Maltreatment-related processes of emotion regulation and social understanding: A study of adolescents in care in New South Wales

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Abstract

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Child abuse and neglect is a significant social issue with long term consequences for affected children and young people, including increased risk of emotional and social difficulties. Models of the impacts of maltreatment outline a developmental process in which maltreating parent-child relationships affect the development of neural networks, which in turn undermine developing cognitive processes, including emotion regulation and social understanding, thereby increasing risk of emotional and social difficulties. This study explores a subset of these cognitive processes in a sample of adolescents in long-term out-of-home care as a result of maltreatment, relative to a sample of non-maltreated peers, including situation selection (conditioned avoidance and risk-taking), attentional deployment (attention biases and attention control) and cognitive change (interpretation bias), as well as aspects of social understanding (mentalising, emotion understanding and prosocial responding). Further, the relative effects of maltreatment factors, and the relationship between emotion regulation and social understanding with adolescent adjustment was also explored. Results demonstrated maltreatment-related effects in conditioned avoidance, risk-taking, attention processes and social understanding, and explored the relative effect of exposure to physical abuse on the development of these processes, differences in such processes did not appear to significantly predict poor or normative adjustment of maltreated adolescents. These results are discussed with respect to models of maltreatment, emotion regulation and social understanding, with implications for the development and implementation of interventions.

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Ngiyanhigin.gu galin.gabangburgu
For our (collective) children

Note on terms: The author recognises the diverse nations and cultures of Aboriginal and Torres Strait Islander peoples. In this thesis, the terms "Aboriginal" and "Torres Strait Islander" are used separately to refer to these distinct groups of First Nations peoples of Australia.

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1. Introduction

Exposure to early child maltreatment increases an individual's risk for psychopathology and peer difficulties across the life course (Cicchetti and Toth, 2005). Understanding the mechanisms by which child maltreatment confers vulnerability is of critical importance to those caring for children and young people exposed to early maltreatment in order to support more positive trajectories following exposure to adversity. More broadly, such research will also contribute to the understanding of the effects of early environmental adversity on neuropsychological and cognitive development across developmentally-sensitive periods, and how this relates to later mental health outcomes. In addressing the questions concerning mechanisms, several models from developmental psychopathology that consider the cascading impacts of maltreatment on different neurocognitive systems across developmental-time will be outlined in this Chapter. These emphasise the important role of emotion regulation processes on subsequent emotional and social functioning – and how early environmental adversity may disrupt relevant cognitive and sociocognitive processes that regulate emotions. This literature provides the context for a growing body of empirical work which will also be reviewed here. From this work, more specific hypotheses can be built and these form the basis of the subsequent empirical Chapters of this thesis. However, first, definitions of maltreatment will be outlined.

1.1 Definition of Maltreatment

In general, "child maltreatment" refers to parenting practices that are thought to place children and young people at risk of physical or emotional harm. These include acts of physical abuse, neglect, and emotional abuse and "exemplifies a toxic relational

environment that poses considerable risk for maladaptation across diverse biological and psychological domains of development" (Cicchetti and Toth 2005 : pp 410). Practices that constitute child maltreatment are those that fail to meet the community's standards for appropriate or acceptable care (Barnett et al., 1993). There are therefore two frameworks relevant to the definition of child maltreatment in this study: the socio-legal definition of child maltreatment in the Australian community, and the operational definition of maltreatment used to identify but also classify participants in this study. As maltreated participants in this study are drawn from the out-of-home care population in New South Wales (NSW), Australia, the socio-legal definitions of the community from which they are drawn play an important role in the "selection" of this population, and should be clearly articulated.

The socio-legal definition of child abuse in a given community can be found by examining the relevant legislation or child protection policies that exist in that community. In NSW, the relevant piece of legislation is the *Children and Young Persons (Care and Protection) Act (1998)* (hereafter the Act). Section 23 of the Act outlines the current threshold for child protection as being those where the child is at "risk of significant harm", including the risk of a child's basic physical or psychological needs not being met, a failure of the parents or caregiver to provide necessary medical care or mandated education, the risk of physical or sexual harm, and exposure to psychological harm due to domestic violence or parental behaviour. The legislation also outlines that individual notifications as well as chronicity (total number of notifications) should be considered when assessing risk. Members of the community play an important role in these notifications through their reports of suspected abuse to authorities. Reporting is

mandatory for those who come in contact with children as part of their employment or other formal roles if they suspect a child to be at significant risk of harm. The majority of reports regarding children and young persons were from mandatory reporters (AIHW, 2013).

Within this context, exposure to childhood maltreatment was operationalised on the basis of file information collected by the child protection system in NSW, using the Maltreatment Classification System (MCS) developed by Barnett, Manly and Cicchetti (1993) . The MCS collects information across a series of dimensions relevant to the child's experience of maltreatment, including subtype, severity, chronicity, and timing, as well as experiences of placement changes or other separations occurring in the child's life. The MCS provides clear definitions of maltreatment subtypes as well as guidance on scoring severity of each event, by subtype, from 1 (low) to 5 (high) (**Table 1.1**). More particularly, these are: Physical Abuse (PA), Sexual Abuse (SA), Physical Neglect (N), Emotional Maltreatment (EM), and Moral, Legal or Educational Neglect (MLE). Generally, whilst these subtypes are held to reflect distinct maltreatment forms, different subtypes of maltreatment tend to co-occur, and a given event may include multiple subtypes (Barnett et al., 1993). As such, each notification is analysed in terms of each subtype, and if present, coded for severity to capture the full complexities of child maltreatment (Barnett et al., 1993, Herrenkohl and Herrenkohl, 2009). As the MCS is standardised, it achieves a level of uniformity across studies and populations.

There is a trade-off involved in deciding to use child protection records to operationalize the maltreatment experience of young people (Barnett et al., 1993). Benefits include the availability of contemporaneous details of reported maltreatment

events, including a narrative of events, perpetrators, outcomes, as well as reports on any investigation made by child protection professionals. This has the obvious advantage over retrospective self-reports which are sometimes used (McGee et al., 1995), in that they are not reliant on individual recollections. File review also avoids relying on a parent reporting on maltreatment regarding their own children, which may suffer from reporting biases. However, there also several disadvantages: official records are dependent on individual events coming to the attention of child protection authorities, and therefore may be incomplete. In particular, file records may fail to capture early maltreatment experiences before children have come to the attention of authorities, given younger children's developing verbal skills and limited integration with the broader community (such as schools). There may also be inconsistencies in the detail and recording of events across child protection professionals and other services (such as police). More importantly, particular types of maltreatment may differ in the ease with which they can be assessed, and particular subsets of maltreated children may be more likely to be identified and reported (Barnett et al., 1993). For example, reports of physical abuse may be more successfully investigated than other forms of maltreatment as even minor physical injuries may be noticed and reported by members of the community whereas significant neglect or emotional maltreatment may not leave visible signs. For this study we thought that child protection records provided the best available information regarding the maltreatment experiences of participants, and avoided the need to directly question vulnerable young people about previous traumatic experiences that would be required for self-report classification schemes.

In summary, the records maintained by the child protection system, while being formed in this socio-legal context, facilitate applying operational research definitions with respect to physical abuse, neglect and emotional abuse for each notification.

Table 1.1: Operational definition of maltreatment by subtype, including examples of low and high severity (Barnett, Manly and Cicchetti 1993)

Maltreatment Subtype	Definition	Example (Lowest Severity)	Example (highest severity)
Physical Abuse	Caregiver inflicting deliberate physical harm to child	Inflicting minor marks to the child's body	Causing hospitalisation of child as a result of physical harm
Sexual Abuse	Any sexual contact between child and adult for the purpose of caregiver's gratification or other benefit	Exposing child to explicit stimuli	Sexual penetration or prostitution of a child
Physical Neglect	Failure to Provide: failure to meet the child's developing needs such as food, hygiene or medical care. Lack of Supervision: failure to ensure child's safety relative to developmental needs	FTP: Failing to provide regular meals LOS: inadequate supervision for short periods	FTP: failing to provide adequate nourishment such that the child is severely malnourished LOS: inadequate supervision for more than 12 hours (developmentally inappropriate) or inadequate supervision in life-threatening contexts
Emotional Maltreatment	Persistently frustrating child's need for psychological safety/security, acceptance and age appropriate autonomy	Undermining child's relationships or belittling child	Abandoning or confining the child, or making threats against the child's life
Moral, Legal and Education Neglect	Failure to appropriately socialise or integrate child into community	Allowing child to miss more than 25 days of school annually without explanation	Involving child in drug trafficking, providing no education

1.2 Scope of Child Maltreatment

Child maltreatment is a significant social welfare issue, with 4-16% of children experiencing physical abuse and around 10% experiencing neglect or emotional abuse each year, despite official statistics reporting a significantly lower rate (Gilbert et al., 2009). Cicchetti and Toth (2005) report that the rate of child maltreatment victimisation in the US is approximately 12.3 children per 1000 nationally. In Australia approximately 7.4 children per 1000 were subject to substantiated allegations of maltreatment, up from 6.1 per 1000 in the previous year (AIHW, 2013). The rate in NSW (9.0 per 1000) was slightly higher than the national average (7.4 per 1000), consistent with trends in previous years (AIHW, 2013). Based on the comparison of community studies with official statistics outlined by Gilbert and colleagues, as well as issues raised by those authors regarding under-reporting of child abuse and neglect (Gilbert et al., 2009), it seems probable that true prevalence of childhood abuse and neglect in the Australian community is actually greater than this figure. Nonetheless current rates of maltreatment yield significant health and economic costs, such as through provision of health and mental health services (Cicchetti and Toth, 2005, Reeve and van Gool, 2013).

In those cases that come to the attention of child protection authorities, children who are deemed unable to remain with their families become subject to out-of-home care orders, placing legal parental responsibility for that child with that State. At 30 June 2012, 7.7 Australian children per 1000 were in out-of-home care. Again, the rate in NSW was higher than the national average (10.5 per 1000). The majority of those admitted to care and protection orders in 2011-12 were under the age of 10 (71.7% nationally, 70.9% in NSW) (AIHW, 2013).

1.3 Child Maltreatment impacts on mental health and social function

Exposure to early maltreatment has been consistently associated with a range of adverse outcomes across the lifespan (Ammerman et al., 1986, Cohen et al., 2001, Green et al., 2010, Mersky and Topitzes, 2010, Perepletchikova and Kaufman, 2010, Sawyer et al., 2007). Those exposed to physical abuse, neglect and family violence showed significantly increased risk of reporting mental health symptoms relative to controls, particularly anxiety, in a large cohort study (McLaughlin et al., 2010), as well as increased psychiatric disorder rates (Cohen et al., 2001, Green et al., 2010). Similarly, maltreatment has been associated with significantly increased internalising and externalising symptomology (Mills et al., 2013, Sawyer et al., 2007, Tarren-Sweeney and Hazell, 2006, Teicher et al., 2006), with maltreated samples being said to closely resemble clinical rather than community samples (Tarren-Sweeney and Hazell, 2006). With different maltreatment subtypes often co-occurring (Barnett et al., 1993, Bucker et al., 2012, Cicchetti and Curtis, 2005, Cicchetti et al., 2003, Curtis and Cicchetti, 2011, Dillon et al., 2009, Gibb et al., 2009, Masten et al., 2008, Pears et al., 2008, Shields and Cicchetti, 2001), the number of maltreatment subtypes experienced has been demonstrated as a possible key factor, showing a dose-response relationship with adult mental health (Edwards et al., 2003). Further, research suggests that different maltreatment subtypes may be specifically associated with different outcomes both in terms of mental health (McLaughlin et al., 2010, Teicher et al., 2006) and cognitive function (Gould et al., 2012), although inconsistencies emphasise the need for future studies to consider the role of specific maltreatment subtypes.

Exposure to child maltreatment has also been associated with a range of peer problems, which although not part of a formal psychiatric diagnosis, can nevertheless be disabling, cause distress and affect mental health outcomes. These problems include more antisocial behaviours such as aggression and fewer prosocial behaviours and more dysfunctional peer relationships, with maltreated children less liked, more likely to be rejected by peers, more socially withdrawn and have more negative expectations of others than non-maltreated peers (Anthonysamy and Zimmer-Gembeck, 2007, Bolger and Patterson, 2001, Cicchetti and Toth, 2005, Salzinger et al., 1993, Salzinger et al., 2001, Sawyer et al., 2007, Shields and Cicchetti, 2001, Tarren-Sweeney and Hazell, 2006).

1.4. Theoretical Framework

Exposure to childhood abuse and neglect affects many children in communities all over the world, with significant personal and social costs in terms of impacts to physical and mental health across the lifespan and the provision of appropriate services to address these impacts (Cicchetti and Toth, 2005, Reeve and van Gool, 2013). To begin to understand the mechanisms by which exposure to abuse and neglect impact on an individual's social and emotional adjustment, a developmental psychopathology perspective will be taken (Cicchetti and Toth, 1995). This seeks to develop an understanding of the role of biological, cognitive and behavioural factors and processes along with their environmental and social context in adaptive and maladaptive developmental trajectories. As such, these authors emphasised the need for understanding adversity across multiple levels (Cicchetti and Toth, 1995). Adolescence is identified as a particularly important developmental period to be considered within a

developmental psychopathology framework, given the significant biological, cognitive and behavioural changes as well as changing social contexts during this period of transition into adulthood (Cicchetti and Rogosch, 2002). Further, both normative and maladaptive development should be considered together, as a proper understanding of each is based on its relationship with the other (Cicchetti and Rogosch, 2002).

As such, whilst this study is particularly focused on the emotional and social cognitive processes that may confer risk for emotional and social difficulties arising as a result of child maltreatment, it draws on the broader literature regarding the impacts of early life stress on biological systems, as well as current models regarding the development of social and emotional processes in order to contextualise this research. These models will now be explored.

1.4.1 Models of Maltreatment

Over-arching models of maltreatment (**Figure 1.1**) emphasise the interaction of gene and environment over the course of development, impacting on the individual's phenotype and vulnerability to emotional and behavioural difficulties (Heim and Nemeroff, 2001, Loman et al., 2010). This approach makes a number of key points. First, the genetic and environmental contexts interact over development, impacting on ongoing neurodevelopment, in particular the stress response system and associated networks. These neurobiological changes in turn impact on developing systems of emotion regulation, which in turn lead to internalising and externalising symptoms and peer problems. Second, these processes are not unidirectional. Rather, emotion regulation can also affect how the organism engages with the environment resulting in exposure of specific environmental events (Howell and Sanchez, 2011). Processes of

emotion regulation therefore play an important role, providing the cognitive link between neurobiological functioning and subsequent psychosocial adjustment, whilst also affecting future engagement with the environment. Finally, the caregiving context emerges as a specific early environmental factor that plays a critical role influencing the developing neurobiological and cognitive processes. As such, this model emphasises the importance of "expected parental care", or what has been termed the "serve and return" interaction with caregivers in regulating brain systems and shaping the developing brain, particularly the hypothalamic-pituitary-adrenocortical (HPA) axis (National Scientific Council on the Developing Child 2012). Where this expected care is missing (neglect) or otherwise inappropriate (abusive), the developing neurobiological and cognitive systems are not buffered from these adverse environments, increasing the individual's risk of emotional and behavioural disorders (Loman et al., 2010).

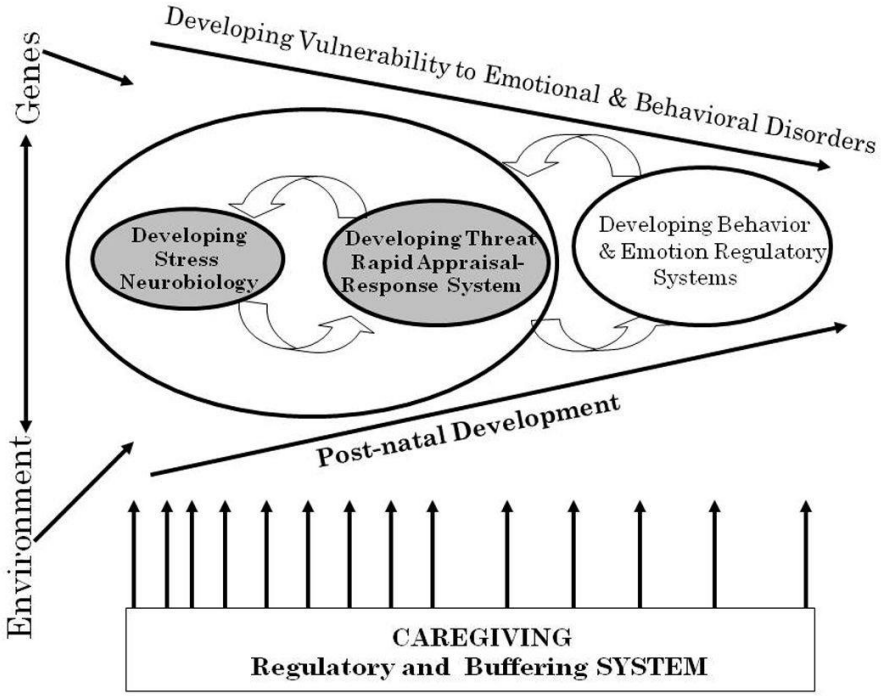


Figure 1.1: Early Life Stress Model (Loman and Gunnar 2010) GXE interaction influences developing vulnerability to emotional and behavioural disorders in the context of parental responsiveness. These factors lead to differences

in neurobiologically based stress response systems and their subsequent impacts on behaviour and emotion regulation systems.

This model draws on other models with more specific foci, such as the Biological Sensitivity to Context Model (Boyce and Ellis, 2005) and the Allostatic Load Model (McEwen and Stellar, 1993) which both focus on the neurobiological impacts of early environmental context; and the Ecological-Transactional Model (Cicchetti and Lynch, 1993) which emphasises the social context of human development. The neurobiological models explain the environmental adaptation of the stress response system (seen as an evolutionary mechanism by which development calibrates the individual to its environment (Boyce and Ellis, 2005, Juster et al., 2011), and implicate three main brain structures which may be functionally and structurally affected (Juster et al., 2011, McEwen and Gianaros, 2011): the amygdala, prefrontal cortex and hippocampus, which are associated the detection of environmental threats, cognition and top-down control and learning from previous experience respectively (Danese and McEwen, 2012, Juster et al., 2011). The Ecological-Transactional Model meanwhile emphasises the ongoing transaction between distal and proximal influences, and risk and protective factors across development (Cicchetti and Lynch, 1993). Accordingly, it is the balance of risk and protective factors across the system that determines the likelihood of maladaptive outcomes, with more proximal factors (individual or family factors) carrying more weight than relatively distal ones (community factors) (Cicchetti and Lynch, 1993, Lynch and Cicchetti, 1998).

An additional feature of the model outlined by Loman and Gunnar (2010) reflects the impact of developmental timing, with the converging lines each side of the model reflecting greater impact or risk earlier in development. Developmental timing of

early life stress is important (Perry, 2009). Different regions and circuits of the brain mature at different rates, giving rise to the idea of sensitive periods within the neurobiological models of early exposure to stress (Boyce and Ellis, 2005). Pechtel and Pizzagalli (2011) outline a set of general principals of brain development in normative populations that provide a basic framework within which to consider the impacts of early abuse and neglect. They outline that brain development is generally a non-linear process, guided by an individual's genotype, including gender, but also critically shaped by environmental influences. Further, higher-order cortices develop only after lower-order cortices have matured. These late developing regions are evolutionarily "younger", are linked to complex skills such as decision-making, executive functioning and inhibition, and are more prone to impairments of early life stress. As such, it is considered that the timing of maltreatment is a key factor in the effects of maltreatment on the brain, with the section of the brain undergoing development at that time especially affected by a failure of the expected environment (Pechtel and Pizzagalli, 2011).

In summary, the Early Life Stress Model (Loman et al., 2010) has integrated these frameworks, describing the relationship between early adverse environments and subsequent risk of psychopathology in terms of both environmental impacts on neurodevelopment and important social contexts, in particular proximal factors of the individual (genetic, cognitive processes) and family (parent-child relationship), in addition to the developmental timing of these environmental influences. Central to this account is the role of cognitive processes of emotion regulation, which provide the functional link between the impact of early adverse environmental contexts on

neurodevelopment and the development of emotional and social difficulties. The construct of emotion regulation refers to those processes that regulate the emotional experience by influencing the nature and intensity of the emotional impact of internal or external stimuli. These processes are held to link neurobiological impacts of maltreatment to emotional and behavioural outcomes (**see Figure 1.1**). The bidirectional nature of this link means that developing processes of emotion regulation not only influence vulnerability to emotional or social difficulties, but are also said to influence future experiences and their ongoing impact on neurobiological systems, such that processes of emotion regulation could be said to play a pivotal role in the ongoing developmental trajectories of those exposed to early maltreatment. As such, understanding the emotion regulation processes affected by maltreatment across development is important not only to understanding mechanisms of risk and vulnerability for emotional and social difficulties, but also in developing effective interventions to address such vulnerability and promote resilience. A more detailed outline of the construct of emotion regulation informing this study will be provided in the following section.

This study seeks to extend these frameworks, by identifying more precisely the *cognitive* mechanisms of emotion regulation that may be associated with risk or resilience of subsequent emotional or social difficulties in those exposed to maltreatment. Based on the above models, such processes of emotion regulation would possess particular characteristics. First, their development would be largely dependent on parent-child interactions, particularly early in life. In normative development, early caregiving helps to regulate the child's arousal and buffer potential threats through

"serve and return" interactions (National Scientific Council on the Developing Child, 2012). However, in maltreating contexts, these interactions are either not present (such as neglect) or inappropriate (abuse), leading to significant changes to cognitive processes of emotion and behavioural regulation. Second, they should be functionally linked in the literature with neural networks implicated in the effects of maltreatment, particularly the fronto-limbic network including the amygdala, prefrontal cortex and cingulate cortex and hippocampus. Finally, variations in the processing of these mechanisms should be linked to emotional and social difficulties in non-maltreated children and adolescents.

Models of emotion regulation will now be examined to identify more specific cognitive processes that could be perturbed in individuals exposed to early maltreatment and which could explain poorer outcomes. First, cognitive processes implicated in emotion regulation are outlined, identifying particular aspects that may be affected by maltreatment placing maltreated children and young people at greater risk of emotional difficulties. Next, models of social cognition are discussed, focusing on cognitive processes involved in the understanding of social situations that may also be affected by maltreatment, contributing to the social difficulties experienced by maltreated children and young people. Importantly, I highlight how these emotional and social processes can be studied empirically using experimental tasks. Existing evidence of the impacts of maltreatment on these emotional and social processes are then explored. On the basis of existing limitations in the literature, I outline the broad research questions that will be the focus of subsequent chapters.

1.4.2 Cognitive Models of Emotion Regulation

As is clear from the maltreatment models discussed above, cognitive processes of emotion regulation are said to provide a critical link between neurobiological adaptations to the environment and subsequent risk of emotional and social difficulties, both presently and over the life course. The construct of emotion regulation is therefore central to understanding the emotional and social difficulties experiences by those exposed to maltreatment, as well as those that demonstrate resilience in the face of such adversity (Cicchetti, 2010).

Emotion regulation refers to the ability to regulate one's emotional state to promote appropriate or optimal engagement with the environment (Kim and Cicchetti, 2010), or "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998: pp 275). Emotions are held to serve important individual and social functions, such as influencing decision making (Gross, 1998), and as such "emotion regulation is critical both in initiating, motivating and organising adaptive behaviour, and in preventing stressful levels of negative emotions and maladaptive behaviour" (Cicchetti, Ackerman and Izard 1995 : pp. 6). Emotion regulation influences the emotion generative process (**Figure 1.2**), with each point influencing later points as well as subsequent cycles, forming a feedback loop or transactional process (Gross and Thompson, 2007, Gross, 2008). As such, emotion regulation processes can be distinguished with respect to the stage of the emotion generative process in which they operate (Gross and Thompson, 2007) (see **Figure 1.2**).

Situation Selection involves strategies or processes that make it more or less likely that an individual will end up in a situation that will increase or decrease a particular emotion. Situation Modification refers to those processes enacted to ultimately alter the parameters of the situation and thereby its emotional impact. Attentional Deployment refers to processes or strategies with respect to how one directs their attention resources, to focus on or ignore particular features and thereby regulate its emotional impact. Cognitive Change refers to those processes that relate to how one interprets or appraises the situation. Finally, Response Modulation refers to strategies or processes to directly influence responding, such as controlling the display of emotional expression. These processes can further be categorised as those that have their impact prior to emotional experience (antecedent-focused) and those that aim to modulate or respond to the emotions after they arise (response-focused) (Gross and Thompson, 2007). These processes have been functionally associated with neural networks including the amygdala, prefrontal cortex and anterior cingulate cortex (Mueller, 2011, Ochsner and Gross, 2005, Ochsner and Gross, 2008).

All of these processes are top-down focused on increasing or decreasing a given emotional response (Ochsner and Gross, 2007). However, whilst being goal-driven, emotion regulation is not necessarily a conscious or effortful process (Gross and Thompson, 2007). Dual-process frameworks have been developed to structure this range of processes (Gross, 2008), defining explicit emotion regulation processes as those that require some level of conscious effort, awareness and monitoring, whereas implicit processes occur automatically, without insight or awareness (Gyurak et al., 2011). Although most research has focused on explicit processes of emotion regulation like

rumination or cognitive reappraisal, more implicit processes such as selective attention (Todd et al., 2012) are beginning to be considered (Amstadter, 2008, Koole and Rothermund, 2011, Mauss et al., 2007a, Mauss et al., 2007b, Todd et al., 2012).

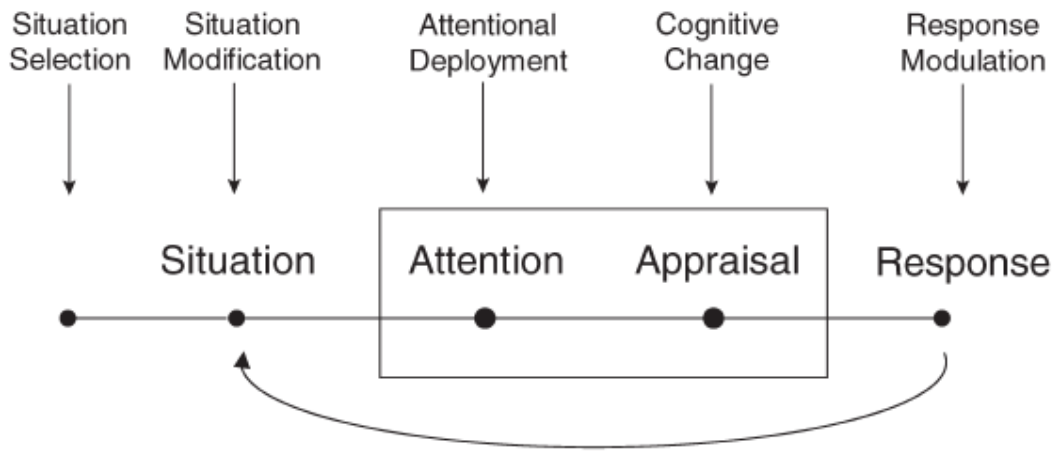


Figure 1.2: The emotional generative process (below), with emotion regulation strategies listed above at the point in which they are hypothesised to operate. From Gross and Thompson (2007), pp. 10.

Importantly, the development of emotion regulation processes is closely related to the child's early relationships, with caregivers showing "coregulation of infant emotion that is sensitive to the infant's needs, ... coconstruction of emotion narratives by mother-child dyads that may serve as later emotion "scripts" for the child, and ... maternal encouragement of autonomy as the child learns how to regulate independently of the mother (Southam-Gerow and Kendall 2002: pp 197). It is therefore likely that emotion regulation processes will be affected by abusive or unresponsive caregiving relationships, and hence emotion regulation is central to models explaining the increased vulnerability to emotional and social difficulties experienced by those exposed to childhood maltreatment (Loman et al., 2010). In fact, maladaptive emotion regulation processes across the emotion generative process are associated with

emotional difficulties, such as mood and anxiety disorders (Campbell-Sills and Barlow, 2007) and externalising problems such as hyperactivity and social problems (Mullin and Hinshaw, 2007).

Within this work, implicit processes of emotion regulation have not attracted much empirical attention (Amstadter, 2008, Koole and Rothermund, 2011, Mauss et al., 2007a), despite the possibility that such processes may play an important role in psychopathology (Etkin et al., 2010, Gyurak et al., 2011, Mauss et al., 2007a). In the present study, I explored whether the following implicit cognitive processes of emotion regulation were affected by maltreatment and whether these explained emotional difficulties in young people who had been exposed to abuse and neglect.

1.4.2.1 Situation Selection Processes

Models of situation selection seek to explain decision-making processes of avoidance of and approach towards emotional, particularly threatening situations. The balance of avoidance to approach behaviours seeks to maximise rewards and minimise exposure to negative outcomes. One influential model of avoidance and approach of threat-related stimuli emphasises the interactions of three neuropsychological mechanisms, the Fight/Flight/Freeze System (FFFS), the Behavioural Approach System (BAS), and the Behavioural Inhibition System (BIS), and their role in disorders of fear and anxiety (Gray and McNaughton, 2000, McNaughton and Corr, 2004). Under this model, the FFFS, associated with the periaqueductal gray, medial hypothalamus and amygdala, is activated by aversive stimuli such as those associated with threat or punishment while the BAS, associated with the dopaminergic neurotransmitter system including the prefrontal cortex, striatum and pallium, is associated with positive outcomes such as

reward or the absence of aversive stimuli. The BIS, distributed among the septo-hippocampal system and amygdala, is activated when conflicting goals arise, such as situations involving conditioned threat cues (Corr, 2004), or those requiring approach in the presence of threat (Gray and McNaughton, 2000, McNaughton and Corr, 2004). The activation of the BIS is associated with anxiety, and is associated with inhibiting ongoing behaviour, promoting risk analysis and vigilance in order to resolve the conflict, favouring the FFFS over the BAS to do so (Gray and McNaughton, 2000, McNaughton and Corr, 2004).

Exposure to maltreatment may disturb the functioning of these systems, leading to differences in avoidance and approach tendencies, which have been associated with emotional difficulties such as anxiety and depression (Fareri et al., 2008). Processes of approach and avoidance in the face of threat can be examined empirically, using well-established paradigms of conditioned avoidance and risk-taking (that is, pursuit of reward in the presence of threat) (Lissek et al., 2005, Maner et al., 2007, Morrongiello et al., 2012). In this study we therefore examine possible differences in this aspect of emotion regulation by exploring the performance of maltreated adolescents on tasks of conditioned avoidance and risk taking, in comparison to that of non-maltreated peers.

1.4.2.2 Attentional Deployment

Selective attention operates to focus attentional resources on particular features of the environment which then impact on how the environment is perceived and the emotional impact thereof, and is therefore associated with attentional deployment (Gross and Thompson, 2007). Threat-related selective attention plays a central role in cognitive models of anxiety, with a number of experimental paradigms developed in

order to examine their nature (see Cisler and Koster 2010 for a review). Attention biases towards threatening stimuli have been consistently reported in anxious samples (Bar-Haim et al., 2007), however debate is ongoing regarding whether such processes reflect vigilance towards threatening stimuli (Mathews and Mackintosh, 1998, Mogg and Bradley, 1998), difficulty disengaging from threat-related stimuli (Fox et al., 2001, Fox et al., 2002), or difficulties associated with attention control (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2009, Eysenck et al., 2007, Eysenck and Derakshan, 2011). As such, it is important to consider not only whether threat-related biases of selective attention are present in maltreated adolescents, but also their nature, drawing on this broader theoretical and empirical work. In this study we examine whether threat-related processes of selective attention of maltreated adolescents differ from those of their non-maltreated peers. Further, we explore whether such differences, if present, are best explained by facilitated attention, delayed disengagement or attention control accounts of threat-related biases.

1.4.2.3 Cognitive Change

Implicit processes of emotion regulation in this stage of the emotional generative process are those that influence the way in which emotional stimuli are interpreted and the appraisal or attributions made thereof (Gross and Thompson, 2007). Such interpretation biases have been associated with emotional difficulties in child and adolescent samples (Mathews and MacLeod, 2005, Taghavi et al., 2000), using questionnaire and social vignette paradigms developed for this purpose, including indications that induced negative interpretation biases predict a negative change in affect for some adolescents (Lau et al., 2011). As with processes of selective attention, threat-related interpretation biases are an important part of paediatric anxiety

frameworks (Lau and Pine, 2008), emphasising the role of these cognitive processes in the development of anxiety disorders. The presence of such interpretative biases in maltreated adolescents could likewise play an important role in the emotion regulation difficulties of maltreated adolescents and the emotional difficulties experienced by this group. As such this study seeks to examine whether the appraisals of maltreated adolescents are significantly more negative or hostile than those of non-maltreated peers. As with the above, we focused on attributions of ambiguous social situations, which are likely to be particularly relevant to adolescents given the central role of social relations.

1.4.3 Social Understanding

While maladaptive emotion regulation may contribute to the emotional difficulties of maltreated children, they may also contribute to the social difficulties experienced by maltreated children. However, other aspects of social understanding may also contribute to the social difficulties prevalent in maltreated populations. Social models such as the Social Information Processing model (Crick and Dodge, 1994) outline a number of steps in a cycle of information processing in social situations (**see Figure 1.3**), with emotion considered "integral" to each step (Crick and Dodge 1994 ; pp. 81) As such, the regulation of emotion is also central to social information processing and social interactions, with processes such as selective attention and interpretation biases playing an important role in social interactions (Crick and Dodge 1994 ; **see Figure 1.3**, Steps 1 & 2). However, this model also includes a "database" of social skills, knowledge and schemas which are central to the processing of social information, developing qualitatively and quantitatively over development and as a result of social experiences. Therefore, while the impact of maltreatment on processes of emotion regulation may

contribute to both the emotional and social difficulties experienced by those exposed to maltreatment, the social difficulties of those exposed to maltreatment may also reflect differences in this social "database" in terms of the skills and knowledge acquired over development.

This database of social skills is consistent with the conceptualisation of "social understanding", referring to "a range of skills including emotion recognition and understanding, perspective taking, attribution of intentions, and false belief understanding" (Luke and Banerjee 2013 , pp:3). As outlined above, these skills develop within the social context and through social interactions, and are particularly dependent on parent-child interactions in early life (Carpendale and Lewis, 2006), providing important mental-state language (Peterson and Siegal, 2000) and conceptual scaffolding through interactions tailored to the child's current understanding (Nelson et al., 2012). As such, parenting that is characterised by abuse or neglect is unlikely to provide this important scaffolding for understanding the internal mental states of others (Cicchetti et al., 2003). Further, social understanding has been linked to particular neural networks, including the amygdala, prefrontal cortex and anterior cingulate cortex (Adolphs, 2001, Blakemore, 2012, Nelson et al., 2005, Pelphrey and Carter, 2008), which are affected by maltreatment (Dannlowski et al., 2012, Hart and Rubia, 2012, Hassel et al., 2011, McCrory et al., 2010, McCrory et al., 2011). Therefore, abusive or neglectful parent-child interactions may lead to a deficient or maladaptive database of social knowledge and skills, in turn contributing to the social difficulties experienced by this population. Therefore, in addition to the aforementioned studies targeting processes of emotion regulation, this study also sought to investigate the impact of maltreatment on

social understanding, specifically the understanding of emotion and of the internal mental states of others, as well as the social responding of maltreated adolescents relative to their non-maltreated peers.

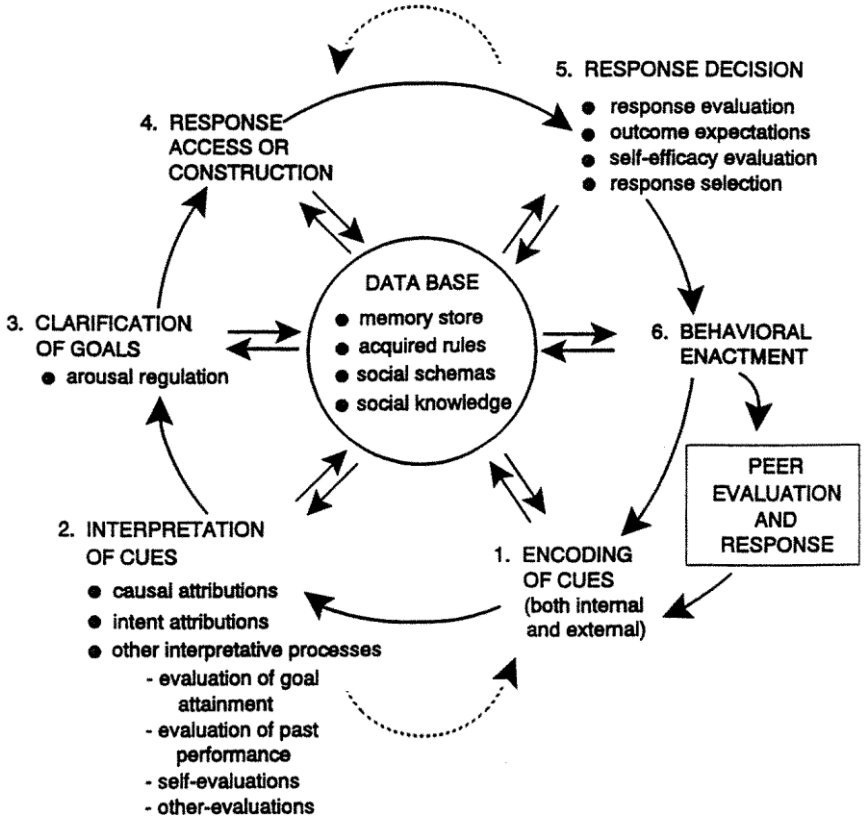


Figure 1.3: Social information processing model, as seen in Crick and Dodge 1994

1.4.4 Summary: Theoretical Framework

There are a number of cognitive processes, such as approach and avoidance behaviours, selective attention and interpretation biases which are associated with emotional difficulties and which may be affected by early maltreatment experiences. In addition to these cognitive processes, aspects of social understanding including emotion understanding and understanding the thoughts, feelings and intentions of others may also explain why individuals who have experienced maltreatment may manifest with social difficulties across development. My thesis will examine the degree to which

maltreatment experiences affect these specific cognitive processes and explain why individuals who have experienced maltreatment display emotional and social difficulties.

While not the focus of this thesis, additional theoretical frameworks may nevertheless also contribute to the vulnerability of those exposed to child abuse and neglect. In particular, differences in attachment style may be one additional mechanism that contributes to the vulnerability of maltreated children and young people (Oshri et al., 2015). Attachment theory describes the development of a pattern of behaviours that promotes survival, largely through seeking proximity of caregivers, which come to serve as both a "safe haven" in the presence of perceived threats or a "secure base" from which to explore (Moretti and Peled, 2004, Crittenden and Ainsworth, 1989). Attachment patterns emerge across development, typically within the context of caregiver relationships (Crittenden and Ainsworth, 1989). Further, early attachment relationships develop into internal working models that inform children's expectations about social relationships (Cicchetti and Toth, 2005, Bacon and Richardson, 2001). Maltreatment has been associated with a greater prevalence of insecure and disorganized attachment (Cyr et al., 2010), associated with later difficulties (Carlson et al., 2003) possibly mediated via its influence on the development of emotion regulation (Cassidy, 1994). As such, attachment patterns may also contribute to the relationship between maltreatment and emotional and social difficulties in childhood and adolescence.

1.5 Effects of maltreatment: empirical evidence

Models outlining the impact of child maltreatment assert that such experiences lead to significant changes in neurobiological stress response systems, affecting the development of cognitive processes and processes of emotion regulation, thereby increasing vulnerability to emotional and social difficulties (Heim and Nemeroff, 2001, Loman et al., 2010). Consistent with the models outlined above, research has demonstrated that maltreatment is associated with significant changes in the operation of the stress response system, particularly the hypothalamic-pituitary-adrenal (HPA) axis (Cicchetti and Rogosch, 2001, Glaser, 2000, Gunnar and Cheatham, 2003, Heim and Nemeroff, 2001, Tarullo and Gunnar, 2006, van der Kolk, 2003), and in the structure and function of related brain regions including the amygdala, hippocampus, prefrontal cortex, anterior cingulate cortex, corpus callosum and cerebellum (Dannlowski et al., 2012, Hart and Rubia, 2012, McCrory et al., 2010, McCrory et al., 2011, Teicher et al., 2012, Tottenham and Sheridan, 2009). These alterations have been linked to changes with cognitive and affective functioning (Hassel et al., 2011, Pechtel and Pizzagalli, 2011, Wilson et al., 2011) and vulnerability to psychopathology (Heim and Binder, 2012, Heim and Nemeroff, 2001, Jackowski et al., 2009, McCrory et al., 2010, McCrory et al., 2011). Consistent with the maltreatment models outlined above, the role of genetic and epigenetic processes of outcomes (Champagne and Curley, 2009, Heim and Binder, 2012, McCrory et al., 2010, McCrory et al., 2011) as well as the importance of developmental timing (Heim and Binder, 2012, Perry, 2009) have also been demonstrated. While studies have reported difficulties in 'cold' cognitive functions (Beers and De Bellis, 2002, Bucker et al., 2012, De Bellis et al., 2009, DePrince et al., 2009, Gould et al., 2012, Nolin and Ethier, 2007, Pollak et al., 2010) in those exposed to

maltreatment or institutional deprivation (a rearing environment characterised by severe neglect), studies have only recently focused on the impact of maltreatment on cognitive strategies of emotion regulation and social understanding (Hassel et al., 2011, Pechtel and Pizzagalli, 2011), which is at the core of this study.

Maltreatment has been found to be associated with emotion dysregulation in a series of studies completed by Cicchetti and colleagues (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields and Cicchetti, 2001, Shields et al., 2001, Teisl and Cicchetti, 2008). In these studies, the emotion regulation of children attending a camp (some of whom were previously exposed to maltreatment) was coded based on the observations of trained camp counsellors. Maltreated children showed dysregulated emotions when exposed to inter-adult aggression (Maughan and Cicchetti, 2002), with ambivalent emotion regulation mediating the link between maltreatment and symptoms of anxiety and depression. Similarly poorer emotion regulation was associated with externalising symptoms, which were related to later peer rejection and externalising symptoms (Kim and Cicchetti, 2010) and more disruptive and socially withdrawn behaviours, social difficulties and increased risk for both victimisation and bullying, particularly for those exposed to abuse rather than neglect (Shields and Cicchetti, 2001). Better emotion regulation was associated with more adaptive outcomes such as peer acceptance and fewer internalising symptoms (Kim and Cicchetti, 2010). While these studies emphasised the important role of emotion regulation in emotional and social adaptation, they take a broad view of emotion regulation, coded on the basis of behavioural observations rather than identifying the specific cognitive processes (see **Figure 1.2**) underlying this broad construct that may be relevant to the

development of emotional and social difficulties in maltreated children. Two studies have demonstrated the mediating role of specific cognitive processes, specifically interpretation bias, between maltreatment and social difficulties (Shields et al., 2001, Teisl and Cicchetti, 2008). These studies demonstrated that maltreatment (or specifically physical abuse in the case of Teisl and Cicchetti 2008) was associated with a tendency to make more negative interpretations of other's intentions, which significantly predicted social difficulties such as aggressive behaviour and peer rejection. In doing so, Teisl and Cicchetti (2008) emphasise the importance of considering multiple processes of development when exploring the impact of maltreatment on later adjustment. This research seeks to build on this work, exploring the role of a range of cognitive processes of emotion regulation and social understanding in the emotional and social adjustment of maltreated adolescents.

1.6 Processes of Emotion Regulation and Maltreatment

1.6.1 The effects of Maltreatment on Situation Selection - Avoidance and Approach

Tendencies of approach or avoidance are important processes of emotion regulation, referring both to avoidance of aversive stimuli (avoidance) and to pursuit of rewards in the presence of risk (approach). Whilst the finding of withdrawn social behaviour exhibited by maltreated children (Anthonysamy and Zimmer-Gembeck, 2007, Klimes-Dougan and Kistner, 1990) suggests behavioural avoidance, there is a clear absence of direct studies investigating conditioned avoidance in individuals who have experienced maltreatment.

In contrast maltreatment has been associated with greater adolescent risk-taking behaviours including delinquency, with slight subtype differences with physical abuse associated with overall risky behaviour and neglect with substance use (Taussig, 2002). Results from experimental paradigms are mixed, with studies reporting maltreatment to be associated with more risky decisions and slower responses (Weller and Fisher, 2013), whilst another study found no difference in risk-related decisions and generally quicker responses to risky decisions (Guyer et al., 2006). Further, maltreated children appeared to view rewards less favourably (Dillon et al., 2009) and be less sensitive to changing risk probabilities, showing consistent response times in decision making tasks regardless of risk and reward contingencies (Guyer et al., 2006, Weller and Fisher, 2013) relative to non-maltreated peers.

Table 1.2: Studies exploring conditioning processes in maltreated children (avoidance and reward processes)

Study	Subjects	Process/Task	Findings
Taussig 2002	110 youth in foster care, 7-12 years	Time 1: Demographic, behavioural and social questionnaires Time 2: Adolescent Risk Behaviour Survey	• Physical abuse associated with delinquency and overall risk behaviours at Time 2. Neglect associated with delinquency and substance use at Time 2. • Lower social support and greater perceived acceptance were both associated with risk taking
Weller and Fisher 2012	137 children (25 maltreated), 8-12 years	Experimental task – risk for gains or losses	• Maltreated made more risky decisions • Maltreated did not vary response speed as contingencies changed, particularly in the loss domain. • Maltreated showed slower responses
Dillon et al 2009	13 maltreated (M=24 years) and 16 controls	Experimental task and fMRI data, with cues to predict gains,	• Maltreated rated rewards less favourably than non-maltreated peers. • Maltreated showed slower responses • fMRI showed decreased activity in left pallidus in anticipation of reward.

	(M=37 years), male	losses or no-change	No difference with respect to loss cues.
Guyer, Kaufman, Hodgdon, Masten, Jazbec, Pine and Ernst (2006)	38 maltreated and 21 controls, 8-14 years	Experimental task – probabilistic rewards	• Maltreated no general difference in risk-related decisions • Maltreated children selected risk options faster than controls • Maltreated did not vary response speed as contingencies changed • Maltreated children with depressive disorders selected less risky options more frequently than controls

There is then little data available with respect to the approach and avoidance tendencies associated with maltreatment generally (**see Table 1.2**). However, of note are animal models demonstrating the possible impacts to these processes arising from early adverse rearing experiences (Callaghan and Richardson, 2011, Kosten et al., 2012, Nelson et al., 2009, Pryce et al., 2004, Ruedi-Bettschen et al., 2005). Therefore there is considerable need to translate this research and explore whether exposure to maltreatment or particular subtypes thereof is associated with differences in both avoidant and approach behaviours relative to non-maltreated peers in adolescence, and whether such processes are associated with emotional and social difficulties. This study therefore investigated the tendency for avoidance and approach responding in the presence of threat of maltreated adolescents compared to their non-maltreated peers, using experimental paradigms of conditioned avoidance and risk taking.

1.6.2 The effects of Maltreatment on Attentional Deployment - Selective Attention

Differences in selective attention between maltreated and non-maltreated children have also been observed (**Table 1.3**), suggesting that maltreated children show hyper-vigilance to threatening cues across a number of experimental reaction time tasks (Gibb et al., 2009, Pollak and Tolley-Schell, 2003, Pollak et al., 2005, Shackman et al.,

2007) as well as physiological data such as ERPs (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Pollak et al., 1997, Pollak et al., 2005, Shackman et al., 2007). Studies have generally associated exposure to maltreatment, particularly physical abuse, with a selective attention bias towards threat related cues. However, other studies using equivalent reaction time paradigms have reported avoidance of threatening stimuli associated with physical abuse but not neglect, which showed no threat-related attention biases (Pine et al., 2005). In addition, bias towards sad but not angry facial expressions has been demonstrated in physically abused children (Romens and Pollak, 2012) but only following a sad mood-state induction procedure and significantly longer periods of exposure to the emotional stimuli. However, while this study focused on physical abuse, the authors also note that "children with high levels of emotional abuse attended more to anger cues across all time points" (Romens and Pollak 2012, pp.123).

In general then, the majority of studies suggest that maltreatment is associated with threat-related attention biases towards threatening emotional stimuli, however avoidance has also been reported (Pine et al., 2005), which may reflect sampling differences such as the high rate of PTSD reported by Pine et al (2005). Further, bias towards sad but not threatening faces associated with physical abuse has also been reported (Romens and Pollak, 2012), however this may reflect methodological differences such as longer exposure duration specifically to examine depression-related biases as opposed to threat-related biases. Finally, while such biases are generally related to physical abuse, the small number of studies examining the impact of different maltreatment subtypes urges caution regarding such conclusions, and as a result of these inconsistencies, additional studies are required. This study therefore sought to

explore possible threat-related biases of selective attention associated with maltreated, as well as exploring the mechanisms by which such biases may operate, and the relative role of different maltreatment subtypes.

Table 1.3: Studies exploring processes of selective attention in maltreated samples

Study	Subjects	Process/Task	Findings
Romens and Pollak (2012)	61 adolescents (11-14 years), freq of physical abuse scored by questionnaire, 5 children met diagnostic criteria for conditions such as ADHD, ODD and phobias	Reaction time (dot probe) with neutral, happy, sad and angry facial expressions (exposure time: 1500ms). Induced sad emotional state	•Association between physical abuse and increased bias towards sad faces (but only after sad mood state induction). •Association between emotional abuse and increased bias to anger cues. No threat-related bias associated with physical abuse
Shackman, Shackman and Pollak (2007)	Study 1: 16 physically abused and 14 non-abused (M=9.81 years) Study 2: 14 physically abused, 14 non-abused (M=9.42 years)	Modified oddball emotion recognition task involving anger, happiness and sadness. Study 1: attend to facial expression whilst ignoring voice emotion. Study 2: attend to voice emotion whilst ignoring facial expression	•Physically abused show increased bias towards task relevant and task irrelevant anger cues •Threat related bias towards anger reflected in physiological responses
Pine et al (2005)	34 maltreated (22 with PTSD) and 21 non-maltreated, 7-13 years	Reaction time (Dot probe) including angry, happy and neutral faces (500ms)	•Association between physical abuse and increased bias away from angry faces (but this may be mediated by presence of PTSD). •No association between neglect and attention biases towards/away from angry faces
Pollak, Vardi et al (2005)	11 Physically abused and 22	Autonomic and behavioural response to interpersonal situation –	•Increased anticipatory monitoring of environment

	non-abused 4-5 years	Connors Continuous Performance Test	among children with histories of physical abuse
Pollak and Tolley-Schell (2003)	14 physically abused and 14 non-abused 8-11 years	Reaction time (Spatial cueing) task using angry or happy faces (500ms) – behavioural and EEG measures	• Attention bias towards angry relative to happy faces in physically abused group. No evidence of response slowing
Gibb, Schofield and Coles (2009)	217 undergraduates, 47 self-reported abuse mean age 19.24 years	Reaction time (Dot probe) with angry, sad and happy expressions (1000ms) Interpretation Bias: morphing task using angry, sad and happy expressions	• Maltreated group showed attention bias towards angry faces and increased sensitivity to angry expressions at lower intensities. • Persisted when controlling for anxiety.

1.6.3 The effects of Maltreatment on Cognitive Change – Interpretation Bias

The interpretation biases of those exposed to maltreatment have been examined, generally in relation to their attributions regarding the social behaviours of others (Dodge et al., 1990, Dodge et al., 1995, Downey and Walker, 1989, Keil and Price, 2009, Price and Glad, 2003, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008), with mixed results (**Table 1.4**). While some studies have reported more hostile interpretations of the intentions of others (Dodge et al., 1990, Dodge et al., 1995, Price and Glad, 2003, Teisl and Cicchetti, 2008), particularly with respect to exposure to physical abuse, other studies have reported no such interpretative biases associated with maltreatment generally (Downey and Walker, 1989), or exposure to physical abuse (Sabourin Ward and Haskett, 2008). The interpretation biases of physically abused children was found to predict aggressive and disruptive behaviours (Teisl and Cicchetti, 2008). Keil and Price (2009) found that those exposed to both Physical Abuse and Neglect were more likely to make hostile attributions of others in situations of peer

provocation but not group entry (that is, when making a social approach to join a group activity), whereas exposure to neglect alone was not associated with hostile attributions. In particular, Shields, Ryan and Cicchetti (2001) reported not only that maltreated children had more negative representations of parents than non-maltreated peers, but such negative representations were associated with emotion dysregulation and peer difficulties, demonstrating the hypothesised mediating role of such interpretation biases between maltreatment and peer difficulties in childhood.

