, were examined. It was necessary to assess whether ER interventions culminated to improvements not just in ER abilities, but also in other domains relevant to childhood functioning and wellbeing. Finally, in addition to the quantitative outcomes, the current study evaluated qualitative information on the types of ER-based interventions available and tested for children and adolescents, summarised across a variety of populations and settings.

1.3.1. Study aims. In sum, the primary aim of this meta-analysis was to establish if interventions with a primary ER focus improved abilities to regulate affect among children and adolescents, in comparison to having no treatment or receiving an alternative treatment. The main outcome measure was overall improvement in ER. It further evaluated whether the magnitude of treatment effect differed if assessed using behavioural or clinical outcome measures. The methodological quality of the included studies was systematically examined. Lastly, several pertinent study factors (e.g. the duration of treatment, the age of participants) were assessed to determine if they moderated the effectiveness of ER-based treatments.

2. Method

2.1. Selection of Studies

A study was deemed to be suitable for inclusion in the meta-analysis if it met the following criteria: (1) examined the effectiveness of an intervention for ER among children and adolescents, (2) included at least post-treatment scores and a control group (with or without randomisation), (3) written in English, (4) published in a peer-reviewed journal (dissertations and book chapters were

excluded), (5) provided the necessary quantitative data for the calculation of effect sizes, and (6) all participants in the samples were age 19 or below (with the exception of Batacount et al. (2014) who applied a United Nations definition of 'youth', and included participants age 15 to 24).

For the purposes of this meta-analysis, an ER-based intervention was defined as any child and/or adolescent focussed treatment programme that explicitly promoted the improvement of ER. This objective would primarily be achieved through the discussion of emotion-related concepts (e.g. what is emotion, identify affective cues) in conjunction with facilitating the development and application of specific regulatory strategies (e.g. reframing the situation, problem-solving) in order to effect better functioning and/or address clinical symptomology, as defined by the authors and/or treatment developers. The framework, proposed by Berking et al. (2008), consisting of various core components representative of an ER intervention, was further employed to inform the inclusion process.

2.2. Literature Search

A systematic search was conducted for articles published before 22nd November, 2015, on the following electronic databases: PsycINFO, MEDLINE and ERIC. The search terms used were (emotion regulation) in combination with (treatment, intervention, therapy) and (children, adolescent, teenager, youth, boy, girl). The respective terms with truncation were first searched and subsequently combined using Boolean searching. During the initial selection process, the abstracts of the citations identified were screened according to the inclusion criteria outlined above. The full text of studies that met the selection criteria at this stage were then retrieved and reviewed to ensure their relevancy as well as

ensure that there were no duplicated studies and/or data. Figure 1 illustrates the search and inclusion process.

2.3. Coding of Studies

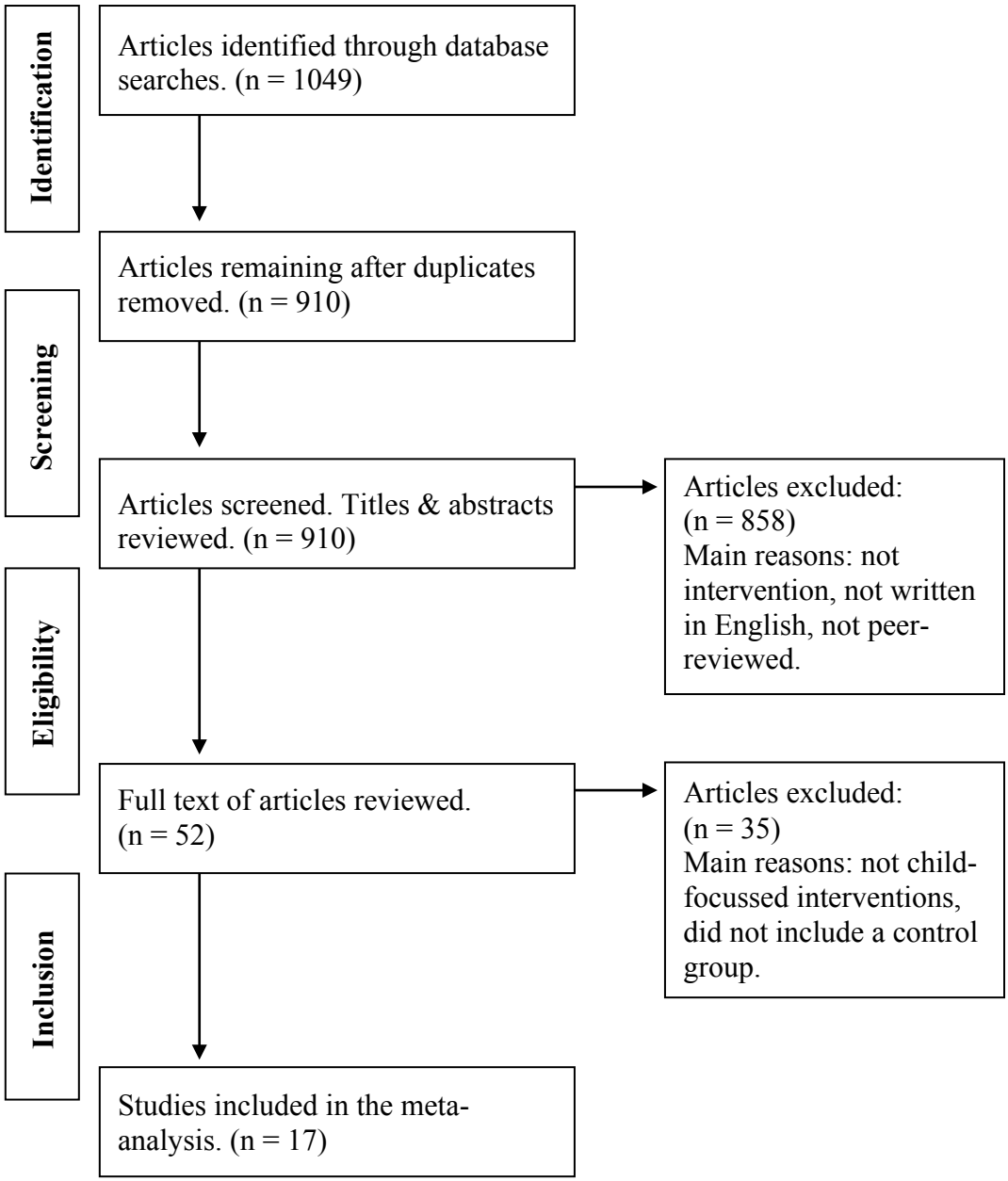
All studies were coded in order to characterise the differences and to identify potential moderators. The methodological quality of the studies was also assessed. Both procedures were completed by the author and reviewed separately by an independent researcher. Any disagreements on the study characteristics were discussed and resolved through consensus.

The following study information was coded: study design, sample size, age of participants, sample origin (e.g. clinical or community population), mode of delivery (e.g. individual or group), setting (e.g. community-based treatment or inpatient), treatment modality (e.g. CBT or writing programme), number of sessions, follow-up period (if any), outcome measure and effect size. For this meta-analysis, the group that did not receive the target intervention and/or receive treatment as usual (TAU) was classified as the control condition.

The 27-item Quality Index (Downs & Black, 1998), designed to classify both randomised and non-randomised healthcare research trials across various criteria such as reporting, methodology, validity and statistical analysis (e.g. power analysis), was adapted for this meta-analysis. An abbreviated version consisting of 16 items was used to appraise the methodological quality of the studies included in this meta-analysis (see Appendix B). Answers were scored as either 0 (No) or 1 (Yes), yielding a maximum overall summary score of 16.

Figure 1

Information about study screening, selection and inclusion



2.4. Analysis

Cohen's *d* (Cohen, 1988) was selected as the main effect size metric used in the meta-analysis. This was either extracted directly from the study or calculated using the data provided; by subtracting the mean of the control group at post treatment (M_C) from the mean of the treatment group at post treatment

(M_E) and dividing this difference by the pooled standard deviation of both groups (SD_P). A $d = .20$, $d = .50$ and $d = .80$ would be considered a small, medium and large effect size respectively (Cohen, 1992). If studies had more than one treatment condition (e.g. CBT vs. ER CBT vs. Waitlist), the intervention with a specific focus on ER was used (i.e. ER CBT) as a comparison.

The primary outcome of the meta-analysis was overall emotion regulation (OER). This was calculated using the reported total score of the primary ER measure. If a total score was not available, the weighted average of the effect sizes across various subscales of an ER measure was computed and used in place of a total score. Similarly, if a study did not utilise an ER-based outcome measure, the identified primary measure was used in the pooled effect size analysis instead. When necessary, the Cohen's *d* coefficient was reversed so that a positive effect size reflected an improvement in OER in the appropriate direction. Additionally, a number of domains of measurement were included as secondary outcomes; these include behavioural (e.g. aggression, externalising behaviours) and clinical (e.g. anxiety, post traumatic stress symptoms) outcomes.

Based on the characteristics of the studies included in this current study as well as previous research, a number of categorical variables were included for moderator analysis. They were: (a) age (children vs. adolescents), (b) sample origin (clinical vs. community), (c) duration of intervention (less than and/or equal to 12 sessions vs. more than 12 sessions), and (d) type of control group (other treatment control, i.e. received an alternative form of intervention vs. no-treatment control, i.e. waitlist or received no treatment).

The statistics package R (R Development Core Team, 2008) was used in conjunction with SPSS syntaxes adapted from Field and Gillett (2010) to

calculate pooled effect sizes and moderator analyses. A random-effects model analysis was decided *a priori* and applied to calculate the overall standardised mean difference. A common effect size, which is assumed in a fixed-effects model, is unlikely due to the variation in study parameters such as differences in methodology and diverse samples. In addition, standard deviations in effect sizes of psychological meta-analyses tend to differ (e.g., Field, 2005). A random-effects model has broader confidence intervals and reduces the probability of Type-I errors. It is more appropriate to assume that there would be considerable heterogeneity due to true differences in effect sizes. As heterogeneity was expected, outliers were noted but not routinely excluded from the meta-analysis.

Two tests (Q-statistic and I^2-statistic) were conducted to determine the presence of heterogeneity. The Q-statistic (Cochran, 1954) operates on the assumption of effect size homogeneity across individual studies and thus a significant Q-statistic indicates differing effect sizes (i.e. between and within studies variability). Many researchers (e.g., Hardy & Thompson, 1998) have cautioned that the Q-statistic may be underpowered to detect heterogeneity when the meta-analysis has a small number of studies and suggested the inclusion of the I^2-statistic. This index is expressed as a percentage of true variability in effect sizes in relation to random errors within studies. According to the guidelines published by Higgins and Thompson (2002), $I^2 = 25\%$ represented low heterogeneity, $I^2 = 50\%$ represented moderate heterogeneity and $I^2 = 75\%$ represented high heterogeneity.

2.5. Publication Bias

Studies with non-significant results are less likely to be submitted and published which creates a bias commonly referred to as the 'file drawer problem'

(Rosenthal, 1979). As a preliminary attempt to assess and account for the potential presence of publication bias, this meta-analysis estimated the number of studies that were not published due to null results using the formula, 5*k+10 (Rosenthal, 1991) and calculated the fail-safe index (Rothstein, Sutton, & Borenstein, 2006). The fail-safe index represents the number of studies needed to reject the conclusion of a meta-analysis. Hence, the results of the meta-analysis would be considered valid if the fail-safe index is more than the number of file drawer studies.

The issue of publication bias was further examined using a funnel plot and performing a "trim and fill" procedure. A funnel plot is a simple scatterplot in which the standard error (or other precision estimate) is plotted against the effect size of each study included in a meta-analysis. In the absence of bias, results from these studies should cluster around the population effect size in a symmetrical manner and has the shape of an inverse funnel. Smaller or less precise studies, because of higher variability, have a wider distribution from the mean compared to bigger studies. This can cause asymmetry, which reflects a possibility of publication bias (Egger, Smith, Schneider, & Minder, 1997). The "trim and fill" method is a non-parametric statistical technique that augments the funnel plot and corrects for publication bias (Duval & Tweedie, 2000). First, the number of unpublished studies is estimated and the corresponding number of actual studies is then imputed from the meta-analysis. The overall mean effect size is calculated based on the omitted studies and the process is iterated until symmetry is restored. The final adjusted mean effect size incorporates the effect of the hypothetical missing studies.

3. Results

3.1. Characteristics of Included Studies

In all, 17 studies fulfilled all the selection benchmarks and were included in this meta-analysis. Table 1 presents a detailed summary of the included studies. Together, these studies had 1984 (59.9%) participants in the treatment conditions and another 1328 (40.1%) participants who served as controls. All the studies were published between the years 2009 to 2015. The majority of the studies were conducted in the United States of America (USA) (7; 41.2%), six others were based in Europe (35.3%) and lastly, there was one study each (5.9%) from Iran, Sierra Leone, Australia and the State of Palestine.

A diverse range of questionnaires was utilised by the studies to assess improvement in ER. For example, the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997) measures both emotion lability (e.g. "displays appropriate negative emotions in response to hostile, aggressive or intrusive acts by peers") and regulation (e.g. "can modulate excitement in emotionally arousing situations"). Conversely, the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) has items that reflect changes in emotion responses (e.g. "indicate the extent you feel upset / scared / irritable") but not regulatory behaviours. Other dependent variables were also assessed through self, parent and teacher reports. These included behavioural and/or psychological symptomology (e.g. depression and trauma), school functioning (e.g. days of absence) and general adjustment (e.g. quality of life).

The majority of the studies included in this meta-analysis had interventions administered in a group format using CBT-based principles (k = 14; 82.4%). Qualitative inspection of these interventions revealed that they typically

comprised of two core treatment phases where ER-related concepts were systematically introduced: (a) affective psychoeducation as well as (b) emotional coping and regulatory strategies. The first stage of treatment involved the identification and expression of feelings in self and others through activities such as drawing and storytelling. Children were guided to understand the relationship between their affective states and the types of ER behaviours (e.g. attention shifting, avoidance). Many authors of the included studies highlighted the distinction between typical CBT programmes, which focus on one specific emotion (e.g. anxiety), and their ER interventions, which engage participants in exploring a broader spectrum of emotions (e.g. happiness, grief, hope, anger).

Subsequently, ER programmes built on developing the capacity to regulate affect in a more contextually helpful manner. Through role-plays and/or the use of vignettes, children learnt specific techniques to manage emotions more adaptively including relaxation and mindfulness, distress tolerance, active problem solving and reappraising situations. In one study (Scarpa & Reyes, 2011), ER for children with ASD was facilitated through learning "appropriate tools" (e.g. reframing difficult situation) to "fix" intense emotions. A mindfulness-based ER treatment focussed on changing a young person's relationship to emotions and encouraged reduced reactivity to negative affective states (Broderick & Metz, 2009). Interestingly, some of the interventions also included sessions aimed at enhancing positive emotion experience (e.g., Gimenez-Dasi, Fernandez-Sanchez, & Quintanilla, 2015; Punamaki, Peltonen, Diab, & Qouta, 2014). It is clear that emotion-related concepts and regulatory behaviours have been systematically integrated in the ER programmes reviewed.

