The effects of war trauma and displacement on affective processing and mental health of refugee children

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Submitted in partial fulfilment of the requirement of the
Degree of Doctor of Philosophy

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Abstract

Emotion processing plays a crucial role in psychosocial development and is shaped by early environments. Atypicalities in emotion recognition and attention have been linked to early adversity, such as child maltreatment, and to poorer mental health throughout the lifespan. However, it is currently unknown if other types of early stress can impact affective processing with similar consequences. This thesis aims to investigate the effects of war related trauma and displacement on refugee children affective processing and mental health.

We used cognitive tasks and eye-tracking to investigate emotion recognition and emotional attention of Syrian refugee and Jordanian nonrefugee children, and questionnaires to assess children's trauma (caregiver-reported) and psychopathology (child-reported). Firstly, using an emotion recognition task we found that both refugee and nonrefugee children displayed a similar bias, where they perceived neutral faces as sad rather than happy. Secondly, with a free-viewing eye-tracking measure we found that refugee and nonrefugee children showed similar patterns of sustained attention to threat, although refugee children displayed an initial aversion to angry and happy emotions. Importantly, the severity of trauma exposure was linked to increased sustained attention to threat. Finally, using a dot probe task to measure attention bias to anger and sadness, we found that refugee children and their mothers displayed an attention bias to anger suggestive of hypervigilance (children and mothers) and disengagement difficulties (mothers). The link between maternal depression and child conduct problems were moderated by child attention bias to anger. Overall, our findings present novel insights into affective processing of refugee children, suggesting an impact of war-related trauma on attention distribution related to threat-processing, and highlighting the importance of cognitive biases as a potential intervention target in vulnerable populations.

Thesis supervisors: Prof Isabelle Mareschal and Prof Thomas Dixon

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Chapter 1 - Introduction

1.1 Affective processing

1.1.1 The importance of emotions and emotional development

Emotions are one of the most fundamental aspects of our lives and are considered a prominent motivator for our behaviours (Adolphs & Anderson, 2018). Attending to, recognising, and understanding other people's emotional states underlies healthy social communication (Jack & Schyns, 2015) and is important for interactions, relationship forming, and judging others' character and intentions (South Palomares & Young, 2018; Todorov et al., 2015). Therefore, atypicalities in emotion processing may result in difficulties in everyday relationships and even in social isolation (LeMoult et al., 2009), and can have detrimental effects on our mental health and wellbeing (e.g., Penton-Voak et al., 2017; Simcock et al., 2020).

Our ability to detect and perceive other's emotions is largely determined by our childhood environment and early experiences. Although two of the most prominent emotional development models – the differential and the functionalist theories – highlight the importance of early childhood experiences and learning on successfully producing and processing emotions, only the latter puts a specific emphasis on emotions being a dynamic and *relational* process between the child and their environment (Campos & Barrett, 1984; Izard, 1971). In their earliest years, parents followed by peers, friends, and teachers, play a crucial role in children's emotional development. Through observation, modelling, imitation, and conversations children learn how to accurately recognise others' emotions. They learn the consequences of their own emotional expressions, gain the understanding of other people's

feelings and emotions, and learn how to successfully use cognitive strategies to regulate their emotions (Thompson, 2011). The functionalist theory of emotional development proposes that from early infancy children learn how to interpret and navigate social environments and form expectations about persons in their immediate surroundings (e.g., Klinnert et al., 1986; Lewis et al., 1992). Violations of these expectations result in the child adjusting their emotional responses to their environment, which may impede their emotional development. Therefore, it is not surprising that biases in emotion processing, such as misperceptions of emotions and systematic shifts in attention to specific emotional stimuli, have been linked to early experiences of stress and might act as potential mechanisms linking childhood adversity and subsequent emotional and behavioural problems (Pollak, 2012).

1.1.2 Emotion processing network

Childhood is a period of intense growth and maturation of the brain regions involved in affective and cognitive processing. Studies in both humans and non-human animals highlight the importance of the limbic system (most notably the amygdala), the hippocampus, and the prefrontal cortex as emotion-processing networks in the brain (Phelps & LeDoux, 2005; Rajmohan & Mohandas, 2007). Both the limbic structures and the prefrontal cortex show heightened activation to processing of emotional compared to neutral content (e.g., Gur et al., 2002; Kesler-West et al., 2001). Some researchers even suggest that the medial prefrontal cortex, associated with cognitive control and other executive functions, might play a more significant role than the limbic system, emphasising the importance of connectivity between the amygdala and other brain regions (Pessoa & Adolphs, 2010). Whilst the emotion-processing network has been implicated in emotion perception as well as more cognitive aspects of emotion processing, such as emotional learning, memory, and emotion regulation (Hamann & Canli, 2004), the focus of this thesis is on the perception of emotional states from

facial expressions. The proposed phases of emotion perception from faces are presented in Figure 1.1.

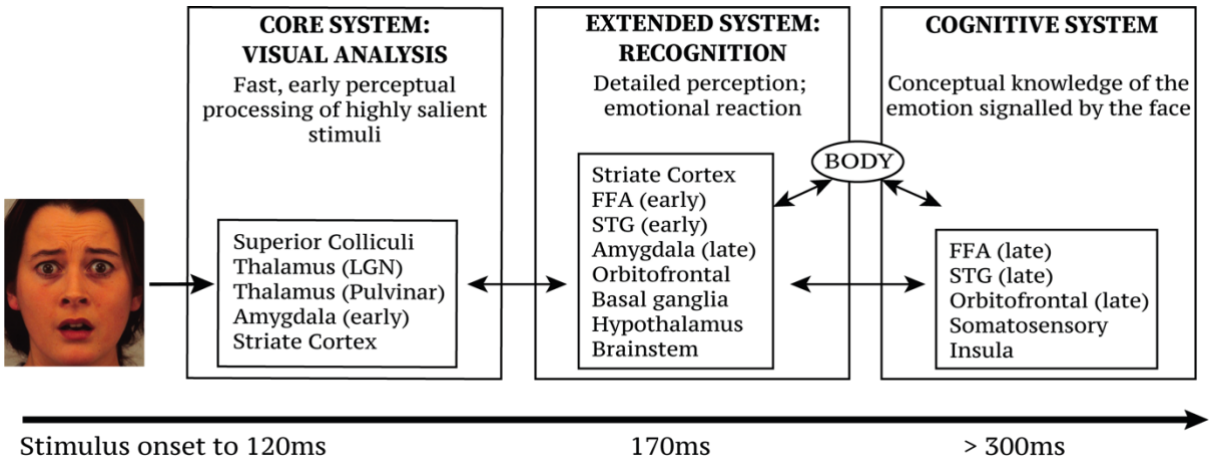

Figure 1.1 Schematic overview of the stages of emotion perception from facial expressions, modified from Adolphs (2002)

LGN = lateral geniculate nucleus; FFA = fusiform face area; STG = superior temporal gyrus. Schematic representation of the cognitive stages of processing facial expressions (example of fear) from the onset of the stimulus, highlighting the most prominent brain regions involved in each process. Stimulus taken from the Karolinska Directed Emotional Faces database (KDEF image ID: AF14AFS; Lundqvist et al., 1998).

The complexity of the emotion-processing network, coupled with increased brain plasticity in childhood, suggests that the emotion-processing network may be influenced by environmental factors at various stages of development. Indeed, exposure to hostile environments and deprivation early in life may lead to abnormalities in brain regions associated with emotion processing, with the majority of studies reporting abnormal activation of the limbic system in response to emotional stimuli among children with a history of early adversity (e.g., Dannlowski et al., 2012; McLaughlin et al., 2015). Furthermore, hyperactivity in the limbic system in response to emotional stimuli has also been linked to various psychopathologies among children, including anxiety and depression (e.g., Barch et al., 2012;

Gaffrey et al., 2011; Monk et al., 2006). Overall, these associations indicate that early environments play a significant role in the functional atypicalities of brain regions linked to emotions, which in turn might underlie the onset and development of paediatric psychiatric disorders.

1.2 Inferring emotional state from facial expressions

Being able to correctly interpret others' emotions allows us to gather information about the environment, detect possible threats, and adjust our own behaviours accordingly (Jack et al., 2016). We detect salient, emotional cues much faster and with higher accuracy than neutral cues, and we use our attention to preferentially engage with specific environmental signals – the emotional significance of external information affects the way we control our attention (Vuilleumier, 2005). We can recognise people's emotional states from many cues including voices and gestures (Aviezer et al., 2012; Cordaro et al., 2016; de Gelder, 2009; Scheiner & Fischer, 2011), but perception of emotions from facial expressions is considered to be the fundamental aspect of social communication (Ekman, 1992; Martinez & Du, 2012; Schmidt & Cohn, 2001). The heightened perceptual ability and preference for faces begins early in development: human neonates exhibit interest in face-like stimuli within minutes of being born (Nelson, 2001; Wilkinson et al., 2014), and even foetuses in the third trimester of development were shown to orient to this type of stimulus (Reid et al., 2017), suggesting innate face perception. Therefore, it is not surprising that conveying our emotional states through facial expressions is a key facet of social communication. Indeed, people can make subconscious judgments about an individual very quickly and based only on their faces (e.g., Rule & Ambady, 2008; Willis & Todorov, 2006). In fact, we can differentiate between angry, happy, and neutral facial expressions within 90 milliseconds of stimulus presentation, and only 10

milliseconds after distinguishing a face from a 'scrambled' image (Dima et al., 2018). We begin to develop this enhanced attention to emotionally salient faces, together with the contextual understanding of other's emotional expressions, by the first year of age (e.g., Leppänen & Nelson, 2008).

1.2.1 Facial expressions of basic emotions

One of the most influential theories for emotion perception was proposed by Paul Ekman in the 1970s and is largely based on Darwin's (1872) concept of "universality of emotions". Ekman's universal emotions theory argued that there were six basic emotions (anger, fear, disgust, surprise, happiness, and sadness, see Figure 1.2), which were innate and evolutionary in origin, and conveyed by unique morphological changes to the face (Ekman, 1970, 1992). For instance, a furrowed brow and a scowl are considered a prototypical expression of anger, whilst eyes wide-open are an expression of fear. These specific morphological patterns for each basic emotion were comprehensively described in the Facial Action Coding System (FACS, Ekman & Friesen, 1978). The basic emotions theory proposes that these facial signatures of emotional states are reliably expressed and recognised across races and cultures – a view based on Ekman's and Friesen's seminal findings amongst tribes in Papua New Guinea (Ekman & Friesen, 1971) with largely supportive follow up studies (e.g., Elfenbein & Ambady, 2002; Izard, 1994; Jack, 2013). However, this theory has been challenged by the findings that emotional states might be expressed and understood differently depending on context and the intensity of the experienced emotion, and that the facial expressions created with the FACS show exaggerated displays which rarely occur in everyday life (e.g., Barrett, 2011; Barrett et al., 2011, 2019). In addition, recent work suggests that 'fear' and 'disgust' show large cross-cultural variability in identification (e.g., Jack et al., 2016), challenging the basic emotions theory.

Despite its limitations, this theory shaped the field of affective processing over the past 50 years. Indeed, emotion processing is still often examined using versions of Ekman's and Friesen's original Pictures of Facial Affect database (POFA; Ekman & Friesen, 1976), which involve expressions of emotions posed by actors of different genders, ethnicities, and ages. These databases have been extensively validated, showing consistent similarities in ratings, and are widely used in adult and child research (e.g., Karolinska Directed Emotional Faces database (KDEF, Lundqvist et al., 1998), Radboud Faces Database (Langner et al., 2010), and Child Affective Facial Expressions (CAFE, LoBue & Thrasher, 2015)) to examine individual differences and the development of emotion perception, as well as the relationship between affective processing and psychopathology symptoms.

Figure 1.2 Facial expressions of basic emotions from the Karolinska Directed Emotional Faces (KDEF) database, adapted from Goeleven et al. (2008)

1.2.2 Measures of emotion recognition

Accurate emotion recognition – vital for most social interactions and an important aspect of emotional development – has been exhaustively studied using different experimental paradigms. In addition to measuring emotion identification abilities, it is also useful to extract an individual's *biases* in their recognition of facial expressions. This is often done by creating a series of images 'morphed' from one emotional expression to another (such as from happy to sad), in regular morph intervals (Pollak & Kistler, 2002 – emotion identification task). Participants must then indicate which emotion the different morphed faces display (e.g., either happy or sad). Doing this, it is possible to measure the *point of subjective equality* (PSE), where participants are equally likely to identify either of the two emotions in the face. In healthy individuals the PSE corresponds to the morphed face with equal amounts of the two emotions (e.g., 50% happy / 50% sad, or 100% neutral), and any shifts in the PSE from this midpoint represent a bias to perceive the ambiguous expression as one emotion more than the other. Similar results can be achieved by asking participants to indicate which of the two unmorphed expressions a morphed stimulus looks most like, which has the advantage of bypassing semantic understanding of emotional language (e.g., Pollak & Kistler, 2002 – emotion categorisation task).

Emotion recognition can also be measured with simpler tasks, where participants view images of different emotional expressions and are asked to select the corresponding emotional labels. These emotion recognition tasks measure accuracy for different expressions and can include either the entire face (e.g., Palermo & Coltheart, 2004) or just the eye region (e.g., Reading the Mind in the Eyes Task, RMET; Baron-Cohen et al., 2021). These types of tasks provide information about how well participants are able to recognise emotional expressions

and are used to compare accuracy between different emotions, as well as between participant groups.

Finally, it is also useful to measure the minimum amount of perceptual information required for expressions to be recognised. To measure differences in intensity or clarity of expressions for different emotions, studies use a priming index, where participants are required to identify emotions from images with varying levels of perceptual cues (e.g., Pollak et al., 2009; Pollak & Sinha, 2002). These tasks can use stimuli varying in emotional intensity (e.g., different morph levels between emotional and neutral expressions) as well as in information clarity (e.g., different levels of noise on the stimuli).

Emotion recognition tasks, such as the ones discussed above, have been useful in assessing emotion identification abilities in controlled settings but are blind to the neurocognitive processes involved in emotion perception, and require participants to understand the semantic meaning of the emotions. One way of overcoming this is with the addition of neuroimaging methods, such as EEG or fMRI; however, these are much more invasive and rarely applicable to studying vulnerable child populations. Alternatively, it is possible to examine the processes underlying emotion perception without the need for semantic knowledge by measuring how children allocate their attention when viewing expressive faces.

1.2.3 Measures of emotional attention processes

The way people allocate their attention can reveal information about increased or decreased vigilance, as well preference for - or disengagement from - specific emotions. A common method for measuring attention patterns is the dot probe paradigm where participants are briefly presented with an emotional face (usually angry or sad) paired with a neutral face, followed by a probe appearing in the location of either type of stimulus (Mogg & Bradley,

1998). The participants' task is to respond as quickly and accurately as possible to the probe, with their accuracy and reaction times used to establish an attention bias towards (or away from) the emotional expressions. Alternatively, the Go/NoGo task consists of emotional and neutral expressions labelled as targets and non-targets, to which participants must respond or withhold a response, respectively (Pollak et al., 2001). Although some forced-choice tasks (such as the dot probe task) can be used to infer specificity of the bias (vigilance v disengagement difficulties, e.g., Koster et al., 2004), newer methods such as eye tracking provide higher resolution information about how attention is distributed in time, with the ability to record both initial orienting and sustained attention in adults and children (e.g., Leppänen, 2016; Mele & Federici, 2012; Michalska et al., 2017; Oakes, 2012).

1.3 Childhood adversity and its effects on affective processing

Early experiences, both positive and negative, shape children's developmental trajectories (e.g., Kadosh et al., 2013; Pollak, 2005, 2012; Zelazo & Carlson, 2012). Childhood adversity, often referred to as *adverse childhood experiences* (ACEs), is a critical public health concern with widespread influence on cognitive and affective development, and mental and physical health outcomes across the lifespan (Felitti et al., 1998). ACEs can be thought of as negative, potentially traumatic experiences which deviate from the accepted norms of childhood environment (Boullier & Blair, 2018; Mclaughlin, 2016). According to the cumulative-risk model, one of the most influential approaches in adversity research, different traumatic experiences have additive effects on child development, with more instances of adversity leading to worse functional or psychosocial impairments (Felitti et al., 1998). Most studied forms of early adversity are types of childhood maltreatment, such as physical and emotional abuse, neglect, poverty, and household dysfunction (Felitti et al., 1998; Mclaughlin, 2016). The

degree of adversity is usually determined from either official records (such as child services and medical records), interviews, or questionnaires given to parents, teachers, or self-reported by the children (e.g., Pollak et al., 2000; Zarse et al., 2019)).

Both youth and adults with a history of childhood adversity face an increased risk for psychopathology, substance abuse, as well as physical illness, including heart conditions, obesity, diabetes, and cancer (Felitti et al., 1998; Karatekin, 2019). Although the exact mechanisms behind these vulnerabilities are not yet known, variables such as heightened sensitivity to stress (mostly linked to the hypothalamic pituitary adrenal (HPA) axis), cognitive dysregulation, and even epigenetic changes may be involved (Papale et al., 2018; Raymond et al., 2018; Romens et al., 2015; Seltzer et al., 2014), and studies suggest an interplay between environmental and genetic factors in the negative outcomes of early adversity (Keers & Pluess, 2017; McCrory et al., 2012). In addition to impairing mental health, ACEs can also affect emotional development across the lifespan. A number of emotional and behavioural problems, dysfunctions in emotion regulation, and altered emotion perception have been reported in children who experienced early adversity (Harms et al., 2019). These emotion processing atypicalities are often linked to psychiatric symptomatology and persist into adulthood (Berzenski, 2018; Gibb et al., 2009; Pollak, 2012). In the following section I will focus on abnormalities in emotion perception in children after early adversity, with an emphasis on the effects of childhood maltreatment on emotion recognition and emotional attention patterns.

1.3.1 Atypicalities in recognition of emotions

Emotion recognition dysfunction was first linked to childhood adversity in the late 1990s, when differences in affective processing between children with and without a history of maltreatment were investigated using brain-related potentials (Pollak et al., 1997). Atypicalities

in emotion recognition are particularly detrimental to children's socio-emotional development and can lead to dysfunctional emotion regulation patterns and mental health issues (Harms et al., 2019). Some of the first studies investigating emotion recognition difficulties in children with a history of adversity found impairments in discrimination of emotional expressions, with a particular tendency to overidentify angry expressions. Specifically, Pollak and colleagues (2000) found across a range of different emotion perception tasks that children who suffered physical abuse matched facial displays of *anger* to more scenarios from short stories vignettes (i.e., they interpreted the protagonist of the scenarios as angry), whereas physically neglected children tended to match more *sad* facial expressions to the same scenarios. Furthermore, neglected children were worse than controls at discriminating between pairs of facial expressions of anger, sadness, and fear (Pollak et al., 2000). In another study, using morphed facial expressions Pollak and Kistler (2002) found that abused children overidentified expressions of anger compared to controls, suggesting that abused children perceived more facial expressions as angry than sad or fearful (Figure 1.3), although performance with happy expressions was similar to that of controls. Physically abused children also showed heightened recognition ability of angry facial expressions: these children recognised angry faces earlier in an expression evolution sequence (where expressions are initially obscured and then increase in clarity in the sequence), than non-abused children (Pollak & Sinha, 2002). The overall pattern emerging from these studies suggests that atypicailties in emotion recognition depend on the type of adversity. Early experiences related to threat (such as physical abuse) result in enhanced perception of negative expressions mostly specific to anger, whilst experiences of deprivation (such as physical neglect) tend to be linked to poorer recognition of all emotions (Harms et al., 2019).

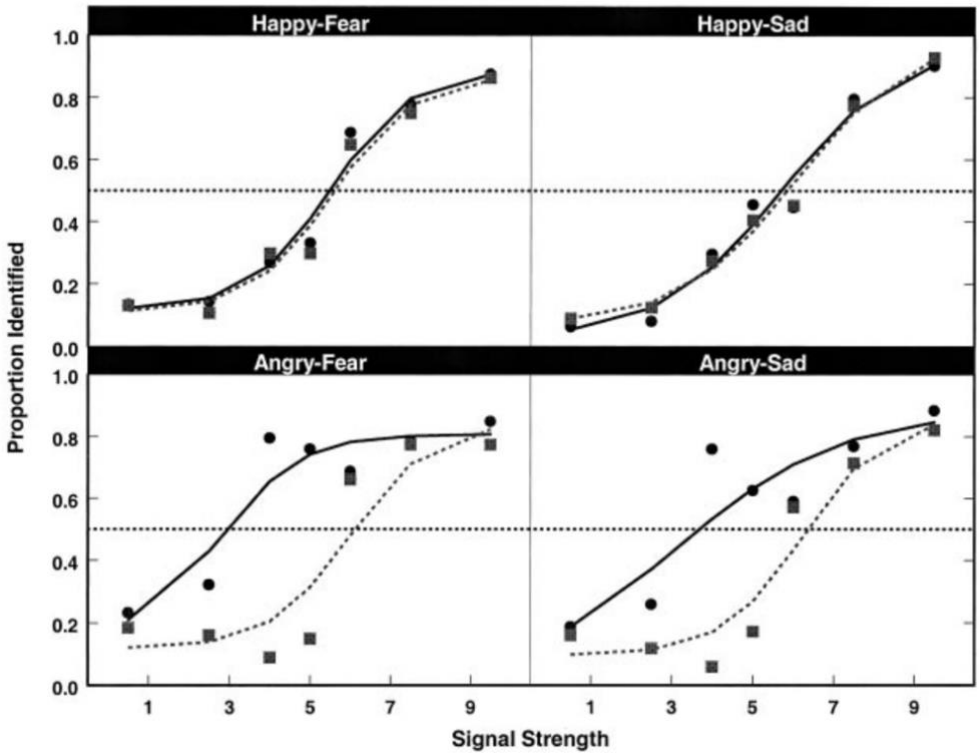

Figure 1.3 Emotion identification of abused (dashed line) and non-abused children (solid line), adapted from Pollak and Kistler (2002)

Results of an emotion identification task by Pollak and Kistler (2002). Abused children are represented by dashed line, controls by solid line. Signal Strength refers to morph category (e.g., 1 = 90% angry/10% fearful, 9 = 90% fearful/10% angry, etc.). Clear differences can be seen in the identification of morphed faces on the angry-fear and angry-sad continua: where abused children perceive faces of most morph levels as angry rather than fearful or sad, in contrast to non-abused children.

1.3.2 Attention biases to emotional faces

Children with a history of early adversity also display an enhanced detection of threat: maltreated children are not only better at identifying angry cues in their environment but also display a bias in attention allocation towards anger. For example, physically abused children were both quicker at detecting angry faces and showed difficulties in disengagement from threat cues in a study using a selective attention task (Pollak & Tolley-Schell, 2003). Using

both visual (facial expressions) and auditory emotional stimuli (neutral sentences with emotional intonations) from mothers of abused children, Shackman, Shackman, and Pollak (2007) found that maltreated children attended to angry cues even when instructed to disregard them and attended to angry faces over happy audio stimuli. Lakshman and colleagues (2020) also found that children who experienced early life trauma displayed a heightened attention to angry expressions which was also influenced by gender, with a stronger attention bias to threat among males. This enhanced anger perception amongst maltreated children can also be seen in cognitive brain event-related potential studies, showing heightened brain activity (larger P3b amplitude, indicative of increases in attentional engagement) to angry expressions in maltreated compared to non-maltreated children, as well as a higher response accuracy to anger (Pollak et al., 1997, 2001). Interestingly, threat attention biases significantly mediated associations between childhood abuse and child anxiety, such that children with heightened P3b amplitude in response to maternal displays of anger showed higher rates of self-reported anxiety symptoms (Shackman et al., 2007). Similarly, an attention bias to threat influenced the association between family violence and child anxiety in a study using an emotional dot-probe task (Briggs-Gowan et al., 2015). These two important findings hint at the link between early adversity and childhood psychopathology – it is possible that the emotion processing biases associated with ACEs might act as a mechanism for the onset of mental health problems, such as anxiety and depression. Other forms of childhood adversity also show similar patterns of attention allocation to threat. For instance, children living in high-crime neighbourhoods showed increased selective attention to threat in a study using images of objects, such as a weapon, instead of facial expressions (McCoy et al., 2016). Although most of the evidence suggests that there is an increased attention to threat, Pine and colleagues (2005) showed that severe family violence (but not physical neglect) was associated with *avoidance* of facial expressions of anger. These results emphasise the complexity of cognitive mechanisms behind

emotional processing and suggest that experiences of threat and deprivation have different impacts on affective development.

1.3.4 Effects of adversity on brain development

Neuroimaging studies reveal atypicalities in emotion processing brain networks after childhood adversity, predominantly showing hyperactivity in the limbic system (e.g., Dannlowski et al., 2012; McLaughlin et al., 2015). For instance, children with a history of early life stress (defined here as a milder form of adversity, such as loss of a pet) displayed increased functional reactivity in the amygdala in response to emotional facial expressions in general, whereas those with a history of traumatic events (defined here as a more intense type of adversity, such as physical abuse or death of a sibling) displayed more activation in the amygdala and the anterior cingulate cortex in response to sad expressions only (Suzuki et al., 2014). Furthermore, the association between stressful life events and increases in left hippocampal activity in response to sadness was influenced by depression diagnosis. Interestingly, certain parts of the limbic system (amygdala and the cingulate cortex) were specifically activated in response to sad expressions only, and right amygdala activation further differed depending on psychopathology in this population of children (Suzuki et al., 2014). Specifically focusing on children exposed to family violence, McCrory and colleagues found increased activation of the amygdala and the anterior insula in response to angry, but not sad facial expressions, and left anterior insula activity was associated with family violence severity (McCrory et al., 2011). Further disturbances in the amygdala after adversity can be seen in adolescents with a history of trauma, who showed heightened amygdala activity in response to an emotional conflict task (i.e., identifying emotional expressions whilst ignoring task-irrelevant words of conflicting emotional valence), which was in turn linked to poorer emotion regulation capabilities (Marusak et al., 2015). Finally, a meta-analysis including studies of

children, adolescents, and adults with a history of childhood maltreatment suggests hyperactivation of bilateral amygdala to emotional facial expressions in general (Hein & Monk, 2017). In addition to the limbic system overactivity, childhood adversity and its severity might also be associated with smaller amygdala and hippocampus volumes, which are linked to fear conditioning abnormalities and externalising psychopathology (McLaughlin et al., 2015). Childhood maltreatment was also linked to volume reductions in other emotion processing brain regions, including areas of the prefrontal cortex in adolescents (Gold et al., 2016), as well as to abnormalities in the networks between brain regions involved in emotion processing (Hart & Rubia, 2012).

Overall, these findings suggest that cognitively observed mechanisms of affective processing abnormalities might be linked to heightened reactivity in the limbic system, which could in turn play a role in the development of emotional and behavioural problems in children with a history of early adversity.

1.3.5 How does the early environment influence affective processing?

Enhanced threat recognition could act as an adaptative mechanism for children living in unstable or frightening conditions. Living in a threatening and uncertain family environment often means increased exposure to unexpected expressions of anger and hostility (Pollak & Kistler, 2002), therefore responding quickly to anger and recognising it from very few cues would be beneficial for the child to avoid potentially threatening and unsafe situations (Pollak, 2012). For example, abusive mothers were found to show atypical facial and vocal displays of anger (i.e., less expressive prototypical displays, such as lowered brows), as well as to smile less in comparison with non-abusive mothers (Shackman et al., 2010). These poorer maternal displays of anger were associated with increased symptoms of anxiety and depression, as well as more aggressive behaviours in their children (Shackman et al., 2010). Similarly, and perhaps

unsurprisingly, a recent study found that abused children were exposed to much higher levels of expressions of anger from their caregivers (Plate et al., 2019). Although useful in the short-term, children's enhanced biases for threat might be maladaptive in the long-term and result in dysfunctional cognitive strategies which could lead to development and maintenance of emotional and behavioural problems. For instance, children who continuously misinterpret ambiguous expressions as threatening might develop hostile attribution bias, which could lead to aggression and problems with social functioning (e.g., Harms et al., 2019). Studies show that abused children tend to view neutral interpersonal scenarios as antagonistic (Perlman et al., 2008) and employ poorer emotion regulation strategies (Gibb, 2002).

For children exposed to neglect, their generalised abnormalities in emotion recognition could be explained by a lack of appropriate and enriching social interactions in the immediate family environment. Neglected children might simply not have enough opportunities to learn social cues and lack of exposure to different expressions of emotions might prevent them from acquiring necessary skills for emotion recognition and regulation (e.g., Harms et al., 2019; Heleniak et al., 2016). The results discussed above highlight the differences between abusive and deprived environments on cognitive mechanisms, emphasising that both types of maltreatment might have uniquely dysfunctional effects on emotional development.

1.3.6 The dimensional model of adversity

Differences in the effects of abuse and neglect are consistent with the dimensional model of adversity and psychopathology (DMAP). In contrast to the cumulative-risk model, the DMAP proposes that early experiences of threat (such as physical abuse) result in activation of neurodevelopmental mechanisms that are different to those activated by early experiences of deprivation (such as physical neglect), and that these differences manifest in the variety of

mental health and cognitive processing outcomes (McLaughlin et al., 2014). These differences in outcomes for the two dimensions of adversity have been reported for executive functions, such as cognitive control, fear conditioning, reward processing, emotion regulation, and emotional learning, as well as psychiatric outcomes, such as depression and anxiety (Machlin et al., 2019; McLaughlin et al., 2019; Mclaughlin et al., 2020; Milojevich et al., 2019; Sheridan & McLaughlin, 2014). Similarly, specific types of childhood adversity might also have different effects on emotion perception. It is therefore vital to investigate the influence of other forms of childhood stress on affective development and its links to psychopathology and socio-emotional functioning. However, childhood adversities tend to co-occur, and it is often difficult to conceptualise and define specific adversity categories, which makes it less straightforward to interpret the current findings (Smith & Pollak, 2021a). The effects of early stress might also differ depending on its chronicity and the developmental stage in which it occurred, with some suggesting the importance of *sensitive periods* in emotional development: specific developmental stages when children are more vulnerable to adversity (e.g., Woodard & Pollak, 2020). These limitations have recently caused much debate in the field (see also McLaughlin et al., 2021 and Pollak & Smith, 2021). Examining the role of other environmental factors, such as predictability and contingency, as well as children's subjective experiences of their trauma exposure might shed more light on the differences in emotion processing and psychopathology outcomes from different dimensions of adversity (Smith & Pollak, 2021).

1.4 Affective processing abnormalities in paediatric psychopathology

Early adversity is one of the main risk factors for mental illness in childhood and adulthood (e.g., Nanni et al., 2012; Tracy et al., 2019), and affective processing dysfunctions have been proposed to play a role in the development and maintenance of psychopathology (Bourke et

al., 2010; Harms et al., 2019) Atypicalities in emotion processing are evident in internalising disorders characterised by emotional problems, such as anxiety and depression, as well as in externalising symptomatology, characterised by behavioural and attention problems such as conduct disorder and oppositional defiant disorder. Although clinically distinct, the comorbidity within different internalising (Almeida et al., 2021; Cummings et al., 2014; Ladouceur et al., 2005) and externalising disorders (Bourke et al., 2010; Connor et al., 2010; Connor & Doerfler, 2008; Sasayama et al., 2010) is very high. Furthermore, it is not uncommon for symptoms of, for instance, anxiety to be present in externalising disorders as well, especially in children (Essau & de la Torre-Luque, 2021; Flannery-Schroeder et al., 2004; Polier et al., 2012; Rietz et al., 2021). Although most studies investigate emotion processing biases in relation to only one of the possible mental health outcomes, this exceptionally high comorbidity often makes it difficult to fully disentangle the effects of specific symptomatology on emotion recognition or attention. Below I present research evidence linking the main mental health risks associated with early adversity (namely anxiety, depression, PTSD, and externalising disorders) and abnormalities in affective processing.

1.4.1 Internalising disorders

1.4.1.1 The cognitive model of depression

The cognitive theory of depression proposed by Aaron Beck posits that the development and maintenance of depressive disorders is the result of dysfunctional cognitions, encompassing perceptions, attention, memory, and schemas, which mostly present themselves as a negativity bias (Beck, 1976, 2002). These maladaptive cognitive patterns generally tend to involve increased processing of negative information, such as heightened initial attention and longer sustained attention to dysphoric stimuli, including faces, voices, and ambiguous

scenarios (Peckham et al., 2010), enhanced recognition of negative (e.g., sad) facial expressions, enhanced memory for negative stimuli, rumination, and negative sense of self (Barch et al., 2019; Jenness et al., 2015; Smith et al., 2018). These dysfunctional cognitions occur in both adults and children and can act to maintain the depressive symptomatology.

Studies focusing on facial emotion recognition in depressed youth suggest enhanced recognition, or overidentification, of negative stimuli, although findings do not consistently relate to one specific emotion type. For instance, depressed children and adolescents did not exhibit poorer emotion recognition overall; however, when emotional faces were more ambiguous, they generally tended to perceive them as sad (Schepman et al., 2012). Depressive symptomatology was also associated with poorer recognition of anger, as well as better and faster recognition of fear, although interestingly, recognition of sadness was not affected (Simcock et al., 2020). Currently depressed adolescents were also found to perceive both happy and sad expressions as angry more often than adolescents during remission, and healthy controls (Jenness et al., 2015). In contrast, emotion recognition was not associated with depressive symptoms among adolescents in a recent and comprehensive study of cognitive biases in mental health (Smith et al., 2018), emphasising the lack of consistency in the child/adolescent literature on emotion recognition biases and depression.

Patterns of attention biases in children with depression are even less clear. Although some studies find that depressed children preferentially attend to sadness, other findings are inconsistent. For instance, clinically depressed children and adolescents displayed an attention bias *towards* sad facial expressions, whilst depressed boys with comorbid anxiety also showed attentional avoidance of happy expressions, hinting at potential gender differences in attention patterns (Hankin et al., 2010). Sex differences were also reported in a study of children at risk

for depression, where attention bias towards sadness was present in girls only (Kujawa et al., 2011). Children with a history of maltreatment and higher instances of rumination (a negative cognitive schemata present in depression), also displayed preferential attention towards sad emotions, revealing associations between different cognitive biases of the disorder (Romens & Pollak, 2012). Surprisingly however, Harrison and Gibb (2015) report that children with clinical depression exhibit an avoidance bias - attention *away* from sad facial expressions - as well as an attention bias *towards* happy expressions. Studies of infants also show similar patterns of attention to sadness, and it has been proposed that this avoidant behaviour could be an attempt at emotion regulation (Montague & Walker-Andrews, 2001). Similarly, infants of depressed mothers tend to show less interest (indicative of avoidance behaviours) during mother-child interactions (Pickens & Field, 1993). More recent studies suggest that genetic differences might play an important role in influencing the association between risk for depression and attention biases displayed by children (e.g., Gibb et al., 2009; Owens et al., 2016).

1.4.1.2 'Vigilance' and 'maintenance' cognitive theories of anxiety

The two main cognitive models of anxiety propose that clinical anxiety and anxious traits are influenced by the *vigilance-avoidance* (Mogg & Bradley, 1998) and *attention maintenance* (Fox et al., 2001) mechanisms of threat processing. The *vigilance-avoidance* model posits that anxious individuals display an increased initial attention to threat early in the information processing stages, after which they tend to avoid threatening stimuli during the later processing stages (Mogg & Bradley, 1998; Mogg et al., 2004). Whilst the increased vigilance to angry faces in the early stages of visual processing is proposed to increase anxiety symptoms, the subsequent avoidance of angry faces might represent an attempt at emotion regulation (e.g., efforts to disregard threatening stimuli and maintain positive mood) and

avoidant behaviours seen in anxiety disorders (Mogg & Bradley, 1998). On the other hand, the *attention maintenance* model proposes that anxiety is associated with overall increases in attention to threat, represented by difficulties with disengagement from threatening stimuli (i.e., anxious individuals are slower to disengage from threat) (Derryberry & Reed, 2002; Fox et al., 2001). Such difficulties in disengaging from threatening cues might reflect dysfunctional cognitions related to explicit awareness of threat, which may maintain anxiety symptoms (Weierich et al., 2008).

Although these two models of anxiety disorders appear difficult to reconcile, Weierich and colleagues (2008) propose that they might not be mutually exclusive. In fact, attention patterns in line with both increased vigilance followed by avoidance, as well as attention maintenance may be employed depending on the stages of threat perception, the type of presented stimuli (e.g., angry face viewed in isolation, angry face paired with a neutral face, angry face in a crowd of happy faces), as well as the timescale of attention measures available in different tasks (Weierich et al., 2008). Weireich and others suggest that empirical evidence in support of the *vigilance-avoidance* model might be related to the measures of a longer time scale of attention patterns, such as visual search or free viewing tasks, whereby anxiety is linked to early initial detection of threat, followed by subsequent avoidance of the threatening information in favour of other, simultaneously presented cues over the course of several seconds. Meanwhile, evidence supporting the *attention maintenance* model may be found in shorter time scale experiments, such as the dot probe task, whereby anxiety is linked to heightened, covert shifts in attention towards threatening stimuli, followed by difficulties in disengagement (Weireich et al., 2008). This approach suggests that the maintenance of attention on threat cues occurs within the early detection stages of emotion processing (Figure 1.4). Substantial support for both theories has been found in adult studies of anxiety, indicating

both enhanced threat detection (facilitated attention, in line with the vigilance hypothesis) and disengagement difficulties (in line with the maintenance hypothesis) from threat-related stimuli (Cisler & Koster, 2010).