Table 1.4: Studies exploring interpretation or attribution biases in maltreated samples

Study	Subjects	Process/Task	Findings
Dodge, Bates and Pettit (1990)	309 children aged 4yrs, 46 considered likely exposed to physical abuse	Ambiguous vignettes	• Physically abused children showed hostile attribution in response to negative acts in ambiguous scenarios
Dodges, Pettit, Bates and Valente (1995)	584 children, recruited in kindergarten, 69 considered likely exposed to physical abuse	Ambiguous vignettes	• Physically abused children showed hostile attribution in response to negative acts in ambiguous scenarios
Shields, Ryan and Cicchetti (2001)	121 children (76 maltreated) 8-12 years old	Narrative task involving vignettes of parent-child interactions	• Maltreated children's representations of parents more negative/constricted and less positive/coherent than non-maltreated • Negative representations associated with emotion dysregulation and peer rejection
Price and Glad (2003)	100 (44 maltreated) aged 6.5 years	Ambiguous vignettes	• Physically abused boys more likely to make hostile attributions than non-maltreated children • Boys more frequently abused made most hostile attributions

Downey and Walker (1989)	83 children, 25 from maltreated families (mostly neglect), 7-14 years	Ambiguous vignettes	• Maltreatment showed no difference in attributions relative to controls
Keil and Price (2009)	188 children (100 maltreated) Maltreatment occurred between 4 and 6 years, aged 5-8	Social vignettes - peer provocation and group entry	• Those exposed to both physical abuse and neglect made more hostile attributions than non-maltreated (peer provocation). • Neglect-only group showed no difference in attributions
Teisl and Cicchetti (2008)	267 children in two cohorts (167 maltreated), 6-12 years	Social vignettes,	• Physically abused showed hostile bias relative to non-maltreated • Significantly predicted aggressive/disruptive behaviour
Ward and Haskett (2008)	98 physically abused, 77 non-maltreated, 5-10 years	Ambiguous vignettes	• Physically abused did not show any difference in hostile attributions • "Hanging in there" maltreated cluster showed more hostile attributions than "socially well-adjusted" maltreated children

However, whether these interpretational biases persist into adolescents, where social situations and peer relationships are particularly important (Steinberg and Morris, 2001), is unclear, as is whether similar appraisals are made regarding peers. This study therefore sought to examine whether the appraisals (specifically social appraisals) of maltreated adolescents regarding parents/carers and peers are significantly more negative or hostile than those of non-maltreated peers, and whether such interpretational biases, if present, are associated with particular maltreatment subtypes or factors.

1.6.4 The effects of Maltreatment on Social Understanding

While differences in the above processes of emotion regulation may also contribute to the social difficulties of those exposed to childhood maltreatment, models of social processes also emphasise the role of social understanding in social interactions (Crick and Dodge, 1994). As such, differences in social understanding, including emotion understanding and understanding the thoughts, feelings and intentions of others, are central to social interactions, and may therefore also explain or contribute to the social difficulties of those exposed to maltreatment.

1.6.4.1 Social Understanding: Emotion Understanding

A number of studies (**Table 1.5**) have examined the understanding and processing of emotions in maltreated samples (Fishbein et al., 2009, Gibb et al., 2009, Masten et al., 2008, Pears and Fisher, 2005, Pollak et al., 2000, Pollak and Sinha, 2002, Pollak and Kistler, 2002, Tarullo et al., 2007). In general, exposure to maltreatment is associated with poorer emotional recognition and understanding, including the recognition of emotional expressions and of emotions in vignettes (Luke and Banerjee, 2013, Pears and Fisher, 2005). Maltreatment effects on emotion recognition and understanding appear to differ by maltreatment subtype. Neglect has been associated with poorer discrimination of facial expressions compared to non-maltreated or even physically abused peers (Fishbein et al., 2009, Pollak et al., 2000). Meanwhile physical abuse has been associated specifically with facilitated recognition of angry (Gibb et al., 2009, Pollak and Sinha, 2002, Pollak and Kistler, 2002) or fearful (Masten et al., 2008) faces, across childhood and adult samples (**see Table 1.5**).

Table 1.5: Studies examining emotion recognition differences in maltreated samples

Study	Subjects	Process/Task	Findings
Masten et al (2008)	29 maltreated and 17 control, 8-15 years	Emotion recognition morphing faces (happy, neutral and fearful)	• Maltreated children identified emotional facial expressions (particularly fearful) on the basis of less stimuli • No difference in labelling of emotions (accuracy) • Maltreated children with and without PTSD faster identifying fearful faces
Pollak and Sinha (2002)	24 physically abused and 23 non-maltreated, 8-10 years	Emotion recognition morphing faces (angry, happy, sad and fearful).	• Physically abused children identified facial expressions of anger on the basis of less stimuli
Gibb, Schofield and Coles (2009)	217 undergraduates, 47 self-reported abuse mean age 19.24 years	Morphing task using angry, sad and happy expressions	• Maltreated identified facial expressions of anger on the basis of less stimuli
Pollak and Kistler (2002)	23 physically abused and 17 non-maltreated, M=9.25 years	Faces morphed from happy or angry to either fearful or sad	• Physically abused children identified facial expressions of anger on the basis of less stimuli
Tarullo, Bruce and Gunnar 2007	120 children; 40 institutional care, 40 in foster care (international), 40 birth children, 6-7 years	emotion recognition: facial expressions – happy, sad, mad, scared) vignettes	• No difference in recognition of facial expressions or situations • Foster care group poorer at understanding antecedents of emotion, however not significant when controlling for verbal ability or years in US
Pollak, Cicchetti, Hornung and Reed (2000)	Study 1: 33 maltreated and 15 non-maltreated, 3:3-5:6 years Study 2: 28 maltreated and 11 non-	Study 1: emotional recognition vignette (happy, sad, disgust, fear and anger) Study 2: Discrimination of facial expressions (same/different)	• Study 1: Neglected children had more difficulty discriminating emotional expressions than non-maltreated or physically abused children. • Study 2: Neglected children saw fewer distinctions between emotions. Physically abused children showed most variance across

	maltreated, 3:5 – 5:8 years		emotions, non-maltreated saw discrete emotions as dissimilar
Pears and Fisher (2005)	60 foster children, 31 community controls, 3-5 years	Emotion recognition (happy, sad, angry, scared) and perspective taking	• Children in foster care showed poorer emotional understanding (emotion recognition and emotion perspective taking) controlling Age, IQ and executive function.

1.6.4.2 Social Understanding: Internal Mental States

The ability of maltreated children to understand the internal mental states of others has also been explored (Cicchetti et al., 2003, Pears and Fisher, 2005) (**Table 1.6**). In general, those exposed to adverse early care (including severe neglect in the form of institutional deprivation) demonstrated delayed understanding of the internal mental states of others, including false belief understanding (Cicchetti et al., 2003, Colvert et al., 2008, Pears and Fisher, 2005, Tarullo et al., 2007) with delays particularly associated with maltreatment occurring between the ages of 1.5 and 3 years, in particular physical abuse (Cicchetti et al., 2003). These studies have generally focused on maltreated children, however such skills continue to develop into adolescence (Dumontheil et al., 2010). Therefore, this study sought to examine the mental state understanding of adolescents exposed to childhood maltreatment relative to non-maltreated adolescents, as well as whether the mental state understanding of maltreated adolescents is associated with particular maltreatment factors, including maltreatment subtypes.

Table 1.6: Studies exploring understanding of other's internal mental states in maltreated samples

Study	Subjects	Process/Task	Findings
Cicchetti, Rogosch et al (2003)	203 low SES maltreated 143 low SES non-maltreated, 172 middle SES non-maltreated, children 3-8 years	False belief task	• Maltreated children showed delayed performance on false belief understanding • Maltreatment between 1.5 and 3yrs of age and physical abuse particularly associated with delayed false belief understanding
Pears and Fisher (2005)	60 maltreated foster children, 31 community controls, 3-5 years	Perception taking, fulfilled and unfulfilled desires (stories), belief tasks (including discrepant beliefs), and appearance-reality tasks.	• Children in foster care showed poorer perspective taking, belief and false-belief understanding • No association with length of time in care or number of transitions
Colvert et al 2008	165 adoptees from Romanian orphanage, 144 adopted before 43 months, and 52 within UK adoptees, adopted before 6 months, tested 11 years	Strange Stories task	• Institutionally deprived showed poorer understanding of other's mental states (mental stories of Strange Stories task)
Tarullo, Bruce and Gunnar 2007	120 children; 40 institutional care, 40 in foster care (international), 40 birth children, 6-7 years	False-belief task,	• Institutionally deprived children showed delayed false belief understanding

1.6.4.3 Social Understanding: Social Responding

Social models assert that "socially maladjusted children make response decisions that result in the attempt to enact behaviour that is maladaptive" (Crick and Dodge 1994 : pp. 91), selecting more antisocial and fewer prosocial responses in social interactions. Maltreated children have been found to display more inappropriate responses to peer distress (**Table 1.7**) (Klimes-Dougan and Kistner, 1990, Main and George, 1985). These studies found that when faced with peer distress, physically abused children made more negative responses, such as responding with aggression, anger, or withdrawal. Further, physically abused children tended to be more often the cause of peer distress, and were more likely to produce negative responses even when not the cause of peer distress, although the rate of prosocial responses did not differ between maltreated and non-maltreated children. Other studies have found that physically abused children generated fewer prosocial responses and evaluated aggressive responses more favourably in social situations (Keil and Price, 2009, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008), however maltreated children not exposed to physical abuse have also been reported to make more aggressive responses than non-maltreated children in social situations (Teisl and Cicchetti, 2008). This study explored the prosocial responding to distress in those exposed to maltreatment using a simple experimental paradigm of a simulated social interaction, extending the findings in maltreated children reviewed above (involving samples aged up to 12 years) into adolescents.

Table 1.7: Studies exploring response to peer distress in maltreated samples

Study	Subjects	Process/Task	Findings
Main and George 1985	10 physically abused and 10 non-maltreated children, 1-3 years	Observation of children in child care setting	• Abused children noted distress of others, • Tended to respond with aggression, anger or fear rather than concern
Klimes-Dougan and Kistner 1990	11 physically abused (M=55.64 months) and 11 non-maltreated (M=52.27 months)	Observations in child care setting	• Physically abused children did not differ on prosocial responses to bystander distress, but also showed more negative responses (aggressive or withdrawing) • Physically abused children more often the cause of peer distress
Keil and Price (2009)	188 children (100 maltreated) Maltreatment occurred between 4 and 6 years, aged 5-8	Social vignettes - peer provocation and group entry	• Those exposed to both physical abuse and neglect suggested fewest competent responses in social situations • Those exposed to neglect only made more aggressive responses in situations of group entry, also suggested fewer competent responses than non-maltreated but more than physically abused
Teisl and Cicchetti (2008)	267 children in two cohorts (167 maltreated), 6-12 years	Social vignettes,	• Those exposed to physical abuse plus other maltreatment subtypes showed higher proportion of cue interpretation errors and more aggressive responses. • Other maltreated (no Physical Abuse) made more aggressive responses
Ward and Haskett (2008)	98 physically abused, 77 non-maltreated, 5-10 years	Ambiguous vignettes	• Physically abused children suggested fewer solutions that were of poorer quality in social situation relative to non-maltreated peers

Studies then have demonstrated that exposure to early maltreatment may result in significant differences in the function of a range of implicit processes of emotion regulation, such as selective attention, situation selection (avoidance and approach), and cognitive change (interpretation bias), particularly with respect to threatening stimuli. Similarly, differences in aspects of social understanding such as emotion understanding, understanding the internal mental states of others and social responding have also been reported. These factors may relate to the emotional and social difficulties experienced by those exposed to childhood maltreatment. However, these domains have shown inconsistent results (selective attention to threat, interpretation/attribution bias), or have only been examined in childhood (social understanding, response to peer distress), or are generally marked by insufficient data (avoidance, risk taking). Inconsistent results may arise due to critical differences in experimental paradigms or sample characteristics, particularly given the significant co-occurrence of different maltreatment subtypes.

The conspicuous absence in the literature of studies exploring cognitive processes in adolescents exposed to childhood abuse and neglect (**see Tables 1.2 to 1.7**) is quite understandable. As outlined in the prevalence data above, those exposed to abuse and neglect are most commonly identified in childhood, with the majority of those placed in out-of-home care being under the age of 10 years old (Australian Institute of Health and Welfare 2013). Thus, understanding these processes at this point is a logical approach to meeting the needs of such children as early as possible. However, the needs of adolescents exposed to childhood abuse and neglect should not be overlooked. Adolescence is an important period in development in its own right, with significant

social-cognitive development evident at this time (for example see Blakemore 2008), associated with the maturation of important neural networks – and it is not yet clear how early environmental adversity might interact or modulate these typical developmental changes. Further, many mental health problems first emerge during adolescents (Carr, 2006), further emphasising the importance of this period. Indeed, from a developmental psychopathology perspective, filling in this important gap in the developmental literature is essential in creating a clear picture of the trajectories from childhood through to adulthood (Cicchetti and Rogosch, 2002). Given the capacity for shifts in developmental trajectories during this time (Cicchetti and Rogosch, 2002), identifying not only risk for shifting to more problematic trajectories, but also the value of targeted interventions at this time in supporting shifts to more adaptive ones. Implicit emotion regulation processes such as those identified here may be amenable to training (Todd et al., 2012), and may promote resilience for those at risk due to exposure to maltreatment (Downey and Walker, 1989).

1.7 The Current Study

Therefore, as processes of approach and avoidance, selective attention, interpretation biases and social understanding 1) play a central role in models that explain both adaptive and maladaptive emotional and social processes, 2) are functionally associated with neural networks affected by maltreatment, and 3) are held to rely on important parent-child interactions for their normative development, we reasoned that these cognitive processes might play a central role in both the emotional and social difficulties consistently observed in maltreated children and adolescents. Models of maltreatment emphasise the importance of caregivers in buffering the

impacts of environmental threats and stress on the developing child, with abusive or neglectful care impacting on neurobiological systems underlying cognitive processes of emotion regulation, which in turn confers risk of emotional and social difficulties (Loman et al., 2010). That is, children exposed to dysfunctional or substandard parenting show difficulties in emotion regulation or dysregulation that impact on their ability to maintain adaptive functioning in the face of intrinsic or extrinsic emotive cues. While the role of emotion regulation in later adaptive functioning has been demonstrated (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields and Cicchetti, 2001) the specific cognitive processes that serve to regulate the emotional experience and place maltreated children at greater risk of emotional and social difficulties are not well understood, particularly in the important adolescent period, and particularly with respect to their relationship, if any, with specific maltreatment subtypes. This research sought to address this gap in the literature by examining implicit processes of emotion regulation in a sample of maltreated adolescents, drawing on existing cognitive models as well as existing empirical evidence, in order to clarify the impact of maltreatment on these particular processes of emotion regulation that may contribute to the emotional and social difficulties experienced by those exposed to childhood maltreatment. However, social difficulties could also reflect deficits in social understanding, and therefore processes of emotion and internal mental state understanding were also examined, extending existing research in child samples into adolescents.

The next section will outline the general procedures and relevant participant characteristics of this research program, including the examination of emotional and social functioning of this sample of maltreated adolescents relative to their non-

maltreated peers. Following that, avoidance and approach tendencies in the presence of threat, such as conditioned avoidance and risk-taking will be examined, drawing on a comprehensive model of approach and avoidance (Gray and McNaughton, 2000, McNaughton and Corr, 2004). Processes of selective attention and attention control will then be examined, drawing on recent research of these processes from cognitive models of anxiety. Interpretative biases will then be examined, particularly in relation to the interpretation of social cues. Finally, processes of social understanding will be explored including emotion understanding, understanding the internal mental states of others, and responding to peer distress as a potential alternative explanation for the social difficulties of maltreated adolescents. The broad questions asked in this study, and our hypotheses are outlined below, with more specific background and detailed hypotheses outlined in subsequent chapters.

1. Do maltreated adolescents show greater emotional and social difficulties than non-maltreated peers?
    a. Maltreated adolescents will demonstrate greater emotional and social difficulties, and fewer prosocial behaviours, than non-maltreated peers (Chapter 2)
    b. Greater severity of maltreatment, as well as earlier and more chronic exposure will be associated with greater difficulties (Chapter 7)
    c. There may be some specific variations associated with particular maltreatment subtypes (Chapter 7)

2. Do maltreated adolescents show differences in responding to positive or negative cues, such as conditioned avoidance of threat cues, or increased risk tasking in response to reward?
    a. Maltreated adolescents will show greater conditioned avoidance of threat cues relative to non-maltreated peers (Chapter 3)
    b. Greater conditioned avoidance may be particularly associated to those exposed to physical abuse (Chapter 7)
    c. Maltreated adolescents may take greater risks relative to non-maltreated peers (Chapter 3)
3. Do maltreated adolescents show threat-related attention biases and difficulties in attention control?
    a. Maltreated adolescents will show a threat-related attention bias relative to non-maltreated peers. It is tentatively suggested that this bias will be toward threat-related stimuli. (Chapter 4)
    b. Maltreated adolescents will show difficulties in attention control. (Chapter 4)
    c. Threat-related attention biases may be particularly associated with physical abuse and emotional maltreatment, rather than neglect, given the hypothesised increased salience in threat cues as a result of exposure to these maltreatment subtypes. In contrast, neglect may be associated with impoverished attention control (Chapter 7)
4. Are maltreated adolescents more likely to make more negative or hostile interpretations of other's behaviour?

a. Maltreated adolescents will show more negative interpretations of the ambiguous social actions of others, have more negative expectations of other's social behaviours and more negative perceptions of their peers and themselves (Chapter 5)
b. This may be particularly the case for those exposed to physical abuse as opposed to neglect (Chapter 7)

5. Do maltreated adolescents show delayed social understanding, including understanding of the internal mental states of others?
    a. Maltreated adolescents will show delayed understanding of the internal mental states of others (Chapter 6)
    b. Difficulties understanding the internal mental states of others may be particularly associated with specific maltreatment subtypes (Chapter 7)
    c. Maltreated adolescents will be less able to recognise the likely emotional impact of social interactions relative to non-maltreated peers (Chapter 6)
    d. Neglected maltreated adolescents in particular may experience difficulties in emotion understanding (Chapter 7)
    e. Maltreated adolescents will respond to the distress of others in less prosocial ways relative to non-maltreated peers. (Chapter 6)
    f. Maltreatment factors may differentially affect prosocial behaviours of maltreated adolescents (Chapter 7)
6. Cognitive processes of emotion regulation and social understanding such as those explored in this study may mediate the relationship between maltreatment status and adolescent adjustment (Chapter 7)

2. General Methods

This chapter provides a brief outline of the sample and methods of this study. First, the sample is outlined, including inclusion and exclusion criteria. Next, the process of coding file data for maltreatment ratings is discussed, describing the maltreatment experiences of this sample. A range of general measures applicable across subsequent chapters are then described, before exploring differences between maltreated and non-maltreated samples in terms of demographic, household and symptom data. Finally, the general analytical approach consistent across subsequent chapters is outlined.

2.1 Participants

Participants for the study were recruited from the greater Sydney area of New South Wales, Australia. Fifty one maltreated and 30 comparison adolescents aged 11-17 were drawn from 51 households (32 foster care households and 18 comparison households, with 3 households providing both biological and foster children). Within the maltreatment group there were 9 pairs of biological siblings, and one set of three siblings, with 7 pairs of biological siblings in the comparison group, as well as one set of three siblings. Adolescents were recruited for the Maltreated group in conjunction with the NSW Department of Community Services, drawn from those who entered care prior to 2010 to avoid overlap with a different study. A small number of foster-carers declined to participate, citing concerns regarding the child's current situation (for example, difficulty with birth family contact) or a more general reluctance to participate in research. Comparison participants were recruited through foster care support organisations and their networks in the same geographic region, with effort to match participants on age and gender. All interested participants were provided with written

information and invited to discuss any concerns with the researcher. All adolescents also had the research explained verbally, in the presence of their parent or guardian, and given the opportunity to ask questions. Adolescents were asked to assent to their participation.

Descriptive data for the final sample including Age, IQ and ethnicity, parent/carer features and symptom scores are provided below (**see Tables 2.1, 2.2, 2.5 through 2.8**).

2.1.1 Maltreatment Ratings

Experiences of maltreatment were coded using the Maltreatment Classification Scheme (MCS) developed by Barnett, Manly and Cicchetti (1993) , outlined previously. Notifications made to child protection authorities regarding suspected maltreatment events and subsequent investigation are examined for information regarding different maltreatment "subtypes", including Physical Abuse (PA), Sexual Abuse (SA), Physical Neglect (two subtypes include Failure to Provide – FTP, and Lack of Supervision - LOS) , Emotional Maltreatment (EM) and Moral, Legal or Educational Maltreatment (MLE), with severity ratings (1-5) for each applicable subtype. Each notification is coded for each maltreatment subtype, with the overall maximum severity score of each subtype recorded for each participant. Consistent with other studies (Garrido et al., 2011, Litrownik et al., 2005), absence of a particular subtype was coded 0, producing a range of 0-5. Overall presence or absence of a given subtype reflects a coding of at least 1 across all notifications received. Severity scores for each participant reflects the most severe coding made for each maltreatment subtype, ranging from 0 (absent) to 5 (highest severity). Just over a quarter (27%) of all maltreated participant's Child Protection records were coded by two researchers independently. Inter-rater reliability

for maltreatment subtype presence or absence was as follows: kappas, PA=0.659, SA=1.00, LOS=1.00, MLE=0.837. All participants in this subset were coded as having experienced Physical Neglect in terms of Failure to Provide and Emotional Maltreatment, with complete agreement between raters. Similarly, inter-rater reliability for maximum lifespan severity was also compared: ICC= PA=0.923, SA=1.00, FTP=0.976, LOS=0.925, EM=0.701, MLE=0.708).

Table 2.1: Co-occurrence of maltreatment subtypes in the current sample

Maltreatment Subtype	No. of participants
Physical Abuse (PA)	25
• PA+EM • PA+EM+FTP • PA+LOS+FTP • PA+LOS+EM • PA+FTP+LOS+EM • PA+SA+FTP+LOS+EM • PA+FTP+LOS+EM+MLE	• 2 • 4 • 1 • 1 • 9 • 2 • 6
Sexual Abuse (SA)	4
• SA+FTP+LOS+EM • SA+LOS+EM+MLE • SA+PA+FTP+LOS+EM	• 1 • 1 • 2
Neglect (FTP & LOS)	48
• FTP Only • LOS Only • FTP+EM • FTP+LOS • LOS+EM • FTP+EM+PA • FTP+LOS+PA • FTP+LOS+EM • LOS+EM+PA • FTP+PA+LOS+EM • FTP+PA+SA+LOS • FTP+LOS+EM+MLE • LOS+SA+EM+MLE • FTP+PA+SA+LOS+EM	• 2 • 2 • 2 • 3 • 1 • 4 • 1 • 11 • 1 • 9 • 1 • 2 • 1 • 2

• FTP+PA+LOS+EM+MLE	• 6
Emotional Maltreatment (EM)	43
• EM Only • EM+FTP • EM+ PA • EM+LOS • EM+FTP+PA • EM+LOS+FTP • EM+LOS+PA • EM+PA+FTP+LOS • EM+SA+FTP+LOS • EM+FTP+LOS+MLE • EM+SA+LOS+MLE • EM+PA+SA+FTP+LOS • EM+PA+FTP+LOS+EM	• 1 • 2 • 2 • 1 • 4 • 11 • 1 • 9 • 1 • 2 • 1 • 2 • 6
Moral/Legal/Educational (MLE)	9
• MLE+FTP+LOS+EM • MLE+FTP+LOS+EM • MLE+PA+FTP+LOS+EM	• 2 • 1 • 6

A general breakdown of the maltreatment experiences of this sample can be seen in **Table 2.1**. Consistent with other similar studies, maltreatment subtypes co-occurred (Barnett et al., 1993, Bucker et al., 2012, Cicchetti and Curtis, 2005, Cicchetti et al., 2003, Curtis and Cicchetti, 2011, Dillon et al., 2009, Gibb et al., 2009, Masten et al., 2008, Pears et al., 2008, Shields and Cicchetti, 2001). Approximately 90 percent of maltreated adolescents were coded as being exposed to two or more maltreatment subtypes, with three (33.3%) or four (27.5%) subtypes being most common. Given the high co-occurrence of the two neglect subtypes (of the 40 coded as being exposed to Lack of Supervision, 36 were also coded as Failure to Provide) and in order to reduce the number of variables, a combined Neglect category was formed. For future analysis, we focused on overall presence and severity of physical abuse (PA), neglect (N), and

emotional maltreatment (EM). It has been argued that sexual abuse is a distinct form of maltreatment (Noll, 2008), with significantly greater impacts on later mental health that were not substantially associated with other family factors as was the case with other types of maltreatment (Fergusson et al., 2008), as well as distinct effects on cognitive performance (Gould et al., 2012). As such, and given the small number of participants exposed to sexual abuse (4), the decision was made to exclude these individuals from further analysis.

Parents of comparison participants completed a brief screening interview to ensure that those in the Non-maltreated group were not exposed to adverse experiences in their childhood. Two comparison participants were excluded as a result, leading to a final sample of 47 maltreated adolescents and 28 comparison adolescents.

Other maltreatment-related factors were also recorded (**see Table 2.2**), including chronicity, number of maltreatment subtypes, age of first reported maltreatment, number of notifications on file that attracted a coding for at least one maltreatment subtype, age of first entry to care, and the number of placements experienced. Chronicity of maltreatment was defined based on the developmental periods in which maltreatment was reported and whether these were consecutive. Consistent with previous studies (English et al., 2005a, English et al., 2005b) developmental periods in the MCS were flattened into four stages (pre-natal to 1.49 years; 1.5 years to 2.99 years; 3 years to 5.99 years; 6 years and above) developing 5 categories based on the number of developmental stages in which maltreatment was reported, and whether these were consecutive (see **Table 2.3**) that can be treated as an ordinal variable (English et al., 2005a).

Table 2.2: Descriptive statistics of maltreatment factors in the current sample

	Mean Max Severity (SD)	Median	Range	Male Mean (SD)	Female Mean (SD)	Gender Differences (Significance)
Physical Abuse (PA)	1.4 (1.66)	0.00	0-5	1.72 (1.74)	1.05 (1.53)	U=217.0, z=-1.346, p=0.178
Neglect (N)	3.23 (1.31)	3.00	0-5	3.52 (1.05)	2.91 (1.51)	U=221.0, z=-1.199, p=0.231
Emotional Maltreatment (EM)	2.94 (1.55)	3.00	0-5	2.80 (1.78)	3.09 (1.27)	U=265.5, z=-0.219, p=0.827
No. Maltreatment Subtypes	2.26 (0.74)	2.00	1-3	2.32 (0.80)	2.18 (0.66)	U=239.0, z=-0.831, p=0.406
No. Notifications	9.28 (6.40)	8.00	1-27	8.72 (6.62)	9.91 (6.23)	U=229.5, z=-0.974, p=0.330
Age at first report	1.32 (1.64) years	0.5	0-6.92 years	1.58 (1.93)	1.03 (1.19)	U=307.5, z=0.695, p=0.487
Chronicity	3.00 (1.46)	3.00	1-5	2.72 (1.49)	3.32 (1.39)	U=210, z=-1.422, p=0.155
Age First Entry to Care (years)	3.92 (3.56)	2.83	0-12.58	4.17 (4.12)	3.65 (2.87)	U=271.5, z=-0.075, p=0.940
No. Placements	4.21 (4.39)	3.00	1-29	4.92 (5.60)	3.41 (2.28)	U=241.5, z=-0.724, p=0.469

There were no differences between male and female maltreated adolescents on these factors (**see Table 2.2**), including presence of maltreatment subtypes (PA: χ^2= 1.066, p=0.302; N: χ^2=3.642, p=0.056; EM: χ^2=1.842, p=0.175).

Table 2.3: Maltreatment chronicity categories

Category	Definition
Situational	Maltreatment reported in only one developmental period
Limited Episodic	Maltreatment reported in two non-consecutive developmental periods
Limited Continuous	Maltreatment reported in two consecutive developmental periods
Extended Episodic	Maltreatment in three or four developmental periods, with an intervening period free of maltreatment
Extended Continuous	Maltreatment in three or four consecutive developmental periods

2.2 Procedures

Ethical approval for this study was first gained through the University of Oxford. Approval was also sought and gained from the NSW Aboriginal Health and Medical Research Council (AHMRC), an accredited Human Research Ethics Committee in Australia. Given the historic issues regarding child protection and research in Aboriginal communities in Australia, and the ongoing over-representation of Aboriginal young people and families in the child protection system, additional protocols are warranted. These protocols are overseen by the AHMRC in this case, and include requirements for community consultation and engagement. Local Aboriginal community organisations, including local Aboriginal Australian foster care organisations, were consulted regarding this study and accepted this research prior to permission being granted by the AHMRC. The broader foster care community was also consulted and invited to participate in the development and delivery of this study.

Permission for maltreated adolescents to participate was first granted by the NSW Department of Community Services as their legal guardian. Foster carers were then informed of the study by post, and followed up with a brief phone call. Foster carers were asked to consent both on their own behalf, but also on behalf of the adolescent in their care, providing an additional layer of protection for young people in out of home care. Comparison participants were likewise provided with written information, and followed up with a phone call. Consent was gained from the adolescent and their parent/guardian.

The study involved questionnaire and experimental measures (**Table 2.4**), as well as the review and coding of information kept on file by the statutory child protection authority regarding experience of maltreatment for each child in out-of-home care. Questionnaires were completed independently by adolescents and their parent or guardian, and took approximately 1 hour to complete. Experimental tasks and other one-on-one testing took on average an additional hour for young people to complete. Testing was conducted at a time and location acceptable to the young person and their parent or guardian. In the vast majority of cases testing was completed in the family home, with a parent or guardian being present although unable to hear or see responses unless requested by the adolescent. Each task is described in more detail in its respective chapter.

Table 2.4: List of questionnaire and experimental tasks

Category	Measure	Type	Completed by
Child Measures	STAIC	Questionnaire	Adolescent
	CDI	Questionnaire	Adolescent
	Abbreviated Battery: Stanford-Binet Intelligence Test	Pen and Paper	Adolescent
Parent/Carer Self-Report	STAI-T	Questionnaire	Parent/guardian
	BDI-II	Questionnaire	Parent/guardian
Parent/carer re: young person	Strengths and Difficulties Questionnaire	Questionnaire (re: adolescent)	Parent/guardian
Emotion Regulation: Situation Selection	Avoidance Cards Task	Experimental	Adolescent
	Balloon Analogue Risk Task	Experimental	Adolescent
Emotion Regulation: Attentional Deployment	Dot Probe Task	Experimental	Adolescent
	Emotional Attention Control	Experimental	Adolescent
	Neutral Attention Control	Experimental	Adolescent
Emotion Regulation: Cognitive Change	Children's Expectations of Social Behaviours Questionnaire	Questionnaire	Adolescent
	Ambiguous Situations Interpretations Scale	Questionnaire	Adolescent
	Perception of Peers and Self	Questionnaire	Adolescent
Social Understanding	Strange Stories Task	Pen and paper	Adolescent
	Triangles Animation Task	Computer Animations, pen and paper	Adolescent
	Interpersonal Response Task	Experimental	Adolescent

2.3 Adolescent Measures

Anxiety: Children completed the trait version of the Spielberger State-Trait Anxiety Inventory for children (STAIC)(Spielberger, 1973). The STAIC is a widely used 20-item self-report measure, asking children to indicate whether a particular statement describes them *hardly ever, sometimes* or *often,* which are then summed to create an overall anxiety score. Good internal reliability (Cronbach's α=0.88) has been reported, as well as discriminant validity in distinguishing between adolescents with anxiety disorders and those with other disorders or no psychiatric disorders (Kirisci and Clark, 1996). Internal reliability in the current sample was adequate (Cronbach's α=0.824).

Depression: The Children's Depressive Inventory (CDI - Kovacs 1985) was used to measure depressive symptoms in children. The CDI is a 27 item self-report measure, asking children to indicate which statement best describes them (i.e. *I am sad once in a while, I am often sad, I am sad all the time).* An overall depressive symptoms score is then calculated. Overall, the CDI reports adequate validity (Smucker et al., 1986), and is widely used with children. One item was excluded given ethical concerns arising from its direct reference to self-harming behaviour and its use within the maltreated population. Good to excellent internal reliability has been reported (Cronbach's α range 0.80 to 0.94) (Saylor et al., 1984), consistent with this study (Cronbach's α=0.852). Adequate validity has also been reported (Hodges, 1990).

IQ: The Abbreviated Battery of the Stanford- Binet Intelligence Scales – Fifth Edition (SB-V), was used as an estimate of cognitive ability. The Abbreviated Battery IQ (ABIQ) is produced using two routing subtests (Verbal Knowledge and Non-Verbal Fluid Reasoning), producing a standard score with a population mean of 100 and standard

deviation of 15. This measure administered and scored by a registered psychologist (PG). The SB-V reports appropriate reliability and validity.

2.4 Parent/Carer Measures

In addition to the below standardised questionnaires, parents and foster carers also completed a general demographic information form which included age, household income, and highest education achieved (household).

2.4.1 Parent Self-report

Anxiety: Adult participants completed the trait version of the Spielberger State-Trait Anxiety Inventory (Spielberger et al., 1970). This is a 20-item self-report measure asking respondents to indicate how often a particular statement applies to them (example: *I feel nervous and restless: almost never, sometimes, often, almost always).* The STAI-T demonstrates acceptable test-retest reliability (coefficients ranging from 0.65 to 0.86) and good validity, correlating strongly with the Manifest Anxiety Scale (r=0.80) (Spielberger et al., 1970). Observed internal reliability in the current sample was also good (Cronbach's α= 0.86).

Depression: Depressive symptoms were measures using the Beck Depression Inventory 2nd Edition (BDI-II – Beck, Steer and Brown 1996). The BDI-II is a 21 item self-report measure that asks participants to indicate the statement which best describes how they have been feeling over the past two weeks (example: *I do not feel sad, I feel sad much of the time, I am sad all the time, I am so sad or unhappy that I can't stand it).* An overall depression score is then calculated. Validity and reliability have been reported (Cronbach's α>0.92) (Beck et al 1996), consistent with the reliability observed in this sample (Cronbach's α=0.89).

2.4.2 Adolescent functioning

Parents and carers also completed the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997), a brief behavioural screening questionnaire. The SDQ includes 25 items relating to the adolescent's emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behaviour, and asks parents or carers to indicate whether a given statement is not true, somewhat true or certainly true with respect to the subject (for example: *Considerate of other people's feelings*). In addition to scores on each of the scales above, a total difficulties score can also be calculated. There is also a brief impact statement regarding the impact of these difficulties on the adolescent's daily life. Norm data from an Australian adolescent sample is available (Mellor, 2005), with the highest 10% of scores considered "Abnormal/of Concern" and the next 10% considered "Borderline". The SDQ also shows adequate internal reliability (all Cronbach's $\alpha \geq 0.59$ (Mellor, 2005)), consistent with reliability figures observed in this study (Cronbach's α range 0.52 to 0.88). Measure validity has also been reported (Goodman et al., 2003).

2.5 Descriptive Statistics: Group Differences

2.5.1 Demographic data

Participant characteristics such as Gender, Age, IQ, symptom scores and parent/carer characteristics were collected, with the group means detailed in **Table 2.5**.

There were no significant differences in the gender of participants across groups (Chi-Square=1.359, p=0.244). In the Maltreated group, 62% of children were identified as Caucasian, 28% Aboriginal Australian, 10% Other, with data missing for 2 participants. The proportion of Aboriginal Australian participants in our sample (28%) is below the

proportion of Aboriginal and Torres Strait Islander children and young-people in out-of-home care in NSW for those whose cultural background was known (34.9%; Australian Institute of Health and Welfare 2013). In the Non-maltreated group, 79% of children were Caucasian-Australian, whilst 21% were Aboriginal Australian, which is greater than the proportion found in the general population (approximately 4.7%; New South Wales Office of Communities, Commission for Children and Young People 2013), however overall matches the distribution of ethnicities in the Maltreated group (Chi-Square = 3.982, p=0.137).

Table 2.5: Age, IQ and cultural background of participants by group

	Maltreated	Non-maltreated	Significance
N (Male)	47 (25)	28 (11)	p=0.244
Age	13.42 (1.72)	14.13 (1.52)	p=0.077
ABIQ	93.12 (10.73)	101.07 (7.88)	p=0.001*
% Caucasian	62%	79%	p=0.137
% Aboriginal Australian	28%	21%	
% Other cultural background	10%	-	

There was a significant difference in ABIQ scores between the Maltreated and Non-maltreated groups (t(73)=3.404, p=0.001), with the mean ABIQ of non-maltreated adolescents (101.07) significantly higher than that of the Maltreated group (93.33). The mean ABIQ of the non-maltreated adolescents is comparable with the overall mean of this measure in the general population. Further, the observed difference between Maltreated and Non-maltreated groups, with those in the Maltreated group displaying significantly lower IQ scores, is also consistent with existing evidence (De Bellis et al., 2009), however not with others (Bucker et al., 2012), although the weight of data seems

to support the finding of lower IQ in maltreated samples (Pechtel and Pizzagalli, 2011, Wilson et al., 2011).

Table 2.6: Descriptive statistics of parent/carer and household factors

	Maltreated (47)	Non-maltreated (28)	Significance	Reliability (Cronbach's α)
Parent/Carer Age (N=39)	50.55 (11.39)	43.53 (4.45)	p=0.013*	-
Household Income (N=45)	Mdn=1.0 (<$50k)	Mdn=3.0 ($90k-130k)	p=0.002*	-
Caregiver Education (N=43)	Mdn=1.0 (Yr10)	Mdn=3.0 (Degree)	p=0.001*	-
Parent/Carer STAI-T (N=46)	35.73 (6.49)	38.17 (7.50)	p=0.252	0.86
Parent/Carer BDI (N=46)	6.29 (6.21)	8.18 (6.54)	p=0.336	0.89

Parent/Carer factors were also noted (**Table 2.6**), although participants were not matched on parent/carer income or education, with foster carers having significantly lower incomes (Mann-Whitney U = 110.0, z=-3.140, p=0.002) and lower education attainment (Mann-Whitney U=99.5, z=-3.217, p=0.001) than parents of comparison adolescents, as well as being significantly older (t(28.638)=-2.641, p=0.013). It is unclear however whether the reported income of foster families also includes allowances provided to carers of children in out-of-home care, which may significantly affect the overall household incomes of foster families. Other research suggests that labour market changes are common in foster families, with carers reducing or terminating employment commitments in order to be available for children in their care (McHugh,

2013). However, there were no significant differences between the parents/guardians of maltreated and comparison adolescents on self-reported anxiety (t(44)=1.160, p=0.252) or depression (t(44)=0.973, p=0.336) symptoms.

2.5.2 Symptom Data

Table 2.7: Symptom scores by Maltreatment Group

	Maltreated (47)	Non-maltreated (28)	Significance	Reliability (Cronbach's α)
STAIT	33.58 (6.59)	33.00 (6.97)	p=0.718	0.82
CDI	8.98 (5.57)	8.26 (8.04)	p=0.650	0.85
Total Difficulties Score	14.85 (7.12)	7.11 (6.01)	p<0.001*	0.75
Emotional Symptoms	3.15 (2.08)	2.14 (2.34)	p=0.016*	0.62
Conduct Problems	3.83 (2.69)	1.39 (2.88)	p<0.001*	0.70
Hyperactivity	4.96 (2.65)	2.11 (2.36)	p<0.001*	0.88
Peer Problems	2.91 (2.02)	1.46 (1.57)	p=0.001*	0.52
Prosocial	7.13 (2.39)	8.82 (1.02)	p=0.003*	0.76
Impact	2.02 (2.59)	0.61 (1.23)	p=0.008*	

Self-report and parent/carer-report symptom data were examined (**Table 2.7**). There were no observed group differences between adolescents with respect to self-reported anxiety scores (t(73)=-0.363, p=0.718) or depression scores (t(73)=-0.456, p=0.650). One participant in the Maltreated group was omitted from the analysis in the Total Difficulties and Emotional Symptoms scales of the SDQ analyses due to missing data. Due to the apparent skew of the subscale score distributions, non-parametric

methods were used to examine Group and Gender differences on each subscale, with individual samples t-tests used with Total Difficulties scores.

Overall, there was a significant difference between groups on the Total Difficulties Score ($t(72)=-4.802$, $p<0.001$), with those in the Maltreated group exhibiting significantly more Difficulties than Non-maltreated peers. Relative to the Non-maltreated group, maltreated adolescents were reported to exhibit significantly more Emotional Symptoms (Mann-Whitney $U=858$, $z=2.412$, $p=0.016$), Conduct Problems (Mann-Whitney $U=1045.5$, $z=4.317$, $p<0.001$), Hyperactivity/Inattention (Mann-Whitney $U=1054.5$, $z=4.371$, $p<0.001$), and Peer Problems (Mann-Whitney $U=946$, $z=3.210$, $p=0.001$), and significantly fewer Prosocial Behaviours (Mann-Whitney $U=388.5$, $z=-3.004$, $p=0.003$) than their non-maltreated peers. Further, these difficulties were reported to have a significantly greater impact on the lives of maltreated adolescents (Mann-Whitney $U=440.0$, $z=-2.654$, $p=0.008$). There were no gender effects observed across subscale (all p's > 0.16) or Total Difficulties scores ($t(72)=-0.478$, $p=0.634$). Finally, MANOVA explored possible Maltreatment X Gender effects, revealing a significant interaction with respect to the Peer Problems subscale ($F(1,70)=5.120$, $p=0.027$, partial $\eta^2=0.068$). In order to understand this interaction, non-parametric analysis explored gender effects in each Maltreatment group, and Maltreatment group effects in each gender separately. In both Maltreated and Non-maltreated groups there were no significant gender differences with respect to Peer Problems (all p's>0.05), however maltreated adolescent males showed significantly greater Peer Problems than non-maltreated adolescent males ($U=244$, $z=3.705$, $p<0.001$). There were no significant

differences between maltreated and non-maltreated females (U=212.5, z=0.743, p=0.457).

Consistent with higher group means, maltreated adolescents were at significantly higher risk of scoring beyond the cut-offs established in the Australian norms by age and gender (Mellor, 2005) for the Abnormal/of Concern (top 10% of scores) across all subscales and total difficulties (Relative Risk range 2.35 to 4.92) (**Table 2.8**). Rates of non-maltreated comparison participants within the Abnormal/Of Concern range of scores did not significantly differ from the established norms (Mellor, 2005).

Table 2.8: Relative risk (compared to norms – Mellor 2005) of difficulties on SDQ relative to published norms for maltreated and non-maltreated participants *p<0.01

Table 2.8	Maltreated	Relative Risk	95% C.I.	Sig	Non-maltreated	Relative Risk	95% C.I.	Sig
Total Difficulties Score - Mean	Mean 14.85 (7.12)				Mean 7.11 (6.01)	Norm Mean 8.96 (5.62)		
• Abnormal/of concern (10%)	18 (39.1%)	3.93	2.54 – 6.10	p<0.001*	2 (7.1%)	0.72	0.18 – 2.79	p=0.63
Emotional Symptoms	Mean 3.15 (2.08)				Mean 2.14 (2.34)	Norm Mean 2.4 (2.0)		
• Abnormal/of concern (10%)	11 (23.9%)	2.40	1.36 – 4.27	p=0.003*	4 (14.3%)	1.44	0.56 – 3.68	p=0.45
Conduct Problems	Mean 3.83 (2.69)				Mean 1.39 (2.88)	Norm Mean 1.8 (1.7)		
• Abnormal/of concern (10%)	23 (48.9%)	4.92	3.35 – 7.23	p<0.001*	1 (3.6%)	0.36	0.05 – 2.50	p=0.30
Hyperactivity	Mean 4.96 (2.65)				Mean 2.11 (2.36)	Norm Mean 3.2 (2.3)		
• Abnormal/of concern (10%)	17 (36.2%)	3.64	2.31 – 5.73	p<0.001*	4 (14.3%)	1.44	0.56 – 3.68	p=0.45
Peer Problems	Mean 2.91 (2.02)				Mean 1.46 (1.57)	Norm Mean 1.5 (1.6)		
• Abnormal/of concern (10%)	11 (23.4%)	2.35	1.32 – 4.18	p=0.004*	4 (14.3%)	1.44	0.56 – 3.68	p=0.45
Prosocial	Mean 7.13 (2.39)				Mean 8.82 (1.02)	Norm Mean 8.0 (1.7)		
• Abnormal/of concern (10%)	15 (31.9%)	3.21	1.97 – 5.22	P<0.001*	1 (3.6%)	0.36	0.05 – 2.50	p=0.30

Correlations between parent-report and self-report measures were examined in order to further examine the discrepant findings reported above. Overall, both anxious ($r=0.259$, $p=0.026$) and depressive ($r=0.385$, $p=0.001$) symptom scores were positively correlated with SDQ Total Difficulties scores, suggesting that, in general, adolescents with higher self-reported symptoms also tended to be rated as having greater difficulties by their parent or carer. However, this pattern differed on the basis of maltreatment status. Non-maltreated adolescent self-reported symptom scores were significantly positively correlated with parent-report Total Difficulties (anxious: $r=0.638$, $p<0.001$; depressive: $r=0.687$, $p<0.001$). Self-reported symptom scores for maltreated adolescents did not significantly correlate with carer-reported Total Difficulties (anxious: $r=0.083$, $p=0.581$; depressive: $r=0.230$, $p=0.123$). This suggests that there is significant inconsistency between parent-report and adolescent-report difficulties for maltreated carer-adolescent dyads, whereas parent-adolescent dyads of non-maltreated participants generally score adolescent difficulties with greater consistency.

2.5.3 Descriptive Statistics: Summary

Overall, the final sample of this study included 47 maltreated adolescents and 28 non-maltreated adolescents, aged 11-17 years. There were no between-group differences on gender, age or ethnicity, however maltreated adolescents achieved significantly lower IQ scores than their non-maltreated peers, and were in households with significantly older caregivers, and significantly lower income and educational attainment. Importantly, parents and foster carers did not differ with respect to reported anxiety and depression symptoms. Lower IQ scores associated with maltreatment is consistent with the weight of data (Pechtel and Pizzagalli, 2011, Wilson et al., 2011).

Maltreated adolescents were reported as displaying significantly greater difficulties and fewer prosocial behaviours, with a significantly greater impact on their lives, with increased risk relative to the established "Abnormal/of concern" norms (Mellor, 2005) of at least a factor of 2 for all SDQ subscales and Total Difficulties score. This increased risk is consistent with other studies (Tarren-Sweeney and Hazell, 2006). However, adolescents themselves did not report significantly elevated experiences of anxious or depressive symptoms.

2.6 Analytical Approach

The following chapters explore the emotion regulation and social understanding of maltreated adolescents relative to a sample of non-maltreated peers. As outlined, we focus on the implicit processes of emotion regulation including situation selection (conditioned avoidance and risk taking), attention deployment (threat-related attention bias) and cognitive change (interpretation bias) and social understanding of maltreated adolescents relative to their non-maltreated peers. In general, a consistent analytical approach was employed, although specific details of all analyses, including *a priori* analysis, is outlined in each chapter.

First, we explored whether there is a statistical difference in task performance between maltreated and non-maltreated adolescents, generally by way of a mixed measures design (given most tasks have at least two conditions that were administered to all participants i.e. repeated measures). As noted previously, maltreated adolescents significantly differ from the comparison sample with respect to IQ. There are difficulties in accounting for the impact of this factor statistically, as Miller and Chapman (2001) remind us that inclusion of such factors as covariates within analysis of variance removes

any variance associated with the covariate. Where the covariate is not meaningfully related to the independent variable, this approach improves statistical power by reducing noise associated with the covariate that may affect analysis of the primary independent-dependent variable relationship. However, where the covariate is meaningfully associated with the independent variable, its inclusion removes meaningful variance and therefore compromises one's conclusions (Miller and Chapman, 2001). Within this study, Age may share variance with task performance, but is not expected to influence the relationship between our grouping variable (Maltreatment status) and dependent variables (task performance or outcomes). As such, removing the variance found in task performance variables associated with Age will generally remove a relevant source of noise. The same cannot be argued for IQ, which may be meaningfully related to maltreatment status (Pechtel and Pizzagalli, 2011, Wilson et al., 2011). Matching on such variables arguably does not resolve this issue, as such selective recruitment is not representative of each sample (for example, selecting those with relatively high or low IQ scores compared to their respective groups) (Miller and Chapman, 2001). Further, natural variance in IQ between participants (irrespective of group) may affect task performance, however it is not possible to disentangle these possible effects (that is, influence of maltreatment on IQ and other normal variations). In light of these issues, we included both Age and IQ as covariates in initial analyses. Such an approach would remove variance associated with age (which is not expected to be meaningfully related to the dependent variables) and IQ (which may be meaningfully related to the dependent variables).

A full factorial model allowed examination of these covariates with the independent and dependent variables, thereby considering them as additional, potentially meaningful factors. Analyses were repeated including only Age, reflecting the assumption that maltreatment may affect IQ scores and therefore be a meaningful contributor to group differences, however in general both analyses produced consistent results.

Where initial analysis suggests a statistically significant relationship between maltreatment status and task performance, follow up analyses were conducted, including non-parametric methods where appropriate.

As reaction time (**RT**) data is often skewed, log transformations were used to limit the impact of violation of parametric assumptions. In all repeated measures analysis of variance, Greenhouse-Geisser corrections were used as a conservative approach to possible sphericity violations. Significant interactions were all examined further using post hoc tests as appropriate, including non-parametric tests where parametric assumptions were violated. As reported above, a number of sibling groups participated, and are therefore not independent. Additional analyses using only one member of each biological family were conducted. Results were generally consistent with those of the full group although lacked sufficient statistical power. Analysis of the full group is reported in order to maximise sample size in each group and therefore statistical power.

Our initial analyses explored possible differences in the above cognitive processes of emotion regulation and social understanding between those exposed to early maltreatment and their non-maltreated peers (**Chapters 3 to 6**). Following this,

differences in emotion regulation and social understanding were explored within the maltreatment group, including any relationships with maltreatment factors and current functioning (**Chapter 7**). Finally, the mediating role of cognitive processes in the relationship between maltreatment and emotional and social difficulties outlined in models of maltreatment (Loman et al., 2010) was explored (**Chapter 7**).

Maltreatment factors include those identified in previous research (Edwards et al., 2003, English et al., 2005a, English et al., 2005b, McLaughlin et al., 2010, Teicher et al., 2006) and the establishment of the MCS (Barnett et al., 1993). In addition to the presence or absence of particular maltreatment subtypes, the severity of each subtype was explored in terms of the maximum severity coded across the lifetime for PA, Neglect and EM. The use of maximum severity is supported in previous studies (Litrownik et al., 2005). In order to reduce the number of statistical tests, "Neglect" includes the two subcategories "Failure to Provide" and "Lack of Supervision" as coded by the MCS. Number of maltreatment subtypes (co-occurrence) has been demonstrated as important with respect to the impact of maltreatment (Edwards et al., 2003). Age of Onset of maltreatment is considered an important factor regarding the impact of child maltreatment (English et al., 2005b) and was defined as the age of the young person when maltreatment was first reported to child protection services. Chronicity of maltreatment was included consistent with previous studies (English et al., 2005a, English et al., 2005b), as described above. As the severity of maltreatment subtypes are likely to be related, partial correlations were used to examine the relationship with the maximum severity score for each subtype, controlling for any influence of the other two maltreatment subtypes. Correlations with number of maltreatment subtypes and

chronicity were explored using Kendall's tau, while age of onset utilised Spearman's rho due to skewness. Relationships between these maltreatment factors are noted in **Table 2.9** using Kendall's tau correlations.

Table 2.9: Correlations between maltreatment variables

	1	2	3	4	5
1. PA					
2. N	0.026 p=0.835				
3. EM	0.279* p=0.029	-0.228 p=0.067			
4. No. Subtypes	0.743*** p<0.001	-0.029 p=0.819	0.558*** p<0.001		
5. Chronicity	0.247* p=0.046	0.071 p=0.555	0.259* p=0.035	0.245 p=0.053	
6. Age of first report	0.336** p=0.004	-0.118 p=0.295	0.337** p=0.003	0.424*** p<0.001	0.022 p=0.843

***p<0.05; **p<0.01; ***p<0.001**

With respect to maltreatment severity, more severe physical abuse tended to be related to more severe emotional maltreatment. This may reflect violence and hostile within the home more broadly, with emotional maltreatment including exposure to domestic or family violence (Barnett, Manly and Cicchetti 1993). Those exposed to more severe physical abuse and emotional maltreatment tended to be exposed to significantly more maltreatment subtypes, as well as more chronic maltreatment. Finally, those that tended to be older at first report were generally exposed to more severe physical abuse and emotional maltreatment, and tended to experience more maltreatment subtypes.

3. Emotion Regulation in Maltreatment: Situation Selection

3.1 Introduction

Processes of emotion regulation play an important role in models of maltreatment, linking the impacts of exposure to abusive or neglectful parenting on threat-related neurobiological systems and subsequent risk of emotional and social difficulties (Loman et al., 2010). As was argued in Chapter 1, implicit processes of emotion regulation are critical, given their prevalence in daily processes of emotion regulation (Koole and Rothermund, 2011) – and yet these are relatively under-studied in maltreated populations. Implicit processes of emotion regulation include "Situation Selection", which refers to "taking actions that make it more (or less) likely that we will end up in a situation we expect will give rise to desirable (or undesirable) emotions (Gross and Thompson 2007; pp. 11). Thus, avoidance of threat-related stimuli (conditioned avoidance) and approach in the face of possible threats (risk-taking) may fall into this category of implicit ER processes. In this Chapter, I will explore first, whether early maltreatment experiences influence threat avoidance and approach, which may contribute to the higher rates of emotional difficulties such as anxiety and depression, as well as impulsivity and social withdrawal, which are more prevalent in maltreated populations (Anthonysamy and Zimmer-Gembeck, 2007, Klimes-Dougan and Kistner, 1990, Tarren-Sweeney and Hazell, 2006). Of note, previous research has found avoidance and risk taking to be associated with the development of anxiety, depression and impulsivity (Fareri et al., 2008). Conditioned avoidance and risk-taking tendencies can be probed using experimental paradigms. I therefore sought to compare these processes in maltreated adolescents relative to their non-maltreated peers.