Table 1

Characteristics of studies examining into the effectiveness of an ER intervention for children and adolescents

	First author	Design & sample size	RCT	Age	Sample origin	Treatment modality	Setting	Mode of delivery	No. of sessions	Primary ER measure	Follow -up
1	Afshari (2014)	TXM-E = 10 TAU = 10	Y	9-13	Clinical (separation anxiety)	CBT	Outpatient	Group	12	CEMS	Y
2	Batancourt (2014)	TXM = 203 CTRL = 191	Y	15-24	Community	CBT	Community	Group	10-12	DERS	Y
3	Beaumont (2015)	TXM = 35 TXM-C= 34	N	7-12	Clinical (HF ASD)	CBT	School	Group	10	ERSSQ-P ERSSQ-T	Y
4	Broderick (2009)	TXM = 104 CTRL = 17	N	17	Community	CBT (Mindfulness)	School	Group	6	DERS PANAS	N
5	David (2014)	TXM-E = 38 WLC = 27	Y	4-12	Clinical (externalising)	CBT + Parenting	Outpatient	Group	12	Nil	Y
6	Ford (2012)	TXM = 26 TAU = 20	Y	13-17	Clinical (PTSD)	CBT	Outpatient	Individual	12	NMR	N
7	Gimenez-Dasi (2015)	TXM = 38 CTRL = 19	Y	2	Community	CBT	School	Group	27	ERC-P	N

Table 1 Continued

	Author	Design & sample size		Age	Sample origin	Treatment modality	Setting	Mode of delivery	No. of sessions	Primary ER measure	Follow -up
8	Horn (2010)	TXM = 208 CTRL = 151	Y	14	Community	Expressive writing	School	Group	6	PANAS	Y
9	Kennedy (2008)	TXM = 55 WLC = 40	Y	4-8	Community	CBT	Community	Individual	5	ERS-P	N
10	Metz (2013)	TXM = 129 CTRL = 87	N	17	Community	CBT (Mindfulness)	School	Group	6	DERS	N
11	Moreira (2010)	TXM = 560 CTRL = 218	N	9-10	Community	CBT	School	Group	NS	ERCSI	N
12	Punamaki (2014)	TXM = 207 WLC = 197	Y	10-13	Community	CBT	School	Group	2	ERQ-C	Y
13	Scarpa (2011)	TXM = 5 WLC = 6	Y	5-7	Clinical (HF ASD)	CBT	Outpatient	Group	9	ERC-P	N
14	Schuppert (2009)	ERT = 14 TAU = 17	Y	14-19	Clinical (BPD traits)	CBT	Outpatient	Group	19	MERLC	N
15	Schuppert (2012)	ERT = 48 TAU = 49	Y	14-19	Clinical (BPD traits)	CBT	Outpatient	Group	19	LPI-ED MERLC	Y

Table 1 Continued

	Author	Design & sample size		Age	Sample origin	Treatment modality	Setting	Mode of delivery	No. of sessions	Primary ER measure	Follow -up
16	Terzian (2015)	TXM-E = 193 TAU = 130	N	8-9	Community	CBT	School	Group	23	Nil	N
17	Wyman (2010)	TXM = 111 CTRL = 115	Y	5-9	Clinical (Emerging mental health problems)	CBT	School	Group	14	Nil	N

Note: TXM = Treatment, TAU = Treatment as usual, CTRL = Control, WLC = Waitlist control, HF ASD = High functioning autism spectrum disorder, BPD = Borderline personality disorder, CBT = Cognitive behaviour therapy, NS = Not specified, Y = Yes, N = No, RCT = Randomised Controlled Trial.

ER outcome measures: CEMS = Children's Emotion Management Scales, DERS = Difficulties in Emotion Regulation Scale, ERSSQ-P/T = Emotion Regulation and Social Skills Questionnaire - Parent & Teacher, PANAS = Positive & Negative Affect Schedule, NMR = Generalised Expectancies for Negative Mood Regulation, ERC-P = Emotion Regulation Checklist – Parent, ERS-P = Emotion Regulation Scale – Parent, ERCSI = Emotion Regulation and Coping Strategies Inventory, ERQ-C = Emotion Regulation Questionnaire for Children, MERLC = Multidimensional ER Locus of Control, LPI-ED = Life Problem's Inventory Emotional Dysregulation.

One study explored the effect of expressive writing on ER (Horn, Possel, & Hautzinger, 2010). This was a group, school-based programme that encouraged adolescents to explore and share their feelings through writing on themes associated with ER. The topics included labelling of feelings, suppression of emotions and detailing an incident that might have triggered changes in mood and how it was managed. Two of the studies (11.8%) offered individual treatment. The first was an ER therapy (TARGET) with a CBT framework similar to the ones described below (Ford, Steinberg, Hawke, Levine, & Zhang, 2012). In this case, a one-on-one approach was adopted to maximise flexibility in scheduling sessions and improve the attendance rate of participants. The second was a preventive programme for families to promote better ER and consequently enhance sibling interactions through the intervention (Kennedy & Kramer, 2008). Children were taught emotion identification and regulation strategies and practiced them with their siblings over five sessions while their parents observed and received additional coaching from a facilitator (e.g. explanation of the techniques taught, handouts) to aid generalisation. One other group of researchers included a parenting component as an adjunctive treatment to improve the development of adaptive ER skills amongst children with behavioural difficulties (David, David, & Dobrean, 2014). These sessions addressed parental factors such as distress tolerance, marital disagreements and mood difficulties, which might interfere in appropriate parenting behaviours.

3.2. Quality Assessment

Appendix B lists the methodological quality criteria and scores of all studies assessed in this meta-analysis. One study satisfied all criteria and was given a maximum score of 16. The average overall score was 12.06 (*SD* = 2.04),

suggesting the included studies were fairly robust. More than half of the studies (58.8%) provided information relating to whether treatment fidelity was monitored and maintained. However, in most studies, there was no blinding of the participants (88.2%) or the clinicians (76.5%). Seven of the included studies were randomly selected and rated by an independent researcher. There was substantial agreement between the raters ($K = .77$, $p < .001$) according to the criteria recommended by Landis and Koch (1977).

3.3. Overall Effect Size

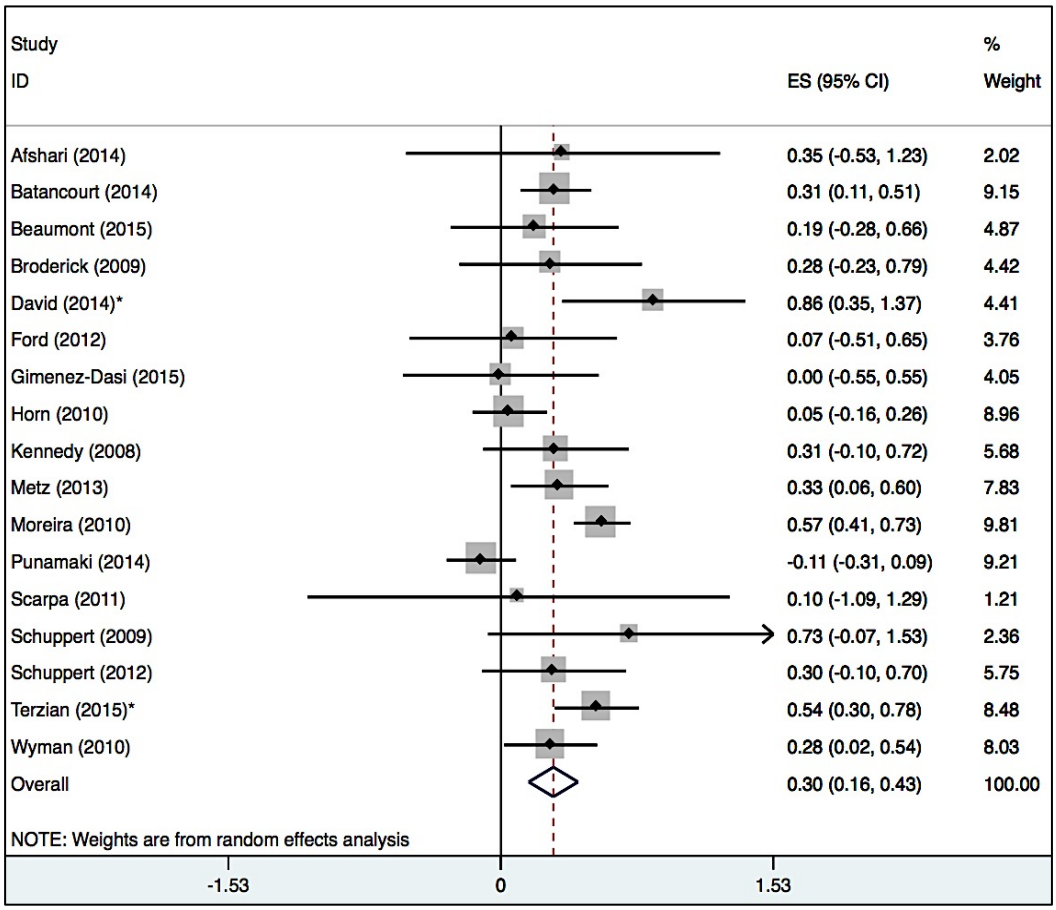
The overall average effect size of the included studies ($k = 17$) on the effectiveness of ER-based treatments for children and adolescents, calculated using a random-effect model, was $d = .30$, 95% CI [0.16, 0.43], $p < .001$. According to Cohen (1992), this represents a small to medium sized improvement following intervention. Treatments with a primary focus on ER appeared to significantly improve abilities to regulate emotions in comparison to the various active control conditions. The effect sizes of the individual studies ranged from $d = -.11$ to $d = .86$; the majority of the studies included an ER outcome measure with the exception of David et al. (2014), Terzian et al. (2015), and Wyman et al. (2010). Figure 2 presents information relating to the respective effect sizes, weights and confidence intervals of the studies.

In addition, the Q-statistic for the primary analysis was significant ($Q(16) = 45.22$, $p < .001$), indicating that there was possible variation in effect sizes across the range of studies in this meta-analysis. Specifically, heterogeneity was moderate ($I^2 = 64.6\%$). Visual inspection of the funnel plot (see Figure 3) indicated a symmetrical inverse funnel suggesting the absence of publication bias. The "trim and fill" analysis further confirmed that no studies needed to be

imputed. Lastly, the fail-safe number of the aggregated effect size was 312, exceeding recommended number (5*17+10 = 95). Taken together, findings from these three indices support the view that the overall primary effect size is reliable and that publication bias is unlikely.

Figure 2

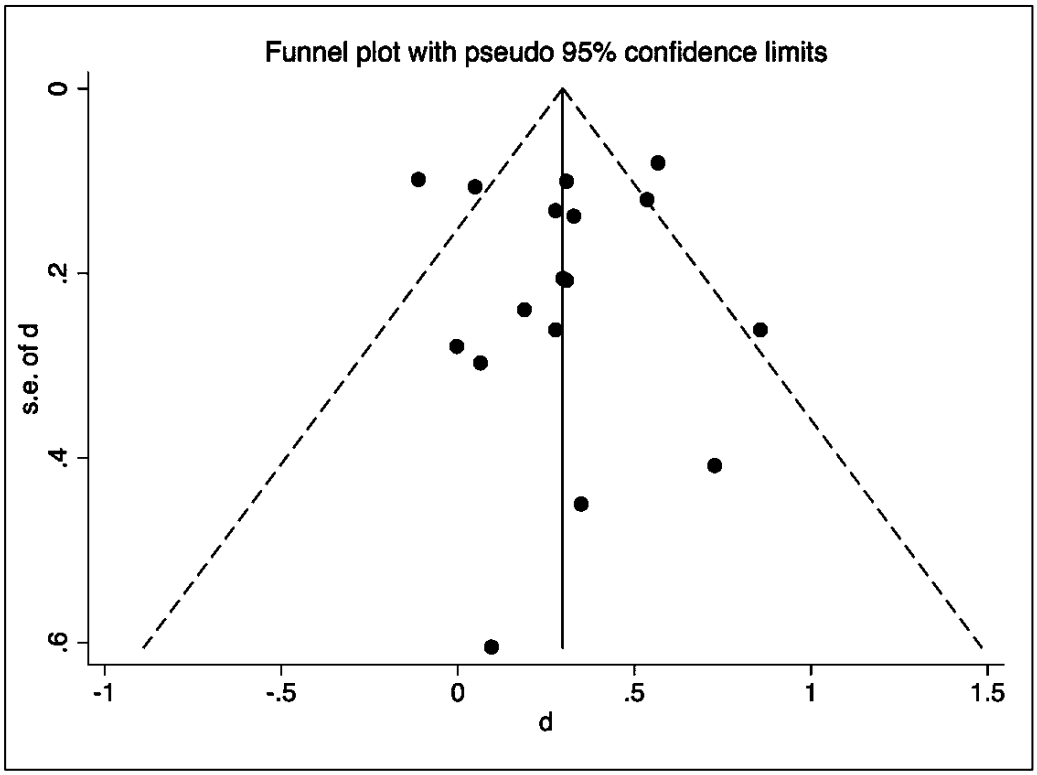
Effects of ER interventions on primary ER outcomes



Note: The black and grey square boxes represent the effect size and the weight of each study respectively. The straight lines show the 95% confidence intervals.

Figure 3

Trim-and-fill funnel plot of included studies



3.4. Moderator Analyses

Clinical, methodological and statistical variability are common contributors to heterogeneity in psychological research. To identify possible sources of variability in this meta-analysis, a moderator analysis was conducted. As mentioned previously, age of participants, presence of a clinical diagnosis, duration of treatment and the type of control conditions were examined as potential moderating characteristics. However, these categorical factors did not significantly moderate the overall reported effectiveness of ER-based interventions. It should be noted that while duration of treatment was not a significant moderator, $X^2(1) = 3.32$, p = .07, interventions with more than 12 sessions yielded an effect size (d = .44, 95% CI [0.28, 0.60]) that was twice as

large as interventions with 12 sessions or less (d = .21, 95% CI [0.06, 0.37]). The aggregated effect sizes derived from some sub-analyses were based on a small number of studies, which resulted in potential publication bias, suggesting that the results should be interpreted with care. These included: age group (adolescents), sample origin (clinical), duration of treatment (less than 12 sessions), and type of control group (alternative treatment). Information about the moderator analyses and the subgroup effect sizes is presented in Table 2.

3.5. Secondary Analyses

Secondary meta-analyses were conducted using subgroups of data because of clinical and/or theoretical relevance, as outlined in the secondary aim.

The researcher examined whether the therapeutic gains from ER interventions differed when measured using two other common categories of outcomes utilised by studies included in the meta-analysis – behavioural (k = 7) and clinical (k = 7). Behaviour-based measures included self-report and/or informant rated questionnaires assessing behavioural functioning such as externalising difficulties, disruptive behaviours and aggression. In contrast, clinical outcome measures evaluated the presence of a mental health difficulty (such as trauma, mood and anxiety problems).

Behavioural measures yielded a significant large effect size of d = .54, 95% CI [0.39,0.70], p < .001. The fail safe number for these studies was 281; bigger than the estimated number of file drawer studies. The effect size for clinical measures was also statistically significant (d = .25, 95% CI [0.08, 0.43], p < .001) but was similar to the calculated overall primary effect size. The safe fail number in this case was smaller than the number of file drawer studies and therefore this particular result should be interpreted with due caution.

Table 2

Overall effect size and categorical moderators analysis

	k	*d*	95% CI	*Q*	*df*	*p*	Fail safe N
Overall sample	17	.30	[0.16, 0.43]	45.22	16	< .001	312
Age Group				.20	1	.65	-
Children	10	.32	[0.10, 0.55]	6.19	9	.72	128
Adolescents	7	.23	[0.12, 0.35]	5.90	6	.44	34[#]
Sample Origin				.33	1	.56	-
Clinical	8	.34	[0.17, 0.50]	6.43	7	.49	35[#]
Community	9	.27	[0.08, 0.45]	5.69	8	.68	125
Duration of Treatment				3.32	1	.07	-
≤ 12 sessions	11	.21	[0.06, 0.37]	8.60	10	.57	49[#]
> 12 sessions	6	.44	[0.28, 0.60]	5.10	5	.40	105
Control Group				.34	1	.56	-
No treatment	11	.27	[0.10, 0.45]	7.86	10	.64	140
Alternative treatment	6	.41	[0.24, 0.58]	4.21	5	.52	28[#]

 # possible publication bias (Fail safe N is smaller than number of file drawer studies)

4. Discussion

The current meta-analysis examined the effectiveness of a number of ER-based interventions among children and youths. A systematic literature review process generated a total of 17 studies that satisfied the inclusion criteria and were included.

4.1. Summary of Main Findings

An overall small to medium effect size was observed for therapies with a primary ER focus; where this type of treatment consistently enhanced general affect regulation abilities in comparison to a control condition (having no intervention or an alternative intervention). Heterogeneity analysis suggested significant variability; in other words, the individual effect sizes differed moderately between the studies. As this meta-analysis on ER-based interventions is the first to date, benchmarks for comparison are not available. However, a large-scale meta-analysis which included a diverse range of psychotherapeutic interventions for children and adolescents demonstrated a medium effect size of $d = .54$ (Weisz, Weiss, Han, Granger, & Morton, 1995). As previously discussed, another qualitative review concluded that ER interventions are beneficial for both clinical and at-risk populations, and can be implemented across a range of settings (Smyth & Arigo, 2009). This is consistent with the current quantitative findings and adds to the evidence base for child-focussed ER programmes.

4.1.1. Moderators of ER interventions. In order to examine whether study characteristics contributed to significant differences in the magnitude of the overall effect size, a moderator analysis was completed. Both children (less than 12 years old) and adolescents (more than 12 years old) responded similarly, in a positive manner, to ER interventions. The magnitude of improvement for

those with a clinical diagnosis was only marginally larger than those without a clinical diagnosis, and this difference was not statistically significant. Taken together, these findings suggest that there is little evidence for individualising ER-based interventions on the basis of age or clinical diagnoses. However, it is important to consider that these interventions may have been tailored prior to administration for a specific population and thus the exact specifications of the interventions should be further examined before that particular conclusion can be drawn.