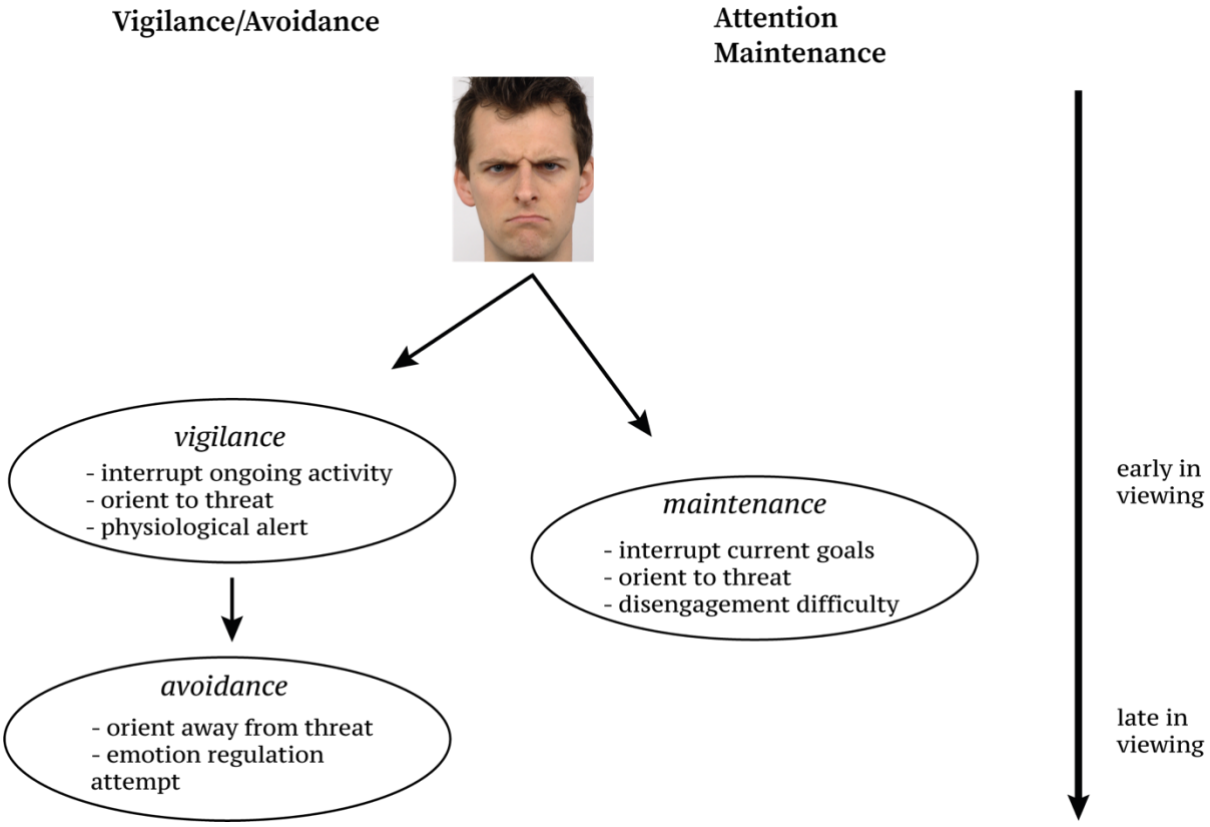

Figure 1.4 Schematic representation of attention processing stages in response to threatening stimuli (e.g., angry face) in anxiety, incorporating the vigilance-avoidance and the attention maintenance models

Schematic overview of different attention allocation patterns to an angry face in early and late viewing stages. Figure modified from Bar-Haim et al. (2007) and Weierich et al. (2008). Stimulus taken from the Radboud Faces Database (Langner et al., 2010).

Among anxious youth, there is generally an increased attention to threatening stimuli. For instance, children diagnosed with various subtypes of anxiety showed heightened attention towards angry faces compared to non-anxious controls (Roy et al., 2008). Children and

adolescents high in trait anxiety displayed heightened attention towards anger in a dot probe task, which was associated with increased activity in prefrontal cortex regions (Telzer et al., 2008). Increased attention biases to threat-related stimuli (including both pictorial and linguistic stimuli) amongst anxious children were also shown in a meta-analysis of dot probe and Stroop tasks, with differences between children with anxiety and healthy controls increasing with age (Dudeney et al., 2015). In a visual search study, children with more anxiety symptoms were faster at identifying both angry and sad facial expressions than those lower in anxiety (Waters & Lipp, 2008). With the majority of studies using research paradigms incapable of distinguishing initial attention from sustained attention, it is currently not clear at which point of information processing the reported increased attention to anger occurs. However, a recent meta-analysis of attention biases using eye-tracking methods showed that anxious children and adolescents are not hypervigilant to threat and tend to sustain their attention on displays of anger for significantly *less* time than healthy controls (Lisk et al., 2020), highlighting the differences in *avoidance* bias to threat between initial and sustained attention, and suggesting the lack of *hypervigilance*. These findings also emphasise the differences in cognitive patterns of attention in anxiety between adults and children, suggesting developmental influences.

1.4.1.3 Emotion recognition in paediatric anxiety

In addition to the atypicalities in attention allocation, anxiety has also been linked to biases in information processing. Similarly to the vigilance and maintenance hypotheses of anxiety, some models propose that anxious individuals are characterised by overidentification of threat, i.e., they tend to perceive ambiguous cues as threatening, which can exacerbate anxiety symptoms (e.g., Rapee & Heimberg, 1997). Another possibility is that anxiety traits lead to diminished exposure to early socialisation and social communication, and therefore to

impairments in global ability to recognise all emotional expressions, linked to poorer social skills (e.g., Beidel & Turner, 2007). Empirical evidence for these claims is mixed. Some studies of emotion recognition linked to childhood and adolescence anxiety emphasise a general impairment in recognition of emotional faces, including both positive and negative affect, as well as neutral faces (Simonian et al., 2001; Waters et al., 2008), although more specific dysfunction in recognising anger and fear has also been reported for anxious youth (Simcock et al., 2020). Clinically anxious-depressed children were also shown to display a negativity bias in a simple emotion recognition task – they perceived ambiguous faces as negative (Walker, 1981), although due to the comorbidity of anxiety and depression in this population it is not clear whether the emotion recognition bias is linked to only one of the two disorders, or a combination of both. Furthermore, abnormalities in amygdala functioning were linked to poorer emotion recognition accuracy in paediatric anxiety (Easter et al., 2005). Interestingly, these effects were found only in response to emotional expressions posed by adult but not child actors (Easter et al., 2005). However, others report a lack of impairments in emotion discrimination. For instance, anxious children did not differ in their emotion recognition abilities from non-anxious controls in a large meta-analysis (Demenescu et al., 2010), and a similar lack of differences was reported for socially anxious youth (Pepper et al., 2018). Overall, poorer emotion recognition abilities might be linked to problems with emotion regulation found in adults (e.g., Mennin et al., 2005), although the inconsistencies in findings from child literature suggest potential developmental differences in emotion processing in anxiety disorders.

1.4.1.4 PTSD

Paediatric post-traumatic stress disorder (PTSD), closely linked to childhood trauma exposure, is a specific type of anxiety disorder present after adverse experiences, and

characterised by extreme worry, re-experiencing traumatic events, distress, avoidance, and hyperarousal, with high variability in symptomatology (Carrion et al., 2002). Although the majority of research focuses on adults, some studies indicate abnormalities in emotion processing among children with PTSD, mostly reporting enhanced perception of threat and trauma-related stimuli (largely consistent with the hypervigilance model of anxiety disorders), as well as abnormalities in emotion regulation and comorbidity with other internalising symptoms (Dalgleish et al., 2001; Herringa, 2017; John et al., 2017). It has been suggested that inhibitory control might influence the relationship between threat attention biases and PTSD symptoms in young adolescents (Bardeen & Daniel, 2017), although it is unclear if these patterns could also be observed in children. Youth with PTSD have also been shown to have poorer emotion recognition accuracy for angry, disgusted, and neutral faces (Heyn et al., 2021). However, other findings are less clear cut (e.g., Masten et al., 2008) and it is often difficult to separate the effects of PTSD and those of specific trauma subtypes (e.g., deprivation v threat) on affective development (e.g., Motsan et al., 2021). Indeed, whilst the traits of childhood anxiety and depression might develop independently from any history of early trauma or adversity, by definition PTSD cannot be studied in isolation from the traumatic experiences that caused it, often making it more difficult to reach clear conclusions on its effects on emotion processing.

1.4.2 Externalising disorders

Externalising disorders are a group of psychiatric conditions characterised by disruptive behaviours, callus-unemotional (CU) traits, and inattention, and include conduct disorder (CD), oppositional defiant disorder (ODD), and attention-deficit/hyperactivity disorder (ADHD), which mostly manifest during childhood and can persist into adulthood (Biederman et al., 2011; Harpin et al., 2016). Externalising disorders have previously been linked to problems in

emotion regulation and social functioning, and a plethora of literature shows long-lasting impacts on executive function, reward processing, and academic achievements (Berlin & Bohlin, 2010; Frankel & Feinberg, 2002; Musser et al., 2013; Petrovic & Castellanos, 2016; Scholtens et al., 2012; Zelazo, 2020), with links to both structural and functional brain abnormalities (Fairchild et al., 2019; Matthys et al., 2021). Atypicalities in emotion processing in externalising disorders are mostly represented by overall poorer emotion recognition. For instance, difficulties with emotional valence discrimination (positive/negative stimuli) were found among adolescents with CD and ODD, and their performance on the task was associated with callus-unemotional traits (Herpers et al., 2019). Similarly, children with CD displayed emotion regulation, learning, and recognition impairments (for both positive and negative expressions), which in turn were associated with more aggressive behaviours and CU traits (Kohls et al., 2020). However, other studies show emotion recognition difficulties more specific to certain emotional expressions. For example, although impairments in recognition of most expressions (angry, disgusted, fearful, happy, and sad) were found in youth with conduct disorder, those with ODD only showed impairments in recognition of anger, indicating differences in cognitive patterns in different externalising symptomatology (Deters et al., 2020). Taken together, there is a general dysfunction in emotion recognition in children diagnosed with externalising disorders (Cooper et al., 2020).

1.5 Intergenerational risk of psychopathology: the role of affective processing

Parental psychopathology is also a major risk factor for child emotional and behavioural problems. For instance, children of depressed mothers are at a higher risk of developing depression as well as other internalising and externalising disorders (Goodman et al., 2011). The theories of intergenerational transmission suggest that this increase in familial risk is due to genetic and environmental factors, but the specific transmission pathways are not yet clear. Affective processing biases, present both in children and adults with psychopathology symptoms, are one of the cognitive mechanisms proposed to play a role in the transgenerational transmission of disorders such as depression and anxiety.

Goodman and Gotlib (1999) proposed that depressed parents' affective biases (focusing specifically on mothers) lead to atypical parenting behaviours, which in turn cause their children to develop depressotypic cognitions and affective biases. The negative bias, exemplified for instance by enhanced recognition of sad emotional expressions, increased attention and memory to negative emotions and scenarios, and rumination, can permeate through parenting styles. These dysfunctional cognitions can then be transmitted to children through behaviour modelling (Goodman & Gotlib, 1999). Empirical studies seem to support this, showing associations between parent and child biases in affective processing, as well as the presence of negative cognitions in children of depressed parents compared to healthy controls. For example, maternal attention bias away from positive stimuli (happy faces) was predictive of a negative attention bias (angry faces) in their children at risk for depression (Waters et al., 2015). Kluczniok and colleagues (2016) found that both mothers with remitted depression and their children were more accurate at recognising sad expressions, and

overidentified other expressions as sad, with a significant association between the mother-child biases. Children of depressed mothers were also found to have poorer general emotion recognition and lower levels of social collaboration in a recent longitudinal study (Priel et al., 2020), which might reflect dysregulated parenting styles. Interestingly, similar effects were found for adolescents rating maternal affect: youths whose mothers reported more depressive symptoms tended to rate maternal disposition as more negative (Luebbe et al., 2013). Effects of maternal depression can even be seen in infancy, with an enhanced attention towards sad expressions found in children of depressed mothers compared to healthy controls (Owens et al., 2016).

Affective biases in anxiety can also play a role in intergenerational risk for the disorder. Hudson and Rapee (2004) proposed that children of anxious parents might be at risk of developing anxiety through the transmission of threat perception and maladaptive coping strategies. When anxious parents model their overly anxious responses to ambiguous situations and use parenting strategies of exaggerated control, they might create an environment conducive of abnormal emotion processing and regulation (Creswell et al., 2010; Hudson & Rapee, 2004). For instance, studies show links between child and mothers threat biases in an interpretation task (Creswell et al., 2005), as well as an association between child threat interpretation bias and maternal attention bias to threat (de Lijster et al., 2020). It is possible that anxious mothers hold negative representations of the world, evident in the interpretation and attention biases, which then impact how their children perceive emotions and attend to threatening stimuli. An influence of maternal anxiety symptoms on attention bias to threat was also found amongst infants (Morales et al., 2017). However, other findings are less clear cut. For instance, amongst children with anxiety disorder and their mothers, maternal and child interpretation biases of threat were not linked, although maternal bias was associated with child

anxiety symptoms (Gifford et al., 2008). Furthermore, no association was found between parent-child biases in attention, although parental anxiety was predictive of child attention biases in the same cohort (Aktar et al., 2019). This study highlighted differential effects of maternal and paternal anxiety symptoms on children's attention biases at different developmental stages: whilst higher maternal anxiety reported when children were 4.5 years old was associated with their child's enhanced detection of anger, higher paternal anxiety measured 3 years later was linked to the child's enhanced detection of happiness (Aktar et al., 2019). Also suggestive of the importance of developmental timelines, a recent eye tracking study with infants found that prenatal but not postnatal anxiety levels in mothers were linked to children's attention bias to threat (Kataja et al., 2019). Further research is necessary to investigate the differential impact of parental mental health and associated biases at different developmental stages in children.

It is important to note that emotion processing biases are only one of the proposed mechanisms of intergenerational transmission of psychopathology, and other factors, such as genetic heritability, dysfunctional parenting styles, contextual stress, and exposure to parental negative affect, should be considered when investigating parent-child psychopathology (Kim et al., 2009; Maciejewski et al., 2018). On balance, although the weight of evidence suggests that affective processing biases might be an important mechanism in transgenerational risks of psychopathology, it is likely that other factors play a more important role.

Early adverse experiences have been shown to significantly affect not only emotion development and affective processing, such as emotion perception and regulation abilities, with potential knock-on effects in later life, but also to pose important risks for the development of psychopathologies, such as anxiety and depression. The main focus in the field of emotion processing after early adversity remains on childhood abuse and neglect, and very little is

known about the effects of different types of trauma on emotion processing, despite the findings that war trauma exposure is a major risk factor for mental health problems among children. In the next chapter, I will discuss the current evidence on the effects of war-related trauma on mental health and emotion processing in refugee children, discuss their current lived experience, and explore the potential cultural differences in the context of emotion processing of facial expressions.

Chapter 2 - War-related adversity, mental health, and affective processing in refugee populations

2.1 The Syrian refugee crisis and its consequences

As of mid-2021, the United Nations High Commissioner for Refugees (UHNCR) agency estimates that there are over 84 million forcibly displaced people and 35 million of them are children (UNHCR, 2021a). The Syrian civil war, currently its 11th year, has been considered one of the worst humanitarian crises in the modern world, resulting in international displacement of almost 7 million Syrian refugees, and an almost equal number of internally displaced people (UNHCR, 2021b). The civil unrest in Syria began in March 2011, when a group of school-aged children were arrested and tortured for writing anti-government graffiti in the Syrian town of Daraa. This sparked anti-regime, pro-democracy protests across the country, following the Arab Spring uprisings across the Middle East in the early 2010s. The authoritarian ruling of President Bashar Al-Assad, ongoing economic problems, environmental difficulties (i.e., the 2006-2010 drought), corruption, privatisation policies, worsening poverty, and rising unemployment, paired with excessive violence in the government's response to the unrest, resulted in long-lasting instability and infighting in the country (Kargin, 2018; Lesch, 2012). Millions of Syrians now face the devastating consequences of the civil war. War-related deaths and injuries, lack of primary healthcare and education, extreme poverty, and loss of family members are only some of the countless outcomes of the conflict.

Reports from war-zones and humanitarian settings suggest that refugee adults and children are exposed to an astounding amount of traumatic war events (Ahmad et al., 2000; Allwood et al., 2002; Goldstein et al., 1997; Morgos et al., 2008; Panter-Brick et al., 2009; Sirin & Rogers-

Sirin, 2015) which can lead to complex physical and mental health problems (Dyregrov et al., 2015; Kane et al., 2014; Lindert et al., 2009; Reed et al., 2012; Slobodin & De Jong, 2015; Wylie et al., 2018). Traumatic events most reported by Syrian refugee children include witnessing bombardment or explosions, having their home forcibly searched or demolished, living in a refugee camp, witnessing a family member's death, and seeing a wounded or dead body (Dajani et al., 2018; Reed et al., 2012). Displaced children are forced to leave their homes and, in many cases, to separate from their family, and often experience a lack of basic necessities, such as food, medicine, and provisions (Allwood et al., 2002; Kuterovac et al., 1994; Panter-Brick et al., 2009).

The majority of internationally displaced Syrian refugees fled to the surrounding nations: Turkey, Lebanon, and Jordan (UNHCR, 2021a). According to the most recent estimates, Jordan currently hosts almost 700,000 Syrian refugees, over 80% of whom live in urban areas in the Governorate of Amman and Mafraq (UNHCR, 2021b) (Figure 2.1). In addition to the aftermath of traumatic experiences of war and displacement, life after resettlement poses further substantial challenges, such as racial discrimination and harassment, poverty, and language barriers (Fazel, 2018; Fazel et al., 2012; Sujoldzic et al., 2007), with added consequences on children's development and mental wellbeing. Below I review the current literature regarding mental health of refugee children and potential effects of refugee parents' psychopathology on child outcomes. I then move on to discussing the current living experience of Syrian refugee children after resettlement in Jordan and how these factors can affect their mental health and psycho-social functioning. Finally, I present the potential limitations and drawbacks of emotion perception research in the Syrian refugee context.

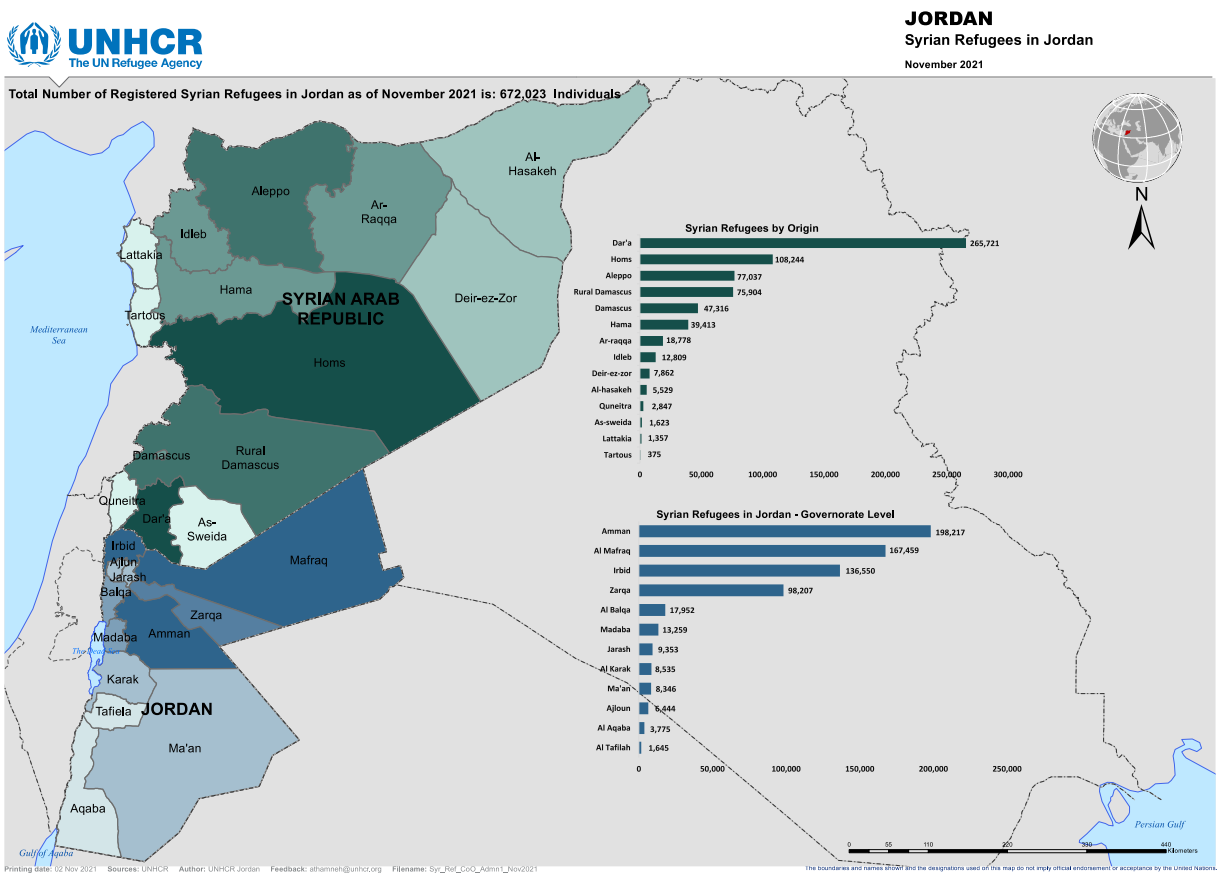

Figure 2.1 Map of the displacement of Syrian refugees displaced in Jordan by area. Adapted from UNHCR (2021d).

2.2 Mental health of refugee children

Refugee children exposed to trauma, displacement, and poverty are at increased risk for emotional and mental health problems, such as depression and PTSD (Henley & Robinson, 2011). These children often struggle with psychological distress and behavioural problems, and have a higher risk of developing chronic psychopathology than non-refugee children (Derluyn et al., 2004; Lindert et al., 2009). Children who have been forcibly displaced as a result of war show increased rates of internalising (the most frequent being PTSD, anxiety, sleep disturbances, depression, and grief) and externalising symptomatology, and many of them experience high psychopathological comorbidity (Henley & Robinson, 2011). According to screening questionnaires and clinical evaluations, rates for these disorders amongst refugee

children can be as high as 50% for PTSD and 40% for depressive symptoms (Alpak et al., 2015; Ozer et al., 2016; Sirin & Rogers-Sirin, 2015; Thabet et al., 2002). Externalising problems, such as conduct disorder, and attention deficit hyperactivity disorder are also common among refugee children (Miller et al., 1999).

2.3 Trauma and psychopathology among refugee parents – consequences for child development

Refugee children's psychosocial functioning and wellbeing may be affected not only by their direct experiences of war and displacement, but also by their parents' exposure to trauma, their mental health, the parent-child relationship, and general family functioning (Miller & Rasmussen, 2017; Reed et al., 2012). Parental psychopathology has been previously linked to negative child outcomes in non-refugee populations with well-established theories of intergenerational psychopathology transmission, and recent studies are beginning to show similar patterns of associations amongst refugee families. For instance, psychopathology scores and parenting stress of Syrian refugee parents living in Turkey were predictive of their children's overall mental health, which included emotional and conduct problems, although no such effect was found for children's PTSD symptoms (Eruyar et al., 2018). Similarly, anxiety and PTSD symptoms of Palestinian children living in the Gaza Strip were reportedly predicted by their parents' anxiety and PTSD levels, in addition to the children's traumatic experiences (Thabet et al., 2009), and caregiver's depression scores were linked to adolescent's depression symptoms in refugee families in Uganda (Meyer et al., 2017). A similar relationship was found for internalising problems between adolescents and their caregivers living in post-conflict Sierra Leone (Betancourt et al., 2015). These results suggest an association between specific child and parent mental health problems in humanitarian context. On a positive note, Betancourt and colleagues (2015) also found that higher levels of family acceptance and lower

levels of community stigma were linked to fewer internalising problems. Similarly, Syrian children and adolescents living in Jordan and Lebanon who reported higher family cohesion and lower levels of family conflict also scored lower on internalising and externalising symptoms, indicating that positive family environment is linked to higher mental wellbeing in refugee youth (Khamis, 2021).

A caregiver's mental health symptomatology as well as war and displacement related trauma can influence their children's development, even for children with no direct experiences of trauma. Studies of children born to refugee parents after resettlement in host countries shed light onto the effects of intergenerational, or secondary, traumatisation (Sangalang & Vang, 2017). For instance, having parents diagnosed with PTSD increased the likelihood of psychiatric comorbidity in a large cohort of children of refugees who resettled in Denmark (Back Nielsen et al., 2019). Maternal PTSD and depressive symptoms mediated the impact of maternal torture experiences on child adjustment (which included perceived racism, bullying victimization, and depressive symptoms) in a sample of Somali refugee families, although there was no direct association between maternal trauma and child mental health (East et al., 2018). Maternal PTSD symptoms have also been linked to psychosocial problems in infants and toddlers, and to higher levels of insensitive, hostile, and unstructured parent-child relationship, and lower emotional availability amongst asylum-seeker and refugee families living in the Netherlands (van Ee et al., 2012). Interestingly, this study also found that children of mothers with higher trauma exposure showed less responsiveness and involvement during mother-child interactions, suggesting that maternal trauma can impact child attachment and affect regulation (van Ee et al., 2012). Furthermore, parental levels of PTSD amongst refugees (predominantly Iraqi and Afghan) rehomed in Australia were linked to emotional problems in their children (Bryant et al., 2018). Bryant and colleagues also investigated how parental war exposure could

affect parental and child mental health, and found that parents with higher exposure to trauma- and displacement-related adversity reported more PTSD symptoms, which in turn were associated with harsher styles of parenting. Harsher parenting was in turn linked to more internalising, externalising, and peer problems in their children (Bryant et al., 2018), emphasising the complexity of trauma transmission on different aspects on child emotional development. Consistent with this, a recent meta-analysis showed that parental war-related trauma was linked to less warm and more harsh parenting styles, which then mediated the association between trauma and child adjustment measures, such as internalising and externalising symptoms, social problems, and quality of life, among refugee families (Eltanamly et al., 2021).

Although specific cognitive mechanisms behind the effects of trauma, displacement, caregiver's adversity, and mental health on child's emotional processing have not yet been investigated in refugee contexts, these associations likely follow similar patterns observed in non-refugee populations. Namely, the cognitive biases displayed by caregivers, combined with changes in family dynamics and negative parenting strategies which show associations with maladaptive emotion regulation, might exacerbate mental health symptoms, behavioural problems, and affective processing disturbances in refugee youth.

2.4 Refugee children's affective development

Although trauma and mental health of refugee children have been extensively studied, we know very little about their affective and cognitive processing (with some exceptions, most notably work by Qouta and others on mental flexibility in Palestinian refugee children (1995)). This is unsurprising given the difficulty of conducting cognitive research in humanitarian settings. We currently do not know whether experiences of war and displacement alter

children's socioemotional development, as has been shown for abuse and neglect. Recent studies show that refugee youth suffer from emotion dysregulation and suggest that emotion processing might also be affected. For example, Syrian children and adolescents who experienced more traumatic events showed higher levels of emotion dysregulation, whilst avoidant copying strategies were associated with more PTSD symptoms (Khamis, 2019). Similarly, different strategies of emotion regulation were found to moderate the influence of traumatic experiences on both depressive and ADHD symptoms amongst North Korean refugee adolescents (Lee et al., 2020). Furthermore, higher levels of PTSD symptoms in Afghan refugee adolescents exposed to trauma were associated with deficits in affective working memory (Mirabolfathi et al., 2020).

In terms of emotion perception, a recently published study investigated emotion recognition accuracy in Syrian refugee children and adolescents resettled with their families in Turkey (Gredebäck et al., 2021). Participating children were asked to label facial expressions shown at different levels of clarity. Their parents' exposure to traumatic events and PTSD symptoms were also assessed. The authors found that children whose mothers reported higher PTSD symptoms performed worse in the emotion recognition task for sad and happy emotional expressions. Surprisingly, trauma exposure of both parents and PTSD symptoms of the fathers were not linked to child emotion recognition, and parents' emotion recognition was not linked to their trauma and PTSD. However, it is not clear if there is an association between children's and parents' emotion recognition, and what mechanisms are responsible for children's poorer recognition of sadness and happiness. In another study with Syrian refugee adolescents resettled in Turkey, participants were presented with happy, angry, and surprised facial emotional expressions and instructed to label them as either positive or negative (Mueller et al., 2021). This study found a link between higher trauma exposure and greater likelihood of

perceiving surprised expressions as negative. These results suggest that increased number of traumatic events might be linked to a negativity bias, leading children to perceive ambiguous emotions as negative. This would be in line with previous findings of childhood adversity, which indicate heightened perception of ambiguous content as negative.

2.5 Why does emotion processing matter in the refugee context?

Whilst it is paramount to investigate mental health outcomes amongst refugee children, it is also vital to understand the cognitive mechanisms affected by war-related trauma and displacement which could contribute to the onset of psychopathology. Addressing the ways in which early adversity might affect these children could be beneficial in targeting specific interventions, identifying those most at risk, and isolating not only risk factors for emotional and behavioural problems but also potential protective factors which might build resilience in the face of adversity. Previous studies have found that positive outcomes, such as higher optimism, experiences of positive emotions, parental and peer support, family cohesion, higher life satisfaction, and better emotion regulation can aid in the process of recovery from war-related adversity and increase resilience amongst refugee children (e.g., Elsayed et al., 2019; Punamäki et al., 2014; Scharpf, Kaltenbach, et al., 2021; Scharpf, Mkinga, et al., 2021; Speidel et al., 2021; Thabet et al., 2009; Veronese et al., 2012, 2021). A heightened attention bias towards positive emotions has been previously linked to better mental health outcomes in post-institutionalised non-refugee children (Troller-Renfree et al., 2017), and attentional bias modification (ABM) interventions (e.g., Shechner et al., 2014) could improve mental wellbeing through scalable and low-cost cognitive-based programs, which would be well suited for use in refugee contexts.

2.6 The context of Syrian refugee children living in Jordan

After fleeing their war-torn country, having experienced war and displacement related trauma, Syrian refugees continue to encounter adversity even after resettlement. The economic impact of the refugee crisis on Jordan has important consequences for the livelihoods of Syrian refugee families. The pre-existing pressures on the public healthcare system and education, fragile economy, and resources constraints were greatly exacerbated during the refugee crisis, resulting in many refugees living in Jordan struggling with basic needs, debt, shelter, and food insecurities (Tiltnes et al., 2019; Hall (UNHCR), 2022). Additionally, Syrian refugees still face high levels of discrimination and harassment, both in urban settings and in the refugee camps (Al-Khatib et al., 2015; Al-Rousan et al., 2018), although humanitarian and cultural factors seem to outweigh the egocentric perceptions, with majority of Jordanians in a recent study reporting positive attitudes towards Syrian refugees (Alrababa'h et al., 2021). Taken together, these widespread post-resettlement vulnerabilities can have important consequences for displaced children's welfare and wellbeing. Below, I present an overview of the common experiences of Syrian refugee children living in Jordan, with the main focus on education, child labour, and child marriage, and the potential implications of these types of adversity for their mental health and wellbeing.

2.6.1 Education

Under Jordanian law, all children have the right to free primary and secondary education, and schooling is compulsory for children between the ages of 6 and 15 years old. This includes all registered Syrian refugee children, who are eligible for fee-free public schooling, and the UNHCR reports that in 2020 136,000 out of 230,000 school-aged Syrian refugee children were enrolled in formal education (UNHCR, 2020). The Jordanian Ministry of Education (MoE) took several steps to accommodate the population of refugee children

arriving in the country, alleviate the strain on the already stretched educational system, and prevent overcrowding, such as opening new schools in refugee camps, and second shift schools in host communities, and hiring new teachers (Delprato & Al-Nahi, 2020). Over 200 public schools in Jordan now operate a two-shift system, with Syrian refugee children attending school in the afternoon, and Jordanian children in the morning (Delprato & Al-Nahi, 2020). However, despite the efforts of the Jordanian government and international agencies, the educational trajectories of many Syrian refugees are disproportionately affected, with much higher numbers of out-of-school (OOS) children in this population compared to Jordanian nationals (Delprato & Al-Nahi, 2020; UNHCR, 2020). Syrian children attending second-shift and camp schools face the most educational disadvantages compared to those attending regular and host community (integrated) schools, with camp schools reporting the lowest performance on the early grade assessments in reading and maths (Delprato & Al-Nahi, 2020).

This disparity between Syrian and Jordanian children became even more prominent in recent years during the COVID-19 lockdowns and school closures. As schools transitioned from face-to-face to online learning, many Syrian refugee (31%) and other vulnerable children were faced with additional difficulties due to the lack of devices and poor or lack of access to the internet (27%). Furthermore, Syrian refugee children report higher rates of discrimination, bullying, and harassment from other students as well as teachers (25% of Syrians compared to 20% of Jordanians) and cite this as the reason for school difficulties and consequently dropping out (Younes & Morrice, 2019; Salem, 2018), although the most recent Vulnerability Assessment Framework (VAF; Hall (UNHCR), 2022) provides somewhat lower numbers (Figure 2.2). Financial situation of the family, lack of transportation and distances to schools, lack of safety, as well as poorer levels of teaching are other reasons for Syrian parents abstaining from sending their children to schools (Figure 2.2 & 2.3, Hall, 2022).

Such high numbers of OOS Syrian refugee children are also the result of many administrative and legal barriers faced by the refugee community, with 'administrative issues' being cited by almost half of Syrian parents in 2018 (Younes & Morrice, 2019). Due to the complex, costly, and often-changing registration policies for Syrian refugees in Jordan, many parents and school principals remain unaware of the current regulations requirements regarding school access for refugee children (Younes & Morrice, 2019). The unavailability and costs of placement tests (required from all children before enrolment), lack of birth certificates, and the continuation of the *three-year rule* (an MoE requirement that all children must not be three years older than their classmates) constitute other key barriers for Syrian children's education in Jordan (Younes & Morrice, 2019; UNICEF, 2018a; Human Rights Watch (HRW), 2016). Interrupted education can have significant impact on children's psycho-social development and wellbeing.

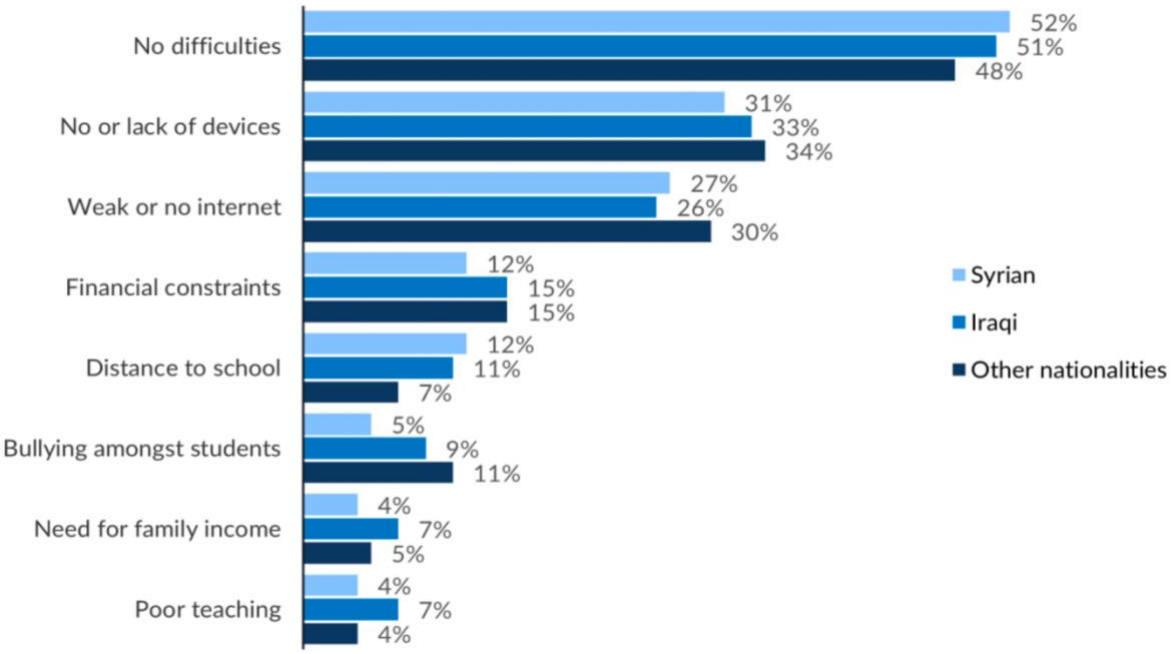

Figure 2.2 Difficulties in school reported for Syrian refugee children living in Jordan (in comparison to Iraqi refugee children and children of other nationalities). Adapted from the VAF (Hall (UNHCR), 2022).