Conditioned avoidance emerges through fear acquisition, where a neutral stimulus is imbued with fear-eliciting properties following consistent pairing with aversive unconditioned stimuli. In turn, this motivates behavioural avoidance towards the fear-eliciting conditioned stimuli which is reinforced by the capacity to reduce fear by the termination of the conditioned stimuli (Mowrer and Keehn, 1958). Facilitated acquisition of fear conditioning has consistently been reported in adult anxiety (Lissek et al., 2005), and extended to child (Lau and Viding, 2007) and adolescent (Lau et al., 2008) samples, with anxious children/adolescents rating conditioned stimuli as more arousing relative to controls (Waters et al., 2009). Conditioned avoidance then "evolves as a means of attenuating fear elicited by potential threat" (Lau and Viding 2007, pp. 1640). If this process of situation selection is disrupted by early adverse environments, it may contribute to the increased risk of emotional difficulties such as anxiety and social withdrawal reported in maltreated samples (Tarren-Sweeney and Hazell 2006; Anthonysamy and Zimmer-Gembeck 2007; Klimes-Dougan and Kistner 1990).

The tendency to approach rewards despite the presence of potential threats (risk taking) is a form of decision making which involves the "balancing of potential harm or danger to the individual with potential achievement or reward" (Reynolds et al 2013, pp. 272). As such, this form of decision making is influenced by the relative strength or sensitivity of those two inputs: sensitivity to threat on the one hand, and sensitivity to rewards on the other. Again relatively risk averse decision making has been linked to anxiety (Maner et al., 2007), while diminished motivation or experience of rewards is a common feature of depressive disorders (Carr, 2006). Risk-averse individuals avoid potential opportunities for positive or rewarding outcomes and the associated positive

emotions. Alternatively, individuals that tend to be particularly risky open themselves to significant negative consequences. Differences in risk-taking tendency can therefore be considered to play a significant role in situation selection, and again, if early adverse environments affect different patterns of risk taking, this may explain the increased vulnerability to emotional difficulties and impulsivity of those exposed to maltreatment. Adolescence is a particularly important period for risk-taking propensity to emerge with different maturation trajectories of neural networks associated with reward-seeking and cognitive control leading to risk-taking peaking in this period (Burnett et al., 2010, Steinberg, 2007, Steinberg, 2008, Steinberg, 2010, Van Leijenhorst et al., 2010). It is therefore likely for the effects of maltreatment on risk taking to emerge in adolescence particularly among males given previously demonstrated gender differences, with males showing greater risk taking tendencies than females (Byrnes et al., 1999, Pawlowski et al., 2008). As such, this study examined the impact of maltreatment on risk-taking behaviours in this period, as well as considering possible gender differences in maltreated and non-maltreated samples.

One line of support for these hypotheses is that the neural networks involved in processes of avoidance and approach to threat cues overlap with those affected by exposure to early abuse and neglect (Dannlowski et al., 2012, Hart and Rubia, 2012, McCrory et al., 2011, McCrory et al., 2010, Teicher et al., 2012, Tottenham and Sheridan, 2009). Thus, it is plausible that early adversity disrupts these processes of situation selection by their impacts on the development of early neurobiological systems. More particularly, neuropsychological models of avoidance and approach implicate three related neural networks: the Behavioural Approach System (BAS), the

Fight/Flight/Freeze System (FFFS), and the Behavioural Inhibition System (BIS) (Corr, 2004, Gray and McNaughton, 2000, McNaughton and Corr, 2004). According to this model, the BAS, associated with the dopaminergic system within the prefrontal cortex, striatum and pallium circuits, motivates approach towards positive situations (that is, reward sensitivity), either by pursuing rewards or avoiding punishment (McNaughton and Corr, 2004). The FFFS, associated with the periaqueductal gray, medial hypothalamus, and amygdala, is associated primarily with fear and is geared toward protecting the individual by promoting movement away from possible threats (that is, punishment sensitivity). The BIS, associated with the septo-hippocampal network and closely related regions such as the amygdala and cingulate cortex, is activated by goal conflict (most commonly the simultaneous activation of the FFFS and BAS) and operates to inhibit any ongoing behavioural response, promoting vigilance in order to resolve this conflict. Activation of the BIS also biases environmental monitoring in favour of the FFFS, preferencing signs of threat or danger (increasing punishment sensitivity) and avoidant responses thereof in order to promote safety (Gray and McNaughton, 2000, McNaughton and Corr, 2004). From a conditioning perspective, the FFFS is associated with unconditioned aversive stimuli, the BAS with conditioned reward, and the BIS with conditioned aversive stimuli (Corr, 2004), such that operation of the BAS and BIS are associated with prior experiences of rewarding or punishing stimuli respectively and their contingencies. That the neural networks associated with these processes are known to be affected by maltreatment suggests that these processes of approach and avoidance may likewise be affected by maltreatment.

Given the possible role that threat-related avoidance and approach play in mediating the effects of maltreatment on later emotional and social difficulties, it is surprising that they are relatively under-studied in relation to maltreatment. There are some animal models of early stress though findings are inconsistent. Some show reduced aversive conditioning in rats after maternal separation (Kosten et al., 2006, Kosten et al., 2012, Stevenson et al., 2009), while others find enhanced aversive conditioning in juvenile rhesus monkeys exposed to maternal separation (Nelson et al., 2009). Some report reduced reward sensitivity in early deprived rats (Ruedi-Bettschen et al., 2005) and primates (Pryce et al., 2004) but again others (Nelson et al., 2009) report increased reward responding following maternal separation in juvenile rhesus monkeys.

There are no studies to the author's knowledge directly exploring the acquisition of avoidance conditioning of maltreated children or adolescents relative to non-maltreated peers. There have been some experimental findings on the effects of maltreatment on risk-taking but these have been inconsistent, with some reporting greater risk taking in maltreated children relative to non-maltreated peers (Weller and Fisher, 2013) as well as greater "real world" risk taking such as delinquency and substance abuse (Taussig, 2002), while others reported no difference (Guyer et al., 2006). Maltreated children also appeared particularly sensitive to punishment (Weller and Fisher, 2013) and rated reward cues less positively (Dillon et al., 2009). This flattened experience of reward was accompanied by reduced response in the basal ganglia (Dillon et al., 2009). As risk taking reflects a combination of these two factors (sensitivity to punishment relative to desire for reward), one might expect that this pattern of results may point towards maltreated samples being particularly risk averse relative to non-

maltreated peers. Given this inconsistency, it was unclear whether maltreated adolescents should be hypothesised to be relatively risky or risk averse. One possibility was offered by Weller and Fisher (2013), who reasoned that risk taking in maltreated samples may reflect increased sensitivity to loss or punishment, leading the individual to attempt to avoid such losses, even if such actions introduce risk for even more adverse consequences. Put simply, maltreated children may be motivated to avoid possible losses or punishments, whatever the costs. Similarly, while gender differences have been reported in risk taking (Byrnes et al., 1999, Pawlowski et al., 2008), the effect of gender on risk taking in maltreated samples is unknown. Risk-taking was not associated with gender in previous studies involving maltreated samples (Guyer et al., 2006, Weller and Fisher, 2013).

Overall, this data appears to emphasise the significant impact of early life stress such as child maltreatment or, in the case of animal studies, maternal separations (akin to neglect) on both avoidance or punishment sensitivity and approach or reward sensitivity but the direction of these effects is unclear. As such, this study sought to examine the avoidance and approach tendencies of adolescents exposed to early abuse and neglect. First, sensitivity to avoidance conditioning was explored through an experimental conditioning paradigm. Next, risk taking was examined using the established Balloon Analogue Risk task (Lejuez et al., 2002, Lejuez et al., 2007).

3.1.1 What experimental paradigms can be used to measure avoidance learning?

A number of applicable paradigms have been developed to measure avoidance conditioning related to anxiety (Field and Lawson, 2003, Lau and Viding, 2007), using a range of unconditioned stimuli. In particular, Lau and Viding (2007) utilised an angry

facial expression as the aversive unconditioned stimulus. Participants were asked to select between two neutral stimuli (playing cards distinguished by shapes) to win points, with each shape being paired with either a masked angry or neutral expression. Selecting the card associated with the neutral facial expression reflected avoidance, with the proportion of such selections in each block and overall serving as the measure of avoidance. Field and Lawson (2003) provided children with negative (versus positive or no) fictional information about three kinds of Australian marsupials (which the participants had never encountered). Children's willingness to approach a box said to contain each animal, as well as self-reported fear of each animal was used to operationalise avoidance, with the marsupial associated with the negative information yielding significantly increasing fear beliefs and behavioural avoidance.

Drawing on the approach taken by Field and Lawson (2003), we first examined whether the use of background "character" information paired with profile photos would serve as effective stimuli for eliciting behavioural avoidance in an adolescent sample. Profiles were created for three adolescents, each represented by a profile picture displaying a neutral expression. One of the profiles was described using positive, friendly terms, another using negative, antisocial descriptors, while the third profile provided neutral information such as their favourite colour. The profile pictures associated with the negative and neutral profiles then served as the face stimuli for the cards task utilised by Lau and Viding (2007) described above. This approach was piloted with a sample of non-maltreated adolescents (See **Appendix 1**) with results casting doubt on the efficacy of this method in eliciting conditioned avoidance in this sample.

We therefore utilised the direct approach established by Lau and Viding (2007), utilising an angry facial expression as the unconditioned stimuli.

3.1.2 What experimental paradigms can be used to measure risk taking?

Risk-taking involves pursuing potential rewards in the face of possible threats or loses, weighing the value of the former against the negatives of the latter. The Balloon-Analogue Risk Task (BART) has been demonstrated to be a useful experimental measure of risk taking behaviour (Lejuez et al., 2002, Schonberg et al., 2011, White et al., 2008), and has demonstrated construct validity given that it is associated with sensation seeking, and risk behaviours such as substance abuse and delinquency in adolescence (Lejuez et al., 2007). In this task, participants are asked to inflate a series of balloons. The larger the balloon is, the more points it is worth. At each step, participants face a decision to either inflate the balloon and thus increase its value, or to bank the balloon, saving the points it already represents. With each inflation participants run the risk of the balloon exploding, losing all the points so far gained. As such, this task pits the desire for increased rewards against the risk of an increasing loss, with responding reflecting the balance individual balance of these factors. Performance on this task is driven by sensitivity to potential losses (Bornovalova et al., 2009). Furthermore, performance of this task is associated with brain regions that have been associated with maltreatment (Dannlowski et al 2012, Hart and Rubia 2012, McCrory, De Brito and Viding 2010, McCrory, De Brito and Viding 2011, Teicher, Anderson and Polcari 2012, Tottenham and Sheridan 2010), including the striatum, insula, anterior cingulate cortex and dlPFC (Chiu et al., 2012, Rao et al., 2008). In particular, decreased ACC response was associated with making inflation choices, reflecting a failure of the ACC to promote a risk avoidant decision, while increased ACC response was associated with successful inflations,

reflecting the growing improbability of successful inflations (Bogg et al., 2012). As such, it reflects one possibility for the examination of risk-taking tendencies of maltreated adolescents.

3.1.3 Hypotheses

It was hypothesised that if emotion regulation processes of situation selection are affected by exposure to early maltreatment, there should be observable differences in both conditioned avoidance and risk taking tendencies of maltreated adolescents relative to their non-maltreated peers. However, given the inconsistency of limited previous studies, the direction of this difference is unclear. On the basis of greater emotional and social difficulties observed in maltreated samples, and the relationship between avoidance and such difficulties, it was hypothesised that maltreated adolescents will show facilitated acquisition of behavioural avoidance of threat-related cues. In this study, this will be reflected by those in the maltreatment grouping displaying a tendency to select the deck associated with the angry facial expression less often than their non-maltreated peers, who are expected to not significantly deviate from chance responding.

Likewise, the expected direction of differences in risk taking tendencies of maltreated adolescents is unclear given the inconsistencies of previous results outlined above. I tentatively suggest that maltreated adolescents will show relatively risk-averse decision making on this task for two reasons. First, previous researchers have reasoned that increased risk taking on other paradigms reflect the enhanced punishment or loss sensitivity of maltreated children (Weller and Fisher, 2013). Second, previous studies have noted that performance on the BART paradigm is driven by punishment sensitivity

(Bogg et al., 2012, Bornovalova et al., 2009). Together, these points may lead to maltreated adolescents choosing to "bank" following fewer pumps relative to their non-maltreated peers.

As noted above, adolescence is an important period in which to consider risk-taking, and maltreatment status may interact with reported gender differences. While one might expect to observe gender differences in the non-maltreated sample, with males showing greater risking-taking than female peers (Byrnes et al., 1999, Pawlowski et al., 2008), previous studies involving maltreated samples have reported no association between risk taking and gender (Weller and Fisher 2013; Guyer et al 2006). Given this possible role of participant gender, gender will be included as a factor when examining the risk-taking of maltreated adolescents relative to their non-maltreated peers.

3.2 Maltreatment Study

3.2.1 Methods

The participant characteristics and overall study design has been discussed previously (see Section 2.1).

3.2.1.1 Avoidance Conditioning: Cards Task

A schematic of the task can be seen in **Figure 3.1**. Participants were asked to select from two decks of cards, marked with either a circle or a triangle. Participants were told they would receive points for the deck that they selected and were encouraged to discover which deck provided the most points by sampling from each, before picking consistently from whichever deck they felt gave the most points.

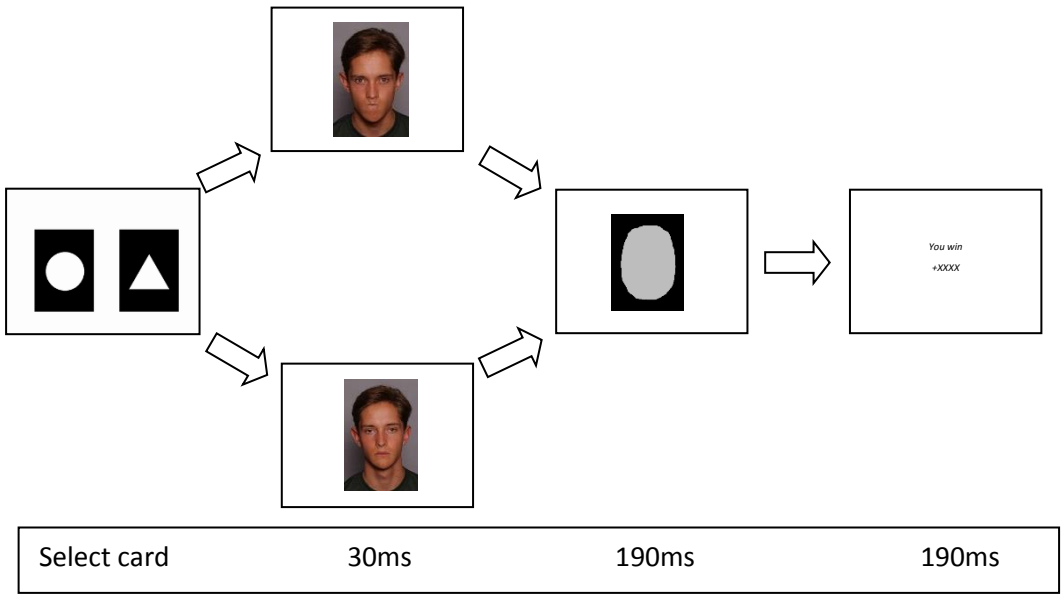


Figure 3.1: Example of card task design

Upon selecting one of the two decks (either circle or triangle), a face would appear for 30ms, masked with a grey oval presented for 190ms. Each shape was paired with either an angry or neutral facial expression (100% reinforcement rate), with shape-expression pairing counterbalanced across participants. This was followed by a four-digit number (2358, 2361, 2459, 2463) indicating how many points the child had won, which was displayed for 190ms. Each number was randomly selected from a range of pre-set scores, balanced across decks so that each deck was worth the same number of points overall. The large numbers and brief display period were designed to make it difficult for participants to track their score. There were 32 trials in each block, with each participant completing five consecutive blocks with a brief rest between blocks. At the completion of the 5th block, participants are told how many points they won. All participants achieved the same score. Therefore avoidance on this task would reflect two stages of conditioning. First, fear conditioning would operate as participants learn that one of the

decks was consistently associated with the aversive social cue (angry facial expression). Second, participants would learn that by not selecting that deck they could avoid exposure to the aversive stimuli.

RTs for each trial were recorded. Trials in which responses were quicker than 200ms were excluded as invalid trials, following general practice on similar RT paradigms (Pine et al., 2005, Waters et al., 2010). The card selected in each 'valid' trial was noted: selections corresponding to the angry expression were scored one, whilst those corresponding to the neutral expression were scored zero. A proportion of responses selecting the neutral profile was produced for each block, with scores closer to 1 reflecting a preference for the angry expression (approach of threat), and scores closer to 0 reflecting a preference for the neutral expression. A mean score of 0.5 indicates no preference, that is, chance. Mean **Preference scores** were calculated for each Block, as well as an overall **Preference score** across all Blocks. **RT**s on valid trials were likewise recorded, with means calculated for each Block.

3.2.1.2 Risk Taking: Balloon Analogue Risk Task

Risk-taking behaviour was analysed using the Balloon Analog Risk Task – Youth. In this task, participants are told to pump up a balloon presented on screen. Participants are told that the more times they pump up the balloon, the bigger it will get, and the more points they will gain. However, if the balloon bursts before they "bank" the points, they will not gain any points from that balloon. Participants pump the balloon by clicking a "Pump" button under the balloon. As they click, the balloon slowly grows in size. There is a "Bank" button on the left of screen. When participants "Bank" the balloon, a sound indicates the number of points they have received. A meter on the left of screen showed

participants the amount of points they had so far banked. After banking, or the balloon bursting, participants move on to the next balloon. Each participant completed 30 trials.

The variable of interest was the average number of pumps on balloons that were banked by the participant, also known as **adjusted pumps average**, consistent with other studies (Chiu et al., 2012, Lejuez et al., 2002, Lejuez et al., 2003, White et al., 2008). This variable is seen as the most appropriate measure of risk taking arising from this task, as it reflects the level of risk tolerated by each participant and is not limited by factors out of their control such as balloon explosions (Lejuez et al., 2002).

3.2.1.3 Analysis

Responses on individual trials for the cards task were filtered such that those faster than 200ms were excluded (Pine et al 2005; Waters et al 2010). Participants with more than 50% of trials excluded in a block were excluded from the analysis as we reasoned that this reflects a lack of adequate attention paid to the task. This level was selected as it would ensure no fewer than 16 acceptable trials in any given Block. In order to ensure that the rate of valid trials did not systematically vary by group and thereby introduce a systematic bias into our later analysis, a 5 X 2 mixed measures ANCOVA was conducted on the proportion of valid trials with Block as a within subjects variable, and Maltreatment Group as a between-subjects variable. The absence of any significant group main or interaction effect on this analysis would suggest that the rate of invalid (and therefore excluded) trials did not differ between Maltreated and Non-Maltreated groups.

Next, a 5 X 2 mixed measures analysis was conducted, with mean **Preference score** in each Block as a within subjects variable and Maltreatment group as a between

subjects variable. Age and IQ were included as covariates. Next, overall **Preference scores** for each group were separately compared against the hypothetical chance level (0.5) using a one-sample t-test. Mean **RT**s across Blocks were also analysed, using a similar 5 X 2 repeated measures design as that reported above. **RT**s in each Block were log-transformed due to issues of skewness. Again, Age and IQ were included as covariates.

With respect to the BART task, univariate ANCOVA was used to explore risk taking as measured by the **adjusted pumps average**. Maltreatment group was included as a between subjects factor. Age and IQ were included as covariates. Given reported gender differences in risk-taking behaviours, gender was also included as a between subjects factor.

3.2.2 Results

3.2.2.1 Avoidance Conditioning

Four participants were excluded from the Maltreatment group due to having fewer than 50% valid trials in any Block for future analysis. There was no significant group difference in number of participants excluded (χ^2=1.862, p=0.172). A 5 X 2 mixed measures ANCOVA was conducted on **proportion of valid trials**, finding no main effects of Block (F(3.612,249.195)=0.218, p=0.914 partial η^2= 0.003), Maltreatment Group (F(1,69)=0.465, p=0.497, partial η^2=0.007) nor a Block X Maltreatment Group interaction (F(3.612,249.195)=0.701, p=0.578, partial η^2=0.010). As such, there appeared to be no group differences in terms of the number of valid trials (either overall or one that emerged across blocks). Whilst relatively lenient, this exclusion criterion ensures that all participants have at least 16 valid trials in each Block. A more stringent exclusion level

such as 75% would require excluding one-third of the overall sample (10 Maltreated, 7 Non-maltreated). Nevertheless removing these participants yielded a similar pattern of results.

Table 3.1: Descriptive statistics of cards task performance of maltreated and non-maltreated participants

		Maltreated (N=43)	Non-maltreated (N=28)
Block 1	Preference	0.46 (0.24)	0.49 (0.21)
	RT (ms)	1228 (701.44)	1180 (578.76)
Block 2	Preference	0.43 (0.28)	0.47 (0.28)
	RT (ms)	743 (296.47)	724 (327.66)
Block 3	Preference	0.41 (0.29)	0.41 (0.24)
	RT (ms)	694 (285.55)	691 (466.04)
Block 4	Preference	0.43 (0.32)	0.47 (0.26)
	RT (ms)	683 (311.31)	551 (193.72)
Block 5	Preference	0.45 (0.35)	0.52 (0.24)
	RT (ms)	650 (212.54)	599 (208.88)
Overall	Preference	0.43 (0.20)	0.47 (0.17)

Means and standard deviations for **preference scores** and **RT**s for both Maltreated and Non-Maltreated groups are provided in **Table 3.1**. **Preference scores** were explored via a 5 X 2 mixed measures ANCOVA, with Block (5 levels) as the within-subjects factor and Maltreatment Group (Maltreated/Non-maltreated) as the between-subjects factor. Age and IQ were included as covariates. There was no main effect of Block ($F(3.739,250.499)=0.325$, $p=0.849$, partial $\eta^2=0.005$), Maltreatment group ($F(1,67)=0.031$, $p=0.861$, partial $\eta^2<0.001$), Age ($F(1,67)=1.806$, $p=0.184$, partial

η^2=0.026), or IQ (F(1,67)=3.829, p=0.055, partial η^2=0.054). There were also no significant two-way interactions (all p>0.5).

A similar approach was conducted to explore any differences in mean **RT** in making selections in each Block, using log-transformed **RT**s. **RT**s showed no main effect of Block (F(3.004,204.304)=0.582, p=0.628, partial η^2=0.008), Maltreatment Group (F(1,68)=0.070, p=0.792, partial η^2=0.001), or Age (F(1,68)<0.001, p=0.985, partial η^2<0.001). IQ significantly impacted on RTs (F(1,68)=4.610, p=0.035, partial η^2=0.063), with correlations revealing that higher IQ scores were associated with lower **RT**s (r=-0.314, p=0.006). There were no two-way interactions observed with respect to **RT**s (all p>0.15).

Planned analysis explored the relationship between the **Overall Preference Score** for each group relative to the hypothetical 0.5 'chance' level using one-sample t-tests. The mean **Overall Preference Score** was significantly less than chance for the Maltreated group (Mean=0.43, t(42)=-2.145, p=0.038), which was not the case for the Non-maltreated group (Mean=0.47, t(27)=-0.8, p=0.431). As such, there was a significant (albeit weak) tendency for maltreated adolescents to avoid selections corresponding to the angry face (collapsed across blocks), whereas the selections of non-maltreated adolescents did not significantly differ from chance (see **Figure 3.2**) (although they did not differ from one another).

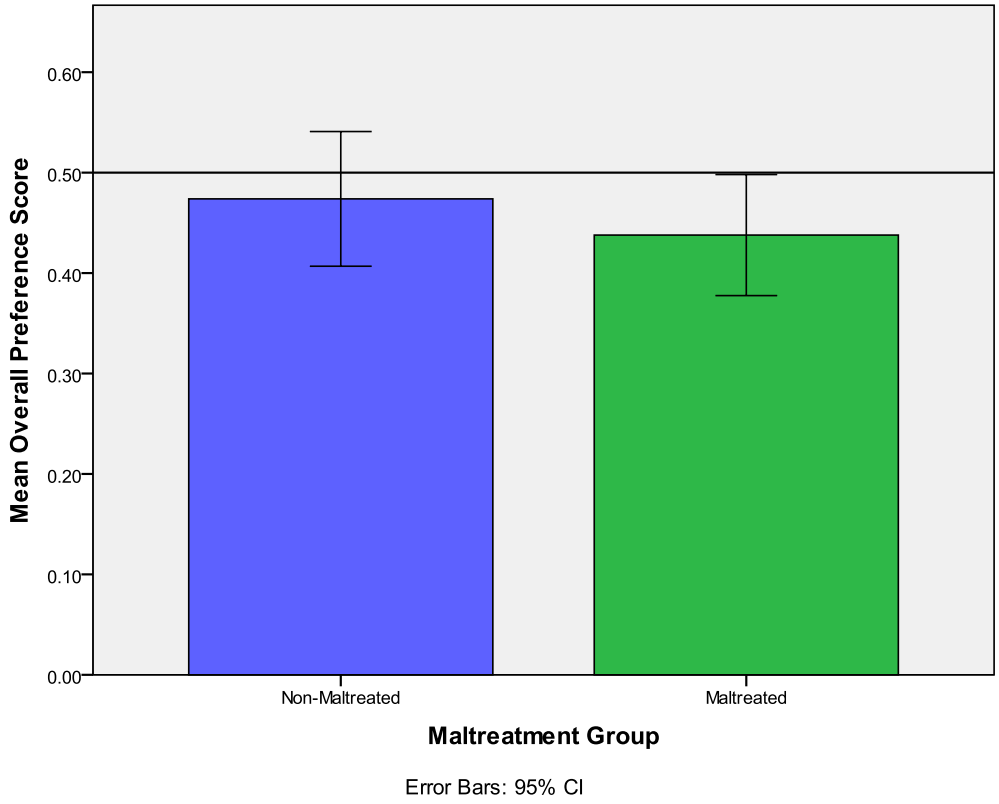


Figure 3.2: Mean Overall Preference Score by Maltreatment Group on Cards Task, relative to 0.5 "chance" level.

3.2.2.2 Risk Taking

Mean adjusted pumps average for each group is shown in **Table 3.2**. Data are further split by gender.

Table 3.2: Descriptive statistics of Balloon Analogue Risk Task performance of maltreated and non-maltreated participants

	Maltreated			Non-Maltreated		
	Total	Male	Female	Total	Male	Female
Adjusted Pumps average	36.23 (13.88)	33.52 (13.99)	39.30 (13.41)	35.17 (11.50)	40.79 (11.47)	31.53 (10.25)

The **average number of pumps** on balloons that participants chose to bank (**Figure 3.3**) was explored using univariate ANCOVA, with Age and IQ as covariates. Given the aforementioned gender differences observed in risk taking, Gender was included as

a between groups factor in addition to Maltreatment group. There was a significant Maltreatment X Gender ($F(1,69)=6.519$, $p=0.013$, partial $\eta^2 =0.086$) interaction observed. There were no other main or interaction effects observed (all $p>0.09$). This interaction effect was examined first by exploring Maltreatment group differences in male and female participants separately using independent t-tests. Within female participants there was a non-significant Maltreatment group trend ($t(37)=-1.983$, $p=0.055$) with maltreated girls taking more risks (by making more pumps) on average than non-maltreated girls. There was no significant maltreatment group difference in male participants ($t(34)=1.512$, $p=0.140$). Next, gender effects across Maltreatment groups were also investigated using independent t tests. Within the Maltreated group, there was no significant effect of gender ($t(45)=1.442$, $p=0.156$), however there was a significant difference in the Non-maltreated group ($t(26)=-2.231$, $p=0.034$), with non-maltreated boys making more pumps on average than non-maltreated girls.

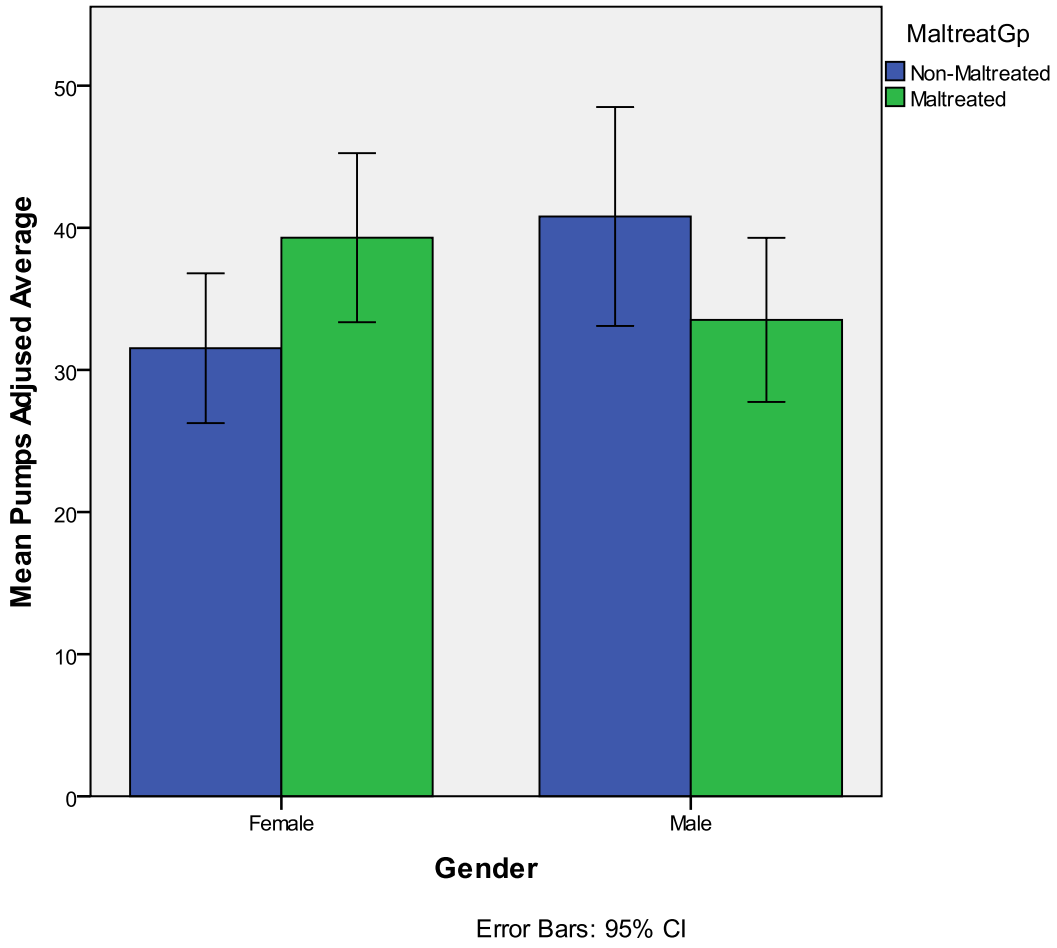


Figure 3.3: Mean Adjusted Pumps Average by Gender and Maltreatment group

3.2.3 Discussion

This study explored the emotion regulation processes of situation selection specifically conditioned avoidance and risk-taking in a sample of maltreated adolescents relative to their non-maltreated peers. It was hypothesised that, as emotion regulation processes are thought to be affected by exposure to early maltreatment, maltreated adolescents may differ from their non-maltreated peers with respect to their acquisition of conditioned avoidance and risk taking tendencies using two previously used experimental paradigms. The results of this study were mixed.

Specifically, with respect to conditioned avoidance, we found no significant group difference between maltreated and non-maltreated adolescents in the selection

of the deck associated with the unconditioned aversive stimuli (an angry face). However, further results suggested that maltreated adolescents may have selected disproportionately fewer cards from this deck, a pattern that was not observed within the non-maltreated sample who selected equally from both decks. Considerable variance between participants was observed, which, along with relatively small sample sizes of each group, may contribute to the failure to observe a statistically significant difference between groups in this study. While only maltreated adolescents showed significant avoidance of the deck associated with the unconditioned aversive stimulus, that maltreated participants did not significantly differ from non-maltreated peers when compared directly means we must be cautious in this interpretation. That maltreated adolescents do not differ from their non-maltreated peers may suggest that processes of conditioned avoidance do not differ with respect to maltreatment status, and as such do not contribute to the emotional and social difficulties of those exposed to abuse or neglect.

Avoidance emerges first via learning the association between an unconditioned aversive stimulus (in this task, the negative face) and the conditioned stimulus (in this task, the card), with the conditioned stimuli then being avoided due to its association with the aversive stimuli, and reinforced by the reduction in fear that accompanies avoidance (Lau and Viding, 2007). Animal studies involving rats and primates exploring avoidance and early adversity, particularly maternal separation, have produced mixed results, with some suggesting reduced avoidance conditioning (Kosten et al., 2006, Kosten et al., 2012, Stevenson et al., 2009) and others enhanced avoidance (Nelson et

al., 2009). To our knowledge, this is the first time that avoidance conditioning has been experimentally examined in a sample of maltreated adolescents.

If maltreated adolescents do in fact exhibit facilitated acquisition of conditioned avoidance, it is equally unclear by which mechanism this difference may emerge. Maltreated adolescence may more quickly learn the association between the UCS and the CS, and therefore select this deck fewer times over the course of the study. Alternatively, maltreated adolescents may learn this contingency at the same rate as non-maltreated adolescents, however are more sensitive to this type of aversive stimuli and therefore are more motivated to avoid it. Consistent with this, maltreated children have been shown to be particularly sensitive to angry facial expressions, with increased amygdala responsiveness to threat-related facial expressions associated with exposure to childhood maltreatment (Dannlowski et al., 2012). Additional studies will be needed in order to first clarify the presence of facilitated conditioned avoidance associated with maltreatment, as well as to explore these two possible mechanisms further.

Importantly, facilitated acquisition of conditioned avoidance has been associated with emotional difficulties such as anxiety in adulthood (Lissek et al., 2005), childhood (Lau and Viding, 2007) and adolescents (Lau et al., 2008). Further, conditioned avoidance has been demonstrated to contribute to increased fear-related beliefs and anxiety (Huijding et al., 2009). Therefore, the facilitated acquisition of conditioned avoidance may contribute to the emotional and social difficulties of those exposed to maltreated, as avoidance of potentially stressful or aversive situations may lead maltreated adolescents to miss important experiences and socialisation opportunities. Given the importance of peers during this period (Steinberg and Morris, 2001), such

avoidance strategies may be particularly damaging in the long term. For example, DuMont et al. (2007) found that being in a supportive relationship predicted resilience in young adults exposed to child maltreatment, demonstrating the importance of social interactions. Such avoidance may even extend more broadly, including social or academic situations, or indeed any situation in which there is a negative consequence. As conditioned avoidance is self-reinforcing, this pattern may become particularly entrenched.

This study built on the paradigm developed by Lau and Viding (2007) by including reaction time data to supplement the preference data, permitting analysis of other aspects of task performance. However there were no significant differences observed between maltreated and non-maltreated adolescents with respect to the average time taken to select a deck. This task then enabled exploration of two aspects of task performance with respect to the emergence of conditioned avoidance; the rate of avoidant choices made, and the time taken to make such decisions. These dimensions reflect just two aspects of task performance associated with conditioned avoidance that may differ between maltreated and non-maltreated adolescents, and potentially contribute to the emotional and social difficulties of the former group. This study then provides a useful foundation for further examination of the role of avoidance in the social and emotional development of children and adolescents exposed to maltreatment, utilising an ecologically valid UCS. However real world avoidance emerges in more complex contexts involving a range of environmental cues and individual factors, such as appraisals of those cues, which may likewise contribute to

differences in conditioned avoidance. These factors may therefore be a focus for future studies.

With respect to risk taking, we hypothesised that maltreated adolescents would differ in risk taking relative to their non-maltreated peers. Previous studies have reported increased risk taking in maltreated samples (Taussig, 2002, Weller and Fisher, 2013), while others reported no difference (Guyer et al., 2006). In general, researchers have argued that risk taking by maltreated samples is particularly driven by punishment or loss sensitivity (Weller and Fisher, 2013). Likewise, performance on the BART is associated with loss sensitivity, with the risk of loss increasing with each additional "pump" (Bornovalova et al., 2009). I therefore offered the hypothesis that maltreated adolescents would show relatively risk-averse decision making given the nature of this paradigm. This hypothesis was not supported. Consistent with previous studies (Byrnes et al., 1999, Pawlowski et al., 2008), non-maltreated participants showed a significant effect of gender, with non-maltreated males making more pumps than non-maltreated females. This pattern was not evident within maltreated adolescents, with no significant difference between male and female participants in this group. Rather, maltreated girls appeared to be marginally more risky than their non-maltreated peers, suggesting that early maltreatment experiences may be associated with greater risk-taking for adolescent girls.

However, this finding appears contrary to the expected mechanism driving decision making in this task, in which performance is associated with loss-sensitivity, leading those who are more loss-averse to "cash out" earlier rather than optimise the balance of risk against reward (Bornovalova et al., 2009), with maltreatment associated

with increased sensitivity of losses (Weller and Fisher, 2013). Further, such loss-averse patterns have been associated with poorer cognitive control, particularly of the mPFC (Bogg et al., 2012), an area that is known to be affected by early maltreatment (Hart and Rubia, 2012, McCrory et al., 2010, McCrory et al., 2011, Teicher et al., 2012, Tottenham and Sheridan, 2009). It was therefore expected that maltreated participants may "cash out" earlier rather than risk losing their existing gains. As such, this finding for female participants is in the opposite direction to that expected, with maltreated adolescent girls more likely to put current winnings at risk in the pursuit of further gains. However the increased riskiness of maltreated samples is not without precedent (Weller and Fisher, 2013, Taussig, 2002). Additionally, emotion dysregulation has been associated with increased risk taking on this task (Magar et al., 2008, Morrongiello et al., 2012). As such, increased risk taking of maltreated adolescent girls may be associated with emotion dysregulation and contribute to the increased risk of social and emotional difficulties of this group, in particular by increasing their exposure to negative outcomes associated with risk-raking. Additional studies utilising differing reward/loss contingencies (Bornovalova et al., 2009) will serve to further examine this increased riskiness and the mechanisms which guide it.

Exposure to child abuse and neglect may disrupt these cognitive processes of situation selection through their impacts on the development of early neurobiological systems that underlie these processes. Maltreatment is known to impact on the development of the fronto-limbic system, including the amygdala, hippocampus, prefrontal cortex, anterior cingulate cortex, corpus callosum and cerebellum (Dannlowski et al., 2012, Hart and Rubia, 2012, McCrory et al., 2010, McCrory et al.,

2011, Teicher et al., 2012, Tottenham and Sheridan, 2009). Models of approach and avoidance such as those developed by Gray and colleagues (Corr, 2004, Gray and McNaughton, 2000, McNaughton and Corr, 2004) implicate the septo-hippocampal system, amygdala and cingulate in avoidance, and the dopaminergic system, prefrontal cortex, striatum and pallium in reward processes. Functional studies have corroborated these models. Specifically, conditioned avoidance has been associated with the operation of the amygdala and prefrontal cortex, with increased amygdala response to aversive cues and reduced recruitment of down-regulatory mechanisms of the ventral prefrontal cortex associated with avoidance (Indovina et al., 2011), and risk taking has been associated with the striatum, dorsolateral prefrontal cortex and anterior cingulate cortex (Bogg et al., 2012, Chiu et al., 2012, Rao et al., 2008). One might therefore expect maltreatment-related behavioural differences on tasks of approach and avoidance, reflecting developmental disruptions to the above neural networks arising from exposure to early abuse and neglect. Additionally, facilitated acquisition of conditioned avoidance and increased risk taking have been associated with emotional and social difficulties (Fareri et al., 2008), which are particularly prevalent in maltreated populations (Anthonysamy and Zimmer-Gembeck, 2007, Klimes-Dougan and Kistner, 1990, Tarren-Sweeney and Hazell, 2006). However, it is beyond the scope of this study to provide evidence regarding the role of underlying neural networks, with imaging studies required to provide direct evidence of this association. Further, while maltreatment group related differences were not observed, there may still be more subtle functional maltreatment-related differences in associated brain regions when completing such tasks that reflect differences in strategy, and which do not manifest to affect the behavioural outcome.

The findings of this study must be considered with respect to a number of limitations. As noted above, while this study reveals maltreatment-related differences in behavioural measures of avoidance and risk-taking, the apparent mechanisms of each are not clear. With respect to the avoidance task, it is not possible to discern whether maltreated adolescents learn about the relationship between the UCS and CS more quickly than non-maltreated peers leading to greater avoidance over the course of the task, or if the avoidance observed rather reflects increased sensitivity to the UCS. Likewise, while previous studies suggest risk taking on the BART task is driven by loss sensitivity, it is unclear whether the apparently increased riskiness of maltreated adolescent girls reflects reduced loss-sensitivity, contrary to previous studies (Weller and Fisher, 2013), or if such participants approach this task in a different way. Additional research in each domain is therefore required in order to clarify the mechanisms of situation selection that are affected by exposure to early abuse and neglect, with respect to the processing of both aversive and rewarding stimuli.

Further, additional research is required to clarify the presence of maltreatment-related differences in processes of situation selection, including conditioned avoidance and risk taking, as well as the hypothesised indirect pathway linking maltreatment and emotional and social difficulties. That maltreatment confers risk of emotional and social difficulties via its impacts on processes of emotion regulation, including situation selection, is consistent with models of maltreatment (Loman et al., 2010), and will be explored in a later chapter (**Chapter 7**). Similarly, the relative impact of different maltreatment factors, including maltreatment subtype, severity, chronicity, co-occurrence and age of onset will also be examined in order to better understand the

impact of maltreatment experiences. Future studies are also required to explore the role of maltreatment-related effects on those neural networks that underlie processes of approach and avoidance, in order to develop a more complete picture of the impacts of maltreatment, and the mechanisms by which such experiences confer risk of emotional and social difficulties. While the evidence reviewed here is consistent with this contention, this association is speculative until it is examined directly. In addition to the above limitations, there are also a range of limitations associated with the nature of the maltreatment sample. As these limitations are held in common across each of the emotion regulation domains included in this study, they will be discussed later in a more general discussion (see **Chapter 8**).

This study examined the acquisition of conditioned avoidance and risk-taking tendencies of maltreated adolescents. These behaviours are enacted in order to increase the probability of desirable situations through avoiding potential threats (conditioned avoidance) or pursuing possible rewards in the face of risks (risk taking). As such, they comprise two aspects of "Situation Selection", a class of emotion regulation processes. As hypothesised, this study found that maltreated adolescents may differ from non-maltreated peers in both their acquisition of conditioned avoidance and, in the case of maltreated girls, in their risk-taking tendencies. Models of maltreatment (Loman et al., 2010) suggest that such processes of emotion regulation may mediate the relationship between maltreatment and emotional and social difficulties. By understanding these relationships better, interventions can be delivered to address these difficulties, specifically targeting the emotion regulation difficulties of individual children and young people that contribute to such maladaptive outcomes.

4. Emotion Regulation and Maltreatment: Selective Attention

4.1 Introduction

4.1.1 Selective Attention as Emotion Regulation

Attention Deployment is an important strategy for emotion regulation and "refers to how individuals direct their attention within a given situation in order to influence their emotions" (Gross and Thompson 2007, pp. 13). While more explicit attention deployment strategies such as distraction or rumination have attracted most of the research in this area (Gross, 2008), processes of selective attention have also been raised as an important implicit process that serves to modulate the resultant emotional experience. Affect-biased attention is one such process in which specific stimuli receives preferential processing or deployment of attentional resources due to its emotional salience (Todd et al., 2012). Todd et al. (2012) argue that affect-biased attention operate via top-down processes in which the attentional systems becomes tuned through experience to prefer particular stimuli due to its emotional salience. As such, these attention biases reflect "attention control settings" that prefers particular information according to established goals. Importantly, affect-biased attention emerges early in life, is tuned by experience and influences subsequent emotional and behaviour outcomes, but is also amenable to manipulation through training (Todd et al., 2012). As such, affect-biased attention may play an important role in the emotional difficulties experienced by maltreated adolescents, with "attention control settings" tuned during their abusive and neglectful childhood environments placing them at greater risk for later difficulties of emotion regulation. In order to explore this possibility, this Chapter examines the existing literature on mechanisms of selective attention in development,

and their relationship with emotional difficulties before outlining the empirical evidence of affect-biased attention associated with maltreatment.

4.1.2 Models of Attention and Developmental Change

Every waking moment we are bombarded with sensory information regarding our environment. Generally, information processing accounts of attention assert that this information exceeds the capacity of our cognitive processes, requiring the individual to prioritise particular stimuli accordingly.

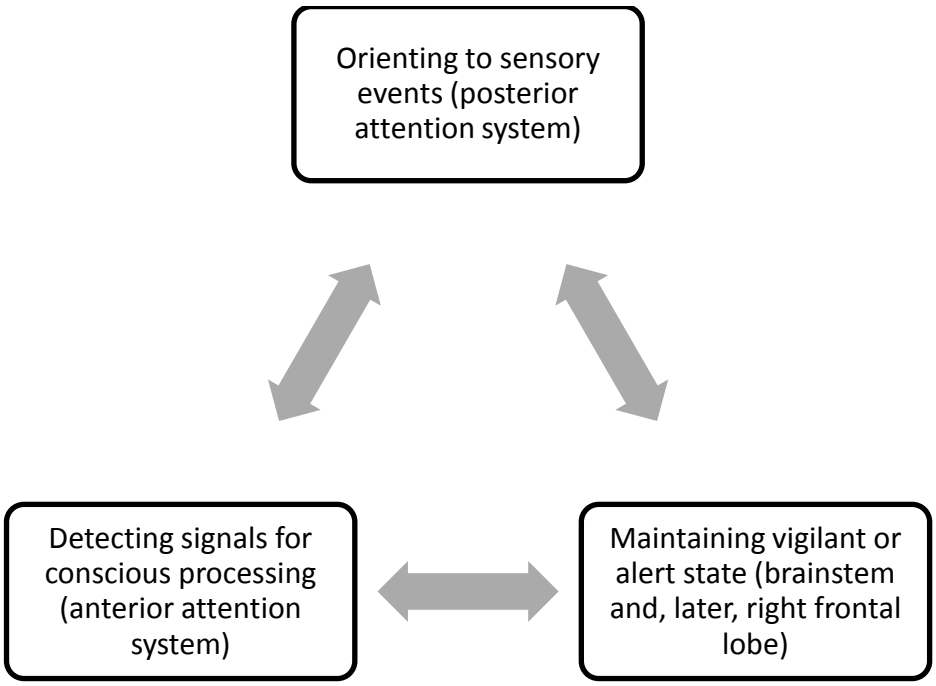


Figure 4.1: Posner and Peterson (1990) model of attention - three subsystems

Two models of selective attention have been described, each focusing on different aspects of attention. The first (**Figure 4.1**) outlines three "streams"; an orienting system, an executive control system, and an alert system, each nested in neurologically separable but overlapping networks (Fan et al., 2005, Posner and Peterson, 1990, Rueda et al., 2004, van de Weijer-Bergsma et al., 2008). A second model (**Figure 4.2**) proposes that stimuli compete for limited cognitive resources, with bottom-

up processes of stimuli salience or top-down goal-focused processes serving to bias this competition toward particular stimuli (Beck and Kastner, 2009, Desimone and Duncan, 1995). For example, highly salient but task irrelevant stimuli may compete with stimuli relevant to current goals, with this competition resolved through individual differences in the relative strength of these processes in that context (Beck and Kastner, 2009, Corbetta and Shulman, 2002, Desimone and Duncan, 1995). These individual differences reflect "attentional control settings" that prioritise particular features based on explicit goals or their behavioural relevance, such as affective information (Folk et al., 1992, Todd et al., 2012). That is, attentional control settings may reflect immediate behavioural or task relevant goals, or longer-term biases of the organism including those based on previous experience. As such, this view asserts that particular biases of selective attention reflect both external and internal processes that influence the salience of a given stimuli. Different aspects of selective attention have shown different developmental trajectories, thought to reflect capacity or efficiency constraints associated with the maturation of underlying neural networks (Heim and Keil, 2012, Plude et al., 1994, Ridderinkhof and van der Stelt, 2000, Ristic and Kingstone, 2009), with important processes of attention control and the integration of top-down and bottom-up processes associated with a dorsolateral frontoparietal network emerging throughout childhood and into adolescence (Heim and Keil, 2012, Ristic and Kingstone, 2009, Scerif, 2010).

Whilst the above models outline mechanisms of selective attention, at what stage this selection operates is also debated (Huang-Pollock et al., 2002). In response to this debate, Lavie and colleagues have proposed two mechanisms of selective attention:

a perceptual filter that reduces distractor perception when perceptual capacity is likely to be exceeded, and a cognitive control mechanism that maintains attention to current goals (Lavie, 1995, Lavie et al., 2004, Lavie, 2005). In this model, the stage of selection is driven by stimulus features but also by individual differences in processing capacity. That is, early selection occurs when processing or perceptual load is high relative to capacity, filtering out potential distractors. When this load is low, task-relevant and task-irrelevant stimuli are both processed and thus cognitive control mechanisms are required to filter out task-irrelevant features to attend to task-relevant ones. These mechanisms are present in childhood, however children switch to early selection at lower levels of perceptual load, thought to reflect the relatively immature capacity of attention control networks (Couperus, 2011, Huang-Pollock et al., 2002, Ridderinkhof and van der Stelt, 2000).

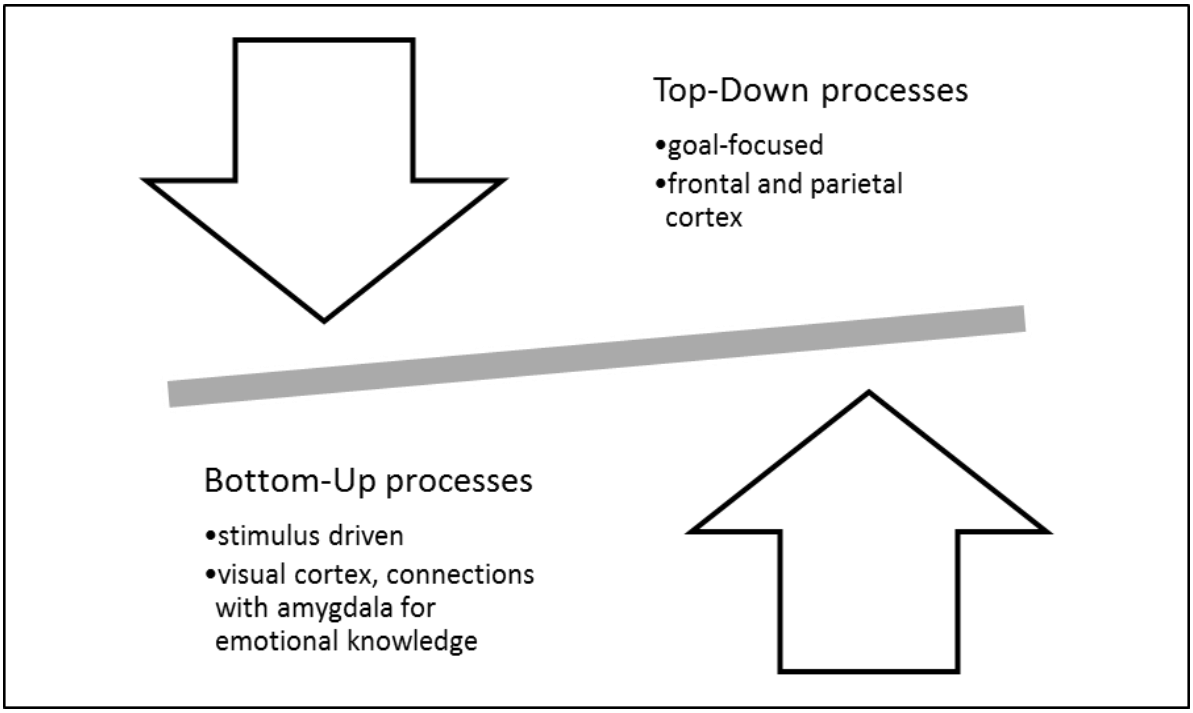


Figure 4.2: Biased competition model, Desimone and Duncan 1995

These frameworks regarding the typical development of attention processes are important for understanding the development of affect-biased selective attention. In brief, the above models suggest that processes of selective attention, reflecting distinct processes nested in specific neural networks, are directed by features of different stimuli in our environment. Critically, the salience of environmental cues is set by programmable top-down "attentional control settings", which reflect current task goals as well as broader settings that are influenced by previous experience. These mechanisms of selective attention operate within the context of current cognitive demands, in which the processing of task-irrelevant cues is dependent on the availability of cognitive resources. As such, affect-biased attention may reflect attentional control settings that prioritise particular cues based on previous experiences of those cues, and where cognitive resources are not otherwise engaged, or where cognitive control of attention is immature or under-developed and therefore unable to actively filter task-irrelevant stimuli.

4.1.3 Maladaptive processes of Selective Attention

That the salience of threat-related stimuli can modulate selective attention is evolutionarily advantageous, priming the organism to attend and respond to threats (LeDoux, 1996). Biases in attention for threat are considered a natural part of an individual's early development, becoming attenuated with the development of processes of cognitive control (Kindt and Van den Hout, 2001). However, biases of selective attention toward threat-related stimuli can be exaggerated and have been associated with maladaptive outcomes such as persistent anxiety (Bar-Haim et al., 2007, Shechner et al., 2012). Models of anxiety have developed to explain the source of this bias (Bishop, 2009, Cisler and Koster, 2010, Eysenck et al., 2007, Lau and Pine, 2008,

Rapee et al., 2009), thought to arise from differences in the underlying neural circuitry, in particular an imbalance between amygdala and prefrontal cortex functioning (Lau and Pine, 2008).