The length of treatment varied considerably (ranging from 2 to 29 sessions) across the studies. The observed effect size for interventions with more than 12 sessions was twice as large as that for programmes with a treatment length of less than 12 sessions. While this did not significantly moderate the effectiveness of ER interventions, the trend suggested that a longer course of ER intervention was more reliably associated with treatment gains. Findings from studies that examined the relationship between the number of sessions in a child, non ER-focussed intervention and treatment gains were inconsistent. Some researchers did not establish a significant association (e.g., Bellini, Peters, Benner, & Hopf, 2007; Quinn, Kavale, Mathur, Rutherford, & Forness, 1999) whilst others found that a longer course of treatment diminished the aggregated treatment effects (Casey & Berman, 1985). It would be worthwhile to evaluate with more empirical data whether the duration of an ER treatment moderates the impact of the intervention for young people. Finally, when studies with a no-treatment control condition were evaluated against those with an alternative form of therapies (e.g. computer-based), no statistical difference was observed.

4.1.2. Behavioural and clinical outcomes. Results from the secondary analysis indicated that treatment gains from ER interventions were significant for both behavioural and clinical outcome measures, demonstrating that ER-based programmes were not only beneficial in enhancing overall ER capacities in children, but also contributed to clinical and behavioural improvements. This is coherent with existing theoretical principles and research findings of ER as a construct implicated in various domains of childhood functioning, as previously reviewed (e.g., Cicchetti et al., 1995; Cole, Michel, & Teti, 1994). The effect size for behavioural outcomes was the largest, which may suggest behavioural changes are more easily observable. Changes in behaviours as a result of better ER abilities may be most outwardly observable in many circumstances and therefore captured in behavioural measurements, compared to the alleviation of clinical symptomology, which may take longer to manifest.

4.1.3. Qualitative considerations. From the narrative overview of the ER programmes investigated in this meta-analysis, many included treatment components that were similar to established CBT approaches. However, it has been argued that emotion and its regulation has a more central and integrative role in ER interventions in comparison to typical CBT (e.g., Suveg, Kendall, Comer, & Robin, 2006). Many disorder-specific CBT interventions address only a specific emotion central to the clinical presentation (e.g. anxiety) but the ER interventions in this meta-analysis distinctively work with a range of positive and negative emotions. Cognitive reappraisal, which has been conceptualised by Gross (2002) as one of the adaptive types of ER, is a key mechanism of change in CBT (Hofmann & Asmundson, 2008) but has been generally utilised as one of several ER strategies (e.g. response-focused types; distress tolerance) discussed

in the intervention studies reviewed here. Interestingly, a number of effectiveness studies have compared an ER based approach to an existing CBT programme and found that individuals who received ER skills training demonstrated more symptom reduction compared to those who only received group CBT (e.g., Berking et al., 2008; Greenberg, 2004).

The measurement of ER was highly variable. Most of the questionnaires used represented ER across core dimensions of regulatory behaviours and emotion reactivity. Interestingly, a small proportion of the outcome measures (e.g. PANAS) assessed the sole domain of emotion reactivity. As discussed earlier, there is no consensus on the extent to which emotional reactivity relates to regulation. The issue of variability and non-equivalence of the measures, to a degree, limits thet conclusions that can be drawn from the meta-analysis but more importantly, reflects the conceptual challenge in the field of ER in general. It highlights the significance of operationalising ER in a standardised manner to facilitate research outcomes and clinical practices.

4.2. Limitations

A few of the study limitations are acknowledged. The meta-analysis was performed using a relatively small number of studies ($k = 17$). This reduces statistical power in terms of detecting potential moderators and limits the generalisability of the effect sizes to the true population. Moreover, a handful of the studies did not clarify and/or did not have procedures in place to ensure that the specified intervention was administered as intended. Some of the sub-analyses may be susceptible to publication bias which, although there was no direct evidence, may result in an overestimation of the effect sizes presented. Dissertations, unpublished studies and studies without a control group were

excluded from the meta-analysis. The results presented may not be fully representative of the range and effectiveness of ER interventions, and thus should be interpreted judiciously. It should be pointed out that the average quality assessment score was fairly high which suggested that the studies examined were generally robust and of high quality. The inclusion and exclusion criteria further maintained a level of uniformity across the included studies for relevant statistical analysis and comparison. Additionally, all of the three publication bias analyses on the population effect size indicated that there was a reliable absence of bias.

Common-method variance may be an issue due to the diversity of self-report ER measures utilised by the included studies. The methodological diversity could also explain for the heterogeneity observed between the studies. Additionally, self-report measures are often associated with response validity problems (e.g. under- or over- stating symptoms) (e.g., Furnham, 1986; van de Mortel, 2008). Westen and Morrison (2001) further caution that investigator's bias and subjectivity can be introduced into meta-analyses through the initial search process, the selection of studies and the coding procedure, thereby influencing the outcome. To address this issue, care was given to maintain objectivity according to the criteria set forth in this study. An independent researcher was included in the process to minimise bias. Comprehensive information about the included studies is presented to maintain transparency and allow other researchers to make an informed judgement on the studies examined.

4.3. Implications for Practice and Future Directions

The current findings have significant research and clinical implications. It is the first meta-analysis that evaluated ER-based interventions for children and

adolescents, which clearly extends the existing empirical base and provides direction for future systematic reviews. The effect sizes indicated that ER programmes improve regulatory abilities as well as clinical and behavioural functioning. A qualitative review of the included interventions suggested that ER programmes are more accessible and less stigmatising. Future replication of the results will facilitate practitioners to implement ER interventions across a diversity of community, school and clinical settings. Based on the large observed effect size on behavioural outcomes, it may be appropriate to augment existing behavioural interventions with an ER component. In addition, core characteristics of ER interventions (e.g. length of treatment) can be tailored according to the moderator analyses. An evidence-based understanding of moderating factors in ER interventions will be pertinent in maximising efficacy, translating to effective cost and resource savings.

Several suggestions for future research are considered. First, it would be meaningful to ascertain the effectiveness of ER interventions by replicating the findings in this meta-analysis through involving a larger number and a bigger variety of treatment studies. Many of the studies investigated were group-based ER programmes with a CBT framework. Hence, little can be concluded about the value of alternative approaches (e.g. expressive writing or mindfulness) and one-to-one interventions in enhancing regulatory abilities. This should be examined further. Supplementing an intervention with a parenting component and/or having an individually tailored ER programme may moderate the treatment effects found in this study, and therefore additional research is necessary.

Next, the current meta-analysis evaluated four moderators and, as noted, might not have adequate power to detect moderating factors given the small

number of studies. Future research should clarify if any specific ER strategies are particularly associated with greater therapeutic gains, as well as whether individual constructs such as presenting diagnosis or cultural background contribute to differences in efficacy. Finally, the effect sizes reported were based primarily on self-report scales completed by a child and/or a parent. ER is a dynamic and complex process and therefore, more objective and/or independent measures, for example observational approaches, should be utilised as far as possible to substantiate evidence of regulation. Moreover, researchers argue that assessing treatment efficacy through self-report measures does not constitute an actual reflection of change in regulation brought about by the treatment (e.g., Cole et al., 2004).

5. Conclusions

Adaptive regulation of emotions has been conceptualised as central to improved psychological, social and academic functioning (e.g., Saarni, 1999). At the same time, ER difficulties have been implicated as a salient risk factor in many developmental studies involving at-risk and clinical populations (e.g., Cicchetti et al., 1995). The current meta-analysis synthesised findings from intervention studies and demonstrated the effectiveness of ER programmes for children and adolescents. The inclusion of an ER-based treatment could provide a foundation for affective education and training, facilitating the alleviation of clinical symptomology and enhancing outcomes.

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Part 2: Empirical Paper

Longitudinal pathways of emotion regulation, maternal depression and early childhood psychopathology

Abstract

From a developmental perspective, emotion regulation (ER) in the context of vulnerability for childhood psychopathology is complex and constitutes a dynamic interplay of factors. *Aims:* The study sought to establish the longitudinal links between ER, and its combined effects with maternal depression on predicting internalising and externalising difficulties during the critical period of early childhood. *Method:* A sample of 94 preschool children was assessed at ages 15, 26 and 37 months for ER using an observational task. Three indices, namely (a) emotion reactivity, (b) social regulation and (c) redirected attention, were taken to represent a broader ER construct. Mothers completed questionnaires relating to maternal mood and their child's externalising and internalising behaviours. *Results:* Growth modelling analysis indicated limited variability in the change of children's ER across time to differentiate the trajectory of later childhood problems. 15-months ER was not predictive of 37-months emotional and behavioural difficulties. One of the ER factors, i.e. emotion reactivity, moderated the relationship between maternal depression and subsequent behavioural problems. Specifically, children with low and average levels of reactivity experienced more behavioural difficulties, in the context of elevated maternal depression. *Conclusions:* Findings emphasise the importance of children's early ER resources in interaction with maternal depression, effecting subsequent behavioural outcomes.

Keywords: emotion regulation, early childhood, externalising behaviours, internalising behaviours, maternal depression

1. Introduction

Interest in affective research became a catalyst for the improved understanding of emotion regulation (ER). ER represents a heterogeneous collection of internal and external processes that serve to monitor, evaluate and modulate one or more feeling states in order to achieve an outcome that is contextually adaptive to environmental demands. Gross (2002) and other contemporary researchers (e.g., Aldao, 2013; Cole, Martin, & Dennis, 2004) theorise that the regulation of emotion is an active process and can be influenced by an individual to a fair extent. It is necessary to highlight, as Aldao (2013) points out, the function of ER is not to singularly eliminate negative affects and substitute them with positive ones.

Despite advances in theory, a major challenge in the field of ER remains to be its conceptual definition and, in particular, there is ongoing discussion regarding whether regulatory behaviours are distinctive from emotions themselves. To date, there has been no consensus on whether (and how) ER relates to emotions. Part of the conundrum concerns the abstract nature of emotions and its definition. Some argue that emotions inherently regulate and shape outcomes, rendering the status of ER as a scientific construct to be less relevant (e.g., Stansbury & Gunnar, 1994). In developmental literature, negative and positive emotions have been consistently implicated in a child's adjustment across different domains (e.g., Kim, Walden, Harris, Karrass, & Catron, 2005). Proponents of ER (e.g. Cole et al., 2004) caution that the sole consideration of emotions, runs the risk of being too limiting as it is equally imperative to consider the mechanisms by which emotions are organised and adjusted for adaptive and maladaptive childhood functioning.

Campos and his associates (2004) contend that regulation and emotions are not independent but actually represent components in the same continuum. Emotions are not merely feelings but, like regulatory behaviours, can be regulating and regulated (e.g., Campos, Campos, & Barrett, 1989; Goldsmith & Davidson, 2004). For instance, the generation of positive emotions has been demonstrated to facilitate the regulation of distress (e.g., Fredrickson & Joiner, 2002) and has the potential to be moderated through specific regulatory strategies. Indeed, until a consensus can be agreed, it may be necessary to jointly examine emotions and regulatory behaviours in a developmental account of ER (Kagan, 1994).

1.1. ER in Childhood Development

ER has been identified as one of the crucial milestones of normative childhood development. In general, young children who can employ strategies to manage and maintain an optimal balance of positive as well as negative affect reactivity, are thought to have adaptive ER capacity (e.g., Cole, Michel, & Teti, 1994). For example, a toddler who is approached by a stranger may experience mild fearfulness but regulates this by holding onto the hands of his mother, and importantly, gradually manages fear reactivity by endogenous means, such as distraction and engagement with the stimulus, to adaptively interact with the stranger. In contrast, responding to the elicited fearfulness through persistent crying or escaping represents a more maladpative pattern of ER and is less likely to effect a successful interaction between the child and the stranger.

Children with contextually more adaptive ER adjust better and function more effectively across psychological, socio-emotional and academic domains (Saarni, 1999). ER skills in young children were positively associated with a

variety of academic outcomes including literacy and mathematics. Those with more adaptive regulatory abilities also demonstrated better classroom productivity (Graziano, Reavis, Keane, & Calkins, 2007). In middle childhood, proficiencies in ER characterised those with better scholastic performance (Gumora & Arsenio, 2002) and were found to predict better social resilience and competency (e.g. Denham et al., 2003; Spinard et al., 2006).

ER is further conceptualised as a key framework for understanding the trajectory of maladaptive symptomology in children (e.g., Cicchetti, Ackerman, & Izard, 1995; Eisenberg et al., 2001). In doing so, it is necessary to consider the early developmental foundations of ER and the range of factors influencing these pathways. In the initial stages of life, an infant may depend on primitive ER behaviours, such as looking away or thumb sucking, to regulate affective responses (Kopp, 1989) and thus also relies heavily on the caregiver to extrinsically regulate emotional states (e.g. proximity seeking or fussing to get attention and be soothed by caregiver) (Gonzalez-Mena & Eyer, 2007). As a child matures in the pivotal period of early childhood, he develops more complex cognitive skills together with the ability to more autonomously organise his feelings and behaviours into patterns consistent with his environment (Gross & Thompson, 2007). Here, his repertoire of regulatory skills expands rapidly and becomes more sophisticated to cope effectively with increasingly intricate emotions (Cicchetti, Ganiban, & Barnett, 1991).

1.2. ER and Developmental Psychopathology

Disturbances in early ER processes may be indicative of, or indeed may directly contribute to, the development of emotional and behavioural disorders in children. Certain regulatory behaviours and emotion reactivity profiles have been

examined and more frequently associated with childhood internalising and externalising psychopathology, although a degree of overlap exists (Shapero, Abramson & Alloy, 2016). Internalising problems are typically associated with an inward direction of emotional distress and are characterised by low mood, anxiety and withdrawal (Achenbach & McConaughy, 1992). Conversely, externalising difficulties refer to the overt manifestation of functionally disruptive behaviours (e.g. defiance, aggression and hyperactivity) on the child's external environment (Hinshaw, 1987), and include disorders such as Oppositional Defiant Disorder (ODD), Conduct Disorder (CD) and Attention Deficit Hyperactivity Disorder (ADHD).

1.2.1. ER features of internalising and externalising behaviours.

Children with internalising and externalising difficulties experience emotions such as fear and anger in a more labile manner and self-rate to be less adept in managing emotionally charged situations when compared to healthy controls (e.g., Eisenberg et al., 1996; Suveg & Zeman, 2004), indicative of poorer regulation capacities. Across both early and middle childhood, a more maladaptive ER pattern of articulating feelings in an exaggerated manner (e.g. persistent fussing and frequent temper tantrums) differentiates those with internalising and externalising symptoms from healthy controls (e.g., Calkins & Dedmon, 2000; Zeman, Shipman, & Suveg, 2002). A smaller cluster of studies found evidence suggesting that preschoolers at risk of developing internalising and externalising behaviours have comparatively dampened emotion expressivity (e.g., Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). Taken together, these emotion reactivity profiles may reflect contextually ineffective and/or under-developed ER attempts to cope with feeling states (Weems & Silverman, 2007).

Along these lines, children with emotional and behavioural difficulties are found to be less proficient at utilising strategies to modulate emotive responses to challenging life events and stressors (e.g., Amstadter, 2008; Garber, Braafladt, & Zeman, 1991). This in turn reinforces the self-perpetuating cycle of internalising and externalising symptoms, as well as the subsequent maladaptive regulation exacerbating overall wellbeing. Regulatory behaviours such as inhibiting the expression of emotions and/or maintaining focus on a distressing object, under certain contextual circumstances, are thought to be more maladaptive and have been associated with those with internalising symptoms (e.g., Aldao & Nolen-Hoeksema, 2010; Gross, 1998). Observational studies involving infants and toddlers have established a positive correlation between these strategies and heightened distress (e.g., Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Grolnick, McMenamy, & Kurowski, 2006). Persistent difficulties with utilising adaptive strategies (e.g. seeking extrinsic support, reappraising the situation) to regulate anger and/or fear states and instead, regulating through behaviours such as confrontation and aggression (e.g. Eisenberg et al., 2001; Keenan, 2000), have been demonstrated to be more prevalent in clinical populations with externalising disorders. For example, boys in middle childhood with attention deficit hyperactivity disorder (ADHD) were found to have elevated problems with ER, including the ineffective use of regulatory strategies (Melnick & Hinshaw, 2000; Walcott & Landau, 2004). Significant difficulties with regulating affective states also characterised young children with aggression (Calkins & Dedmon, 2000).