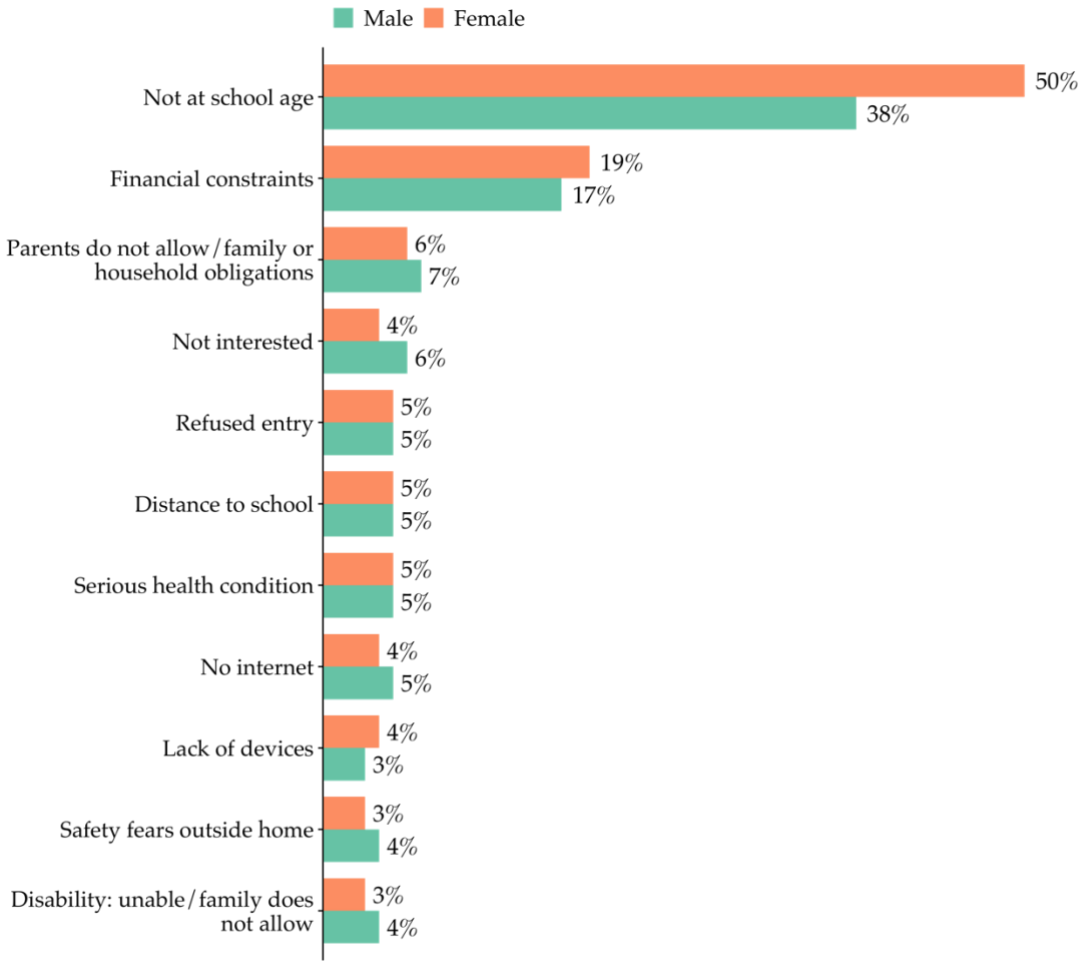

Figure 2.3 Reasons for not attending school, ages 6-15, by gender reported for Syrian refugee children living in Jordan. Adapted from the VAF (Hall (UNHCR), 2022).

2.6.2 Poverty, child labour, and child marriage

Reports estimate that 85% of Syrian refugees outside refugee camps in Jordan live below the poverty line (UNICEF, 2018b). As the vast majority of Syrian families struggle with basic necessities and have limited access to sustainable livelihood options, they need to rely on cash assistance and emergency responses from UNHCR and their partners, which was greatly exacerbated by the COVID-19 pandemic (Hall (UNHCR), 2022). 64% of Syrian refugees living in urban areas, and 84% living in rural areas face high or severe basic needs vulnerability (Hall (UNHCR), 2022). Cuts in humanitarian aid, economic crisis, difficulties in obtaining legal work permits for Syrian refugee adults, and harsh prosecution risk for adults working

illegally contribute to high levels of poverty, and consequently, to instances of child labour (Younes & Morrice, 2019; HRW, 2020; Hall (UNHCR), 2022; Leghtas, 2018; Karim, 2018; see Figure 2.4). Indeed, family poverty and child labour are reported as important reasons for school non-attendance, jeopardising Syrian children's education and future (Younes & Morrice, 2019) - 35% of Syrian refugee child labourers are reportedly not enrolled in school despite being of school-age (Hall (UNHCR), 2022).

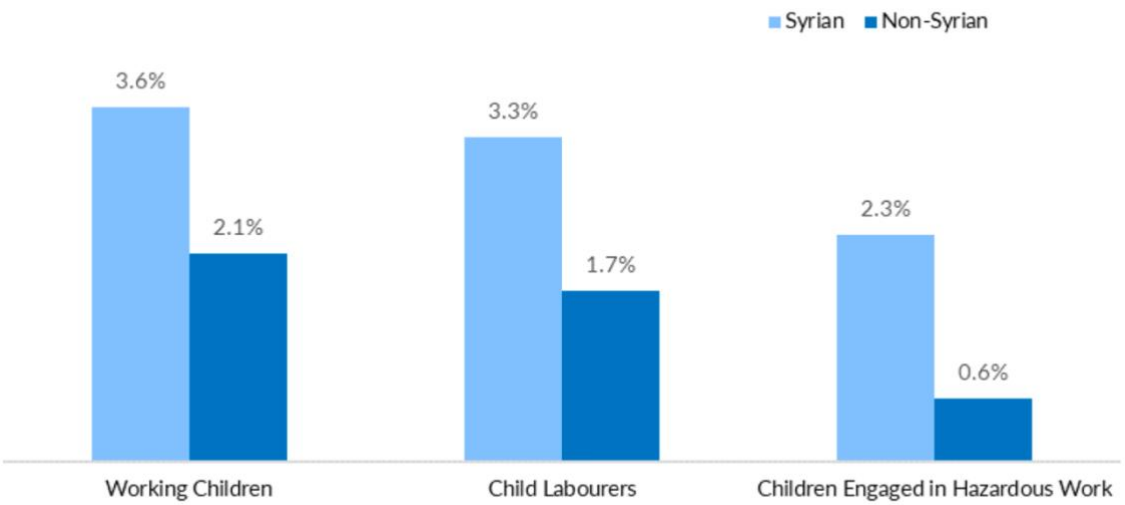

Figure 2.4 Children engaged in work, child labour, or hazardous work, Syrians v non-Syrians, adapted from VAF (Hall (UNHCR), 2022).
Percentage of children aged 6-17.

Another obstacle that refugee children can face is child marriage. This is significantly more prevalent amongst girls than boys, with 1.6% of Syrian girls (aged 6-17 years old) compared to 0.3% of boys being married or divorced according to the most recent VAF (Hall (UNHCR), 2022), although other sources report that underage marriages of Syrian girls constitute a much higher proportion of all marriages in Jordan, at 36% (Younes & Morrice, 2019). Child marriage is often a reflection of the family's poor financial situation (Younes & Morrice, 2019), and can have important consequences for young girls' livelihood, education, and physical and mental health (HRW, 2019). Indeed, 71% of married or divorced girls do not

attend school and 47% of them provide marriage as the main reason for dropping out (Hall (UNHCR), 2022). Poverty, child labour, and child marriage are a strain on children's physical and mental health, cut short their childhoods, disrupt their education, and limit their future and aspirations.

The post-settlement adversities discussed above together with other environmental stressors can be a big burden on children's psychosocial functioning and mental health. Although children and adults might differ in their processing of adversity, a more holistic research approach encompassing the needs and symptoms of a whole refugee family can shed light on the mental health and wellbeing of both refugee children and their parents (Figure 2.5). For instance, a recent literature review found that fear of separation was common in both refugee parents and children, and children's distress and psychological problems linked to adversity were often associated with aggression and violent outbursts (Wells et al., 2016). Furthermore, 38% of displaced Syrian adolescents living in the Za'atari camp reported child abuse in the family as a source of worry and fear (International Medical Corp & UNICEF, 2013), emphasising the strain on the family structure and dynamics during displacement. Overall, this suggests that refugee children living in Jordan might struggle with much higher levels and varieties of adversity than simply war related trauma, potentially resulting in heightened vulnerability for mental health issues, compared to their Jordanian peers.

However, it is important to note that in studies in this thesis including both populations of Syrian and Jordanian children, we found that the two groups did not differ in self-reported mental health and wellbeing outcomes, with the exception of trauma-related measures (traumatic experiences and post-traumatic stress symptoms). This suggests that Syrian refugee and Jordanian non-refugee children participating in studies in Chapters 3 and 4 constitute

relatively comparable groups, with the main measured differences being their exposure to war-related trauma and refugee status.

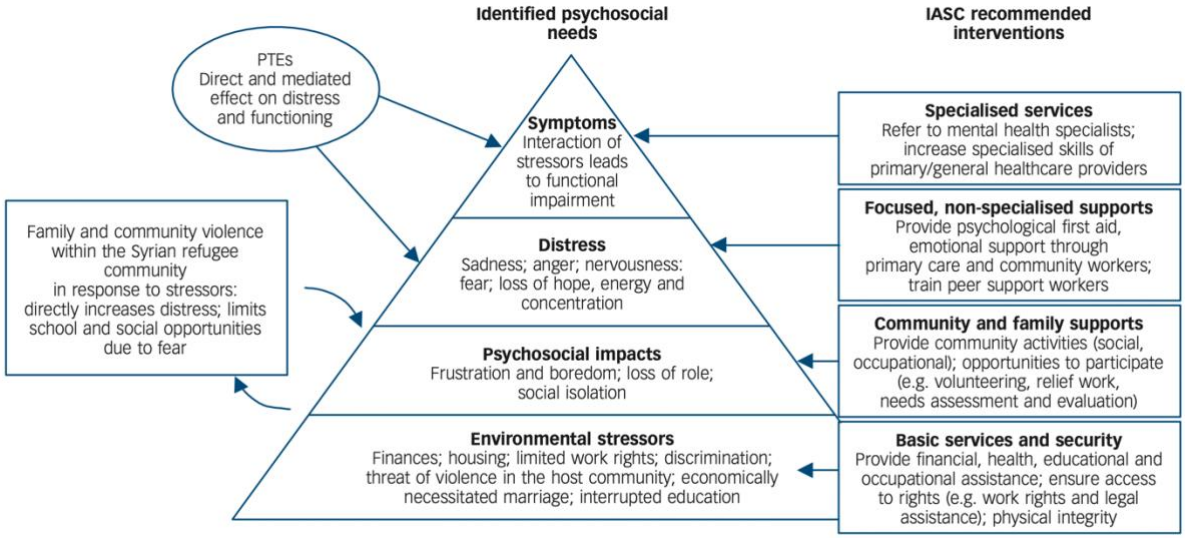

Figure 2.5 Model of psychosocial concerns raised by Syrian refugees living in Jordan, adapted from Wells et al., 2016.

IASC = Inter-Agency Standing Committee, PTE = potentially traumatic event.

Overall, reports suggest that Syrian refugee children resettled in Jordan often struggle with adversities beyond potential trauma from war exposure and displacement. The experiences of food insecurity, disruptions in education, and child labour are common, and may play a crucial role in children's emotional and cognitive development and wellbeing. Despite the work of international humanitarian agencies in trying to improve the living conditions and access to education for Syrian families, refugee children continue to face many challenges in Jordan. Although it was not always possible to include the experiences discussed above as variables in my studies (with the exception of the poverty measure, which did not differ between Syrian and Jordanian families), they may play an important role in both mental health and psycho-social functioning outcomes, and the context of these children's everyday lives should be kept in mind when interpreting the findings.

2.7 Cultural differences in the processing of facial expressions - the limitations of affective processing research in the Middle Eastern context

A large proportion of early childhood emotional development is dictated by observations of - and reactions to - parental behaviours, and it is through the social context and the emotional climate of the family that children learn how to socialise, interpret, express, and regulate their emotions (Sheffield Morris et al., 2007). To fully appreciate the nuances of affective processing after war and displacement related trauma, it is necessary to consider the cultural differences between the typical family structure and dynamics of the Syrian and Jordanian populations compared to predominantly Western-focused research findings discussed in Chapter 1.

Firstly, the differences between collectivist and individualist cultures in their core societal values can affect the way children express and recognise emotions in everyday life. The emphasis on the values of honour, respect, and collective cohesion (typical for many Middle Eastern countries, like Jordan and Syria) create the context in which children are taught to navigate social situations, which might shape their emotional development. For instance, studies suggest increased suppression of emotionality and specific display rules (e.g., it might be socially inappropriate for a parent to express their emotions in front of their children) in collectivist countries (e.g., Matsumoto et al., 2008; Safdar et al., 2009). Fewer displays of emotional expressions in parents or other adults encountered by the child might result in poorer recognition abilities for emotional expressions like anger or sadness. Consequently, children might also be taught from a young age not to express emotions themselves and to avoid confrontations and emotional displays in their environment. It is possible that when contrasted with children in Western societies, where emotional displays and individual expression are

commonplace and socially acceptable, children in the collectivist Middle Eastern countries might exhibit different understanding of emotionality of others.

Secondly, the parenting styles built on child obedience, respect for elders and the religious practices emphasising the importance of the authoritarian and patriarchal family and societal structure, and the high level of gender inequality typical for the Middle East (Markle, 2013; Mourad & Abdella Carolan, 2010; HRW, 2018; 2019; Haneef, 1979; Barakat, 1993; Dwairy, 2009; Aroian et al., 2006) may result in differences in the way children perceive emotional expressions of men and women. As children tend to spend more time with the mother, whose role in the family is internal and submissive, while the father is considered as the head of the household and an external representative of the family (Binghalib, 2007; Mourad & Abdella Carolan, 2010; Haneef, 1993), it might be easier for children to recognise the emotions of women, as they are more familiar with them compared to the expressions of men. On the other hand, as Islam - the most prevalent religion in the Middle East - requires women to cover their heads and often their faces in public, children's exposure to female expressions might be more limited than to those of men, or of other children, depending on the situation. These important differences of the every-day exposure to emotional expressions of children growing up in the Middle Eastern compared to Western countries might play a role in how they perceive and process facial expressions of emotions from men, women, and children.

Furthermore, the pervasive use of physical and emotional (i.e., 'shaming') discipline in the Middle Eastern Muslim households (Nydell, 1987; Barakat, 1993; Haj-yahia, 2002; Haboush, 2007) might potentially result in differences in what children associate with a prototypical 'angry' or 'disappointed' face, and consequently overidentify ambiguous expressions as negative, or vice versa. On the other hand, the large family sizes and strong

family ties result in the extended family members often playing important roles in child-rearing (Haj-yahia, 2002; Binghalib, 2011). Therefore, it is possible that children learn to read emotional cues from a wider range of unique faces through mere exposure to more people from early childhood. This would suggest better ability to identify emotions from facial expressions compared to children brought up in Western-type and usually smaller families.

However, whilst the above speculation might potentially influence children's emotion perception, to my knowledge, there is a lack of systematic, empirical research on affect perception as a function of family dynamics specifically in the Middle East to suggest significant differences in children's emotional processing, as compared to children raised in Western countries. Some cross-cultural research indicates important similarities in various domains of emotional development in general, such as conceptual understanding of emotions, and suggests that perception of basic emotions in children from collectivist and individualist societies show similar patterns (e.g., Cowen et al., 2021; Harris & Cheng, 2022), while other studies suggest some differences (e.g., Wang, 2010; Barrett et al., 2019). The reasons for these inconsistencies might be the use of databases of emotions that are not necessarily culturally sensitive and relevant to the studied population. The lack of extensive and widely validated datasets of emotional expressions presented by Middle Eastern actors limits the validity of these studies and further database development and research is necessary. The possible limitations of using a facial database exclusively standardized in Western populations in a sample of Syrian and Jordanian children are discussed below.

2.7.1 Potential limitations of this thesis regarding cultural differences in emotion perception

The patterns of family dynamics common in the Middle Eastern households and the potential cultural influence on emotion perception discussed above might limit the interpretation of the current findings. The following assumptions might be made regarding the results of studies in this thesis:

1) We might expect differences in how children recognise and attend to male and female emotional facial expressions, based on the prevalent gender roles, which may influence the amount of exposure to male compared to female faces. However, in all empirical studies (Chapters 3-5) we included stimuli from both male and female actors for all emotional expressions. Throughout these studies, we found that there were no significant differences between the way that Syrian refugee and Jordanian non-refugee children recognised (Chapter 3) or attended to (Chapters 4 and 5) emotional expressions depending on actor's gender. Therefore, throughout this thesis, results of emotion processing tasks for male and female faces were combined for subsequent analyses.

2) We might expect differences in how children recognise and attend to emotional expressions presented by adults compared to those presented by other children of similar ages, based on the emphasis on obedience and respect towards elders. Indeed, we wanted to investigate this potential actor age difference on attention distribution to emotional stimuli in the Chapter 4 study. In this study, we used adult actors stimuli from the Radboud Faces Database (Langner et al., 2010) and child actors stimuli form the Child Affective Facial Expressions database (LoBoue & Thrasher, 2015). We found that Syrian and Jordanian children showed similar patterns of attention distribution for emotional expressions

presented by both child and adult actors. Therefore, the child and adult actors data were combined for subsequent analyses. Interestingly, during the validation of these sets of stimuli in a sample of Palestinian children (see details below), we also found no differences in emotion recognition of these expressions for adult compared to child actors. Further research should investigate the effects of actor's age on emotion perception of Middle Eastern children using more culturally relevant databases, however these are rare (for adults) or non-existent (for children).

3) Finally, we might also expect differences in the way Syrian and Jordanian children label emotional expressions presented by actors of varying ethnicities, based on their everyday exposure to these faces and a potential racial bias. To test the presence of this bias in the current studies, I conducted validation experiments of stimuli used in Chapters 4 and 5. A small sub-sample (n = 14, M_{age} = 6.25) of the FIERCE Syrian refugee mother-child dyads labelled emotional expressions from the Radboud Faces Database (Langner et al., 2010) used in the dot-probe task (neutral, anger, sadness) in Chapter 5. The results indicated good emotion recognition accuracy overall, with highest accuracy for anger (94%), followed by sadness (77%) and neutral expressions (59%) (Figure 2.6A). Children and mothers did not differ in their emotion identification. We also asked a separate sample of Palestinian children (N = 21 M_{age} = 9) to identify emotional expressions (anger, sadness, happiness, neutral) from the Radboud Faces Database (Langner et al., 2010) and the CAFE database (LoBue & Thrasher, 2015), used in the eye tracking experiment in Chapter 4. These children showed good recognition accuracy of all faces (Figure 2.6B) and, as expected, performed better than the younger Syrian children (Figure 2.6A). Overall, these patterns of emotion recognition are similar to those previously reported in samples of children in Western countries, with similarly poorer recognition of more ambiguous expressions (such

as fear) compared to explicit emotions, such as happiness and anger, and with recognition accuracy steadily increasing with age (Lawrence et al., 2015; Mancini et al., 2013; Thomas et al., 2007). The two validation studies suggest that (like in Western populations), recognition ability seems to be best for the intense expressions of anger and happiness, and the overall accuracy increases with age.

Interestingly, in a separate study (not part of this thesis, manuscript in preparation) of emotion identification and scan paths of Syrian refugee and Jordanian non-refugee children (N = 128, M_{age} = 9.36), we used an available dataset of culturally relevant emotional faces of Persian actors expressing the emotions of anger, happiness, fear, sadness, and neutral expression (Emotional Faces Database (Heydari et al., 2022)). We found that not only refugee and non-refugee children did not differ in their emotion recognition accuracy (Figure 2.6C) or attention distribution, they also showed similar patterns of identification to my previous validation studies with Caucasian faces, as well as to those previously reported in populations of Western children of similar ages (e.g., Lawrence et al., 2015). Overall, these findings suggest a certain universality of basic emotion perception from facial expressions and indicate that Middle Eastern children who participated in studies in this thesis might identify and attend to emotions expressed by Caucasian and Middle Eastern actors in a similar manner. However, systemic empirical research using datasets of different actor ethnicities in the same population of children is necessary to reach any conclusions about the presence of a racial bias in emotion perception of children in the Middle East.

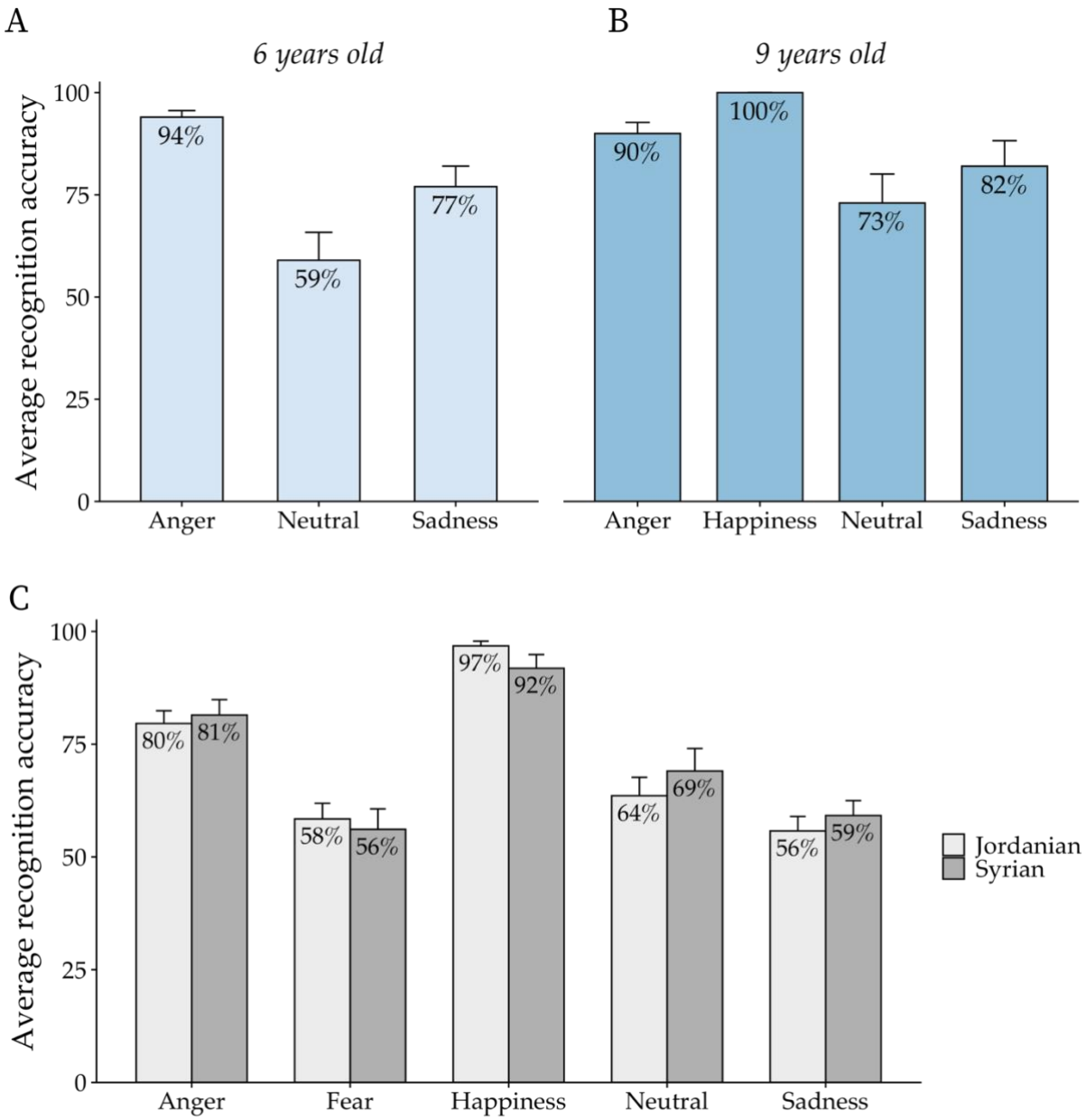

Figure 2.6 Average emotion recognition accuracy scores of children's populations in the Middle East.

(A) Syrian refugee children (N = 14, M_{age} = 6.25; stimuli validation experiment for study in Chapter 5); **(B)** Palestinian children (N = 21 M_{age} = 9; stimuli validation experiment for study in Chapter 4); **(C)** Syrian refugee and Jordanian non-refugee children (N = 128, M_{age} = 9.36; unpublished data from an emotion recognition and eye tracking study – manuscript in preparation).

Error bars represent standard error of the mean.

Nonetheless, the potential limitations discussed above are not an exhaustive list, and they, together with many other caveats, should be kept in mind when interpreting the findings of this thesis. Despite frequent calls for change, the problematic sampling bias continuously present in behavioural sciences makes it difficult to address research questions pertaining to human cognition and behaviour in underrepresented populations (Nagayama Hall & Maramba, 2001; Henrich et al., 2010; Hartman et al., 2013). With the majority of research tools and measures standardised for participants in Western cultures, we must be cautious when interpreting study findings in the refugee context. A much broader body of research encompassing different cultures and ethnicities is necessary for a comprehensive investigation of emotion perception in Middle Eastern children.

2.8 Thesis aims

A wide range of studies show that early adversity has significant effects on children's emotion processing and mental health and wellbeing. However, we do not currently know how different types of adversity, namely war and displacement related trauma, may influence emotion perception and wellbeing of refugee children. Therefore, the aims of this thesis are to investigate the effects of traumatic experiences related to war and displacement on emotion processing among refugee and non-refugee children, and the potential association between emotion processing abnormalities and children's mental health. The thesis specifically focuses on how refugee children perceive and attend to emotional facial expressions.

In chapter 3, I begin by investigating whether early experiences of war trauma have measurable effects on refugee children's perception of emotions. Using an emotion recognition bias task with facial expressions in a cohort of Syrian refugee and Jordanian non-refugee children I assess whether refugee children are biased towards perceiving neutral expressions as happy, sad, angry, or fearful, and how these affective biases relate to their mental health. I find that refugee and non-refugee children are similar in the way they recognise emotional expressions.

Having found no significant group differences in emotion recognition, in chapter 4 I investigate whether war related trauma affects attention allocation patterns. I explore this with a free viewing eye tracking paradigm measuring initial orienting and sustained attention (dwell) while refugee and non-refugee children view emotional expressions of adult and child actors. Although there are no significant group differences in overall dwell, higher trauma is linked to longer maintenance of attention on angry expressions.

Having found an association between attention patterns to threat and trauma, in chapter 5 I further explore attention allocation to emotional faces, this time amongst Syrian refugee children and their mothers, using a dot probe paradigm with facial expressions of sadness and

anger, to examine any potential links between maternal and child attention biases. I also investigate the influence of maternal trauma and psychopathology on child affective processing. I find that although both refugee children and their mothers display a significant attention bias towards angry emotional expressions, there is no significant association between them. I also find that although maternal trauma and psychopathology symptoms significantly predict child mental health outcomes, they are not linked to how children attend to emotional expressions. Interestingly, child attention bias to anger moderates the association between maternal depression and child conduct problems.

Chapter 3 - Emotion recognition biases in refugee and non-refugee children[1]

3.1 Abstract

Early adversity, such as childhood maltreatment, has been linked to impairments in emotion recognition in children, who display a tendency to overidentify ambiguous expressions as negative. However, it is unknown if other types of adversity, specifically war-related, also impact children's emotion recognition. The current study investigated the effects of war-related trauma on emotion recognition biases to happy – sad and angry – fearful morphed emotional expressions, in a sample of Syrian refugee (n = 71; M_{age} = 9.2, SD = 1.7; 41 female) and Jordanian non-refugee children (n = 63; M_{age} = 9, SD = 1.6; 33 female). Validated questionnaires were used to assess trauma (caregiver–reported) and mental health outcomes (self–reported). Refugee and non-refugee children showed similar patterns of emotion recognition biases, displaying a significant bias on the happy – sad dimension only, perceiving neutral expressions as sad. Emotion recognition bias was not associated with trauma or psychopathology, but lower optimism scores were linked to a higher bias towards anger. Our findings suggest that war trauma and displacement might differ from other forms of early adversity in how they influence affective processing in children.

[1] Contents of this chapter have been partially published in *Frontiers in Psychology*: Michalek, J.E., Lisi, M., Awad, D., Hadfield, K., Mareschal, I., & Dajani, R. (2021). The Effects of a Reading-Based Intervention on Emotion Processing in Children Who Have Suffered Early Adversity and War Related Trauma. *Frontiers in Psychology*, 12, 934. https://doi.org/10.3389/fpsyg.2021.613754

3.2 Introduction

3.2.1 Emotion recognition after early adversity

The ability to process emotions is a crucial aspect of development shaped by early experiences and the link between childhood adversity and biases in emotion processing is well established (Pollak, 2012). Research suggests that children with a history of early trauma display enhanced threat processing, with biases in recognition, discrimination, and attention to threatening cues such as angry facial expressions (e.g., Pollak & Sinha, 2002; Shackman et al., 2007). These emotion processing biases are more prominent after moderate to severe childhood maltreatment and may persist into adulthood (Gibb et al., 2009). Generally, children with a history of physical abuse and threat tend to display increased sensitivity to, and overidentification of, angry emotions, while children who suffered neglect and deprivation often show generalised emotion recognition abnormalities (Harms et al., 2019). For instance, physically abused children display increased recognition accuracy of angry facial expressions, whereas neglected children experienced difficulties in discrimination of all types of emotional faces (Pollak et al., 2000). Physically abused children also showed over-identification of angry faces (Pollak & Kistler, 2002), and were able to detect angry facial expressions using less perceptual information compared to non-abused children (Pollak & Sinha, 2002). Increased patterns of brain activity to angry facial expressions were also found in maltreated children compared to non-maltreated controls (Pollak et al., 2001). Poorer global emotion recognition has also been reported in adopted children, with higher levels of pre-adoptive adversity linked to better recognition of negative emotions (Paine et al., 2021). These results highlight that different types of adversity can have a differential influence on emotion processing

It has been suggested that children with a history of early adversity might have enhanced perception of sad and angry faces due to the high frequency of exposure to these emotional expressions in their close environment (Pollak & Kistler, 2002). These perceptual abilities might form a beneficial short-term adaptation, allowing children living in unstable environments to respond quickly to potential threats, since in uncertain situations it is safer/more useful for a child to assume their parent is expressing anger. However, if these emotion recognition biases persist, they could form detrimental styles of emotion processing over time, with consequences to children's socio-emotional development and mental wellbeing.

3.2.2 Emotion recognition and non-war related psychopathology

Childhood adversity is considered a main risk factor for psychiatric disorders, such as PTSD, depression, and anxiety (e.g., Nanni et al., 2012; Nelson et al., 2020; Tracy et al., 2019), and affective processing abnormalities play an important role in the development and maintenance of some mental health disorders (e.g., Bourke et al., 2010; Rutter et al., 2019). However, emotion recognition biases in childhood anxiety and depression are less consistent, with studies reporting strikingly different findings to those of adult populations. For instance, symptoms of both anxiety and depression among adolescents were linked to processing biases of angry and fearful, but not sad emotional expressions (Simcock et al., 2020), and youth diagnosed with depression misattributed anger to expressions of happiness and sadness (Jenness et al., 2015). However, depressed adolescents also misattribute sadness to ambiguous emotional expressions, with no overall deficits in emotion recognition (Schepman et al., 2012). Similarly, child anxiety does not seem to be linked to abnormalities in processing of specific emotions. For instance, children with social anxiety disorder showed poorer emotion recognition for happy, sad, and disgusted faces compared to healthy controls (Simonian et al.,

2001), while Waters et al. (2008) report that more severe anxiety was linked to poorer recognition of neutral faces.

However, other studies suggest no association between impaired recognition of facial expressions and mental health in youth. For instance, a meta-analysis of child anxiety found no significant effects of the disorder on emotion recognition, despite a strong link between the two in adults (Demenescu et al., 2010). A similar lack of association was reported amongst children with social anxiety disorder, who did not differ in emotion recognition abilities compared to healthy controls (Pepper et al., 2018). Furthermore, Masten and colleagues (2008) found that impairments in emotion recognition in children with a history of maltreatment (compared to non-maltreated controls) were not influenced by their post traumatic stress disorder (PTSD) symptoms. Overall, such high variability of findings highlights the complexity of emotion processing in child psychopathology and suggests that other factors (e.g., early life experiences, genetic risk, state affect, etc.) might influence the association between child psychopathology and affective development.

3.2.3 Refugee children: effects of trauma and war related experiences on affective processing

Half of the world's 26.6 million refugees are underage, and 1 million children were born as refugees (UNHCR, 2021a). Studies report a high prevalence of extreme war and displacement related adversities amongst refugee children (Sirin & Rogers-Sirin, 2015; Wylie et al., 2018), which can significantly impact their mental health and wellbeing (Alpak et al., 2015; Henley & Robinson, 2011). Although less widely studied, affective processing and general socio-emotional functioning disruptions have also been reported in refugee youth. For instance, war-related trauma was predictive of emotion regulation difficulties (Khamis, 2019), and emotion regulation strategies were found to moderate the effects of trauma on refugee

youth's depressive and attention deficit hyperactivity disorder (ADHD) symptoms (Lee et al., 2020). Poorer affective working memory has also been linked to experiences of trauma in refugee adolescents high in PTSD symptoms (Mirabolfathi et al., 2020). Finally, a recent study of Syrian refugee families resettled in Turkey found that maternal PTSD symptoms affected emotion recognition accuracy in their children, with higher maternal PTSD symptoms scores associated with poorer recognition accuracy for happy and sad emotional expressions (Gredeback et al., 2021). Interestingly, maternal and paternal trauma, and paternal PTSD symptoms were not predictive of child emotion recognition impairments. However, it is currently unknown if refugee children display any perceptual biases in emotion recognition compared to non-refugee children, and if refugee children's affective processing is influenced by their experiences of trauma and their mental health. This is important since abnormalities in emotion recognition among refugee children might be an important mechanism in maintenance of psychopathology and behavioural problems after war-related trauma.

3.2.4 The current study

The aim of this study was to explore the association between war trauma, biases in emotion recognition, and mental health outcomes in refugee children. Based on previous research findings we had the following hypotheses: 1) refugee children will have significantly higher scores on trauma, PTSD symptoms, internalising symptoms, insecurity, and distress, and significantly lower scores on optimism compared to non-refugee children; 2) refugee children will show an increased emotion recognition bias towards sad and angry faces (specifically, they will perceive ambiguous expressions as sad and angry, rather than happy and fearful) compared to non-refugee children (we call this their *bias*); 3) refugee children will display poorer discrimination between happy – sad and angry – fearful emotions (we call this

their *sensitivity*); and 4) both emotion recognition measures (*bias* and *sensitivity*) will be significantly predicted by trauma exposure and psychopathology scores.

3.3 Methods

3.3.1 Participants

Participants (n = 136) were Syrian refugee (n = 71; M_{age} = 9.2, SD = 1.7; 41 female) and Jordanian non-refugee children (n = 63; M_{age} = 9, SD = 1.6; 33 female). Data collections took place in participants' homes in Sweileh neighbourhood (refugees n = 27), Awael Al Khair Community Centre (refugees n = 22) and Shaqa'eq Al Nouman school (non-refugees n = 20) in Al Hashmi Al Shamali neighbourhood, Al Bonya school in Sahab neighbourhood (nonrefugees n = 25) in February 2019; and in the Khadija Bint Khuwailed Community Centre in Sweileh in June 2019 (refugees n = 23, non-refugees n = 19). Details of testing locations are presented in Table 1 in Appendix A. All children were recruited through the collaborating non-profit organisation *We Love Reading* (Taghyeer), which liaised with schools and community centres to advertise the studies to local families (children tested at homes and community centres) and families of schoolchildren (children tested at schools). The children tested in February 2019 formed the baseline measure for a longitudinal evaluation of the We Love Reading program which was published in Frontiers in Psychology (Michalek et al., 2021).

3.3.2 Trauma and psychopathology

Trauma and mental health problems were measured with questionnaires originally developed in Arabic or adapted to Arabic. All questionnaires were administered by Arabic-speaking field workers using the Qualtrics Offline Application (Qualtrics, Provo, UT). Prior to completing the questionnaires, demographic information was collected from the children,

which included age, gender, and dependency ratio. Dependency ratio was calculated as the number of household members without an income divided by the number of household members with an income and was used as the measure of poverty. This poverty measure was only collected from those children tested in June 2019.

Trauma experiences were assessed using the Traumatic Events Checklist (TEC; Panter-Brick et al., 2009) which includes 21 yes/no questions about trauma exposure relevant to the events in Syria. Due to the challenging nature of the questions and in line with previous studies, this scale was administered to caregivers about the child's exposure. Items included events such as having lived in a refugee camp and having witnessed bombardment. If a child experienced at least one traumatic event as reported by their caregiver (TEC > 0) they were asked if they could recall *any* trauma. Those children were then assessed for PTSD symptoms with the self-reported Child Revised Impact of Events Scale (CRIES 8; Perrin et al., 2005). CRIES is an 8-item measure of PTSD symptoms and asks questions about a traumatic event, such as 'Do you think about it even if you don't mean to?' and 'Do you try to remove it from your memory?'. Items are scored on a scale from (*not at all*) to 5 (*often*) where higher scores indicate greater symptoms severity (n = 131, Cronbach's α = .92). Total possible score ranges from 0 to 40.

Child internalising symptoms were measured using the self-reported Arab Youth Mental Health Scale (AYMHS; Mahfoud et al., 2011), which includes 21 3-point Likert scale questions (*rarely, sometimes, always*). AYMHS rages from 21 to 63, with higher score indicating more symptoms of anxiety and depression (n = 130, Cronbach's α = .86). Questions in this measure relate to the child's wellbeing in the past week and include items such as 'During the last week I was angry' and 'During the last week I was sad'.