The mechanism of this bias remains a source of debate (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2009, Eysenck et al., 2007, Eysenck and Derakshan, 2011, Fox et al., 2001, Fox et al., 2002, Mathews and Mackintosh, 1998, Mogg and Bradley, 1998, Mogg et al., 2007, Waters et al., 2010; see Cisler and Koster 2010 for a review). Facilitated attention accounts argue that threat-related attention biases in anxiety reflect facilitated orienting of attention to threatening stimuli (Mogg and Bradley, 1998). However, individuals differ on their subjective appraisal of threat, with those vulnerable to anxiety displaying a relatively lower threshold or greater sensitivity to threat-related cues (Mogg et al., 2000). Alternatively, delayed disengagement accounts of threat-related biases suggest that threatening stimuli capture attention in a way that impairs one's ability to shift attention to some other stimulus (Fox et al., 2001, Fox et al., 2002) - and that high trait anxiety therefore arises from poor attention control. Experimental studies have demonstrated consistent threat-related biases associated with anxiety, however authors disagree whether such data represents facilitated attention or delayed disengagement (Cisler and Koster, 2010, Koster et al., 2004, Mogg et al., 2008, Salemink et al., 2007). Eysenck et al (2007) propose a competition model of anxiety similar to the general model of Desimone and Duncan (1995) in which anxiety biases the competition between bottom-up processes of sensitivity to environmental cues and top-down processes of attention control in favour of the former. That is, anxious individuals are exceptionally sensitive to environmental cues of threat, which interrupts goal-directed

functioning, such as performance on a probe detection task in which task-irrelevant threat-related stimuli are presented. This account notes that anxious individuals can enact compensatory strategies to maintain performance in these contexts comparable to that of low anxious individuals at the cost of increased effort and cognitive resources (that is, inefficient recruitment of substantial cognitive resources). Others have argued that anxiety is generally related to impoverished recruitment of top-down attention control mechanisms when required to actively filter environmental information, including but not limited to threat-related stimuli (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2008, Bishop, 2009), drawing on the model outlined by Lavie and colleagues (Lavie, 2005), associated with hypo-activation of the prefrontal cortex and hyper-activation of the amygdala (Bishop, 2008). That is, anxiety is associated with difficulty in preventing the processing of task-irrelevant threat-related stimuli, arising from impoverished cognitive control of attention. These impacts can be masked under conditions of high processing load as limited resources lead to the early filtering of competing stimuli, whereas the effortful control of attention is required to prevent further processing of such stimuli under conditions of relatively low perceptual load (Bishop, 2008, Bishop, 2009). Some studies have suggested a role for the effortful control of attention in threat-related attention biases (Lonigan and Vasey, 2009, Susa et al., 2012).

In summary, biases of selective attention with respect to threat-related cues, while serving an evolutionary purpose, can be maladaptive. Attempts to explain threat-related attention biases have emphasised stimuli salience, or the competition between bottom-up stimuli factors and top-down processes of attention control being biased in

favour of the processing of threat-related stimuli, possibly through impoverished attention control. Experimental studies have shown mixed evidence, but generally appear to implicate both processes of stimuli salience and the active control of attention to limit the processing of task-irrelevant stimuli.

4.1.4 Selective Attention in Maltreatment

Differences in attention processes and affect-biased attention have been explored in relation to maltreatment. Maltreatment has been associated with impaired attention control (Beers and De Bellis, 2002, Bucker et al., 2012). Studies investigating affect-biased attention have reported facilitated attention towards threat-related stimuli in maltreated samples relative to non-maltreated peers, using both experimental reaction time tasks (Gibb et al., 2009, Pollak et al., 2005, Pollak and Tolley-Schell, 2003, Shackman et al., 2007)**see Table 1.3**), as well as physiologically based data (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Pollak et al., 1997, Pollak et al., 2001, Pollak et al., 2005, Shackman et al., 2007). These studies suggest that exposure to maltreatment, and particularly physical abuse, is associated with biased attention and greater salience or sensitivity towards threat-related cues, including angry facial expressions (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Gibb et al., 2009, Pollak and Tolley-Schell, 2003, Pollak et al., 1997, Pollak et al., 2001, Romens and Pollak, 2012). Exposure to physical abuse specifically has received the most attention of maltreatment subtypes in this area. Physical abuse has been associated with hypervigilance to and delayed disengagement from threat displayed by angry facial expressions (Pollak and Tolley-Schell, 2003), and attention bias towards task-relevant and task irrelevant anger cues and increased environmental monitoring (Pollak et al., 2005, Shackman et al., 2007), whereas neglected children did not show threat-related attention biases (Pine et al.,

2005), although have shown difficulties in attention, included attention control (De Bellis et al., 2009). It is thought that subtype related differences in affect processing reflects the individual salience and richness of the emotional experiences in parent-child interactions, with the salience of anger and other threat-related cues strong predictors of potential harm for those exposed to physical abuse, and with neglect associated with limited exposure to emotional cues (Cicchetti and Toth, 2005). However, physical abuse has also been associated with avoidance of threatening stimuli (Pine et al., 2005), or biased attention towards sad but not angry facial expressions following a sad mood induction procedure (Romens and Pollak, 2012). These inconsistencies however may be a result of high rates of PTSD in the maltreatment group (Pine et al., 2005) or the influence of sad mood induction and increased period of exposure to the emotional stimuli (1500ms, as opposed to 500ms in other studies) (Romens and Pollak, 2012).

Models of maltreatment suggest that maltreatment impacts on selective attention processes of emotion regulation due to its impact on developing neural networks, particularly those associated with threat-related processes (Loman et al., 2010). Previous studies exploring processes of selective attention have implicated an important role of the amygdala and prefrontal cortex in threat-related attention biases (Lau and Pine, 2008). Bishop (2008) reported hyper-activation of the amygdala in the presence of threat-related stimuli, as well as reduced activation of the prefrontal cortex, implicating reduced recruitment of attention control mechanisms. These brain areas are similarly implicated in research exploring structural and functional neuropsychological differences associated with maltreatment (McCrory et al., 2010). Maltreatment's effects on these developing neural networks may lead to observable differences in processes

of selective attention and attention control. These cognitive differences may likewise be associated with increased risk of emotional difficulties such as anxiety (Bar-Haim et al., 2007, Shechner et al., 2012).

Threat-related biases of selective attention have been associated with maltreatment (Cicchetti and Toth, 2005, Pechtel and Pizzagalli, 2011), however there are some inconsistencies in the existing literature. Threat-related attention biases have also been associated with emotional difficulties such as anxiety in non-maltreated samples (Bar-Haim et al., 2007, Bishop, 2007, Cisler and Koster, 2010, Lau and Pine, 2008). Therefore, threat-related attention biases may therefore mediate the relationship between maltreatment and emotional difficulties such as anxiety. Further, these biases may reflect particular processes of attention that are affected by exposure to maltreatment. For example, maltreatment, and particularly exposure to physical abuse, may programme top-down attentional control settings, biasing attention processes in favour of stimuli associated with abuse such as facial displays of anger. Further, such biases may be moderated by attention control, with immature or impaired attention control associated with exposure to maltreatment resulting in the further processing of task-irrelevant cues, thereby facilitating the operation of such biases.

4.1.5 Our Study

The aim of this study was to clarify selective attention processes associated with maltreatment, in particular investigating the specific mechanisms by which threat-related attention biases associated with maltreatment might operate, such as the prioritised processing of threat-related stimuli and the role of attention control. This study utilises established experimental paradigms of selective attention and attention

control (Bishop et al., 2007, Pine et al., 2005), modifying the former to include a perceptual load component. High perceptual load may mask maltreatment-related selective attention biases as task-irrelevant stimuli are filtered early, and do not require effortful control of attention to prevent the further processing of such stimuli.

First, the dot probe paradigm was used to explore mechanisms of facilitated attention and delayed disengagement to emotional cues; here displayed by facial expressions. In the dot probe paradigm (MacLeod et al., 1986), a pair of faces is displayed around a centrally presented orienting cue. Next, a probe is presented, either congruent (target face and probe appear in same location) or incongruent (probe appears on opposite side to the target face) to the position of the target face. Participants are asked to indicate the location of the probe as quickly and accurately as possible, with faster responses on congruent relative to incongruent trials reflecting either facilitated attention toward or delayed disengagement from threat-related stimuli. By examining the difference between these trials and those where only neutral stimuli are presented, the source of this bias can be clarified. Longer reaction times on congruent trials relative to neutral trials reflect facilitated attention toward threat-related cues, while longer reaction times on incongruent relative to neutral trials reflect difficulty disengaging from the position of the probe (Koster et al., 2004, Susa et al., 2012). This design was modified to allow an exploration of early or late selection in attention by replacing the singular probe with two letter strings replacing the position of each face, with one containing the target (X). This allowed the perceptual features of the task to be manipulated by altering the non-target letters in the string, using either uniform dissimilar letters or a range of similar letters.

Despite the mixed findings within maltreated samples outlined above (Section 4.1.), I tentatively suggest that this bias will be towards threatening stimuli on the basis of the more robust findings associated with anxiety, and the increased risk of anxiety associated with maltreatment. In line with the work of Bishop and colleagues (Bishop et al., 2007, Bishop, 2008, Bishop, 2009), threat-related biases of attention may be masked where the perceptual load of the task is relatively high, and therefore such biases may only be observed where perceptual load is relatively low, suggesting a role for processes of effortful control of attention.

Attention control with respect to emotional and non-emotional task-irrelevant distractors were examined by a pair of tasks utilising the paradigm developed by Bishop, Jenkins and Lawrence (2007) , with both emotional and non-emotional stimuli. In these tasks, participants are asked to identify which of two target letters is present in a letter string. Task-irrelevant distractors are also present in each task in order to explore the extent to which these stimuli interfere with task performance. In the emotional task the letter string is superimposed over images of facial expressions, while the non-emotional task includes distracting letters as task-irrelevant stimuli. Participants must engage effortful control of attention in order to maintain attention on the task-relevant stimuli, and thus the relative effect of different distractors can clarify the nature of attention control difficulties. Perceptual load can also be manipulated by including the target letter amongst similar or dissimilar letters, thereby affecting the ease with which the target letter can be located. It is hypothesized that differences in attention control will only be present when the perceptual load is low, as attention control is required to prevent the interference of task-irrelevant stimuli, the processing of which is terminated

early where task demands are high. Further, if threat-related attention biases in maltreatment reflect a general impoverishment of attention control, then interference effects will be observed in both the emotional and non-emotional tasks. If, however, such biases are specifically related to threatening stimuli, interference effects should only be observed in the presence of threat-related distractors (in this case an angry facial expression), rather than other emotional stimuli (such as fearful expressions), or non-emotional stimuli.

Prior to this analysis however, the tasks were piloted in a non-selected sample of adolescents in order to examine task suitability, in particular the modified dot probe task. First, two possible versions of the low load condition (either a string made entirely of the target (XXXXX), or including the target amongst dissimilar distractors (OOXOO) were explored in the dot probe paradigm, in order to maximise the difference between high and low load conditions of the task (**see Appendix 2.1**). As this analysis found no significant differences between the above alternatives (with respect to either accuracy or response times (**RT**s) the latter approach (including the target amongst dissimilar non-target distractors such as OOXOO) was used for consistency with the attention control tasks, which rely on a finding the target amongst non-target distractors, particularly in the high load condition.

Next, the modified dot probe task and the attention control task were piloted in a larger sample of young people to examine their suitability in a sample of this age (**see Appendix 2.2**). Results suggested that adolescent participants were able to complete the task quickly and with minimal errors, and therefore the task was appropriate to explore threat-related attention processes in maltreated adolescents.

It was hypothesised that maltreatment would be associated with a threat-related attention bias, reflected in a significant difference between congruent and incongruent trials with respect to angry facial expressions, but not fearful facial expressions. On the weight of studies presented above, it is tentatively suggested that such biases would be toward threat-related stimuli, with subsequent analysis examining whether this is best explained by vigilance towards, or delayed disengagement from, angry facial expressions. Additionally, conditions of high perceptual load may mask this bias, reflecting an important role for processes of attention control.

It was further hypothesised that maltreatment may affect processes of attention control, with maltreatment being associated with impaired attention control. However, it was unclear whether maltreatment is associated with generally impoverished attention control, or specific difficulties associated with the preferential processing of emotional or threat-related cues. If maltreatment is associated with generally impoverished attention control, interference effects will be observed in both the emotional and non-emotional tasks. If maltreatment is associated with preferential processing of emotion or threat-related cues, interference effects will only be observed in the emotional task, or in the presence of threat-related cues. Finally, if these results are associated with impoverished recruitment of top-down mechanisms of attention control, they will only be observed when the perceptual load of the task is low and therefore requires the recruitment of these mechanisms to preserve task performance.

4.2 Methods

4.2.1 Participants

Comprehensive details regarding the participants included in this study has been provided in Chapter 2.

4.2.2 Dot Probe Task

In the dot probe task, participants are asked to locate a visual probe presented on screen. First, a fixation cross is presented centrally for 500ms. This is replaced by two images depicting the face of a single model with different expressions (neutral, emotional), presented equidistant from the centre point, to the left and right, for 500ms. These images were replaced by two strings of five letters which permit the manipulation of perceptual load by varying the ease with which the target can be distinguished from the string, presented at the horizontal midline of each image. Participants were asked to indicate which side the target letter (X) was presented by pressing the appropriate key; 'Z' for the left string, and 'M' for the right string, as quickly and accurately as possible. On this basic foundation (**see Figure 4.3**), individual trials differed on the basis of the pair of emotional faces presented on each trial (neutral, angry/fearful), and in terms of the relative perceptual load of the letter strings in which the probe is located (Low/High load).

High perceptual load involved the target being "hidden" amongst a string of similar distractors (H, K, M, W or Z). The Low perceptual load condition involved the target being placed within a string of dissimilar, uniform distractors (O's), leading to a target string such as (OOXOO) and a non-target string of (OOOOO), following the piloting of two differing approaches (**see Appendix 2.1**). The position of the target within the

string was randomised in each trial. The Load condition was presented block-wise, with order (High Load first or Low Load first) counterbalanced across participants.

The emotional expressions and positions thereof relative to the target letter were also varied, producing four basic trial types. Two trial types, Congruent and Incongruent, involved the presentation of an emotional facial expression (angry or fearful) on one side, and a neutral facial expression on the other. Congruent trials were those where the target appeared on the same side as the emotional face. In contrast, Incongruent trials were those where the target appeared on the opposite side as the emotional face. Congruent and Incongruent trials, and High and Low Load conditions, are presented in **Figure 4.3**. Additional trials showed either two angry or two neutral faces.

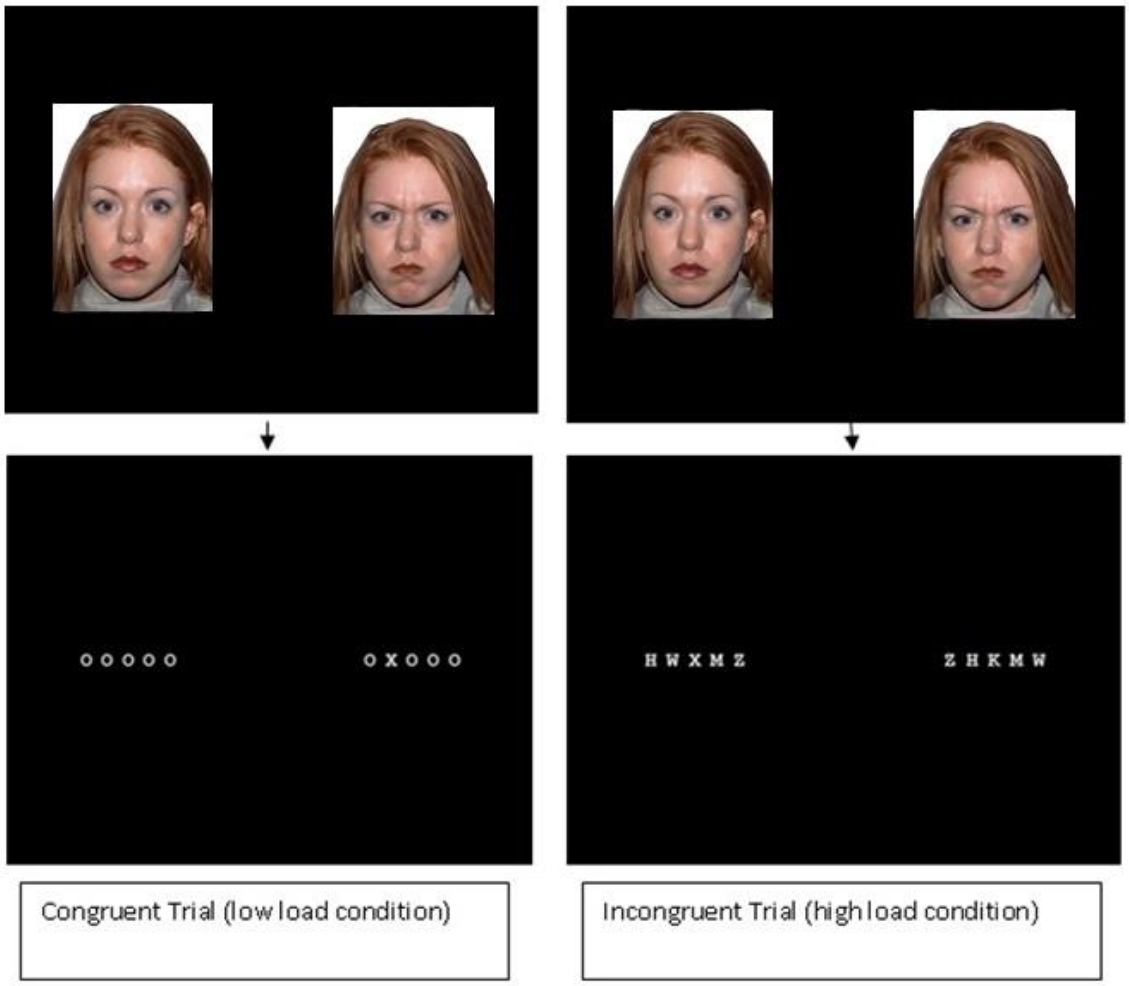


Figure 4.3: Examples of Congruent and Incongruent trials of the dot probe, with Low and High perceptual load

All faces were drawn from the NimStim set of facial expressions, with a total of ten adult models used (5 female). There were 20 trials of each type (angry congruent, angry incongruent, fearful congruent, fearful incongruent, angry only, neutral only) amounting to 120 trials for each level of load (low, high), totalling to 240 trials (**see Figure 4.4**). Probe location was counterbalanced across trials. Participants also completed 5 practice trials in order to ensure that they understood the task. Reaction time (RT) and Accuracy was recorded on each trial.

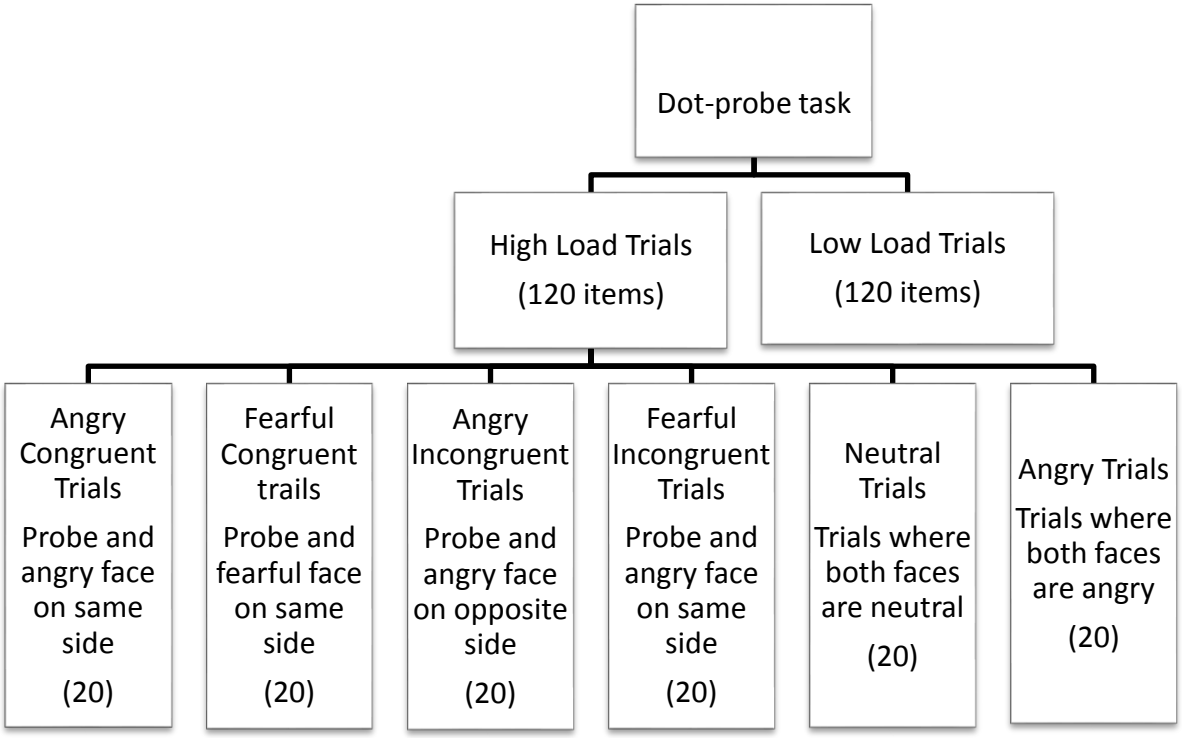


Figure 4.4: Dot probe task breakdown

4.2.3 Emotional Attention Control Task

In this task, participants are required to determine which of two target letters is present in a visually presented string of five letters while ignoring a task-irrelevant background stimulus. First, a fixation cross was displayed for 500ms, replaced by a centrally displayed string of letters super-imposed over the image of a face (**see Figure 4.5**). If the letter 'X' is present, participants are asked to press the letter 'X' on the keyboard. If the letter 'N' is present, participants are asked to press the letter 'N', responding as quickly and accurately as possible. Faces randomly displayed either a neutral, angry or fearful expression to investigate the degree to which the emotional expression modulated attention control. Again 10 models were used (5 female), with each shown twice for each emotion. As with the dot probe task, perceptual load of the task was also manipulated, including the same High and Low Perceptual Load conditions

as the dot probe task, with targets (X or N) being included in a string of similar distractors in the former (H, K, M, W, Z) or uniform dissimilar distractors in the later (for example, OOXOO). There were 60 trials for each level of load (20 of each emotion), for a total of 120 trials.

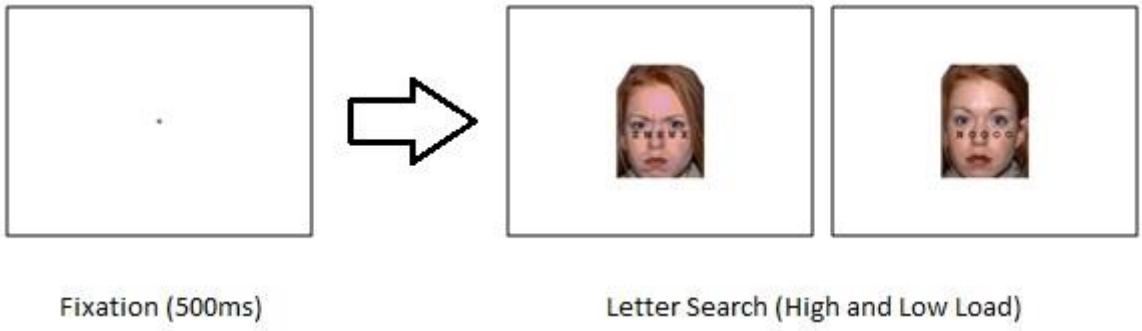


Figure 4.5: Emotional Attention Control Task

4.2.4 Letters Attention Control Task

As well as the above tasks, an additional attention control task was included in this study. First, a fixation cross was displayed in the centre of the display for 500ms. This was replaced by a string of five letters, above which a task-irrelevant distracting letter (either X or N) displayed in a larger font was presented (**see Figure 4.6**). Participants were asked to indicate whether the target string included an 'X' or an 'N' by pressing the corresponding key on the keyboard. Participants were asked to respond as quickly and as accurately as possible. There were two conditions in this task. Congruent trials were those in which the distracting letter and the target letter in the string below were the same. Incongruent trials were those in which the distracting letter and the target letter in the string below were not the same. As with the previous task there were also High and Low Load conditions. The position of the target letter in the string was randomised for each trial.

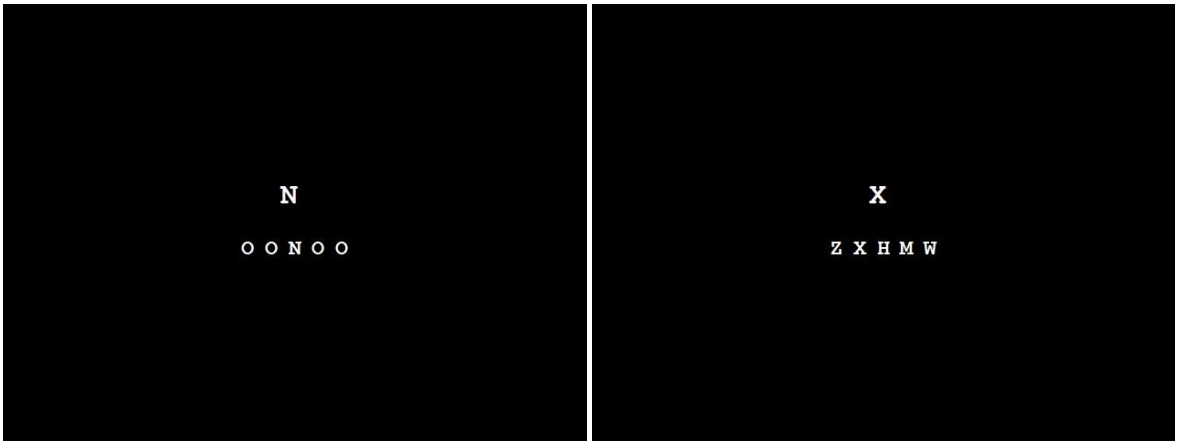


Figure 4.6: Letter Attention Control Task: Low and High Load conditions

4.2.5 Procedure

All participants completed the dot probe task first, followed by the emotional attention control task, followed by the letters attention control task. The High and Low Load conditions of the dot probe task were presented by Block, with the order of Blocks (High Load first or Low Load first) counterbalanced across participants.

4.2.6 Analysis

Valid RT data in each task were those trials in which the probe position was accurately identified, and the response was made slower than 200ms and within two standard deviations of each participant's mean response time for that level of load, consistent with other studies of this type (Pine et al., 2005). In order to filter out data from participants that may not have been attended to the task, participants were only included in the analysis if 75% of trials were valid i.e. met these conditions on a given task. **RT**s in each trial type were the variable of interest across each of the tasks. As mean **RT**s are often skewed, analyses were completed on log-transformed mean **RT**s in each task. First, **Accuracy** scores were examined using a 2x2 mixed measures ANCOVA, in order to examine whether task performance varied between groups (Maltreated/Non-

maltreated) or as an effect of Load (low/high). This approach was used for each task. Age and IQ were included as covariates in each analysis.

4.2.6.1 Dot Probe

Log-transformed **RT**s were entered 2x2x2x2 mixed measures ANCOVAs were conducted including Load (Low/High), Condition (Congruent/Incongruent) and Emotion (Angry/Fearful) as within subject variables and Group (Maltreated/Non-maltreated) as a between subjects factor. Age and IQ were included as covariates.

Interactions involving Condition arising from the above analyses would be examined further through difference scores. **Attention Bias scores** were calculated by subtracting **Congruent RTs** from **Incongruent RTs** such that scores significantly greater than 0 reflect attention bias towards the emotional face, and scores significantly less than 0 reflect bias away from the emotional face. Where a bias is observed, the nature of this bias was examined by creating two additional difference Scores; a **Vigilance Score** (**Neutral-Neutral RTs** minus **Congruent RTs**), with positive scores reflecting vigilance towards the emotional cue, and a **Delayed Disengagement Score** (**Incongruent RTs** minus **Neutral-Neutral RTs**), with positive scores reflecting difficulty disengaging from the emotional cue (Koster et al., 2004, Susa et al., 2012). One-sample t-tests would examine relevant trials to confirm the presence of any apparent attention bias and the direction thereof, by comparing the above difference scores against the hypothetical "no difference" level (0).

4.2.6.2 Emotional Attention Control Task

Log-transformed **RT**s were entered into a 3x2x2 mixed measures ANCOVA with Emotion (Angry/Fearful/Neutral) and perceptual Load (Low/High) as within subject

factors and Group (Maltreated/Non-maltreated) as a between subjects factor. Age and IQ were included as covariates. The effect of Emotion on RTs was examined via simple contrasts, comparing each emotionally-valanced condition against the Neutral condition.

Observed interactions would be further examined via the calculation of difference scores. **Emotion Attention Control scores** were calculated as the difference between trials in which an emotional facial expression was displayed relative to those in which neutral facial expressions were displayed (**Emotion RTs** minus **Neutral RTs**). Positive scores therefore reflect interference of the emotional facial expression relative to the neutral facial expressions. One-sample t-tests were planned to examine these difference scores against the hypothetical "no difference" level (0) where required.

4.2.6.3 Letters Attention Control Task

Consistent with the above, a 2x2x2 mixed measures ANCOVA was conducted with log-transformed **RT**s, with Condition (Congruent/Incongruent) and Load (Low/High) as within-subject factors, and Group (Maltreated/Non-maltreated) as a between-subjects factor. Age and IQ were included as covariates.

Condition effects if present would be examined through the calculation of a difference score. **Non-emotional Attention Control scores** were calculated on the basis of RTs in the Letters Attention Control Task (**Incongruent RTs** minus **Congruent RTs**) such that a positive score reflects greater interference of incongruent distractors relative to congruent distractors. One-sample t-tests were planned to examine these difference scores against the hypothesised "no difference" level (0).

4.3 Results

4.3.1 Dot Probe Task

Forty-six adolescents from the Maltreated group and 28 non-maltreated comparison adolescents were included in the final analysis; one maltreated participant was excluded due to having more than 25% invalid trials. Means and standard deviations of **Accuracy** and **RT**s for each Group across all trial types can be seen in **Table 4.1**.

Table 4.1: Accuracy and RT means for each trial type in the dot-probe task

	Maltreated	Non-maltreated
Overall Accuracy Low Load	0.97 (0.03)	0.97 (0.03)
Overall Accuracy High Load	0.93 (0.05)	0.95 (0.04)
Low Congruent Angry RT (ms)	598.35 (161.10)	462.32 (69.46)
Low Congruent Fearful RT (ms)	599.03 (172.43)	468.44 (75.13)
Low Incongruent Angry RT (ms)	609.34 (176.61)	465.75 (65.74)
Low Incongruent Fearful RT (ms)	597.70 (153.91)	467.31 (62.61)
Low Neutral RT (ms)	607.51 (193.87)	461.55 (61.89)
High Congruent Angry RT (ms)	1062.74 (404.78)	775.96 (196.36)
High Congruent Fearful RT (ms)	1067.68 (434.50)	772.00 (164.92)
High Incongruent Angry RT (ms)	1084.74 (393.70)	813.16 (229.82)
High Incongruent Fearful RT (ms)	1070.65 (375.07)	775.62 (186.44)
High Neutral RT (ms)	1066.27 (432.12)	804.12 (205.05)

A 2x2 mixed measures ANCOVA exploring **Accuracy** revealed no significant main effects of Load ($F(1,70)=0.463$, $p=0.498$, partial $\eta^2=0.007$), Maltreatment Group

(F(1,70)=1.431, p=0.236, partial η^2=0.02), Age (F(1,70)=0.273, p=0.603, partial η^2=0.004) or IQ (F(1,70)=0.028, p=0.867, partial η^2<0.001), nor any significant interactions (all p's>0.085). That is, both Maltreated and Non-maltreated groups performed equally well with respect to accurately identifying the location of the probe, regardless of the level of the Load.

Log-transformed **RT**s were entered into a 2x2x2x2 mixed measures ANCOVA, revealing a significant main effect of Load (F(1,70)=25.425, p<0.001, partial η^2=0.266), with participants significantly faster in the low load condition than in the high load condition. There was also a significant maltreatment group effect (F(1,70)=8.174, p=0.006, partial η^2=0.105), with maltreated adolescents taking significantly longer than non-maltreated adolescents. That is, while Maltreated and Non-Maltreated groups performed equally with respect to **Accuracy**, maltreated adolescents responded significantly more slowly than their non-maltreated peers.

Significant main effects of Age (F(1,70)=11.623, p=0.001, partial η^2=0.142) and IQ (F(1,70)=12.357, p=0.001, partial η^2=0.150) were also observed, with older participants and those with higher IQ scores tending to respond more quickly. The interactions of Load X Age (F(1,70)=4.395, p=0.04, partial η^2=0.059) and Load X IQ (F(1,70)=10.470, p=0.002, partial η^2=0.13) were both significant. Correlations showed that age was significantly associated with **RT**s in both the low load (Spearman's rho=-0.330, p=0.004) and high load (Spearman's rho=-0.348, p=0.002) conditions, while IQ was only significantly associated with **RT**s in the high load condition (Spearman's rho=-0.204, p=0.081) but not the low load condition (Spearman's rho=-0.349, p=0.002). There was also a three way interaction of Condition X Emotion X IQ (F(1,70)=5.063, p=0.028,

partial η^2=0.067). All other main effects and interactions were not significant (all p's>0.05). **Attention Bias scores** for both angry and fearful conditions were calculated in order to explore the significant interaction. IQ scores were significantly positively correlated with **Attention Bias scores** with respect to fearful expressions (r=0.238, p=0.041) and negatively correlated with **Attention Bias scores** with respect to angry facial expressions (r=-0.294, p=0.011). That is, those with higher IQ scores tended to show greater selective attention toward fearful expressions and greater avoidance of angry facial expressions.

4.3.2 Emotional Attention Control Task

Table 4.2: Accuracy and RT means and standard deviations for the Emotional Attention Control Task

	Maltreated	Non-maltreated
Overall Accuracy: Low Load	0.89 (0.05)	0.93 (0.05)
Overall Accuracy: High Load	0.88 (0.06)	0.92 (0.05)
Low Angry RT (ms)	751.87 (175.23)	625.28 (105.71)
Low Fearful RT (ms)	739.21 (163.98)	625.55 (127.80)
Low Neutral RT (ms)	740.25 (160.11)	630.31 (115.40)
High Angry RT (ms)	1453.06 (537.35)	1132.24 (252.25)
High Fearful RT (ms)	1451.55 (508.14)	1157.01 (309.19)
High Neutral RT (ms)	1459.11 (523.70)	1133.96 (270.51)

Five participants were excluded from the Maltreated group and 2 participants were excluded from the Non-maltreated group based on the inclusion criteria above. Mean **Accuracy** and **RT**s for each trial type is provided in **Table 4.2**.

Analysis of **Accuracy** scores revealed no significant main effect of Load ($F(1,64)=0.288$, $p=0.593$, partial $\eta^2=0.004$) nor any significant interactions (all p's > 0.38). However, there was a significant main effect of Maltreatment Group ($F(1,64)=6.476$, $p=0.013$, partial $\eta^2=0.092$), with those in the Maltreated group demonstrating significantly poorer accuracy than those in the Non-maltreated group (see **Figure 4.7**).

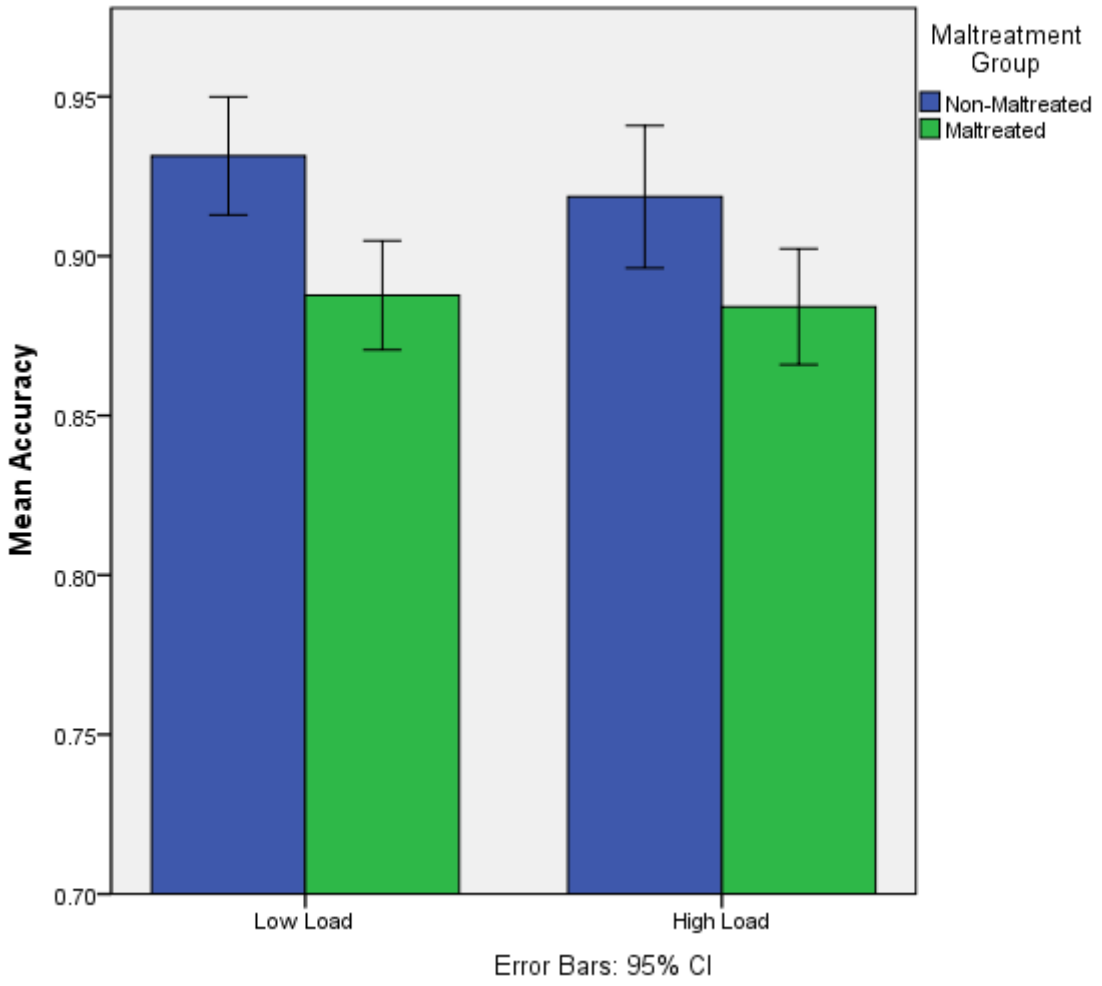


Figure 4.7: Mean Accuracy in Emotional Attention Control Task by Maltreatment Status and Load

A 3x2x2 mixed measures ANCOVA explored log-transformed **RT**s, revealing a significant main effect of Load ($F(1,64)=28.285$, $p<0.001$, partial $\eta^2=0.306$), Age ($F(1,64)=10.998$, $p=0.002$, partial $\eta^2=0.147$) and IQ ($F(1,64)=11.951$, $p=0.001$, partial $\eta^2=0.157$). Participants responded more quickly in the low load condition, with older

participants and those scoring higher on IQ tending to respond more quickly. There was also a significant Load X IQ interaction ($F(1,64)=8.005$, $p=0.006$, partial $\eta^2=0.111$). Correlations revealed that IQ was significantly negatively associated with **RT**s in both the low (Spearman's rho=-0.281, p=0.02) and high (Spearman's rho=-0.306, p=0.011) perceptual load conditions. There was no significant main effect of Maltreatment Group ($F(1,64)=2.074$, $p=0.155$, partial $\eta^2=0.031$), nor any other significant interactions (all p's > 0.09). That is, maltreated participants tended to incorrectly identify the target letter more often than their non-maltreated peers, however there was no significant difference in **RT** between groups. Contrasts revealed no significant difference in **RT**s between either angry or fearful trials and neutral trials (all p's>0.13). That is, **RT**s did not appear to be significantly affected by the presence of angry or fearful facial expressions relative to the presence of neutral facial expressions.

4.3.3 Letters Attention Control Task

Four participants of the Maltreated group were excluded based on the above exclusion criteria. Mean **Accuracy** and **RT** data for each Group can be seen in **Table 4.3**.

Accuracy scores showed no significant main effect of Load ($F(1,67)=0.211$, $p=0.648$, partial $\eta^2=0.003$) or Maltreatment group ($F(1,67)<0.001$, $p=0.992$, partial $\eta^2<0.001$), nor any Load X Group interaction ($F(1,67)=0.265$, $p=0.608$, partial $\eta^2=0.004$). Age ($F(1,67)=1.670$, $p=0.201$, partial $\eta^2=0.024$) and IQ ($F(1,67)=0.200$, $p=0.656$, partial $\eta^2=0.003$) were likewise not significantly associated with **Accuracy** scores, nor any interactions thereof (all p's>0.57).

Table 4.3: Accuracy and RT data from the Letters Attention Control Task, by Maltreatment Group

	Maltreated	Non-maltreated

Accuracy: Low Load	0.92 (0.06)	0.93 (0.05)
Accuracy: High Load	0.92 (0.06)	0.93 (0.06)
Low Congruent RT (ms)	726.79 (149.11)	587.84 (125.55)
Low Incongruent RT (ms)	765.56 (203.45)	593.97 (136.83)
High Congruent RT (ms)	1492.45 (566.47)	1160.04 (309.87)
High Incongruent RT (ms)	1525.55 (543.90)	1137.16 (317.47)

A 2x2x2 mixed measures ANCOVA examined log-transformed **RT**s for both congruent and incongruent trials at each level of perceptual load. There was a significant main effect of Load ($F(1,67)=16.654$, $p<0.001$, partial $\eta^2=0.199$), with participants responding more quickly in the low load condition. Age ($F(1,67)=22.064$, $p<0.001$, partial $\eta^2=0.248$) and IQ ($F(1,67)=17.442$, $p<0.001$, partial $\eta^2=0.207$) also showed significant main effects, with older participants (Spearman's rho=-0.416, $p<0.001$) or those scoring higher on IQ (Spearman's rho=-0.311, $p=0.008$) tending to respond more quickly. There was no main effect of Condition ($F(1,67)=0.455$, $p=0.502$, partial $\eta^2=0.007$). Maltreatment group showed a marginal effect ($F(1,67)=3.781$, $p=0.056$, partial $\eta^2=0.053$), suggesting maltreated adolescents may generally respond more slowly. That is, similar to the dot probe task, maltreated adolescents responded more slowly than their non-maltreated peers, but with equivalent accuracy.

There were also significant interaction effects of Load X Condition ($F(1,67)=5.016$, $p=0.028$) and Load X Condition X IQ ($F(1,67)=8.625$, $p=0.005$, partial $\eta^2=0.114$). This Load X Condition interaction was examined further by examining **Non-emotional Attention Control scores** in each level of load using one-sample t-tests. **Non-emotional Attention Control scores** significantly differed from 0 in the low load

(t(70)=2.396, p=0.019) but not the high load (t(70)=0.330, p=0.742) conditions, with positive mean difference scores suggesting that participants took longer on incongruent relative to congruent trials in the low load condition. Correlations revealed that **Non-emotional Attention Control scores** in the low load condition were significantly negatively associated with IQ (r=-0.312, p=0.008), suggesting that those with lower IQ scores tended to show more impaired attention control. Finally, a Condition X Age interaction (F(1,67)=4.433, p=0.039, partial η^2=0.062) was observed, with Age negatively correlated with both congruent (Spearman's rho=-0.373, p=0.001) and incongruent (Spearman's rho=-0.459, p<0.001) conditions.

4.4 Discussion

This study sought to explore one aspect of emotion regulation, attentional deployment, in a sample of maltreated adolescents relative to their non-maltreated peers. Previous research has reported threat related biases associated with maltreatment, however the direction of these biases is unclear, with some studies reporting hypervigilance (Pollak and Tolley-Schell, 2003, Shackman et al., 2007) or greater responsiveness to threat-related stimuli (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Pollak et al., 1997, Pollak et al., 2001, Pollak and Tolley-Schell, 2003, Shackman et al., 2007), while avoidance of threat-related stimuli has also been reported (Pine et al., 2005). Further, the nature of this bias is unclear. Threat-related attention biases may reflect established attentional control settings increasing sensitivity to specific cues (such as threat), or more generalised difficulties of attention control. Such processes are associated with the amygdala and prefrontal cortex (Bishop, 2008, Lau and Pine, 2008); areas that show structural and functional maltreatment-related effects

(McCrory et al., 2010). The effects of maltreatment on these neural networks may underlie observable differences in selective attention, increasing risk of emotional difficulties (Bar-Haim et al., 2007, Shechner et al., 2012). This study therefore sought to investigate both the presence and direction of threat-related attention biases associated with maltreatment, as well as exploring possible mechanisms of any observed bias, such as impoverished attention control.

This was achieved by including a perceptual load dimension to examine the role of filtering stage. Following the work of Lavie (1995) and later Bishop (2008), it was hypothesised that, if attention biases were an automatic process based solely on the nature of the stimuli, this bias would be present regardless of the perceptual load involved. Conversely, if such biases were related with the deeper processing of these cues, they would only be evident when the perceptual load of the task was low. That is, when the perceptual load of the task is low, cognitive resources remain available for the processing of task-irrelevant information. As such, effortful control of attention is required to prevent this irrelevant information from impacting on performance. Processes of attention control may therefore be implicated if threat-related biases are observed only when the perceptual load of the task is low.

Using a modified dot probe paradigm, there was no evidence of attention bias observed with respect to either angry or fearful facial expressions for either maltreated or non-maltreated adolescents. Maltreated adolescents did not differ from their peers with respect to **Accuracy** on the dot probe task, suggesting that participants were equally able to complete the task. However, maltreated adolescents were found to respond significantly more slowly than their non-maltreated peers across this task,

regardless of perceptual load, even when variance associated with Age and IQ (which likewise contributed significantly to **RT**s) was removed. According to the anxiety model outlined by Eysenck et al. (2007), compensatory strategies can be enacted by high anxious individuals to maintain performance at the cost of increased effort and resources. A similar process may explain the equivalent accuracy of maltreated and non-maltreated adolescents, with maltreated adolescents using a compensatory strategy to maintain accuracy levels at the increased cost of processing resources reflected in the generally slower **RT**s observed in maltreated participants.

The absence of an observed attention bias is in contrast with a number of previous studies that found biases of selective attention towards (Pollak and Tolley-Schell, 2003, Shackman et al., 2007) threat-related stimuli, specifically angry facial expressions. Studies utilising physiological measures likewise suggest that maltreated children show hyper-vigilance to displays of anger or threat in both school aged children (Pollak et al., 1997, Pollak et al., 2001, Pollak and Tolley-Schell, 2003, Shackman et al., 2007) and infants (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011). This biased processing of threat-related cues is argued to be associated with the environmental salience of such cues within the context of maltreating parent-child relationships (Curtis and Cicchetti, 2011, Pollak, 2008). Many studies have focused on the role of physical abuse in particular, in which anger-cues may be particularly salient and the preferential processing of such cues particularly protective. However, other studies have also reported avoidance of angry facial expression amongst physically abused but not neglected maltreated children (Pine et al., 2005). However, Curtis and Cicchetti (2011) warn that neglectful homes may also be characterised by the presence of conflict and

aggression, even in the absence of reported physical abuse. As such, it is perhaps possible that biases of attention both towards and away from threat-related stimuli may arise as a result of exposure to particular maltreating contexts, and the treatment of this heterogeneous group as a homogeneous one masks smaller subgroups that may show opposing effects. One attempt to explore this option by specifically examining the relative effect of physical abuse will be further examined in Chapter 7, along with the role of other maltreatment factors that may affect the emotion regulation of maltreated adolescents.

While the modified dot probe design indirectly examined the role of effortful control of attention, these processes were also examined directly with two tasks exploring the effect of emotional and non-emotional task-irrelevant distractors on performing a simple letter search task. There was no evidence of increased distraction of maltreated adolescents presented with task-irrelevant fearful or angry facial expressions relative to neutral facial expressions, regardless of the level of perceptual load. Rather, there were no significant effects of fearful or angry facial expressions, relative to neutral expressions, nor any general difference in RT between maltreated and non-maltreated participants. However, maltreated participants demonstrated significantly poorer accuracy than non-maltreated adolescents.

Similarly, there was no evidence of maltreatment-related attention control difficulties when task-irrelevant distractors were non-emotional (letters). However, it should be noted that attention control difficulties in this task were significantly associated with IQ, particularly in the low load condition. That is, when the perceptual load of the task was low, participants scoring lower in IQ tended to show greater

response times with respect to incongruent relative to congruent distractors. Previous research has suggested a significant link between childhood maltreatment and impaired performance on IQ measures (De Bellis et al., 2009, Pechtel and Pizzagalli, 2011, Wilson et al., 2011). That this finding was only present when perceptual load was relatively low suggests that it is associated with difficulties of attention control (Bishop, 2008, Lavie, 1995). Together, this may suggest that, to the extent that experiences of maltreatment impair IQ performance, maltreatment may also contribute to general difficulties of attention control. Impoverished attention control is likely to lead to increased processing of environmental cues that others exclude from processing via attention control, and may contribute to the sensitivity of maltreated children and young people to environmental cues, including emotional cues. This impoverished attention control may increase these adolescents vulnerability to emotional difficulties such as anxiety (Bishop, 2008).

The accuracy data urges caution when interpreting across tasks. Maltreated adolescents responded less accurately than their non-maltreated peers on the attention control task when emotional cues were present, whether they were fearful, angry or neutral expressions, while there were no observed group differences with respect to accuracy scores on either the dot probe or non-emotional attention control tasks. Similarly, results from the emotional attention control task differs from those of the other two tasks in that there was no observed group difference in RT, whereas maltreated adolescents consistently responded more slowly than non-maltreated adolescents on both the dot probe and non-emotional attention control tasks. The group differences observed in accuracy scores on the emotional attention control task,

and RTs on the dot probe and non-emotional attention control tasks, are not attributable to IQ or Age, with variance shared with these factors removed. According to the anxiety model outlined by Eysenck et al. (2007), compensatory strategies can be enacted by those that are sensitive to stimulus cues in order to maintain performance at the cost of increased cognitive effort and resources. A similar process may explain the equivalent accuracy of maltreated and non-maltreated adolescents, at the increased cost of processing resources reflected in the generally slower RTs observed in maltreated participants. It is perhaps possible that maltreated participants failed to enact the compensatory strategies required to produce equivalent performance in the ongoing presence of emotional stimuli presented in this way. The inability to compare results between the letters-based and emotion-based attention control tasks limits the conclusions that can therefore draw from this series of studies.

Threat-related attention biases observed in maltreated samples in other studies likely reflect both impoverished recruitment of attention control resources as well as individual differences in "attention control settings" that prioritise the processing of particular cues and stimuli. Such differences in attention control settings are thought to represent the salience of such cues in the individuals life (Todd et al., 2012), and as such one might expect threat-related attention biases to differ on the basis of different maltreatment experiences. The extent to which threat-related attention biases and attention control as measured by these tasks are related to different maltreatment experiences, including maltreatment subtypes, will be explored in a later chapter (**Chapter 7**). Likewise, whether differences in these processes are associated with adolescent functioning will also be explored (**Chapter 7**).

The results of this study must be considered in light of a number of limitations. Most importantly, the limitations in the design of the modified dot probe task undermine the results arising from that task with respect to the inclusion of perceptual load. According to Lavie (Lavie, 1995, Lavie et al., 2004) and Bishop (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2008, Bishop, 2009), when the perceptual load of the task is low, cognitive resources are not fully committed and therefore remain available to process task-irrelevant information. In order to prevent the processing of this task-irrelevant information from interfering with task performance, effortful recruitment of attention control mechanisms is required. Where the perceptual load is high, task-irrelevant cues are filtered early due to capacity constraints, and are therefore not processes. However, the dot probe task differs from the attention control tasks used by the above authors, and also in this study, in an important way. Specifically, the load dimension included on the dot probe task is presented after the task-irrelevant stimuli, rather than simultaneously. Therefore it is unclear whether the perceptual load dimension affects in any meaningful way the processing of the task-irrelevant stimuli, and therefore the observation of threat-related biases of selective attention.

It is possible that the inclusion of a perceptual load dimension as done here fundamentally changes the operation of the dot probe paradigm, which generally relies on the reflexive identification of the location of a probe occurring immediately after the presentation of emotional stimuli. This may be particularly problematic for the high load condition of this task, in which the difficulty of the letter search arguably lends itself to other, possibly effortful or deliberate strategies in order to identify the location of the probe. In contrast, the use of dissimilar distractors in the low perceptual load condition

arguably operates most like the conventional dot probe design, with the location of the probe more obvious. Nevertheless, that the emotional stimuli was presented prior to the onset of the response phase of the task undermines the validity of the current design with respect to the dimension of perceptual load, and in particular, the high load condition, with the low load condition arguably operating similarly to the conventional dot probe design.

Differences noted in accuracy rates across tasks limited the ability to compare performance, in particular between the two attention control tasks, and thereby limiting the conclusions that could be drawn regarding threat-related stimuli. Similarly, while strengthened by the use of two contrasting negative affective cues, additional affective cues, and in particular a positive affective cue, would strengthen the conclusion that maltreatment-related biases of attention are specifically associated with threat-related cues.