Although prior literature supports the notion that ER is related to childhood behavioural and emotional difficulties, many of these studies are

cross-sectional which restricts any conclusion regarding causality. A significant question about the directionality of the relationship remains unanswered: is poor ER a presenting symptom in childhood disorders or does it represent a developmental precursor to the emergence of pathology in later childhood? There is also comparatively more limited evidence on how ER associates with psychological difficulties during the focal period of early childhood. In one of the few longitudinal studies beginning in the preschool period, Halligan and her associates (2013) found that children at risk for externalising problems showed sub-optimal regulation of frustration. Maladaptive ER measured between 12 to 18 months were further predictive of later externalising impairments at age 5. Adaptive ER of frustration in girls at age 2 has also been shown to differentiate the subsequent levels of externalising behaviours measured at age 5 (Hill, Degnan, Calkins, & Keane, 2006). Girls with sub-clinical levels of externalising problems were less likely to have a persistent trajectory of behaviour difficulties if they had contextually more effective regulatory resources compared to girls with poorer ER skills. More longitudinal studies are needed to clarify the heterogeneity of emotional and behavioural problems as characterised by ER, especially among preschool children. Moreover, the findings of both studies reviewed earlier relate primarily to externalising behaviours and the current study attempted to further examine early ER in association with later internalising and externalising problems.

1.3. ER, Maternal Depression and Child Psychopathology

Maternal depression has a significant influence on the caregiving environment and, often as a result, children experience a greater degree of maternal insensitivity and affective negativity (e.g., Downey & Coyne, 1990).

For instance, mothers who experience low mood have infants who are less positive, more irritable and harder to settle (Field, 1995). These infants tend to have a pattern of over- or under- arousal of affective states (e.g. angrier or sadder) (Weinberg & Tronick, 1998). Mothers who are depressed are also less likely to model effective ER strategies and/or provide adequate supportive scaffolding for their children in ER development. Early maternal affective problems have been demonstrated to be longitudinally predictive of subsequent maladaptive patterns of ER in children at age 4 (Maughan, Cicchetti, Toth, & Rogosch, 2007). Perhaps more so than any other developmental stages, infancy and early childhood ER is contingent upon the provision of maternal sensitivity and responsiveness (e.g., Parritz, 1996; Thompson & Meyer, 2007).

Less is known about the extent to which a child's ER resources interact with maternal affective disturbances on childhood psychopathology. While children of mothers with depression, even in early childhood, exhibit heightened risk for a variety of psychological difficulties (e.g., Goodman et al., 2011), not all go on to develop emotional and/or behavioural problems. From a developmental perspective, the regulation of emotion in the context of vulnerability for childhood disorders is certainly not linear but is a complex interplay of multiple factors including maternal depression (Morris, Silk, Steinberg, Meyers, & Robinson, 2007; Thompson & Calkins, 1995).

Using a laboratory-based task designed to elicit negative emotions in 4-7-year old children, Silk and her associates (2006) report that a child's ER resources, in particular the generation of positive affect (e.g. joy), may be protective against the associated impact of maternal depression and childhood emotional problems. Another cross-sectional study involving children aged 7 to

12 indicated that child ER (as measured by self and mother reports) may act as a mediator for maternal affective status and child psychopathology. (Suveg, Shaffer, Morelen, & Thomassin, 2011). Within the context of an unhelpful caregiving environment brought on by maternal affective impairments, children who are unable to regulate adaptively may in turn experience a persistent cycle of elevated negativity and ineffective regulation, leading to the development of emotional and behavioural impairments (Hoffman, Crnic, & Baker, 2006). The limited body of research seems to provide emerging evidence that there is a joint effect of child ER and maternal depression in the context of childhood psychopathology. Continued research is critical in order to examine the exact mechanism at work. Moreover, it remains unclear whether similar or enhanced associations are found in early childhood, a time where ER skills mature exponentially and parents, especially mothers, are significant contributors in socialising and shaping ER development (e.g. Thompson, 2008; Goodman & Gotlib, 1999).

1.4. The Current Study

The current investigation took advantage of longitudinal data and adopted an integrative framework in considering child ER, maternal depression and their interaction on early childhood internalising and externalising symptomology. In light of the complexities of the processes involved in ER, particularly the difficulty of cleanly separating emotional response from regulation, in the current study ER was construed as an umbrella phenomenon involving both emotion reactivity and regulatory behaviours. Specific regulation strategies includes attention shifting, self-soothing, avoidance and/or withdrawal to modulate emotional experiences (Aldao, Nolen-Hoeksema, Schweizer, 2010). Emotion

reactivity refers to an affective response (e.g. fear, sadness) to an emotion-eliciting event and may be experienced by children in differing frequency of occurrence, duration and intensity (Werner & Gross, 2010).

To address the gaps in ER literature during early childhood, the study focussed on the first three years of life and assessed children from when they were 15 months to 37 months. It employed a laboratory-based observational method designed to elicit negative emotions (e.g. mild fearfulness) and ensuing attempts at regulation. Many previous studies have relied on child and/or parent report measures of ER. The use of observational data facilitated a valuable platform to evaluate activated evidence of regulatory behaviours and reactivity, both vital, inter-connected components in a developmental account of ER.

1.4.1. Study aims and hypotheses. The first aim of this study was to prospectively examine ER in the pivotal period of early childhood, i.e. age 15 months to 37 months, as well as to evaluate whether early deficits in emotion reactivity and regulatory behaviours were risk factors for childhood psychopathology over time. It was hypothesised that poorer ER capacity in early life would precede and predict the subsequent development of childhood emotional and behavioural difficulties. A second goal of the study was to clarify whether the ability to adaptively regulate emotions among children protected against the pathway between maternal depression and the development of later difficulties in internalising and externalising behaviours. It was predicted that children's ER abilities would moderate the associations between maternal depression and subsequent childhood internalising and externalising behaviours. Finally, the current study attempted to understand whether the different ER variables (e.g. emotion reactivity and types of regulatory behaviours) and factors

such as gender and maternal depression shaped the development of internalising and externalising difficulties differentially.

2. Method

2.1. Participants

Data collected from mother and child dyads who participated in a completed prospective longitudinal project ("The Development of Children's Emotion-Regulation Skills"), were included in the current study. The original study investigated the associations between mother-child interactions and the child's ER.

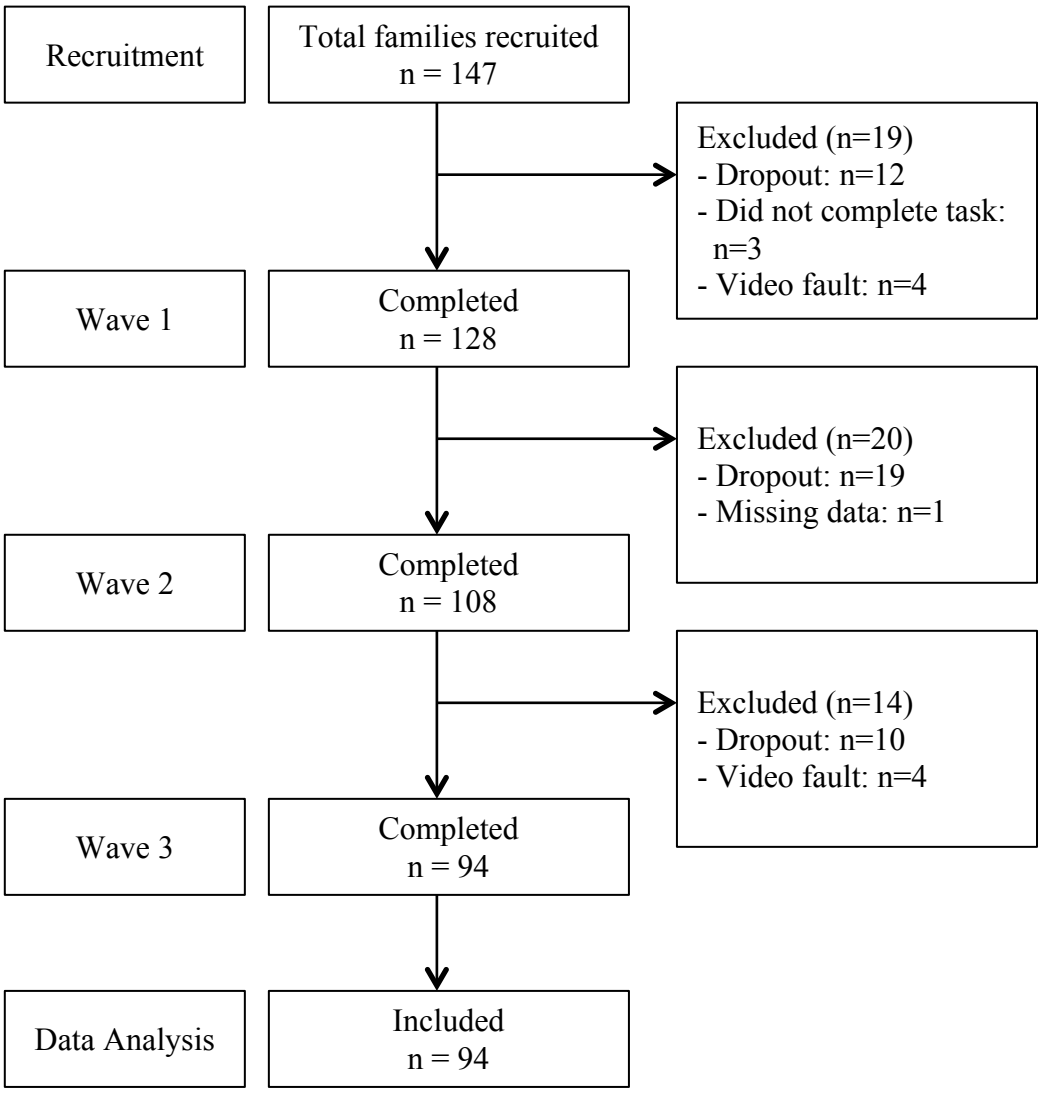
Recruitment for the original study was primarily completed through the Child Development Group Database maintained by the University of Reading. Families were first approached by research staff at the Royal Berkshire Hospital's postnatal maternity ward and invited to be included in the Child Development Group where they might be contacted to participate in future developmental research. Brief demographic and contact details were recorded for families who consented. A study investigator identified and contacted parents on the database with infants approaching 15 months of age. Parents were given an overview of the study. If families indicated interest, an information letter and an informed consent form were sent. All study-related procedures took place after written consent has been obtained and families were given a £10 gift card for their participation.

A total of 147 families were enrolled in the original study over a period of 21 months. As with any longitudinal study, some families dropped out and/or were lost to follow-up in between the visits. Some of the child participants did not complete the observational task because they were unable to settle adequately

(e.g. persistent crying). Furthermore, during the coding process, some of the video files were corrupted and therefore were not coded. Figure 1 describes the rate of attrition at each wave and the respective reasons in detail. In the end, data from 94 pairs of mothers and children were included in the current sample. These were families who participated in all three waves of the original project. To detect a medium effect of $f^2 = 0.10$ (based on a similar study by Halligan et al., 2013), a power analysis performed during the planning stage determined a minimum sample size of 82, at 80% power and 5% significance.

Figure 1

Flow diagram of study recruitment and attrition



No differences were detected at baseline between those who completed the study and those who did not complete and/or were excluded in terms of: child's age ($t(133) = 1.40$, *n.s.*), gender ($\chi^2(1, n=42) = 0.29$, *n.s.*), ethnicity ($\chi^2(11, n=42) = 11.80$, *n.s.*) and number of siblings ($t(124) = 0.10$, *n.s.*), as well as mother's age ($t(123) = 1.72$, *n.s.*), ethnicity ($\chi^2(11, n=40) = 8.91$, *n.s.*), marital status ($\chi^2(12, n=40) = 1.96$, *n.s.*), level of education ($\chi^2(6, n=40) = 8.62$, *n.s.*), and affective mood ($t(123) = 0.44$, *n.s.*).

The 94 child participants were an average of 15.10 months old (*SD* = 0.32; range = 14.11 to 16.02 months) at the point of their first visit. Gender distribution was fairly equal with 49 males and 45 females. The majority of the children in the current sample were White-British (75.5%). The mean maternal age was 34.96 years (SD = 4.24; range = 23 to 46 years), measured during the baseline visit. Most of the mothers described themselves as being White-British (70.2%), and indicated having attained at least a graduate (31.9%) or postgraduate (31.9%) level of education. A detailed summary of the demographic information at baseline is illustrated in Table 1.

2.2. Procedure

As noted above, both mothers and their children attended a total of three study visits held at the University of Reading. All research staff involved in the trial had Disclosure and Barring Service (DBS) clearance and received training in order to carry out the study procedures. The first visit (baseline; Wave 1), took place when the child participant was approximately 15 months old, the second visit (Wave 2) and the third visit (Wave 3) coincided with when the child participant turned 26 and 37 months old respectively.

Table 1

Demographics of children and their mothers at baseline (n=94)

		n	%
Child's gender	Male	49	52.1
	Female	45	47.9
Child's ethnicity	White-British	71	75.5
	White-Others	1	1.1
	Asian or Asian-British	4	4.3
	Black or Black-British	2	2.1
	Mixed	7	7.4
	Others	1	1.1
	Not available	8	8.5
Number of siblings	0	49	52.1
	1	27	28.7
	2	7	7.4
	3	1	1.1
	Not available	10	10.6
Household income (per annum)	< £10,000	3	3.2
	£10,000 - £20,000	1	1.1
	£20,000 - £30,000	5	5.3
	£30,000 - £50,000	28	29.8
	£50,000 - £70,000	18	19.1
	> £70,000	27	28.7
	Not available	12	12.8
Mother's level of education	GCSEs	4	4.3
	A-Levels	9	9.6
	NVQ / HND	12	12.8
	Degree	30	31.9
	Postgraduate degree	30	31.9
	Not available	9	9.6
Mother's marital status	Single	5	5.3
	Unmarried & cohabiting	13	13.8
	Married & cohabiting	68	72.3
	Not available	8	8.5
Child's age (months)	Mean (SD)	15.10 (0.32)	
Mother's age	Mean (SD)	34.96 (4.24)	

All study visits across the three waves were conducted in a similar manner and each lasted approximately one and a half hours. A researcher gave the mother an overview of the activities for the visit while another researcher played with the child, allowing him/her to feel settled before beginning. The child underwent two structured behavioural tasks, namely Attractive Toy task and Stranger Approach task, designed to elicit his/her emotions (i.e. frustration and fear respectively) and associated attempts at regulation, with his/her mother present in the room. The mother of the child was requested to provide an incremental amount of support to her child across various stages of each task; (a) mother not involved (and seated behind child), (b) mother verbally involved (seated next to child, providing verbal support but no physical interaction) and (c) mother fully involved (mother free to interact in any way she saw fit). A leaflet with brief prompts of what to do at each segment was also handed to the mother. If the child demonstrated significant distress at any point, the mother could attend to her child immediately, regardless of the protocol. The entire task was filmed. Subsequently, the child's affective responses and regulatory behaviours were reviewed through the video files and coded using a standardised coding system adapted from Goldsmith and colleagues (1995). The present study used observation data collected from the Stranger Approach task.

Mothers were given a series of questionnaires to complete. These were administered at each visit and collected information relating to demographics, the child's emotional and behavioural difficulties, and maternal affective mood. The visit and activity schedule is summarised in Table 2 below.

Table 2

Study visit and activity schedule

	Wave 1 (15 months)	Wave 2 (26 months)	Wave 3 (37 months)
Demographics	X		
Emotion-regulation task			
Attractive Toy	X	X	X
Stranger Approach	X	X	X
Child-related measure			
Child Behaviour Checklist		X	X
Parent-related measure			
Centre for Epidemiologic Studies - Depression	X	X	X

2.3. Measures

2.3.1 Demographic information. Information was obtained through a questionnaire completed by mothers prior to the first study visit.

2.3.2. ER task. The Stranger Approach task was selected and adapted from the Laboratory Temperament Assessment Battery (LAB-TAB; Gagne, Van Hulle, Aksan, Essex, & Goldsmith, 2011) as an ER observation measure intended to evoke mild fearfulness in the child participants. As previously mentioned, the entire task was filmed from an adjoining observation room in order for elicited emotions and behaviours such as avoidance and contact seeking to be coded quantitatively.