The Human Insecurity and Distress Scale (HIDS; Ziadni et al., 2011) was used to assess insecurity (10 items, n = 121, Cronbach's α = .79) and distress (12 items, n = 128, Cronbach's α = .80). HIDS is a self-reported 4-point Likert scale measure ranging from 1 (*never*) to 4 (*always*), where higher scores are indicative of increased insecurity or distress. Human insecurity is akin to fear and includes items such as 'To what extent do you worry/fear for you and your family's future?'. Distress refers to unpleasant emotions in response to previous adversity and current difficulties and is measured with items such as 'To what extent do you feel frustrated?'. The two subscales were calculated separately, resulting in one score for insecurity and one for distress for each child.

Optimism was measured using components of the Youth Life Orientation Test (YLOT; Ey et al., 2005), which include 4 statements with responses ranging from 0 (*not true for me*) to 3 (*true for me*), such as 'I usually expect to have a good day' (4 items, n = 136, Cronbach's α = .61). In the optimism scale higher scores indicate greater optimism.

3.3.3 Emotion recognition bias task

3.3.3.1 Stimuli

The stimuli consisted of photographs of 4 actors (2 female and 2 male) displaying 5 different emotional expressions: angry, fearful, happy, neutral, and sad. The photographs of 3 actors (2 female 1 male) were taken from the Karolinska Directed Emotional Faces (KDEF; Lundqvist et al., 1998) and the photographs of 1 actor (male) were taken from the Radboud Faces Database (Langner et al., 2010). Photographs were cropped to include the face and remove most hair and accessories. For each identity (actor) we created facial morphs using

FantaMorph software (Abrosoft) that morphed two same identity faces between two extreme expressions going through the neutral face, in steps of 10% on two emotional dimensions: happy – sad (HS) and angry – fearful (AF). This resulted in 21 facial morphs for each identity and dimension (Figure 3.1A). In this procedure, the actor's neutral face is used as the midpoint (ambiguous expression), and each of the two facial expressions was morphed with the neutral face in different proportions (i.e., from 100% neutral to 100% happy).

3.3.3.2 Procedures

A forced-choice emotion recognition task was run using Matlab (Mathworks) and Psychtoolbox (Brainard, 1997) on three Dell laptop computers. Children were shown facial stimuli either along the happy – sad (HS), or the angry – fearful (AF) dimension, displayed in colour on a grey background, and were then asked in Arabic to identify the facial expression (between the choice of the two expressions forming each dimension). Each trial began with a fixation point presented for 250ms, followed by the stimulus which remained on the screen until a response was made. After the response a noise mask was presented for 250ms (Figure 3.1B). A QUEST Bayesian adaptive staircase (Watson & Pelli, 1983) was used to control randomly perturbed estimates of the perceived point of subjective equality (PSE, the facial morph level equally likely to be called happy or sad), which converged after 30 trials. Children were reminded that they could only choose between the two emotions of the dimension and if they were unsure to guess. To minimise key press errors children were asked to respond with their selection out loud, and a field worker recorded their answer. Each child completed the task on the two dimensions in two separate blocks (HS and AF), one block with a male face and the other with a female face. The starting expression dimension and face gender was counterbalanced across participants. All children tested in February 2019 (n = 94) were shown morphs of the female face from KDEF (photographs AF23HAS, AF23NES, AF23SAS,

AF23ANS, AF23AFS) while the male face came from the Radboud Database. Children tested in June 2019 (n = 42) were shown both male and female morphs taken from KDEF (photographs AF20HAS, AF20NES, AF20SAS, AF20ANS, AF20AFS; AM10HAS, AM10NES, AM10SAS, AM10ANS, AM10AFS).

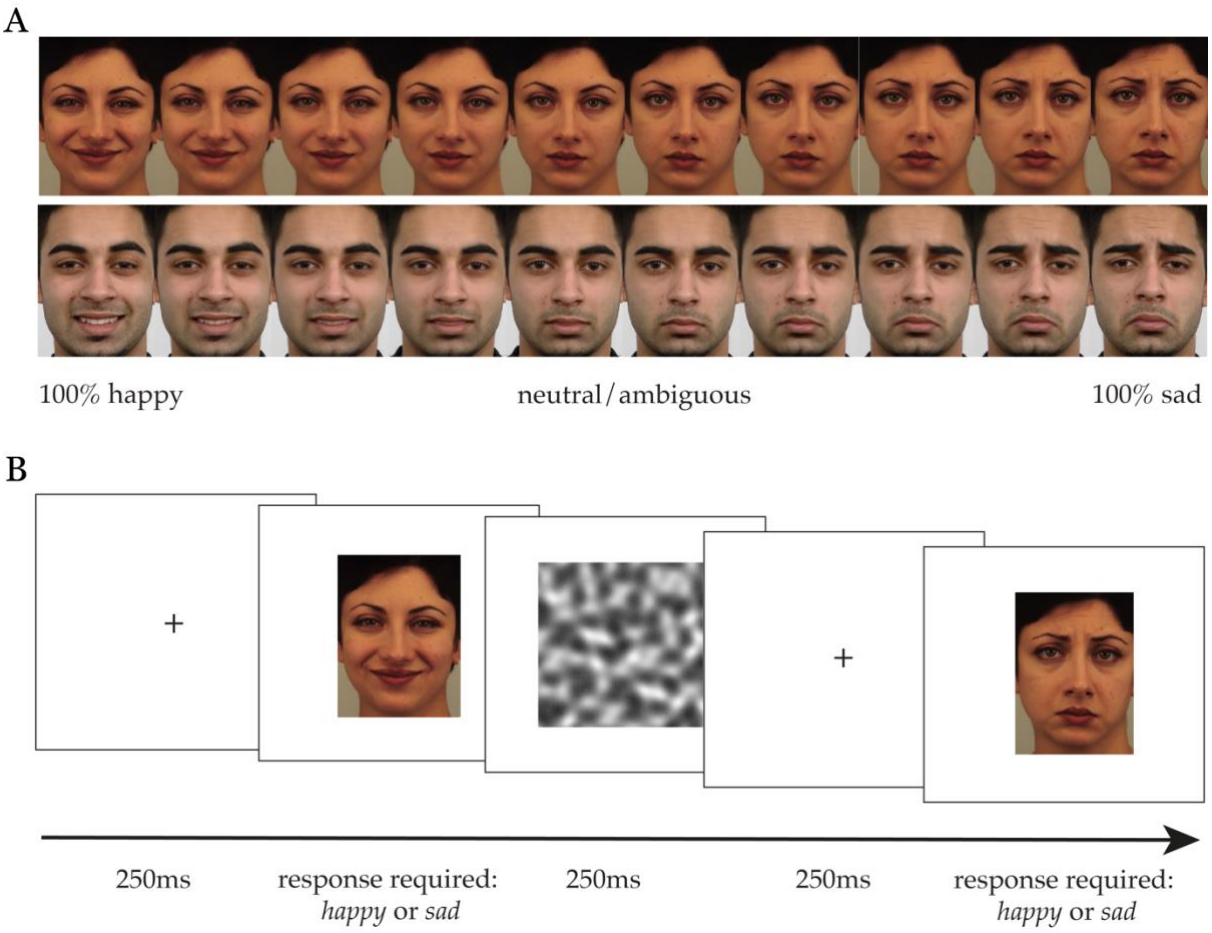

Figure 3.1 Example of the morphed stimuli and task procedure

(A) Female and male morph stimuli on the happy – sad dimension. Facial stimuli were taken from the Karolinska Directed Emotional Faces database (images AF23HAS, AF23NES, AF23SAS; Lundqvist et al., 1998) and the Radboud Faces Database (Langner et al., 2010). **(B)** Example of two consecutive trials in the HS task.

3.3.3.3 Emotion recognition bias parameters

For each child, we fit a cumulative Gaussian function to the proportion of sad (for HS dimension) and fear (for FA dimension) responses and extracted measures of *bias* and *sensitivity*. The *bias* or the *point of subjective equality (PSE)*, was defined as the morph level equally likely to be judged as happy or sad (for HS dimension), meaning the morph level that was perceived to be neutral. The distance between this morph level (i.e., the subjective neutral) and the objective neutral face (i.e., middle image in the morph spectrum) is the child's bias. The *sensitivity* is the slope of the psychometric function and indicates how well the participant can discriminate between each step of the morphed stimuli. A steeper slope (lower slope values) indicates better discrimination. Bias and sensitivity variables were estimated separately for HS and AF dimensions for each participant.

A subset of children was not able to discriminate between *anger* and *fear* on the AF task (refugees $n = 17$, non-refugees $n = 13$) and their data was excluded from further analysis on the AF task only. Excluded children did not differ from the main sample on any of the demographic or mental health measures (all $p > .05$).

3.3.4 General procedure

Caregivers of refugee and non-refugee children participating in the study were given the trauma questionnaire (TEC) by fieldworkers. Children tested in all locations completed the emotion recognition tasks first and then all self-reported questionnaire measures.

3.3.5 Ethics

The project was granted ethical approval from the Queen Mary University of London research ethics board in 2018 (QMERC2018/54). Caregivers gave their informed consent prior

to children taking part, either in person or via phone. Prior to the testing children were asked if they were happy to take part and ensured they could stop at any time. All children were given sweets and juice for participation. Children tested in June 2019 at the Khadija Bint Khuwailed Community Centre were also given 4JOD as reimbursement for travel costs.

3.3.6 Statistical analysis

There were no effects of age or gender on either bias or sensitivity for HS and AF dimensions ($p > .05$). To establish if the *bias* (PSE) varied between groups, a one-way ANOVA was conducted with group (refugees, non-refugees) as the between – subject variable, separately for HS and AF dimensions. To establish if participants were significantly biased towards one of the emotions in each dimension, a one-sample t-test was conducted separately for HS and AF pairs. As the *sensitivity* parameter was not normally distributed, separate Mann-Whitney *U* tests were conducted for the effect of group on HS and AF slopes. To establish if children's discrimination abilities differed for the two dimensions, HS and AF sensitivity were compared with the Wilcoxon Signed – Rank test.

As the questionnaire data were not normally distributed with the scores on an ordinal scale, we used a Mann – Whitney *U* test to compare refugee and non-refugee children's outcomes. To explore the influence of trauma on mental health and wellbeing, we used simple linear regression analysis with trauma as the predictor and PTSD symptoms, internalising problems, insecurity, distress, and optimism as outcomes (5 simple regression models). To account for multiple testing, regression results were corrected using Holm-Bonferroni method (Holm, 1979), with alpha threshold set to being at .05/5 = .01. Further, to establish the associations between questionnaire scores and cognitive task measures (bias, sensitivity), a series of simple linear regressions were conducted for the effects of trauma, PTSD symptoms,

internalising symptoms, insecurity, distress, and optimism (predictors) on child bias and sensitivity scores (outcomes), separately for HS and AF dimensions (12 simple regression models for each dimension). Using Holm-Bonferroni correction, alpha threshold for these regression models was set to begin at .05/12 = .004 for each dimension.

3.4 Results

3.4.1 Trauma and mental health

Trauma, mental health, and demographic results are presented in Table 3.1. Groups did not differ in age, poverty, or gender distribution (all $p > .5$). As expected, refugee children had experienced a significantly higher number of traumatic events compared to non-refugee children, $U = 358.00$, $p < .001$. We also found that trauma scores significantly predicted PTSD symptoms, $F(1, 130) = 37.60$, $p < .001$, $R^2 = .22$, $b = 1.21$, where higher trauma indicated more PTSD symptoms. However, caregiver – reported trauma scores were not predictive of child – reported anxiety/depression symptoms, insecurity, distress, and optimism scores (all $p > .05$).

Similarly, refugee children reported more PTSD symptoms than non-refugee children $U = 1264.00$, $p < .001$, which remained significant after correcting for multiple testing. However, there were no significant differences between refugees and non-refugees in scores on internalising symptoms, feelings of insecurity, distress, and optimism (all $p > .05$). Trauma and psychopathology scores are presented in Figure 3.2. The details of the traumatic events experienced by the children (caregiver-reported) are presented in Figure 3.3B, detailing specific questions included in the TEC.

Country of birth and the proportion of life spent outside of Syria was provided for a subset of participating refugee children ($n = 46$). The majority of refugee children were born

in Syria (n = 40), and a subset were born in Jordan (n = 6) (Figure 3.3A). On average, refugee children spent 70% of their lives in Jordan (SD = 17.29%), with the amount of time ranging from 33-100%. The proportion of life spent outside Syria did not significantly relate to any emotion bias measures (all $p > .3$). However, as can be expected, linear regression analysis showed that the more time children spent in Jordan, the lower their trauma exposure ($F(1, 44) = 7.44$, $p = .009$, $R^2 = .13$, $b = -1.76$), as well as PTSD symptoms ($F(1, 44) = 8.49$, $p = .006$), $R^2 = .15$, $b = -.59$, and insecurity levels ($F(1, 44) = 4.60$, $p = .039$, $R^2 = .08$, $b = -.99$). Association with trauma exposure and PTSD remained significant after multiple testing corrections using the Holm-Bonferroni method.

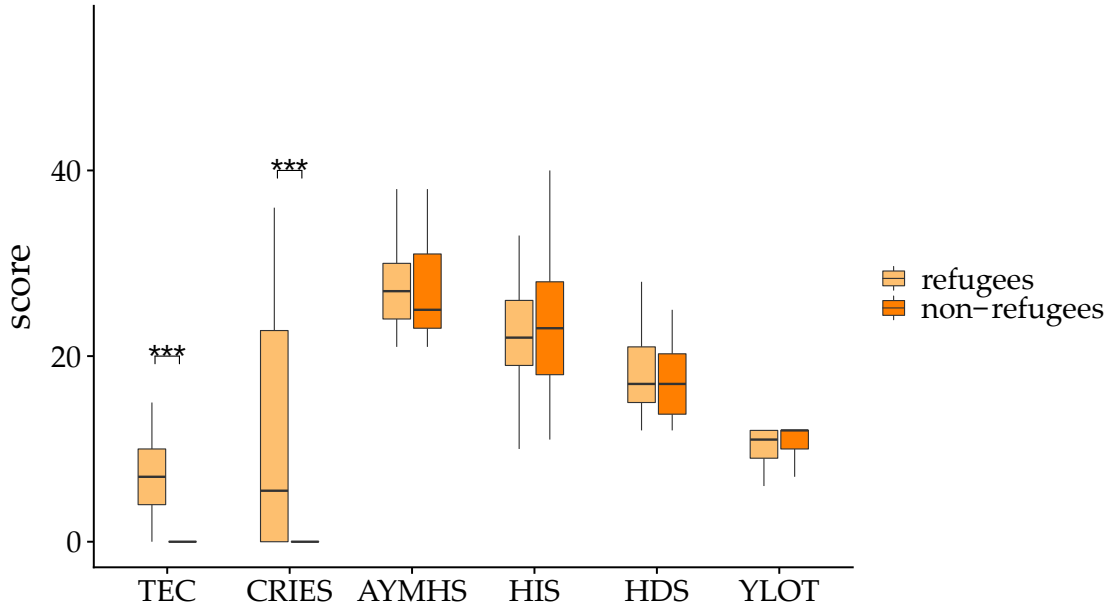

Figure 3.2 Trauma, mental health, and wellbeing questionnaire scores

TEC = Traumatic Events Checklist (caregiver reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale, YLOT = Youth Life Orientation Test (optimism score). Error bars represent 95% confidence intervals, *** $p < .001$

Table 3.1 Refugee and non-refugee children questionnaire outcomes

Variable	Refugees			Non-refugees				
	n	*M*	*SD*	*n*	*M*	*SD*	*U*	*p*
Age	71	9.23	1.73	63	9.04	1.57	2055.00	.41
Poverty	48	0.32	0.22	59	0.37	0.42	1253.00	.30
TEC	71	6.65	3.77	63	0.37	1.29	358.00	< .001
CRIES	70	10.79	11.64	62	2.81	8.37	1264.00	< .001
AYMHS	67	27.70	5.82	63	27.68	6.07	2029.00	.70
HIS	63	22.64	5.93	57	23.60	6.30	1644.50	.43
HDS	65	17.83	5.22	60	17.93	4.14	1842.00	.59
YLOT	71	10.28	2.00	63	10.83	1.75	1877.00	.09

M = mean, *SD* = standard deviation, TEC = Traumatic Events Checklist (parent reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale, YLOT = Youth Life Orientation Test (optimism score).

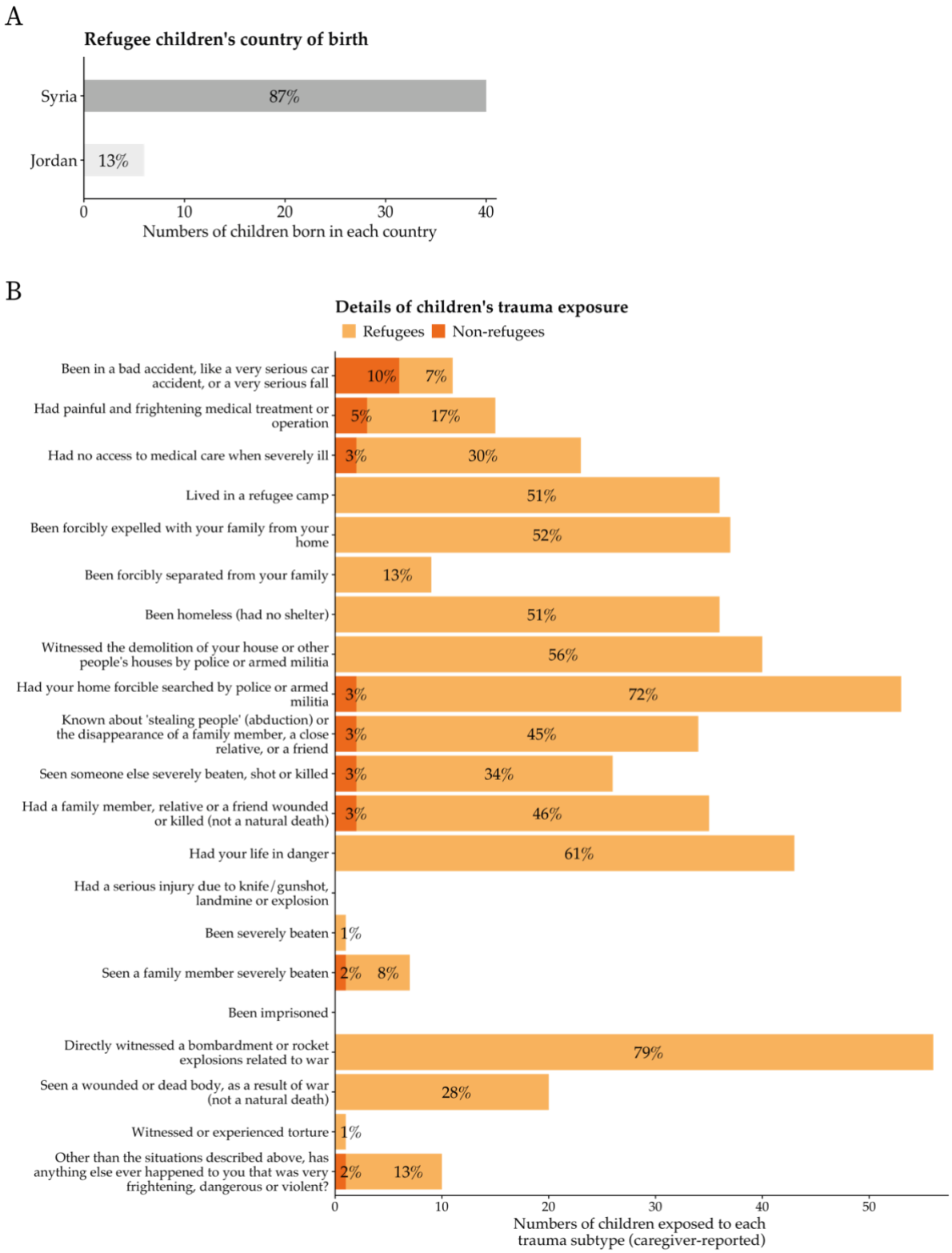

Figure 3.3 (A) Numbers and percentages of refugee children born in Syria and Jordan, (B) Details of the traumatic events experienced by the children, reported by the caregiver (Traumatic Events Checklist questions).

3.4.2 Emotion recognition bias

3.4.2.1 Happy – Sad

One outlier >3SD from the mean was removed from the analysis. The univariate ANOVA showed no significant effect of group on the HS bias, $F(1, 130) = .21$, $p = .65$, $\eta_p^2 = .002$, indicating that all children showed similar biases in emotion recognition regardless of their refugee status. One-sample t-tests showed that both refugee and non-refugee children were significantly biased towards perceiving neutral expressions as sad, $t(131) = -8.66$, $p < .001$ (Figure 3.4A & 3.4C), although Cohen's effect size value ($d = 2.22$) suggests a small practical significance.

Mann - Whitney *U* test on the slope of the psychometric function in the HS dimension showed no significant effect of group, $U = 1955.50$, $p = .48$, suggesting that refugee and non-refugee children were similar in their ability to discriminate between each step of the morphed stimuli (Figure 3.4D).

Linear regressions showed that HS bias and HS sensitivity were not significantly predicted by trauma, PTSD symptoms, anxiety/depression symptoms, insecurity, distress, and optimism ($p > .05$). All linear regression results are presented in Appendix A (Table 2).

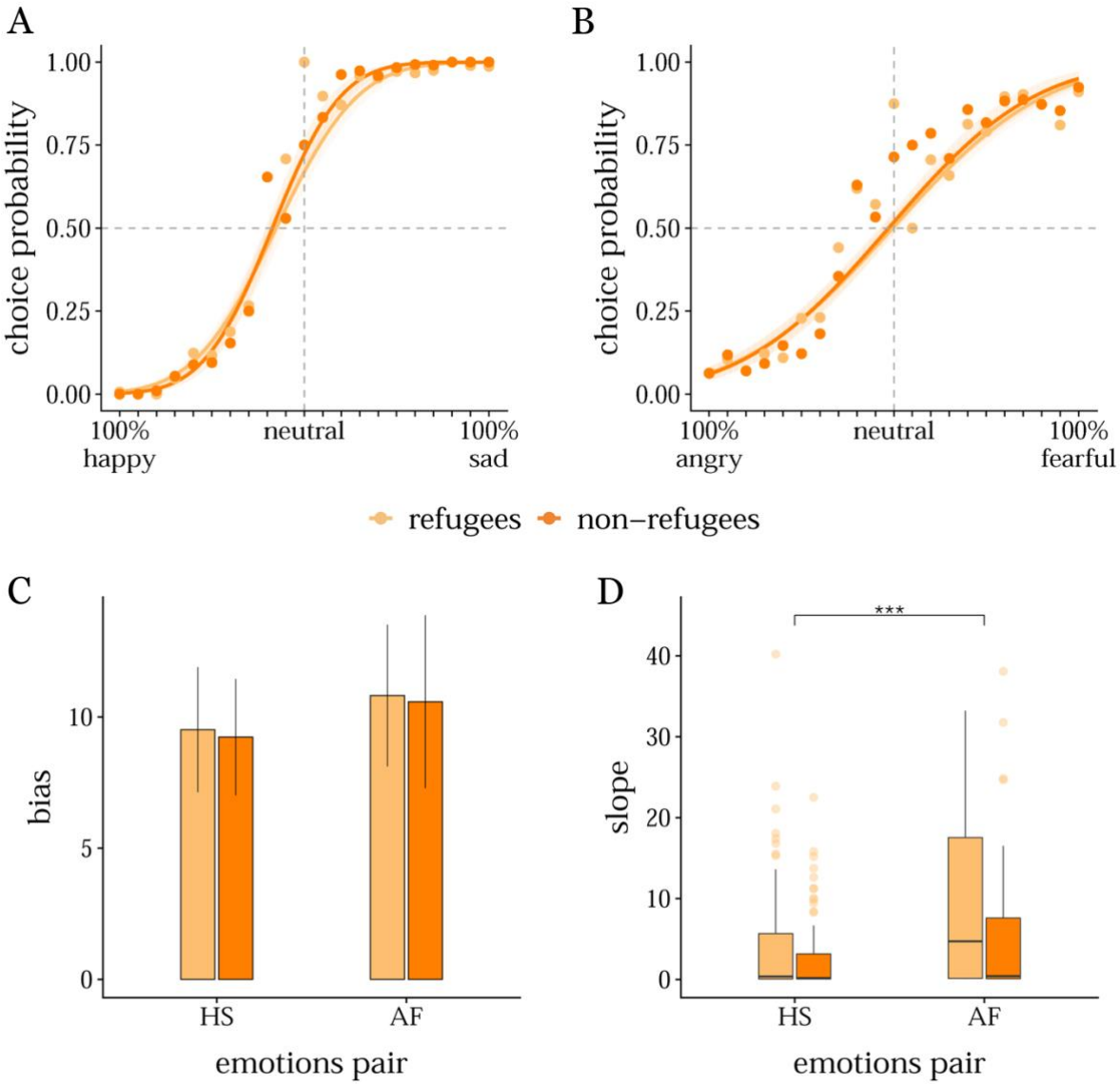

Figure 3.4 Emotion recognition task results

Average psychometric functions for happy – sad **(A)** and angry – fearful **(B)** tasks presented separately for refugee (peach) and non-refugee (orange) children. **(C)** Average bias for happy – sad and angry – fearful for refugee and non-refugee children. Error bars represent standard deviation below and above the mean. **(D)** Happy – sad and angry – fearful sensitivity (slope) for refugee and non-refugee children. Error bars represent 95% Confidence Intervals. *** $p <$ .001.

3.4.2.2 Angry – Fearful

The univariate ANOVA showed no significant group effect on the AF bias, $F(1, 102) = .16$, $p = .69$, $\eta_p^2 = .002$, suggesting that all children showed similar biases in emotion recognition regardless of their refugee status. One-sample t-tests showed no significant bias towards either emotional expression, $t(103) = -1.01$, $p = .32$, Cohen's $d = 2.99$ (Figure 3.4B & 3.4C), suggesting that children were not biased to perceived neutral faces as either angry or fearful.

Mann - Whitney *U* test of the AF sensitivity showed no significant effect of group, $U = 1042.00$, $p = .06$, despite refugee children having a slightly shallower slope (mean rank = 57.20) than non-refugee children (mean rank = 46.27), indicating worse discrimination between morphed stimuli. AF sensitivity values are presented in Figure 3.4D.

Wilcoxon Signed – Rank test showed a significant difference between HS and AF pairs in sensitivity $Z = -3.762$, $p < .001$, suggesting that children were better at discriminating between the happy – sad compared to angry – fearful morphed stimuli (Figure 3.4D).

A linear regression showed that optimism scores significantly predicted AF bias outcomes, $F(1, 102) = 23.74$, $p < .001$, $R^2 = .19$, $b = -.72$, where higher optimism indicated higher likelihood of perceiving neutral faces as fearful rather than angry (Figure 3.5). This result remained significant after Holm – Bonferroni correction for multiple testing ($p < .001$). We also found that AF slope was significantly predicted by trauma score, $F(1, 101) = 5.37$, $p = .022$, $R^2 = .05$, $b = .47$, with higher trauma indicating shallower slopes (i.e. worse discrimination performance). However, this association did not survive multiple testing corrections ($p > .05$). Internalising and PTSD symptoms, insecurity, and distress did not significantly predict AF bias or slope ($p > .05$, Appendix A Table 2).

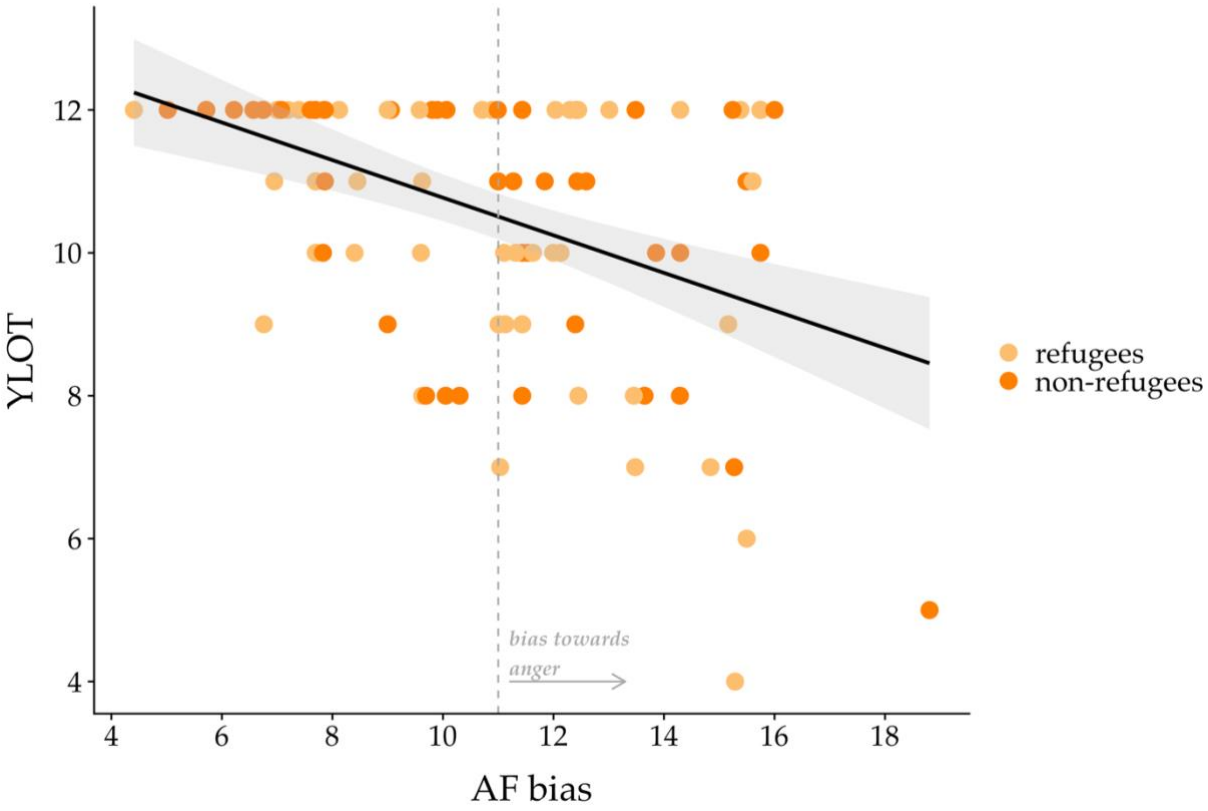

Figure 3.5 Association between optimism scores and angry – fearful bias for refugee and non-refugee children

R^2 = .19. Higher AF biases (>11) indicate a bias towards perceiving neutral faces as angry. Vertical dashed line represents neutral expression (no bias). YLOT = Youth Life Orientation Test (optimism score).

3.5 Discussion

This study had four aims: 1) to establish if refugee children displayed higher trauma exposure, PTSD and internalising symptoms, insecurity, and distress, and lower levels of optimism than non-refugee children; 2) to test if refugee children showed an increased emotion recognition bias towards sad and angry faces respectively; 3) to determine if refugee children displayed poorer discrimination between emotional expressions than non-refugee children; and

4) to establish if emotion recognition biases were significantly linked to trauma and psychopathology in all children.

3.5.1 Trauma and mental health

As expected, we found that refugee children had experienced a significantly higher number or traumatic events, as reported by the caregiver, as well as more (self-reported) PTSD symptoms than non-refugee children. The number of traumatic events experienced was significantly predictive of PTSD symptoms, which is consistent with previous studies of refugee children and youth (Sirin & Rogers-Sirin, 2015). Surprisingly however, symptoms of anxiety/depression, feelings of insecurity and distress, and optimism, were not associated with trauma scores and were similar across both groups. This is contrary to previous findings, which show that refugee children report more psychopathology symptoms and lower wellbeing than non-refugee children (Henley & Robinson, 2011), as well as that war trauma is directly linked to their mental health outcomes (e.g., Jabbar & Zaza, 2019; Karadag & Ogutlu, 2021). It is possible that trauma scores reported by the caregivers do not reflect children's conscious experiences of traumatic events, and therefore the trauma might not significantly impact on their reports of mental health outcomes other than PTSD symptoms. For instance, previous research suggests that primary school refugee children report fewer war-related traumatic events than their caregivers (Goldin et al., 2003). However, due to the distressing nature of the trauma checklist many studies consistently use caregiver-reports of trauma exposure in studies of vulnerable underage populations (e.g., Bean et al., 2006; Hall et al., 2014).

3.5.2 Emotion recognition

Contrary to our second hypothesis, all children showed similar biases in emotion recognition: both refugee and non-refugee children were biased towards perceiving neutral

faces as sad on the HS dimension and displayed no bias towards either angry or fearful expressions on the AF dimension. Furthermore, trauma scores were not significantly associated with emotion recognition biases. These results differ from previous reports that children with a history of early adversity tend to overidentify angry facial expressions (Pollak et al., 2000; Pollak & Kistler, 2002; Pollak & Sinha, 2002). However, it is worth noting that previous research on adversity and emotion processing in children focused mainly on childhood maltreatment, whereas the effects of war trauma and displacement on emotion processing are largely unknown. It is likely that traumatic events related to war might have a different impact on children's perception of emotions than other forms of adversity. Indeed, studies show variability in emotion processing abnormalities between children exposed to physical abuse and physical neglect (Pfaltz et al., 2019), and the dimensional model of adversity and psychopathology emphasises differences in neurodevelopmental mechanisms affected by *threat* versus *deprivation* (McLaughlin et al., 2014). In line with this, a recent study on emotion recognition accuracy in refugee youth showed poorer recognition accuracy only for happy and sad expressions (Gredebäck et al., 2021) whereas previous research on maltreated children reports abnormalities in the perception of anger (e.g., Pollak & Kistler, 2002). Taken together, these results suggest that war-related trauma might have different effects on affective development compared to childhood abuse or neglect.

Although PTSD symptoms, internalising symptoms, insecurity, and distress were not linked to emotion recognition biases, surprisingly, we found that optimism scores *were* significantly associated with the anger bias, where lower optimism was associated with an increased bias towards perceiving neutral faces as angry. Higher optimism has previously been linked to a lower threat bias in an emotional words Stroop task in young adults (Karademas et al., 2007), and optimism scores seem to play a role in affective working memory capacity (Levens & Gotlib, 2012). Optimism scores in the current study could be an indication of

resilience and higher wellbeing (Carver et al., 2010; Hall & Pearson, 2005), suggesting that positive thinking might be a protective factor against the effects of war trauma and displacement. Optimism is also indicative of more beneficial coping strategies (Carver et al., 2010), healthier emotion regulation skills (Ghiasi et al., 2016; Larcom & Isaacowitz, 2009), lower psychological distress (Chasson et al., 2021; Ghiasi et al., 2016), as well as moderating effects of adversity on depression and PTSD outcomes among adults (Kleiman et al., 2015; Kucmin et al., 2018), although further research is needed to establish if similar associations are present in children. Optimism and flexible thinking and coping strategies could also improve resilience and can be learned by both adults and children (Hall & Pearson, 2005), therefore making it a potential intervention target for refugee populations.

Finally, refugee children displayed worse discrimination between the angry and fearful expressions than non-refugee children, although this group difference did not reach statistical significance. We also found a trend between higher trauma scores and worse discrimination on the AF task. This trend suggests that war-related trauma and refugee status might impact children's perceptions of anger or fear, and this potential association should be further investigated. It is possible that war trauma might be linked to worse discrimination abilities between threatening and fearful stimuli, rather than to a specific perceptual bias towards either facial expression. These results align with previous research showing that neglected, but not abused children, had more difficulty in differentiating between angry and fearful emotions than children without a history of early adversity (Pollak et al., 2000), emphasising the differences between the effects of threat and deprivation in affective processing. We also found that the children were better at discriminating between the happy-sad morphed faces, than the angry-fearful morphed faces. This may reflect the fact that happiness and sadness are clearly distinct emotions (positive v negative), whereas anger and fear are both negative emotions making

them more difficult to differentiate. Further research could investigate perceptions of anger and fear with more nuanced approaches, for instance when paired with neutral or positive expressions, to be able to infer if an anger bias is indeed present in refugee children.

3.5.3 Limitations

The current findings should be interpreted in light of several limitations. Firstly, the task in the current study relies heavily on the participating children's understanding of each emotion. The necessary conceptual, semantic, and language requirements of the task limit our interpretation of the results, since we cannot disentangle perceptual and conceptual limits. Including a measure of emotion identification which bypasses the need for emotional labelling, such as comparing a target facial expression to expressions from two ends of the continuum (e.g., Pollak & Kistler, 2002), removes some of the semantic limits. It is also possible that whilst war trauma does not affect children's affective perception, it might affect other cognitive aspects of information processing, such as attention. For instance, children with a history of early adversity tend to display increased sustained attention and hypervigilance to threat (e.g., Briggs-Gowan et al., 2015; Pollak & Tolley-Schell, 2003), with similar abnormalities reported for psychopathology such as anxiety and PTSD (e.g., Armstrong & Olatunji, 2012). Attention patterns during affective processing could be further explored in refugee populations as well.