This study also differed from other studies (Pine et al., 2005) in that maltreated participants responded more slowly in general relative to their non-maltreated peers. The reason for this difference is unclear, however may reflect general processing speed differences between samples, as physical abuse and neglect have been associated with such deficits (Gould et al. 2012). While this overall difference in RTs persisted when shared variance with abbreviated IQ was removed, and IQ was strongly associated with RTs, it is worth noting that the abbreviated measure of IQ used here does not include a measure of processing speed. A direct measure of processing speed would have allowed further exploration of this difference and the role of processing speed, if any, in the slower RTs of maltreated adolescents. Future studies might likewise include an imaging

component in order to examine the hypothesised neural underpinning of maltreatment-related differences in threat-related attention bias and attention control. Further limitations that are applicable across all tasks in this study, such as those that relate to the sample, will be discussed in a later Chapter (**Chapter 8**).

Broadly, this series of studies found no significant maltreatment-related differences in attention processes arising from the experimental tasks. That is, maltreated participants did not show any evidence of threat-related attention biases, or difficulties of attention control in the face of emotional task-irrelevant distractors. However, this study may suggests that differences in IQ, which may be affected by experiences of maltreatment (De Bellis et al., 2009, Pechtel and Pizzagalli, 2011, Wilson et al., 2011), may be associated with generally impoverished attention control, which may also contribute to the emotion regulation difficulties experienced by maltreated adolescents. That is, maltreated adolescents may exhibit difficulties in attention control (associated with differences in IQ scores) which results in such young people being particularly engaged with environmental stimuli, including threat-related stimuli, to the detriment of goal-directed behaviour. These difficulties of attention control may also lead to increased processing of emotionally-valanced environmental stimuli (including threat-related stimuli), affecting their ability to effectively regulate their emotional state, which in turn may contribute to the significantly increased risk of emotional and social difficulties observed in this population.

5. Emotion Regulation in Maltreatment: Cognitive Change

5.1 Introduction

The emotional response to a given situation is also strongly reliant on the meanings individuals draw from the situation, and their assessment of their own ability to cope with the situation. "Cognitive change" therefore "refers to changing how we appraise the situation we are in to alter its emotional significance, either by changing how we think about the situation or about our capacity to manage the demands it poses" (Gross and Thompson, 2007, pp. 14). As with emotion regulation more generally, processes of cognitive change can operate via implicit or explicit processes (Gross and Thompson, 2007). Implicit processes play a central role in the day-to-day regulation of emotion (Koole and Rothermund, 2011) and might include processes of appraisal or "engaging particular beliefs about the situation" (Mauss, Bunge and Gross 2007; pp. 149), serving to either emphasise or down-play emotional (either positive or negative) aspects of the situation. In this paper, interpretation style refers to the meanings one draws from the behaviour or actions of others, and the expectations one has of future situations, behaviours or actions. Negative interpretation bias therefore represents a distortion of this process, in which one's interpretations tend to be overly negative.

While all children are thought to make hostile or negative interpretations regarding the ambiguous behaviour of others, a key aspect of the development of cognitive appraisals is to learn to make more benign interpretations (Dodge, 2006). This development is thought to occur through a combination of maturation of higher order brain structures such as the frontal cortex (Blakemore, 2008, Dodge, 2006) and early experience (Dodge 2006). Learning to make benign cognitive appraisals can be

influenced by parents and caregivers (Gross and Thompson, 2007), and in particular is linked with warm, nurturing care, in which appropriate modelling of benign interpretations can be implemented. For children who do not experience these positive conditions, such as those exposed to physical abuse, these default negative interpretations are reinforced (De Castro et al., 2002, Dodge, 2006). Importantly, interpretation styles impact not only on the capacity to regulate emotions (and therefore subsequent behavioural responses), but may also alter how individuals engage with their environment. For example, interpreting an ambiguous interaction as negative or hostile may generate an aggressive response, which in turn increases the chances that one will experience additional negative or hostile interactions. These subsequent interactions therefore reinforce the initial negative interpretation. Thus, they effectively limit the range of future experiences that may reinforce negative interpretation styles (Dodge, 2006). Therefore, exposure to abusive or neglectful parent-child interactions reinforced negative interpretation biases rather than developing benign interpretations, significantly affecting how they understanding and engagement with their environment.

The tendency to make negative interpretations regarding ambiguous situations has been associated with anxiety and mood disorders (Dearing and Gotlib, 2009, Mogg et al., 2006, Taghavi et al., 2000). Therefore it is plausible that the development of negative interpretation biases mediates the relationship between maltreatment and emotional difficulties. Training paradigms that modify interpretation style have demonstrated not only that this interpretation bias is plastic but also that changes in the interpretation of ambiguous situations can influence subsequent emotional experiences

– therefore suggesting a temporally-causal rather than just correlational relationship (Lau et al., 2013, Lothmann et al., 2011). For example, adolescents can be trained to make more negative or more positive interpretations regarding ambiguous events (Lothmann et al., 2011, Telman et al., 2013), with subsequent impacts on their reporting of mood and current stressors (Lau et al., 2013, Lothmann et al., 2011, Telman et al., 2013). Negative interpretations of ambiguous social information have also been associated with impaired social interactions such as aggression (Dodge, 1980, Dodge, 2006). That is, such cognitive biases may play an important role in emotional and social difficulties such as those experienced by those exposed to maltreatment (Ammerman et al., 1986, Anthonysamy and Zimmer-Gembeck, 2007, Dodge et al., 1995, Haskett and Kistner, 1991, Lamphear, 1985, Mills et al., 2013, Sawyer et al., 2007, Shields and Cicchetti, 2001, Tarren-Sweeney and Hazell, 2006, Teicher et al., 2006, Teisl and Cicchetti, 2008). Therefore, interpretation biases may explain how exposure to abusive or neglectful parent-child interactions affects the emotional and social development of maltreated children and adolescents and their engagement with their environment.

As interpretation biases may mediate the relationship between maltreatment and emotional and social difficulties, it is important to examine the role of interpretation biases for children and adolescents exposed to maltreatment. Previous studies of this nature have reported mixed results (Dodge et al., 1990, Dodge et al., 1995, Downey and Walker, 1989, Keil and Price, 2009, Price and Glad, 2003, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008). Some studies have found maltreatment, and particularly physical abuse, to be associated with more negative or hostile interpretations of the ambiguous social behaviour of others (Dodge et al., 1990, Dodge

et al., 1995, Keil and Price, 2009, Price and Glad, 2003, Teisl and Cicchetti, 2008). Further, maltreated children have been reported as not only having more negative and less positive expectations (which are distinct from, but associated with interpretations) of parent-child interactions, but these negative representations were associated with emotion dysregulation and peer rejection (Shields et al., 2001). However, other studies have reported no such interpretation biases associated with maltreatment (Downey and Walker, 1989, Sabourin Ward and Haskett, 2008). Those exposed to physical abuse were also reported as being more likely to interpret ambiguous facial expressions as displaying an angry expression (Gibb et al., 2009, Pollak and Kistler, 2002).

Most importantly for the present study, two studies have demonstrated the mediating role of interpretation biases in the adjustment of maltreated children (Shields et al., 2001, Teisl and Cicchetti, 2008). Teisl and Cicchetti (2008) reported that physically abused children showed more hostile interpretations of others, and this factor accounted for 10% of the overall relationship between physical abuse status and peer ratings of aggressive and disruptive behaviour. Shields, Ryan and Cicchetti (2001) found that maltreated children made more negative and less positive representations of hypothetical parent-child interactions, with negative representations associated with emotion dysregulation and peer rejection. These authors argued that "maladaptive representations may contribute to the emotion dysregulation that has been documented among maltreated children, setting in motion a complex chain of transactions that reinforce and maintain poor peer relationships and negative representations of social relationships" (Shields, Ryan and Cicchetti 2001: pp. 331). I sought to extend this work in two ways. First, I extended this work by exploring whether

such biases persist into adolescence where social interactions become more important (Steinberg and Morris, 2001). Second, I broadened the focus of this work from children's views of hypothetical parent-child interactions to examine adolescent's representations of interactions with both parents or caregivers as well as peer interaction, which may also be affected by negative biases with important consequences for the development of social relationships. Further, this study took a broad conceptualisation of interpretation bias, examining adolescent's expectations of other's social behaviour and their interpretation of the ambiguous social behaviour of others. Adolescent's perception of peers as well as self-perception were also included.

5.1.1 The Current Study

Biases in interpretation style may therefore arise within the context of maltreating parent-child relationships, and in turn contribute to the emotional and social difficulties of those exposed to maltreatment. Although the role of such interpretation biases in the relationship between maltreatment and later adjustment have been demonstrated (Shields et al., 2001), this study sought to explore whether these biases were evident in adolescence, and if maltreated adolescents demonstrated more negative interpretations of peers as well as parents or caregivers social behaviour. Better understanding of these processes will contribute to the development of more effective, tailored interventions for this vulnerable population.

This study then sought to examine the interpretation biases of maltreated adolescents compared to their non-maltreated peers. Consistent with other studies (Dodge et al., 1990, Dodge et al., 1995, Downey and Walker, 1989, Keil and Price, 2009, Lothmann et al., 2011, Price and Glad, 2003, Sabourin Ward and Haskett, 2008, Teisl and

Cicchetti, 2008, Telman et al., 2013) vignettes involving social situations were used in order to measure the interpretation biases of maltreated and non-maltreated adolescents. Social situations are of particular relevance to adolescents (Steinberg and Morris, 2001), and therefore social situations may be a particularly relevant context for the assessment of such biases. These measures present social vignettes and ask participants to put themselves in that situation and indicate their expectations regarding their interaction with others (caregivers and peers) in that situation (Children's Expectations of Social Behaviours Questionnaire: (Rudolph et al., 1995) or the meaning behind the ambiguous social actions of others (Ambiguous Situations). Following from the work of Dodge and colleagues (1990; 1995) and Price and Glad (2003) with respect to younger children, it was expected that maltreated adolescents may similarly show more negative or hostile expectations of others behaviour towards them in social situations, or by endorsing more negative meanings for ambiguous behaviours. In addition, children's general perception of both themselves and their peers were also assessed (Perception of Peers and Self questionnaire), with maltreated adolescents expected to have more negative perceptions of themselves and others (Luke and Banerjee, 2012). This study then focused on a range of important cognitions, specifically adolescent's expectations of other's actions in social interactions, their interpretation of the ambiguous social behaviours of others, and their perceptions of peers and themselves, in order to identify whether the cognitions of maltreated adolescents tended to be more negative than those of their non-maltreated peers.

5.2 Method

Details regarding participant characteristics and recruitment have been reported in Chapter 2.

5.2.1 Measures

5.2.1.1 Children's Expectations of Social Behaviours Questionnaire (CESBQ)

The Children's Expectations of Social Behaviours Questionnaire (Rudolph et al., 1995) was used to explore negative expectations of imagined social situations. This questionnaire is made up of 15 parent and 15 peer vignettes describing social situations, providing three possible outcomes. Participants are asked to imagine themselves in that situation, and to indicate how they think their parent or carer, or peers at school, would likely behave in that situation. For example, one item read "You come home from school one day and you're feeling kind of sad because some of the kids at school were making fun of you. You go to tell your mum what happened. What do you think she might do? A) She might give me a hug and talk it over with me so I don't feel so bad, B) She might tell me that it's nothing to get so upset about and I should ignore it, C) She might tell me that I'm acting like a baby and I should be able to stick up for myself". The three responses were coded as either positive (response A in example), indifferent (response B in example) or negative/hostile (response C in example) and scored accordingly (positive=0, indifferent=1, negative=2) as per Rudolph, Hammen and Burge (1995), with scores summed such that higher scores reflect more negative interpretations, with a possible maximum of 30 for each scale. Rudolph, Hammen and Burge (1995) report good reliability (Cronbach's α= 0.74 for mother scale; 0.84 for peer scale), which was also observed in this sample (0.82 Mother scale, 0.87 Peers scale). Good test-retest reliability

at both 1-month (Mother: 0.86, Peers: 0.91) and 5-months (Mother: 0.82; Peers: 0.68) is also reported (Rudolph et al., 1995).

5.2.1.2 Ambiguous Situations Interpretations Scale (ASI)

Similarly, Ambiguous Situations Interpretations Scale (Lau et al., 2013) involved 8 items, with each describing a hypothetical social situation with ambiguous outcomes, such as "You go to your classmate's house to play together. You ring the bell, but nobody opens the door". Participants were asked to imagine themselves in these situations. Following each hypothetical scenario participants were asked "Why do you think this happened to you?", and were given two possible reasons; one benign ("The classmate is not at home") and one negative or hostile ("He doesn't want to open the door because I'm boring"). Participants scored their agreement with each possible reason from 1 (I would not think that at all) to 5 (I would immediately think that). Scale reliability in this sample was good, with Cronbach's alphas of 0.74 (Benign) and 0.77 (Negative) observed for each scale.

5.2.1.3 Perception of Peers and Self (PoPS)

Finally, the Perception of Peers and Self involves two 15-item subscales describing children's perceptions of their peers and themselves. For example, a Peer item read "Other kids cannot be trusted", and a Self item read "I am a lot of fun to be with". Items are scored between 1 (not at all true) to 4 (very much true), with some reversed scored such that higher scores reflect more negative perceptions of themselves or others. Rudolph, Hammen and Burge (1995) reported good reliabilities, with Cronbach's alphas of 0.75 for peer scales and 0.83 for the Self scale, which was also observed in our sample (Peers=0.85; Self=0.81). Acceptable test-retest reliabilities at 1

month (Peer=0.69, Self=0.69) and 5 months (Peer=0.55, Self=0.60) were also reported (Rudolph et al., 1995).

5.2.2 Analysis

As each of the above measures includes two scales, three 2x2 mixed measures ANCOVAs were used, examining responses for each measure. Within-subjects factors included Subject (Mother or Carer/Peers) on the CESBQ, Interpretation Type (Negative/Benign) for the ASI, and Scale (Peers/Self) for the PoPS. In each analysis, Maltreatment Group (Maltreated/Non-maltreated) was included as a between subjects factor. In order to be consistent across Chapters, Age and IQ were included as covariates in each of the above analyses. However, in light of the issues raised by Miller and Chapman (2001) and discussed in Chapter 2, additional analyses excluding these factors was also completed, with similar results.

5.3 Results

Table 5.1 contains the means and standard deviations of all scales both for adolescents who had experienced early maltreatment and their non-maltreated peers.

Table 5.1: Descriptive statistics for interpretation bias questionnaires by Maltreatment Group

		Maltreated	Non-maltreated
CESBQ	Parent/Carer	5.73 (5.62)	5.18 (3.09)
	Peers	3.25 (5.01)	3.82 (4.34)
Ambiguous Situations	Negative	2.22 (0.79)	2.25 (0.62)
	Benign	3.40 (0.84)	3.53 (0.51)
Perception of Peers and Self	Self	27.29 (7.06)	27.40 (7.09)
	Others	28.99 (8.20)	28.38 (6.87)

5.3.1 Children's Expectations of Social Behaviour Questionnaire

A 2x2 mixed measures ANCOVA with Scale (Parent/Carer, Peers) as the within subjects variable and Maltreatment Group (maltreatment, control) as the between

subjects variable. Age and IQ were included as covariates. Two participants were excluded due to incomplete data. There was no main effect of Scale ($F(1,69)=0.116$, $p=0.73$, partial $\eta^2=0.002$), Group ($F(1,69)=0.124$, $p=0.726$, partial $\eta^2=0.002$), Age ($F(1,69=0.114$, $p=0.737$, partial $\eta^2=0.002$) or IQ ($F(1,69)=1.199$, $p=0.277$, partial $\eta^2=0.017$), nor any interaction effects (Scale X Age $F(1,69)=0.011$, $p=0.916$, partial $\eta^2<0.001$; Scale X IQ $F(1,69)=0.092$, $p=0.763$, partial $\eta^2=0.001$; Scale X Maltreatment Group $F(1,69)=0.463$, $p=0.499$, partial $\eta^2=0.007$). Thus there were no significant differences between maltreated and non-maltreated adolescents in their expectations of the social behaviours of parents/carers and peers.

5.3.2 Ambiguous Situations Interpretations Scale

A 2X2 mixed ANCOVA with Interpretation Type (Negative, Benign) as the within subjects factor and Maltreatment Group (Maltreated/Non-maltreated) as the between subjects factor explored scale scores on the ASI. Data from three participants was incomplete, leading to a final sample of 44 maltreated and 28 non-maltreated adolescents. Age and IQ were included as covariates. There was no main effect of Scale ($F(1,68)<0.001$, $p=0.984$, partial $\eta^2<0.000$), nor any Maltreatment Group ($F(1,68)=0.381$, $p=0.539$, partial $\eta^2=0.006$), Age ($F(1,68)=0.323$, $p=0.572$, partial $\eta^2=0.005$) or IQ ($F(1,68)=0.352$ $p=0.555$, partial $\eta^2=0.005$) main effects. There were also no significant Scale X Age ($F(1,68)=0.606$, $p=0.439$, partial $\eta^2=0.009$), Scale X IQ ($F(1,68)=2.401$, $p=0.126$ partial $\eta^2=0.034$) or Scale X Maltreatment Group ($F(1,68)=0.012$, $p=0.915$, partial $\eta^2<0.001$) effects. Overall, maltreated and non-maltreated adolescents did not significantly differ in their endorsement of benign or negative interpretations of ambiguous social situations.

5.3.3 Perception of Peers and Self

A 2 X 2 mixed ANCOVA with Scale (Peers/Self) as the within subjects factor and Maltreatment Group (Maltreated/Non-Maltreated) as the between subjects factor. Age and IQ were included as covariates. There were no main effects of Scale ($F(1,70)=0.046$, $p=0.830$, partial $\eta^2=0.001$), Maltreatment Group ($F(1,70)=0.244$, $p=0.623$, partial $\eta^2=0.003$), Age ($F(1,70)<0.001$, $p=0.984$, partial $\eta^2<0.001$), or IQ ($F(1,70)=3.130$, $p=0.081$, partial $\eta^2=0.043$). There were also no significant Scale X Maltreatment Group ($F(1,70)=0.145$, $p=0.705$, partial $\eta^2=0.002$), Scale X Age ($F(1,70)=0.004$, $p=0.947$, partial $\eta^2<0.001$) or Scale X IQ ($F(1,70)=0.007$, $p=0.931$, partial $\eta^2<0.001$) effects. Maltreated adolescents did not demonstrate more negative perceptions of peers or themselves relative to non-maltreated peers.

5.4 Discussion

This research extends research of implicit emotion regulation processes of cognitive change focused on childhood (Dodge et al., 1990, Dodge et al., 1995, Downey and Walker, 1989, Keil and Price, 2009, Price and Glad, 2003, Sabourin Ward and Haskett, 2008, Shields et al., 2001, Teisl and Cicchetti, 2008) to the important period of adolescence, where information professing of social situations may be particularly important (Steinberg and Morris, 2001).

This study found no evidence that the interpretations or expectations of social behaviours differed between maltreated and non-maltreated adolescents. Specifically, maltreated adolescents made similar ratings on three scales assessing their expectations of the behaviour of their parent/guardian and peers in social interactions, their endorsement of benign or negative explanations of other's ambiguous social behaviour,

and their perceptions of peers or self. Previous research in this area has reported mixed results, with some observing generally more negative biases in these cognitions associated with maltreatment, and particularly physical abuse (Dodge et al., 1990, Dodge et al., 1995, Keil and Price, 2009, Price and Glad, 2003, Shields et al., 2001), whilst others observed no such negative bias associated with maltreatment (Downey and Walker, 1989, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008).

In particular, Shields, Ryan and Cicchetti (2001) demonstrated that negative biases mediate the relationship between maltreatment and peer difficulties, arguing that this operates by undermining emotion regulation processes that affect peer engagement. That is, maltreated children may become defensive and avoidant through misinterpreting social cues, and this emotionally dysregulated behaviour affects how peers engage with maltreated children. In contrast to the study of Shields, Ryan and Cicchetti (2001), this study found no such relationship between interpretation biases and maltreatment status. However, the current study differed from that of Shields and colleagues in a number of ways, and these differences may contribute to the different findings.

First, Shield and colleagues focused on a younger sample, with participants aged 8-12 years compared to the adolescent sample examined in the current study. Second, the maltreated sample reported by Shield and colleagues appears to have been a sample of children living in a maltreating family context, with confirmed reports of maltreatment and attention and support from social services. This contrasts with the current sample, all of whom had entered foster care due to reports of maltreatment, with the average period of time in alternate care being 9.12 years. These two issues may

be central to the presence and persistence of these biases, with developmental data showing that children naturally exhibit negative or hostile appraisals (Dodge, 2006). Specifically, learning to make more benign interpretations emerges across development through warm, nurturing care and modelling with parents playing a central role. However, maltreating parent-child relationships reinforce these negative or hostile interpretations, not allowing them to change to benign styles. As such, it is possible that maltreated children are delayed in adopting a more benign interpretation style, but catch up so that by adolescence are largely indistinguishable from non-maltreated peers. The majority of existing studies reporting maltreatment related negative interpretation biases focus on early childhood, while those reporting no interpretation biases generally referring to late childhood samples (see Table 1.4), a pattern that is consistent with this explanation. However, this explanation is contrary to the hypothesised effect of maltreating relationships, said to reinforce negative interpretations and establish a cycle in which negative social appraisals affect ongoing peer relationships and continue to reinforce negative interpretations due to ongoing peer rejection (Shields et al., 2001). Rather, a more likely explanation is that maltreated adolescents in the current study have benefited from exposure to relationships outside of their maltreating home environment, with more appropriate modelling of benign interpretations. As interpretation biases are able to be modified (Lau et al., 2013, Lothmann et al., 2011), and the fact that the maltreated sample in the current sample first entered foster care, on average, prior to their 4th birthday, and have been in foster placements for an average of 9.11 years (SD: 3.77), this is a plausible explanation for the contrasting finding between this and previous studies reporting maltreatment-related interpretation biases. Later studies mapping the interpretation biases of maltreated

children from early childhood, or at least (within the Australian context) age of entry into care, through to adolescence would help address this important question.

Methodological issues could also be responsible for the absence of observed interpretation biases in the current study. For example, it is possible that the vignettes used failed to adequately measure the implicit interpretations of adolescents, with participant's not engaging adequately with imagining the scenarios and placing themselves in the scene, or finding the scenario less relevant or evocative. However, similar approaches have been successfully utilised in previous studies of maltreated (Dodge et al., 1990, Dodge et al., 1995, Keil and Price, 2009, Price and Glad, 2003) and non-maltreated (Lau et al., 2013, Lothmann et al., 2011, Telman et al., 2013) samples, making such a conclusion unlikely. Similarly, the measures used may not adequately distinguish between hostile and negative interpretations, which may be a critical distinction for maltreated children, with those exposed to physical abuse arguably more likely to have hostile appraisals reinforced. Open-ended response forms that are then coded, such as that used by Shields, Ryan and Cicchetti (2001) may be more appropriate for accurately measuring the appraisals of maltreated respondents, whose natural responses may not be captured by the forced-choice methodology adopted here, developed for young people that have not been exposed to maltreating parent-child interactions.

Alternatively, or even possibly additionally, maltreated adolescents may be capable of making benign rather than negative or hostile interpretations of social situations, but fail to enlist these interpretations in "real world" contexts which carry far greater emotional salience, similar to that reported by Luke and Banerjee (2012) in their

interviews with experienced foster carers. That is, even if maltreated adolescents in foster care are able to make more benign interpretations of ambiguous social situations, they may not be able to access these interpretations in "live" social situations. More ecologically valid, or more emotive vignettes (using visual cues for example) may be more effective in tapping the interpretations of maltreated adolescents.

Finally, Teisl and Cicchetti (2008) demonstrate that maltreatment subtypes may be a critical factor in negative interpretation biases of maltreated children. Teisl and Cicchetti (2008) reported no difference in interpretation biases on the basis of maltreatment status, however subsequent analysis revealed that maltreated children that had experienced physical abuse were more likely to show this negative bias. Further, the negative interpretation bias of physically abused children contributed significantly to their social difficulties. That is, physically-abused maltreated adolescents may demonstrate negative interpretation biases, however their inclusion within the larger "maltreatment" category obfuscates this difference. As such, further analysis in **Chapter 7** will directly explore whether subtype-related differences with respect to interpretation biases are present within the maltreatment group, in particular whether negative interpretation biases are associated with the presence of severity of physical abuse.

In addition to the above limitations, there are a range of general issues regarding maltreatment samples that may play a significant role in this study. As these issues are common across each of the studies they will be discussed more generally in the broad discussion in **Chapter 8**.

Overall, this study aimed to explore whether maltreated adolescents demonstrate a negative interpretation bias in their appraisal of other's ambiguous social behaviours and their expectations of other's behaviour in social interactions, or more negative perceptions of peers or themselves. Such appraisals are an implicit process of cognitive change, an aspect of emotion regulation, and have been associated with emotional and social difficulties. As such, these processes may contribute to the difficulties experienced by maltreated adolescents, and may also represent an important factor that may be targeted in specifically designed interventions. However this study found no evidence that maltreated adolescents are prone to making more negative interpretations of the behaviour or expectations regarding the behaviour of others, be it peers or parental figures, or their perception of peers or self, relative to non-maltreated peers. That is, in general, this sample of maltreated adolescents did not display a significantly more negative interpretation style compared with non-maltreated peers.

6. Social Understanding and Maltreatment in Adolescence

6.1 Introduction

So far, this study has focused on the emotion regulation processes that may be perturbed by exposure to childhood maltreatment, contributing to later risk for emotional difficulties. Those exposed to early maltreatment also exhibit significant social difficulties. Maltreated samples demonstrate difficulties in relationships with others; they have been shown to be more aggressive, withdrawn and demonstrate fewer prosocial behaviours in social situations (Ammerman et al., 1986, Anthonysamy and Zimmer-Gembeck, 2007, Dodge et al., 1995, Haskett and Kistner, 1991, Lamphear, 1985, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008), and are more disliked or rejected by peers (Anthonysamy and Zimmer-Gembeck, 2007, Haskett and Kistner, 1991). Processes of emotion regulation, including situation selection, attentional deployment and cognitive change, are thought to be associated with emotional difficulties. Models of social functioning such as the Social Information Processing model (Crick and Dodge, 1994) argue that such processes also play an important role in social functioning (see **Figure 1.3**). In particular, processes of emotion and emotion regulation are central to the processing of social information (Crick and Dodge, 1996). However, there are other aspects of social functioning that might also contribute to the social difficulties experienced by maltreated adolescents, characterised as a database of social skills and knowledge which develop throughout childhood as a result of social experiences, including parent-child interactions (Crick and Dodge, 1994). This central database of skills and knowledge of social understanding influences each step of the

social information processing model, influencing how social situations are experienced and our responses to them.

Social understanding refers to an appreciation of the mental and affective states of others, and the impact thereof in terms of behaviour and interaction with others (Adolphs, 2001, Carpendale and Lewis, 2006). "Social understanding" includes knowledge of emotional cues in order to be able to recognise the emotional states of others, as well as being able to understand the perspectives and internal mental states of others, often described as 'theory of mind' or mentalising, and the interpretations one makes about the beliefs or motives of others. As such, social understanding can be conceptualised as a toolbox or database of related but distinct skills underlying social behaviour including: emotion understanding and emotion recognition, mentalising skills, and interpretations (Luke and Banerjee, 2013). In typically developing individuals, this 'toolbox' continues to develop and mature across childhood through to adolescence and young adulthood. In fact, adolescence may be a time in which these skills are particularly called for given an increased peer orientation in this period (Steinberg and Morris, 2001). Further, alterations in these processes during adolescence may contribute to negative outcomes such as anxiety or depression (Hassel et al., 2011). Maltreatment-related alterations in these processes may therefore contribute to the increased risk of emotional and social difficulties experienced by those exposed to maltreatment.

In this Chapter, I explore whether exposure to childhood maltreatment leads to disruptions in social understanding in adolescence. While many studies have focused on measuring the effects of maltreatment on social understanding in childhood, this study

focuses instead on *adolescent* social understanding. Moreover, this study covers the diverse range of skills encompassing social understanding, including: (i) Emotion understanding and recognition, which refers to the ability to accurately identify emotions and understand the causes of particular emotional expressions; and (ii) Mentalising, that is the ability to understand and infer the internal mental states of others; that others have internal thoughts, beliefs and intentions that underlie and guide their behaviour (Wellman, Cross and Watson 2001). This builds on from the previous chapter, in which the social interpretations of maltreated adolescents were examined for hostile or negative bias, which has likewise been associated with emotional and social difficulties (Crick and Dodge, 1996, Dearing and Gotlib, 2009, Mogg et al., 2006, Taghavi et al., 2000).

6.1.1 Development of Social Understanding

Social understanding is often described as progressing in a stepwise fashion from an early age, with each skill serving as a building block for more sophisticated social understanding strategies (Pelphrey and Carter, 2008). Pons, Harris and Rosnay (2004) outline the development of emotion understanding and recognition, identifying three phases of emotion understanding. First, around 5 years of age, children can understand emotional expressions and their external causes. Second, around 7 years of age, children understand that emotions are linked to internal mental states, the beliefs and desires of the individual, and emotions can be concealed or masked. Finally, by around 9 to 11 years of age, children come to understand the possibility of mixed or conflicting emotions and the cognitive regulation of emotion.

Mentalising develops alongside these skills, with children's understanding of the external causes of behaviour being linked with the development of mentalising skills (Weimer et al., 2012). Early understanding of others' perspectives is apparent by one year of age, with children engaging and directing the attention of others. Later, around 2.5 years, the use of social strategies such as lying emerges. Finally, more advanced uses such as "white lies" are seen by the early school years (Burnett and Blakemore, 2009). These social skills require the understanding that another's internal mental state may not accurately reflect reality, known as false belief understanding. Children become more competent at this aspect of mentalising, with performance on such tasks consistently shifting from below chance to above chance performance between 3.5 and 5 years old (Wellman et al., 2001). False belief understanding is an important marker of social understanding as it clearly demonstrates an understanding of the distinction between mental states and the physical world (Wellman et al., 2001).

Recent neuropsychological studies have highlighted the significant maturation of the social brain beyond childhood into adolescence and even adulthood (Blakemore and Choudhury, 2006, Blakemore, 2012, Pfeifer and Blakemore, 2012, Sebastian et al., 2012), particularly those neural networks associated with mentalising, including medial prefrontal cortex and associated parietal regions (Blakemore, 2008, Dumontheil et al., 2010). Consistent with this evidence, ongoing development of mentalising abilities has been demonstrated from childhood (7.3-9.7 years) through late adolescence (14-17.7 years) and into adulthood (19-27 years), with performance on a task requiring one to take another's perspective into account showing continued improvement in adolescence (Dumontheil et al., 2010). As such, aspects of social understanding such as

mentalising abilities develop as the underlying neural networks mature. While many aspects of social understanding emerge relatively early in child, this work demonstrates that such processes and their associated neural networks continue to develop and mature through adolescence. It is therefore important to understand the role of processes of social understanding not just in childhood, but also throughout the adolescent period in which young people spend increasing time with peers rather than parents (Steinberg and Morris, 2001).

Adolescent social understanding develops alongside the ongoing maturation of certain underlying neural structures. Neurodevelopmental disorders and lesion studies have consistently demonstrated that deficits in social understanding can arise from anomalies or damage to critical brain structures (Blakemore, 2012, Cicchetti et al., 2003, Kennedy and Adolphs, 2012, Pelphrey and Carter, 2008); a broad network known as the social brain. This social brain includes areas such as the temporal lobe, temporoparietal junction, medial prefrontal cortex, superior temporal sulcus and the amygdala (Kennedy and Adolphs, 2012). However, early environmental inputs, particularly early parent-child interactions, can accelerate, but also disrupt social understanding trajectories. Environmental features such as the discussion of mental states with the child have been implicated in the development of social understanding, particularly focusing on parent-child interactions (Nelson et al., 2012). For example, the abnormal development of mental state understanding of deaf children in hearing families despite normal intelligence demonstrates the key role of environmental inputs such as mental state discussion for the development of social understanding, with deaf children in hearing families showing mentalising difficulties, whilst those in signing families showing

normative development, implicating a conversational account of the former's difficulties (Peterson and Siegal, 2000). Nelson, Adamson and Bakeman (2012) demonstrated the critical role of social inputs by observing parent-child interactions in a false belief task at 3 different time points. They found that false belief performance improved with age in the preschool and early school years. Importantly, mothers were found to play a critical role in guiding and encouraging the mental-state understanding of their child, naturally adjusting the guidance they provided to their child according to their child's developing proficiency. Across three annual visits, the content and nature of mothers' utterances whilst completing a false-belief task with their child changed as children's false-belief understanding developed. These data supported the importance of affective interpersonal engagement in the development of social understanding.

Differences in emotion recognition and understanding are likewise prone to early environmental inputs. Perlman, Kalish and Pollak (2008) suggest that children develop and apply strict rules for understanding causes of emotion. These authors hypothesize that children initially expect that a given event will lead to a specific reaction, however as children experience more social situations their understanding of emotion generally becomes more flexible. Exposure to atypical social experiences can therefore lead to individual differences in the understanding of emotions. For example, exposure to childhood abuse and neglect has been associated with both poorer understanding of emotion and their external causes, as well as differences in the recognition of emotional expressions (see Luke and Banerjee 2013 for meta-analysis and review).

Thus, whilst biological maturation plays an important role in the development of social understanding, social factors also make a significant contribution to individual differences in these skills. Therefore, this study focuses on the impact of atypical parent-child interactions as characterised by exposure to childhood maltreatment on social understanding. Specifically, this study builds on previous work exploring emotion understanding, mentalising and social responding in childhood, extending it into adolescence. This period is of critical importance not only because of the ongoing development of underlying brain regions (Blakemore, 2012, Burnett et al., 2011), but also because of the central role that social relationships with peers come to play during this period (Steinberg and Morris, 2001).

6.1.2 The Effects of Maltreatment on Social Understanding

If the caregiving environment and neurobiological development are essential to the normal development of social understanding, then their development within disrupted care environments such as maltreatment may be particularly illuminating (Cicchetti et al., 2003). Maltreating environments involve disrupted parent-child dyads by definition. Further, exposure to maltreatment has been associated with differences in neurobiological development, affecting fronto-limbic networks including the medial prefrontal cortex and the amygdala (Hart and Rubia, 2012, McCrory et al., 2010) and front-striatal networks including the dorsolateral prefrontal cortex and parieto-temporal regions (Hart and Rubia, 2012), areas associated with the social brain and social understanding. As social understanding may be adversely affected by exposure to childhood maltreatment, three key aspect of social understanding were examined in order to identify possible maltreatment-related differences: understanding the internal

thoughts and feelings or mental states of others, emotion understanding, and responding in social situations. Existing literature in these areas will be discussed below.

6.1.2.1 Understanding internal mental states of others

The ability to understand the internal mental states of others is a critical aspect of social development that has been reported as being affected by exposure to early maltreatment (Burack et al., 2006, Cicchetti et al., 2003, Colvert et al., 2008, Pears and Fisher, 2005). Such studies have reported that maltreated children aged 3 to 8 showed poorer false belief understanding (Cicchetti et al., 2003, Pears and Fisher, 2005) and poorer understanding of the thoughts, beliefs and desires (Pears and Fisher, 2005) than matched, non-maltreated peers. These studies have generally relied on false-belief tasks, such as using a box with deceptive content (Cicchetti et al., 2003). After showing children the actual, unexpected contents of the box, children are asked what a naive friend would say is in the box. Children must realise that their friend's perspective differs from their own, and from reality, in order to successfully complete these tasks. Older children (7-12 years) and adolescents (13-17 years) exposed to maltreatment have also shown deficits in age appropriate mentalising, with better mentalising evident in those with fewer internalizing and externalizing symptoms (Burack et al., 2006). Colvert et al (2008) found that older children (aged 11) exposed to profound early deprivation beyond the first 6 months of life showed poorer understanding of the thoughts, feelings, beliefs and motivations of vignette characters relative to other adoptees not exposed to institutional neglect, using the Strange Stories paradigm, a measure of the understanding of the internal mental states of others (Happe, 1994). Further, mental state understanding of maltreated children aged 3 to 8 was particularly poor when exposure to maltreatment (particularly physical abuse) was during the toddler years,

suggesting evidence for the idea of sensitive periods in the development of social understanding (Cicchetti et al., 2003). Disrupted parent-child interactions, as characterised by maltreating family contexts, during these years when mental state understanding is emerging (Nelson et al., 2012) appears to be particularly damaging on developing mental state understanding (Cicchetti et al., 2003). Difficulties with mentalising have also been associated with severe neglect arising from institutional deprivation (Kumsta et al., 2010), consistent with those associated with autism (Happe, 1994, Castelli et al., 2002), leading to the formulation of a deprivation-specific psychological pattern termed "quasi-autism" (Kumsta et al., 2010). This pattern was characterised by a marked impairment in the ability to comprehend social cues and contexts consistent with autism, and persistent into adolescence (Kreppner et al., 2010). It is as yet unclear the extent to which the difficulties of social understanding associated with child maltreatment persist to adolescence. However tasks used in previous studies are inappropriate for adolescent samples due to ceiling effects (Dumontheil et al., 2010). As such, mentalising tasks in adolescence have generally involved other paradigms that require an understanding of mental states through narratives such as the Strange Stories task (Colvert et al., 2008) developed by Happe (Happe, 1994).

6.1.2.2 Emotion Understanding

The most rigorously studied aspect of social understanding in relation to maltreatment is emotional understanding and recognition, consistently demonstrating that maltreatment status or severity is associated with poorer performance on tasks of emotional understanding and recognition (Pears and Fisher, 2005). Results of a recent meta-analysis reported that maltreated children showed generally poorer emotion understanding than non-maltreated peers (Luke and Banerjee, 2013). In particular,

maltreated children differed in their understanding of negative emotions, judging positive and negative events as equally plausible causes of anger or sadness (Perlman et al., 2008). In addition to this general difficulty associated with maltreatment, specific effects of different maltreatment subtypes have been reported. Specifically neglect has been associated with general difficulties in emotion recognition (Fishbein et al., 2009, Pollak et al., 2000) while physical abuse has been associated with facilitated recognition of angry or fearful expressions (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002). As such, it was expected that maltreated adolescents would likely exhibit deficits in the understanding of the causes of emotion, assessed on the basis of animated vignettes displaying the interaction of non-person shapes. Although these results seem robust, there is some suggestion that maltreatment-related differences in emotion understanding are significantly associated with IQ, with such differences no longer apparent after controlling for IQ (Barahal et al., 1981, Frodi and Smetana, 1984). Given that maltreatment has been associated with lower IQ (Pechtel and Pizzagalli, 2011, Wilson et al., 2011), and given the noted difficulties associated in disentangling maltreatment-related variance in IQ from normal population variance, it is unclear to what extent maltreatment-related differences in IQ may contribute to the above results.

6.1.2.3 Responding in social situations

Finally, the social information processing model suggests that social difficulties are associated with enacting more antisocial and fewer prosocial responses in social interactions. Maltreated preschool children have been shown to display difficulties in understanding and responding appropriately to the distress of peers in classroom observations (Klimes-Dougan and Kistner, 1990, Main and George, 1985). Physically

abused preschoolers exhibited more aggressive and withdrawing responses to the distress of others (Klimes-Dougan and Kistner, 1990, Main and George, 1985), and were more frequently the cause of peer distress than non-abused peers (Klimes-Dougan and Kistner, 1990). Similarly, physically abused children tended to evaluate aggressive responses more favourably (Keil and Price, 2009, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008); making such antisocial responses more likely to be enacted (Crick and Dodge, 1994).

6.1.3 The Current Study

The above studies then outline that maltreatment is associated with difficulties across the various skills underlying social understanding. These difficulties may arise from the impacts of early abuse and neglect on the underlying neural structures, or from the disrupted parent-child interaction associated with maltreatment, or from the interaction of each of these factors and their effects on social understanding. Exploring these impacts may further enhance our understanding of the development of social understanding, as well as how early maltreatment increases risk of social difficulties. For example, it could be that peer difficulties in adolescence reflect ongoing difficulties in understanding the internal mental states of others, as a result of suboptimal parent-child interactions. However, it could be that by adolescence, much of this delay has been "caught up", but other areas such as the regulation of the emotional aspects of social interactions, and how these patterns impact on behaviour, continue to be disrupted. Foster carers reported that some maltreated children appeared to have attained appropriate social understanding, but became overwhelmed in social situations and were therefore unable to draw on these skills when needed, such as interacting with peers (Luke and Banerjee, 2012).

Similarly, maltreated adolescents may understand the internal mental states of others, but may be more likely to believe these beliefs to be hostile and generally respond in less prosocial ways. A similar pattern has been associated with conduct disorder, described as demonstrating a "theory of nasty minds", and a similar explanation may explain the social difficulties of maltreated adolescents and limit their engagement in positive social interactions (Luke and Banerjee, 2013). Being able to engage in positive social interactions with peers may protect against the negative effects of early maltreatment (Kim and Cicchetti, 2010). For example, the presence of a supportive partner relationship predicted positive psychosocial adjustment in young adulthood for those exposed to childhood maltreatment (DuMont et al., 2007). Despite these points, relatively few studies have explored social understanding in maltreated children, and even fewer in adolescence. Given the importance of social understanding and peer relationships in this period (Steinberg and Morris, 2001), and its relationship with both risk and resilience as outlined above, a better understanding of these pathways would likely contribute to the development of more effective, tailored interventions to promote resilient functioning for those exposed to early maltreatment.

This study therefore seeks to answer a number of specific questions regarding the relationship between early maltreatment and social understanding in adolescence. Specifically, this study will explore whether there are significant maltreatment-related differences in the ability to understand the internal thoughts, beliefs and intentions of others. It is hypothesized that, in general, those exposed to early maltreatment may demonstrate poorer understanding of the internal mental states of others relative to

non-maltreated peers. Maltreated adolescents are also expected to show poorer emotional understanding, and less prosocial responding in social situations.

Mentalising will be explored using two tasks developed previously (Strange Stories: Happe 1994, White, Happe, Hill and Frith 2009; Frith-Happe Animations: Abell, Happe and Frith 2000, White, Coniston, Rogers and Frith 2011) in a sample of maltreated adolescents aged 11-16 years. As Dumontheil et al (2010) note, tasks used in the early development of mentalising (such as those in Cicchetti et al 2003 , Pears and Fisher 2005) are not useful in older samples as ceiling is achieved much earlier. Hence, two tasks were selected that have previously been used in older samples (Colvert et al., 2008, White et al., 2009, White et al., 2011). The Strange Stories task (Happe, 1994, White et al., 2009) involves a set of vignettes in which a character says something which contradicts what the participant knows to be true. In order to respond correctly, participants must understand the underlying beliefs and intentions of the character that motivates their untrue statement. These vignettes are supported by a second set of stories that relate to physical situations to serve as control stories.

The Frith-Happé Animations involves participants watching silent animations depicting two triangles moving around on the screen in twelve independent clips. Four clips show the triangles moving apparently without purpose, four show apparently "goal-directed" interactions where the triangles appear to engage with each other in response to observed physical actions towards each other, and four "mental" animations in which the triangles seemingly react to the "mental state" of the other triangle (White et al., 2011). This task benefits from an objective scoring procedure, with participants being asked to identify the type of animation from three options. Where

participants correctly identify a mental interaction, multiple choice questions asking about how each triangle might "feel" in that situation further explore the child's understanding of others emotions (White et al., 2011). Both of these tasks have been successfully used in adolescent or older samples, and therefore should not suffer from ceiling effects as might be expected of the tasks utilised by Cicchetti et al (2003) and Pears and Fisher (2005) with children.

It was hypothesised, based on previous work with maltreated and institutionalized populations (Cicchetti et al., 2003, Colvert et al., 2008, Pears and Fisher, 2005), that maltreated adolescents will perform poorer than non-maltreated peers when the task requires participants to understand or attribute internal mental states, such as in the "mental" stories or animations but not in the control stories and goal directed animations, beyond the effects of Age and IQ.

Emotion understanding will be examined via multiple choice questions following mental animations in the Frith-Happé task (as described above). In order to accurately identify the likely emotional state of each triangle, participants must have a good working understanding of the social causes of emotions. It was hypothesised that maltreated adolescents may show poorer emotion understanding relative to non-maltreated peers.

Finally, the social responding of adolescents will be explored via the Interpersonal Response Task (Dadds and Hawes, 2004, Dadds et al., 2008), a computer-based task that simulates a game of "Catch" between the participant and two younger children (P1 and P2). This task sets up a dynamic in which participants have to choose whether to make a prosocial response or to pursue a material reward. Participants are

motivated to make a prosocial response through the facial expression of one of the participants, who becomes upset if not included in the game. It was hypothesised that maltreated adolescents will make fewer prosocial responses relative to non-maltreated peers.

6.2 Method

Details regarding participant characteristics and recruitment have been reported previously (**Chapter 2**).

6.2.1 Measures of Social Understanding

6.2.1.1 Strange Stories

The Strange Stories task involves two sets of 8 vignettes involving "mental" and "physical" stories (Fletcher et al., 1995). Each vignette was printed on one side of an A4 sheet of paper, with the question written on the other side. In general, vignettes were read to participants by the researcher with the sheet placed in front of the participant, allowing them to read along with the researcher. The sheet was then turned, revealing the question which was read to them by the researcher. The child's response was noted, and scored according to the schedule set out by White et al (2009) creating separate scores for "physical" and "mental" stories, scoring either 0 (incorrect or irrelevant answer), 1 (partially correct) or 2 (correct and reflecting the full events or reference to correct mental states or motivation), leading to two **scale scores** with a possible range of 0 to 16. If the child's initial response was not clearly in a particular coding category, children were asked to provide more information via the prompt "Can you tell me a bit more about that". Some of the older children read the stories themselves but were first asked to read the practice story aloud to the researcher to demonstrate adequate

reading and comprehension skills. Participants were reminded to pay close attention to the story before turning the page, as once they turned the page they could not return to the story. The presentation of the stories within sets was uniform, with the order of the sets (mental, physical) counterbalanced across participants.

6.2.1.2 Frith-Happé Animations

The Frith-Happé Animations were those used by Abell et al. (2000). All animations were displayed on a laptop, with the general testing conditions as described previously. First, participants were told that they would see a clip showing two triangles moving around. Participants were shown a response sheet, numbering the 12 clips with the three multiple choice options (random interaction, physical interaction, mental interaction) listed, and were told that each clip would show one of those three types of interactions, using the definitions provided by White et al. (2011). Examples of each of these trial types were demonstrated via practice items. Participants were also told that some clips might also have additional multiple choice questions.

Each participant completed the clips in the same order. Participants were asked to indicate, either verbally or by pointing to the response sheet, what type of clip they felt they had just seen which would then be circled by the researcher. If participants accurately identified "mental" clips they were further asked to identify which word from a list of five best described how the small triangle and the large triangle felt at the end of the clip. This task took approximately 15 minutes. **Accuracy** in identifying the type of trial (random interaction, physical interaction, mental interaction) was summed producing three **scores** with a possible maximum score of 4 for each scale. Further, for those in which the mental interaction was correctly identified, the correct identification

of the emotions of each triangle was summed to create an **emotion understanding score**, with a possible maximum of 8. In this way, correct identification of the emotion is based on an understanding of the context and causes of emotion, rather than deciphering facial or other emotional cues.

6.2.1.3 Interpersonal Response Task

This task involved a computer based experimental task designed to explore the participant's sensitivity and responses to the apparent distress of another child at the expense of fewer monetary rewards (Dadds and Hawes, 2004, Dadds et al., 2008). In this task, participants engage in a computerised ball-game with two other "players", represented on the screen by an image of two young children (P1 and P2). Both "players" were also shown to have money, represented by the image of three coins ($2AUD) above each player's image. Participants were told that they were to engage in a game of "catch" with P1 and P2, and it was their task to decide to whom to throw the ball. This decision was made by using the arrow keys to point an on-screen arrow towards one of the two children, and to press the space bar to make their selection. Graphics then showed the ball move to the indicated child, who would smile, and throw the ball back to the participant. The measure of interest is the **proportion** of trials in which the participant chose to throw the ball to P1 rather than P2 across three Blocks.

In the first Block (**Figure 6.1, left**), both P1 and P2 responded in the same fashion. P1 and P2 would catch the ball and throw it back to the participant. Whilst doing so, the Player would smile, and would also throw a coin to the participant. Receiving coins was equivalent to earning "points". This Block ran for 10 trials, and it was expected that

participants would throw the ball equally to both “Players” as there were no differences between them.

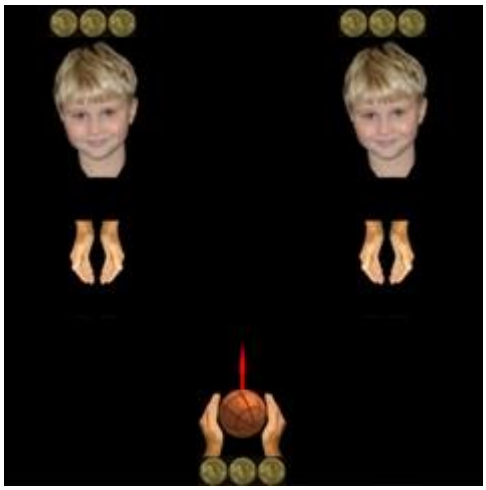
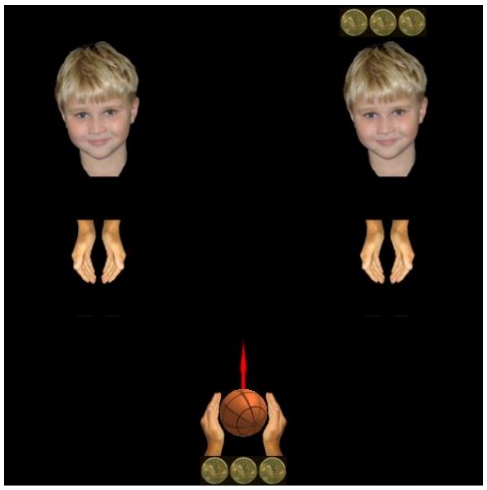


Figure 6.1: Layout of Interpersonal Response Task: Block 1 (left) shows both P1 and P2 with coins. In Blocks 2 and 3 (right), P1 has no coins.

In the second Block, P1, on the left of screen, abruptly ran out of coins (**Figure 6.1, right**). Thus, if the ball was thrown to P1, he would still smile and return the ball, but would no longer return coins. In contrast, P2 still had coins displayed, and continued to both smile and throw a coin when included in the game.



Like Block 1, this Block lasted 10 trials. This Block examines the effectiveness of the coin “points” system, and whether participants learn that one player (P2) is more lucrative than the other (P1). Other than the coin contingency, there is no difference between P1 and P2 in this Block; P1 maintains the same facial expression as P2 throughout, and responds in exactly the same way as P2.

In Block 3, P1 continues to not have any coins while P2 continues to return coins if the ball is tossed to him. However, if P1 was left out, he would display a distressed facial expression (**see Figure 6.2)**. Moreover, the intensity of distress displayed correlated with exclusion from ball-tossing. As such, a social cost is now introduced in excluding P1. There were 21 trials in this Block. Block 3 therefore represents the participant's response to the distress of a younger child relative to the desire to receive a material reward.



Figure 6.2: Progression in Block 3 of Interpersonal Response Task, as P1 gets more upset, from baseline (left) to the most upset (right).

Measures of interest on this task include the **proportion** of trials in each Block in which the participant throws the ball to P1 (range from 0 to 1, with 0.5 reflecting a response pattern that included both children equally), and the **maximum level of distress** displayed by the child on the left in Block 3 (range from 1 – least distressed to 6 – most distressed).

6.2.2 Analysis

6.2.2.1 Strange Stories

Responses on the Strange Stories task were coded as per White et al (2009) . A subset (16 participants, approximately 20%) was independently scored by two doctoral level students. Inter-rater reliability was acceptable (Cohen's kappa = 0.621). However, cross-tabulation revealed a small proportion of cases (2%) with considerable disagreement between raters. Discussion of these cases, and of all items more generally,

resolved these disagreements, improving the inter-rater reliability (Cohen's kappa = 0.739). The remaining participants were then coded and summed into **scale scores**.

Differences between Maltreated and Non-maltreated groups' performance in both physical and mental stories were examined 2X2 mixed measures ANCOVA with Story Type (Physical, Mental) as within subjects variables and Maltreatment Group (Maltreated/Non-maltreated) as the between subjects factor, including Age and IQ as covariates.

6.2.2.2 Frith-Happé Animations

A 3X2 mixed measures ANCOVA was used with **Accuracy** scores, with Animation Type (random interaction, physical interaction, mental interaction) as within subjects factors with Maltreatment Group (Maltreated/Non-maltreated) as the between subjects factor, with Age and IQ included as covariates. Group differences in **Emotion Understanding scores** were compared across groups via univariate ANCOVAs, with Age and IQ included as covariates. However, as emotion understanding has been significantly associated with IQ (Barahal et al., 1981, Frodi and Smetana, 1984), a second analysis was conducted in which variance associated with IQ was not removed, with only Age included as a covariate.

6.2.2.3 Interpersonal Response Task

The decision made in each Block was calculated into a **Proportion Score**, reflecting the proportion of trials in which the participant chose to throw the ball to P1 in each Block. As such, a score of 0.5 reflects no observed preference, with participants choosing to include both P1 and P2 equally. Scores greater than 0.5 indicate a preference for P1 whilst less than 0.5 indicates a preference for P2. Block 1 was

considered a control Block, with relatively equivalent responding expected. As such participants were excluded if responding in this Block was less than 0.4 or greater than 0.6. **Proportion scores** in each Block were entered into a 3 x 2 mixed measures ANCOVA, with Block (Block 1, Block 2, Block 3) as the within subject factor and Maltreatment Group (Maltreated/Non-maltreated) as the between subjects factor with Age and IQ as covariates. The **maximum distress** displayed was compared across groups using independent samples analyses.