Children were placed in a highchair while their mothers were seated diagonally behind them. Mothers were requested not to interact with their children and to remain neutral during this initial approach stage ("mothers-not-involved" condition). This facilitated observations of children's elicited emotions

and ensuing efforts at affect regulation without maternal inputs. The task began when a researcher (stranger), whom the child had never met, entered the room. She moved incrementally towards the child for the next 30 seconds and at the end of the episode, paused to greet the child by saying, "Hello. I am here to play with you today." Immediately after, the researcher continued her approach until she was next to the child (this took 20 seconds) and tickled the child under his/her chin. The researcher introduced herself to the child, and talked to the child for another 30 seconds before the child's mother was invited to come forward and sit next to the child.

The mother was prompted to only verbally support her child by joining in and continuing with the conversation initiated previously ("mothers-verbally-involved" condition). After 60 seconds, the researcher invited both the child and the mother to play with a novel interactive toy on the floor. The child was picked up from the highchair and seated on the floor next to his/her mother. The researcher then demonstrated one way of playing with the toy and suggested the child and his/her mother to join in the play, which lasted 60 seconds. Here, the child's mother was free to interact and/or intervene in any way ("mothers-fully-involved" condition). This allowed for a more naturalistic indication of how the mothers supported their children in an emotion-eliciting context.

2.3.3. Child-related questionnaire. *The Child Behaviour Checklist for Ages 1.5 to 5* (CBCL/1.5-5; Achenbach & Rescorla, 2001). The CBCL consists of 99 items designed to measure the frequency a child's problem behaviour within the past six months as rated by parents. Items are rated on a 3-point scale (0 = Not True, 1 = Sometimes or Somewhat True, or 2 = Very True or Often True). It yields three broadband problem scales (including Total Problem,

Internalising and Externalising) as well as seven narrow-band syndrome subscales (including (a) Emotionally Reactive, (b) Anxious/Depressed, (c) Somatic Complaints, (d) Withdrawn, (e) Attention Problems, (f) Aggressive Behaviour, and (g) Sleep Problems). The Internalising problem scale is derived from the summation of the first four syndromes while the Externalising problem scale is obtained from combining the final two syndromes. The CBCL has been validated extensively in developmental studies and shown to have robust psychometric properties. For example, the average test-retest reliability across various problem and syndrome scales was .85 (Rescorla, 2005).

2.3.4. Parent-related questionnaire. *Centre for Epidemiologic Studies - Depression Questionnaire* (CES-D; Radloff, 1977). The CES-D is a 20-item brief screening measure of depression. The respondent (i.e. mother of the child participant) was asked to rate each of the 20 CES-D items using a 4-point likert scale indicating how often in the past week they experienced symptoms of low mood, ranging from 0 = Rarely or not at all to 3 = Most or all of the time. An elevated total score reflects higher levels of low mood (maternal depression). The CES-D has been used extensively with both community and clinical samples and has demonstrated strong internal consistency (α = .85 to .94; e.g., Knight, Williams, McGee, & Olaman, 1997).

2.4. Coding Preparation and Procedure

2.4.1. Inter-rater fidelity. A total of 297 (Wave 1: 100, Wave 2: 99 and Wave 3: 98) Stranger Approach task videos were coded for the current study. A researcher, who was trained and previously involved in the original study, coded 95 of the videos. Two independent investigators (the author and another doctoral trainee, see Statement on Joint Working, Appendix A) completed the coding for

the remaining 202 sets of video data. To ensure consistency and fidelity of the coding process across all raters, the two new investigators underwent a rigorous training process with the principal investigator of the original study. To further reduce the potential of bias, the investigators were blind to all other aspects of the data until coding was completed.

First, ten videos that were originally coded by the researcher were selected at random and re-coded by both investigators. Joint coding was carried out by the investigators on two of these videos with the intention of familiarising themselves with the pre-established variables. Once the investigators were confident that they had a good understanding of the criteria, the remaining eight videos were coded separately. These codes were compared between the investigators and to the original researcher for reliability. Then any discrepancies were discussed. Coding agreement was assessed through intraclass correlation (ICC). There was significant consistency in the ratings between the researcher and each of the investigators – ICC coefficients were between .75 to .90 for reactivity and .93 to .95 for regulatory behaviours. After inter-rater agreement was established, the remaining videos were divided between the investigators and coded independently. Throughout this process, one out of every 20 videos was picked at random and separately coded by both investigators to confirm that coding consistency was maintained. Rating agreements between the investigators were excellent (Cicchetti, 1994) for emotion reactivity (ICC = .89, 95% CI [0.85, 0.92]) and regulatory behaviours (ICC = .99, 95 % CI [0.98, 0.99]).

2.4.2. Coded variables. The task videos were coded for children's affective responses and ER strategies, using a coding scheme adapted from the original protocol in the LAB-TAB manual. A total of 13 variables were coded:

four parameters for emotion reactivity were examined and a further nine were included to measure regulatory behaviours. As described previously, the stranger in the task approached and engaged the child across distinctive stages and, for the purpose of coding, each stage was divided into several 10-second epochs. All variables were scored accordingly across the time epochs. A peak intensity score (0 to 3 or 0 to 5) was assigned for all of the emotion reactivity variables. Regulatory behaviours were dichotomously coded as either present or absent. Table 3 includes the list of coded variables, brief operational definitions as well as the derived composite factors. Please refer to Appendices C, D and E for more details on the coding protocol and a sample of the coding sheet.

2.4.3. Data preparation and reduction. The raw scores for each of the emotion reactivity and regulatory behaviour factors were added and aggregated across the time intervals for every participant. In order to minimise the number of subsequent statistical analyses and the probability of Type I error, correlational and factor analyses (PCA) were conducted to identify consistently related variables, which were checked for their conceptual interpretability.

The four emotion reactivity factors, namely facial anger, facial sadness, vocal distress and escape behaviours were positively inter-correlated (ranging from $r = .23$, $p < .01$ to $r = .68$, $p < .01$). These were entered into a principle component analysis (PCA) and direct oblimin rotation was used to rotate the factors, which yielded a clear one-factor solution (accounting for 30.2% of variance) with robust loadings (ranging from .61 to .90). The mean scores of the emotion reactivity factors were transformed into weighted standardised T-scores and combined to form a new composite variable known as ‘emotion reactivity’.

Table 3

Definitions of coded ER behaviours and composite variables

Composite	Coded behaviour	Description
Emotion reactivity	Intensity of Facial Fear (0-3)	Brows drawn, faint furrows, eyes tense, mouth less than wide open.
	Intensity of Facial Sadness (0-3)	Inner corners of brows move upwards, droopy cheeks, lip corners drawn down.
	Vocal Distress (0-5)	Audible protests including crying or screaming.
	Intensity of Escape Behaviour (0-4)	Attempts to get away (e.g. sinking into the chair, twisting away).
Social regulation	Approaches Mother (Y/N)	Reaches or leans towards mother.
	Looks to Mother (Y/N)	Looks to or tries to look for mother (if she is out of sight).
	Withdrawal (Y/N)	Purposefully increases bodily distance from stranger.
Redirected attention	Gaze Aversion (Y/N)	Looks away or shifts gaze (briefly) without focussing on any object.
	Self-soothing (Y/N)	Engages in repetitive manipulation with body part (e.g. thumb sucking, fiddling).
	Active Stimulation (Y/N)	Engages in high-energy behaviours without apparent focus (e.g. flapping hands, fast kicking).
Not applicable	Approaches Stranger (Y/N)	Reaches or leans towards stranger
	Dealing with the Stimulus (Y/N)	Plays or communicates with the stranger in an appropriate manner.
	Distraction towards another Object (Y/N)	Looks at an object unrelated to the episode.

Correlation and factor analyses were performed to examine the associations between eight of the nine coded regulatory behaviours. The decision was made to exclude 'distraction towards another object' due to coding errors and validity issues with some of the previously coded raw data. PCA suggested a two-factor solution. The variance accounted for by factor 1 and factor 2 was 23.67% and 20.6% respectively. 'Approach stranger' and 'dealing with the stimulus' loaded evenly across both factor structures and therefore were excluded. The first factor consisted of the following components: (a) approach mother, (b) looks to mother and (c) withdrawal (from stranger), while the second consisted of: (a) gaze aversion, (b) self-soothing and (c) active stimulation (loaded negatively). The mean scores for all regulatory behaviour factors falling into one of these factors were transformed into weighted standardised T-scores and aggregated to form two new composite variables, corresponding to 'social regulation' and 'redirected attention' respectively.

2.5. Data Analysis

Analyses of the data were completed in several steps. The distributions of the data were first inspected. The emotion reactivity and social regulation scales revealed extreme skewness. Standard square root and log transformations were performed but did not sufficiently improve the distributions. Box-cox estimates of the optimal transformation suggested inverse transformations for emotion reactivity and social regulation, raised to the power of -5 and -2.5 respectively. The transformations significantly improved the distributions, although the emotion reactivity factor remained somewhat kurtotic (skewness = .44, *SE* = .15; kurtosis = -.74, *SE* = .29).

Correlational analysis was used to examine, descriptively, the associations between variables. To address the first hypothesis, growth modelling analyses were performed to identify any significant longitudinal changes in reactivity and regulatory behaviours, as well as to derive the baseline level (intercept) and the rate of change (linear slope) in ER for each child over time. The individual intercepts and slopes for each child were calculated from these growth models and used in subsequent analyses. Regression analyses were run to determine whether these variables (the intercept and slope) differentiated internalising and externalising outcomes at 37 months. Gender and maternal depression served as covariates. Next, in line with the second hypothesis, the moderating effects of ER on maternal depression and childhood difficulties were investigated using multiple regression, with interactions coded as the product of the main effects variables.

3. Results

The results are organised into three sections. First, descriptive information on how specific study variables relate to the three ER indices (i.e. reactivity, social regulation and redirected attention) are presented. Next, the basis of the longitudinal findings using basic growth modelling is described. The last section presents results from the regression analyses, which examined whether early ER in isolation, and in combination with maternal depression, predicted later childhood emotional and behavioural difficulties.

3.1. Preliminary Analysis

3.1.1. Gender differences in ER. To test if ER differed between the genders, a two-tailed independent sample T-test was conducted at each wave. There was a statistically significant effect of gender for emotion reactivity at

Waves 2 and 3. Boys (Wave 2: $M = 217.64$, $SD = 43.20$; Wave 3: $M = 191.15$, $SD = 13.09$) consistently showed more reactivity than girls (Wave 2: $M = 199.28$, $SD = 20.27$; Wave 3: $M = 185.73$, $SD = 12.41$) in both Wave 2 ($t(92) = 2.60$, $p = .01$, $d = .54$) and Wave 3 ($t(92) = 2.06$, $p < .05$, $d = .43$). No gender differences were found at Wave 1. Gender differences were not detected for social regulation and redirected attention. When regulatory strategies were examined individually, boys were more likely than girls to withdraw (i.e. move away from the stranger) when in a fearful situation at age 26 and 37 months (Wave 2: $t(92) = 2.14$, $p < .05$, $d = .45$; Wave 3: $t(92) = 3.56$, $p < .001$, $d = .74$). They also displayed more self-soothing attempts at age 26 months ($t(92) = 2.22$, $p < .03$, $d = .46$).

3.1.2. Descriptive statistics. The means and standard deviations of the study variables, including ER factors, maternal depression as well as internalising and externalising difficulties, are shown in Table 4.

Table 4

Sample characteristics across various study measures

	Mean (SD)		
	15 months	26 months	37 months
Emotion reactivity*	202.59 (34.73)	208.85 (35.25)	188.56 (12.99)
Social regulation*	144.76 (17.66)	151.88 (20.19)	153.36 (25.23)
Redirected attention	152.41 (18.00)	135.72 (22.31)	161.87 (14.61)
Maternal depression	8.05 (7.37)	6.77 (6.11)	16.58 (5.18)
Child - Internalising	-	5.74 (4.73)	6.04 (4.41)
Child - Externalising	-	11.54 (6.99)	10.07 (7.23)

Note: * Pre-transformation values

In addition, correlation coefficients for these study variables are presented in Table 5. Contrary to expectations, 15 months emotion reactivity, social regulation and redirected attention were not reliably correlated with internalising symptoms at 37 months. Similarly, no significant relationship was found between the ER indices at 15 months to externalising problems measured at 37 months. A weak negative association was observed between 15 months maternal depression and the use of social regulation strategies at 26 months (r = -.23, p < .05) but not at 15 months (r = .09, *n.s.*) or 37 months (r = -.09, *n.s.*). Current low maternal mood was related to the use of redirected attention (r = .21, p < .05) by children at 37 months. No other significant correlations were found between maternal depression and the ER factors. Strong positive associations between maternal depression and childhood difficulties were noted. No other factors were related to internalising and externalising problems. Lastly, boys and girls showed comparable patterns of externalising (t(88) = 1.00, *n.s.*) and internalising behaviours (t(88) = 0.31, *n.s.*).

3.2. Basic Growth Modelling

To examine the first hypothesis, a linear mixed model was performed using the longitudinal reactivity and regulation data to assess the pattern of change over time using maximum likelihood estimation. Linear mixed modelling is a flexible multivariate data analytic approach that allows all cases to be analysed even with some missing data. It estimates initial levels (intercept) and growth trajectories (e.g. linear slope) of child ER which can be used in subsequent analyses (Curran & Willoughby, 2003). The linear slope examines if there are inter-child changes in ER over time.

Table 5

Correlations between ER, maternal depression and child psychopathology

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Emotion reactivity														
1. 15 months	-													
2. 26 months	.26*	-												
3. 37 months	.11	.25*	-											
Social regulation														
4. 15 months	.61**	.27**	.16	-										
5. 26 months	-.22	.01	.12	.02	-									
6. 37 months	.14	.22*	.83**	.23*	.04	-								
Redirected attention														
7. 15 months	.02	-.01	-.07	.15	.12	-.07	-							
8. 26 months	-.11	.10	.08	.09	.40**	.09	.35**	-						
9. 37 months	.13	-.14	-.20	-.06	-.22*	-.17	.02	-.07	-					
Maternal depression														
10. 15 months	-.00	-.06	-.07	.09	-.23*	-.09	.03	-.14	-.03	-				
11. 26 months	-.00	-.05	-.12	-.00	-.18	-.13	-.01	-.09	.14	.54**	-			
12. 37 months	.12	.05	-.13	.09	-.04	-.15	-.00	-.02	.21*	.39**	.50**	-		
Child psychopathology														
13. Internalising 37 months	-.11	.05	.07	.04	.00	.09	.10	.06	.07	.29**	.18	.36**	-	
14. Externalising 37 months	-.17	-.17	-.02	-.07	-.04	-.01	.09	.10	.11	.31**	.27*	.40**	.63**	-

*Note: * $p < .05$; ** $p < .01$*

Linear mixed modelling revealed a positive linear slope with time (β = 3.09, 95% CI [1.85, 4.32], $p < .001$) for emotion reactivity. There was significant inter-individual variability in the intercept (*SD* = 1.59, 95% CI [1.07, 2.37], $p < .001$) and linear slope (*SD* = .47, 95% CI [0.21,1.04], $p < .001$). For social regulation, the linear slope for time was not significant (β = .14, 95% CI [-0.01, 0.28], *n.s.*). Inter-individual differences were not significant in the intercept (β = .02, 95% CI [0.002, 1.14], *n.s.*) and the linear slope (β = .03, 95% CI [0.01, 0.09], *n.s.*). A negative linear slope with time was found for redirected attention (β = -80.97, 95% CI [-97.51, -64.43], $p < .001$). The analysis demonstrated non-significant inter-individual variability in the intercept (β = 16.69, 95% CI [10.72, 25.99], *n.s.*) and linear slope (β = 4.65, 95% CI [2.32, 9.32], *n.s.*).

The findings above suggested that the variances in the slopes of the ER factors were either limited or near zero. Furthermore, bivariate correlations revealed that the coefficients between the intercept and the slope of each of the three ER scales were extremely high (ranging from .99 to 1.00). These indicated that baseline levels and the amount of inter-individual changes over time for reactivity and regulatory behaviours could not be reliably distinguished. Inter-individual variability in ER was mostly observable from baseline, and therefore the analyses focussed only on the intercept – i.e., the 15 month ER scales in the subsequent analyses.