Secondly, the choice of stimuli might not be the best to measure the impact of war and displacement related trauma. Whilst most studies on childhood maltreatment use facial expressions as stimuli since this type of adversity reflects interpersonal relationships, perhaps a more fitting stimulus for refugee children could include emotionally loaded images that are not based on facial expressions of emotions. For instance, McCoy and others showed a link between a negative attention bias and neighbourhood crime using affective images, such as

pictures of weapons, instead of facial expressions in a version of a dot-probe task (McCoy et al., 2016), although this type of stimulus is not appropriate for use in young refugee children. Furthermore, the emotional expressions used in the task were not presented by Middle Eastern actors and might not be representative of emotional expressions usually encountered by Syrian and Jordanian children. Therefore, the bias results could have been influenced by the *other race effect* (poorer recognition of faces of different ethnicities). However, as we were interested in differences in emotion recognition biases across groups, any *other race effect* should affect refugee and non-refugee children equally. Nonetheless, future studies should use stimuli with Middle Eastern actors or include emotion recognition accuracy validation studies to rule out potential confounds.

Finally, the testing environment could affect children's performance on behavioural tasks. Laboratory conditions used in the majority of studies allow for undisturbed and noise-free testing, whereas children in the current study completed assessments in their homes, schools, and community centres, with different levels of noise and distractions. Further research should aim to eliminate variability in testing conditions to allow comparison of the impact of war-related trauma with other types of adversity.

3.5.4 Conclusion

In conclusion, we found that both refugee and non-refugee children display an emotion recognition bias towards sad expressions, and that lower optimism scores were linked to an increased bias towards angry expressions. Although we did not find significant group differences, nor significant effects of trauma and psychopathology on emotion recognition, trend results suggest that refugee status and war-related trauma might have an influence on discrimination abilities between angry and fearful facial expressions. Our findings highlight

that war trauma and displacement differ from other forms of early adversity, and future studies could further investigate the cognitive mechanisms of affective processing in refugee children using more nuanced methodology, such as attention allocation. Attention patterns measurements might shed more light on cognitive processes occurring *prior to* (and possibly influencing) the conscious recognition of emotions, as well as provide information on affective processing mechanisms in a more natural settings (e.g., attending to multiple emotions at the same time).

Chapter 4 - War-related trauma linked to increased sustained attention to threat in children[2]

4.1 Abstract

Experiences of war and displacement can have profound effects on children's affective development and mental health, with studies indicating increased symptoms of depression, anxiety, and PTSD, as well as emotional and behavioural problems amongst refugee children. Despite recent increases in research on the relationship between war trauma and psychopathology in children, the mechanism(s) underlying these effects remain unknown. The current study investigated the association between war and displacement related trauma and attention to affective stimuli in Syrian refugee (n = 31, M_{age} = 9.55, 12 female) and Jordanian non-refugee (n = 55, M_{age} = 9.98, 30 female) children living in Jordan. We used a free-viewing, eye tracking paradigm to measure children's visual attention to emotional facial expressions, and self-reported validated questionnaires were used to assess PTSD symptoms, internalising symptoms, insecurity, and distress. Child traumatic experiences were reported by the caregivers. We found that refugee children showed greater initial avoidance of angry and happy faces compared to non-refugee children, and that higher trauma exposure was linked to increased attention to angry stimuli. These findings suggest that war-related trauma may have differential effects on the early and later stages of affective processing in refugee children and indicate atypicalities in attention to threat in this population.

[2] Contents of this chapter have been previously published in the *Journal of Child Development*: Michalek, J.E., Lisi, M., Binetti, N., Ozkaya, S., Hadfield, K., Dajani, R., & Mareschal, I. (2022). War-related trauma linked to increased sustained attention to threat in children. *Child Development*. https://doi.org/10.1111/cdev.13739

4.2 Introduction

4.2.1 Early adversity and emotion processing

Early adversity, such as childhood maltreatment, is linked to abnormalities in affective processing including altered emotion regulation and recognition (Berzenski, 2018; Pollak, 2012). Children who experienced early adversity often display atypical attention allocation to negative emotional stimuli. For instance, young children who had experienced family violence responded more quickly to angry facial expressions in an emotional dot-probe task (Briggs-Gowan et al., 2015), and abused children made fewer errors when responding to anger in a Go/NoGo task (Pollak et al., 2001). Maltreated children also showed heightened attention to angry faces compared to controls, even when instructed to ignore them (Shackman et al., 2007), and physical abuse has been linked to difficulties in disengaging from threatening facial expressions (Pollak & Tolley-Schell, 2003).

Pollak (2012) proposed that this increased attention to anger may reflect a useful short-term adaptation in response to adverse and unsafe environments. For example, abusive mothers tend to display atypical facial expressions of anger, which may result in children's heightened responsivity to negative emotions (Shackman et al., 2010). However, this constant vigilance to threat may impair social functioning in the long run and become a potential cause for maladaptive and aggressive behaviours, as well as subsequent psychopathology in childhood and adolescence (Harms et al., 2019). Although the majority of studies report attention *towards* negative stimuli, Pine et al. (2005) report that children who experienced severe domestic abuse displayed attentional *avoidance* of threatening faces. This bias was only observed in physically maltreated but not neglected children, suggesting varying patterns of affective development for different types of childhood adversity. This is consistent with the dimensional model of

adversity and psychopathology (DMAP) which proposes that different neurodevelopmental mechanisms are activated by deprivation and by abuse which could lead to different mental health and behavioural outcomes (McLaughlin et al., 2014). It is also possible that different types of childhood adversity affect different *stages* of information processing (i.e., the initial detection of threat versus the subsequent attention/avoidance of it).

4.2.2 Psychopathology and atypical emotion processing

Psychopathology is also often associated with atypical emotion processing. For example, anxiety disorders and PTSD are often characterized by increased attention to threat stimuli such as angry faces (Dalgleish et al., 2001; Roy et al., 2008), with studies reporting both hypervigilance and sustained attention (Armstrong & Olatunji, 2012; Dudeney et al., 2015). In line with both the *vigilance* and *maintenance* hypotheses of anxiety (Weierich et al., 2008), these types of attentional biases might increase state and trait anxiety and contribute to the maintenance of the disorder (Cisler & Koster, 2010).

Children at risk for- or diagnosed with- depression display increased attention towards sad and fearful stimuli (Romens & Pollak, 2012; Tsypes et al., 2017), and neuroimaging studies reveal atypicalities in brain activity during the presentation of sad stimuli in preschool children at risk for the disorder (Barch et al., 2012). The increased maintenance of attention on dysphoric stimuli is consistent with the cognitive model of depression (Beck, 1976) and indicates links to negative affect and maladaptive cognitive patterns present in the disorder (Peckham et al., 2010). However, differences in attentional responses associated with depression in childhood also vary across different studies (Gibb et al., 2016) and these discrepancies suggest that attention patterns may vary depending on the processing stage, the type of stimuli and task, as well as the youth's developmental stage, and their psychopathology.

4.2.3 Refugee children: linking adversity, mental health, and affective processing

Many child refugees experience a variety of extremely traumatic events (Khamis, 2019), and high rates of war trauma exposure and displacement-related experiences are a major risk factor for child behavioural problems (Bryant et al., 2018). Indeed, high rates of post-traumatic stress disorder (PTSD), anxiety, depression, and high psychopathological comorbidity, as well as poorer physical health are regularly reported by refugee children and adolescents (Yayan et al., 2020). Refugee children's adverse experiences may also affect their overall wellbeing and psychosocial functioning, as reported using human insecurity and distress scales (e.g., Panter-Brick et al., 2018; Ziadni et al., 2011).

Although poorer mental health is well documented in refugee children, much less is known about co-occurring cognitive and affective impairments, which might significantly influence or moderate behavioural and wellbeing outcomes in these children. A recent study of Syrian refugee children and adolescents showed a significant link between greater difficulties in emotion regulation and higher trauma exposure and PTSD symptoms (Khamis, 2019). Similarly, a study on Korean refugee adolescents showed that emotion regulation may act as a mediator between early life trauma and mental health (Lee et al., 2020), which emphasizes the impact of war on affective processing. Furthermore, Afghan refugee adolescents with a history of trauma and high levels of PTSD showed impairments in affective working memory capacity (Mirabolfathi et al., 2020), indicating that cognitive processing as well as emotion regulation may be disturbed by early adversity. Taken together, these findings suggest that affective processing in general may be impaired in refugee children which might in turn play an important role in maintaining the association between trauma exposure and psychopathology.

4.2.4 Attention allocation measure using eye tracking

The majority of research conducted on attentional biases in children with a history of early adversity or mental health problems employed cognitive paradigms relying on reaction times and percent correct measures, such as the dot-probe task (Mogg & Bradley, 1998) and the emotional Stroop task (Williams et al., 1996). However, these tasks rely on children actively tracking and responding to stimuli, which does not give insight into how children may *naturally* distribute their attention.

One method which bypasses these issues is eye tracking which records where a person looks on an image or video with very high spatial and temporal accuracy and is often used as a proxy for attention. In free viewing eye tracking procedures, it provides a more "natural" index of attention, since participants are not given a task. It also minimizes the need for language or semantic knowledge which is particularly beneficial in studies with young and vulnerable populations. Free viewing tasks also allow for presentation of more complex stimuli, such as video clips or images of scenes, where it is possible to measure the child's distribution of attention to multiple different stimuli within individual frames (e.g., Rider et al., 2018). Eye tracking has been used not only to investigate how gaze patterns are distributed on basic visual tasks, but also to examine psychological and behavioural traits. For example, it has been used to explore attentional patterns in individuals with symptoms of anxiety and depressive disorders, linking initial orienting of attention and sustained attention to specific types of stimuli (e.g., threatening objects) to different psychopathological states (e.g., Kaiser et al., 2019; Lee & Lee, 2013; Michalska et al., 2017). Hence, eye tracking provides a precise, non-invasive, and dynamic, real-time measure of gaze during stimulus presentation which is linked to attentional patterns or biases in children (e.g., Owens et al., 2016).

4.2.5 This study

Attention biases in children with a history of early stress and mental health problems have been studied extensively, however this aspect of affective processing has not been explored in displaced refugee children, a group who are at a substantially increased risk for psychopathology. Similarly, although war trauma and displacement negatively influence mental health and wellbeing (Yayan et al., 2020), we do not know which cognitive mechanisms link war trauma exposure to this increased vulnerability. Therefore, our aim was to explore the relation between war-related adversity, attentional biases to affective stimuli, and mental health outcomes in 7-11-year-old refugee and non-refugee children living in Amman, Jordan. Based on previous research we hypothesised that 1) refugee children will have higher scores on measures of trauma exposure (caregiver-reported), post-traumatic stress symptoms (PTSS), anxiety/depressive symptoms, insecurity, and distress (all child-reported) than non-refugee children; 2) refugee children will spend significantly more time attending to angry and sad facial expressions than non-refugee children; and 3) the proportion of time spent attending to negative emotional faces will be positively associated with trauma exposure, anxiety/depression, PTSS, insecurity and distress in all children.

4.3 Methods

4.3.1 Participants

Participants (N = 86) were Syrian refugee (n = 31; M_{age} = 9.55, SD = 1.84; 12 female) and Jordanian non-refugee children (n = 55; M_{age} = 9.98, SD = 1.78; 30 female) aged between 7 and 11 years, living in Amman, Jordan. Children were recruited through a non-profit organisation (We Love Reading, Taghyeer), collaborating with the Zaha Culture Centre in the

Al Zohour neighbourhood of Amman. Testing took place at the Zaha Culture Centre, which advertised the study to local parents of refugee and non-refugee children. Caregivers of children taking part in the study were given the trauma events checklist while their children completed the behavioural tasks and the survey measures. Data collection took place in March 2020.

4.3.2 Demographics, trauma, and psychopathology

Trauma, mental health, and demographics were measured using questionnaires which were originally developed in Arabic or adapted to Arabic. Questionnaires were administered by Arabic-speaking fieldworkers using the Qualtrics Offline Application on a portable laptop (Qualtrics, Provo, UT). Demographic information collected included age, gender, and dependency ratio which was calculated as *number of dependents* / *number of non-dependents* for each household (i.e. number of individuals who do not provide income divided by number of individuals who provide income), and was used as the poverty measure, where a higher dependency ratio indicates higher poverty. In this study, the information on country of birth and the proportion of life spent outside of Syria were not available for refugee participants.

Trauma exposure was measured using the 21-item Traumatic Events Checklist (TEC; (Panter-Brick et al., 2009) which assesses war trauma exposure. Parents answered yes or no about their child's exposure to traumatic events such as having lived in a refugee camp, having witnessed torture, or having their home forcibly searched by the police or an armed militia. This questionnaire was administered to caregivers about the child's exposure, due to the challenging nature of the questions. Children with TEC scores of 1 and above (i.e., they had experienced at least one traumatic event as reported by the caregiver) were asked if they remembered any traumatic experiences. Those children who were able to recall any traumatic

experiences (refugees *n* = 11, non-refugees *n* = 18) were assessed for PTSS using the Child Revised Impact of Events Scale (CRIES 8; Perrin et al., 2005), administered to the participants. No single traumatic event was specified to the children. Children with TEC scores of 0 (their parent or caregiver indicated that the child had experienced no traumatic events), and those who did not recall any traumatic events were excluded from the measure. CRIES measures symptoms of PTSD (described in detail in Chapter 3) and showed good internal reliability Cronbach's α = .87).

Child self-reports of depression and anxiety symptoms were measured using the Arab Youth Mental Health Scale (AYMH; Mahfoud et al., 2011), which is described in detail in Chapter 3 and showed good reliability in this sample (Cronbach's α = .74).

The Human Insecurity and Distress Scale (HIDS; Ziadni et al., 2011), described in Chapter 3, was used to assess two separate constructs: insecurity (10 items, Cronbach's α = .78) and distress (12 items, Cronbach's α=.80).

4.3.3 Attention bias

4.3.3.1 Stimuli & procedure

We used adult and child faces as stimuli but were unable to find a database with images of Arabic children's faces, consequently we used Caucasian faces for both the adult and child stimuli. The stimuli consisted of 16 photographs of 4 actors: two of the actors were adults (1 female) taken from the Radboud Faces Database (Langner et al., 2010), and two were children (1 female) taken from the Child Affective Facial Expressions (CAFE) database (LoBue & Thrasher, 2015). Each actor expressed 4 emotions: anger, happiness, sadness and neutral. We

validated the stimuli in an independent convenience sample of Arabic children living in Palestine (N = 21, aged 8–10 years old) via an online study using Qualtrics, with good recognition accuracy for all emotional expressions (angry = 90%, happy = 100%, neutral = 73%, sad = 82%), and no significant differences in emotion recognition accuracy between child and adult actors' expressions (all $p > .05$). The stimuli were in colour and displayed on a white background using Matlab (Mathworks, version 2018b) and Psychtoolbox-3 (Brainard, 1997) routines on two Dell laptop computers with a screen resolution 1366 x 678 (59 participants completed the tasks on a 31cm screen laptop, and 27 participants completed the task on a 29.5cm screen laptop). Eye movements were recorded using a Tobii Eye Tracker 4C mounted onto the screen with a sampling rate of 90hz and children sat approximately 57 cm from the screen without the use of a chin rest.

The eye tracking task was a free viewing procedure (no response is required from the child) and adapted from Bodenschatz et al. (2019). It took approximately 10 minutes to complete, including instructions and gaze calibration. On each trial of the task the child saw 4 same identity faces of an actor displaying the four different emotions. Each image of the actor subtended 5.45×8.18 degrees and was displayed in a square 2×2 grid in the centre of the display. Trials were randomised in such a way that each emotional expression for each actor appeared in every corner of the grid at least once. The grid location of emotional expressions was pseudo-randomised, and trials were fully randomised between participants. Each trial began with a fixation cross in the centre of the screen for 250ms, immediately followed by the presentation of the 4 faces grid displayed for 4000ms (Figure 4.1A). The adult and child stimuli were run in separate blocks of 32 trials each and were counterbalanced across children.

Prior to each block, the child's gaze was calibrated using a 9-point display using small images of dinosaurs to ensure accuracy of the eye gaze recordings. If the calibration was

deemed too noisy (by visual inspection), it was repeated until successful. After calibration, the children were instructed to simply look at the images on the screen however they wanted ("free viewing", no responses required) and to stay as still as possible.

4.3.3.2 Eye gaze processing

Regions of interest (ROIs) were defined using Matlab by drawing 4 squares around each of the four photographs (face + background), separately for the two testing laptops. Data from the two laptops was combined and we pooled data from ROIs for each emotion across all trials, separately for the adult and child actors. We measured two eye gaze parameters: 1) *dwell*: the proportion of all gaze position samples located within each emotion ROI averaged across the trials, and 2) *entry time*: the average time taken from the start of each trial to the onset of the first 100ms fixation in each emotion ROI. *Dwell* provides information about sustained attention (late attentional stage) and *entry time* indicates initial attention allocation (early attentional stage). Sample raw gaze data from one child's trial, superimposed on the stimuli from that trial is presented in Figure 4.1B.

There is usually some data loss with eye tracking studies, because of environmental conditions and/or the participant briefly looks off screen. In our study, trials with over 50% of missing data (i.e., 11ms samples falling outside of the computer screen or not recorded by the eye tracker, which comprised 1.6 trials on average across the study), and children with over 50% of missing trials (refugees n = 4, non-refugees n = 1) were excluded from the analysis. With presentation time of 4 seconds the inclusion of a small number of trials with 50% missing data provides 2 seconds of gaze recordings, which is sufficient for capturing eye movements across all 4 regions of interest. The number of missing data (invalid samples) of each participant did not vary as function of group (refugee v non-refugee) or any other variables of interest (all

$p > .05$). As there were no significant differences in children's data using either the child or adult actors (entry time and dwell $p > .05$), all subsequent analyses were conducted on the adult and child conditions combined.

4.3.4 General procedure

Caregivers of refugee and non-refugee children taking part in the study completed the trauma questionnaire (TEC), which asked about their children's experiences. After receiving consent forms from the parents (written or verbal), children completed the computer eye-tracking tasks and self-reported questionnaires (demographics, PTSD symptoms, internalising problems, insecurity, and distress).

4.3.5 Ethics

The project was granted ethical approval from the Queen Mary University of London research ethics board in 2018 (QMERC2018/54). Parents or guardians gave their informed consent prior to children taking part. Before and during the testing, children were asked if they were happy to proceed and informed that they could stop at any time. Each child was given a sleeve of stickers, juice, and 4JOD for travel costs for the child's family.

4.3.6 Statistical analysis

To test whether eye gaze patterns differed between refugee and non-refugee children, we conducted a 2-way mixed-model ANOVA, with group as a between-subjects factor (2 levels: refugees, non-refugees) and emotion condition as a repeated within-subjects measure (4 levels: happy, angry, neutral, sad). ANOVAs were performed separately on dwell and entry time and post-hoc tests were corrected for multiple testing with the Holm-Bonferroni correction (Holm, 1979).

To compare scores on trauma, PTSD symptoms, internalising problems, insecurity, and distress between refugees and non-refugees, the groups were compared using a Mann–Whitney *U* test, as the questionnaire data was not normally distributed and used ordinal scales.

Linear regression analyses were conducted to explore the association between attention patterns (dwell and entry time) and scores on trauma. Separate multiple linear regression models were then fitted with each mental health outcome as a predictor and attention measures for each emotion as the outcome. To account for multiple testing, all regression results were corrected using the Holm-Bonferroni correction (Holm, 1979). One family of comparisons comprised of 5 tests (trauma, PTSD, anxiety/depression, insecurity, and distress) on two attention measures (dwell and entry time; therefore, the alpha threshold was set to begin at .05/10 = .005.

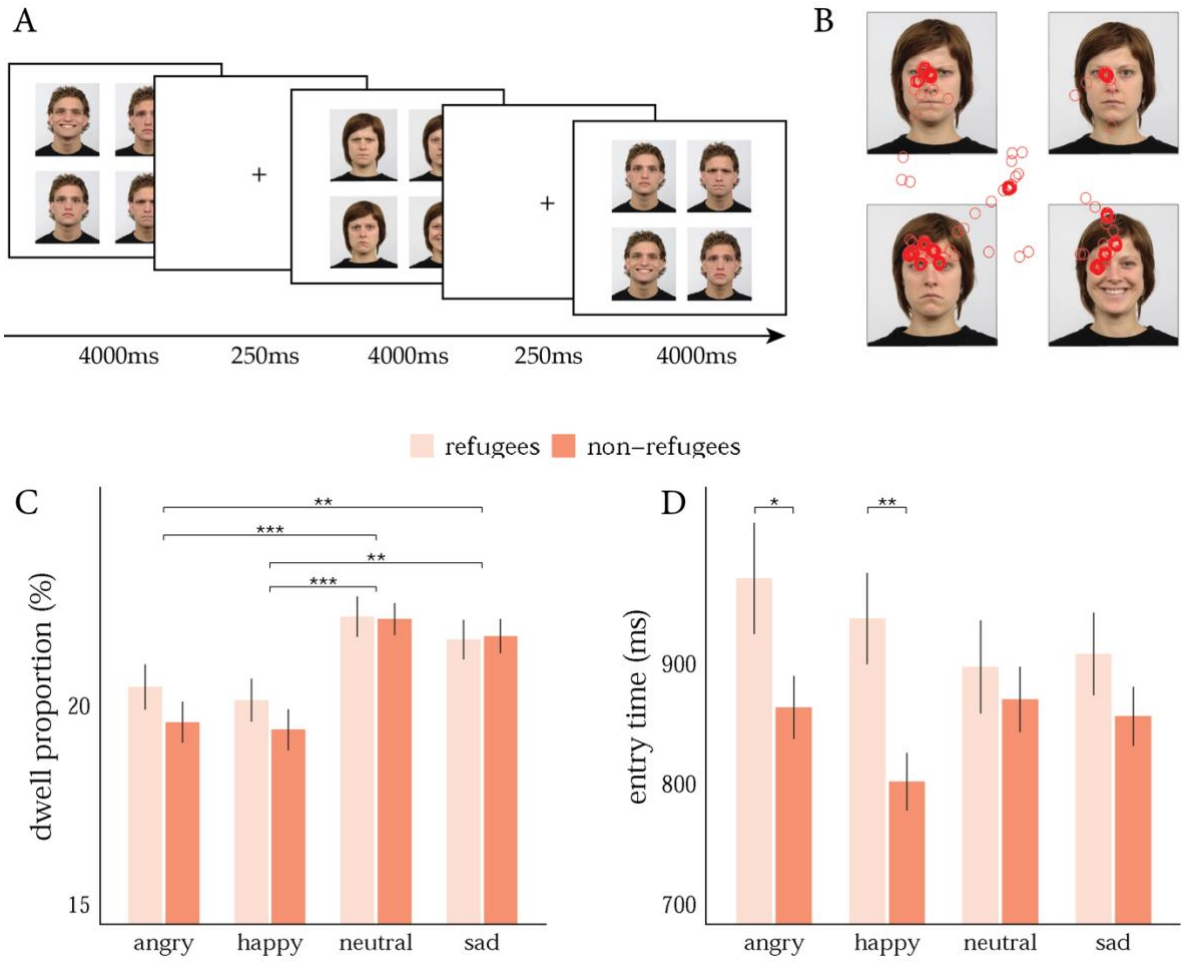

Figure 4.1 Experimental procedure and data

(A) Three consecutive trials in the adult faces block. **(B)** Example of gaze position measured during one trial, superimposed on the stimulus for illustrative purposes only. Bar plots of **(C)** average proportion of dwell and **(D)** entry time for each emotional expression separated by group. Error bars represent standard error of the mean.

*** $p < .001$, ** $p < .01$, * $p < .05$

4.4 Results

4.4.1 Trauma, PTSD, anxiety/depression, insecurity, and distress

Trauma, mental health, and demographic results are presented in Table 4.1 and Figure 4.2. The two groups did not differ in age or poverty levels ($p > .05$). As expected, we found that refugee children had experienced significantly more trauma compared to non-refugee children, $n = 74$, $U = 1119.00$, $p < .001$. Caregiver-reported trauma scores were not significantly correlated with scores on PTSS, anxiety/depression, insecurity, or distress. The details of the Traumatic Events Checklist (TEC) outcomes for all participating children are presented in Figure 4.3.

Among the children who could subjectively recall at least one traumatic event (refugees $n = 11$, non-refugees $n = 18$), there was no significant difference between refugee and non-refugee children in PTSS scores, $U = 105.00$, $p = .39$, and most children who remembered exposure to trauma did not report any PTSD symptoms (59%, $n = 17$).

Refugee children reported more anxiety and depression symptoms compared to non-refugee children, $n = 68$, $U = 685.50$, $p = .021$; however, this difference became a trend after correcting for multiple comparisons ($p > .006$). There were no significant differences between refugees and non-refugees in terms of insecurity ($n = 67$, $U = 491.50$, $p = .46$) or distress ($n = 75$, $U = 657.00$, $p = .31$).

Table 4.1 Outcomes for refugee and non-refugee groups

Characteristic	Refugees			Non-refugees				
	n	*M*	*SD*	*n*	*M*	*SD*	*U*	*p*
Age	31	9.55	1.84	55	9.98	1.78	736.50	.29
Dependency ratio	26	0.23	0.16	52	0.20	0.10	693.00	.86
TEC	26	6.38	3.10	48	1.58	2.03	1119.00	< .001
CRIES	11	6.91	8.20	18	5.78	8.18	105.00	.39
AYMHS	25	26.33	3.12	44	24.95	3.81	685.50	.02
HIS	21	20.00	6.21	46	19.65	5.48	491.50	.46
HDS	24	17.63	5.22	51	16.69	4.14	657.00	.31

M = mean, *SD* = standard deviation, TEC = Traumatic Events Checklist (parent reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale.

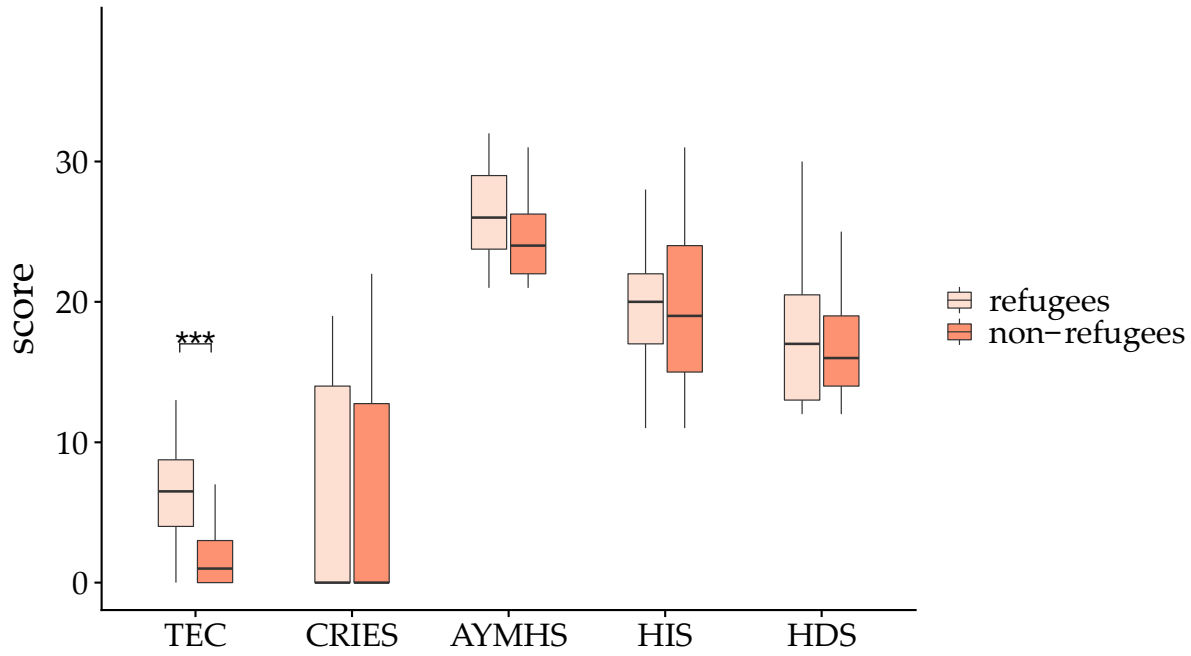

Figure 4.2 Median scores on trauma and psychopathology by group

TEC = Traumatic Events Checklist (caregiver reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale. Error bars represent 95% confidence intervals, *** $p < .001$

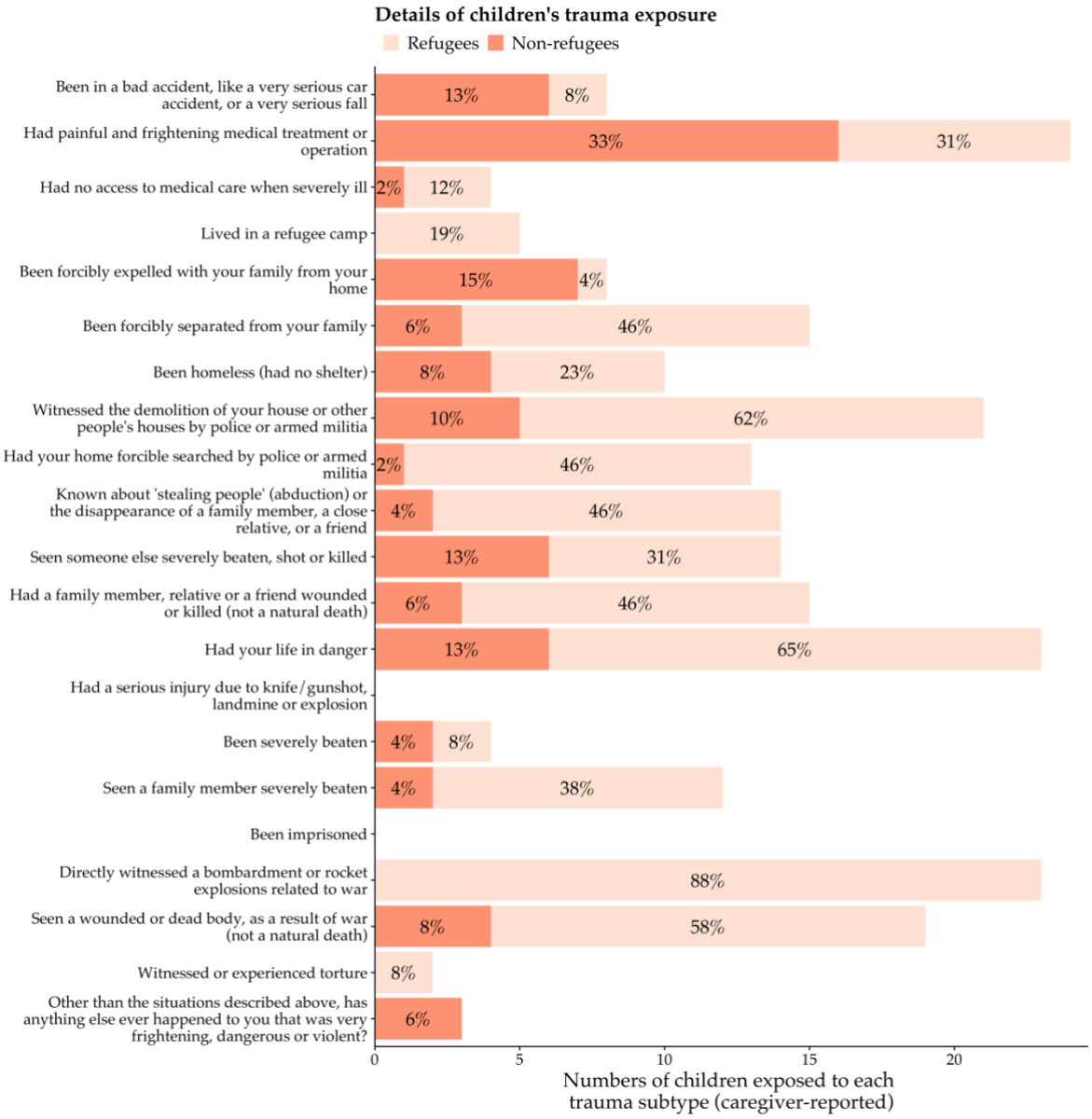

Figure 4.3 Details of the traumatic events experienced by the children, reported by the caregiver (TEC questions).

4.4.2. Dwell

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(5) = .76$, $p = .001$, Greenhouse Geisser $\varepsilon = .85$, and therefore results are reported using Huynh-Feldt correction ($\varepsilon = .89$). One outlier > 3SD from the mean was excluded from analysis. The 2 x 4

(group x emotion) mixed model ANOVA on dwell showed a significant main effect of emotion, $F(2.67, 205.30) = 11.28$, $p < .001$, $\eta_p^2 = .13$, suggesting that the proportion of dwell varied for different emotions. There was no main effect of group, $F(1,77) = .71$, $p = .40$, $\eta_p^2 = .01$, or group x emotion interaction, $F(2.67, 205.30) = .41$, $p = .72$, $\eta_p^2 = .01$, indicating that the proportion of dwell on the different emotions did not differ between refugee and non-refugee children. Post-hoc tests revealed significant differences in dwell between angry – neutral ($p < .001$), angry – sad ($p = .004$), happy – neutral ($p < .001$) and happy – sad ($p = .001$), revealing that both refugee and non-refugee children spent less time looking at angry and happy faces as compared to sad and neutral faces (Figure 4.1C & Appendix B Table 1). These results remained significant after multiple testing corrections.

Linear regression analysis (Appendix B Table 2) showed that proportion of dwell on anger was significantly predicted by trauma scores, $F(1,44) = 8.66$, $p = .005$, $b = .39$, $R^2 = .164$, indicating that the children with higher trauma scores spent more time attending to angry faces (Figure 4.4). This result remained significant after multiple testing corrections. Dwell on any emotion was not significantly predicted by any of the mental health measures.

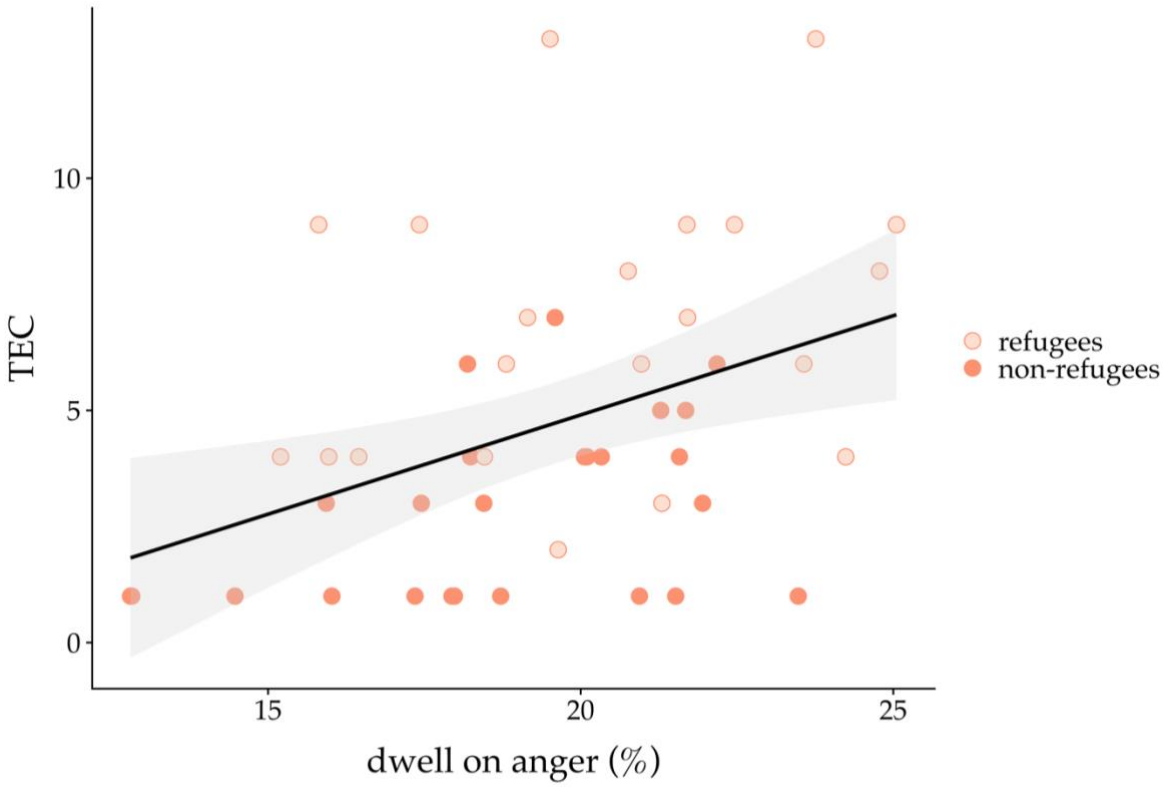

Figure 4.4 Trauma exposure (TEC) and sustained attention to angry expressions (dwell)

4.4.3 Entry time

Two outliers >3SD from the mean were excluded from the analysis. There was no significant effect of emotion on entry time, $F(3, 228) = 1.85$, $p = .14$, $\eta_p^2 = .02$. However, there was a significant effect of group, $F(1,76) = 4.09$, $p = .047$, $\eta_p^2 = .05$, revealing that refugee children took longer to attend to the stimuli than non-refugee children. There was also a significant group x emotion interaction, $F(3,228) = 3.06$, $p = .029$, $\eta_p^2 = .04$, indicating that entry times from refugee and non-refugee participants were different for different emotions. Post-hoc tests revealed differences between refugees and non-refugees in entry time for anger ($p = .033$, $\eta p^2 = .06$) and happiness ($p = .003$, $\eta p^2 = .12$); refugee children were slower to look at anger and happiness than non-refugee children (Figure 4.1D & Appendix B Table 3). These results remained significant after multiple testing corrections.