6.3 Results

Table 6.1 contains the means and standard deviations for the various measures of social cognition both for adolescents who had experienced early maltreatment and their non-maltreated peers.

Table 6.1: Means and standard deviations for Social Understanding tasks

Task		Maltreated	Non-maltreated
Strange Stories	Physical Stories	8.49 (2.53)	10.14 (2.78)
	Mental Stories	9.94 (1.96)	12.32 (1.70)
Frith-Happé Animations	Random Interaction	3.34 (1.01)	3.57 (0.74)
	Physical Interaction	3.51 (0.78)	3.50 (0.64)
	Mental Interaction	3.15 (1.00)	3.36 (0.73)
	Emotion	2.47 (1.77)	3.71 (2.05)
Interpersonal Response Task	Block 1 Proportion	0.5 (0.06)	0.49 (0.06)
	Block 2 Proportion	0.31 (0.12)	0.38 (0.16)
	Block 3 Proportion	0.37 (0.21)	0.48 (0.14)
	Maximum Distress	2.74 (1.68)	3.89 (1.42)

6.3.1 Strange Stories

Scores on each scale ranged from 5 to the upper limit of 16, with only one participant scoring the maximum in each scale. A 2 x 2 mixed ANCOVA with story type (mental, physical) as the within-subject factor, Maltreatment Group (Maltreated/Non-maltreated) as the between-subject factor, and Age and IQ as covariates yielded main effects of Story Type ($F(1,71)=9.516$, $p=0.003$, partial $\eta^2=0.118$), with **scores** generally higher for Mental stories than Physical Stories. There was also a main effect of Maltreatment Group ($F(1,71)=5.074$, $p=0.027$, partial $\eta^2=0.067$), with maltreated participants performing poorer than non-maltreated participants across both sets. Further, there were also significant Age ($F(1,71)=16.327$, $p<0.001$, partial $\eta^2=0.187$) and IQ ($F(1,71)=15.302$, $p<0.001$, partial $\eta^2=0.177$) effects, with better performance associated with older participants and those with higher IQ scores. There was a significant Story Type X Maltreatment Group interaction ($F(1,71)=5.078$, $p=0.027$, partial $\eta^2=0.067$), as well as a significant Story Type X Age interaction ($F(1,71)=9.365$, $p=0.003$, partial $\eta^2=0.117$). There was no Story Type X IQ ($F(1,71)=1.757$, $p=0.189$, partial $\eta^2=0.024$) interaction.

Separate ANCOVAs were conducted for each Story Type, again including Age and IQ as covariates, in order to unpack the observed interaction effects (**Figure 6.3**). Within Physical Stories, there was no significant effect of Maltreatment Group ($F(1,71)=0.266$, $p=0.608$, partial $\eta^2=0.004$), however both Age ($F(1,71)=20.732$, $p<0.001$, partial $\eta^2=0.226$) and IQ ($F(1,71)=12.757$, $p=0.001$, partial $\eta^2=0.152$) showed significant effects, with performance improving with Age and IQ. Within the Mental Stories, there was a significant effect of Maltreatment Group observed ($F(1,71)=12.869$, $p=0.001$, partial $\eta^2=0.153$), as well as significant effects of IQ ($F(1,71)=7.970$, $p=0.006$, partial $\eta^2=0.101$),

however no significant effect of Age ($F(1,71)=3.299$, $p=0.074$, partial $\eta^2=0.044$). That is, maltreated adolescents performed significantly poorer than non-maltreated peers on Mental Stories, but not significantly different on Physical Stories. Participants with higher IQs also tended to score better on Mental Stories ($r=0.409$, $p<0.001$).

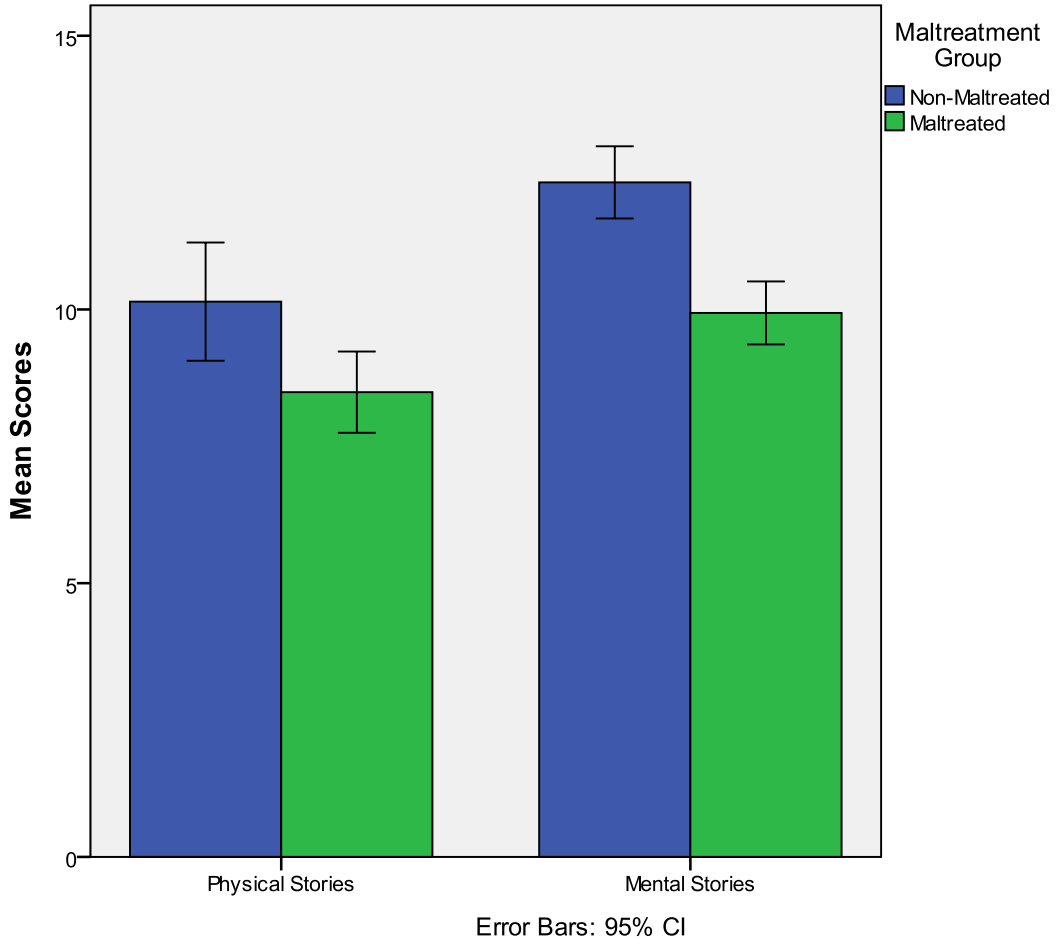


Figure 6.3: Mean Scores on Strange Stories task by Story Type and Maltreatment Group

6.3.2 Triangles task

6.3.2.1 Understanding internal mental states of others

Scores on each interaction type ranged from 0 to 4, with two participants (3%) scoring the minimum (0) and forty-six participants (61%) the maximum (4) with respect to random interactions, one participant (1%) scoring the minimum and forty-five participants (60%) scoring the maximum with respect to physical interactions, and one

participant (1%) scoring the minimum and thirty-five participants (47%) scoring the maximum with respect to mental interactions.

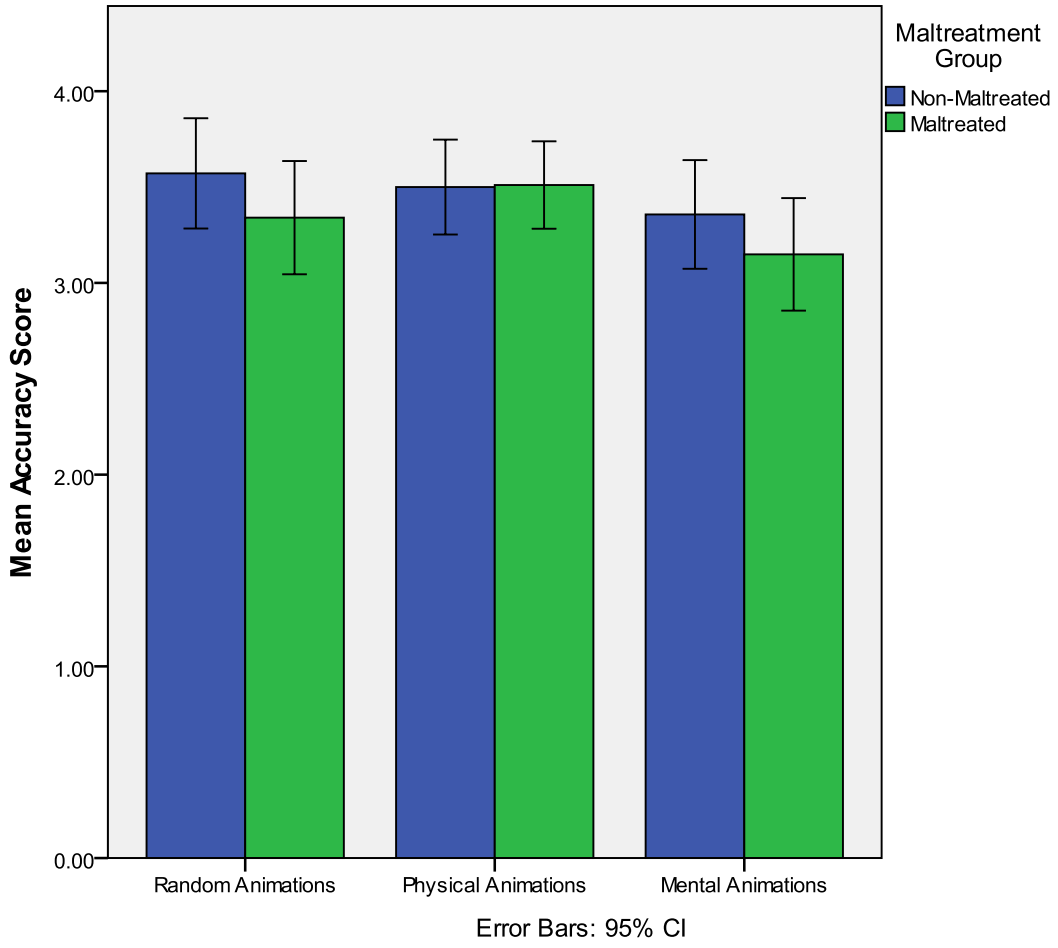


Figure 6.4: Mean Accuracy scores on Frith-Happé animations, by type and Maltreatment Group

Accuracy scores were entered into a 3 x 2 mixed measures ANCOVA with interaction type (mental, physical, and random) as the within-subject factor, Maltreatment Group (Maltreated/Non-maltreated) as the between-subject factor, and Age and IQ as covariates (**Figure 6.4**). There was a main effect of Interaction Type ($F(1.841,130.705)=4.375$, $p=0.017$, partial $\eta^2=0.058$), with simple main effects suggesting that participants performed better in physical relative to mental animations ($p=0.033$). Significant main effects were observed for both Age ($F(1,71)=10.828$, $p=0.002$, partial $\eta^2= 0.132$) and IQ ($F(1,71)=28.756$, $p<0.001$, partial $\eta^2= 0.288$).

Significant Interaction Type X Age (F(1.841, 130.705)=4.427, p=0.016, partial η^2=0.059) and Interaction Type X IQ (F(1.841, 130.705)=3.417, p=0.04, partial η^2=0.046) were also observed such that Age was significant positively associated with performance on Random (r=0.279, p=0.015) and Mental (r=0.257, p=0.026) animations but not Physical (r=-0.156, p=0.180), and IQ was only significantly associated with performance on Mental animations (r=0.302, p=0.008; Random r=0.142, p=0.220, Physical r=0.131, p=0.259). There was no Maltreatment Group main effect (F(1,71)=2.057, p=0.156, partial η^2=0.028), nor any Interaction Type X Maltreatment Group interaction (F(1.841, 130.705)=0.452, p=0.621, partial η^2=0.006).

6.3.2.2 Emotion understanding

Emotion understanding scores (see **Figure 6.5**) ranged from the possible minimum (0) to the maximum possible (8), with seven (9%) participants scoring the minimum and one (1%) participant scoring the maximum. Group differences in **Emotion understanding scores** were analysed using a univariate ANCOVA, with Age and IQ as covariates. There was no main effect of Maltreatment Group (F(1,70)=1.193, p=0.278, partial η^2=0.017). Both Age (F(1,70)=7.209, p=0.009, partial η^2=0.093) and IQ (F(1,70)=6.627, p=0.012, partial η^2=0.086) showed significant main effects, with higher Age and IQ both associated with improved performance identifying the correct emotion displayed by each animated triangle in this task.

A second analysis explored **emotion understanding scores** without removing shared variance associated with IQ. There was a main effect of Maltreatment Group observed (F(1,71)=5.299, p=0.024, partial η^2=0.069), with maltreated adolescents performing poorer than their non-maltreated peers. There was also a main effect of Age

(F(1,71)=4.064, p=0.048, partial η^2=0.054), with correlations suggesting better emotion understanding with increasing age (r=0.282, p=0.015).

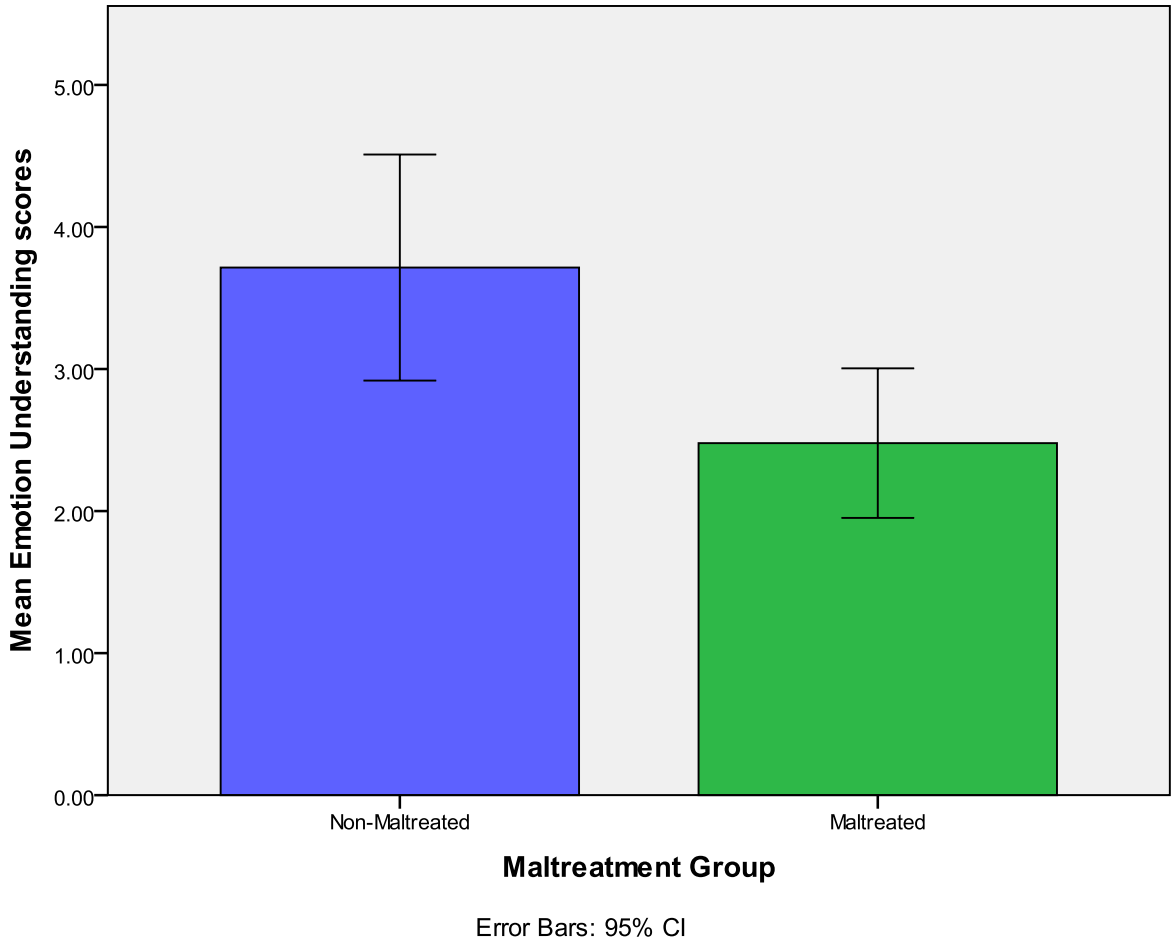


Figure 6.5: Mean Emotion Understanding scores by Maltreatment Group

6.3.3 Interpersonal Response Task

The exclusion criteria resulted in 5 maltreated and 1 non-maltreated participants being excluded from further analysis, as responding in Block 1 suggested biased responding (participants with **proportion scores** that did not fall between 0.4 to 0.6 were excluded – full range 0.0 to 0.6). Exclusions did not differ significantly by group (χ^2=1.191, p=0.275). A 3 x 2 mixed ANCOVA with block (Block 1, Block 2, Block 3) as the within-subject factor, Maltreatment Group (Maltreated/Non-maltreated) as the between-subject factor and Age and IQ as covariates was performed on '**proportion**

scores'. **Proportion scores** reflected the proportion of trials in which the participant chose to throw the ball to Player 1 (P1) over the course of each Block. There were no significant main effects of Block observed ($F(1.815,117.957)=0.089$, $p=0.898$, partial $\eta^2=0.001$), Age ($F(1,65)=0.160$, $p=0.690$, partial $\eta^2=0.002$) or IQ ($F(1,65)=0.291$, $p=0.591$, partial $\eta^2=0.004$), nor any significant Block X Age ($F(1.815,117.957)=0.801$, $p=0.440$, partial $\eta^2=0.012$) or Block X IQ ($F(1.815,117.957)=0.250$, $p=0.758$, partial $\eta^2=0.004$) interaction effects. However there was a significant main effect of Maltreatment Group ($F(1,65)=6.549$, $p=0.013$. partial $\eta^2=0.092$) with those in the Maltreated group choosing to throw the ball to P1 less than those in the Non-maltreated group. There was also a significant block-by-group interaction ($F(1.815,117.957)=3.607$, $p=0.034$, partial $\eta^2=0.053$).

This interaction was examined further by group differences in **Proportion scores** across each Block separately using multivariate ANCOVA. There was no significant difference in **Proportion scores** between groups observed in Block 1 ($F(1,65)=0.358$, $p=0.552$, partial $\eta^2=0.05$). However, **Proportion scores** differed significantly between groups in Block 2 ($F(1,65)=4.656$, $p=0.035$, partial $\eta^2=0.067$) and Block 3 ($F(1,65)=5.493$, $p=0.022$, partial $\eta^2=0.078$), with non-maltreated participants including P1 more in both Blocks (**Figure 6.6**). Paired-samples t-tests explored differences between Blocks within each Group. Maltreated adolescents showed a significant difference in **Proportion scores** between Block 1 and Block 2 ($t(41)=9.137$, $p<0.001$), and between Block 1 and Block 3 ($t(41)=4.201$, $p<0.001$), but no difference between Block 2 and Block 3 ($t(41)=-1.647$, $p=0.107$), suggesting a pattern for this group in which **Proportion scores** fall significantly from Block 1 to Block 2, but do not significantly rise as a result of the introduction of the emotional cue. In contrast, the Non-maltreated group showed a

significant difference between Block 1 and Block 2 (t(26)=3.319, p=0.003), and between Block 2 and Block 3 (t(26)=-2.883, p=0.008), but not between Block 1 and Block 3 (t(26)=0.309, p=0.76), suggesting that **Proportion scores** fell from Block 1 to Block 2, and returned to these levels in Block 3. Neither Age nor IQ were significantly associated with **Proportion scores** in any Block (all p's>0.34).

Finally, **Proportion scores** were compared against the objectively "fair" level (0.5) using one-sample t-tests. Non-maltreated adolescents did not differ from this level in Block 1 (t(26)=-0.625, p=0.537) or Block 3 (t(26)=-0.635, p=0.531), however significantly excluded P1 in Block 2 (t(26)=-3.923, p=0.001). Maltreated adolescents also showed "fair" responding in Block 1 (t(41)=-0.240, p=0.812), however significantly excluded P1 in both Block 2 (t(46)=10.918, p<0.001) and Block 3 (t(46)=-4.773, p<0.001).

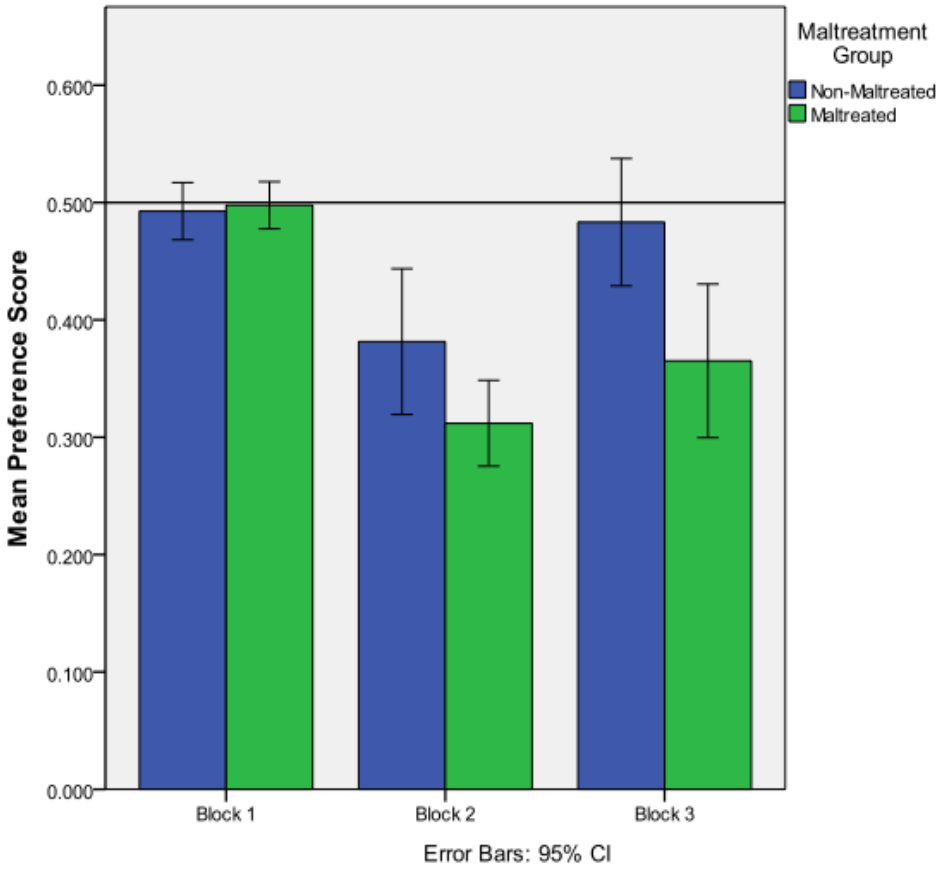


Figure 6.6: Mean preference score in IRT. Scores of 0.5 (horizontal line) indicate no preference for either P1 or P2

Group differences in **Maximum Distress** level reached by P1 in Block 3 was analysed using univariate ANCOVA, with Age and IQ including as covariates. There was a significant main effect of Group ($F(1,65)=4.810$, $p=0.032$, partial $\eta^2=0.069$), with those in the Maltreated group allowing a greater level of distress in P1 than those in the Non-maltreated group. There were no effects of Age ($F(1,65)=0.663$, $p=0.418$, partial $\eta^2=0.01$) or IQ ($F(1,65)=0.429$, $p=0.515$, partial $\eta^2=0.007$). This main effect was followed up using non-parametric independent samples analysis due to violations of normal assumptions. There was a significant difference between groups (Mann-Whitney $U=344.5$, $z=-2.836$, $p=0.005$), with those in the Maltreated group allowing P1 to become significantly more upset than those in the Non-maltreated group.

6.4 Discussion

This study explored a range of social cognition processes in a sample of adolescents exposed to earlier maltreatment, comparing their performance with a sample of non-maltreated peers. Specifically, this study explored the understanding of other's internal mental states, emotion understanding, and the social responding of a sample of adolescents exposed to early maltreatment and a comparison sample of non-maltreated peers. This research extends previous research focused on childhood (Cicchetti et al., 2003, Colvert et al., 2008, Dodge et al., 1990, Dodge et al., 1995, Klimes-Dougan and Kistner, 1990, Luke and Banerjee, 2012, Luke and Banerjee, 2013, Main and George, 1985, Pears and Fisher, 2005, Price and Glad, 2003) to the important period of adolescence, where social skills and peer relationships become more important (Steinberg and Morris, 2001). This also reflects recent evidence showing the ongoing development of the social brain (Blakemore and Choudhury, 2006, Blakemore, 2012,

Pfeifer and Blakemore, 2012, Sebastian et al., 2012) as well as the cognitive processes themselves (Dumontheil et al., 2010).

Two experimental tasks investigated the understanding of other's internal mental states in maltreated adolescents, with inconsistent results. Maltreated adolescents performed poorer overall on the Strange Stories task relative to non-maltreated peers, over and above any group differences of Age and IQ. Further, participants generally performed better on mental stories relative to physical stories, reflecting established differences in difficulty (White et al., 2009). As such, group differences were examined separately for each story type. Importantly, maltreated participants performed significantly poorer on those stories requiring an understanding of the protagonist's internal mental state relative to non-maltreated peers. In contrast, the Frith-Happe animations showed no significant difference between maltreated and non-maltreated adolescents in identifying mentalising interactions using animated vignettes. It seems likely that the Frith-Happe animations suffered from ceiling effects, with a considerable number of participants (47%-61%) achieving the maximum score in the different Animation types. It is possible that group differences were present but not observed using this paradigm as a result of these ceiling effects. However, ceiling effects do not appear to be an issue with respect to the Strange Stories paradigm, with only one participant (<2%) achieving the maximum score in each scale. The Strange Stories task revealed a significant difference between maltreated and non-maltreated participants, reflecting relatively impaired mentalising skills of maltreated adolescents. Results then offer partial support for previous research demonstrating significant deficits in mental

state understanding in maltreated children (Cicchetti et al., 2003, Pears and Fisher, 2005) and those exposed to profound deprivation in childhood (Colvert et al., 2008).

Emotion understanding was also explored using the Frith-Happe animations, in which participants were asked to identify the emotion of animated triangles. This differs from previous emotion recognition studies in that correct identification relies on understanding the context in which specific emotions arise rather than decoding emotion cues such as facial expressions. When excluding variance shared with IQ, there was no evidence of Group differences on this measure suggesting that to some extent maltreated adolescents are equally able as non-maltreated peers to identify likely emotions from animated social interactions. However, when IQ was not included as a covariate, and therefore not removing variance in emotion understanding shared with IQ, there was a significant effect of maltreatment status, with maltreated adolescents showing poorer emotion understanding than non-maltreated peers. This is consistent with previous studies reporting impaired emotion understanding associated with maltreatment (Luke and Banerjee, 2013, Pears and Fisher, 2005, Perlman et al., 2008), as well as those studies reporting that maltreatment-related deficits in emotion understanding are linked with variance in IQ (Barahal et al., 1981, Frodi and Smetana, 1984). Therefore it appears that maltreated adolescents in general show deficits in emotion understanding relative to non-maltreated peers. However, it is not possible to disentangle the effects of population based variations in IQ from maltreatment-related differences (Pechtel and Pizzagalli, 2011, Wilson et al., 2011). Following from Miller and Chapman (2001), controlling for such variance through covariance is arguably not representative of the maltreated population. As such, it seems likely that maltreatment

is associated with emotion understanding difficulties, however this may operate via maltreatment impacts on IQ, or may reflect a common underlying difference associated with maltreatment. Alternatively, maltreated adolescents with relatively higher IQs may have been able to increase their chances of selecting the correct answer from the available choices through a process of elimination rather than a genuine understanding of emotion likely to arise in the given social context. Further, analysis on the basis of maltreatment status may obscure important subtype related differences. Previous research exploring emotion recognition have reported subtype related differences, with neglected children showing general impairments in emotion recognition (Fishbein et al., 2009, Pollak et al., 2000) whereas physically-abused children show relative facilitation of some (generally negative) emotional cues (Gibb et al., 2009, Masten et al., 2008, Pollak and Sinha, 2002, Pollak and Kistler, 2002). The relative impact of physical abuse will be explored in Chapter 7 in order to examine this possibility.

Social responding was explored via the Interpersonal Response Task which compared the response of maltreated and non-maltreated adolescents to the distress of a younger child relative to responses pursuing a material reward. In general, all participants equally included P1 and P2 when there was no difference in their response or contingency (Block 1). When the reward contingency changed, such that P2 was associated with a material reward, and excluding P1 was not associated with any cost, participants generally shifted towards P2. However, participants generally included P1 a small number of times, presumably to "test" this new contingency. In Block 3, this situation was altered by the introduction of a social cost – in terms of the increasing distress of P1. Non-maltreated adolescents responded to this social cost by shifting back

towards a more even distribution between P1 and P2, however maltreated adolescents did not appear to significantly alter their responding. That is, maltreated adolescents did not appear to respond in a prosocial way given the introduction of cues of peer distress.

There was no observed between group difference in Block 1, showing that both maltreated and non-maltreated participants initially included both P1 and P2 equally, suggesting that each group approached this task similarly. While both groups shifted away from P1 when he "ran out of money", this shift was more pronounced for those in the Maltreated group, with a significant group difference emerging in the second Block. It could be that maltreated adolescents were more motivated by the material reward, identifying the contingency earlier. Alternatively, non-maltreated participants may have recognised or anticipated the possibility of P1 feeling excluded despite no visual cues of this child's mood, and hence made more prosocial choices despite no objective "cost" with respect to the task. Unfortunately this Block was compromised by a relatively small number of trials. Subsequent studies would be well served by extending the number of trials in this Block slightly in order to facilitate analysis of this difference. In Block 3 non-maltreated adolescents as a group returned to a pattern of responding that was not significantly different from that in Block 1, including both P1 and P2 equally. That is, the introduction of social distress prompted a return to an objectively "fair" pattern of responding, offsetting the apparent preference for the reward established, relatively strongly, in Block 2. Maltreated adolescents however included P1 significantly less than those in the Non-maltreated group in this Block, and significantly less than they themselves had in Block 1. It could be that maltreated adolescents didn't notice the social cue, either at all or until significantly greater levels of intensity, or failed to

understand the displayed emotion and its causes or were less motivated by social relative to the material cues.

Related to this, the intensity of distress shown with maltreated participants was significantly greater than for non-maltreated adolescents, many of whom shifted to including P1 equally after only one shift in level of distress displayed. Alternatively, it could be that maltreated adolescents were not able to understand the internal mental state of the other participant, or that they were the cause of the young person's distress by excluding them, which requires the ability to understand the internal mental states of others. The results of the mentalising component of this study provide some support for this possibility. Some participants spontaneously indicated to the experimenter that they felt P1 was a "sook" when they failed to immediately cease their distress if the ball was again passed to them, and therefore decided to ignore their distress. A follow up questionnaire to investigate the reasons for each participant's pattern of responding may therefore contribute to the understanding of this general result.

Overall, however, this study is consistent with previous research showing less prosocial responses to the distress of peers (Klimes-Dougan and Kistner, 1990, Main and George, 1985), even if it does not clarify the reasons for this pattern of responding. Future studies however could involve alternate social strategies in the same general paradigm (such as P1 becoming increasingly hostile or aggressive at exclusion) to examine the response of children and adolescents to these situations, building on the results presented here.

As with previous chapters, the maltreatment-related differences noted here with respect to understanding the internal mental states of others or responding to cues

of peer distress, may be differentially associated with aspects of the maltreatment experience such as maltreatment subtype, severity, or chronicity. Previous studies have associated physical abuse with delayed mental state understanding (Cicchetti et al., 2003), however severe neglect such as institutional deprivation has also been linked with deficits in this area (Colvert et al., 2008). Neglect has also been associated with impaired emotion recognition (Fishbein et al., 2009, Pollak et al., 2000), with physical abuse associated with facilitated recognition of some emotions, such as anger and fear (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002). Finally, previous research exploring prosocial responding and access to aggressive social responses have focused on physical abuse (Keil and Price, 2009, Klimes-Dougan and Kistner, 1990, Main and George, 1985, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008), and as such it is unclear whether such findings are uniquely associated with physical abuse, as well as the relative role of neglect or emotional maltreatment in such processes. Further, differences in these aspects of social understanding may contribute to the emotional or social difficulties experienced by those exposed to childhood maltreatment. These issues will be investigated in **Chapter 7**.

In addition to the discrepant findings and ceiling effects observed with respect to the understanding of the internal mental states of others, additional limitations must be considered. Emotion understanding difficulties were only observed when variance associated with individual differences in IQ was not removed. This study is unable to disentangle the relative effects of maltreatment and IQ with respect to the emotion understanding of maltreated adolescents. The emotion understanding task used in this study asks participants to correctly identify the emotion arising from an animated social

interaction enacted by two triangles. As such, it may not be the most ecologically valid measure of emotion understanding. However, this task builds on previous studies which focus on the ability of maltreated children and adolescents to recognise emotional facial expressions (see Luke and Banerjee 2013), instead relying on adolescent's understanding of the social causes of emotion. Additionally, the small number of emotion understanding items limits the ability of this task to identify whether emotion recognition difficulties are generalized, or associated with a particular subset of emotions. Maltreatment generally has been associated with difficulties understanding negative emotions (Perlman et al., 2008), although physical abuse has been associated with facilitated recognition of negative emotions such as anger or fear (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002). It is possible that maltreated adolescents' difficulties in understanding the social contexts in which particular emotions arise may likewise be associated with particular subsets of emotions. Finally, while maltreated participants showed generally reduced prosocial responding, the task design does not permit further investigation of the reasons behind participants' choices. A brief questionnaire about the task at its conclusion may have identified additional reasons for the response patterns observed, some of which may have related more to the task design than underlying differences in the prosocial behaviours of individual respondents. Finally, In addition to these limitations, factors associated with the maltreatment sample may also affect task performance. These issues will be discussed in **Chapter 8**.

Overall, maltreated adolescents showed difficulties in the understanding of the mental states of others and tended to behave in less prosocial ways, even in the

presence of clear social cues of distress. Maltreated adolescents also appeared to display difficulties in emotion understanding relative to their non-maltreated peers, associated with variations in IQ. These results suggests that maltreatment-related deficits in mental state understanding (Cicchetti et al., 2003, Pears and Fisher, 2005) and emotion understanding (Luke and Banerjee, 2013, Pears and Fisher, 2005, Perlman et al., 2008), as well as patterns of less prosocial and more aggressive social behaviours (Klimes-Dougan and Kistner, 1990, Main and George, 1985) observed in younger samples may persist into adolescence. In addition to the greater emotion regulation difficulties evident in a sample of maltreated adolescents, this group also shows a range of difficulties associated with social understanding, affecting social behaviours. These difficulties may contribute to the ongoing social difficulties experienced by maltreated adolescents, as well as adversely affecting emotional outcomes.

Chapter 7: Relationship between maltreatment factors, cognitive processes and social and emotional functioning

7.1 Introduction

Thus far, this thesis has examined the impact of childhood maltreatment on emotional and social difficulties and a number of cognitive processes associated with emotion regulation and social understanding. Compared to their non-maltreated peers maltreated adolescents showed greater conditioned avoidance of a threat cue; greater risk-taking (in females only) (Chapter 3); differences in mean **RT**s and **Accuracy** during attention tasks (Chapter 4); and poorer mentalising, poorer emotion understanding, and fewer prosocial tendencies (Chapter 6). No differences emerged in negative attributions (Chapter 5). The current chapter extends these findings in two ways. First, as childhood maltreatment is complex and maltreated adolescents are unlikely to be a homogeneous group, this chapter explores the relationship between maltreatment factors (e.g. subtypes, severity, chronicity, age of onset, co-occurrence,) and current adjustment on differences in cognitive processes of emotion regulation and social understanding. Second, as models of maltreatment outline the mediating role of cognitive processes of emotion regulation and social understanding in the relationship between maltreatment and later functioning (Loman et al., 2010), the second goal of this Chapter is to investigate this hypothesised mediating relationship in a sample an adolescent sample.

7.1.1 Maltreatment factors, outcomes and cognitive processes

The parent-child relationship is central to developing neural and cognitive processes (including emotion regulation and social understanding) that underlie behaviour (Loman et al., 2010). While abusive or neglectful parent-child relationships

are associated with negative outcomes, other factors such as subtype, severity, chronicity, age of onset and co-occurrence may also moderate outcomes (Ammerman et al., 1986, Barnett et al., 1993, Egeland et al., 1983, English et al., 2005b, Lamphear, 1985). Whether these factors also affect the emotion regulation and social understanding of maltreated adolescents is not yet known.

Different maltreatment profiles are associated with different cognitive, emotional and social difficulties (Pears et al., 2008). Studies have contrasted the relative effects of physical abuse and neglect (Hildyard and Wolfe, 2002) with respect to mental health and cognitive functioning outcomes (Gould et al., 2012, McLaughlin et al., 2010, Teicher et al., 2006) but also on aspects of emotion regulation and social understanding. Physically abused and neglected adolescents differed in their pattern of real-world risk taking, with physical abuse associated with overall risky behaviours and neglect associated with substance use, while both were associated with greater delinquency (Taussig, 2002). However, the relative impact of maltreatment subtypes on risk-taking has not yet been widely studied. Likewise, the role of maltreatment subtype on processes of avoidant conditioning is unknown. Physical abuse but not neglect has been associated with threat-related biases of attention, however biases both towards (Pollak and Tolley-Schell, 2003, Pollak et al., 2005, Shackman et al., 2007) and away from threatening cues (Pine et al., 2005). Negative interpretation biases have been associated with exposure to physical abuse (Dodge et al., 1995, Dodge et al., 1990, Keil and Price, 2009, Price and Glad, 2003, Teisl and Cicchetti, 2008). Maltreatment subtype effects have been noted with respect to emotion understanding, with neglect associated with generally impaired emotion recognition (Fishbein et al., 2009, Pollak et al., 2000) while

physical abuse has been associated with facilitated recognition of angry and fearful expressions (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002). Likewise, studies investigating children's prosocial responding to peer distress or access to hostile or aggressive social responses have focused on physical abuse (Keil and Price, 2009, Klimes-Dougan and Kistner, 1990, Main and George, 1985, Teisl and Cicchetti, 2008) Sabourin Ward and Haskett, 2008).

Severity of maltreatment subtypes also appears to account for a lot of the variance in child outcomes suggesting that maximal severity by subtype is the optimal approach for examining the effects of maltreatment severity (Litrownik et al., 2005).

Age of onset and chronicity also affect the impact of child maltreatment, with the developmental timing of maltreatment and its persistence across developmental periods both influencing the subsequent impacts on development (Hildyard and Wolfe, 2002). This aspect is captured in the model outlined previously (see **Figure 1.1**), with the possible effects of maltreatment (represented by the horizontal lines at the top and bottom) converging with age (Loman et al., 2010). Earlier experiences of maltreatment, and more persistent or chronic maltreatment, are hypothesised to have greater developmental effects on the cognitive and behavioural outcomes of maltreated children, associated with the development of underlying neural networks (Perry, 2009). Similarly, exposure to more chronic maltreatment is associated with greater social and emotional disruption (Bolger and Patterson, 2001).

Finally, the co-occurrence of maltreatment subtypes has displayed a dose-response relationship with mental health outcomes in adulthood (Edwards et al., 2003,

Teicher et al., 2006) and may therefore likewise differentially affect cognitive processes of emotion regulation and social understanding (Loman et al., 2010).

Differences may also exist between maltreated adolescents on the basis of adaptive functioning despite exposure to early adversity (Cicchetti, 2010, Cicchetti, 2013, DuMont et al., 2007, McGloin and Widom, 2001). Such 'resilience' generally reflects normative functioning or competence in one or across a number of relevant indicators, or even the absence of maladjustment (Cicchetti, 2013, Luthar and Cicchetti, 2000). Resilience is considered to be a fluid classification shifting over development (Cicchetti, 2013, DuMont et al., 2007). Maltreated adolescents that are better adjusted may differ from their maladjusted peers in a number of ways, including their emotion regulation and social understanding. Identifying those processes that are meaningfully associated with better or poorer socio-emotional outcomes is an important step in developing interventions to promote resilience for maltreated adolescents. These cognitive processes are consistently associated with emotional adjustment and social outcomes for both maltreated (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields and Cicchetti, 2001, Shields et al., 2001, Teisl and Cicchetti, 2008) and non-maltreated (Campbell-Sills and Barlow, 2007, Cicchetti et al., 1995, Crick and Dodge, 1994) samples.

7.1.2 Mediation Model

According to models of maltreatment (Loman et al., 2010) maltreating parent-child relationships confer risk of emotional or social maladjustment via impacts on cognitive processes of emotion regulation and social understanding (see **Figure 7.1**). As outlined previously (see **Section 1.5**), there is a wealth of evidence demonstrating the

emotional and social impacts of early maltreatment (**Path A in Figure 7.1**). Previous research has also supported the hypothesised relationship between maltreatment and cognitive processes of emotion regulation (**Path B in Figure 7.1**) including Situation Selection (**Chapter 3**), Attentional Deployment (**Chapter 4**) and Cognitive Change (**Chapter 5**), as well as the relationship between such processes and subsequent emotional and social functioning (**Path C in Figure 7.1**). Aspects of social understanding including mentalising, emotion understanding and social responding have also demonstrated maltreatment-related effects, are dependent on parent-child relationships for their development, and have been associated with social difficulties (see **Chapter 6**). As such, cognitive processes of social understanding may also mediate the relationship between maltreatment and later adjustment.

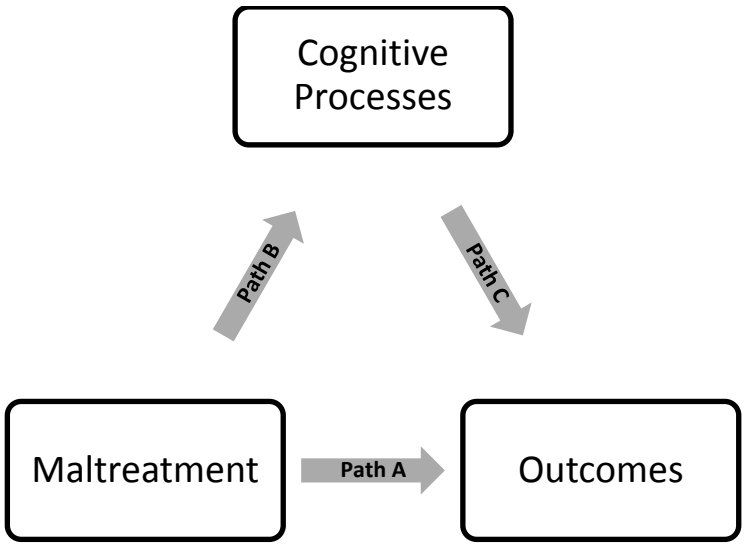


Figure 7.1: Mediation Model of the relationship between Maltreatment, Cognitive Processes and later adjustment

While there is evidence of each of the individual paths outlined in models of maltreatment (**Figure 7.1**) consistent with a mediating relationship, direct evidence of

the mediating role of emotion regulation processes is less common, although not entirely absent (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001).

Using the Emotion Regulation Q-Scale (Shields and Cicchetti, 1997), an observation based measure scored by trained camp counsellors, maltreated children were rated as displaying more emotion dysregulation than their non-maltreated peers (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008). Emotion dysregulation was found to mediate the link between maltreatment and anxious and depressive symptoms (Maughan and Cicchetti, 2002), and was associated with later social difficulties including peer rejection and externalising symptoms (Kim and Cicchetti, 2010, Shields and Cicchetti, 2001). Conversely, better emotion regulation was associated with more adaptive emotional and social outcomes (Kim and Cicchetti, 2010). While these studies demonstrate the important role of emotion regulation in later emotional and social adjustment for maltreated children, they are limited by their broad view of emotion regulation. Understanding the operation of specific cognitive processes of emotion regulation may reveal important information regarding the relationship between maltreatment and emotion dysregulation, and provide clues that are necessary to the development of targeted interventions aimed at improving emotion regulation of those exposed to childhood maltreatment. For example, negative interpretation biases have been shown to mediate the relationship between maltreatment and peer difficulties, in addition to poor emotion regulation more generally (Shields et al., 2001, Teisl and Cicchetti, 2008). The current study hopes to extend this work, exploring the role of a broader range of

cognitive processes associated with emotion regulation and social understanding, in addition to interpretation bias, in a sample of maltreated adolescents.

7.1.3 Hypotheses

This chapter then aims to explore a number of broad issues. First, it explores the role of maltreatment factors on cognitive processes of emotion regulation and social understanding, as well as on adolescent functioning. Maltreated participants were divided on the basis of the presence or absence of physical abuse, as this division yielded sufficient participants in each group for analyses. This facilitated the examination of the relative effect of physical abuse.

Given that conditioned avoidance arises from pairing with an aversive stimulus, sensitivity to the aversive stimuli is a key aspect of this acquisition. As physical abuse is associated with sensitivity to angry facial expressions (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Gibb et al., 2009, Pollak and Tolley-Schell, 2003, Pollak et al., 1997, Pollak et al., 2001, Romens and Pollak, 2012), it was hypothesised that the presence of physical abuse would be associated with facilitated acquisition of conditioned avoidance, with more severe experiences of physical abuse associated with conditioned avoidance.

Greater real-world risk taking of physically abused and neglected adolescents relative to non-maltreated peers have been reported (Taussig, 2002), although the pattern of risk-taking behaviours differed by subtype. This study examined the relative impact of the presence of physical abuse on a risk-taking paradigm driven by punishment sensitivity (Bogg et al., 2012, Bornovalova et al., 2009). As noted previously

(**Chapter 3**), gender differences have been reported (Byrnes et al., 1999, Pawlowski et al., 2008) and will be included as a factor in this analysis.

Threat-related attention biases, if associated with strengthened "attentional control settings" for possible danger cues, may be associated with the severity or presence of physical abuse. That is, only those maltreated adolescents exposed to physical abuse may show evidence of threat-related attention biases, which may have been obscured by the analysis in Chapter 4 which examined the maltreatment group as a homogeneous group. This study hopes to extend previous research showing attention control difficulties in maltreatment (Beers and De Bellis, 2002, Bucker et al., 2012), exploring the relative effect of physical abuse on attention control.

Previous studies have reported negative interpretation biases specifically in relation to physical abuse (Dodge et al., 1995, Dodge et al., 1990, Keil and Price, 2009, Price and Glad, 2003, Teisl and Cicchetti, 2008). As such, negative interpretation biases may be specifically associated with physical abuse. Despite the absence of specific maltreatment-group effects, analysis in this chapter therefore seeks to identify whether such subtype-related differences of negative interpretation biases are present.

While physical abuse has specifically been associated with mentalising difficulties (Cicchetti et al., 2003), institutional deprivation (a form of severe neglect) has also been associated with such difficulties (Colvert et al., 2008). This study then seeks to add to this existing literature by exploring the relative effect of the presence of physical abuse on adolescent mentalising.

Neglect has been associated with difficulties in emotion recognition and understanding (Fishbein et al., 2009, Pollak et al., 2000), while physical abuse has been associated with facilitated recognition of some (particularly negative) emotions (Gibb et al., 2009, Pollak and Kistler, 2002, Pollak and Sinha, 2002, Pollak and Tolley-Schell, 2003, Pollak et al., 2005, Shackman et al., 2007). Pears and Fisher (2005) reported pervasive deficits in emotion understanding associated with maltreatment, however noted that the majority of their sample suffered neglect, with two-thirds of their sample being classified as neglect in a hierarchical scheme in which physical abuse was coded above neglect. As such, it is hypothesised that the absence of physical abuse amongst maltreated adolescents may be associated with relative impairments in emotion understanding.

Finally, previous studies exploring prosocial responding to peer distress have focused on physically abused children (Klimes-Dougan and Kistner, 1990, Main and George, 1985). Physically abused children have also been demonstrated to evaluate aggressive responses more favourably (Keil and Price, 2009, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008). As such, physical abuse may be associated with less prosocial responding on the IRT.

The relationship between emotion regulation and social understanding processes and maltreatment factors of severity, age of onset, chronicity and co-occurrence, will also be explored, as important features of the maltreatment experience (Barnett, Manly and Cicchetti 1993). As outlined above, earlier onset, more chronic and exposure to multiple subtypes of abuse have each been associated with poorer outcomes. These factors may also affect the emotion regulation and social

understanding of maltreated adolescents, and this possibility will be further explored in this study via correlations. In general, it is expected that poorer emotion regulation and social understanding will be associated with greater severity and chronicity, earlier onset and greater co-occurrence of maltreatment subtypes.

In order to explore possible differences in emotion regulation and social understanding between well-adjusted and poorly-adjusted maltreated adolescents the maltreatment group was divided based on carer-reported adolescent difficulties. It was hypothesised that those considered to display significant difficulties would display greater avoidance, risk-taking and poorer social understanding.

Finally, regression was used to explore whether cognitive processes of emotion regulation and social understanding mediated the relationship between maltreatment status and adolescent difficulties as hypothesised by maltreatment models (Loman et al., 2010).

7.2 Method

General methods of data collection including participant recruitment and characteristics, the coding of maltreatment factors and the measurement of current emotional and social functioning were detailed in **Chapter 2**. This chapter presents an additional exploratory analysis of that dataset in order to build on those described in the previous chapters (**Chapter 2 to Chapter 6**).

7.2.1 Analysis

7.2.1.1: Role of maltreatment factors

Maltreated adolescents were split into two groups based on the presence or absence of physical abuse (Physically Abused/Other Maltreated)(Teisl and Cicchetti, 2008). It should be noted that participants in each group were exposed to other maltreatment subtypes, including neglect and emotional maltreatment. Given the co-occurrence of maltreatment subtypes, identifying groups exposed to only one subtype is not generally representative of maltreated samples. This approach allows the exploration of the relative impact of physical abuse on processes of emotion regulation, social understanding and outcomes. The general analytic strategy outlined in each chapter was repeated in order to explore group differences.

Correlations explored the effect of maltreatment factors such as severity, chronicity, age of onset and co-occurrence on task performance and adolescent adjustment. Severity scores were explored using partial correlations, controlling for any influence of other maltreatment subtypes. Rank correlations analyses explored relationships between ordinal variables of number of subtypes and chronicity (Kendall's tau) and the continuous variable age of onset (Spearman's rho).

7.2.1.2: Relationship with emotional and social functioning

The Maltreated group was divided into two groups on the basis of emotional and social adjustment with standardised cut-offs associated with the SDQ Total Difficulties. Maltreated adolescents with scores in the "Borderline" or "Abnormal" range (top 20%) relative to the age- and gender- standardised sample (Mellor, 2005) were placed in a "poor adjustment" group, with all other participants placed in a "normal adjustment"

group. Analysis included those behavioural measures of emotion regulation and social understanding which demonstrated maltreatment-related effects, following the same analytic strategy.

7.2.1.3: Mediation analysis

Establishing the mediating role of a particular factor or class of factors requires a number of causal steps (Baron and Kenny, 1986). A relationship between the independent and dependent variables must be present, such that the hypothesised mediator has some relationship to mediate (**Path A in Figure 7.1**). The hypothesised mediating variable must also be significantly related to the independent variable (Maltreatment – **Path B in Figure 7.1**) as well as the dependent variable (emotional and social difficulties: **Path C in Figure 7.1**). These steps establish the zero-order associations of each proposed path. Finally, if the regression coefficient of the independent variable predicting the dependent variable reduces when including both the independent and mediating variables, and the effect of proposed mediator remains significant, some mediating role is indicated.

The significance of the indirect path can be examined directly by calculating the product of the regression coefficients and dividing it by the standard error of the combined path, and comparing it against a normal distribution (Howell, 2002). Therefore, in order to examine the hypothesised mediating role of emotion regulation and social understanding variables on the relationship between maltreatment and adolescent difficulties, a series of regression analyses were planned.

First, the direct effect of the independent variable (maltreatment status) on the dependent variables (outcome measures) would be examined. Next, regression analyses

would explore the effect of the independent variable on the proposed mediating variables; the outcome variables for each task. Following this, the direct effect of mediating variables on outcome measures would be explored. Finally, the indicated indirect models would be examined.

In **Chapter 2**, I reported a significant difference between maltreated and non-maltreated adolescents in social and emotional difficulties as measured by the SDQ, completed by their parent or foster carer. Maltreated and non-maltreated adolescents did not differ on self-reported anxiety and depression symptoms. As only SDQ Total Difficulties showed a significant maltreatment-related effect, other measures of adolescent functioning were not included in subsequent mediation analysis. **Chapters 3 to 6** demonstrated that maltreated adolescents demonstrated significant differences in emotion regulation and social understanding, identifying potential mediating variables. Specifically, these chapters reported findings in which maltreated adolescents differed from their non-maltreated peers in avoidance conditioning and, with respect to adolescent girls, showed greater risk taking (**Chapter 3**). Finally, maltreated adolescents were found to differ in aspects of social understanding, showing impaired understanding of the internal thoughts, feelings and beliefs of others, poorer emotion understanding and less prosocial responding to peer distress (**Chapter 6**). Therefore only these variables were included in the following mediation analysis.