3.3. Regression Analysis

Subsequently, a series of hierarchical regressions were conducted to evaluate the associations of initial ER (i.e. 15 months emotion reactivity, social regulation and redirected attention) with later childhood difficulties (i.e. internalising and externalising symptoms as measured by the CBCL at 37

months). Gender, as well as maternal depression, measured at 15 months were entered into the first block of the model (and also served as covariates) throughout followed by 15 months ER predictors into the second block.

3.3.1. Main effects of ER on childhood difficulties. Gender and maternal depression accounted for a significant proportion of variance (R^2 = .10, F (2, 81) = 4.60, p = .01) in externalising difficulties at 37 months. Next, 15 months emotion reactivity, social regulation and redirected attention scores were included in the regression model and contrary to hypotheses, the inclusion of these factors did not significantly enhance the fit of the model, ΔR^2 = .03, ΔF (3, 78) = .74, *n.s.*. The final regression model was not significant (R^2 = .13, F (5, 78) = 2.26, *n.s.*). None of the ER scales were unique significant predictors of externalising behaviours. The findings are summarised in Table 6. In addition, as seen from Table 6, the overall model when regressing children's internalising problems at 37 months on 15 months reactivity and regulatory behaviours after covarying gender and 15 month maternal depression was not significant (R^2 = .10, F (5, 78) = 1.68, *n.s.*). The inclusion of the three ER scores did not contribute to a more statistically meaningful increase in the proportion of variance explained (ΔR^2 = .01, ΔF (3, 78) = 0.29, *n.s.*). Similarly, 15 months emotion reactivity, social regulation and redirected attention did not reliably predicted internalising difficulties at 37 months.

3.3.2. Interaction effects between ER and maternal depression on childhood difficulties. In line with the second hypothesis to investigate whether emotion reactivity, social regulation and redirected attention interacted with maternal depression in relation to childhood psychopathology outcomes, i.e. externalising and internalising difficulties, additional regression analyses were

performed using the PROCESS macro (Hayes, 2008). Gender served as a covariate. Primary independent variables including all ER related factors and maternal depression were mean centred before they were entered in the regression models (Aiken & West, 1991). As seen in Table 7 below, child emotion reactivity measured at 15 months was a significant moderator on the associations between 15 months maternal depression and 37 months externalising problems (β = -.12, 95% CI [-0.23, -0.001], t = -2.01, p < .05). Conversely, 15 months social regulation and redirected attention did not moderate the effects of maternal depression on the levels of externalising behaviours at 37 months.

Simple slopes were plotted to examine the interaction in detail (refer to Figure 2). Visual inspection of the interaction plot suggested that as emotion reactivity decreased and maternal depression increased, externalising problems increased. When emotion reactivity was measured 1 SD below the mean, there was a positive significant relationship between maternal depression and externalising symptoms (β = .52, 95% CI [0.30, 0.74], t = 4.67, p < .001). This association was replicated at the mean (β = .32, 95% CI [0.17, 0.48], t = 4.21, p < .001). However, at 1 SD above the mean for emotion reactivity, the relationship between maternal depression and externalising behaviours was not significant (β = .13, 95% CI [-0.14, 0.40], t = 0.93, *n.s.*). Taken together, this implies that toddlers who demonstrated low and average levels of emotion reactivity at 15 months experienced elevated externalising symptoms, particularly when their mothers also reported high affective difficulties than when there was low maternal depression (with the steepest slope for children with lowest level of emotion reactivity). Children with high levels of emotion reactivity presented

with similar levels of externalising difficulties irrespective of the levels of maternal depression.

Table 6

Regression analyses predicting 37 months externalising and internalising difficulties from 15 months ER factors, covarying gender and maternal depression

	Externalising problems (37 months)		Internalising problems (37 months)	
	β	*t*	*β*	*t*
Step 1				
Gender	.58	.38	-.49	-.53
Maternal depression (15m)	.31	3.03	.17	2.70**
R^2	.10	-	.09	-
F	4.60*	-	3.88*	-
Step 2				
Emotion reactivity (15m)	-.57	-1.06	-.22	-.64
Social regulation (15m)	-1.04	-.15	1.72	.41
Redirected attention (15m)	.03	.61	.02	.62
ΔR^2	.03	-	.01	-
ΔF	.74	-	.29	-
Total R^2	.13	-	.10	-
Total F	2.26#	-	1.68	-

Note: 15m = measured at 15 months

** p < .05; ** p < .01; # p = .06*

Table 7

Interaction of 15 months ER variables and maternal depression predicting 37 months externalising symptoms

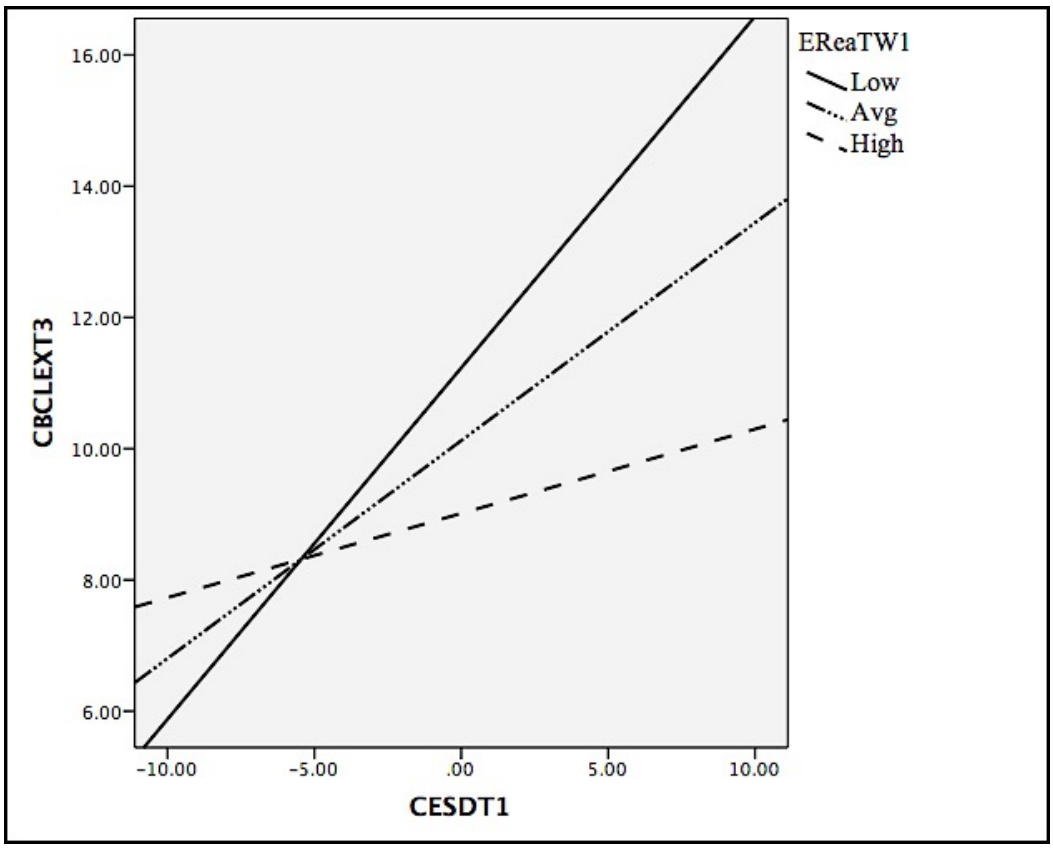
	Externalising symptoms			
	b	*S.E.*	*t*	ΔR^2
Regression Model 1				.156***
Emotion reactivity	-.67	.45	-1.49	
Maternal depression	.32	.08	4.21***	
Interaction	-.12	.06	-2.01*	.034*
Regression Model 2				.116**
Social regulation	-4.63	5.54	-.84	
Maternal depression	.29	.11	2.60**	
Interaction	.64	.81	.80	.007
Regression Model 3				.117**
Redirected attention	.03	.05	.70	
Maternal depression	.27	.10	2.60**	
Interaction	.01	.01	1.18	.01

Gender served as a covariate for all regression models above.

** p < .05; ** p < .01; *** p < .001*

Figure 2

Interaction of 15 months emotion reactivity and maternal depression on 37 months externalising symptoms



Note: Low = 1 SD below mean, Average (Avg) = mean, High = 1 SD above mean. EreaTW1 = 15 months emotion reactivity; CESDT1 = 15 months maternal depression; CBCLEXT3 = 37 months externalising symptoms

Table 8 summarises the moderation effects of the three ER factors on the relationship between maternal depression and subsequent child internalising difficulties. The analyses revealed that the interactions between 15-months emotion reactivity, social regulation and redirected attention on 15-months maternal depression were not significant.

Table 8

Interaction of 15 months ER variables and maternal depression predicting 37 months internalising symptoms

	Internalising symptoms			
	b	*S.E.*	*t*	ΔR^2
Regression Model 1				.134**
Emotion reactivity	-.18	.30	-.59	
Maternal depression	.18	.07	2.60**	
Interaction	-.08	.05	-1.70#	.044#
Regression Model 2				.094
Social regulation	.47	3.50	.14	
Maternal depression	.15	.07	2.06*	
Interaction	.35	.61	.58	.006
Regression Model 3				.103
Redirected attention	.02	.03	.80	
Maternal depression	.14	.08	2.00	
Interaction	.004	.005	.75	.01

Gender served as a covariate for all regression models above.

** p < .05; ** p < .01; *** p < .001 # p = .09*

4. Discussion

The primary goals of the study were to evaluate the prospective associations of ER on the development of childhood difficulties, as well as to explore whether there was a combined effect of ER and maternal depression on externalising and internalising behaviours during the critical developmental period of early childhood. The joint influence of the often co-occurring components of emotion reactivity and specific regulation behaviours were examined and taken to represent distinct aspects of the broader ER construct. Through the use of a mild fearfulness observational task, children's emotion reactivity and regulatory behaviours (i.e. the use of social regulation and redirected attention) were assessed across three time points, coinciding with when they turned 15, 26 and 37 months old.

4.1. Summary of Main Findings

First, the study sought to address whether there was a longitudinal association between ER and emotional and behavioural problems. It was predicted that emotion reactivity and regulatory behaviours would differentiate the trajectory of childhood difficulties over time. Contrary to expectations, longitudinal analyses through growth modelling revealed that reactivity and regulatory behaviours though demonstrating some changes over time, did not consistently show reliable inter-individual variability between age 15 months to 37 months. In other words, while there was substantial variability in the baselines for reactivity and regulation, and group-level changes across time, much of the later reactivity and regulatory behaviours data at the individual level was predictable from the baseline measurements. It was thus not possible to meaningfully distinguish the ER growth profiles and associate them in relation to

childhood psychopathology, beyond what was captured by the intercepts (the starting points for these measures at 15 months). For that reason, the study focussed on the earliest (15 months) ER measures to test the current and subsequent hypotheses.

The analyses revealed that the ER factors, i.e. emotion reactivity, social regulation and redirected attention, measured at 15 months did not predict subsequent levels of internalising and externalising problems at 37 months, even after adjusting for the possible influences of gender and maternal affective mood. Previously published cross-sectional studies do indicate that very young children who present with more contextually adaptive ER are less likely to have concurrent difficulties in internalising and externalising behaviours. For example, redirected attention, which was posited to be an adaptive ER behaviour, was associated with reduced behavioural symptoms in preschoolers (e.g., Gilliom et al., 2002). Toddlers who were able to shift their attention away from a fearful stimulus (instead of sustaining focus) were found to experience less distress (e.g., Buss & Goldsmith, 1998). The small handful of longitudinal studies reviewed earlier further implicates ER problems as a precursor in the subsequent developmental trajectory of behavioural and emotional difficulties from early to middle childhood (e.g., Halligan et al., 2013; Kim-Spoon, Cicchetti, & Rogosch, 2013). In these contexts, the results of the current study were surprising.

While the current study assessed various distinctive facets central to the complex processes of ER by coding reactivity and regulatory data, certain cognitive-based and/or implicit ER behaviours (e.g. reappraisal or rumination) could not be directly observed and evaluated. Less is known about a child's

ability to cognitively modulate affective states; although one study did demonstrate the emergence of utilising cognitive strategies to regulate frustration among 3-year-olds (Stansbury & Sigman, 2000). It is a possibility that more covert ER processes have a contributory role in predicting difficulties in early childhood across time.

Another probable reason for the lack of findings relates to the low risk, relatively homogeneous normative sample of the current study. As noted, the children recruited were predominantly from educated, middle-class, dual-parent families and, as a group, they presented with lower than average levels of internalising and externalising symptoms. Within the context of a low risk sample, reactivity and regulatory behaviours may not be sufficiently predictive of emotional and behavioural functioning over time. Indeed, Hill and her associates (2006) found that while adaptive ER reliably differentiated the developmental pathways of young children with sub-clinical and clinical thresholds of externalising behaviours, it was not a significant predictor for those with normative and low risk profiles. It is also worthwhile to highlight that consistent individual differences in the developmental trajectory (i.e., linear change over time) in ER between children were found to be limited in the present study. In general, the results demonstrated that baseline levels of ER tended to be highly correlated with subsequent changes in ER. It may be that early ER abilities among children with a low risk profile show less variability and greater predictability than would be the case in more at-risk samples. Conversely, the development of ER may be more varied among at-risk children and ostensibly, may become a more critical predictor of different childhood outcomes in higher risk contexts.

The fact that most of the inter-individual variability in the linear growth in ER was accounted for by the baseline level (15 months), could partially be attributable to early innate individual differences such as temperament. In particular, domains of temperament such as effortful control, negative affectivity (Rothbart & Bates, 1998), and behaviour inhibition (Fox, 1994), have been shown to contribute towards the foundations of ER in young children. Nonetheless, the findings pointed to some small but significant group changes in reactivity levels and regulatory behaviours when comparing one time point to another. Children in the current study were assessed from 15 to 37 months. It is plausible that the role of emotion reactivity and regulatory behaviours as predictors of internalising and externalising difficulties become more apparent at a later age, and hence a longer period of follow-up may be necessary.

Secondary analysis revealed a gender difference in one of the ER scales. Boys demonstrated higher levels of emotion reactivity during the observational task at age 26 and 37 months in comparison to girls. Some researchers postulate that, developmentally, girls mature earlier than boys, and these cognitive and/or physical variations inevitably shape gender differences in ER capacity (Keenan & Shaw, 2003). It is probable that boys continue to rely more heavily on external inputs to regulate negative affect (e.g. communicate distress to mothers through the display of emotive reactivity) while girls have developed an expanded array of ER behaviours, and hence engage in comparatively more independent and/or intrinsic regulation of emotions.

The second issue addressed was the joint effect of child ER and maternal depression on internalising and externalising symptoms. The results revealed that one index of ER in particular, emotion reactivity, moderated the relationship

between maternal affective mood and early childhood behavioural difficulties, whilst social regulation and redirected attention did not. At 15 months old, children who displayed low and average levels of emotion reactivity (i.e. reduced expressions of fear and sadness, verbalisation of distress and escape behaviours) tended to show higher levels of externalising behaviours at 37 months when they were also exposed to an environment of high maternal depression, relative to those with higher emotion reactivity. The interactions between the three ER factors and maternal depression at age 15 months did not appear to influence the development of childhood internalising behaviours at 37 months.

A relationship consistent with the above findings was reported by Cole et al (1996); children with less facial expressivity during an observational task were found to have higher concurrent (age 5) and subsequent (age 7) behavioural difficulties. The pattern of reduced emotion reactivity demonstrated by the child participants during the fear-eliciting task in our study is further consistent with the low fearfulness found in studies examining childhood psychopathic traits (e.g., Raine, 1993; 2002). One prospective study concluded that a low fear reactivity profile in early childhood provides an underpinning to antisocial behaviours (Glenn, Raine, Venables, & Mednick, 2007). In particular, those who were less reactive to fear when undergoing a fearfulness task at age 3, had higher psychopathic traits in adulthood. Hence, taken together the results suggest that low emotion reactivity in combination with maternal depression, occurring in early development may shift a child onto a longer-term developmental pathway characterised by heightened risk for externalising problems.

An alternative explanation is that the low reactivity reflects the outcome of maladaptive attempts to regulate fear through more covert, response-focussed

strategies (i.e. activated as a reaction to the experience of an emotion) such as suppression and passivity (Gross, 1998). Refraining from responding to elicited negative affects (e.g. fear, sadness and displaying vocal distress) resulted in the down-regulation of emotion reactivity (Gross & Levenson, 1993). This ER style of low reactivity has been postulated to implicate childhood difficulties – it brings about temporary affective relief and generates a rebound in subjective distress, which can manifest as externalising behaviours if the distress is consequently directed outwards (Webb, Miles, & Sheeran, 2012). Hence, the study's findings suggest that, while maternal depression has a direct impact on behavioural difficulties, the influence of the disturbance is magnified when a child persistently employs contextually poorer regulatory resources, such as suppression, to cope with the disruption.