Linear regression analyses showed that trauma, internalising problems, insecurity, and distress did not significantly predict entry time on any emotions (Appendix B Table 4).

4.5 Discussion

The aims of this study were three-fold. Firstly, to investigate if early adversity negatively impacts mental health in displaced refugee children in Jordan; secondly, to examine if refugee children attend to negative faces more than non-refugee children; and thirdly, to measure whether increased attention to negative emotional faces was associated with poorer mental health and higher trauma exposure across all children.

4.5.1 Trauma and mental health

As predicted, we found that refugee children experienced more traumatic events related to war and displacement than non-refugee children. Refugee children also reported more internalising problems, related to anxiety and depression, than non-refugee children. Surprisingly, they had lower scores for PTSD symptoms severity, as well as for feelings of insecurity and distress than previously reported using the same measures, (e.g., Panter-Brick et al., 2018) and these scores did not differ between our groups. There are a few reasons why the refugee children may have had lower symptom severity than previously reported. Firstly, Khamis (2019) reports that time spent living in a host country significantly reduces PTSD symptoms in Syrian refugee children and adolescents. Furthermore, while mental health outcomes were reported by the children, trauma was reported by the caregiver, and many

children did not recall the caregiver-reported traumatic events. Considering that, for instance, paediatric PTSD has been previously linked to trauma memory (e.g., McGuire et al., 2021), the lack of conscious trauma recall in most of the children might explain the lack of group differences in PTSD symptoms, as well as the lack of associations between parent-reported trauma scores and child-reported psychopathology. We also did not investigate severity of trauma reported, which might influence both affective processing and trauma recall. Finally, previous studies mainly investigated mental health in refugee children living in refugee camps (e.g., Sirin & Rogers-Sirin, 2015) whereas we have focused on those living outside of refugee camps; we have chosen to focus on youth outside refugee camps because 83% of refugees in Jordan live in urban areas (UNHCR, 2021b), highlighting the importance of the current environment in children's development. Taken together, our results suggest that time passed since the experience of war-related events and current living conditions may mitigate the effects of early war-related adversity on children's development. This seems consistent with recent findings in non-refugee groups that conscious, subjective recall of early life trauma is a more important factor in later mental health problems than objective records of exposure (Danese & Widom, 2020; Rivenbark et al., 2020).

4.5.2 Attention biases

Contrary to our second hypothesis, we found no differences between refugee and non-refugee children in their sustained attention (dwell time) to the emotional faces. However, both groups of children spent more time attending to neutral and sad faces compared to angry and happy faces. In this, our results differ from previous studies using different paradigms, which report that children with a history of adversity display an attention bias *towards* threatening stimuli (Berzenski, 2018; Briggs-Gowan et al., 2015). The similarities in dwell on the emotional faces in refugee and non-refugee children may reflect the lack of group differences

we found in mental health measures and poverty. This suggests that other factors might affect emotion processing more than war-related trauma, emphasising the differential influence of adversity types on outcomes such as cognitive processing and mental health (McLaughlin et al., 2014). Indeed, children exposed to different types of abuse (physical, sexual, and neglect) can display different types of impairments in emotion processing in adulthood, reinforcing the idea that adversity does not have a general effect on affective processes (Pfaltz et al., 2019).

Although there were no group differences for overall attention to threat stimuli as measured through dwell, we found that refugee children displayed increased initial avoidance of angry and happy faces, compared to non-refugee children. Threat avoidance in children after early adversity has been reported previously (Pine et al., 2005), although most findings suggest hypervigilance to threat (Briggs-Gowan et al., 2015). It is possible that the initial avoidance to angry and happy stimuli in our refugee group reflects differences in the saliency or intensity of these expressions as compared to neutral and sad faces (e.g., a general initial aversion to *intense* facial expressions). Additionally, the gaze direction of presented faces may play a role in avoidance tendency. For instance, previous findings in high and low anxious adults indicate increased avoidance of threatening faces when the stimuli gaze was directed at the participants. Interestingly, high anxious individuals displayed increased avoidance to happy faces regardless of gaze direction (Roelofs et al., 2010). However, these outcomes might vary depending on age, and considering that children tend to perceive a wider range of gaze as directed towards them (Mareschal et al., 2016), the influence of gaze direction on attention allocation might be different in children. Another possibility might be that children were able to rapidly deploy their covert attention to the emotional stimuli when they initially appeared on the screen, and then avoided the stimulus during overt attention allocation. Studies with adult participants suggest that angry faces can be accurately detected in parafoveal vision within the first 150ms

of presentation in adults (Calvo et al., 2006), although it is not clear if the same patterns can be observed in children.

As predicted in our third hypothesis, children who experienced more trauma spent more time attending to angry faces (longer dwell) irrespective of refugee status. Longer sustained dwell on the angry faces in children with higher trauma might suggest disengagement difficulties. Our findings are consistent with previous literature which highlights the effects of early adversity on increased attention to threatening stimuli (Briggs-Gowan et al., 2015; McCoy et al., 2016; Lakshman et al., 2020), and could represent a detrimental cognitive strategy leading to future emotional problems. Overall, our findings highlight differences in early and later processing stages, suggesting a differential impact of war trauma on initial orienting versus sustained attention to emotional stimuli. Further studies should explore attention biases in young refugee children as vulnerability factors for subsequent psychopathology.

4.5.3 Limitations

Several limitations should be considered when interpreting our findings. Firstly, low scores on mental health scales differentiate the current cohort from some other studies of refugee children and adolescents (Ozer et al., 2016). Although these differences might be explained by the living conditions of children in our study (resettled rather than living in a camp), this could also reflect resilience or protective factors, which we did not measure (Zwi et al., 2018). Individual, relational, and contextual resilience has been linked to better mental health outcomes in Syrian refugee youth (Panter-Brick et al., 2018), and could also play a role in children's affective processing. Indeed, caregiver's trauma, psychopathology, and parenting practices affect children's mental health outcomes, cognitive development, and emotion

regulation, both post-adoption as well as in refugee settings (Bryant et al., 2020; Eruyar et al., 2018; Koss et al., 2020; Meyer et al., 2017).

Secondly, although our findings suggest that children with higher trauma exposure may have trouble disengaging from threat, we were unable to investigate the specific mechanisms driving this process. Attentional control theory proposes that difficulties in disengaging from threat are regulated by impairments in inhibitory mechanisms, suggesting general disruptions to cognitive control (Eysenck et al., 2007). In fact, impairments in effortful control have been previously linked to attention bias to threat in healthy, non-abused children (Lonigan & Vasey, 2009), as well as to early deprivation experiences (Machlin et al., 2019). Disengagement difficulties might also be moderated by emotion dysregulation (e.g., inability to regulate emotional state by employing threat avoidance) and disturbances in emotion regulation strategies have been previously linked to both early adversity and psychopathology (Heleniak et al., 2016). Recent studies find similar emotion regulation atypicalities in war-affected refugee children and adolescents (Khamis, 2019; Lee et al., 2020). Future studies should include measures of emotion regulation strategies, as well as measures of general cognitive control, to evaluate the influence of these closely related mechanisms on attention processing.

Thirdly, anxiety disorder symptoms are usually associated with biases for anger or threatening stimuli, whereas depressive disorders have been linked to biases to sad stimuli in children living in high-income contexts (e.g., Roy et al., 2008; Tsypes et al., 2017). However, the mental health measure used to assess anxiety and depression (AYMHS) does not separate the symptoms of these two disorders, and instead provides a combined measure of internalising problems. Therefore, the current study did not have the capacity to look more finely at the association between individual negative emotional stimuli (e.g., anger and sadness) and

separate psychological states. Further research could separate these constructs to identify a more specific set of symptoms and behavioural traits that might be related to affective processing.

Furthermore, the lack of group differences in PTSD symptoms might reflect the fact that the CRIES measure in the current study pertains to *any* traumatic event. Due to the distressing nature of the questionnaire and the young age of the children, we gathered information on their PTSD symptoms only about a traumatic event they remembered. It is possible that refugee children reported their PTSS about a relatively un-traumatic experience, whilst experiencing PTSS relating to other traumatic events was not captured. This would artificially decrease their PTSD symptoms making them more similar in their reports to the non-refugee children. Given our small sample of children with PTSD, we are limited in interpreting the lack of association between trauma and PTSD in the current study. Moreover, due to small sample size overall we were unable to further explore the effects that different types of trauma may have on attention to emotional stimuli and mental health outcomes.

Finally, due to the lack of availability of Arabic faces databases at the time of the study, we used Caucasian faces which might be less common to our sample of children. However, we were interested in comparing performance between groups of Arabic children, so this potential effect of test face ethnicity should be minimal.

4.5.4 Conclusion

In conclusion, we found that refugee children displayed greater initial avoidance towards angry and happy stimuli than non-refugees and that those children who experienced more trauma dwelled on anger longer. Our findings highlight the link between war-related

trauma and emotion processing in refugee children and emphasise the difference between early and later attention stages in affective processing after adversity.

Chapter 5 - The effects of maternal trauma and psychopathology on attention biases in refugee mother-child dyads.

5.1 Abstract

War-related trauma can impact parents' mental health with potential knock-on effects for their children's mental health and emotion processing. This study therefore investigates the impact of refugee mother's trauma and mental health on their child's attentional biases to emotional stimuli. We used a modified dot-probe task to measure attention allocation to facial emotional expressions of anger and sadness in a sample of Syrian refugee children (N = 324; M_{age} = 6.25, SD = 1.20; 50% female) and their mothers (N = 324; M_{age} = 32.59, SD = 7.02). Validated questionnaires were used to assess maternal trauma, symptoms of PTSD, anxiety, and depression, as well as child internalising, conduct, and attention problems (all mother-reported). We found that both refugee children and their mothers displayed an attention bias towards angry emotional expressions only. Maternal trauma and mental health predicted child mental health outcomes, but not child attention biases. The association between maternal depression and child conduct problems was moderated by the child's attention bias to angry emotional expressions. These findings highlight the significance of maternal mental health on children's mental health and socio-emotional development and suggest that the child's attention bias might moderate the effects of maternal mental health on their behavioural problems.

5.2 Introduction

5.2.1 Early adversity, attention biases, and child mental health

Childhood adversity has been linked to disturbances in emotion processing, including heightened attention to negative stimuli, impaired emotion recognition, and emotion dysregulation, both in children and adults (e.g., Bodenschatz et al., 2019; Pollak, 2012; Pollak et al., 2000; Powers et al., 2019). More specifically, greater attention to threatening stimuli in children has been linked to childhood trauma, maltreatment, and neighbourhood crime (Briggs-Gowan et al., 2015; Lakshman et al., 2020; McCoy et al., 2016; Pollak, 2008, 2015a). Neuroimaging studies also indicate a link between early adversity and abnormalities in both structural and functional brain development associated with affective processing (Gold et al., 2016; Hart & Rubia, 2012). Generally, children with a history of adversity have smaller amygdala volumes and greater amygdala activity during emotion processing tasks compared to controls, revealing the impact of early stress on this brain structure involved in the processing of emotion and threat stimuli (McCrory et al., 2012; Mclaughlin, 2016; Pollak et al., 2001; Suzuki et al., 2014)

Impairments in emotion processing are also evident in children diagnosed with or at-risk for psychopathology. For instance, heightened attention to threat has been linked to anxiety (Armstrong & Olatunji, 2012; Dudeney et al., 2015; Roy et al., 2008), and increased attention to dysphoric (e.g., sad faces) stimuli has been associated with depressive symptoms (Romens & Pollak, 2012; Tsypes et al., 2017) in children and adolescents. Youth diagnosed with externalising disorders also showed impaired recognition of emotions compared to healthy controls, with increased impairment for anger recognition in participants with oppositional

defiant disorder (Deters et al., 2020, see also Cooper et al., 2020 for a systematic review of atypical emotion processing in children with externalising behaviours). Therefore, one suggestion is that emotion processing biases arise from early experiences of threatening and unstable environments and contribute to the development and maintenance of poor cognition and psychopathology.

5.2.2 Effects of parental trauma and psychopathology on child development

The association between parental psychopathology and child emotional and behavioural outcomes have been well established in the literature. Research suggests that poor parental mental health (e.g., anxiety, PTSD, and depression) can be predictive of child mental health outcomes, including internalising and externalising problems, as well as negative affect and behaviour (Clavarino et al., 2010; Goodman et al., 2011; Lambert et al., 2014; Mirzaaghasi et al., 2014; Morris et al., 2012). Some studies suggest that the influence of parental mental health on child wellbeing might be attributable to parenting styles (McLeod et al., 2007).

Since mental health issues in adults are linked to an increased display of negative affect, cognition, and behaviour (e.g., Bögels & Brechman-Toussaint, 2006; Goodman et al., 2011), it is possible that the environment in which their children grow up is conducive of atypical socio-emotional development. This could result in children of caregivers with psychopathology developing maladaptive strategies for both processing and regulating emotions. Integrative models of familial transmission risk for psychopathology suggest that some cognitive patterns exhibited by depressed or anxious parents (such as enhanced threat detection or interpreting ambiguous situations as negative) might be involved in the intergenerational transmission of anxiety and depression (Goodman & Gotlib, 1999; Hadwin & Field, 2010). By responding to the environment in line with their emotion biases, these parents might model atypical cognitive-

behavioural strategies to their children, who consequently develop similar biases in their emotion processing. In support of this, it has been shown that higher levels of maternal anxiety are linked to heightened attention to threatening stimuli in infants and school age children (Aktar et al., 2019; Morales et al., 2017). Furthermore, children of depressed mothers were found to misattribute sadness to other emotions (Kluczniok et al., 2016), display an attention bias to sad stimuli (Owens et al., 2016), perceive more negative affect in maternal emotional states (Luebbe et al., 2013), and display impaired emotion recognition overall (Priel et al., 2020). However, disentangling the effects of genetic and environmental risk for psychopathology in these children is difficult.

Some studies also suggest an association between child and parent biases in how they allocate their attention. For instance, children of mothers with emotional disorders (anxiety, mood disorders) displayed an attention bias to threat which was linked to their mother's attention bias (Waters et al., 2015). Furthermore, children's interpretation bias for threat was associated with maternal attention bias to threat, although the mother's and children's attention biases were not associated (de Lijster et al., 2020). Similarly, other studies report a lack of an association between child and maternal attention biases in anxious or depressed participants (Aktar et al., 2019; Platt et al., 2021), suggesting that additional factors might play a more important role in familial risk for these mental health disorders.

5.2.3 Humanitarian settings: is parental trauma linked to child emotion processing?

Refugee children are at a heightened risk for poorer mental health, problematic behaviour, disruptions in emotion regulation, and overall poor emotion processing (Durà-Vilà et al., 2012; Gredebäck et al., 2021; Hodes & Vostanis, 2018; Khamis, 2019; Scherer et al.,

2020; Yayan et al., 2020). These impairments in socio-emotional development can occur both through direct pathways of war trauma exposure, displacement, and continuing adversity, as well as indirectly through their parents' trauma and consequently, their parents' poor mental health (Miller & Rasmussen, 2017). Various studies in post-conflict, war zones, and refugee settings report an association between child and caregivers' distress, PTSD, internalising and externalising symptoms (Betancourt et al., 2012, 2015; Field et al., 2013; Meyer et al., 2017; Thabet et al., 2009). More recently, Syrian refugee children's emotional and behavioural problems were predicted by their parents' poorer general mental health (Eruyar et al., 2018). Parental war trauma has also been linked to child conduct problems and child hyperactivity in refugee families (Bryant et al., 2018; Eruyar et al., 2018). Parenting styles and caregivers' displays of anger (often linked to their own trauma and PTSD) might play a role in the associations between parent-child mental health problems in refugee contexts (Hinton et al., 2009; Thabet et al., 2009). Overall, parental trauma, mental illness, poor parenting strategies, and unstable family environments can all be contributing factors to impairments in emotional and behavioural outcomes in refugee children. However, little is known about emotion processing biases in refugees, which provide a potential cognitive mechanism for how caregiver's trauma and psychopathology might influence child socio-emotional development and mental health.

5.2.4 The current study

The aim of the current study was to investigate the association between attention biases to emotional stimuli (angry and sad) in refugee children and their mothers and to explore if maternal trauma and psychopathology scores are linked to child attention biases. Based on previous research we had the following hypotheses: 1) refugee children's internalising, externalising, and attention problems will be significantly linked to maternal trauma exposure,

symptoms of PTSD, anxiety, and depression; 2) refugee children and their mothers will display a significant attention bias towards angry and sad emotional expressions; 3) child-mother dyads' attention biases will be significantly positively correlated; and 4) refugee children and their mothers' attention biases will be significantly linked to maternal trauma and psychopathology. Further, we also investigated if the significant attention biases reflected emotional vigilance or difficulties with disengagement from emotional stimuli. Additionally, we were also interested in the potential moderating effects of mother and child attention biases on the associations between maternal and child mental health. However, as this analysis was exploratory in nature, we did not have specific hypotheses about the outcomes.

5.3 Methods

5.3.1 Participants

Participants were Syrian refugee mother – child dyads living in Jordan (N = 324, child M_{age} = 6.25 (1.20) years, 50% female, maternal M_{age} = 32.59 (7.02) years). Data collection took place at participants' homes in Amman (n = 235) and in the Al-Zaatari refugee camp (n = 86). Families living in Amman and Al-Zaatari did not significantly differ on child or maternal age, child gender distribution, cognitive measures, or mental health outcomes (all $p > .05$). However the families living in Al-Zaatari reported higher poverty than families living in Amman ($t(194.45) = 3.39$, $p = .001$, Cohen's $d = 1.87$).

Refugee children and their mothers were recruited through the non-profit organisation, *Taghyeer*, and were taking part in a randomised control trail (RCT) evaluation of their "We Love Reading" program for children (FIERCE - RCT ID: AEARCTR-0006523). Child attention biases were measured at the start of the FIERCE project (February – May 2021), whereas maternal attention biases and all questionnaire measures were collected following the

FIERCE project (May – August 2021). As we did not expect mothers' responses to be influenced by the *We Love Reading* program, all variables were treated as if collected at one timepoint.

5.3.2 Demographics and data collection

Demographic data, maternal trauma, and mother and child psychopathology were measured using questionnaires originally developed in Arabic or adapted to Arabic, administered by Arabic-speaking field workers. All questionnaire data was collected using KoBo Toolbox (2021) on a portable Dell laptop. All questionnaire measures (mother and child) were obtained from the mother. Demographic information pertaining to the current study included child age and sex, mother's age, and whether the mothers had lived in a refugee camp in the past (yes/no).

5.3.3 Maternal trauma and mental health

Maternal trauma was measured with the self-reported Traumatic Events Checklist (TEC, Panter-Brick et al., 2009), consisting of 21 *yes/no* questions related to war trauma and displacement (described in detail in Chapter 3). Due to the distressing nature of the trauma questionnaire, only a subset (n = 120) of participating mothers completed this measure before it was replaced with a less distressing PTSD questionnaire.

Maternal PTSD symptoms were assessed with PTSD Checklist for DSM-5 (PCL-5, Weathers et al., 2013) 2013), which includes 20 items (Cronbach's $\alpha = .92$). This scale was completed by a subset of participants (n = 128), tested from June onwards. PCL-5 is a 5-point Likert scale with responses ranging from 0 (*not at all*) to 4 (*extremely*) to a list of problems that people might have in response to a very stressful experience. The participating mothers were

asked to keep their worst event in mind and indicate how much they have been bothered by each problem in the past month, with questions such as 'Repeated, disturbing, and unwanted memories of the stressful experience?' and 'Blaming yourself or someone else for the stressful experience or what happened after it?'. A total symptom severity score is calculated by summing all scores and can range from 0 to 80, with scores over 31-33 indicative of probable PTSD (Weathers et al., 2013).

The anxiety subscale of the short form Depression, Anxiety, Stress (DASS-21, Henry & Crawford, 2005) was used to measure maternal anxiety symptoms (7 items, Cronbach's α = .79). DASS-A is a 4-point Likert-scale ranging from 0 (*did not apply to me - never*) to 3 (*applied to me very much, or most of the time – almost always*) which includes statements, such as 'I felt scared without any good reason' and 'I was aware of dryness in my mouth'. Participating mothers were asked to what extent each statement applies to their feelings over the past month. Scores between 10 and 19 are indicative of moderate to severe anxiety (Henry & Crawford, 2005).

Maternal depression symptoms were measured using the Centre for Epidemiological Studies – Depression Scale (CES-D, Radloff, 1977), which includes 10 items (Cronbach's α = .79) on a 4-point Likert scale ranging from 0 (*rarely, or none of the time*) to 3 (*most, or almost all the time*). Participating mothers were asked about the way they have felt or behaved over the past month, with statements such as 'I felt depressed (inner sadness)' and 'I felt that everything I did was an effort'. Two items ('I felt hopeful about the future' and 'I was happy') were reverse-scored and depression symptoms score was obtained by summing all items, with higher score indicative of higher symptoms severity, with scores above 10 suggesting potential depression (Radloff, 1977).

5.3.4 Child mental health

All child measures were reported by their mothers, using the short version of the Paediatric Symptoms Checklist (PCS – 17, Jellinek et al., 1988). PCS-17 contains three subscales, which measure separate constructs: internalising, externalising, and attention problems, on a 3-point Likert scale ranging from 0 (*never*) to 2 (*often*). Internalising subscale (5 items, Cronbach's $\alpha = .63$) contains statements related to the child's feelings of anxiety and depression, such as 'Feels sad, unhappy' and 'Worries a lot'. Externalising subscale (7 items, Cronbach's $\alpha = .75$) includes statements related to the child's conduct and behavioural problems, such as 'Fights with other children' and 'Does not listen to rules'. Attention subscale (5 item, Cronbach's $\alpha = .64$) relates to child's inattention and hyperactivity, e.g., 'Distracted easily' and 'Fidgety, unable to sit still'. The three subscales were calculated separately resulting in one score for each construct, where higher scores indicate higher symptoms severity.

5.3.5 Attention bias task

5.3.5.1 Stimuli

Stimuli consisted of photographs of 20 adult actors (10 female) displaying 4 emotional expressions: anger, sadness, happiness, and neutral, from the Radboud Faces Database (Langner et al., 2010). Happy expressions were only used for the practice trials (n = 12) given to the children only and were not part of the experiment. The stimuli were validated for emotion recognition by a subset of the participants (children $n = 14$, mothers $n = 14$) after completing all other measures. All emotional expressions had good recognition accuracy among children and mothers: angry = 94%, sad = 77%, neutral = 60%.

5.3.5.2 Procedure

We used a modified dot probe task to measure the attention bias (Macleod et al., 1986) using Matlab (Mathwords, version 2020a) and Pyschtoolbox (Brainard, 1997). We used two types of emotional expressions (angry and sad expressions). These were always shown in a pair with the (same identity) neutral face (40 trials of each pair). We also used 20 baseline trials with pairs of (same identity) neutral – neutral expressions. Stimuli were displayed in colour on a Dell laptop computer (screen size = 27.7cm x 15.6cm, screen resolution = 1366 x 768). At the viewing distance of 57 cm, images of the emotional faces subtended 7.1 x 9.5 degrees of visual angle and the distance between the centre of the screen and the centre of each image was 5.8 degrees of visual angle. All stimuli were randomly interleaved across the 100 trials. Each trial began with a fixation dot for 500ms, followed by the face pair displayed for 500ms. Upon extinction of the face pair, a coin (probe) appeared in the location of either the emotional (congruent) or neutral (incongruent) face (Figure 5.1A). Congruency and emotional expression locations (left or right) were evenly split and randomised across trials. Participants indicated the position of the coin (left or right) as quickly and accurately as possible using a keypress, and the probe remained on the screen until a response was made. Participants were instructed to 'catch' as many coins as possible. After each 40 trials and at the end of the experiment they were informed of the number of coins they caught.

5.3.5.3 Attention bias

A subset of participants (children n = 33, mothers n = 11) who did not understand instructions, did not pay attention to the rules, could not focus, or were distracted due to excessive noise were excluded from all analyses including attention bias variables, resulting in a final sample of 293 children and 307 mothers.

Participants with accuracy less than 65% (children n = 17, mothers n = 3), trials with reaction times faster than 200ms, slower than 7s, and more than 3 standard deviations away from individual participants' mean reaction time (<1% of trials) were excluded from the analysis, in line with previous studies (e.g., Briggs-Gowan et al., 2015). Parameters extracted to measure the attention bias were accuracy and reaction times for the congruent and incongruent trials, separately for the two emotional expressions (angry and sad), as well as the baseline (both faces neutral) trials. In dot probe tasks, faster reaction times on congruent trials (where probe is located on the same side as the emotional face) suggest facilitated attention to emotional expressions. The attention bias for the two emotion categories was estimated by subtracting reaction times for congruent trials from incongruent trials.

5.3.6 General procedure

Mothers and children were tested simultaneously in their homes by two trained Arabic field workers, as part of the FIERCE project. Mothers completed the cognitive tasks at the start of the FIERCE project (timepoint 1) and questionnaire measures 3 months later (timepoint 2). Children completed the cognitive tasks only (timepoint 1).

5.3.7 Ethics

The project was granted ethical approval from the Trinity College Dublin research ethics board (01E/2020/10) and the Prime Minister's Office of Jordan. Mothers gave their consent and children their assent prior to taking part in the study. Families were reimbursed 5JD for their participation at timepoint 1 (February – May) and 10JD at timepoint 2 (May – August).

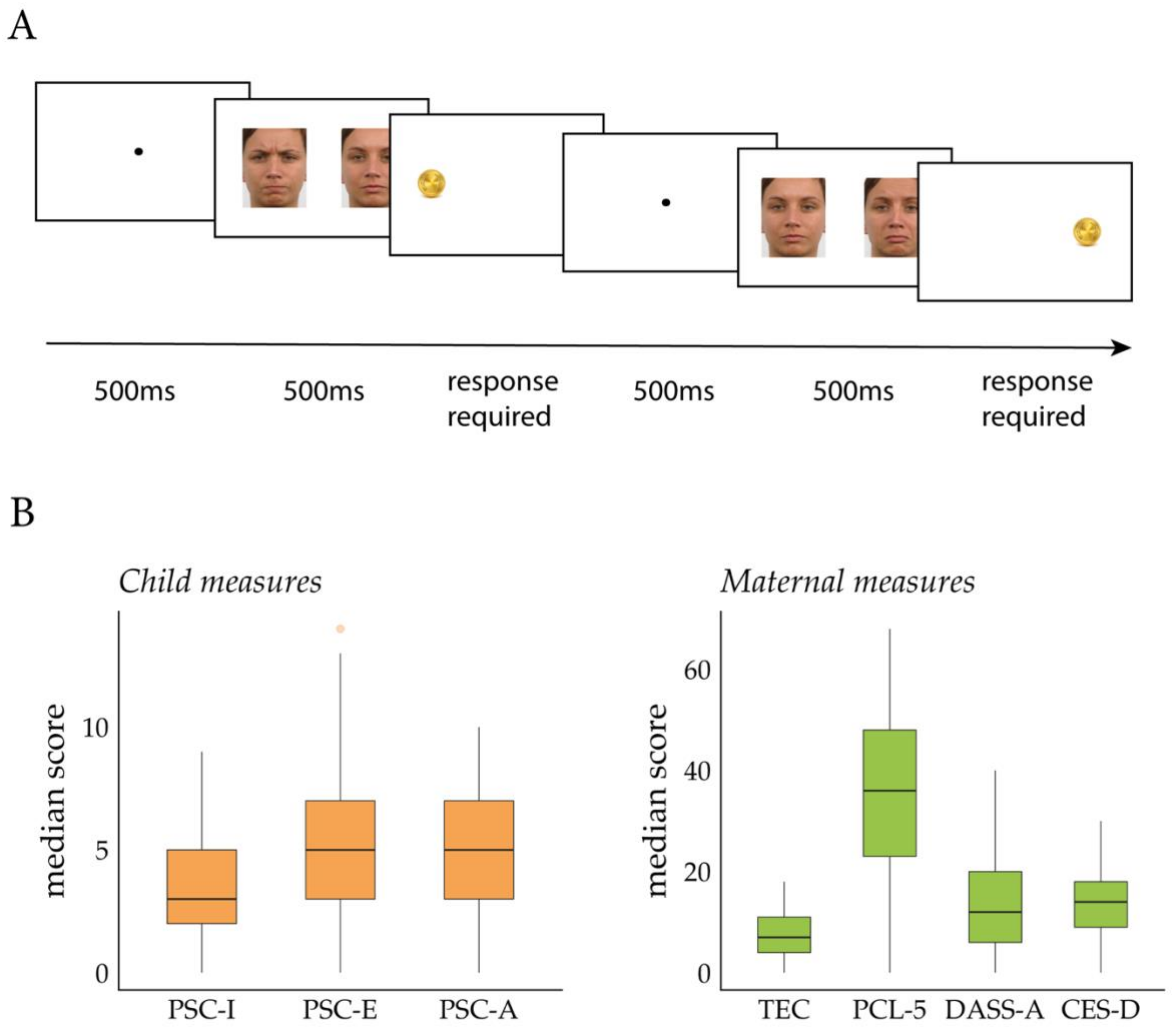

Figure 5.1 Sample attention bias task & questionnaire outcomes

(A) Examples of two congruent trials with stimuli pairs angry – neutral and sad – neutral. Participants should press either the *left* or *right* arrow on the keyboard depending on the coin location. **(B)** Median scores of child mental health, maternal trauma, and maternal mental health. Error bars represent 95% confidence intervals.

TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale, PSC-I = Paediatric Symptoms Checklist – Internalising symptoms subscale, PSC-E = PSC Externalising symptoms subscale, PSC-A = PSC Attention symptoms subscale.

5.3.8 Statistical analysis

There were no effects of child age or gender, nor mother age on either the angry or sad attention bias ($p > .05$). To establish if participants were significantly biased in their attention towards the emotional faces, a one-sample t-test was conducted separately for the angry and sad bias.

In addition to the main analyses concerning attention biases, exploratory analyses were conducted to differentiate *vigilance* and *disengagement difficulties* from the significant attention bias measures (Koster et al., 2004). The exploratory analyses used participants' average reaction times (RTs) to the neutral – neutral trials as a baseline measure of their attention to the task when no emotional stimuli are present. The congruent trials refer to emotional trials (i.e., angry – neutral or sad - neutral) with the probe in the same location as the emotional stimulus, and the incongruent trials refer to emotional trials with the probe in the opposite location to the emotional stimulus. Using the congruent, incongruent, and *baseline* RTs measures, the following analyses were conducted:

1. *Vigilance*: Shorter RTs on (emotional) congruent trials compared to baseline RTs indicate heightened vigilance to emotional stimuli, because they suggest that participants' gaze and attention remains in the location of the emotional stimulus. Therefore, they are able to respond more quickly when the probe is located behind the emotional face, compared to their baseline response time.
2. *Disengagement difficulties*: Longer RTs on (emotional) incongruent trials compared to baseline RTs indicate difficulties in disengagement from emotional stimulus, because participants require more time to switch their attention away from an emotional stimulus, compared to their baseline response time.

Thus, paired samples t-tests were conducted to compare congruent RTs to baseline RTs (*vigilance*) and to compare incongruent RTs to baseline RTs (*disengagement difficulties*) for mothers and children separately. Overall, compared to baseline RTs, shorter congruent RTs indicate heightened vigilance, while longer incongruent RTs indicate disengagement difficulties.

To establish the relationship between maternal and child attention biases, two linear regression analyses were conducted, with maternal attention bias as predictor and child attention bias as outcome, separately for the angry and sad biases. To test the association between maternal questionnaire measures and child attention, a series of simple linear regression models was conducted with maternal trauma, PTSD, anxiety, and depression as predictors and child angry and sad attention bias as outcomes (4 tests for each emotion bias). To account for multiple testing corrections the regression models were corrected using a Holm-Bonferroni method (Holm, 1979), with alpha level set from .05/4 = .0125 Further, we used a one-way ANOVA to examine if there were differences in child and maternal biases between those who had lived in a refugee camp and those who had not.

Linear regression analyses were conducted to investigate the association between maternal scores on trauma, PTSD, anxiety, and depression, and child internalising, externalising, and attention problems, with each maternal questionnaire measure as predictor and each child mental health measure as outcomes. To account for multiple testing corrections in all linear regression results, Holm-Bonferroni corrections were applied (Holm, 1979).

Exploratory moderation analyses were conducted using linear regression models, to investigate the impact of child attention biases (moderators) on the relationship between

maternal anxiety and depression (predictors), and child internalising and externalising problems (outcomes). All predictor and moderator variables were mean centred prior to the analysis.

5.4 Results

5.4.1 Trauma and mental health

Demographics, trauma, and mental health scores are presented in Table 5.1 and Figure 5.1B. The details of the traumatic events experienced by the refugee mothers (as questions included in the TEC) are presented in Figure 5.2B. Maternal trauma and mental health measures were significantly correlated (Table 1, Appendix C) and all average scores for maternal psychopathology symptoms met diagnostic cut-off points.

Country of the child's birth and the proportion of their life spent outside of Syria was available for 317 participating families (children born in Syria n = 260; children born in Jordan n = 46, Figure 5.2A). Refugee children spent on average 77% of their lives in Jordan (SD = 17.52%), with the range of 14-100%. Linear regression analyses showed that the proportion of life spent away from Syria did not significantly relate to child anger or sadness attention bias, nor to child internalising, externalising, or attention problems (all $p > .4$). Similarly, there were no differences on child emotion processing or mental health measures between the children who were born in Syria compared to children who were born in Jordan (all $p > .1$).

Table 5.1 Demographics and mental health information

Variable	*N*	*M*	*SD*
	Children (boys n = 165, 50.9%)		
Age	324	6.25	1.20
PSC-I	315	3.20	2.05
PSC-E	312	5.09	3.10
PSC-A	314	5.17	2.36
	Mothers		
Age	322	32.59	7.02
Poverty	316	7.92	1.89
Time spent in Jordan (years)	318	8.31	2.51
TEC	119	7.50	4.57
PCL-5	129	34.84	16.32
DASS-A	310	13.25	9.26
CES-D	304	14.01	6.22

M = mean, *SD* = standard deviation. TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale, PSC-I = Paediatric Symptoms Checklist – Internalising symptoms subscale, PSC-E = PSC Externalising symptoms subscale, PSC-A = PSC Attention symptoms subscale.

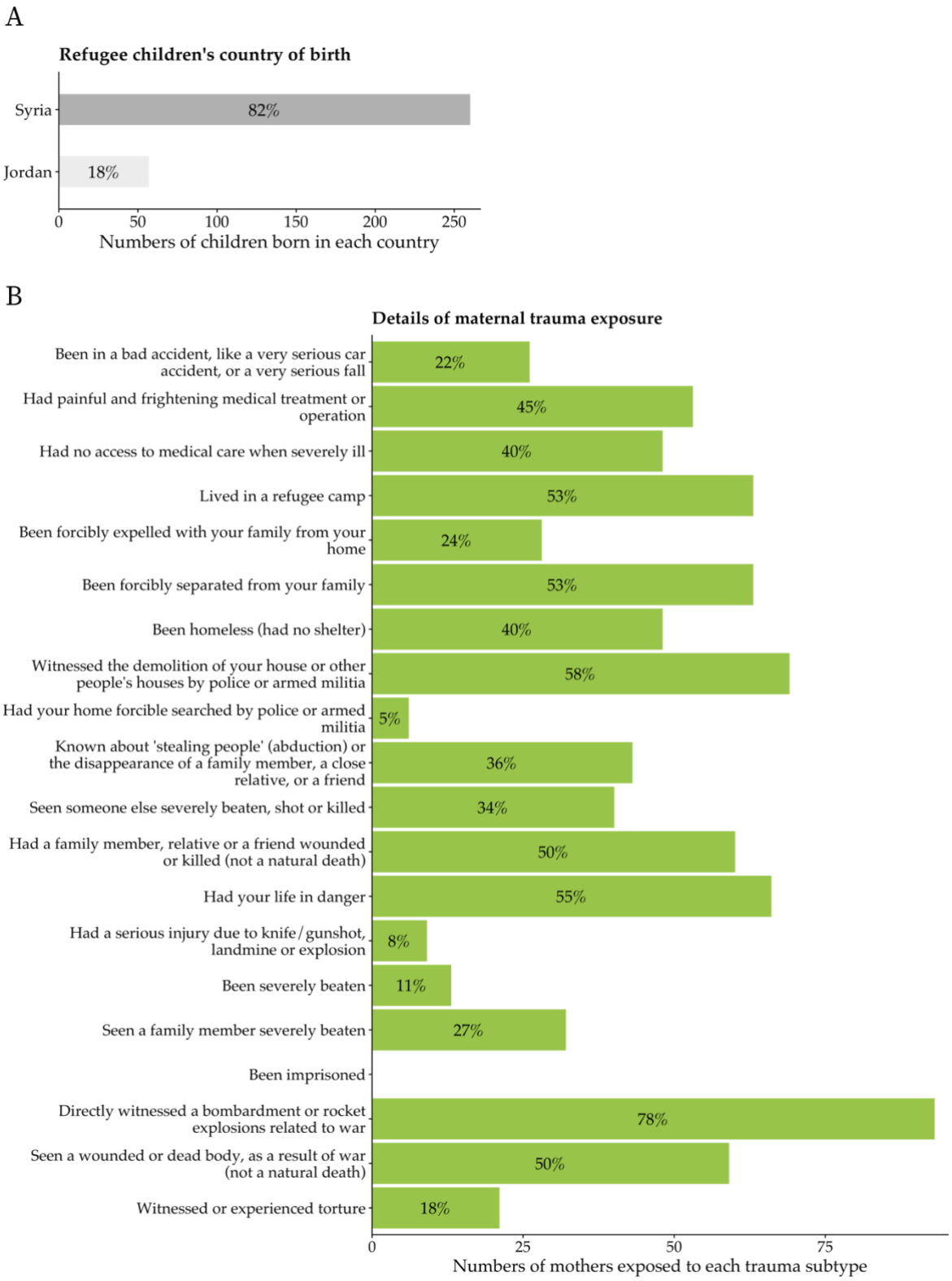

Figure 5.2 (A) Numbers and percentages of refugee children born in Syria and Jordan, (B) Details of the traumatic events experienced by the mothers (TEC questions)

5.4.2 Effects of maternal trauma and psychopathology on child psychopathology

To test the first hypothesis, we conducted a series of simple linear regressions with maternal trauma and mental health measures as predictors and child mental health measures as outcomes. We found that both maternal trauma and maternal PTSD symptoms significantly predicted child internalising and attention problems, but not externalising problems. Maternal anxiety and depression predicted child internalising, externalising, and attention problems (Table 5.2, Figure 1 Appendix C). All results remained significant after multiple testing corrections. Considering the relatively large sample we also included child age and gender as covariates in the linear regression models of trauma and psychopathology. The significant effects of maternal trauma and psychopathology symptoms on child mental health outcomes were not affected by the inclusion of these covariates (Appendix C Table 2).