7.3 Results

7.3.1 Maltreatment factors

7.3.1.1 Maltreatment Subtype

Table 7.1: Descriptive statistics of Physically Abused and Other Maltreated groups (*=p<0.05)

	Physically Abused	Other Maltreated	Sig
Number (female)	23 (9)	24 (13)	χ^2=1.066, p=0.302
Age	13.98 (1.68)	12.89 (1.61)	t(45)=-2.270, p=0.028*
IQ	92.30 (12.10)	93.92 (9.44)	t(45)0.511, p=0.612
SDQ Total Difficulties	15.77 (6.11)	14.00 (7.97)	t(44)=-0.841, p=0.405
STAI-C	13.13 (8.09)	14.01 (4.89)	t(45)=0.453, p=0.653
CDI	9.10 (6.54)	8.86 (4.60)	t(45)=-0.143, p=0.887
EM Presence	22	17	χ^2=5.122, p=0.024*
N Presence	21	23	χ^2=0.403, p=0.525
EM Severity	3.52 (1.12)	2.38 (1.71)	U=165.5 z=-2.543, p=0.011*
N Severity	3.17 (1.40)	3.29 (1.23)	U=273.5, z=-0.055. p=0.956
No. Maltreatment Subtypes (exc. PA)	1.87 (0.34)	1.67 (0.48)	U=220.0 z=-1.625, p=0.104
Age First Report	2.10 (1.92)	0.57 (0.79)	U=122.5 z=-3.276, p=0.001*
Chronicity	3.30 (1.43)	2.71 (1.46)	U=208.0 z=-1.485, p=0.138
Age First Entry to Care (years)	5.11 (3.64)	2.78 (3.15)	U=174.0 z=-2.172, p=0.03*
No. Placements	4.91 (5.81)	3.54 (2.32)	U=249.5 z=-0.572, p=0.567

Descriptive statistics and significance tests of these groups are provided in **Table 7.1**. Of note, those in the Physically Abused group were on average older, more likely to

also be exposed to emotional maltreatment, and experienced on average more severe emotional maltreatment than those in the Other Maltreated group. Physically Abused adolescents also tended to have their first report to child protection authorities and also enter foster care are an older age than those exposed to other forms of maltreatment.

Situation Selection

Table 7.2: Situation Selection task performance of Physically Abused and Other Maltreated participants

Measures	Physically Abused	Other Maltreated
Conditioned Avoidance	0.41 (0.17)*	0.47 (0.22)
Risk Taking	36.72 (13.82)	35.75 (14.22)
Risk Taking – Male	34.57 (13.93)	32.18 (14.61)
Risk Taking - Female	40.07 (13.75)	38.77 (13.72)

Note: * significant difference relative to 0.5 one-sample t-test (p<0.05)

Situation Selection aspects of emotion regulation for each group are presented in **Table 7.2**. One-sample t-tests explored the acquisition of avoidance conditioning in each group against the hypothesised "chance" level of 0.5, using the **proportion** of trials overall in which they selected the deck associated with the angry facial expression. Only the Physically Abused group demonstrated avoidance of the angry cue, selecting the deck associated with the angry facial expression significantly less the chance ($t(20)=-2.478$, $p=0.022$). The Other Maltreated group did not differ from chance ($t(22)=-0.755$, $p=0.458$). As with previous analysis (**Chapter 3**), 5 X 2 mixed measures ANCOVAs explored group differences in **proportion scores** and **RT**s in each Block, with Age included as a covariate. No significant effects were observed (all $p>0.2$).

Univariate ANCOVA explored risk-taking between groups and across genders with **Adjusted Pumps Average** as the dependent variable and age included as a covariate. No significant effects were observed (in all cases $p>0.09$).

Attentional Deployment

The relative effect of the presence of physical abuse was examined in the dot probe task (**Table 7.3**). Mixed measures ANCOVA examined whether there were any group differences with respect to **Accuracy** scores in each level of perceptual load, with Age included as a covariate. There were no significant effects with respect to **Accuracy** on this task (all p's>0.15).

Table 7.3: Dot probe performance variables for Physically Abused and Other Maltreated Participants

Measures	Physically Abused	Other Maltreated
Accuracy: Low Load	0.97 (0.03)	0.98 (0.02)
Accuracy: High Load	0.92 (0.06)	0.93 (0.05)
Low Congruent Angry RT (ms)	613.62 (194.88)	583.07 (120.91)
Low Congruent Fearful RT (ms)	613.22 (219.74)	584.85 (110.05)
Low Incongruent Angry RT (ms)	631.73 (220.79)	586.96 (118.34)
Low Incongruent Fearful RT (ms)	608.63 (186.38)	586.77 (116.06)
Low Neutral RT (ms)	622.86 (239.13)	592.16 (138.59)
High Congruent Angry RT (ms)	1077.15 (486.77)	1048.33 (312.67)
High Congruent Fearful RT (ms)	1099.12 (539.74)	1036.24 (304.60)
High Incongruent Angry RT (ms)	1081.96 (443.04)	1087.53 (347.48)
High Incongruent Fearful RT (ms)	1076.40 (439.45)	1064.90 (307.52)
High Neutral RT (ms)	1114.21 (554.50)	1018.32 (263.94)

Subsequent analysis examined **RT**s in a 2x2x2x2 mixed measures ANCOVA, with Load, Congruence and Emotion as within-subject variables, and Subtype Group (Physically Abused/Other Maltreated) as a between subjects variable. Results showed no significant main effect of Subtype Group ($F(1,43)=0.404$, $p=0.528$, partial $\eta^2=0.009$), nor any interactions thereof (all $p>0.21$). There was a significant main effect of Load ($F(1,43)=10.304$, $p=0.003$, partial $\eta^2=0.193$), but not Emotion or Congruence (all $p>0.23$).

There were significant Emotion X Congruence ($F(1,43)=4.994$, $p=0.031$, partial $\eta^2=0.104$) and Emotion X Congruence X Age ($F(1,43)=5.459$, $p=0.024$, partial $\eta^2=0.113$) interactions, but no other significant effects (all $p>0.05$). These were examined further creating **Attention Bias Scores** for each emotion (angry/fearful), and compared against the hypothetical "no difference" level (0) using one-sample t-tests. Given the significant main effect of Load, and a priori hypotheses regarding the role of perceptual load, the Emotion X Congruence interaction was examined separately for each level of load. In the low load condition there was a non-significant trend suggesting vigilance towards angry facial expressions (mean: 11.00, SD: 42.47, $t(45)=1.756$, $p=0.086$) but not fearful expressions (mean: -1.34, SD: 48.55 $t(45)=-0.187$, $p=0.853$). **Attention Bias Scores** with respect to angry or fearful facial expressions did not significantly differ from 0 in the high load condition ($p's>0.47$). That is, there was some evidence suggesting hyper-vigilance toward threatening (angry facial expressions) cues, however only when the perceptual load of the task was low. Finally, correlations revealed that Age showed a non-significant positive trend with **Attention Bias Scores** for angry facial expressions when perceptual load was high ($r=0.274$, $p=0.065$) but not when perceptual load was low ($r=0.188$, $p=0.211$), nor with respect to fearful facial expressions (Low Load: $r=0.064$, $p=0.672$; High Load: $r=-0.177$, $p=0.238$), suggesting that older participants tended to respond more quickly in the congruent relative to the incongruent condition when an angry facial expression was presented and perceptual load was low.

Accuracy in each level of the emotional attention control task was examined via mixed measures ANCOVA, with Age included as a covariate (**Table 7.4**). There were no significant effects observed (all $p>0.6$).

RTs were examined using a 2 X 3 X 2 mixed measures analysis, with Load and Emotion included as within-subjects factors, and Subtype Group as a between-subjects factor. Age was included as a covariate. Results revealed only a significant main effect of Load ($F(1,39)=16.462$, $p<0.001$, partial $\eta^2=0.297$), with participants responding more quickly in the low load condition (all other $p>0.14$).

Table 7.4: Emotional attention control task performance for Physically Abused and Other Maltreated participants

Measure	Physically Abused	Other Maltreated
Accuracy: Low Load	0.89 (0.07)	0.89 (0.04)
Accuracy: High Load	0.89 (0.04)	0.88 (0.07)
Low Angry RT	737.73 (193.34)	763.56 (162.24)
Low Fearful RT	719.73 (181.82)	755.30 (149.88)
Low Neutral RT	720.52 (171.92)	756.54 (151.60)
High Angry RT	1432.70 (643.96)	1469.88 (445.17)
High Fearful RT	1414.37 (622.71)	1482.26 (402.21)
High Neutral RT	1409.58 (599.18)	1500.02 (462.08)

Similar analyses explored the relative effect of physical abuse on the non-emotional attention control task (**Table 7.5**). Mixed measures ANCOVAs explored **Accuracy** across each level of Load, with Age included as a covariate. No significant effects were observed (all $p>0.3$).

Table 7.5: Letters Attention Control Task performance for Physically Abused and Other Maltreated participants

Measure	Physically Abused	Other Maltreated
Accuracy : Low Load	0.92 (0.07)	0.93 (0.05)
Accuracy : High Load	0.92 (0.06)	0.92 (0.05)
Low Congruent RT	720.45 (167.27)	732.84 (133.20)

Low Incongruent RT	757.32 (239.85)	773.44 (166.93)
High Congruent RT	1447.41 (589.51)	1535.43 (553.93)
High Incongruent RT	1503.69 (554.78)	1546.42 (545.52)

A 2x2x2 mixed measures ANCOVA examined log-transformed **RT**s in the non-emotional attention control task. Importantly for this analysis, there was no significant main effect of Subtype Group ($F(1,40)=0.010$, $p=0.922$, partial $\eta^2<0.001$), nor any significant interactions (all $p>0.07$). Consistent with previous analysis there was a significant effect of Load ($F(1,40)=24.969$, $p<0.001$, partial $\eta^2=0.384$), with participants responding more quickly in the low load condition. Further, there was a significant effect of Congruence ($F(1,40)=9.188$, $p=0.004$, partial $\eta^2=0.187$), as well as a significant Congruence X Age interaction ($F(1,40)=7.811$, $p=0.008$, partial $\eta^2=0.163$). This was examined further by calculating a **Non-emotional Attention Control Score**, and compared against the hypothesised "no difference" level (0) using one-sample t-tests. Given the significant main effect of load and a priori hypotheses, this was done separately at each level of perceptual load. Results revealed that the **Non-emotional Attention Control score** significantly differed from 0, but only when the perceptual load was low ($t(42)=2.306$, $p=0.026$) rather than high ($t(42)=0.636$, $p=0.528$), reflecting that in this sample of maltreated participants, there were difficulties with attention control when required to actively filter task-irrelevant information. Correlations showed a non-significant trend between **Non-emotional Attention Control scores** and age when the perceptual load was high ($r=-0.274$, $p=0.075$) but not low ($r=-0.149$, $p=0.34$), suggesting that younger participants were slower on incongruent relative to congruent trials when the relatively high perceptual load added to task difficulty.

Cognitive Change

Although no maltreatment-related differences were observed on measures of interpretation bias, the relative effect of maltreatment subtypes was explored using three 2 X 2 mixed measures ANCOVAs, given the presence of specific subtype-related hypotheses. Age was included as a covariate. Group means are presented in **Table 7.6**.

There was a significant Scale X Subtype Group interaction with respect to the CESBQ ($F(1,42)=4.401$, $p=0.042$, partial $\eta^2=0.095$). However follow-up independent-samples t-tests revealed no differences between Physically Abused and Other Maltreated adolescents with respect to either the Parent/Carer focused scale ($t(44)=1.554$, $p=0.127$) or the Peer scale ($t(44)=-0.613$, $p=0.543$). There were no other significant effects with respect to the CESBQ, ASI or PoPS scales (all $p>0.15$).

Table 7.6: Cognitive Change measures for Physically Abused and Other Maltreated participants

Measures	Physically Abused	Other Maltreated
CESBQ - Parent	4.48 (4.45)	7.03 (6.47)
CESBQ - Peer	3.68 (6.06)	2.81 (3.72)
ASI – Benign	3.32 (0.82)	3.46 (0.87)
ASI - Negative	2.24 (0.89)	2.20 (0.72)
POPS – Peers	30.36 (9.13)	27.68 (6.94)
POPS – Self	27.69 (8.63)	26.89 (5.22)

Social Understanding

Group differences in aspects of social understanding were explored (**Table 7.7**). First, group differences on mentalising ability as measured by the Strange Stories task was examined using a mixed measures ANCOVA. This analysis showed a significant effect of Story Type ($F(1,44)=9.312$, $p=0.004$; partial $\eta^2=0.175$), reflecting that participants performed better on mental relative to physical stories (Chapter 6). There was also a Type X Age interaction ($F(1,44)=6.467$, $p=0.015$, partial $\eta^2=0.128$) with correlations showing a significant relationship with performance on physical stories

(r=0.376, p=0.009), suggesting that as participants get older they perform better on these stories. There were no other significant main or interaction effects (all p>0.09).

Group differences in emotion understanding were also examined, using a univariate ANCOVA design with Age as a covariate. There was no significant difference between Physically Abused and Other Maltreated adolescents with respect to emotion understanding ($F(1,43)=0.264$, $p=0.610$, partial $\eta^2=0.006$).

Table 7.7: Social Understanding performance measures for Physically Abused and Other Maltreated participants

Measures	Physically Abused	Other Maltreated
Mentalising (Strange Stories)	9.83 (2.25)	10.04 (1.68)
Emotion Understanding	2.73 (1.96)	2.25 (1.59)
Prosocial responding Block 1	0.51 (0.06)	0.49 (0.07)
Prosocial responding Block 2	0.30 (0.10)	0.32 (0.13)
Prosocial responding Block 3	0.41 (0.20)	0.32 (0.21)
Maximum Distress	2.70 (1.62)	2.77 (1.77)

Subtype-related effects on prosocial responding were also explored. A 3 X 2 mixed measures ANCOVA explored **proportion scores** in each Block. No significant effects were observed (all p>0.2) suggesting that Physically Abused and Other Maltreated adolescents showed the same pattern of responding on this task (see **Chapter 6**).

Maximum distress displayed in Block 3 was also examined using univariate ANCOVA, with Age as a covariate. There was no significant effect of Subtype Group or Age (all p>0.45).

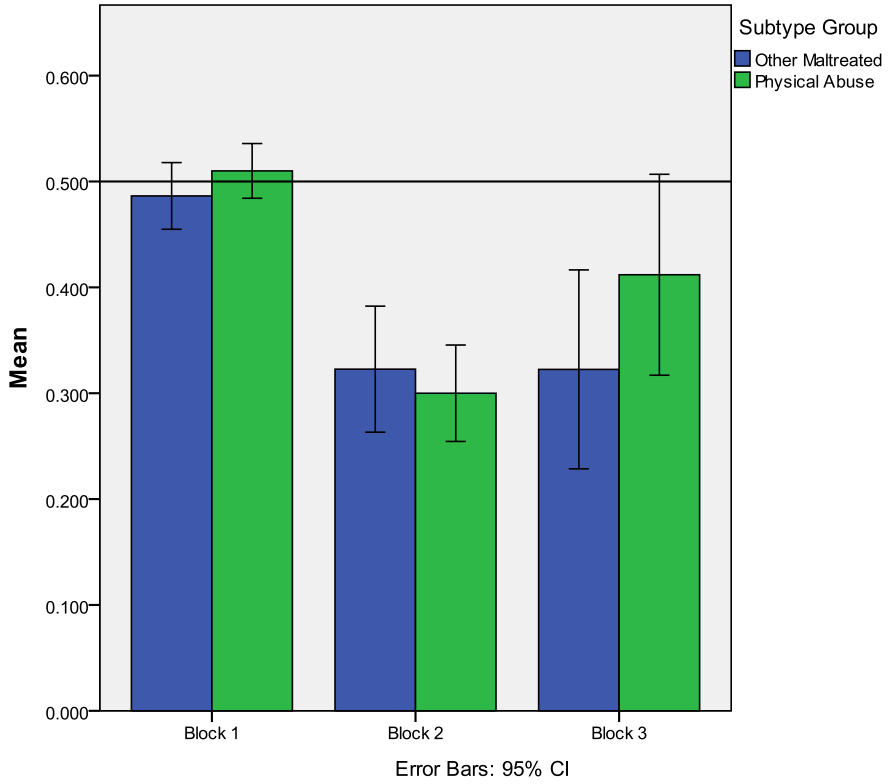


Figure 7.2: Response pattern in Interpersonal Response Task by subtype grouping relative to "fair" 0.5 responding

7.3.1.2 Other Maltreatment Factors

Correlations explored relationships between maltreatment factors (maltreatment severity, age of onset, chronicity and number of maltreatment subtypes) and outcomes measures gathered, such as symptom scores and task performance. Only those task performance measures that showed maltreatment-related effects were examined, and, for brevity, only those that demonstrated a significant correlation are reported here.

Number of maltreatment subtypes was significantly associated with SDQ Total Difficulties (Kendall's tau=0.422, p=0.001) and Emotion Understanding, as measured by participants identification of the emotional state arising from the animated interaction of the triangle (see **Chapter 6**) (Kendall's tau=-0.201, p=0.034). Emotion understanding was also significantly associated with severity of physical abuse (r=0.283, p=0.016) and

severity of emotional maltreatment (r=-0.287, p=0.014). Finally, risk taking, as measured by **adjusted pumps average,** was significantly correlated with chronicity of maltreatment for female adolescents (Kendall's tau=0.336, p=0.043) and age of onset for male adolescents (Spearman's rho=-0.402, p=0.046). These correlations should however be treated cautiously, as Bonferroni correction would result in all (except the relationship between number of subtypes and SDQ Total Difficulties) no longer being considered significant. As such it is possible that such correlations arise by chance, rather than reflecting meaningful relationships between variables.

7.3.2 Adjustment of Maltreated Adolescents: SDQ Total Difficulties

In addition to significant differences between maltreated adolescents on the basis of their specific experiences of maltreatment, maltreated adolescents also differed on the basis of their current functioning as reported by their caregiver. While maltreated adolescents were significantly more likely to be experiencing difficulties relative to non-maltreated peers or normative populations (Chapter 2), there was a subset of maltreated adolescents who might be considered to be showing resilience. For example, approximately 15% (7 of 46) of maltreated adolescents were rated as falling within the "normal" range on each of the five SDQ subscales, while approximately 26% (12 of 46) of maltreated adolescents were rated within the normal range in at least four subscales, but were never rated within the highest risk group (top 10%) (Mellor, 2005).

For the purposes of this analysis, maltreated adolescents were divided into two groups on the basis of age-standardised cut-offs of the SDQ Total Difficulties score (Mellor, 2005), with those in the "normal" range considered to be well-adjusted and those in the "Borderline" or "Abnormal" range (top 20% of scores in the standardised

sample) considered poorly-adjusted. Approximately 39% (18 of 46) of maltreated adolescents were rated within the "normal" range on the Total Difficulties score by their caregiver. Well-adjusted maltreated adolescents were compared against their poorly-adjusted maltreated peers first with respect to basic demographic data including Age and IQ, and maltreatment factors (see **Table 7.8**).

Table 7.8: Maltreatment factors by Adjustment Group

	Maltreated – poor adjustment	Maltreated – normal adjustment	Sig.
Number (female)	28 (13)	18 (9)	χ^2=0.056 p=0.813
Age	13.53 (1.73)	13.35 (1.76)	t(44)=-0.347, p=0.731
IQ	91.96 (12.08)	93.89 (7.48)	t(44)=0.604, p=0.549
PA Presence	16	6	X^2=2.489 p=0.115
PA Severity	1.64 (1.66)	0.89 (1.53)	U=186.5, Z=-1.614 P=0.107
N Presence	27	16	X^2=1.022 p=0.312
N Severity	3.29 (1.18)	3.22 (1.52)	U=251.0 Z=-0.023 P=0.981
EM Presence	25	13	X^2=2.220 p=0.136
EM Severity	3.14 (1.41)	2.56 (1.76)	U=216.5 Z=-0.868 P=0.385
No. Maltreatment Subtypes	2.43 (0.74)	1.94 (0.64)	U=156.0 Z=-2.338 P=0.019*
Age First Report	1.23 (1.75)	1.28 (1.31)	U=240.5 Z=-0.260 P=0.795
Chronicity	3.11 (1.55)	2.83 (1.38)	U=229.0 Z=-0.531 P=0.595
Age First Entry to Care (years)	3.98 (3.60)	3.61 (3.54)	U=239.5 Z=-0.282 P=0.778
No. Placements	4.54 (5.37)	3.44 (2.06)	U=244.0 Z=-0.183, P=0.855

There was no significant difference in gender distribution, nor any significant group differences with respect to Age or IQ, presence or severity of PA, Neglect or EM, Chronicity, Age of First Report, Age of First Entry to Care, or Number of Placements. However well-adjusted Maltreated adolescents were exposed to significantly fewer maltreatment subtypes.

7.3.2.1 Situation Selection

Situation selection measures were examined for adjustment-group differences (see **Table 7.9**). One-sample t-tests were used to explore the relative acquisition of avoidance conditioning of each group, using the **overall preference score** established in Chapter 3. Only poorly-adjusted maltreated adolescents demonstrated scores significantly different from the 0.5 chance level, reflecting facilitated avoidance ($t(25)=-2.542$, $p=0.018$). Responding of well-adjusted maltreated adolescents did not significantly differ from chance ($t(16)=-0.164$, $p=0.872$).

Univariate ANOVA was used to explore group differences in risk taking, with **adjusted pumps average** as defined in Chapter 3 as the dependent variable. Given the observed gender effect outlined previously, gender was also included as a variable. No significant effects were observed (all $p>0.13$).

Table 7.9: Situation Selection task performance of well-adjusted and poorly-adjusted maltreated adolescents

Situation Selection	Maltreated poorly-adjusted	Maltreated well-adjusted
Conditioned Avoidance	0.41 (0.19)*	0.49 (0.21)
Risk Taking - Male	35.93 (12.96)	30.53 (16.17)
Risk Taking - Female	42.32 (9.46)	34.94 (17.37)

***= one-sample t-test shows significant difference from 0.5 ($p<0.05$)**

7.3.2.2 Social Understanding

Social understanding outcomes were also examined with respect to outcomes (see **Table 7.10**). Scores on the mental stories of the Strange Stories task were re-examined using independent-samples t-tests. There was no difference between well-adjusted and poorly-adjusted maltreated adolescents with respect to performance on mental stories ($t(44)=1.082$, $p=0.285$). A similar analysis explored emotion understanding, finding no significant difference between well-adjusted and poorly-adjusted maltreated adolescents ($t(24.418)=0.196$, $p=0.846$).

Table 7.10: Social Understanding task performance of well-adjusted and poorly-adjusted maltreated adolescents

Social Understanding	Maltreated poorly-adjusted	Maltreated well-adjusted
Mentalising (Strange Stories)	9.61 (2.01)	10.22 (1.66)
Emotion Understanding	2.33 (1.24)	2.44 (2.18)
Prosocial responding Block 1	0.50 (0.06)	0.49 (0.07)
Prosocial responding Block 2	0.30 (0.12)	0.33 (0.12)
Prosocial responding Block 3	0.41 (0.19)	0.31 (0.21)
Maximum Distress	3.00 (1.71)	2.44 (1.63)

Finally, results from the IRT task were examined (see **Figure 7.3**). First, **proportion scores** were entered into a 3 X 2 mixed measures ANOVA in order to compare Adjustment Groups across each Block. Although there was no significant effect of Adjustment Group ($F(1,39)=0.683$, $p=0.414$, partial $\eta^2=0.017$) nor significant Block X Adjustment Group interaction ($F(1.647,64.248)=3.026$, $p=0.065$, partial $\eta^2=0.072$), there was a significant effect of Block ($F(1.647,64.248)=23.221$, $p<0.001$, partial $\eta^2=0.373$) consistent with the pattern of responding of maltreated adolescents reported in Chapter 6. That is, well-adjusted and poorly—adjusted maltreated adolescents did not differ in their pattern of responding on this task.

Maximum distress displayed in Block 3 was examined using non-parametric independent samples analysis. Results revealed that well-adjusted maltreated adolescents did not significantly differ from those rated by their carer as demonstrating significant difficulties (Mann-Whitney $U=162.0$, $z=-1.067$, $p=0.286$).

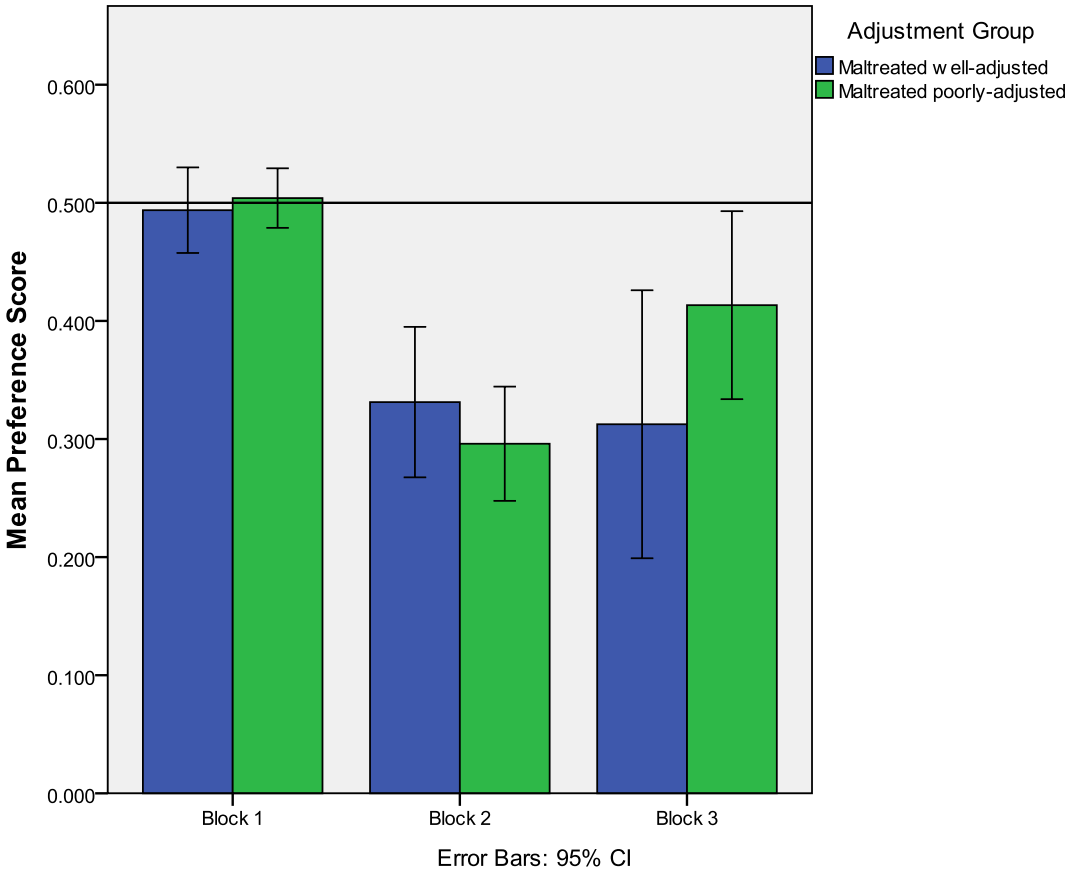


Figure 7.3: Mean Preference Scores on Interpersonal Response Task by Adjustment group

7.3.3 Mediation Analysis

First, regression analysis explored the direct effect of maltreatment status on adolescent functioning, as measured by the parent-report version of the Strengths and Difficulties Questionnaire. Maltreatment status significantly predicted SDQ Total Difficulties scores (β=0.493, t(72)=4.802, p<0.001), with this model explaining a significant proportion of the variance in SDQ Total Difficulties scores (R^2=0.232, F(1,72)=23.057, p<0.001).

Table 7.11: Regression statistics of maltreatment status predicting emotion regulation and social understanding task performance

Predictor	Total R^2	Standardised β	F	p-value
Avoidance	0.009	-0.094	0.623	0.432

Risk Taking	0.002	0.04	0.116	0.735
Emotion Understanding	0.094	-0.307	7.502	0.008*
Mentalising	0.281	-0.530	28.589	<0.001**
Prosocial Responding (Block 3)	0.091	-0.301	6.695	0.012*
Prosocial (Distress)	0.114	-0.338	8.640	0.005*

Next, similar regression analyses were conducted with maltreatment status predicting differences in the hypothesised mediating variables (**Table 7.11**), with the same inclusion criteria applied for each task as in their respective Chapter. Maltreatment status did not significantly predict differences in avoidance (β=-0.094, t(70)=-0.790, p=0.432) or risk taking (β=0.040, t(73)=0.340, p=0.735). However, maltreatment status did significantly predict emotion understanding (β=-0.307, t(72)=-2.739, p=0.008), mentalising ability (β=-0.530, t(73)=-5.347, p<0.001) and prosocial responding, both with respect to predicting responses in Block 3 (β=-0.301, t(67)=-2.588, p=0.012) and the level of distress shown (β=-0.338, t(67)=-2.939, p=0.005).

Next, the relationship between those mediating variables predicted by maltreatment status and SDQ Total Difficulties scores were examined (**Table 7.12**). Mentalising ability (β=-0.324, t(72)=-2.906, p=0.005) significantly predicted SDQ Total Difficulties scores. Neither emotion understanding (β=-0.137, t(71)=-1.167, p=0.247), nor prosocial responding in terms of including P1 in Block 3 (β=-0.088, t(66)=-0.719, p=0.475) or the level of distress shown (β=-0.210, t(66)=-1.745, p=0.086) predicted SDQ Total Difficulties.

Table 7.12: Regression statistics of possible mediating variables predicting SDQ Total Difficulties score

Predictor	Total R^2	Standardised β	F	Sig
Emotion Understanding	0.019	-0.137	1.363	0.247
Mentalising	0.105	-0.324	8.443	0.005
Prosocial Responding (Block 3)	0.008	-0.088	0.517	0.475
Prosocial (Distress)	0.044	-0.210	3.046	0.086

Finally, only mentalising ability was included in a regression analysis, including maltreatment status as a predictor (**Table 7.13**) at step 1, and task performance at step 2. Maltreatment status remained a significant predictor of SDQ Total Difficulties despite including mentalising ability – suggesting that the latter did not mediate the effects of the former. As such, there was no evidence of a mediating role of any of the behavioural measures of emotion regulation or social understanding in the relationship between maltreatment status and adolescent functioning as measured by the Strengths and Difficulties Questionnaire.

Table 7.13: Regression statistics of mediating variables

Model	Total R^2	Change R^2	Standardised β (Group)	Standardised β (med)	F	F Change	Sig
Step 1: Maltreatment Group	0.243	0.243	0.493		23.057	23.057	p<0.001
Mentalising	0.246	0.004	0.452	-0.073	11.595	0.343	p=0.56

7.4 Discussion

Having identified maltreatment-related differences in the function of a range of cognitive processes of emotion regulation and social understanding in previous

chapters, this chapter aimed to explore possible differences in these processes associated with maltreatment factors and current functioning. These results will be discussed below.

First, this approach found that maltreated participants differed on the basis of maltreatment factors. Physically abused adolescents were more likely to also experience emotional maltreatment, and of a greater severity, than those not exposed to physical abuse. Given that emotional maltreatment includes exposure to family violence, this result is consistent with previous research linking exposure to domestic violence with other forms of abuse (Holt et al., 2008). Perpetrators of child physical abuse might be more likely to display aggressive or abusive behaviours towards others in the home. That is, violent or aggressive strategies for dealing with frustration or managing social relationships may increase the risk for abuse and emotional maltreatment including family violence. Further, physically-abused maltreated adolescents tended to be reported later and enter care later than their non-physically abused maltreated peers. This is consistent with the notification issues raised previously, with documented cases of physical abuse arguably unlikely before children start to have more contact with adults outside the home, such as school. Neglect, particularly related to substance abuse, may be more likely to be identified early by medical professionals during pregnancy, with families monitored by child protection authorities more closely in the early years of life as a result.

Maltreated adolescents also differed with respect to current functioning. Previous studies have noted the presence of resilient individuals within the maltreated population – those that appear to be coping within acceptable norms despite exposure

to significantly adverse or traumatic experiences (Cicchetti, 2013). Consistent with this literature (DuMont et al., 2007, McGloin and Widom, 2001), a noteworthy subset of maltreated adolescents showed apparent resilience as rated by their caregiver on the SDQ. This figure ranged from 15-39% depending on definition used for resilience, however it should be noted that resilience is a fluid notion that shifts over development and across different contexts (Cicchetti, 2013, DuMont et al., 2007). Further, well-adjusted maltreated adolescents were generally exposed to fewer maltreatment subtypes. This finding is consistent with previous research reporting the presence of a dose-response relationship between the number of maltreatment subtypes and adult mental health (Edwards et al., 2003, Teicher et al., 2006).

Maltreatment-related factors and adolescent adjustment were also associated with different patterns of performance on behavioural measures of emotion regulation and social understanding. These findings will be discussed below.

7.4.1 Situation Selection

Situation Selection aspects of emotion regulation include the tendency to avoid potential threats and the pursuit of rewards in the face of risk. While there was no maltreatment group differences observed with respect to conditioned avoidance (**Chapter 3**), planned analyses provided weak support for the suggestion that maltreated but not non-maltreated adolescents tended to avoid the deck associated with unconditioned aversive stimuli (an angry face). On the basis of previous research suggesting that physical abuse is associated with generally increased sensitivity to displays of angry facial expressions (Gibb et al., 2009, Pollak and Sinha, 2002, Pollak and Kistler, 2002, Pollak et al., 2005, Pollak and Tolley-Schell, 2003, Shackman et al., 2007),

it was hypothesised that physical abuse may likewise be associated with the facilitated acquisition of conditioned avoidance of angry facial cues. As with analysis in **Chapter 3**, there was no significant difference between Physically Abused and Other Maltreated participants observed, however one-sample analysis suggested that exposure to physical abuse was associated with the tendency to avoid threat-related stimuli. Facilitated conditioned avoidance is a consistent finding in child, adolescent and adult anxiety (Lau and Viding, 2007, Lau et al., 2008, Lissek et al., 2005) and the observed facilitated acquisition of conditioned avoidance may contribute to the increased incidence of emotional difficulties and social withdrawal of those exposed to physical abuse (Anthonysamy and Zimmer-Gembeck, 2007, Klimes-Dougan and Kistner, 1990, Tarren-Sweeney and Hazell, 2006).

Maltreated adolescents who were considered "at risk" with respect to emotional and social difficulties tended to show conditioned avoidance that was not evident in their well-adjusted peers. This offers some support to the claim that facilitated acquisition of conditioned avoidance, such as that associated with physical abuse reported here may also be associated with greater risk of emotional and social difficulties. However, there was no evidence of an indirect path whereby the apparent tendency to develop conditioned avoidance mediated a significant portion of the relationship between maltreatment status and adjustment in adolescents. As noted above, these results should be interpreted with caution, noting that between-groups analysis revealed no significant differences in deck preferences. Further research is required to clarify both the presence of facilitated conditioned avoidance with respect to maltreatment generally, and physical abuse more specifically.

Maltreated adolescent girls tended to take more risks relative to their non-maltreated peers whereas maltreated adolescent boys did not differ from their non-maltreated peers (**Chapter 3**), although non-selected adolescents boys tended to be more risky than their female counterparts, consistent with previous studies (Byrnes et al., 1999, Pawlowski et al., 2008). More chronic exposure to maltreatment was associated with increased risk-taking tendencies for maltreated adolescent girls, while earlier first-reported maltreatment was associated with greater risk taking in maltreated adolescent boys, although it should be noted that dividing the sample in this way substantially limits the sample size. The presence or absence of physical abuse did not appear to be significantly associated with risk-taking tendencies for maltreated adolescents, regardless of gender. This study is unable to disentangle the relative effects of exposure to other maltreatment types, and as such it is not clear whether a particular maltreatment subtype, or maltreatment more generally, contributes to this difference along with maltreatment chronicity. Well-adjusted maltreated adolescents did not significantly differ from their poorly-adjusted maltreated peers with respect to risk taking behaviour. There was also no evidence that risk-taking tendency as measured by the BART mediated the relationship between maltreatment and adolescent adjustment.

7.4.2 Attentional Deployment

Maltreated adolescents tended to differ from their non-maltreated peers with respect to either response time or accuracy on tasks of selective attention, although there was no evidence that maltreated adolescents showed threat-related biases of attention (**Chapter 4**). Further, while interference effects of emotionally-laden stimuli were not observed, significantly reduced accuracy on this task by maltreated adolescents suggested that there may have been a significantly different approach taken

to this task. When task-irrelevant stimuli were not emotionally-laden, interference effects were observed and significantly associated with IQ. As maltreatment has been linked with lower scores on IQ measures (De Bellis et al., 2009, Pechtel and Pizzagalli, 2011, Wilson et al., 2011), it appears plausible that while maltreatment-related differences were not observed, maltreated adolescents may be more at risk for generally impoverished attention control, given this relationship with IQ.

Analysis in this Chapter found no evidence that exposure to physical abuse is particularly associated with hypervigilance to threat. Previous research has suggested greater sensitivity to angry facial expressions associated with physical abuse (Gibb et al., 2009, Pollak and Kistler, 2002, Pollak and Sinha, 2002, Pollak et al., 2005, Pollak and Tolley-Schell, 2003, Shackman et al., 2007) consistent with the hypothesis that differences in the "attention control settings" (Folk et al., 1992, Todd et al., 2012) with respect to possible cues of danger which, for those with histories of physical abuse, include facial displays of anger and hostility.

Analysis in this chapter however revealed that maltreated adolescents, as a group, may display a threat-related attention bias, specifically in the low load condition, although no between-groups (Maltreated/Non-Maltreated) difference was observed in **Chapter 4**. While this is partly consistent with previous research suggesting vigilance toward angry facial expressions amongst those exposed to maltreatment, it is possible that exposure to any violence may affect the "attention control settings" associated with such experiences. While the Physically Abused group was directly harmed by the physical violence of their parents or other adults responsible for their care, those in the Other Maltreated group include those exposed to family violence, coded under the MCS

as emotional maltreatment (Barnett et al., 1993). Exposure to aggressive interpersonal strategies may affect the calibration of "attention control settings", whether this is directly (as a victim of physical abuse) or indirectly (as a witness of family violence). This may contribute to the absence of a significant group effect on the basis of subtype in this analysis. Additionally, there was some evidence suggesting that maltreated adolescents show difficulties in attention control with respect to non-emotional task-irrelevant distractors. Neglect has previously been associated with impaired attention control generally (Beers and De Bellis, 2002, Bucker et al., 2012), and that is consistent with results here, with those in the Physically Abused and Other Maltreated groups both being exposed to Neglect. It is noteworthy that both of these effects were only present when the perceptual load of the task was relatively low (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2008, Bishop, 2009, Lavie, 1995, Lavie et al., 2004). These findings implicate an important role for the effortful control of attention, which is required to filter out task-irrelevant stimuli, whereas in trials where the perceptual load is relatively high, processing constraints prohibit the further processing of these stimuli (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2008, Bishop, 2009, Lavie, 1995, Lavie et al., 2004).

It should be noted that previous analysis (**Chapter 4**) did not show any evidence of maltreatment-related biases of selective attention or difficulties with attention control, such as those reported here, when considering maltreated adolescents relative to their non-maltreated peers. As such these results should be considered cautiously.

7.4.3 Cognitive Change

Although maltreatment related differences in interpretation biases were not observed in previous analysis (**Chapter 5**), the relative role of maltreatment subtypes

were explored on the basis of previous research finding interpretation biases associated with physical abuse (Dodge et al., 1995, Dodge et al., 1990, Keil and Price, 2009, Price and Glad, 2003, Teisl and Cicchetti, 2008). This study found no evidence of negative interpretation biases amongst maltreated adolescents regardless of the presence or absence of physical abuse. As was argued in discussing the results in **Chapter 5**, it is possible that, by adolescence, the negative interpretation bias observed in childhood samples has been addressed. Further, given that maltreated adolescents in this study have been in foster care for an extended period of time, their experiences in foster care may have assisted in overcoming any early negative interpretation bias that may have existed.

Given the general absence of maltreatment-related effects with respect to interpretation biases in this sample, there is no evidence that interpretation biases as an aspect of emotion regulation mediate the relationship between maltreatment status and adolescent adjustment, contrary to previous studies (Shields et al., 2001, Teisl and Cicchetti, 2008).

7.4.4 Social Understanding

Chapter 6 reported maltreatment-related differences in cognitive processes of social understanding, including mentalising abilities and prosocial responding. While maltreated adolescents demonstrated significantly poorer mentalising abilities relative to non-maltreated peers (**Chapter 6**), there was no evidence that the presence or absence of physical abuse significantly affected mental state understanding. This may suggest that maltreatment-related difficulties in mentalising abilities is likely associated with the presence of neglect or emotional maltreatment, or with exposure to

maltreatment more generally. Given that previous research reported similar difficulties in mentalising in institutionally deprived samples (Colvert et al., 2008), it perhaps seems more probable that maltreatment-related mentalising difficulties in this sample is associated with neglectful parent-child relationships that was prevalent amongst both Physically Abused and Other Maltreated groups. However, Cicchetti et al (2003) reported that physical abuse was associated with poorer mentalising abilities in a sample of maltreated children. It could be that the absence of appropriate "serve and return" relationships, regardless of maltreatment subtype, contributes to the poor mentalising abilities of maltreated children and adolescents. Well-adjusted maltreated adolescents did not differ in their mental state understanding relative to poorly-adjusted maltreated peers. Maltreatment factors were also not significantly related with mentalising abilities.

Emotion understanding differences between maltreated and non-maltreated participants were observed (**Chapter 6**), however only when variance shared with IQ was not co-varied. In this Chapter, I explored the relative role of physical abuse on emotion understanding. While there was no difference between physically abused and other maltreated adolescents in emotion understanding, correlations revealed that exposure to more severe physical abuse was associated with relatively better emotion understanding, whereas exposure to more severe emotional maltreatment was associated with relatively poorer emotion understanding. This is somewhat consistent with previous research reported that physical abuse is associated with facilitated recognition of particularly negative emotions (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002). However, well-adjusted and poorly-

adjusted maltreated adolescents did not significantly differ with respect to emotion understanding.

Physically abused and non-physically abused maltreated adolescents did not differ from each other in their pattern of responding in the IRT. This extends previous studies of prosocial responding to peer distress that have focused on physically abused children (Klimes-Dougan and Kistner, 1990, Main and George, 1985), suggesting that these results may extend to other maltreatment subtypes, or maltreatment more generally, which cannot be disentangled in this study.

Prosocial responding patterns were also explored relative to social and emotional adjustment. The pattern of prosocial responding did not significantly differ between well-adjusted and poorly-adjusted maltreated adolescents, suggesting that both groups showed a similar pattern to that observed in **Chapter 6**, which observed that maltreated adolescents tended to show less prosocial responding than their non-maltreated peers. This suggests that, in general, this maltreatment-related difference in prosocial responding is not generally associated with the experience of emotional and social difficulties as measured by the SDQ Total Difficulties.

Although mentalising abilities were significantly predicted by maltreatment status and significantly predicted variations in adolescent emotional and social difficulties, there was no evidence that any of the above aspects of social understanding significantly mediated the relationship between maltreatment status and adolescent adjustment.

Overall, this study informs the Loman and Gunnar (2010) model, building on previous chapters and studies reporting maltreatment-related differences in important cognitive processes of emotion regulation and social understanding. In particular, this study emphasises the importance of particular aspects of the parent-child relationship that is dysfunctional in maltreating families and their effects on maltreated children in adolescence. As noted in previous studies (Ammerman et al., 1986, Barnett et al., 1993, Bolger and Patterson, 2001, Edwards et al., 2003, Egeland et al., 1983, English et al., 2005b, Hildyard and Wolfe, 2002, Lamphear, 1985, Litrownik et al., 2005, Teicher et al., 2006), maltreatment factors including subtype, severity, chronicity, age of onset and co-occurrence of maltreatment were each associated with some aspect of the cognitive processes of maltreated adolescents. This emphasises the importance of considering "maltreatment" as a heterogeneous sample and population when exploring the effects of childhood abuse and neglect.

7.4.5 Limitations

The above findings are suggested tentatively and are largely exploratory, although emphasise the need to consider maltreated samples as a broad and heterogeneous population. However, these findings should also be considered with respect to the following limitations.

First, the relatively small sample size significantly limits the power of this study to observe effects that may be relatively small. While the observable behavioural effects of maltreatment on the development of cognitive processes of emotion regulation and social understanding may be relatively small, their relative influence with respect to the emotional and social functioning of maltreated children and adolescents may be more

considerable. Previous studies have reported that emotion regulation difficulties of maltreated children may contribute more than half of the variance in measures of social difficulties (Teisl and Cicchetti, 2008). The limitations of sample size become particularly restricting when considering the role of maltreatment factors such as the presence or absence of physical abuse, and the mediating role of variables reflecting emotion regulation and social understanding, as well as considering possible gender differences such as those explored with respect to risk-taking. Larger sample sizes help provide additional power to examine the relative effects of different maltreatment factors, including maltreatment subtypes, and gender effects, that may provide invaluable insights regarding the likely developmental trajectories of children and young people that come in contact with child protection systems. These insights will help these systems develop and implement interventions to more effectively address the effects of early abuse and neglect and promote emotional and social adjustment.

Second, although this study focused on well-established behavioural measures that reflect cognitive processes associated with emotion regulation and social understanding, this study would have benefited from the inclusion of a comprehensive alternative measure of emotion regulation, such as the Emotion Regulation Q-Scale. However, this measure relies on extensive observations over time which were not possible in the current study. The inclusion of this measure would have permitted an assessment of the extent to which each behavioural measure associated with emotion regulation is related to emotion regulation as measured in other similar studies. For example, Teisl and Cicchetti (2008) reported that interpretation biases contributed around 10% of variance in peer difficulties, with emotion regulation contributing a

further 55%. I have argued that interpretation biases are a component of emotion regulation as outlined by Gross and Thompson (2007) , and therefore would be expected to share some variance with measures of emotion regulation such that "emotion regulation" as the broad construct expressed by Gross and Thompson (2007) might be said to contribute a total of around 65% of the variance in peer difficulties measured by Teisl and Cicchetti (2008) . However, Teisl and Cicchetti (2008) reported that emotion regulation (as measured by the Emotion Regulation Q-Scale) was not significantly correlated with interpretation biases. This finding emphasises the need to understand the relationship between behavioural measures of cognitive aspects of emotion regulation, such as those studied here, and naturalistic observational scales of emotion regulation such as the Emotion Regulation Q-Scale, in terms of disentangling the contribution of different cognitive processes of emotion regulation in the emotional and social difficulties experienced by those exposed to maltreatment.

Similarly, it is worth noting that models of maltreatment arguably do not suggest a simple mediating model with emotion regulation directly mediating the relationship between maltreatment and emotional and social difficulties. Rather, neurobiological impacts associated with early maltreatment, particularly affecting the stress response system, are said to predict processes of emotion regulation such as those included in this study, which in turn affect emotional and social difficulties. An underlying assumption of this approach is that the observed differences in cognitive processes correlate with differences in neural processes, and while this assumption appears perfectly plausible given other studies examining the relationship between such processes and neuropsychological functioning outlined in each chapter, the inclusion of

imaging data is required from additional studies to examine this aspect of the broader model.

7.4.6 Conclusion

In conclusion, this Chapter sought to explore possible sources of variance within the maltreatment group that may contribute to variations in both cognitive processes of emotion regulation and social understanding and differences in adolescent emotional and social difficulties. In doing so, this portion of the thesis builds a more nuanced view of the maltreatment group as a heterogeneous sample representing a broad, diverse population. A number of maltreatment factors were found to contribute to differences in processes of emotion regulation and social understanding, including the role of different maltreatment subtypes. Further, the relationship between different processes of emotion regulation and social understanding and adolescent adjustment were explored. Although these largely exploratory findings should be considered in light of the limitations noted above, particularly with respect to the relatively small sample size and the absence of comparison measures of emotion regulation, this research represents an important attempt to examine behavioural measures of emotion regulation and social understanding and their role in contributing to the emotional and social difficulties of adolescents in foster care as a result of childhood maltreatment.

Chapter 8: General Discussion

This study explored maltreatment-related differences in specific cognitive processes of emotion regulation and social understanding. In particular, emotion regulation processes associated with reward and punishment, selective attention, and interpretation, as well as cognitive aspects of social understanding such as emotion understanding, understanding the internal mental states of others, and responding to others' distress were examined in a sample of maltreated adolescents relative to a sample of non-maltreated peers. Differences in such processes are thought to be associated with the increased emotional and social difficulties of those exposed to childhood maltreatment.

However, those exposed to childhood maltreatment are not a homogeneous group, with individuals showing significant variance with respect to their experiences of maltreatment. Maltreatment factors such as subtype, severity, chronicity, and co-occurrence have been outlined in previous studies as important factors when considering the impact of maltreatment (Edwards et al., 2003, English et al., 2005b, English et al., 2005a, Gould et al., 2012, McLaughlin et al., 2010, Teicher et al., 2006), such as the impact of maltreatment on the operation of cognitive processes of emotion regulation and social understanding examined in this study. As such, this study examined not only the effect of maltreatment status on cognitive processes of emotional regulation and social understanding, but also the effect of specific maltreatment factors on these processes, and how each of these aspects may affect the emotional and social difficulties experienced by maltreated adolescents.

In this final chapter, a general summary of findings will be provided, followed by a discussion of the theoretical and practical implications, including methodological limitations, future research directions and insights regarding the wellbeing of young people exposed to early abuse and neglect.

8.1 Summary of Findings

The sample utilised in this study was introduced in **Chapter 2**. Maltreatment experiences were classified on the basis of contemporaneous file records maintained by the child protection authorities, utilising an established coding system (Barnett et al., 1993). While limitations of file records were noted, it was argued that this approach represented the best available source of maltreatment information, benefitting from contemporary narrative accounts and investigations from social workers and other professionals, although they rely on children coming to the attention of child protection authorities and may differ in their completeness. Importantly, it was demonstrated that the operational definitions of maltreatment on which this system is based is consistent with the socio-legal definitions in the jurisdiction from which participants were drawn, which gives confidence in the consistency of classifications in this study with those of other studies. As such, this approach provides the best available data regarding the experiences of maltreated adolescents in this sample, and that these classifications are consistent with other similar studies utilising the MCS. Further, the experiences of abuse and neglect for this maltreated sample was largely consistent with other studies from different jurisdictions (Barnett et al., 1993, Bucker et al., 2012, Cicchetti et al., 2003, Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Dillon et al., 2009, Gibb et al., 2009, Masten et al., 2008, Pears et al., 2008, Shields and Cicchetti, 2001) with respect to the

co-occurrence of maltreatment subtypes, with approximately 90% of maltreated adolescents reportedly exposed to two or more maltreatment subtypes. The maltreated sample reported here was also broadly consistent with the out-of-home care population from which it was drawn in terms of cultural background, and was well matched with non-maltreated comparisons in this regard.

Maltreated adolescents showed relative impairments on IQ as measured by the Abbreviated Battery of the Stanford-Binet Intelligence Scales – Fifth Edition (SB-V), broadly consistent with previous research (De Bellis et al., 2009, Pechtel and Pizzagalli, 2011, Wilson et al., 2011). Differences in IQ may affect task performance, however it is difficult to disentangle variance associated with non-maltreatment related variations in IQ and maltreatment-related variations (Miller and Chapman, 2001). Foster care households also differed from comparison households in terms of socio-economic indicators, consistent with other research noting the impact of fostering on carers employment (McHugh, 2013). Foster carers were also significantly older than the parents of non-maltreated adolescents, however there is some indication that this is somewhat representative of the carer population (McHugh, 2013). These broad differences between groups makes it difficult to design and conduct research that appropriately controls for such variations. However, consistent with Miller and Chapman (2001) , from a practical perspective this study explores differences between maltreated adolescents and their non-maltreated peers, which may be affected in some meaningful way by differences arising from their household characteristics, in particular the relationship with the primary caregiver. Artificially controlling for these differences may impact the practical, real-world applications of such research. That is, selecting

younger foster and kinship carers that are more closely matched to the parents of their adolescent's peers would not be representative of the lived experience of many adolescents in foster care.