The current findings underscore the importance of young children's ER, in interaction with parental mental health status, especially maternal depression. Within the context of early childhood, extrinsic processes of ER are more salient than in middle childhood or adolescence as toddlers rely more heavily on support from their environment, particularly from parents, to regulate affective states (e.g., Cole et al., 2004; Eisenberg & Morris, 2002). For instance, children in kindergarten were found to depend more frequently on adults to cope with a stressful incident while older children used more independent strategies like problem-solving (Bernzweig, Eisenberg, & Fabes, 1993). Mothers with low affective mood typically react more negatively and/or are more emotionally withdrawn towards their children's feelings compared to mothers without depression (Goodman & Gotlib, 1999). They may negatively prime the way in which their children respond in an emotion-inducing situation, for example,

through verbal scripts like "you should not be afraid" (Gross & Thompson, 2007). Mothers who are depressed are therefore less likely to model healthy ER or socialise their children towards adaptive strategies (e.g., Silk et al., 2006; Thompson & Meyer, 2007). Either way, it is not too surprising that a negative family climate as a result of elevated maternal depressive symptoms in combination with a child's maladaptive ER, even in the first year of childhood, consequently places a child at risk for increased behavioural difficulties.

Interestingly, at high levels of emotion reactivity, behavioural symptoms were comparable for young children regardless of the levels of maternal depression. Many theorists have reiterated that ER is not categorically presumed to be good or bad but, instead, is conceptualised as adaptive or maladaptive after considering contextual factors and the ensuing consequences (e.g., Gross & Thompson, 2007; Thompson & Calkins, 1996). In the present study, higher observed emotion reactivity might be within the limits of a normative response to a mildly fearful situation and should not be regarded as dysregulated reactivity.

4.2. Study Considerations and Limitations

A number of important contextual issues must be taken into account when interpreting the current findings in relation to existing evidence. One of the most crucial distinctions is that ER was examined in a fear-eliciting context in contrast to studies that used frustration- or anger- eliciting protocols (e.g., Halligan et al., 2013; Hill et al., 2006). While an exact claim cannot be made, the type of emotions elicited may well influence the children's reactivity and regulatory behaviours to an extent. Moreover, the assessment of ER through an observation task improved objectivity (see Cole et al., 2004), as opposed to the more common utilisation of self- or parent- report measures in other studies (e.g.,

Suveg et al, 2011). Lastly, by focussing on the early period of childhood development (i.e. 15 months), the possibility of ER conflating with externalising and internalising symptoms was minimised.

The limitations of the study should also be recognised. First, the relatively homogeneous nature of the sample meant that generalisability of the current findings is fairly restricted and should be regarded as preliminary. The associations found using a normative, low-risk sample may well vary when a diverse, high-risk clinical sample is involved. Secondly, the use of a prospective, longitudinal design was a definite strength and afforded some conclusions about the directionality of the observed findings. However, the utilisation of a correlational design to examine a couple of the hypotheses meant that the results might be subjected to influences from extraneous factors which could not be fully evaluated in the study. As with any longitudinal study, attrition was an issue and this could potentially impinge on the findings discussed. However, discrepancy analysis did suggest that, at baseline, the families who did not complete the study were not distinctive from the ones who did.

Another issue relates to the inherent limitations of observational methods. As mentioned, the absence of data relating to cognitive and/or implicit regulation may have a bearing on the results and may be especially relevant in the later time points where children have more mature ER resources. For instance, it was not possible to distinguish if toddlers were also engaging in other types of cognitive regulatory behaviours. Finally, with the length of the observation task lasting less than five minutes, non-significant and/or modest findings were not surprising, and might have confounded with issues such as tiredness and irritation.

4.3. Implications and Future Directions

Results from the current study offered significant insights relevant to the understanding of early childhood ER and; through an integrative developmental framework, it addressed child (i.e. ER factors) and maternal (i.e. affective mood) influences in predicting subsequent externalising and internalising behaviours. The study served as a reminder that, especially in the early stages of life, a multitude of elements (not limited to the ones evaluated here) could be implicated in future childhood functioning. Most treatment and preventive programmes are informed predominantly by behavioural and cognitive principles (Southam-Gerow & Kendall, 2002). In light of the growing body of affective research, it is increasingly relevant for clinicians to formulate the contributing effect of ER, as well as consider its interaction with other parental factors to augment assessment and treatment plans for children and families. Future replication of the findings will inform theoretical conceptualisation of ER in early childhood as well as clinical practices by shaping relevant treatment programmes. For example, children of mothers who have depression could receive early preventive intervention aimed at building up children's regulatory resources and/or mothers' abilities to provide adaptive emotional socialisation, in order to minimise the risk for childhood externalising behaviours at a later age. Alternatively, identifying mothers with depression whose children differ in their emotional and regulatory profiles may aid in the appropriate targeting of interventions designed to improve child, as well as maternal, outcomes.

In view of the limitations and implications, future research should continue to incorporate a longitudinal, prospective design where possible and examine early vulnerability indicators in terms of ER for specific childhood

clinical diagnosis, such as ADHD and anxiety. More research is needed to evaluate how other family members (e.g. father, siblings), the influence of contextual factors (e.g. parenting practices, marital stressors) and the family system as a whole, affect ER development in young children. It would also be beneficial to replicate the study using a more diverse sample of families, include measurements of implicit and/or cognitive-based ER behaviours as well as a longer follow-up period.

5. Conclusions

The current study sheds some light on the intricate mechanisms in which early ER can interact with factors in a child's environment as precursors to poorer emotional and behavioural functioning across time. ER indices like emotion reactivity, social regulation and redirected attention were not longitudinally predictive of internalising and externalising symptoms. However, the combined effects of lower emotion reactivity and higher maternal depression in the first year of a child's life increased the probability of subsequent childhood difficulties, particularly externalising behaviours. The paper further pointed to certain caveats that warranted careful future empirical attention.

Adaptive regulation of emotions is essential for the overall well-being of children (Saarni, 1999) but it is certainly not a singular, straightforward process. An emerging body of studies has adopted a broader, developmental framework in studying ER among young children, and together with the current findings, would hopefully serve as a catalyst for a more comprehensive conceptualisation and improved understanding of a child's capacity to regulate emotions.

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Part 3: Critical Appraisal

1. Introduction

This critical appraisal seeks to consider some of the central issues that arose throughout the course of the research project, with the goal of sharing information that may be useful for future researchers in the field of childhood emotion regulation (ER). It begins with a description of how I became interested in the subject area of ER. The second section summarises a number of key learning points. It then extends into a discussion of some of the practical and conceptual challenges encountered as well as a consideration of how these issues could have been resolved. Finally, it concludes with a broad exploration of how culture may have an implication on ER amongst children.

2. Choice of Research Area

Prior to clinical psychology training, I was involved in a randomised controlled trial (RCT) for children with disruptive behaviour disorders and facilitated several successions of weekly, group-based anger management interventions as part of the study protocol. The programme was informed by cognitive behavioural principles which included, amongst other things, the psychoeducation of feelings with a particular focus on anger as well as the practical use of strategies such as problem solving and cognitive reappraisal of situations. While many benefitted from the treatment, some of the children continued to have marked anger-related difficulties. These children appeared to experience anger and other feeling states more quickly and intensely, found it challenging to engage with the strategies taught and instead, reported a higher frequency of venting behaviours (e.g. throwing a chair or slamming a door) to cope. My curiosity about the observed individual differences and the efficacy of outcomes prompted some hypotheses. Specifically, I wondered about a broader

formulation that encompassed not merely anger issues but extended to the experience of other feeling states as well as generalised difficulties managing them.

Through researching, I came across the construct of ER, which provided the empirical link to the clinical observations I was making. Furthermore, the multi-dimensional mechanism of ER is appealing because it serves as a transdiagnostic framework for understanding adaptive and maladaptive functioning in children (e.g., Kring & Sloan, 2009). This is important as the common pathway of regulatory deficits demonstrated in many at-risk and clinical populations can be sufficiently addressed through broad-spectrum community-based ER interventions, without the need for tailoring disorder-specific treatments (e.g., Hannesdottir & Ollendick, 2007). Consequently, when I was contemplating a potential topic for my dissertation, I was keen to focus my research on a developmental perspective of ER. Coincidentally, there was an opportunity to evaluate regulatory behaviours in preschoolers using data collected from a completed, prospective longitudinal study.

3. Learning Points and Challenges

3.1. Main Learning Points

Data collection for the original study was completed when I took up the project. Hence, another trainee and I were responsible for coding regulatory and reactivity data collected using the Stranger Approach task, which was designed to elicit negative affectivity (see Statement on Joint Working, Appendix A). The coding process was tedious because of the number of variables examined. However, it enabled me to develop my research skills around a new methodology. Before my involvement in the empirical project, I was unfamiliar

with the process of coding qualitative data into quantitative variables. In developmental research, the reliability and validity of self report data from younger children has historically been regarded as less than robust (e.g., Norwood, 2007), which prompted many researchers to adopt a multi-informant approach by including teacher- and parent- reports of study outcomes. The use of an experimental task to elicit targeted emotions and observe regulatory attempts allowed a more objective and accurate operationalisation of ER in comparison to self report measures (Cole, Martin, & Dennis, 2004), and could be adapted for childhood research studies in other domains.

More importantly, the coding of the ER data afforded me an invaluable, experiential platform to observe and learn the many ways in which emotions could be expressed and regulated by children, as well as how mothers responded to their child's emotional cues (although this was not the focus of the empirical study). It came across like a clinical experience where I was able to extend my observation abilities as a psychologist. At the same time, it allowed me to study the corresponding, mostly normative, levels and changes in emotion reactivity and regulatory behaviours at different developmental ages, which would provide the basis to conceptualise about emotions and its regulation in future therapeutic work with various at-risk and clinical populations.

Added to the above, there were clear positives of collaborative working with another trainee. In the early stages of coding, we were able to jointly familiarise with the various reactivity and regulatory parameters and consulted with each other to resolve any discrepancies. This facilitated a seamless and organised process of grasping the coding protocol and establishing inter-rater reliability. The shared workload also meant that data from a larger sample of

families could be coded and included in the final analysis. To me, this represented a more realistic experience of clinical research where shared expertise and inputs from a team of investigators is the norm.

The final key learning point relates to my personal belief around research findings. A number of the findings in my empirical study had modest effects or were not statistically significant and therefore the corresponding hypotheses were not supported, contrary to prior expectations. This triggered a fair amount of anxiety and frustration. I had thoughts of deviating from my original aims and exploring other hypotheses that could possibly yield significant findings, which I brought up with my research supervisor. He reminded me that the purpose of research was not to singularly seek positive results but to publish evidence on the basis of what the finding represented. It was a lesson well reminded. I reflected upon the discussion and noticed that I held implicit notions about significant results representing a "well-executed and worthwhile" research, and conversely, null findings suggesting a "failed" study. Currently, there has been a move away from the convention where publication bias favours significant findings in psychology research (e.g., Laws, 2013; Vasilev, 2013). Contemporary researchers, including myself, have increasingly acknowledged the value of publishing null results in order to advance scientific knowledge.

3.2. Practical and Conceptual Challenges

Being part of a completed study brought about its unique set of practical difficulties despite the typically problematic recruitment and data collection phases no longer an issue. A couple of challenges were associated with the conceptualisation of ER in the literature review and the empirical study.

3.2.1. Video files and coding process. One of the biggest and perhaps most unexpected challenge relates to the saved video files of the observational task. During coding, the other trainee and I came across a number of videos that were corrupted and not readable by certain computers. We installed an array of media players and used computers with different operating systems to access the files for coding – this process was often time consuming and mostly frustrating as we had pre-collected raw data but were unable to code a proportion of them for inclusion in the analysis. However, this was something inevitably beyond our control due to the quick advances and cross-compatibility in technology.

There were also instances where the task segment (i.e. the Stranger Approach task; Gagne, Van Hulle, Aksan, Essex, & Goldsmith, 2011) was missing from the recorded footage. It appeared that the child had attended the session with his/her mother but somehow did not complete the task. In some cases, we were able to verify from viewing the video that the child participant was distressed and therefore unable to settle for the task. It would have been beneficial to know the specific reasons for why these missing segments occurred. Additionally, a small handful of the raw observational data could not be fully coded as the child participants were partially obscured from view, usually due to video angles and/or were blocked by an adult (i.e. mother or researcher). Having general notes about a child's emotive states and observable regulatory behaviours during times when unforeseen issues arose, such as those described above, might subsequently facilitate a more complete and precise coding of the reactivity and regulatory variables. Taken together, I believe these issues illustrated the significance of keeping proper, good quality and systematic documentation in research, which in turn foster accountability, transparency and

replicability. For example, details about the missing data and problems faced could be disseminated and kept in mind when designing follow-up studies.

3.2.2. Data discrepancy. A researcher involved in the original study had coded a portion of the Stranger Approach videos. In the interest of time, instead of re-coding these videos, the decision was made to combine her data set with what the other trainee and I had coded. During the process of data cleaning and checking, discrepancies were spotted within one of the primary regulatory behaviour variable, i.e. 'distraction from another object'. This was brought to the attention of my research supervisor. We spent some time speculating about how the errors came about but did not made significant progress. Separately, the researcher was contacted, however, we were unable to retrieve previous code sheets as they had been discarded. Again, this highlighted the need to retain research documents so subsequent researchers examining the data would have access to archival records to investigate errors. In hindsight, although this particular coded factor had to be excluded from the analysis because its reliability could not be verified, it was nonetheless valuable to participate in the process of problem solving and considering alternatives when a difficult situation arose in the later stages of the research project.

3.2.3. Conceptual definition of ER. The definition of ER has regularly been implied rather than explicitly stated in many studies (Berking & Wupperman, 2012). Further to this, studies have adopted a variety of outcome measures to assess ER in children ranging from questionnaires to observational methods (Bariola, Gullone, & Hughes, 2011). The inconsistencies in operationalisation and assessment of ER have echoed the primary conceptual challenge that I had to manage in the course of my research. Within the scientific

community, efforts have been centred on trying to disambiguate ER and underscore the importance of explicitly operationalising the various aspects of ER that are being measured (e.g., Goldsmith & Davidson, 2004; Thompson, 1994). Hence, in the empirical study, reactivity and regulatory behaviours were taken to represent a broader construct of ER and the reasons for this has been discussed in detail in the introduction section of the empirical paper. My initial presumption was that ER was limited to regulatory attempts, i.e. specific strategies that are deployed to modulate feeling states. At the end of my dissertation project, I developed a much deeper appreciation for the complexities of ER that has been the subject of much debate in affective research.

Similarly, while conducting a systematic search for ER-based interventions in my meta-analysis, I came across an extensive number and array of programmes that have been tagged with ER keywords. Many of these therapeutic programmes appeared to have only an inferred and/or indirect outcome of improving specific regulatory abilities in children. It was clear that I needed an explicit set of criteria, defining elements representative of an ER intervention, which would facilitate my decision process to include or exclude a particular intervention. Upon systematic review, only a small handful of the treatment studies met the inclusion criteria. Future researchers should carefully consider available conceptual definitions of ER to aid study designs, methodology and the choice of outcome measures amongst other things.

4. Emotion Regulation and Culture

The psychology of culture and emotions has been widely studied (e.g., Mesquita & Leu, 2007). However, cultural factors have received very minimal attention in the field of ER and to add, majority of the studies published involved

samples that were more representative of populations in America and Europe (Rubin, 1998). During the course of coding, I noted anecdotally, that children and/or those with mothers who were from Black and Minority Ethnic (BME) backgrounds appeared to express and modulate their emotions in a different manner compared to those who were from the White-British ethnic group. Due to the homogenous nature of the study sample, there were insufficient participants to quantitatively evaluate the research question of whether cultural differences influenced regulatory processes among young children.

Developmental studies that addressed the issue of culture in ER are few and far between. Interestingly, one group of researchers compared the differences in ER among two-year-old Japanese and German girls (Friedlmeier & Trommsdorff, 1999) and used the same observational task employed in the current empirical study. They demonstrated that Japanese girls expressed higher levels of negative affectivity and depended primarily on their mothers to regulate their emotions in contrast to the German toddlers. Japanese mothers were also more sensitive and reacted to soothe their child's distress more promptly. Separately, Keller and Otto (2009) reported that majority of the infants from a rural Cameroonian background effectively regulate negative affects through passivity and non-expressivity. This pattern of regulatory behaviour has been more commonly conceptualised as contextually maladaptive according to existing developmental literature (Gross, 1998).