Table 5.2 Linear regression models of the effects of maternal trauma and psychopathology on child psychopathology

	F	*df*	*p*	*adj.R²*	*t*	*b*	*β*
PSC-I							
TEC	7.19	1, 117	.008	.05	2.68	.11	.24
PCL-5	7.41	1, 126	.007	.05	2.72	.03	.24
DASS-A	14.35	1, 307	< .001	.04	3.79	.05	.21
CES-D	44.58	1, 301	< .001	.13	6.68	.12	.36
PSC-E							
TEC	0.06	1, 114	.809	-.01	0.24	.01	.02
PCL-5	2.72	1, 127	.101	.01	1.65	.03	.15
DASS-A	23.42	1, 304	< .001	.07	4.84	.09	.27
CES-D	18.35	1, 298	< .001	.06	4.28	.12	.24
PSC-A							
TEC	6.69	1, 117	.012	.05	2.58	.12	.23
PCL-5	10.30	1, 125	.002	.07	3.21	.04	.28
DASS-A	18.06	1, 306	< .001	.05	4.25	.06	.24
CES-D	24.56	1, 301	< .001	.07	4.96	.10	.28

TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale, PSC-I = Paediatric Symptoms Checklist – Internalising symptoms subscale, PSC-E = PSC Externalising symptoms subscale, PSC-A = PSC Attention symptoms subscale.

5.4.3 Attention bias

Outliers >3SD from the group mean were excluded from the analysis (children: angry $n = 8$, sad $n = 4$; mothers: angry $n = 3$, sad $n = 5$). Children and mothers performed the task well, with 94% and 99% accuracy respectively, and average reaction times of 1100ms for the children and 590ms for the mothers (Table 3 Appendix C).

In order to determine if participants were significantly biased in their attention to emotional stimuli (hypothesis 2), we conducted one sample 2-tailed t-tests. We found that both refugee children, $t(251) = 2.19$, $p = .002$, and their mothers, $t(290) = 5.39$, $p < .001$, showed a significant attention bias (calculated as the difference between congruent and incongruent reaction times) towards angry expressions, with relatively small effect sizes (Cohen's $d = .20$ and $d = .32$, respectively). However, neither refugee children, $t(255) = .38$, $p = .702$, Cohen's $d = .02$, nor their mothers, $t(288) = .77$, $p = .439$, Cohen's $d = .05$, displayed a significant attention bias to sad expressions (Figure 5.3A).

5.4.4 Threat vigilance or disengagement difficulties?

We conducted paired-samples t-tests with congruent, incongruent, and baseline reaction times to explore the types of attention bias to anger displayed by the participants. RTs to congruent angry trials were significantly shorter than baseline RTs in children $t(255) = -2.01$, $p = .023$, Cohen's $d = -.13$, indicating that the anger bias reflects a potential heightened vigilance to threat. The difference between RTs on incongruent angry trials and baseline RTs did not reach statistical significance, $t(255) = 1.15$, $p = .127$, Cohen's $d = .07$, suggesting lack of disengagement difficulties in children.

RTs to congruent angry trials in mothers were significantly shorter than their baseline RTs, $t(289) = -2.58$, $p = .005$, Cohen's $d = -.15$, suggesting heightened threat vigilance. RTs to incongruent angry trials were significantly longer compared to baseline RTs, $t(288) = 41.59$, $p < .001$, Cohen's $d = 2.45$, also suggesting disengagement difficulties, with relatively large effect size. Vigilance and disengagement difficulties results are presented in Figure 5.3B.

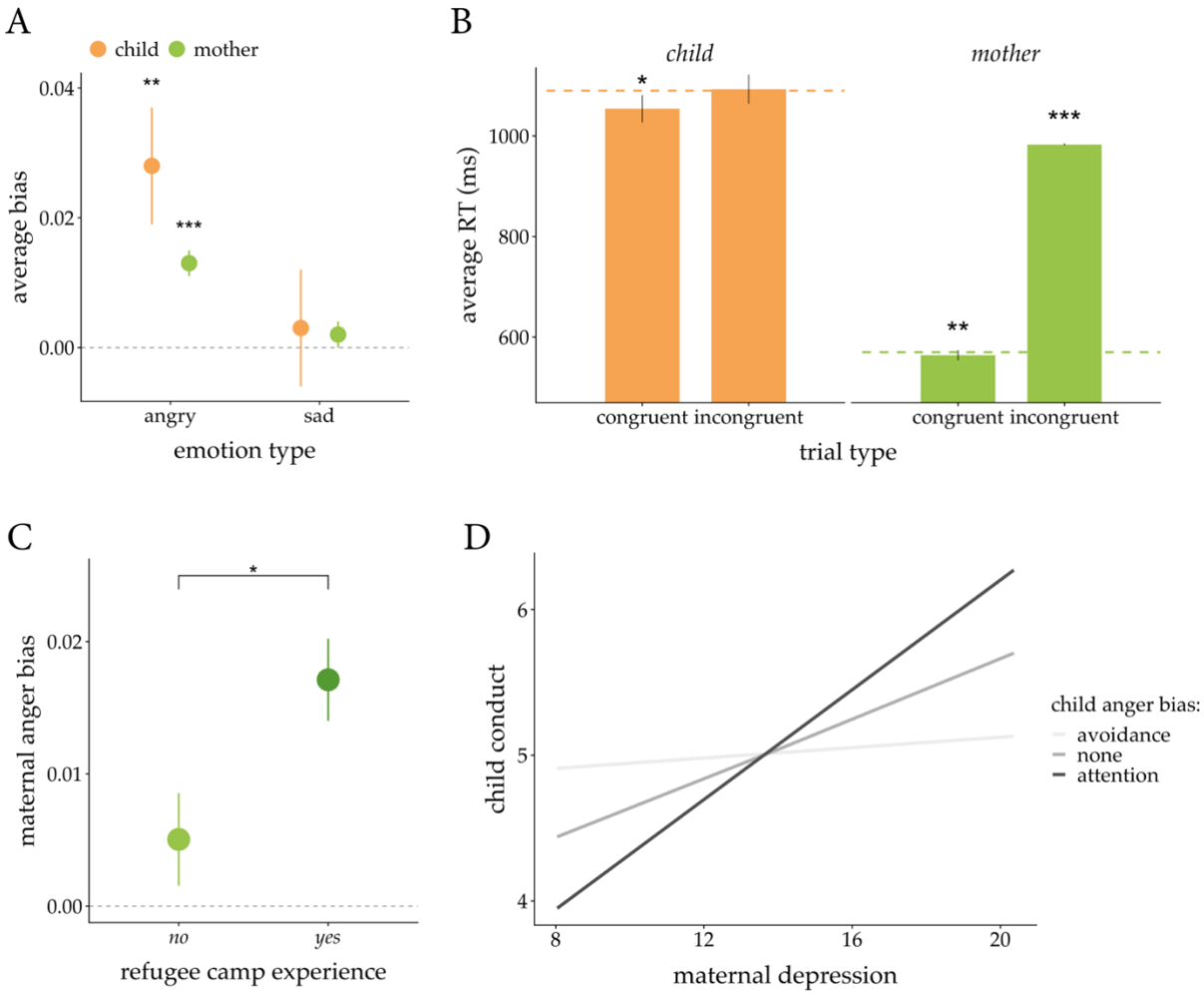

Figure 5.3 Attention bias task results

(A) Average angry and sad attention biases presented separately for children (*anger bias* = .023 (.138), *sadness bias* = .003 (.139)) and mothers (*anger bias* = .013 (.040), *sad bias* = .002 (.040)). ***p* < .01 and ****p* < .001 indicate significant bias **(B)** Average reaction times in milliseconds for each trial type for the anger stimuli. Horizontal dashed lines represent baseline reaction times (to neutral-neutral trials). **p* < .05, ***p* < .01 and ****p* < .001 indicate significant differences in RTs compared to baseline RTs **(C)** Average maternal anger bias for those who had and had not lived in a refugee camp, group difference **p* < .05. **(D)** Association between maternal depressive symptoms and child conduct problems moderated by the type of child attention bias (avoidance, none, attention).

Error bars represent standard error of the mean.

5.4.5 Relationship between child and mother attention biases

Contrary to our third hypothesis, linear regression analyses showed that children and mothers did not have a significant association between their attention bias to anger, $F(1, 224) = .57$, $p = .45$, $R^2 = .003$, or sadness, $F(1, 226) < .01$, $p = .96$, $R^2 < .001$ (Figure 2 Appendix C).

5.4.6 Effects of psychopathology and maternal trauma on attention biases

To test the fourth hypothesis, we ran a series of simple linear regression models (Table 4 and 5 Appendix C). The results showed no significant effects of maternal trauma exposure, PTSD, anxiety, and depression symptoms on child or maternal attention biases (all $p > .05$). Similarly, child internalising, externalising, and attention problems were not significantly linked to child attention biases (all $p > .05$). Child internalising, externalising, and attention problems were not linked to child age or gender ($p > .05$).

A one-way ANOVA revealed a significant difference in maternal attention bias towards angry faces between participants who had lived in a refugee camp compared to those who had not, $F(1, 288) = 6.15$, $p = .014$, $\eta^2 = .02$ (Figure 5.3C). Child attention biases and maternal attention bias to sad expressions did not significantly differ depending on this measure (all $p > .05$).

5.4.7 Exploratory analysis: moderating effects of child attention biases

Moderation analysis revealed that child attention bias to anger significantly moderated the effects of maternal depression on child conduct problems, $F(3, 227) = 5.46$, $p = .001$, $R^2 = .07$ (Figure 5.3D, Table 6 Appendix C). A significant interaction effect between maternal

depression and child attention bias on child conduct problems, $F(1, 227) = 5.42$, $p = .03$, $R^2 = .02$, suggests that:

1. When children display avoidance bias to anger, there is a non-significant positive association between their conduct problems and maternal depression, $b = .02$, 95% CL [-.08, .12], $t = .35$, $p = .73$.
2. When children display a small bias towards anger, there is a significant positive association between their conduct problems and maternal depression, $b = .10$, 95% CL [.04, .17], $t = 3.17$, $p = .002$.
3. When children display an attention bias to anger, there is a significant positive association between their conduct problems and maternal depression, $b = .19$, 95% CL [.09, .28], $t = 3.92$, $p < .001$.

5.5 Discussion

The current study had four aims: 1) to establish if refugee children's internalising, externalising, and attention problems are linked to maternal trauma exposure, PTSD, anxiety, and depression; 2) to investigate if refugee children and mothers have an attention bias towards angry and sad expressions; 3) to test if children's and mother's biases are linked; and 4) to test if refugee children's and mothers' attention biases are linked to maternal trauma and psychopathology scores. We also tested whether the significant attention bias was linked to emotion vigilance or disengagement difficulties in an exploratory analysis. Additionally, we also investigated if the association between maternal mental health (PTSD, anxiety, depression) and child mental health (internalising and externalising problems) were moderated by child or maternal attention biases.

5.5.1 Trauma and mental health

As expected, the majority of participating mothers had experienced high numbers of traumatic events related to war and displacement (7.5 events on average), and their trauma scores were predictive of depression and anxiety symptoms. Mothers also reported a high number of PTSD symptoms, with average scores above the clinical cut-off point (Blevins et al., 2015). The mother's relatively high scores also suggest moderate to severe anxiety (Henry & Crawford, 2005), and potential depression (Radloff, 1977). These scores are consistent with previously reported rates of trauma exposure and psychopathology symptoms in adult refugees and suggests that war and displacement put refugees at an increased risk for mental health and emotional problems (Miller & Rasmussen, 2017; Silove, Tay, et al., 2017; Silove, Ventevogel, et al., 2017). Given these high rates of trauma exposure, most women reported being distressed by the trauma questionnaire which was then discontinued.

We also found that maternal anxiety and depression symptoms were linked to child internalising, conduct, and attention problems, consistent with previous literature (Clavarino et al., 2010; Goodman et al., 2011; Mirzaaghasi et al., 2014; Priel et al., 2020; Ross et al., 2020) High rates of both internalising and externalising problems have also been previously found in populations of refugee children and adolescents (Jabbar & Zaza, 2019; Scherer et al., 2020). In line with our findings, mental health issues and problematic behaviours amongst refugee children seem to be linked to increased trauma exposure (Karadag & Ogutlu, 2021; Yayan et al., 2020), as well as to poorer parental mental health (Bryant et al., 2018; Meyer et al., 2017) 2017). Our findings add to the growing body of research which highlights the importance of maternal mental health on child's development in refugee context (e.g., Bryant et al., 2018; Eruyar et al., 2018). Parental mental health and wellbeing are also important to consider when

creating interventions which target child mental health in refugee populations, as improvements in child mental health have been reported after parental depression treatments (e.g., Gunlicks & Weissman, 2008).

Surprisingly, we found that maternal trauma and PTSD symptoms were linked to child internalising and attention problems, but not to externalising problems. This is contrary to previous reports showing a link between parental trauma and parental PTSD and child conduct problems (e.g., Bryant et al., 2018). Our findings suggests that the association between maternal war trauma and related PTSD symptoms with child anxiety/depression and attention/hyperactivity issues might be stronger than with child conduct problems. Externalising or conduct problems in refugee children could be dependent on other factors previously reported for non-refugee populations, such as genetic risk or negative parenting styles (Schulz-Heik et al., 2010; Viding et al., 2009). These additional factors, together with measures of conduct-related callous-unemotional traits (Saunders et al., 2019), could be included in further research to establish the mechanisms between maternal trauma and child conduct problems in refugee families.

5.5.2 Attention biases

We found that both children and mothers displayed a significant attention bias towards angry faces, consistent with previous reports linking adversity and psychopathology with attention biases to threat (e.g., Briggs-Gowan et al., 2015; Powers et al., 2019; Roy et al., 2008). We found no significant attention bias towards sad expressions. Establishing consistent attention biases amongst refugee children could point to maladaptive cognitive strategies after early adversity, which could lead to development of internalising and externalising symptoms later in life (Harms et al., 2019). Attention biases to threat could be a potential target for

relatively low-cost interventions using cognitive tasks, such as the dot probe (e.g., Shechner et al., 2014), aiming to increase socio-emotional processing abilities and improve mental wellbeing in refugee children. However, with no control group of non-refugee children and mothers these findings alone cannot determine if Syrian refugee families show an increased bias towards anger compared to non-refugees, for instance Jordanian families. Future studies could include additional participants from local communities to establish the extend of emotion processing biases in refugee context.

Surprisingly, we did not find any associations between maternal trauma, maternal mental health, and maternal and child attention, nor between child mental health scores and child attention to either emotional expression. These results differ from the previously well-established links between adversity, mental health, and attention biases, both in children and adults (e.g., Bodenschatz et al., 2019; Cisler & Koster, 2010; Hadwin et al., 2003; Pollak, 2015b; Reid et al., 2006), although recent meta-analyses and reviews suggest some inconsistencies in these findings (e.g., see Kruijt et al., 2019 and Lisk et al., 2020). Contrary to our results, it has been reported that children of depressed mothers usually show biased attention to dysphoric stimuli (e.g., sad facial expressions) and children of anxious mothers show enhanced attention to threat (Burkhouse et al., 2015; Kujawa et al., 2011; Morales et al., 2017; Owens et al., 2016). As discussed in Chapter 4, we had also previously found a link between child war-related trauma experiences (caregiver-reported) and attention to angry expressions in a different sample of refugee children, whilst Gredeback and others showed that maternal PTSD is linked to worse recognition accuracy of sad emotions in refugee children (Gredebäck et al., 2021). However, it is possible that maternal trauma does not play as important a role in their child's affective development as trauma reported by the children themselves. In fact, many children in the current study might be unaware of their mother's

traumatic experiences and had not experienced war-related trauma themselves. A lack of report from the children about their mental health and wellbeing also suggests that mothers' reports do not accurately reflect children's emotional states. These findings hint at the importance of subjective experiences as the main contributor to emotional processing difficulties in refugee children, similar to the important effects of subjective adverse experiences on mental health following trauma found in other populations (Danese & Widom, 2020).

Contrary to our hypotheses, we also did not find a link between maternal and child attention bias for either angry or sad pairs. With few studies investigating these associations and high variability of findings, our results are contrary to some (de Lijster et al., 2020; Waters et al., 2015) and in line with other (Aktar et al., 2019; Platt et al., 2021). It is possible that high variability in the distribution of children's biases (average *SD* = .14) and low variability in the biases of their mothers (average *SD* = .04) might blur the association. However, our results suggest that maternal attention biases might not have a significant impact on child attention biases, and that transgenerational effects of familial psychopathology could be influenced by other factors, such as parenting or attachment styles.

Interestingly, those mothers who reported experiences of living in a refugee camp did show an increased attention bias to angry expressions, suggesting that the trauma associated with living in a camp might have a more pronounced impact on emotion processing than other types of trauma. This might explain the lack of association between attention biases and the trauma checklist, which includes other war related traumatic events. It is worth noting that trauma score (TEC) was only available for a subset of participating mothers (n = 120) and those mothers who currently live in a refugee camp did not differ in their biases compared to those living in urban areas. The low numbers of participating families living in the Al-Zaatari camp

(*n* = 86 out of 324) and uneven distribution lowers the power of this comparison. Nonetheless, it is possible that this type of trauma might have a delayed effect on emotion processing, where e.g., participating mothers had not fully realised the gravity of their experiences in the refugee camp until they had left it. Overall, having previously lived in a refugee camp might be a stronger indicator for potential emotional and mental health consequences linked to attention biases than other subtypes of war trauma, and these should be investigated in more details to establish how they differ in affecting refugees' affective processing and mental health.

5.5.3 Attention bias types

The attention bias to anger displayed by refugee children suggests vigilance to threat, albeit with small effect sizes, but no disengagement difficulties. This is somewhat contrary to our previous findings, where higher trauma was linked to increased sustained attention to anger (suggesting potential problems with disengaging from threat) but not initial vigilance. We previously found that both refugee and non-refugee children showed initial avoidance of angry and happy expressions (Chapter 4), although this could be caused by the differences in methodology (eye-tracking v behavioural task, number of presented stimuli). However, previous studies also reported hypervigilance to threat in children following early adversity and at-risk for poorer mental health (e.g., Briggs-Gowan et al., 2015; Pollak et al., 2001; Roy et al., 2008), indicating that heightened initial detection of threat might be an important mechanism for formation of detrimental cognitive patterns (Harms et al., 2019). Refugee mothers displayed attention biases suggesting vigilance to threat as well as disengagement difficulties, with a relatively large effect size of the latter. Both threat vigilance and disengagement difficulties have been previously linked to adversity and psychopathology in non-refugee children (Armstrong & Olatunji, 2012; Bar-Haim et al., 2007; Felmingham et al., 2011; Lee & Lee, 2013), and could potentially suggest more general cognitive control

difficulties (Cisler & Koster, 2010; Eysenck et al., 2007). Taken together, these findings emphasise the different mechanisms behind attention biases to threat in at-risk populations.

5.5.4 Exploratory analysis findings

Finally, the moderation analysis showed that child anger bias moderated the effects of maternal depressive symptoms on child externalising symptoms: for children who displayed a higher threat bias, an increase in maternal depression predicted an increase in child conduct problems. Conduct problems in childhood and adolescence, including aggression, rule breaking, and lack of regard for others (Bayer et al., 2012), can be predictive of substance abuse, mental illness, and antisocial behaviour (Blair et al., 2014; Fergusson et al., 2005). Both externalising and internalising problems are prevalent among refugee children (Reed et al., 2012), and their occurrence has been linked to parental PTSD symptoms and harsh parenting (Bryant et al., 2018). Conduct problems have also been previously linked to abnormalities in emotion processing and emotion regulation in children and youth in non-refugee populations (Cooper et al., 2020; Kleine Deters et al., 2020), as well as maternal depression (Oh et al., 2020). Furthermore, irritability, defined as increased proclivity for anger and often present in externalising disorders (Evans et al., 2002; Leibenluft, 2017), has also been linked to increased attention to threat in a community sample of children and adolescents (Salum et al., 2017).

Although different from threat avoidance, a positive bias (i.e., increased attention to happy stimuli) was also linked to fewer internalising problems, anxiety symptoms, more pro-social behaviour, and a trend for fewer externalising symptoms in post-institutionalised children (Troller-Renfree et al., 2017). Together, these findings indicate that a threat avoidance bias or a positivity bias might be a protective factor against mental health problems in at-risk populations. Interestingly, an attention bias to threat amongst young adults has also been linked

to poorer emotion regulation strategies (Arndt & Fujiwara, 2012), which have been proposed as a potential mechanism behind childhood adversity's impact on psychopathology (Weissman et al., 2019). Recent reports suggest high rates of emotion dysregulation in Syrian refugee children (Khamis, 2019), and a potential protective role of positive emotion regulation strategies (such as cognitive reappraisal) on the effects of trauma on both internalising and externalising problems in refugee adolescents and adults (Lee et al., 2020; Nickerson et al., 2015). On a more positive note, attentional bias modification (ABM) studies are promising in showing reductions in negative attention biases (Clarke et al., 2017), and improvements in emotion regulation strategies (van Bockstaele et al., 2019), as well as mental wellbeing (MacLeod & Mathews, 2012; Shechner et al., 2014). Interventions employing beneficial cognitive strategies aimed at increasing attention to positive stimuli and decreasing attention to negative stimuli, could focus on improving the avoidance bias and diminishing attention bias to threat-related stimuli in refugee children at risk for externalising problems.

5.5.5 Limitations

The current study has some limitations. Firstly, despite the dot probe task being widely used to study attention biases, it generally has poor test-retest reliability and poor internal consistency (Brown et al., 2014; Macleod et al., 2019; Schmukle, 2005; Staugaard, 2009), although some have reported good internal consistency (e.g., Bar-Haim et al., 2007). Furthermore, the dot probe task provides a measure of attention allocation limited to the initial stimulus presentation timing (i.e., it measures only attention biases present within the first 500ms of stimuli presentation), rather than a broader evaluation of attention allocation. Future studies could employ a version of a dot probe task modified to use with additional measures of attention, such as eye tracking. For instance, by using average time to fixate on the probe on congruent and incongruent trials rather than response (button-press) reaction time, as the

attention parameters assessed this way are not affected by motor responses and show higher accuracy of measurement (Burris et al., 2017). Furthermore, as the shifting of attention can occur within the first 200ms of stimuli presentation (Kappenman et al., 2014; Müller & Rabbitt, 1989), it is possible that participants might disengage their attention between the presentation of the stimulus and the probe, although it is unclear if shifting this quickly also occurs in children. Nonetheless, this caveat could also be eliminated with the addition of an eye tracking or event-related potentials (ERPs) measures to the dot probe task.

Secondly, both child and maternal psychopathology were reported by the mothers, and it is possible that mothers with more psychopathology symptoms perceived their child's behaviours in a more negative light, thereby artificially increasing child psychopathology scores. For instance, parental emotional distress and anxiety levels have been shown to influence their reporting of child anxiety (Krain & Kendall, 2000; Niditch & Varela, 2011), although parents are often thought to be reliable reporters of child mental health, with parental reports used across many studies (e.g., Abate et al., 2018; Murphy et al., 2012). Furthermore, due to the challenging nature of some of the psychopathology questions and the young age of the participating children, it was not appropriate to gather self-reported mental health information from the children.

5.5.6 Conclusions

To conclude, we found that both refugee children and mothers displayed an attention bias to angry emotions, although their biases were not correlated. We also found that maternal trauma and psychopathology symptoms are linked to child internalising and externalising symptoms, and that the child's anger bias might moderate the effects of maternal depression on their conduct problems. Furthermore, mothers who had experience of living in a refugee

camp showed a significantly stronger attention bias towards threat. Overall, our findings emphasise that maternal experiences of war and symptoms of psychopathology might impact children's mental wellbeing and should be considered when creating interventions targeting refugee children's wellbeing. Furthermore, child attention biases might impact the effects of maternal depression on child conduct problems, and future studies could further investigate this link in refugee families.

Chapter 6 - General discussion and future directions

6.1 The overall aim of the thesis

Although childhood adversity has been studied extensively over the years, we still lack the understanding of the effects of war and displacement related experiences on children's emotional development. These specific and complex types of adversity might differ in the way they influence affective processing compared to (more often studied) abuse and neglect. UNHCR (2021c) reports that displaced people constitute over 1% of the world's population and around half of them are under the age of 18. More recently, a further 10 million people, many of them children, were uprooted from their homes in Ukraine as the result of the ongoing war, leading to one of the largest humanitarian crises in Europe in recent decades (UNHCR, 2022). Refugee children can experience unprecedented amounts of trauma, which increases their risk for psychological problems (e.g., Blackmore et al., 2020; Bryant et al., 2018, 2020). It is therefore paramount to investigate how the exposure to these traumatic events might affect their mental health and wellbeing, and what consequences it might have for their cognitive and emotional development.

This thesis set out to investigate the effects of war-related adversity on refugee children's affective processing and psychopathology, specifically focusing on emotion recognition and attention allocation to emotional facial expressions. Firstly, we examined the differences in emotion recognition between refugee and non-refugee children and the associations between their emotion biases and their mental health and wellbeing. Having found that refugee and non-refugee children show a similar tendency to recognise ambiguous expressions as sad, we then examined attention allocation during emotional processing using a free-viewing eye tracking paradigm in refugee and non-refugee children. We found a significant link between heightened

attention to anger and war-related trauma. In the final study, we explored the association between emotional attentional biases of refugee children and their mothers and investigated the effects of maternal trauma and mental health on child emotional attention processing. The findings of these studies have advanced our understanding of war and displacement related adversity on refugee children's emotional development and highlight potential areas for targeted interventions in humanitarian settings. The key findings of the thesis and their implications will be discussed here.

6.2 Emotion recognition in refugee children

The main aim of the first study in this thesis was to investigate the differences in emotion recognition biases between school-aged Syrian refugee and Jordanian non-refugee children. Previous studies found that children with a history of maltreatment tend to overidentify angry expressions and display general difficulties in emotion discrimination (e.g., Pollak et al., 2000; Pollak & Kistler, 2002), but no research so far explored these emotion processing biases in children with relation to war trauma and displacement. Here, using an emotion recognition task we showed that both refugee and non-refugee children were biased to perceive ambiguous faces as sad rather than happy, but showed no significant biases towards anger or fear on the anger – fear continuum. War and displacement related trauma was also not associated with the sadness bias, indicating that this type of early adversity might influence emotion processing in different ways than childhood maltreatment. Interestingly, a recent study reported that recognition accuracy of sad facial expressions was impaired in refugee children whose mothers reported more PTSD symptoms (Gredeback et al., 2021), suggesting potential influences of parental mental health. The sad recognition bias found in the current study as well as the impairments in sadness recognition accuracy highlighted by Gredeback et al. (2021) might

suggest that trauma is linked to abnormalities in processing of dysphoric emotional stimuli, although a lack of differences between refugee and non-refugee children in our study prevents us from drawing definitive conclusions.

We also sought to explore the relationship between emotion recognition and poorer mental health and wellbeing, which are associated with experiences of early life stress (e.g., Hughes et al., 2016). Although we found no evidence for links between emotion processing and mental health outcomes, we did find that higher optimism was associated with lower anger bias amongst all the children. This is consistent with previous studies which show that more optimistic individuals tend to display a smaller bias towards threat (e.g., Karademas et al., 2007). Our results highlight that optimism, positive thinking, and positive affect might act as potential protective factors against negative effects of war and displacement related adversity. Higher optimism and life satisfaction are associated with better mental health outcomes and healthier emotion regulation strategies (e.g., Chasson et al., 2021; Ghiasi et al., 2016), and could be indicative of resilience amongst refugee children, standing out as a potential focus for interventions targeting not only emotional processing but also mental health and wellbeing.

Finally, trend results suggested that refugee children had more difficulty discriminating between angry and fearful faces compared to non-refugee children, as well as that higher trauma was linked to poorer discrimination performance on this emotion dimension. Similar results have been reported amongst neglected children (e.g., Pollak et al., 2000) and could suggest potential effects on war-related trauma and refugee status on emotion discrimination abilities for perception of threat-related stimuli. An inability to accurately discriminate between fearful and angry expressions might be linked to difficulties in identifying emotional cues presented by others, which could lead to inappropriate emotional display (e.g., reacting with

aggression) and reactivity, as well as problems with navigating social situations (e.g., Harms et al., 2019).

The findings of this study suggested a general lack of differences between refugee and non-refugee children in emotion recognition, but trend results imply potential atypicalities in processing of threat-related stimuli. To further investigate the cognitive mechanisms behind emotion processing and capture potentially unconscious biases which do not require semantic understanding of emotion categories, we turned to measuring attention allocation patterns to multiple emotional stimuli in a different cohort of refugee and non-refugee children.

6.3 Sustained attention to threat and war-related trauma

The second study of this thesis was concerned with emotional attention processing biases in Syrian refugee and Jordanian non-refugee children. Using eye-tracking, we showed that refugee children were more avoidant of angry and happy expressions during the initial fixations, but those children with higher trauma exposure tended to dwell for longer on angry expressions later during information processing. Although there is some evidence for attentional avoidance of threat after childhood adversity (Pine et al., 2005), our findings of specifically *initial* avoidance to both angry and happy emotions amongst refugee children suggest possible aversion to very intense or salient facial expressions, rather than an attention pattern specific to threat avoidance. It is possible that earlier, covert, initial attention (i.e., earlier than the average 800 milliseconds) showed different attentional patterns; however, we were not able to capture this with our eye-tracking method. Interestingly, the association between trauma and longer sustained attention on angry faces is consistent with previous findings in children with a history of other forms of early adversity (e.g., Lakshman et al.,

2020), and together with the trend for discrimination difficulties reported in the previous study could be suggestive of abnormalities in threat processing systems. Specifically, increased sustained dwell might indicate difficulties with disengagement from threat, and these patterns could influence potentially detrimental cognitive strategies, such as dysfunctional emotion regulation.

This study established an association between war-related trauma and atypicalities in threat processing. Next, we aimed to explore specific pathways through which these attentional abnormalities might arise, and their potential links to child mental health outcomes. Particularly, we wanted to examine if there was evidence for intergenerational transmission of trauma and psychopathology – via affective processing biases - amongst refugee mother-child dyads.

6.4 Attention biases in refugee mother-child dyads

In chapter 5 we investigated the effects of maternal trauma, maternal mental health, and maternal attention biases on the mental health and attention biases of their children. Using a modified dot-probe task, we found an attention bias to anger in both refugee children and their mothers, which is consistent with previous findings amongst children with a history of adversity (e.g., Briggs-Gowan et al., 2015). We did not find significant attention biases towards sad expressions, again emphasising that threat-processing biases might be more pronounced in refugee populations. Surprisingly, we did not find support for the intergenerational transmission of affective biases, as neither maternal biases, nor their trauma or psychopathology symptoms predicted attention biases in their children. Previous findings largely support the importance of emotion processing biases in the transmission of

psychopathology within families, highlighting that maternal cognitions and behaviours might influence their children's affective development (e.g., Creswell et al., 2005; Kluczniok et al., 2016; Waters et al., 2015), although research on parent-child bias links is largely inconsistent (e.g., Aktar et al., 2019; Platt et al., 2021). Our unexpected findings suggest that other mechanisms, such as parenting strategies and social support systems, might play a more important role in refugee mother-child mental health than attention biases. We also found no effect of maternal trauma on child and mother's biases, although refugee mothers who had lived in a refugee camp in the past showed higher anger bias compared to those who did not, suggesting that the experience of living in a refugee settlement may influence threat processing.

Further exploration of the anger biases showed that whilst children's bias was indicative of potential vigilance to threat, mother's anger bias suggested both threat vigilance and, to a larger extent, difficulties with disengagement from threatening stimuli. The initial avoidance of anger and happiness in refugee children in the study in chapter 4 suggests opposite patterns of attention allocation to the threat vigilance found here, although this might be caused by differences in methodology, considering that threat vigilance is usually found in studies of maltreated children (e.g., Pollak et al., 2000). Threat vigilance and threat disengagement difficulties found in refugee mothers might reflect atypicalities in cognitive control, possibly linked to executive functions (Cisler & Koster, 2010), and emotion regulation problems. These maladaptive cognitions and poorer emotion regulation strategies, if continuously modelled in interactions with their children, might create dysfunctional environment for emotional development and lead to functional impairment in their offspring (Goodman & Gotlib, 1999). Finally, with an exploratory analysis we also found that child anger bias significantly moderated the effects of maternal depression on child conduct problems. These findings suggest potential protective effects of child anger avoidance bias on their externalising

symptoms in refugee populations at risk for mental health problems. Threat avoidance bias might be related to better emotion regulation mechanisms, where children are capable of switching their attention away from a distressing stimulus, which can be useful in coping with stress and improve emotional wellbeing (e.g., Weierich et al., 2008).

6.5 Mental health and wellbeing of refugee children

Although overall we found that refugee children were exposed to more traumatic events than non-refugee children, their mental health scores did not significantly differ, with the exception of higher PTSD symptoms amongst refugee children in the emotion recognition bias study in chapter 3. Furthermore, there were no significant associations between trauma and mental health measures in either cohort, again except for the trauma – PTSS link in the chapter 3 study. This is especially surprising, given the association between trauma and sustained attention to threat found with eye tracking (chapter 5). These findings were largely unexpected, as previous research suggests high prevalence of symptoms of PTSD, depression, and anxiety amongst refugee children (Henley & Robinson, 2011; Panter-Brick, Dajani, et al., 2018), although rates tend to vary (Frounfelker et al., 2020). Similarly, mother-reported symptoms of internalising, externalising, and attention problems in children in chapter 4 appear to be below the cut-off (scores above the cut-off suggest the need for further assessment) for each subscale, although the PSC-17 has predominantly been used to assess children in the western countries. Nonetheless, there are several factors which might affect the higher scores on refugee children's mental health and wellbeing (indicative of better mental health), such as time passed since the adverse experiences and conditions of resettlement (i.e., majority of participating children live in urban areas of Jordan). Refugee and non-refugee children did not differ on our measures of poverty suggesting similarities in their social economic status and living

conditions. As poverty and socioeconomic deprivation increases risks for psychopathology and can lead to disturbances in brain development (Luby et al., 2013; Wadsworth & Achenbach, 2005), similar current living conditions might affect both refugee and non-refugee children equally, resulting in similar mental health outcomes. Considering that all participants in our studies live below the poverty line, a more precise measure of relative wealth might be necessary to record differences between the groups. Children in our studies also represented a younger cohort of refugees than reported above (e.g., Panter-Brick et al., 2018), and many of them would not have experienced any trauma directly, while those who did might have been too young to have a conscious memory of the event. Indeed, chapter 5 included families who had been living in Jordan for 8 years on average, which means many of the participating children would not have been born in Syria. Poorer mental health might also be more evident in late childhood and adolescence (e.g., Hasanović et al., 2005), whereas the children in our studies are very young. Further research should investigate the effects of war trauma on emotional and behavioural problems in a wider range of ages. However, it is also possible that even if refugee children do not consciously recall trauma, it might still have detrimental effects on their cognitive and affective development. Indeed, many children experience war and displacement related trauma at very early ages (e.g., Goldstein et al., 1997) with still very little information on how this type of trauma may affect their socio-emotional functioning. Therefore, it is important to employ measures that do not require self-report but that may nonetheless reveal differences in affective development.