Culture is shared within a group; it provides the environment to which individuals can coordinate values, organise behaviours, and demonstrate possible consequences, which are then socialised across the generations (Kâgitçibâsi, 1996; Matsumoto, Yoo, & Nakagawa, 2008). In light of this, culture like many

other contextual factors (e.g. maternal depression), has been gradually underscored by a small group of researchers and posited to have a differential effect on the development of ER among infants and young children (e.g., Eisenberg, Liew, & Pidada, 2004; Trommsdorff & Rothbaum, 2008).

A substantial gap exists in ER research – more studies are critically needed to evaluate the specificity of culture on ER in children. For me, the individual differences I observed while coding brought up many questions about the joint effects of culture and the regulation of emotion. Trommsdorff and her associate (2008) contend that cultural expectations and scripts depict the goal of ER – in most non-Western culture, regulatory behaviours function in the context of understanding the feelings of others and adapting to societal norms. In line with this, and for example, it is not known whether ER strategies such as suppression or avoidance have similar effects on the trajectory of maladaptive outcomes after taking into consideration cultural variability (Butler, Lee, & Gross, 2007). Upon the completion of training, I will be returning to Singapore and am keen to continue research into childhood ER. Equally, I am curious to find out whether the findings described in my empirical paper would be relevant among children in Singapore.

5. Conclusions

In summary, this critical appraisal extends some of the key learning points and specific challenges encountered since embarking on this research project. It further considered the influence of culture on ER in children, which was not explored in the empirical study. It is hoped that the information presented here serves as a useful resource for subsequent researchers interested in the advancing the relatively young field of ER.

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Appendix A

Statement on Joint Working

1. Background of Original Study

The empirical section of the thesis was completed using data collected as part of a completed prospective study titled, "The Development of Children's Emotion-Regulation Skills", which evaluated the associations between the quality of mother-infant interactions and children's emerging capacities for emotion regulation. The completed study was funded by the Economic and Social Research Council (ESRC) and had ethical approvals.

2. Extent of Joint Working

Another Doctorate in Clinical Psychology trainee, Elsa Tan Hin Hui, who investigated the influence of parents' emotion regulation abilities on their child's emotion regulation abilities, made use of the same data set from the original study.

(a) Coding and Data Cleaning - The Stranger Approach observational task videos were coded for reactivity and regulatory behaviours in conjunction with the other trainee. Data entry, initial data cleaning and checking were done in SPSS and undertaken jointly.

(b) Data Analysis – Both trainees had a copy of the emotion regulation SPSS data file. Each trainee also downloaded additional data from specific outcome measures of interest from the original study database. Data from the outcome measures were examined individually. Overall data analysis was conducted individually.

(c) Write-up - All sections of the thesis were independently written up. The other trainee's study had a different focus and examined distinctive hypothesis from this current thesis.

Appendix B

Methodological Quality Assessment of Studies (Adapted from Downs & Black, 1998)

	1. Afashari (2014)	2. Batancourt (2014)	3. Beaumont (2015)	4. Broderick (2009)	5. David (2014)	6. Ford (2012)	7. Gimenez-Dasi (2015)	8. Horn (2010)	9. Kennedy (2008)	10. Metz (2013)	11. Moreira (2010)	12. Punamaki (2014)	13. Scarpa (2011)	14. Schuppert (2009)	15. Schuppert (2012)	16. Terzian (2015)	17. Wyman (2010)
Reporting																	
a. Is the hypothesis/aim/objective of the study clearly described?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
b. Are the main outcomes to be measured clearly described in the Introduction or Methods section?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
c. Are the characteristics of the patients included in the study clearly described?	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1
d. Are the interventions of interest clearly described?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	1. Afashari (2014)	2. Batancourt (2014)	3. Beaumont (2015)	4. Broderick (2009)	5. David (2014)	6. Ford (2012)	7. Gimenez-Dasi (2015)	8. Horn (2010)	9. Kennedy (2008)	10. Metz (2013)	11. Moreira (2010)	12. Punamaki (2014)	13. Scarpa (2011)	14. Schuppert (2009)	15. Schuppert (2012)	16. Terzian (2015)	17. Wyman (2010)
e. Are the main findings of the study clearly described?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
f. Does the study provide estimates of the random variability in the data for the main outcomes?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
External Validity																	
a. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Internal Validity - Bias																	
a. Was an attempt made to blind subjects to the intervention they have received?	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
b. Was an attempt made to blind those measuring the main outcomes of the intervention?	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0

	1. Afashari (2014)	2. Batancourt (2014)	3. Beaumont (2015)	4. Broderick (2009)	5. David (2014)	6. Ford (2012)	7. Gimenez-Dasi (2015)	8. Horn (2010)	9. Kennedy (2008)	10. Metz (2013)	11. Moreira (2010)	12. Punamaki (2014)	13. Scarpa (2011)	14. Schuppert (2009)	15. Schuppert (2012)	16. Terzian (2015)	17. Wyman (2010)
c. Were the statistical tests used to assess the main outcomes appropriate?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
d. Was compliance with the intervention(s) reliable?	0	1	1	0	1	1	1	1	1	1	0	1	0	0	1	0	0
e. Were the main outcome measures used accurate (valid & reliable)?	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Internal Validity – Confounding																	
a. Were the participants in different intervention groups recruited from the same population?	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
b. Were the study participants randomised to intervention groups?	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1
c. Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was completed?	0	1	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1

	1. Afashari (2014)	2. Batancourt (2014)	3. Beaumont (2015)	4. Broderick (2009)	5. David (2014)	6. Ford (2012)	7. Gimenez-Dasi (2015)	8. Horn (2010)	9. Kennedy (2008)	10. Metz (2013)	11. Moreira (2010)	12. Punamaki (2014)	13. Scarpa (2011)	14. Schuppert (2009)	15. Schuppert (2012)	16. Terzian (2015)	17. Wyman (2010)
Power a. Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	0	0
Overall Score	**11**	**15**	**11**	**10**	**16**	**14**	**12**	**12**	**13**	**11**	**10**	**14**	**9**	**12**	**14**	**9**	**12**

Appendix C

Stranger Approach Emotions Coding Protocol

Fear Task Emotion Coding Help

Intensity of facial fear: Peak intensity of facial fear or fear blends is noted in each epoch and rated on the following scale:

0 No facial region shows codable fear movement.
1 *Only one facial region shows codable movement, identifying a low intensity fear, or expression is ambiguous.
2 Only two facial regions show codable movement, or expression in one region is very clear.
3 An appearance change occurs in all three facial regions, or coder otherwise has impression of strong facial fear.

***Note**: Non-fear expression may occur in this episode. Specifically, it is common to see lip corners drawn straight back along with the inner corners of the brows drawn down and together, eyes squinted, and cheeks raised. Lip corners drawn straight down is usually associated with fear while the rest of this expression (brows, cheeks, and eyes) is usually associated with anger. To guard against including these movements in our fear coding, we use the following convention: if a fear mouth (corners drawn straight back) occurs with anger brows, cheeks and eyes, the highest possible facial fear intensity rating is '1'. Another possibility with the above facial configuration is that the mouth is a low intensity anger mouth and therefore the entire configuration is anger. If the lip corners are drawn straight back and are beginning to look squarish or the lips are pressed tightly together while being drawn back, you may want to consider a '0' for fear.

Intensity of facial sadness: Peak intensity of facial sadness or sadness blends is noted in each epoch:

0 No facial region shows codable sadness movement.
1 Only one facial region shows codable movement, identifying a low intensity sadness, or expression is ambiguous.
2 Only two facial regions show codable movement, or expression in one region is very clear.
3 An appearance change occurs in all three facial regions, or coder otherwise has impression of strong facial sadness.

Intensity of smiling: Peak intensity of facial joy is noted in each epoch:

0 No smiling at all.
1 Small smile, with lips slightly upturned, and no involvement of cheeks or eyes.
2 Medium smile, with lips upturned, perhaps mouth open, slight bulging of cheeks, and perhaps some crinkling about the eyes.
3 Large smile, with lips stretched broadly and upturned, perhaps mouth open, definite bulging of cheeks and noticeable crinkling of eyes.

	Movements in Forehead/Brows Regions	Movements in Eyes/Nose/Cheeks Regions	Movement in Mouth/Lips/Chin Regions	Notes
Fear	• Entire brow should be raised and drawn together. • Brows may also look straighter than usual. • Faint horizontal furrows may be present in forehead.	• Upper eyelids raised making the eyes appear wider. • Eyes have tense appearance.	• Lip corners are drawn straight back. • Mouth is usually less than wide open.	• Don't confuse interest brows for fear. • **See illusion of sadness note.
Sadness	• Inner corners move upward and together resulting in bulging/furrows in middle of forehead.	• Cheeks may look lower than usual or have a droopy appearance. • Alternatively, cheeks may be raised and eyes squinted.	• Lip corners should be drawn down. • Bottom lip may be pushed up and out by the chin, which may be tense or wrinkled.	**
Joy	• Most likely remain neutral.	• Cheeks raised. • Furrow below the eyes deepens. • "Crows feet" will extend from the outer corners of the eye. • Eyes may appear squinted.	• Lip corners are raised. • Nasolabial fold deepens.	

****Note on the potential for an "illusion of sadness"**
There are several occasions when an illusion of sadness may appear. Sadness should not be coded in these situations:

- The first situation is when brows are drawn tightly down and together. In this case, it is common for the inner most corners of the brows to bulge up in the middle falsely giving the appearance of sadness. This is most likely due to the large amount of fat in the infant's face.
- The second situation is when the outer corners of the brows are lowered falsely giving the appearance that the inner corners have raised. In this case, be sure to observe the actual movement of the brows. In sadness, the inner corners need to be raised and drawn together. Simply observing a still frame of this expression is not sufficient to distinguish between true sadness and the illusion of sadness.
- Finally, an illusion of sadness may occur when children inhale deeply during a bout of crying. In this situation, the lip corners will be drawn down by the inhaling action giving the impression of sadness.

Intensity of distress vocalisations*: Peak intensity of distress vocalisations is noted in each epoch:

0 No distress.
1 Mild protest verbalisation that may be difficult to identify as hedonically negative.
2 Definite protest, limited to a short (1-2 second) duration.
3 Longer protest, fussing or mild, low intensity cry (cry has extended or rhythmic quality).
4 Definite non-muted crying.
5 Full intensity cry / scream (child is losing control).

***Note**: Some vocalisations in this episode will not be fear-related and should not be coded.

Intensity of bodily fear: Peak intensity of bodily fear is noted in each epoch and rated on the following scale*:

0 No sign of bodily fear.
1 Decreased activity: an apparent and sudden decrease in the activity level of child.
2 Tensing: visible and sustained tensing of the muscles, associated with decreased activity.
3 Freezing or trembling: tensing of the entire body with no motion, or trembling due to extreme muscular tension.

***Note**: Bodily fear should only be coded across epochs when the intensity is '2' or higher, unless a lower intensity behaviour, '1', is repeated or changes in the following epochs.

Intensity of bodily sadness: (slight slump, drop of head, slumped shoulders, head in arms or hands)

0 No detectable sadness.
1 Very clear, detectable sadness.

Startle response: (jumps and maybe blinks too)

0 Absent.
1 Present.

Intensity of escape*: Peak intensity of escape:

0 No escape behaviour or social referencing (e.g., turning to see mum).
1 Mild or fleeting escape behaviour (e.g., turning away, sinking into chair).
2 Moderate escape behaviour resulting in significant, but not extreme attempts to get away or resist. Full body movements such as arching back, twisting away, and leaning away are included, as well as hitting, pushing, and/or slapping.
3 Vigorous escape behaviour, usually involving, linked intense full-body movements like those found in '2'. These movements usually last for the entire epoch.

***Note**: Escape is a very active behaviour; it should only be coded when the action of escaping is made. Also, it should only be coded when the initial escape behaviour is made or when it is repeated or intensified. Do not include escape behaviours due to dislike of highchair or a desire to reach a toy.

Positive vocalisations: Presence of positively toned babbling, squealing etc (if unsure about whether 'positive' noise or not, look for if combined with smiles and the lack of fear / sadness).

0 Absent.
1 Present.

Appendix D

Stranger Approach Emotion Regulation Coding Protocol

Fear Task Emotion Regulation Coding Help

I. Duration of attention: amount of time per epoch child is looking at stranger (in real time) seconds looking at stranger / seconds of epoch.

II. Disengagement of attention

Gaze aversion: child looks away / shifts gaze from stranger without focussing on any particular object >> this is extremely brief in duration and includes searching for another object to focus on. (scored as present=1 or absent=0)

Distraction towards an object: child looks at an object that is unrelated to the episode >> this is usually longer in duration than gaze aversion (This does not include child looking at toy in T5 or child looking at object whilst pointing it out to stranger unless child looks at object for a few seconds before pointing. (scored as present=1 or absent=0)

Distraction towards toy: child looks at and/or plays with toys in T5. (scored as present=1 or absent=0)

III. Social Strategies

Looks to mother: child looks to mother, or tries to look for mother when she is out of view. (scored as present=1 or absent=0)

Approaches mother: child reaches for or holds onto mother for physical reassurances; include child approaching mother when moving to the floor. (scored as present=1 or absent=0)

IV. Approach / Withdrawal

Approach: child approaches stranger >> reaches or leans towards when in high chair (does not include pointing). (scored as present=1 or absent=0)

Withdrawal: child withdraws from stranger – increases bodily distance from stranger (e.g., turns head or twists away, leans away, or sinks into chair). Not just gaze aversion, but also child purposefully moves body away from stranger. (scored as present=1 or absent=0)

V. Redirected attention

Self-soothing: child uses a body part to engage in repetitive manipulation >> e.g., thumb sucking, absent-minded fiddling (with self or chair etc), nose picking. (scored as present=1 or absent=0)

Active stimulation: child engages in high energy behaviour with no apparent instrumental focus >> e.g., fast kicking, pushing against table. Do not count

wriggling due to dislike of being strapped in chair. (scored as present=1 or absent=0)

VI. Dealing with the stimulus

Exploring or playing: child plays or communicates with stranger in an appropriate manner, either initiating interaction, such as pointing to gain shared attention (checking back to stranger and back to the stimulus) (e.g., plays peek-a-boo with stranger, points at something to gain stranger's attention), or playing appropriately with stranger, responding to stranger's words or actions, and turn taking / accepting stranger's role in play with toy in T5. Can include nodding or shaking head in response. (scored as present=1 or absent=0)

Appendix E

Sample Code Sheet

Stranger Approach Emotions Scoring

Participant # _____ DVD # _____ Scorer _____ Date scored _____

	T1 - Approach				**T2 - Approach**			**T3 – Mother-not-involved**					**T4 – Mother-verbally-involved**							**T5 – Mother-fully-involved**						
	S Enters	Moves toward C	Pauses & Speaks		Moves Near C	Pauses Near C		Tickle under chin	10s	10s	10s		M sits next to C	10s	10s	10s	10s	10s		Sit	10s	10s	10s	10s	10s	
Time begin/ end				Avg			Avg					Avg							Avg							Avg
Intensity of facial fear (0-3)																										
Intensity of facial sadness (0-3)																										
Intensity of smiling (0-3)																										
Intensity of vocal distress (0-5)																										
Intensity of bodily fear (0-3)																										
Presence of bodily sadness*																										
Presence of startle response*																										
Intensity of escape behaviour																										
Positive vocalisations*																										

* coded: 0 = Absent; 1 = Present

Stranger Approach Emotion Regulation Scoring

Participant #_____

	T1 - Approach				T2 - Approach			T3 – Mother-not-involved					T4 – Mother-verbally-involved							T5 – Mother-fully-involved						
	S Enters	Moves toward C	Pauses & Speaks		Moves Near C	Pauses Near C		Tickle under chin	10s	10s	10s		M sits next to C	10s	10s	10s	10s	10s		Sit	10s	10s	10s	10s	10s	
Time begin				Avg			Avg					Avg							Avg							Avg
Duration spent looking at stranger																										
Gaze aversion*																										
Distraction towards another object*																										
Looks to toy*																										
Looks to mother*																										
Approaches mother*																										
Approaches stranger*																										
Withdrawal*																										
Self-soothing*																										
Active stimulation*																										
Dealing with the stimulus*																										

* coded: 0 = No; 1 = Yes