6.5.1 Mental health and affective processing biases

One of the aims of this thesis was to examine if refugee children's affective processing biases were indicative of poorer mental health. Unexpectedly, we found no significant links between emotion processing biases and symptoms of PTSD, anxiety, or depression, nor

feelings of distress and insecurity in our sample of children. It is possible that the lack of associations is due to the better mental health outcomes in our cohorts, as discussed above. Mental health questionnaire scores suggest that refugee children in our study are unlikely to fall into a clinical disorder group, and therefore might have escaped maladaptive cognitive processes previously linked to psychopathologies. Furthermore, inconsistencies in findings among children suggest that cognitive patterns of affective processing might differ from those (more reliably) found in adults. Previously, studies of depression in children have found enhanced recognition of sadness (Schepman et al., 2012) and anger (Jenness et al., 2015), poorer recognition of anger (Simcock et al., 2020), overall lack of emotion recognition dysfunctions (Smith et al., 2018), as well as both attention *towards* (e.g., Hankin et al., 2010) 2010) and *away* from sadness (Harrison & Gibb, 2015). Similar variations have been found in studies of childhood anxiety. Anxiety diagnosis or symptoms in children have been previously linked to both heightened (Roy et al., 2008) and decreased attention to threat (Lisk et al., 2020) and impaired recognition of emotional expressions (Simonian et al., 2001), whilst other studies reported overall lack of associations between anxiety and emotion recognition (Demenescu et al., 2010). Such high variability of results in non-refugee populations of children prevents us from making definitive conclusions about the lack of associations between mental health outcomes and emotion processing biases in our studies. However, our findings are consistent in showing that emotion perception is not related to symptoms of PTSD, anxiety, and depression across different cohorts of children and with the use of a wide range of cognitive tasks (forced choice, eye tracking) and mental health measures (both child- and mother-reported). Similarly, emotion processing amongst refugee mothers was also not predicted by their mental health. Interestingly, however, our finding that children's attention bias to threat moderated the relationship between maternal depression and child externalising symptoms, suggests potential protective effects of an avoidance bias in at risk children. Taken together,

our results highlight the complexity underlying the relationship between cognitive biases and psychopathology amongst refugee populations.

Another possible explanation for the lack of associations between children's mental health and emotion processing is the influence of some unmeasured protective factors. Indeed, our association between optimism scores and anger recognition bias found in chapter 3 (where children lower in optimism tended to perceive ambiguous expressions as angry) is suggestive of protective factors, potentially linked to resilience. Previous studies have shown that optimism and positive thinking might be linked to better mental health, improved wellbeing, and higher resilience (Carver et al., 2010), and some studies reported moderating effects of optimism on the link between adversity and mental health amongst adults (e.g., Kucmin et al., 2018). Optimism could be considered a potential protective factor amongst refugee children as well. However, the current task was restricted to measuring an *anger* bias only relative to a *fear* bias (i.e., the forced choice was between *anger* and *fear*), rather than a bias in anger perception overall. Other methods, such as morphs of *neutral-angry* expressions or priming indices of anger (angry expressions with different levels of clarity), might be more suitable to investigate emotion recognitions in relation to optimism. Other protective factors could also play a role, such as emotion regulation strategies, positive affect, parental presence, exposure to positive parenting, and the feelings of safety, all of which have been linked to better mental health outcomes (Brody et al., 2019; Lee et al., 2020).

6.5.2 The impact of maternal trauma and mental health on child emotional and behavioural outcomes

Maternal psychopathology, which could potentially be linked to parenting styles and levels of support provided to the children, predicted child mental health outcomes in chapter 5. Previous research in refugee populations suggests that parental trauma and psychological difficulties may have a negative influence on parenting strategies, with knock on effects on children's emotional and behavioural problems (e.g., Bryant et al., 2018; Eruyar et al., 2018). It is possible that the feelings of safety and protection from the parent is what shelters the refugee children studied here from the negative effects of adversity on their emotional development. Our findings that mother's trauma and psychopathology symptoms were predictive of their children's mental health outcomes support the potential intergenerational transmission of trauma and psychopathology risks (e.g., Goodman et al., 2011). However, we did not find evidence that affective attention biases are the mechanism responsible for this familial risk, which suggests that other aspects of cognition could play a more important role in the ways in which this possible transmission occurs. Including measurements of maternal expressions of anger and sadness in everyday life (e.g., do they show exaggerated or diminished emotional expressions?) might also help clarify the impact of their affective processing on emotion biases in their children. It is also worth noting that although the PTSD, anxiety, and depressive symptoms reported by the refugee mothers can be considered moderate to severe and indicate potential psychopathology, they are not a clinical population. In other words, high scores on the self-reported measures are not equivalent to a clinical diagnosis, and the mechanisms of intergenerational psychopathology transmission might not be evident among the refugee mothers in our study. Various other maternal characteristics could influence both their resilience and the impact on their children's wellbeing, including genetic vulnerability and stress reactivity (Kim et al., 2009).

6.5 Potential implications

How does war related trauma and displacement affect emotion processing? Potential difficulties in emotion discrimination of threat-related stimuli, as well as increased sustained attention to threat suggest specific effects of war and displacement experiences. Abnormal threat-processing has been linked to various socio-emotional impairments in children, suggesting it could lead to problems with emotion regulation and knowledge, aggression and hostility, peer acceptance and forming relationships, as well as to internalising and externalising disorders (e.g., Harms et al., 2019; Izard et al., 2001; Teisl & Cicchetti, 2008), 2008). Therefore, it could have widespread consequences on their social functioning and mental health. The specificity of biases found in our studies to the threat-processing pathways could indicate disturbances in the amygdala function (such as heightened activity), as similar abnormalities linked to the limbic system after early adversity have been reported previously (e.g., McLaughlin et al., 2015; Pechtel & Pizzagalli, 2011). Further research is necessary to fully understand the neurocognitive pathways affected by war trauma in refugee children.

Heightened attention to threat-relevant stimuli can become a target for cognitive-based interventions aimed at improving mental health and socio-emotional functioning in refugee children. Attentional bias modification (ABM) programs, first introduced by MacLeod and colleagues (2002), use the dot-probe paradigm modified to increase attention towards positive and decrease attention to negative stimuli. ABM programs have been successful not only in increasing positivity bias, but also improvements in emotion regulation strategies and emotional problems, such as anxiety and depressive symptoms (Clarke et al., 2017; MacLeod & Mathews, 2012; van Bockstaele et al., 2019). Moderating effects of attention to threat on children's externalising problems found in chapter 4 suggest that threat attention biases could

regulate mental health outcomes in children at risk for externalising disorders, and ABM programs might also help alleviate the cognitive aspects of this risk. Additionally, emotion recognition training (ERT) programs, which employ similar paradigms to the emotion recognition bias task used in the chapter 3 study and which aim to shift negative perceptions of ambiguous expressions to positive ones (Adams et al., 2013), also show potential for improvements in mental health symptomatology. For instance, ERT has been linked to diminished symptoms of depression, decrease in reported anger and aggressive behaviours, and lower negative affect in studies of young adults and adolescents (Adams et al., 2013; Lothmann et al., 2011; Penton-Voak et al., 2017; Rawdon et al., 2018), as well as improvements in conduct problems and affective empathy in children high in callus-unemotional traits (Dadds et al., 2012). Given our findings that both refugee and non-refugee children showed a tendency to perceive ambiguous expressions as sad, ERT programs might be a useful approach for positive modification of perceptual biases in similar populations. More recently, our group reported short-term improvements in an emotion recognition bias following a reading-based program amongst Syrian refugee children, indicating that, through socialisation, low-cost and scalable community interventions (not necessarily focused on emotion processing) might also be influential in improving affective biases in vulnerable children (Michalek et al., 2021).

Finally, the results of this thesis also emphasise the importance of maternal mental health on the wellbeing of refugee children. These findings are in line with recent studies of refugee families which highlight that parental trauma exposure, stress, and poorer mental health, including symptoms of PTSD, anxiety, and depression, can lead to higher symptomatology and adjustment problems in their children (Betancourt et al., 2015; East et al., 2018; Eruyar et al., 2018; Meyer et al., 2017; Miller & Rasmussen, 2017). One way that parental mental health could affect child development is through parenting styles; refugee parents with poorer mental

health may use harsher and less warm parenting strategies which can lead to poorer emotional and behavioural outcomes in their children (e.g., Bryant et al., 2018; Eltanamly et al., 2021; van Ee et al., 2012). This suggests that targeting positive parenting strategies, increasing family cohesion, and improving parent-child relationships through parenting training (Bryant et al., 2018; Eruyar et al., 2018; Khamis, 2021) might be particularly beneficial for refugee children's mental health and emotional development.

6.6 Limitations and future directions

The studies in this thesis have a number of general limitations. Firstly, the participants in all the studies were refugee children with relatively low scores on trauma questionnaires, which might suggest low exposure to war trauma and displacement related adversity. Almost all refugee families in the current studies also live in the urban neighbourhoods of Amman. Therefore, the findings of this thesis might not be applicable to a wider population of refugee children with a history of high war trauma exposure and/or who are living in refugee settlements. Children living in urban neighbourhoods struggle with a unique set of hardships, including housing and food insecurity, parental employment problems, and lack of social and economic support, which they might not experience in refugee settlements (e.g., Jacobsen, 2006), and which could potentially influence their mental health and psychosocial wellbeing. Nonetheless, considering that less than 20% of refugees in Jordan live in refugee camps (UNHCR, 2021b), research on young refugee children resettled in urban areas is essential to further our understanding of the effects of early trauma and transgenerational trauma transmission on affective development and wellbeing in refugee populations.

Secondly, our studies are limited to investigating the perception of emotions from facial expressions only, which might not account for real-world viewing of emotional cues that occur across multiple modalities. Indeed, we rarely encounter displays of facial expressions in isolation of other cues. Advances in eye tracking methodology now allow for measuring eye movements in 3D space and in an environment not confined to computer screen stimuli (e.g., Rogers et al., 2018; Valtakari et al., 2021), and could be used for instance during mother-child play activities. Tasks like these could further explore attention patterns in the dyads in a more naturalistic setting and would allow us to observe attention distribution during social interactions. It is possible that refugee children would perceive and recognise emotions differently when viewing facial expressions of their own mums compared to unknown actors, and these viewing patterns could further vary depending on the type of interaction (e.g., play v reading), as well as individual child and mother characteristics (e.g., parenting styles, attachment types, temperament). Incorporating more socially relevant tasks might help us understand emotion processing in refugee children in different contexts and circumstances. Moreover, other aspects of affective and cognitive development should be further investigated, including emotion regulation, pro-sociality, and executive functions. Psychosocial functioning overall is an incredibly complex phenomenon, influenced by multiple lower and higher order processes and their interactions. Whilst simple sensory perception atypicalities might not show strong effects related to war adversity, various cognitive biases might collectively have an impact on higher order processes, such as regulating emotions and social learning, which might result in poorer mental health and functional impairment (e.g., Miu et al., 2022). Future studies should explore these additional facets of affective processing to gain a more comprehensive view of child development in humanitarian context.

Furthermore, we were limited to assessing child mental health outcomes using mostly self-reported questionnaires. Although the questionnaires used in the studies have been either developed in Arabic or validated amongst Middle Eastern children, there are few mental health surveys that are both culturally appropriate and validated amongst refugees (particularly for children as young as 6). It is also likely that such young children do not have the most accurate insight into their own emotional states and mental health, although this issue was resolved with addition of maternal-reported measures in the chapter 5 study. Although the surveys provide a systematic measure of emotional and behavioural problems and are considered suitable for use in vulnerable population, additional tools accounting for cultural and societal factors are necessary (e.g., considering the stigma often associated with mental illness). A much more informative and comprehensive method of establishing mental health and wellbeing outcomes would be actual psychological evaluations and interviews. Furthermore, whilst we were able to measure children's own perceptions of their mental health, we were not able to assess their own perceptions of adversity, and the way in which they construed the experiences of the traumatic events they were exposed to. Emerging findings suggest that these subjective perceptions of adversity are better predictors of mental health than objective reports of trauma (Danese & Lewis, 2022; Danese & Widom, 2020), and future studies in refugee context should consider these individual interpretations of adversity.

Moreover, whilst the studies in this thesis were primarily concerned with the effects of war-related trauma, a plethora of other factors might also play a role in refugee children's response to adversity. Studies suggest that both risk and protective factors span a range of contexts, from individual, family, community, and societal influences affecting developmental outcomes (Arakelyan & Ager, 2021; Reed et al., 2012, Figure 5.1). The influence of child characteristics, such as their attachment style and temperament, as well as family dynamics, including

parenting strategies and parent-child closeness, and community support have been shown to impact emotional and behavioural outcomes in refugee children (Bryant et al., 2018; Eruyar et al., 2018; Reed et al., 2012). Furthermore, emerging research highlights the importance of positive social relationships and the associated perceptions of safety as a prominent factor in healthy emotional development and psychosocial functioning, and proposes the *lack of safety* as an arising model of childhood adversity (Smith & Pollak, 2021b). Additionally, the simplicity of the cumulative model of trauma measure used in our studies (sum of all events) does not account for investigating more detailed aspects of traumatic experiences, such as how severe they were to the individual, their frequency, and length. A more in-depth exploration of the severity, chronicity, and timing of the reported trauma could also shed more light on the developmental mechanisms involved in emotion processing and their response to adversity (Smith & Pollak, 2021a), although this is particularly challenging in populations of young vulnerable children. Finally, we did not examine the effects of genetic factors on children's psychopathology symptoms or functional impairments. Given the high heritability of mental illness (e.g., Kendler et al., 2006), the environmental effects previously discussed might reflect genetic vulnerability or the gene-environment interplay (e.g., Assary et al., 2018; Keers & Pluess, 2017) rather than purely environmental factors. Large, longitudinal studies are needed to disentangle the effects of genes and the environment on affective processing and psychosocial development.

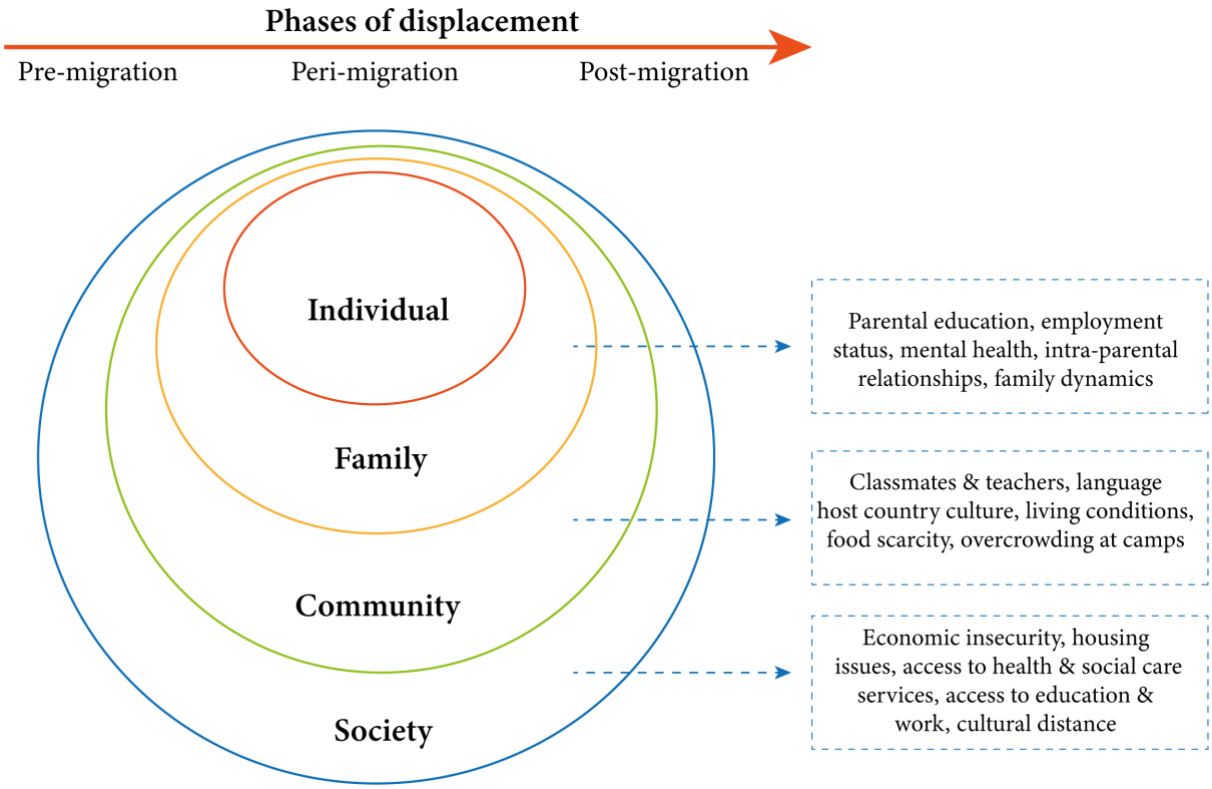

Figure 6.1 Conceptual framework of factors influencing affective development of refugee children, adapted from Arakelyan and Ager (2021), and Reed et al. (2002)

It is also worth noting that the *adversity* measure used in our studies is limited to only war and displacement related events, which are conceptually very different from the models of early adversity studied so far. However, as discussed in chapter 2, refugee children continue to experience a multitude of stressors after resettlement in the host country (Frounfelker et al., 2020), and it is possible that these more current types of hardships have causal effects on their emotion processing, even over and above the trauma they suffered. In fact, recent studies suggest that poverty – a deprivation-linked adversity – was a better predictor of executive function than trauma in a sample of Syrian refugee youth living in Jordan (Chen et al., 2019). Difficulties such as discrimination, racism, and economic hardship, as well as the need to navigate novel environments (such as new school systems and new language) could play a vital

role in further emotional and cognitive development of refugee children, and those environmental factors should be taken into account not only in future studies but also in intervention development.

6.7 Final remarks

Emotional attention processes and emotion perception have been extensively studied in children with a history of early adversity. In this thesis, we investigated the influence of a specific type of adversity: war and displacement related trauma, on refugee children's affective processing. With the currently increasing number of displaced individuals exposed to traumatic events of war, we need an informed framework for addressing their mental health and wellbeing needs. Exploring the mechanisms of affective processing biases can shed light on *how* these adversities affect mental health and psychosocial functioning, and inform intervention development. Affective processing, such as accurate emotion recognition and appropriate attention allocation, plays a crucial role in children's emotional and psychosocial development and largely depends on children's early experiences (e.g., Pollak et al., 2000; Pollak, 2012).

Overall, the findings of this thesis suggest that while emotion recognition seems largely unaffected by war trauma and displacement, refugee children overall tend to pay more attention to angry expressions. In this way, war trauma differs from the generally studied childhood abuse and neglect, emphasising the specificity of threat-processing pathways, rather than the processing of sad stimuli. Our findings also emphasise the importance of maternal mental health on refugee children emotional and behavioural functioning and suggest that child affective processing biases might moderate these effects. Our research indicates that cognitive

modification interventions might be beneficial for improving mental health and psychosocial development in at-risk children.

This research is one of the first to investigate children's affective processing in refugee settings and highlights the differences in the effects of adversity type on emotion perception. It emphasises the complexity of emotion processing biases amongst refugee children and suggests an important role of parental influences on children's emotional development and wellbeing.

Chapter 7 - Bibliography

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Appendix A

Table 1.

Details of data collection locations and participant specifications for each neighbourhood in Amman, reported for 2 testing timepoints.

Characteristics	**Sweileh**		**Al Hashmi Al Shamali**	**Sahab**
Area	Northern Amman		Eastern Amman	Southern Amman (suburban)
Residents' characteristics	Large number of residents are Syrian refugees (especially in the poorer areas)		Large number of residents are Syrian refugees	Large number of residents are Syrian refugees due to inexpensive rent
SES	Low & middle		Low	Middle
	February 2019 data collection			
Testing location	Participants' homes	Awael Al Khair community centre	Shaqa'eq Al Nouman school	Al Bonya school
Refugees	27	22	0	0
Non-refugee	0	0	25	20
	June 2019 data collection			
Testing location	Khadija Bint Khuwailed community centre		-	-
Refugee	23		-	-
Non-refugees	19			

Note. SES = Socioeconomic Status.

Table 2.
Linear regression analyses for the effects of mental health and optimism outcomes on happy-sad and angry-fearful biases and sensitivity scores

	F	*df*	*p*	*adj.R²*	*t*	*b*	*β*
HS bias							
TEC	0.68	1, 130	.413	-.002	0.82	.04	.07
CRIES	0.11	1, 68	.738	-.01	-0.34	-.01	-.04
AYMHS	1.07	1, 126	.302	.001	-1.04	-.03	-.09
HIS	0.31	1, 117	.579	-.01	.056	-.02	-.05
HDS	0.74	1, 121	.390	-.002	0.86	.03	.08
YLOT	1.64	1, 130	.202	.01	1.28	.13	.11
HS slope							
TEC	0.30	1, 128	.585	-.01	0.55	.06	.05
CRIES	0.20	1, 66	.660	-.01	0.44	.02	.05
AYMHS	1.85	1, 125	.176	.01	1.36	.10	.12
HIS	0.21	1, 115	.647	-.01	0.46	.04	.04
HDS	0.13	1, 120	.716	-.01	-0.36	-.03	-.03
YLOT	0.05	1, 128	.817	-.01	-0.23	-.05	-.02
AF bias							
TEC	0.14	1, 102	.712	-.01	0.37	.03	.04
CRIES	0.34	1, 52	.563	-.01	-0.58	-.02	-.08
AYMHS	2.61	1, 101	.110	.02	1.62	.08	.16
HIS	0.87	1, 89	.353	-.001	0.93	.05	.10
HDS	0.12	1, 95	.743	-.01	0.33	.02	.03
YLOT	23.74	1, 102	< .001	.18	-4.87	-.72	-.44
AF slope							
TEC	5.37	1, 101	.022	.04	2.32	.47	.23
CRIES	0.60	1, 52	.442	-.01	-0.77	-.08	-.11
AYMHS	0.46	1, 100	.501	-.01	-.068	-.10	-.07
HIS	0.25	1, 89	.617	-.01	0.50	.08	.05

HDS	0.14	1, 94	.710	-.01	-0.37	-.06	-.04
YLOT	0.47	1, 101	.495	-.01	-0.69	-.33	-.07

Note. TEC = Traumatic Events Checklist (caregiver reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale, YLOT = Youth Life Orientation Test (optimism score).

Appendix B

Table 1.

Means, standard errors, and confidence intervals for the proportion of dwell duration (%) on anger, happy, neutral, and sad stimuli

Emotion	*M*	*SE*	95% Confidence Intervals	
			Lower Bound	Upper Bound
Anger	20.04	.418	19.20	20.87
Happy	19.82	.413	18.99	20.64
Neutral	22.24	.341	21.56	22.91
Sad	21.69	.353	20.98	22.39

Table 2.

Linear regression models of the effects of trauma and mental health scores on sustained attention (dwell) on each emotion.

	F	*df*	*p*	*adj.*R^2	*t*	*b*	*β*
Anger							
TEC	8.66	1, 44	.005	.15	2.94	.39	.410
CRIES	0.43	1, 13	.522	-.04	-0.66	-.05	-.18
AYMHS	0.001	1, 62	.971	-.02	-.04	-.01	-.01
HIS	3.00	1, 61	.089	.03	1.73	.15	.22
HDS	0.08	1, 70	.773	-.01	-0.29	-.03	-.04
Happiness							
TEC	1.89	1, 45	.176	.02	1.37	.21	.20
CRIES	0.45	1, 14	.512	-.04	-0.67	-.06	-.18
AYMHS	0.23	1, 63	.634	-.01	0.48	.06	.06
HIS	0.07	1, 61	.794	-.02	0.26	.02	.03
HDS	1.60	1, 70	.210	.01	1.26	.12	.15

Neutral							
TEC	2.21	1, 45	.144	.03	1.49	.19	.22
CRIES	0.02	1, 14	.898	-.07	0.13	.01	.04
AYMHS	0.03	1, 63	.864	-.02	-0.17	-.02	-.02
HIS	0.01	1, 61	.933	-.02	-0.84	-.01	-.01
HDS	0.01	1, 70	.910	-.01	0.11	.01	.01
Sadness							
TEC	0.54	1, 45	.468	-.01	0.73	.12	.12
CRIES	0.02	1, 14	.885	-.12	0.15	.03	.05
AYMHS	0.03	1, 62	.864	-.02	-0.17	-.02	-.02
HIS	0.62	1, 60	.436	-.01	0.79	.06	.10
HDS	0.004	1, 69	.947	-.01	-0.07	-.01	-.01

Note. TEC = Traumatic Events Checklist (parental reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale.

Table 3.

Means, standard errors and univariate analysis of variance results for group differences of entry times (ms) on anger, happy, neutral, and sad faces.

Emotion	Refugees		Non-refugees		$F(1,76)$	p	Partial η^2
	M	*SE*	*M*	*SE*			
Anger	88.29	3.64	78.52	2.58	4.79	.033	.059
Happy	85.23	3.12	73.67	2.20	9.24	.003	.108
Neutral	81.58	3.48	79.62	2.46	.21	.648	.003
Sad	82.56	3.13	77.85	2.21	1.51	.223	.025

Table 4.
Linear regression models of the effects of trauma and mental health scores on initial orienting (entry time) on each emotion.

	F	*df*	*p*	*adj.R²*	*t*	*b*	*β*
Anger							
TEC	0.42	1, 43	.519	-.01	0.65	.61	.10
CRIES	0.39	1, 14	.544	-.04	-0.62	-.49	-.16
AYMHS	0.01	1, 61	.393	-.02	0.08	.05	.01
HIS	1.70	1, 59	.197	.01	-1.31	-.57	-.17
HDS	0.14	1, 67	.710	-.01	0.37	.20	.05
Happiness							
TEC	3.45	1, 43	.070	.05	1.86	1.63	.27
CRIES	0.01	1, 14	.941	-.07	0.08	.06	.02
AYMHS	0.00	1, 62	.987	-.02	0.02	.01	.00
HIS	0.29	1, 60	.590	-.01	-0.54	-.21	-.07
HDS	0.88	1, 68	.350	.00	0.94	.42	.11
Neutral							
TEC	0.00	1, 43	.962	-.02	0.05	.04	.01
CRIES	0.39	1, 14	.542	-.04	0.63	.41	.17
AYMHS	0.03	1, 62	.857	-.02	0.18	.11	.02
HIS	0.70	1, 60	.408	-.01	-0.83	-.33	-.11
HDS	2.45	1, 68	.122	.02	1.56	.73	.19
Sadness							
TEC	0.09	1, 43	.761	-.02	0.31	.24	.05
CRIES	0.13	1, 14	.721	-.06	0.36	.22	.10
AYMHS	0.31	1, 61	.580	-.01	-0.56	-.31	-.07

HIS	1.80	1, 59	.100	.03	-1.67	-.58	-.21
HDS	0.12	1, 67	.728	-.01	0.35	.15	.04

Note. TEC = Traumatic Events Checklist (parental reports), CRIES = Child Revised Impact of Events Scale (PTSD symptoms measure), AYMHS = Arab Youth Mental Health Scale (anxiety/depression measure), HIS = Human Insecurity Scale, HDS = Human Distress Scale.

Appendix C

Table 1.

Associations between maternal trauma and mental health measures.

Variable	1	2	3	4
1. TEC	-	-	.28	.40
2. PCL-5	-	-	.48	.72
3. DASS-A	.28	.48	-	.60
4. CES-D	.40	.72	.60	-

Note. All correlations are significant at $p < .001$. TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale. Participants completed either TEC or PCL-5 measure, never both; hence, these two variables cannot be correlated.

Table 2.

Linear regression models of the effects of maternal trauma and psychopathology on child psychopathology with child age and gender as covariates.

	F	*df*	*adj.*R^2	*p*	*t*	*b*	*β*
PSC-I							
1. Overall model	2.71	3, 115	.04	.048			
TEC				.015	2.47	.11	.23
age				.520	0.65	.10	.06
gender				.498	-0.62	-.27	-.06
2. Overall model	2.97	3, 123	.05	.045			
PCL-5				.009	2.65	.03	.23
age				.290	1.06	.16	.09
gender				.518	0.65	.22	.06
3. Overall model	5.51	3, 303	.042	.001			
DASS-A				< .001	3.81	.05	.21

age				.187	1.32	.13	.07
gender				.851	-0.19	-.04	-.01
4. Overall model	15.11	3, 297	.124	< .001			
CES-D				< .001	6.64	.12	.36
age				.389	-0.86	.08	.05
gender				.798	0.26	.06	.01
PSC-E							
1. Overall model	0.43	3, 112	-.015	.730			
TEC				.912	0.11	.01	.01
age				.539	0.62	.14	.06
gender				.400	0.85	-.46	-.08
2. Overall model	1.82	3, 124	.019	.147			
PCL-5				.161	1.41	.02	.13
age				.841	0.20	.05	.02
gender				.101	-1.65	-.89	-.15
3. Overall model	9.01	3, 300	.073	< .001			
DASS-A				< .001	4.72	.09	.26
age				.813	-0.24	-.03	-.01
gender				.039	-2.08	-.71	-.12
4. Overall model	7.63	3, 294	.063	< .001			
CES-D				< .001	4.14	.12	.23
age				.568	-0.57	-.08	-.03
gender				.035	-2.12	-.74	-.12
PSC-A							
1. Overall model	2.87	3, 115	.045	.039			
TEC				.021	2.35	.11	.22
age				.473	0.72	.12	.07
gender				.263	-1.13	-.47	-.10
2. Overall model	5.12	3, 122	.090	.002			
PCL-5				.004	2.95	.04	.26
age				.111	1.61	.29	.14

gender				.184	-1.34	-.54	-.12
3. Overall model	7.37	3, 302	.059	< .001			
DASS-A				< .001	4.33	.06	.24
age				.263	1.12	.12	.06
gender				.192	-1.31	-.34	-.07
4. Overall model	9.20	3, 297	.076	< .001			
CES-D				< .001	4.89	.10	.27
age				.408	0.83	.09	.05
gender				.195	-1.30	-.34	-.07

Note. TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale. PSC-I = Paediatric Symptoms Checklist – Internalising symptoms subscale, PSC-E = PSC Externalising symptoms subscale, PSC-A = PSC Attention symptoms subscale.

Table 3.

Reaction times in seconds for each emotion pair, separately for congruent and incongruent trials.

Participants	Emotion type	Condition	*M*	*SD*
Children	Angry - neutral	congruent	1.08	.48
		incongruent	1.12	.51
	Sad - neutral	congruent	1.10	.48
		incongruent	1.10	.47
Mothers	Angry - neutral	congruent	.59	.26
		incongruent	.60	.25
	Sad - neutral	congruent	.58	.24
		incongruent	.58	.24

Table 4.

Linear regression models of the effects of maternal trauma and psychopathology on child and mother attention biases.

	F	*df*	*p*	*adj.R²*	*t*	*b*	*β*
			Child attention biases				
Anger bias							
TEC	1.76	1, 88	.188	.005	-1.33	-.01	-.14
PCL-5	1.64	1, 100	.203	.006	-1.28	-.001	-.13
DASS-A	1.45	1, 243	.230	.002	1.20	.001	.08
CES-D	0.90	1, 235	.344	.000	0.95	.002	.06
Sadness bias							
TEC	0.06	1, 91	.813	-.010	0.24	.001	.03
PCL-5	1.29	1, 100	.259	.003	-1.14	-.001	-.11
DASS-A	1.28	1, 244	.259	.001	-1.13	-.001	-.07
CES-D	0.71	1, 236	.401	-.001	-0.84	-.001	-.06
			Mother attention biases				
Anger bias							
TEC	3.05	1, 107	.084	.019	-1.75	-.001	-.17
PCL-5	0.27	1, 120	.605	-.006	-0.52	.000	-.04
DASS-A	0.49	1, 284	.483	-.002	0.70	.000	.04
CES-D	0.56	1, 281	.691	-.003	0.40	.000	.02
Sadness bias							
TEC	0.28	1, 106	.599	-.007	-0.53	.000	-.05
PCL-5	1.02	1, 122	.314	.000	-1.01	.000	-.09
DASS-A	0.45	1, 282	.804	-.003	0.25	.000	.02
CES-D	0.01	1, 279	.942	-.004	-0.07	.000	-.01

Note. TEC = Traumatic Events Checklist, PCL-5 = PTSD Checklist for DSM-5, DASS-Anxiety = Anxiety subscale of the Depression, Anxiety, Stress Scale short form, CES-D = Centre for Epidemiological Studies – Depression Scale.

Table 5.

Linear regression models of the effects of child mental health on their attention biases

	F	*df*	*p*	*adj.*R^2	*t*	*b*	*β*
Anger bias							
PSC-I	0.05	1, 246	.817	-.004	-0.23	-.001	-.02
PSC-E	0.48	1, 245	.489	-.002	0.69	.002	.05
PSC-A	1.97	1, 245	.161	.004	-1.41	-.007	-.09
Sadness bias							
PSC-I	0.03	1, 247	.871	-.004	-0.16	-.001	-.01
PSC-E	0.05	1, 246	.814	-.004	0.24	.001	.02
PSC-A	1.76	1, 246	.186	.003	-1.33	-.005	-.08

Note. PSC-I = Paediatric Symptoms Checklist – Internalising symptoms subscale, PSC-E = PSC Externalising symptoms subscale, PSC-A = PSC Attention symptoms subscale.

Table 6.

Moderation analysis results on child conduct problems (outcome)

	b	*β*	*t*	*p*	*Confidence Intervals*	
					LL	*UL*
Constant	5.06	0.20	25.35	.000	4.67	5.46
CES-D (centred)	0.10	0.03	3.17	.002	0.04	0.17
child anger bias (centred)	0.34	1.45	0.23	.815	-2.51	3.19
CES-D x child anger bias	0.62	0.27	2.33	.021	0.10	1.14

Note. CES-D = Centre for Epidemiological Studies – Depression Scale (maternal depression measure). Predictor variables were mean centred prior to analysis. R^2 = .07.

Figure 1.
Associations between maternal and child mental health outcomes

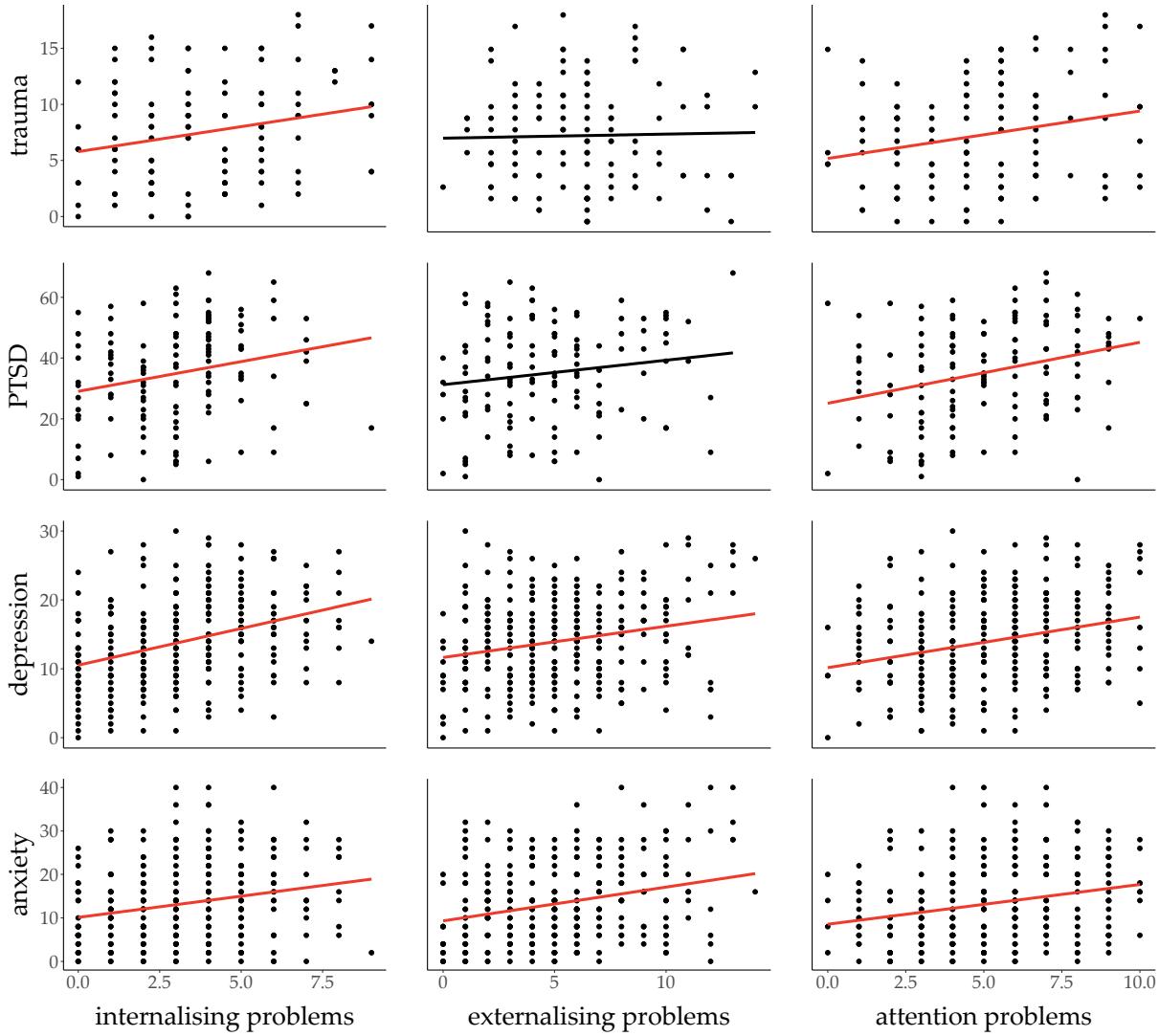

Figure 2.

Associations between child and maternal attention biases to angry and sad expressions.