First, it was hypothesised that maltreated adolescents would show greater emotional and social difficulties relative to non-maltreated peers. Additionally, it was hypothesised that these difficulties will be generally associated with more severe maltreatment, earlier onset of maltreatment, more chronic exposure and exposure to more maltreatment subtypes. Consistent with studies reporting greater emotional and social difficulties of those exposed to maltreatment (Cohen et al., 2001, Green et al., 2010, Mills et al., 2013, Teicher et al., 2006, Sawyer et al., 2007, Tarren-Sweeney and Hazell, 2006), parent-reported measures suggested that maltreated adolescents displayed significantly greater emotional symptoms, conduct problems, hyperactivity and peer problems and fewer prosocial behaviours, with significantly greater impact on their daily lives as measured by the Strengths and Difficulties Questionnaire. However, young maltreated people themselves reported no significantly greater incidence of anxious or depressive symptoms relative to non-maltreated peers. Adolescent adjustment as rated by their caregiver was associated with the number of maltreatment subtypes, with those considered to be showing significant difficulties relative to standardised data generally exposed to more maltreatment subtypes. This is consistent with previous studies linking number of maltreatment subtypes and adult mental health (Edwards et al., 2003, Teicher et al., 2006). Adolescent adjustment was not significantly associated with maltreatment subtypes contrary to previous studies (McLaughlin et al., 2010, Teicher et al., 2006), nor was it associated with age of onset, chronicity, or

placement factors including age at entry to care or number of placements. As noted in **Chapter 2**, there was significant inconsistency between parent-report and adolescent-report difficulties for maltreated participants, whereas non-maltreating parent-adolescent dyads responses were highly consistent. While adolescent self-reported anxious and depressed symptom scores were generally positively correlated with parent- or carer-reported Total Difficulties, this relationship differed on the basis of maltreatment status. Self- and parent-reported scores were positively correlated for non-maltreated adolescents, whereas self-reported symptom scores did not correlate with parent-reported Total Difficulties for maltreated adolescents. Maltreated adolescents and their foster carers appear to be "out of step" when it comes to identifying and reporting the difficulties of maltreated adolescents. The source of this inconsistency could be either party; that is, maltreated adolescents in this study may generally under-report their own difficulties, and carers may over-report the difficulties of young people in their care. However, it is important to note that the SDQ Total Difficulties does not simply reflect emotional difficulties, but also includes other behavioural and social difficulties in the composite. It could be that for non-maltreated adolescents, the difficulties (as measured by the SDQ) are more closely associated with emotional difficulties, whereas the difficulties of maltreated adolescents are broader, with emotional, social and other behavioural difficulties contributing to the difficulties experienced by maltreated adolescents.

8.1.1 Emotion Regulation: Situation Selection

Emotion regulation processes of situation selection refer to the pursuit of reward or desirable situations and the avoidance of threats of aversive situations (**Chapter 3**). This study explored the acquisition of conditioned avoidance and risk-taking tendencies,

that is, the response of maltreated adolescents in response to aversive cues and rewards in the presence of potential threats. It was hypothesised that maltreated adolescents would show greater conditioned avoidance of threat cues, and may display greater risk-taking tendencies. This study produced mixed results regarding the situation selection of maltreated adolescents. While there was no observed group difference between maltreated and non-maltreated adolescents, one-sample analysis for each group suggested that maltreated but not non-maltreated adolescents may show facilitated acquisition of avoidance conditioning. Further, maltreated adolescent girls but not boys may display greater risk taking tendencies than their non-maltreated peers, although this result was a non-significant trend.

Facilitated acquisition of conditioned avoidance was expected to be particularly associated with physical abuse, rather than exposure to neglect. Relationships between Situation Selection task performance and maltreatment factors were explored in **Chapter 7**, exploring the relative effect of the presence or absence of physical abuse in addition to other maltreatment subtypes, such that if facilitated acquisition of avoidance is associated with physical abuse, only this group would show evidence of facilitated conditioned avoidance. Consistent with this hypothesis, maltreated adolescents exposed to physical abuse tended to show conditioned avoidance of threat-related stimuli, whereas non-physically abused maltreated adolescents did not show conditioned avoidance. Again, this result should be treated cautiously, with no between-groups difference observed, emphasising the need for further research. Maltreated adolescents considered “at risk” on the basis of parent-or carer-reported Total Difficulties (Mellor, 2005) tended to show conditioned avoidance, whereas well-

adjusted maltreated adolescents did not show any evidence of conditioned avoidance. While it is not possible in this cross-sectional study to determine whether facilitated acquisition of conditioned avoidance contributes to the "at risk" status of maltreated adolescents, facilitated conditioned avoidance is consistently associated with anxiety (Lau and Viding, 2007, Lau et al., 2008, Lissek et al., 2005), and contributes to increased fear-related beliefs (Huijding et al., 2009).

The presence or absence of physical abuse was not significantly associated with risk-taking, suggesting that maltreatment in general, or exposure to other maltreatment subtypes (such as emotional maltreatment or neglect) which were equally present in both the physically abused and non-physically abused groups, may be associated with greater risk-taking for maltreated girls (maltreated boys did not differ from their non-maltreated peers). More chronic exposure to maltreatment was associated with increased risk-taking tendencies for maltreated adolescent girls, whereas earlier onset of maltreatment was associated with greater risk-taking for maltreated boys. Maltreated adolescents considered "at risk" did not differ in their risk-taking tendency from relatively well-adjusted maltreated peers. If maltreated adolescents, and particularly maltreated adolescent girls, show significantly greater risk-taking, this may be associated with greater real-world risk-taking such as delinquency or substance abuse later in development (Taussig, 2002). As such, maltreated adolescent girls may be more likely to be exposed to the negative consequences of risk-taking behaviours.

8.1.2 Emotion Regulation: Attentional Deployment

Processes of attentional deployment are those by which an individual determines where to invest their limited attention resources, thereby affecting which

environmental stimuli are processed and therefore able to influence one's emotional state (**Chapter 4**). This study examined implicit processes of selective attention, in particular whether maltreated adolescents display threat-related attention biases and difficulties with attention control. Previous research has produced mixed results, with some reporting attention biases towards threat (Cicchetti and Curtis, 2005, Curtis and Cicchetti, 2011, Gibb et al., 2009, Pollak et al., 1997, Pollak and Tolley-Schell, 2003, Pollak et al., 2005, Shackman et al., 2007), while others show avoidance of threat (Pine et al., 2005).

Cognitive models of threat-related attention biases have outlined a number of potential mechanisms of such biases, including hypervigilance (Mathews and Mackintosh, 1998, Mogg and Bradley, 1998), delayed disengagement (Fox et al., 2001, Fox et al., 2002), and difficulties in attention control (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2009, Eysenck et al., 2007, Eysenck and Derakshan, 2011). Further, perceptual load has been identified as an important feature of selective attention (Lavie, 1995, Lavie et al., 2004) that may play an important role in threat-related biases (Bishop et al., 2004, Bishop et al., 2007, Bishop, 2008, Bishop, 2009). Specifically, when the perceptual load of the task is low, top-down attention control must be enacted in order to actively filter task-irrelevant environmental information so if there are problems with attention control, one would expect biases to occur in the low load condition.

It was hypothesised that maltreated adolescents would show threat-related attention biases and impoverished attention control. Further, this study aimed to explore the possible mechanisms accounting for this bias. This hypothesis was partially supported, with some evidence of threat-related biases of attention observed.

Specifically, where the perceptual load of the task was low, results suggested a possible attention bias towards angry but not fearful facial expressions. Threat-related attention biases were not specifically related to physical abuse as suggested by previous research, however this may reflect the exposure of participants in both the Physically Abused and Other Maltreated groups of familial violence, either as a direct victim of violence (physical abuse) or as a witness to domestic violence (coded here as emotional maltreatment). That this threat-related attention bias was only present in the low load condition suggests a possible role for the effortful control of attention, which is required to filter out the further processing of task-irrelevant stimuli. These findings may suggest that maltreated adolescents show difficulties in the effortful control of attention to filter out task-irrelevant threat-related stimuli, which then impacts on processes of selective attention. Attention control processes were examined directly, using both emotional and non-emotional cues, again with tentative evidence that maltreated adolescents show general difficulties of attention control in the presence of non-emotional task-irrelevant stimuli. Consistent with previous research, this may have been associated with the presence of neglect (Beers and De Bellis, 2002, Bucker et al., 2012), being present across the maltreated sample generally. However, this study is underpowered to consider the relative effects of neglect compared to other forms of maltreatment, given the significant rates of co-occurrence in this sample.

These results should be considered tentatively, particularly as they were not borne out in initial analyses examining processes of attentional deployment for maltreated adolescents relative to their non-maltreated peers (**Chapter 4**), but rather when considering such processes amongst the Maltreated group only. However,

maltreated and non-maltreated adolescents significantly differed in performance across these tasks which may complicate direct comparison between maltreated and non-maltreated adolescents. First, maltreated adolescents responded with equivalent accuracy in the dot probe and non-emotional attention control designs, however responded significantly more slowly, even after shared variance associated with IQ was statistically removed. In contrast, maltreated adolescents responded with equivalent speed in the emotional attention control task, however this was offset by significantly poorer accuracy, again after shared variance associated with IQ was removed. These results may suggest a performance trade-off for maltreated adolescents relative to their non-maltreated peers, possibly akin to the "compensatory strategies" outlined by Eysenck and colleagues (Eysenck et al., 2007). This offers some suggestion that maltreatment is associated with difficulties in cognitive processes of attention.

8.1.3 Emotion Regulation: Cognitive Change

Cognitive change refers to those processes by which we draw meaning from or appraise environmental cues which can influence one's emotional arousal (**Chapter 5**). This study examined whether maltreated adolescents demonstrated negative interpretation biases, particularly with respect to their interpretation and expectations of the social behaviours of others. That is, whether maltreated adolescents tended to appraise the ambiguous social actions or expectations of others in more negative rather than benign ways. Again, previous research has produced mixed results, with negative interpretation biases observed in some (Dodge et al., 1995, Dodge et al., 1990, Keil and Price, 2009, Price and Glad, 2003, Shields et al., 2001) but not other (Downey and Walker, 1989, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008) studies.

It was hypothesised that maltreated adolescents, particularly those exposed to physical abuse and possibly emotional maltreatment, may demonstrate a negative interpretation bias. There was no evidence of any interpretation bias associated with maltreatment in this study with respect to expectations of the social behaviours of others, the interpretation of ambiguous social behaviours, and participants' perceptions of peers and themselves. However, this study differed from previous studies reporting the presence of interpretative biases (Dodge et al., 1995, Dodge et al., 1990, Keil and Price, 2009, Price and Glad, 2003, Shields et al., 2001), with adolescent rather than child participants as well as maltreated participants being in long-term alternate care. These differences may explain the absence of negative interpretation biases in this study, with more benign interpretations arising from non-maltreating carer-child relationships in foster care.

8.1.4 Social Understanding

In **Chapter 6** it was argued that, while maltreatment-related differences in cognitive processes of emotion regulation may contribute to the social difficulties of those exposed to maltreatment, cognitive processes of social understanding may also contribute to these difficulties (Crick and Dodge, 1994). Previous research has demonstrated maltreatment-related deficits in a number of aspects of social understanding, including understanding the internal mental states of others (Burack et al., 2006, Cicchetti et al., 2003, Colvert et al., 2008, Pears and Fisher, 2005), and emotional understanding and recognition (Fishbein et al., 2009, Gibb et al., 2009, Luke and Banerjee, 2013, Masten et al., 2008, Pears and Fisher, 2005, Perlman et al., 2008, Pollak et al., 2000, Pollak and Kistler, 2002, Pollak and Sinha, 2002), although few of these studies examined maltreated adolescents (Colvert et al., 2008, Masten et al.,

2008). As such, this study aimed to extend this research into adolescence, where peer relationships become more important (Steinberg and Morris, 2001).

It was hypothesised that maltreated adolescents would show relative deficits in mentalising and emotion understanding, particularly those exposed to neglect. Consistent with previous research in maltreated or institutionally deprived children (Cicchetti et al., 2003, Colvert et al., 2008, Pears and Fisher, 2005, Tarullo et al., 2007), this study found that maltreated adolescents also demonstrated poorer mentalising abilities than their non-maltreated peers. Further, there was some evidence that maltreated adolescents may also show difficulties in emotion understanding, associated with differences in IQ. That is, to the extent that group differences in IQ are associated with children's experiences of maltreatment, maltreatment may also be associated with poorer understanding of the social contexts in which emotions arise. This extends previous research showing maltreatment-related difficulties in emotion understanding and recognition in childhood (Barahal et al., 1981, Frodi and Smetana, 1984, Luke and Banerjee, 2013, Pears and Fisher, 2005, Perlman et al., 2008). While the task used in this study may not be the most ecologically valid, as noted in **Chapter 6**, this task builds on previous studies examining the understanding of emotion of maltreated children and adolescents (see Luke and Banerjee 2013).

Maltreatment-related difficulties in mentalising and emotion understanding observed in **Chapter 6** did not differ with respect to the relative presence or absence of physical abuse, suggesting that maltreatment-related difficulties in these areas are associated with other maltreatment subtypes such as neglect or emotional maltreatment. Previous research has linked mentalising difficulties with maltreatment (Pears and Fisher, 2005),

and significant neglect (Colvert et al., 2008), however such difficulties have also been associated with physical abuse (Cicchetti et al., 2003). With respect to emotion understanding, previous research suggests that physical abuse is associated with facilitated emotion understanding (Gibb et al., 2009, Masten et al., 2008, Pollak and Kistler, 2002, Pollak and Sinha, 2002), while neglect has been associated with deficits of emotion understanding (Pollak et al., 2000, Fishbein et al., 2009). In this study, in addition to general maltreatment-related difficulties, emotion understanding was also positively correlated with severity of physical abuse and negatively correlated with severity of emotional maltreatment. That is, physical abuse was associated with relatively facilitated emotion understanding, however emotional maltreatment rather than neglect was associated with emotion understanding deficits. There was no difference between well-adjusted and "at risk" maltreated adolescents with respect to their understanding of the internal mental states of others or their emotion understanding.

This study also examined the responding of maltreated and non-maltreated adolescents when faced with peer distress (**Chapter 6**). Previous research has demonstrated that maltreated children show fewer prosocial responses to peer distress (Klimes-Dougan and Kistner, 1990, Main and George, 1985) and evaluate inappropriate responses more favourably (Keil and Price, 2009, Sabourin Ward and Haskett, 2008, Teisl and Cicchetti, 2008), leading to the hypothesis that maltreated adolescents may likewise respond in less prosocial ways to peer distress. This hypothesis was supported. The studies listed above particularly focused on physically abused children rather than other maltreatment subtypes. This study extended this research, investigating prosocial

responding in adolescents as well as the patterns associated with the presence or absence of physical abuse in addition to other maltreatment subtypes. This study found that maltreated adolescents showed less prosocial responding in the presence of peer distress relative to non-maltreated peers. In general, maltreated adolescents did not appear to be affected by the introduction of the emotional cue in Block 3, failing to significantly alter their responding. Subsequent analysis in **Chapter 7** suggested that the relative presence or absence of physical abuse did not significantly alter this pattern. It is possible that reduced prosocial responding is associated with maltreatment generally, or with some other aspect of maltreatment that co-occurred in this sample. For example, exposure to violent interpersonal styles, rather than exposure to physical abuse, may be associated with reduced prosocial response patterns. As emotional maltreatment, which includes exposure to domestic violence, was equally present in both the Physically Abused and Other Maltreated groups, this may explain why these groups did not differ in their pattern of prosocial responding across Blocks. Further, the pattern of responding for well-adjusted maltreated adolescents did not significantly differ from that of their poorly-adjusted maltreated peers. The maximum level of distress displayed by the excluded child in Block 3 was significantly higher for maltreated participants, but did not differ on the basis of the presence of absence of physical abuse, or on the apparent adjustment of adolescents as rated by their primary caregiver. Similarly, the severity or co-occurrence of maltreatment subtypes, chronicity or age of onset were not significantly associated with the proportion of responding in the presence of the emotional cue, or the maximum distress level displayed in Block 3.

8.1.5 Mediating role

Maltreated adolescents then differ from their non-maltreated peers on key cognitive processes of emotion regulation and social understanding. Further, different maltreatment factors such as maltreatment subtype, severity, chronicity and co-occurrence influence the impact of maltreatment on these important cognitive processes. Differences in the function of these cognitive processes may also be associated with adolescent emotional and social outcomes, as scored by caregivers. Having examined these relationships, this study finally explored the hypothesised mediating role of cognitive processes of emotion regulation and social understanding in the relationship between maltreatment status and emotional and social difficulties (Loman et al., 2010) through a series of regression analyses (see **Section 7.3.3**).

Contrary to previous studies (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008), there was no evidence that performance on these behavioural measures of emotion regulation and social understanding mediated the relationship between maltreatment status and adolescent adjustment. However, analysis of the mediating relationship was significantly limited by the size of the current sample and the absence of additional overall measures of emotion regulation, as well as the inconsistencies between parent- or carer-report and adolescent self-reported difficulties.

8.2 Implications

8.2.1 Theoretical Implications

Overall, this study reported that maltreated adolescents differ from their non-maltreated peers in the operation of a number of cognitive processes. Maltreated

adolescents generally showed greater risk taking (specifically female participants), poorer mentalising skills, and difficulties with emotion understanding, as well as demonstrating less prosocial responding relative to non-maltreated peers. Maltreated adolescents did not significantly differ from non-maltreated peers with respect to conditioned avoidance, negative interpretation biases or threat-related attention biases and attention control, however results suggested that maltreated adolescents may display facilitated conditioned avoidance, attention biases towards threat and difficulties with attention control in the absence of emotional stimuli, although these effects were not strong enough to yield significant group differences. Additionally, results were also affected in some cases by maltreatment factors, with the presence of physical abuse associated with facilitated avoidance, while more severe physical abuse was associated with improved emotion understanding and more severe emotional maltreatment associated with impaired emotion understanding. More chronic maltreatment was associated with greater risk-taking for maltreated adolescent girls, while earlier onset of maltreatment was associated with greater risk-taking for maltreated adolescent boys.

These cognitive processes are associated with emotion regulation (Gross and Thompson, 2007) and the Social Information Processing model (Crick and Dodge, 1994), and as such are theorised to contribute to the emotional and social functioning, both adaptive and maladaptive, of children and young people. Processes of situation selection, attentional deployment and cognitive change examined in this study play an important role in emotion regulation, affecting the emotional impact of environmental cues. Cognitive processes of emotion regulation influence the type and magnitude of

the emotional experience, operating at different points of the emotion generative process and influencing down-stream as well as subsequent processes (Gross and Thompson, 2007, Gross, 2008). Such processes range from implicit, automatic processes to explicit, deliberate processes, however implicit processes may be particularly critical in an individual's day-to-day life and therefore adaptive or maladaptive functioning (Etkin et al., 2010, Gyurak et al., 2011, Mauss et al., 2007a). Further, processes may be considered antecedent or response-focused (Gross and Thompson, 2007, Mauss et al., 2007a), with antecedent-focused emotion regulation occurring early in the emotion generative process, prior to the emotional experience arising, and response-focused emotion regulation occurring after and in response to an emotional response. As such, this study focused on largely implicit processes of Situation Selection, Attentional Deployment and Cognitive Change, in order to begin to explore any maltreatment-related differences in the operation of cognitive processes of emotion regulation. In general, the operation of these implicit processes of emotion regulation showed patterns consistent with the development of emotional and social difficulties, including greater avoidance, impoverished attention control and threat-related attention biases, and, in the case of maltreated girls, greater risk taking. Each of these processes can also be considered antecedent-focused, occurring early in the emotion generative cycle.

The Social Information Processing model (Crick and Dodge, 1994) outlines a cyclic process of social situations, in which emotions, and the regulation thereof, play an important role, including the emotion regulation processes outlined above. However, a "database" of social skills is also proposed that is central to the processing of social information, including the ability to understand the internal thoughts, feelings and

intentions of others, and the ability to understand emotional stimuli. Previous research has demonstrated that cognitive processes of social understanding and social responding are also adversely affected by exposure to maltreatment (Luke and Banerjee, 2013). These social processes may also contribute to the social difficulties experienced by those exposed to maltreatment. Specifically, maltreated adolescents displayed difficulties understanding the internal mental states of others, difficulties of emotion understanding, and showed a less prosocial response pattern relative to non-maltreated peers. As discussed in previous chapters, this pattern of difficulties of social understanding is consistent with the development of social difficulties.

This study offers some evidence that suggests that physical abuse is associated with patterns of emotion regulation consistent with the over-representation of environmental threat or threat-related cues. In particular those exposed to physical abuse showed some evidence facilitated conditioned avoidance of threat-related social cues, although direct group analysis found no difference relative to maltreated peers not exposed to physical abuse. Conditioned avoidance is an implicit, antecedent-focused process of emotion regulation, and as such likely affects the emotional experience of physically abused adolescents in their daily life. If the facilitated acquisition of conditioned avoidance reflects increased sensitivity to threat-related cues, children and young people exposed to physical abuse may be more likely to be affected by cues associated with potential threats which may be likely to adversely affect their emotional experience on a daily basis. In addition to conditioned avoidance, such young people may be more likely to display defensive responses associated with the activation of the stress response system, prompting fight/flight/freeze responses, consistent with the

concept of 'defensive distance' in models of defense and anxiety (McNaughton and Corr, 2004).

Exposure to more severe emotional maltreatment was associated with difficulties of emotion understanding, however emotion understanding did not significantly differ between well-adjusted and poorly-adjusted maltreated adolescents. These findings may suggest that emotional maltreatment in particular may adversely impact on the development of emotion understanding, although this did not appear to impact on adolescent adjustment. Consistent with this, emotion understanding was not found to mediate the relationship between maltreated and adolescent adjustment.

Maltreatment more generally was associated with difficulties of social understanding and, for adolescent girls, risk-taking tendency. Rather than increased focus or sensitivity to threat-related cues, these difficulties are likely associated with a more generalised difficulty in regulating their emotional experience and broad difficulties of developing and understanding social relationships. Given the co-occurrence of maltreatment subtypes such as emotional maltreatment and neglect, this study was unable to disentangle the relative effects of the presence of these subtypes.

The Early Life Stress model (Loman et al., 2010) emphasises the pivotal role of such cognitive processes in the development of emotional and social difficulties associated with maltreatment. Previous studies have demonstrated the key role of emotion regulation in mediating the relationship between maltreatment and later difficulties (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008), however few of these studies focus on the specific cognitive processes by which this risk may be conferred (Shields et

al., 2001, Teisl and Cicchetti, 2008). However, one should also consider the dual concepts of equifinality, which notes that diverse processes may lead to a common outcome, and multifinality, which notes that divergent outcomes may arise from a given origin, when considering such developmental pathways (Cicchetti and Rogosch, 2002). As such, this study sought to clarify some of the cognitive processes that may contribute to the emotional and social difficulties of those exposed to childhood maltreatment, noting the heterogeneity of this population. On the basis of the Early Life Stress model and other associated models three key criteria were outlined in order to identify candidate processes. First, they would develop within parent-child relationships, and therefore be vulnerable to the absence of normative "serve and return" parent-child interactions. Second, in published literatures, they should be functionally linked with the fronto-limbic network, including the amygdala, prefrontal cortex, cingulated cortex and hippocampus, as these networks are known to be affected by maltreatment (Dannlowski et al., 2012, Hart and Rubia, 2012, McCrory et al., 2010, McCrory et al., 2011, Teicher et al., 2012, Tottenham and Sheridan, 2009). Third, variations in the operation of these cognitive processes should be associated with emotional and social difficulties.

Further, it was argued that given the overlap between emotion regulation and social information processes, aspects of social understanding that also meet these criteria may also contribute to the difficulties experienced by those exposed to maltreatment. In general, the results observed in this study are consistent with the contention of the Early Life Stress model. That is, while this study was unable to demonstrate the indirect path by which maltreatment increases risk of emotional and

social difficulties via differences in patterns of cognitive processes associated with emotion regulation and social understanding, the pattern of maltreatment-related differences in the cognitive processes of emotion regulation and social understanding explored here are consistent with research elsewhere demonstrating a link between such cognitive processes and emotional and social difficulties, as discussed in the respective chapters. While this is not strong evidence of this link, it provides some corroboration of this model, identifying a number of candidate processes and providing evidence of maltreatment-related patterns consistent with emotional and social difficulties. Therefore, this study draws attention to specific cognitive processes of emotion regulation and social understanding that may be affected by maltreatment and may contribute to the social and emotional difficulties of those exposed to maltreatment, building on previous research focused on maltreated children.

There is also some suggestion that maltreatment factors, including maltreatment subtypes, may affect which processes are affected and the nature of this impact. This is consistent with concepts of equifinality, in that similar outcomes in terms of emotional or social difficulties may reflect maladjustment of different cognitive processes. Importantly, this study extends existing research largely focused on the effects of maltreatment on child's cognitive processes into the adolescent period, a stage which is currently under-represented in the literature given the importance of this period (Cicchetti and Rogosch, 2002). Building on this foundation of research in children, this study suggests that many of the effects of maltreatment observed in childhood persist into adolescence, despite removal from the maltreating home environment and placement into foster families. The notable exception arising from this study was

interpretation bias, which was not observed in adolescence despite previous findings in younger samples (Dodge et al., 1990, Dodge et al., 1995, Price and Glad, 2003, Teisl and Cicchetti, 2008). It was argued that, in this case, it is possible that as a result of age or their experiences in foster care, adolescents in this sample may have overcome previously negative interpretation biases, or at the very least learned to answer such questions without bias even if they may display such bias in emotionally salient interactions, as suggested elsewhere (Luke and Banerjee, 2012).

While this study draws attention to the specific cognitive processes that may be affected by maltreatment and contribute to the emotional and social difficulties of which those exposed to maltreatment are at significantly greater risk, it is not an exhaustive list of possible contributing processes. As mentioned above, processes of emotion regulation can be categorised in terms of implicit or explicit, and with respect to the point in the emotion generative cycle in which they operate (Gross and Thompson, 2007). That this study focused on largely implicit, antecedent-focused processes leaves many processes that may operate explicitly and later in the emotion generative cycle that may nevertheless contribute to the emotional and social difficulties of this population. Similarly, additional aspects of social information processing may also be affected by maltreatment and contribute to the difficulties of this population. While this study is not exhaustive, it identified a simple checklist of the likely characteristics of such processes, based on the existing theoretical and experimental literature. That is, these processes should develop within parent-child relationships, be functionally linked to those brain regions affected by early

maltreatment, and be linked with the onset or maintenance of emotional or social difficulties.

8.2.2 Practical Implications

There are a number of practical implications arising from this study. First, this study contributes yet more evidence that those exposed to childhood abuse and neglect show significant difficulties. In particular this study found that adolescents in out-of-home care as a result of significant risk of harm arising from abusive or neglectful parenting were rated by their caregivers as having significantly greater emotional symptoms, conduct problems, hyperactivity and peer problems and fewer prosocial behaviours relative to non-maltreated peers, which had a significant impact on their daily lives. Additionally, standardised data associated with this screening measure suggest that maltreated adolescents were at least twice as likely to score in the top 10% for difficulties in these areas. These difficulties persisted for maltreated adolescents despite having spent on average more than 9 years in foster care. This finding emphasises the fact that the impacts of childhood maltreatment persists even after interventions to remove children and young people from maltreating home environments.

Interventions to improve outcomes for maltreated children and young people in foster care have been described as existing on a continuum, from least intensive services that screen and refer for supplementary supports through to intensive, multidimensional programmes to provide therapeutic foster care (Fisher et al., 2009). A number of intensive programs have been outlined (National Scientific Council on the Developing Child, 2012) noting that such interventions are more effective when

delivered early, such as prior to two years of age, although interventions later in childhood and adolescence have also demonstrated some efficacy (Leve et al., 2009). Such preventative interventions target parent-child relationships and promote positive behaviour and appropriate regulation (Dozier et al., 2006, Fisher et al., 2000, Leve et al., 2009, Lieberman et al., 2005), and may therefore be particularly beneficial in placing young people on a more positive developmental trajectory (Grogan-Kaylor et al., 2008). Such programs may be effective by enhancing the parent-child relationship such that those "serve and return" processes that are critical for the development of the above cognitive processes are restored, supporting the eventual repair of these processes. Interventions may also offer more specific interventions such as counselling and social skills training (Leve et al., 2009).

In addition to producing improved behavioural outcomes, such studies have also demonstrated biological effects, leading to improved stress response (Fisher et al., 2006, Dozier et al., 2006). Such behavioural and neurobiological alterations are likely essential to improving the emotional and social outcomes across the lifespan for those exposed to childhood maltreatment. Evidence suggests that the negative effects of maltreatment persist into adulthood and are associated with more abusive or neglectful parenting practices that contribute to the intergenerational transmission of maltreatment (Champagne and Curley, 2009, Weiss et al., 2011), including mechanisms for increased behavioural sensitivity to and neural representations of conditioned fear cues in subsequent generations (Dias and Ressler, 2014). More recent models emphasise the intergenerational transmission of resilience or vulnerability to stress via long-term adaptations of neural networks and processes associated with responding to stress

(Bock et al., 2014). These perspectives highlight the importance of providing effective interventions to support maltreated children and adolescents in order to promote more resilient outcomes and thereby intervene in this potentially damaging intergenerational cycle. Such interventions may therefore promote resilience in maltreated children and young people through effectively targeting the range of social, psychological and neurobiological factors that contribute to resilient functioning (Wu et al., 2013).

This study also draws attention to a number of specific cognitive processes of both emotion regulation and social understanding that may show evidence of impairment or maladaptation as a result of exposure to maltreatment. Further, these maltreatment-related effects are consistent with increased risk of emotional and social difficulties. These insights may be used to develop and evaluate interventions that aim to improve the emotional and social outcomes of those exposed to maltreatment. That is, if maladaptive patterns of these processes associated with maltreatment contribute to the risk of emotional and social difficulties, interventions that attempt to shift these processes to more adaptive patterns may be effective in improving outcomes for maltreated children and adolescents. While not exhaustive, the processes of emotion regulation examined in this study are largely implicit, antecedent-focused processes that influence the type and extent of emotional experiences that arise through engagement with emotional cues in the environment. Such processes are considered to be central to day-to-day emotional processes (Etkin et al., 2010, Gyurak et al., 2011, Mauss et al., 2007a), and are therefore perhaps likely to play an important role in both adaptive and maladaptive emotion regulation. Such processes are also broadly considered to be amenable to change (Todd et al., 2012), with research exploring such paradigms for the

modification of both attention and interpretation biases (Eldar et al., 2012, Lothmann et al., 2011, Telman et al., 2013). Such interventions may even be “gamified” and delivered via modern mediums (Dennis and O'Toole, 2014) that may be particularly engaging for young people. Interventions that target cognitive processes such as trauma-focused cognitive behavioural therapy (TF-CBT) have been demonstrated to be effective in helping children and young people to recover from early trauma such as abuse and neglect (Leenarts et al., 2013).

Targeted interventions may also aim to address social understanding in addition to emotion regulation processes. Such interventions have been developed to be delivered through “after-school programs”, and have been demonstrated to effectively improve self-perceptions and promote more positive or prosocial behaviours as well as improved academic outcomes (Durlak et al., 2010, Durlak et al., 2011). As those exposed to maltreatment are more likely to perform relatively poorly at school (Townsend, 2012, Veltman and Browne, 2001), such programs may be particularly well suited to improving outcomes for those exposed to childhood abuse and neglect.

The emotional and social as well as educational outcomes of children in out-of-home care may therefore be improved by adopting such interventions either universally, or following comprehensive screening procedures to identify those young people most at risk. Extensive evaluations of such approaches including large scale randomised controlled trials are reportedly underway (Fisher et al., 2009), and are critical to the development and implementation of evidenced-based interventions for children and young people in foster care. This and other studies demonstrating maltreatment-related differences in cognitive processes of emotion regulation and social understanding

suggest that interventions may be improved if supplemented by some of the above training paradigms in order to directly modify biases that may be contributing to the difficulties experienced by maltreated children and adolescents. Specifically, as different experiences of maltreatment may tend to affect particular processes (such as facilitated acquisition of conditioned avoidance being associated with physical abuse), targeted interventions may be developed to address specific maladaptive processes on an individual basis. In practice, initial assessment of such cognitive processes may be included early in each child or young person's journey through child protection systems in order to identify maladaptive processes and to tailor interventions accordingly, perhaps as part of comprehensive assessments (Chambers et al., 2010). However, it is noteworthy that recent research has suggested that neurodevelopmental disorders associated with the symptoms commonly seen in maltreated samples, and reflected in the carer-reported SDQ data here, tend to cluster, and that broader interventions to address all related symptoms may be more beneficial (Pettersson et al., 2013).

Interventions may be particularly critical to those exposed to multiple maltreatment subtypes, with greater co-occurrence associated with greater difficulties, consistent with previous studies (Edwards et al., 2003, Teicher et al., 2006). Further, the above mentioned intergenerational implications (Bock et al., 2014) suggest that interventions may also be effectively delivered for maltreated children and adolescents in adulthood, in order to support those exposed to abuse and neglect to provide positive and nurturing care to their own children. The state may be particularly morally obliged to provide such interventions for those children for whom it has assumed parental responsibility, and would hinge on the development and maintenance of a positive and

supportive relationship between child protection services and children and young people across the lifespan.

These considerations emphasise that while maltreated adolescents may share a number of characteristics, there may also be significant differences within this group. In addition to differences with respect to the impact of experiences of maltreatment on emotion regulation and social understanding, this study also outlines that despite the apparent long-lasting impacts of childhood maltreatment, a not insignificant subset of children and young people exposed to abuse and neglect nevertheless display adaptive functioning. Within this sample, some 39% were rated by their caregiver as following in the "normal" range with respect to total difficulties as measured by the SDQ, or 26% were rated as falling in the "normal" range for at least four of the five SDQ subscales. Other studies have likewise identified a subset of those exposed to maltreatment that display resilient functioning. For example, Dumont et al (2007) reported that approximately 39% of adolescents and 30% of young adults exposed to early maltreatment demonstrated resilience, while in another study 22% of adults exposed to childhood maltreatment were identified as displaying resilience (McGloin and Widom, 2001). Studies have consistently reported small but not insignificant subsets of resilient maltreated children and young people, although significant fluidity of resilient functioning over time has also been reported (Cicchetti, 2013, DuMont et al., 2007). Importantly, this study found that those maltreated adolescents that were rated by carers as showing "normal" levels of difficulties did not significantly differ from their relatively poorly-adjusted maltreated peers with respect to the presence or severity of maltreatment subtypes, age of first report, chronicity, or placement variables such as

age at entry to care or the number of placements. As noted above, those in the "well-adjusted" group experienced on average fewer maltreatment subtypes to their poorly-adjusted maltreated peers, consistent with previous studies (Edwards et al., 2003, Teicher et al., 2006). Well-adjusted and poorly-adjusted maltreated adolescents did not differ with respect to their acquisition of conditioned avoidance, risk-taking tendency or social understanding. That is, particular aspects of emotion regulation and social understanding that showed significant maltreatment-related differences did not significantly differ between well-adjusted and poorly-adjusted maltreated adolescents.

Finally, the evidence outlined in this and other research regarding the maladaptive development of key cognitive processes of emotion regulation and social understanding also indicate some of the likely difficulties that maltreated adolescents are likely to encounter, at home, at school and in their relationships with peers. In particular, the emotion regulation difficulties revealed in this study are hypothesised to operate implicitly in their engagement with their environment. Therefore, if maltreated adolescents do in fact display particular patterns of such processes including facilitated acquisition of avoidance, threat-related attention biases, and greater risk-taking tendency, they may be more likely to perceive the world as a more threatening place, and more likely to develop maladaptive responses. This may lead to apparently incongruent responses, with such cues activating fight or flight responses that appear unwarranted or inexplicable to caregivers, teachers and peers. These difficulties may contribute to placement stress and breakdown and impair engagement or lead to exclusion from school. Additionally, these difficulties may also contribute to impaired academic performance (Townsend, 2012), particularly difficulties with attention control

(Slade and Wissow, 2007), which are likely to significantly limit future opportunities. These issues reinforce the need to ensure that important individuals that provide the daily care and guidance for maltreated adolescents understand the cognitive and behavioural impacts of exposure to maltreatment, and are also supported in their role in order to produce the best possible outcomes for these vulnerable young people.

8.3 Limitations

There are a number of broad limitations to consider when interpreting these findings, in addition to those more specific limitations outlined in previous Chapters. First, the maltreatment sample is a relatively diverse sample with respect to the nature of their experiences of abuse and neglect as well as subsequent experiences through the child protection system. Differences in their experiences of abuse and neglect such as subtypes, severity, chronicity and developmental timing may meaningfully affect the impacts of maltreatment. For example, two siblings exposed to the same experiences of abuse and neglect (for example, domestic violence) might reasonably be expected to differ in terms of the impacts of these events due to individual differences in maturity, neuropsychological development, and the social expectations and meanings drawn from the same event. Although, as noted previously, this is consistent with the reality of maltreating parent-child interactions, this aspect limits the ability to disentangle the relative effects of different aspects of maltreatment, particularly given the limited sample size. Future studies involving considerably larger samples would allow these within-group differences to be explored in much greater detail, providing important insights regarding the impacts of maltreatment.

Additionally, despite efforts to accurately code and account for maltreatment experiences, this information relies solely on the reports collected and investigated by the state child protection service. This decision was driven by the strengths of such approaches, including access to outcomes from casework investigations, the existence of a comprehensive coding system and the apparent alignment between socio-legal definitions within the study's jurisdiction and coding classifications, giving confidence that file information was the best information available regarding the possible maltreatment experiences of all participants. However, this information is also limited. Most notably, such information relies on maltreating families to come to the attention of child protection services, which may not reliably occur in the very early years of life before many families engage with external services such as schools or child care centres. As such, records regarding the maltreatment experiences suffered in the earliest years of life are likely to be the least reliable, despite this period arguably being the most critical in terms of development, as outlined by models of maltreatment (Loman et al., 2010). In addition to the accurate identification of maltreatment subtypes, these limitations may particularly affect factors such as chronicity and age of onset, and may explain why these factors were not significantly associated with emotional and social difficulties as expected. Additionally, this limitation carries the small but notably risk that participants within the Non-maltreated group may have also been exposed to maltreatment of some kind that did not come to the attention of child protection services. While appropriate steps were taken to ensure those in the Non-maltreated group were in fact free from maltreatment experiences, there is still the possibility that this is not the case.

Further, individual reports differ on the extent to which they are or even can be investigated or confirmed. Allegations of physical abuse might be well substantiated with medical records, whereas the impact or even presence of emotional maltreatment or neglect may be much harder to establish. While such reports are assessed on the balance of probabilities and in light of previous reports in establishing whether a child or young person should enter care, this threshold is arguably inadequate for the purposes of such studies. While some of the effects of these limitations may be mitigated by the consideration of other sources of data, including questionnaire and interview methodologies, such approaches are also prone to limitations (Barnett et al., 1993).

This study is also limited by the relatively small sample size, particularly given the diversity inherent in the maltreated sample as discussed above. As a result, the ability to examine maltreatment related differences, and in particular examine the hypothesised model in which emotion regulation and social understanding are held to mediate the relationship between maltreatment and emotional and social difficulties is limited by a lack of power. Likewise, the issues of non-independent sampling outlined in **Chapter 2** also introduces difficulties to this data. As outlined previously, the data was also examined excluding participants that were biologically related, finding a consistent pattern of results as those reported here, taking into consideration the limited statistical power arising as a result of reducing the sample size in this way. As such, there can be some confidence that the non-independence of some participants does not significantly affect the overall results of this study.

This study focused on a particular class of emotion regulation processes, namely those that are largely implicit, antecedent-focused. However, there are additional processes that are likely to affect the emotion regulation or dysregulation of maltreated adolescents which could be included in future studies. The ability to explore the hypothesised mediating role of emotion regulation processes relative to other similar studies was likewise limited, as while the explored processes align with the construct of emotion regulation, how they relate to other common measures of emotion regulation is unclear. Additionally, while the use of behavioural measures reflecting specific cognitive processes provides important insights into particular mechanisms of risk for maltreated adolescents, it introduces possible difficulties of measurement error with respect to the extent to which it reflects or contributes to the over-arching construct of emotion regulation. As such, this study would have benefited from the inclusion of other measures of emotion regulation such as the Emotion Regulation Q-Scale (Shields and Cicchetti, 1997) commonly utilised elsewhere (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008). However, this intensive, naturalistic observational measure was not logistically possible in this study, as it usually relies on a camp setting in order to gain the necessary insight into each participant.

Attachment mechanisms may likewise contribute to emotional and social difficulties but do not fall in the scope of our study which focused on processes of emotion regulation and social understanding. In particular, attachment has been found to influence social and emotional outcomes in maltreated individuals, possibly through its effects on emotion regulation (Alink et al., 2009). While this research focused

specifically on cognitive processes of emotion regulation and social understanding, future research could also include attachment in order to investigate its relationship with both emotion regulation and emotional and social outcomes.

Significant differences between groups in terms of individual differences in IQ, or household factors such as parent education and socio-economic status are also worth discussing. As outlined by Miller and Chapman (2001), such factors cannot simply be "controlled for" by including them as covariates in analyses of variance. Further, such differences may in fact introduce meaningful differences between maltreated and non-maltreated participants that contribute to differences in outcomes. As such, including these factors as covariates removes some of this important variance. In this study, IQ was included in each analysis in order to first explore whether this factor shared a significant relationship with task performance. Follow-up analysis generally examined task performance without removing shared variance of IQ, in line with Miller and Chapman's (2001) point that this group difference may in fact be a critical between groups difference, with removal of this shared variance affecting the meaningful relationship between maltreatment status and task performance.

Familial factors introduce yet another source of contention, with the foster families of those in the Maltreated group significantly differing both in terms of parental education and family income. That maltreated adolescents were reported as being from households with lower incomes and lower educational attainment is arguably of concern. Lower socio-economic status has been associated with psychopathology (Flouri et al., 2010a, Flouri et al., 2010b), and may therefore represent a potential confound in this study. Further, it has been argued that differences in emotion

regulation may mediate the relationship between socio-economic status and psychopathology (Chen and Miller, 2014). As such, the observed difference between maltreated and non-maltreated children observed in this study may present one significant confound. It was not possible in this study to determine the parent education or socio-economic status of maltreated participant's birth families, as this data is not kept on file. It is therefore not clear to what extent changes in socio-economic status from birth to placement into statutory care might impact on differences between groups, or if current foster family factors would form a meaningful point of comparison. As such, it was decided to base the recruitment of the comparison sample not along socio-economic lines, but instead in terms of local regions, such that the comparison group was, as much as possible, comprised of the neighbourhood and school peers of maltreated participants. However, these factors may still have played a meaningful role in the differences in emotional and social difficulties and processes of emotion regulation and social understanding. Future research should endeavour to match participants more closely on these features.

There was a significant and unexpected discrepancy between self-reported and carer-reported symptom measures observed in this study, with maltreated adolescents not reporting significantly greater anxious or depressive symptoms relative to their non-maltreated peers, while carers reported maltreated adolescents to display greater difficulties with significantly greater impact relative to parent reports of their non-maltreated biological children. This may reflect maltreated adolescents reporting a relatively "normalised" experience from their individual perspective, given that the self-report questionnaires ask adolescents to indicate how often they experience a particular

emotional state, or apparent dissociation or avoidance of their own emotional state as one method of emotion regulation. Conversely, carers of maltreated adolescents may be somewhat prone, through their experience as carers, to somewhat "over-report" difficulties. Previous research suggests that foster carers show good agreement with teachers with respect to externalising symptoms, but poor agreement with respect to internalising symptoms (Tarren-Sweeney et al., 2004), although agreement with teacher report may not necessarily be indicative of accuracy with respect to adolescent's difficulties, particularly with respect to internalising symptoms. Given that rates of difficulties in this study are largely consistent with other research in domestic and international jurisdictions, it seems reasonable to have some confidence in the ratings of parents and carers with respect to the difficulties of adolescents in this sample. Regardless, this apparent inconsistency limits our understanding of the actual difficulties of maltreated adolescents in this sample relative to their non-maltreated peers. The inclusion of an additional source, such as teacher-reported difficulties, may help to resolve this issue.

Further, as recruitment was conducted via foster care providers, it is possible that this led to a somewhat non-random sample. That is, particular foster carer households may have been more or less likely to engage with this research project. However, it is unclear whether this would introduce a particular bias. For example, foster families with positive, supportive relationships with their foster care provider may be more likely to engage, and, as a result of this support, have generally better than average outcomes for those in their care. Alternatively, some carers appeared to prefer to limit their involvement with foster agencies, including this research, in order to

operate as a more normative family unit. That all maltreated participants had been removed from their family, a traumatic experience in itself, is another potential issue, making it impossible to disentangle the effects of removal from those of maltreatment. However, all children and young people in foster care share this experience, and this issue, while introducing some minor difficulties, is representative of the target population.

8.4 Future Directions

This study explored the impact of childhood maltreatment on emotion regulation and social understanding and their role in the relationship between maltreatment and adolescent emotional and social functioning. In particular this study extended previous research by focusing on specific cognitive processes of implicit, antecedent-focused emotion regulation and social understanding, including processes of situation selection, attentional deployment and cognitive change, as well as mentalising ability, emotion understanding, and prosocial responding. Further, this study extended previous research focusing on these maltreatment-related processes in child samples to the relatively under-studied adolescent period. Finally, efforts were made examine the relationship between such processes and significant features of the maltreatment sample, such as maltreatment subtype, severity, chronicity, co-occurrence and age of onset, as well as current functioning. The results of this study were generally consistent with existing models of the impact of maltreatment which suggest that early exposure to inappropriate or unresponsive parent-child relationships (that is, parental abuse or neglect) affects the development of critical neuropsychological mechanisms associated with the stress response system, which in

turn affects cognitive processes of emotion regulation, which in turn affects social and emotional functioning.

Future research efforts may seek to build on this and other studies in a number of ways. Such studies may address the limitations outlined above, involving a significantly larger sample, or clarify the mixed results observed such as those regarding conditioned avoidance, threat-related attention biases and attention control. Future research may also explore additional aspects of emotion regulation. In particular, more explicit processes, or those that operate later in the emotion generative cycle may be explored. Further, the extent to which experimental measures of these cognitive processes, such as those utilised here, align with other commonly used measures of emotion regulation such as the Emotion Regulation Q-Scale (Shields and Cicchetti, 1997), and the relative contribution of different cognitive processes to the emotional and social difficulties of maltreated children and adolescents. Such studies could also explore the relative effects of different maltreatment factors, in order to better clarify the likely pathways through which experiences of abuse and neglect confer risk of greater emotional and social difficulties.

As noted above, interventions that seek to modify these processes may be particularly effective for this sample. Future studies are needed to test the efficacy of such programs, such as attention bias modification paradigms, for maltreated adolescents. Such interventions may prove to be useful additions to existing programs that seek to improve outcomes for this vulnerable population.

This study would also be significantly enhanced by the inclusion of an imaging component, examining the structural and functional differences of key neural networks

associated with these cognitive processes. As noted in previous chapters, Loman and Gunnar (2010) suggest that both genetic and environmental contexts interact within maltreating parent-child relationships leading to structural and functional alterations of important neurobiological systems, which in turn affect cognitive processes of emotion regulation. While this study has focused on cognitive processes of emotion regulation and related processes of social understanding, particularly those that rely on parent-child interactions for their development and are functionally related to those neural networks known to be affected by maltreatment, this nevertheless provides only indirect support for the model as proposed. While this study provides additional evidence, particularly in adolescents, of maltreatment-related differences in important cognitive processes and is consistent with previous studies supporting this broad model, future research would benefit from the inclusion of additional biological and neuropsychological measures to investigate the model's claims directly. Such research may possibly reveal particular sub-groupings of maltreated children or adolescents with particular patterns of emotion regulation or difficulties in social understanding, perhaps associated with aspects of their maltreatment experience or genetic vulnerabilities, as well as help our understanding of those features that promote resilience (Daskalakis et al., 2013).

Of particular importance to future research in this area is the development of meaningful relationships with those systems and services that share these fields. This is particularly critical in the area of child protection and out-of-home care, which is very sensitive area with respect to community expectations and, more importantly, the rights of the children and families they serve. Relationships between researchers and statutory

authorities and out-of-home care service providers are critical to improving outcomes for those exposed to maltreatment. Researchers gain valuable insights from the experience of front-line workers, young people and foster families regarding the lived experience and difficulties facing young people recovering from early adverse care in order to develop and refine empirical models, setting the foundations for the continued development of evidenced-based approaches that work to improve the outcomes of children and young people. Practically, such relationships may facilitate large scale longitudinal projects that are essential given the diversity inherent in child maltreatment samples and the influence of ongoing developmental processes. Such studies would address many of the limitations evident in this study, resulting in a clearer understanding of the effects of maltreatment and the challenges and strengths of maltreated children and young people and contribute to the ongoing evaluation and improvement of services in order to provide maltreated children and young people with the best life opportunities possible. Initial research may begin by the regular reporting of important benchmark data, particularly those that are routinely collected by statutory child protection authorities and other government agencies such as education or health outcomes, to focus political and policy efforts on addressing the myriad of difficulties facing those recovering from child abuse and neglect, similar to those that exist to "Close the Gap" associated with Aboriginal and Torres Strait Islander disadvantage (see https://www.coag.gov.au/closing_the_gap_in_indigenous_disadvantage).

Child protection systems represent the community's standard for appropriate parental care, and intervene where the child is at "risk of significant harm". Interventions that include the removal of a child or young person from their families and

assuming parental responsibility is seen as a last resort in order to protect the child from harm. This action, while removing the child from harm and seeking to provide a safe and caring home, carries with it the obligation to ensure children and young people receive the appropriate care and services to overcome the adverse effects of maltreatment and to equally enjoy the opportunities present in society, in accordance with the child's human rights; opportunities that are likely to be significantly limited by the presence of emotional and social difficulties. Ongoing development and evaluation of child protection and out-of-home care systems and interventions delivered at the individual, familial and community levels are essential in order to meet these obligations, which are in turn built on the foundations provided by developmental models of maltreatment and normative development, in line with the developmental psychopathology perspective. As such, ongoing research of these models is essential.

8.5 Conclusions

Overall, this study emphasises that maltreated adolescents differ from their non-maltreated peers in the function of a range of cognitive processes associated with emotion regulation and social understanding, which may contribute to the emotional and social difficulties experienced by those exposed to maltreatment. While previous studies have emphasised the mediating role of emotion regulation in the relationship between maltreatment and emotional and social functioning (Kim and Cicchetti, 2010, Maughan and Cicchetti, 2002, Shields et al., 2001, Shields and Cicchetti, 2001, Teisl and Cicchetti, 2008), this study focused on the role of specific cognitive processes associated with emotion regulation, as well as the contribution of social understanding. These include greater risk taking (in the case of maltreated girls), impaired mentalising ability

and emotion understanding as well as less prosocial responding in the presence of cues of peer distress. While there were no significant differences between maltreated and non-maltreated participants with respect to conditioned avoidance, threat-related attention, attention control or interpretation bias, there was some evidence that maltreated adolescents may exhibit facilitated acquisition of conditioned avoidance, threat-related attention biases and impoverished attention control, with further studies required to clarify these mixed results. Further, exposure to different maltreatment subtypes affected some of these processes in different ways. These results were generally consistent with previous studies exploring such processes in maltreated children, demonstrating that many of these issues identified in childhood persist into adolescence. Given the important role of these processes in social development (Crick and Dodge, 1996) and the social orientation of adolescence (Steinberg and Morris, 2001), that these processes remain affected into this period may be particularly problematic for maltreated young people. However, some aspects of emotion regulation, in particular interpretation bias, were not found to significantly differ from non-maltreated peers, which may reflect that such impairments may eventually recovery, either as a result of development or as a result of removal from the maltreating family context and placement within foster care.

These results provide additional evidence regarding the social and emotional development of those exposed to childhood abuse and neglect, consistent with models (Loman et al., 2010) emphasising that maltreatment affects the development of cognitive processes of emotion regulation and social understanding which in turn place children and young people exposed to early maltreatment at increased risk of social and

emotional difficulties. This evidence further highlights the hypothesised importance of these processes, and suggests that interventions that aim to improve the emotion regulation and social understanding of maltreated children and adolescents, such as attention bias modification, may be particularly effective in improving outcomes for maltreated children and young people.

While maltreated adolescents (and indeed all adolescents) differ in their emotion regulation patterns and social understanding, this fact reminds us that "one-size fits all" interventions may possibly be supplemented by targeted interventions to address specific cognitive processes that may enhance their effectiveness. As outlined above, interventions to alter implicit processes of emotion regulation such as attention and interpretation biases are showing some efficacy with respect to anxiety. Similarly, interventions could target deficits in social understanding such as mentalising and emotion understanding, in order to better equip children and adolescents with the social skills required to negotiate adolescence. Effective interventions will assist young people in overcoming the risks associated with early abuse and neglect, and intervene in the intergenerational transmission of trauma and trauma-related symptoms.

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Appendix 1: Pilot of Avoidance Conditioning Task

A1.1: Introduction

To determine the best way to study avoidance, a pilot was conducted to test the effectiveness of a hybrid conditioned avoidance paradigm, drawing on the methodologies employed by Field and Lawson (2003) and Lau and Viding (2007) . This approach investigated behavioural avoidance of conditioned stimuli, utilising profile photos of fictional adolescent peers that were paired with negative (antisocial), positive (prosocial) or neutral descriptions of that peers character. Field and Lawson (2003) showed that information can be used as an aversive stimulus using a paradigm that described small marsupials about which participants were naive in negative, positive or neutral terms. Children showed an increase in self-reported fear beliefs as well as behavioural avoidance of animals associated with negative information, being less willing to approach a box said to contain the animal, whereas the opposite pattern was observed for an animal described in positive terms. Profile photos associated with antisocial characteristics then served as an aversive stimulus in a subsequent conditioning paradigm adapted from Lau and Viding (2007) in which participants were asked to select between two shapes, one of which was paired with the aversive stimulus. The other shape was paired with the profile photo described in neutral terms. In contrast with Lau and Viding (2007), both profile photos displayed a neutral facial expression, with the aversive aspect being conferred by the provided information, with the shapes coming to serve as conditioned stimuli for each of the profiles. Selection of the shape associated with neutral rather than the antisocial profile would reflect conditioned avoidance of this aversive stimuli. As such, this task sought to examine behavioural avoidance within a social context, based on third-party information regarding an

adolescent's character. Avoidance emerging in this context would likely have significant implications for the social relationships of young people.

A1.2: Method

Eighty-five students were recruited from a school in New South Wales, Australia, to complete this task within the classroom environment. Participants were provided with a brief description of 3 young people matched to sample age and participant gender. Of the three profiles, one described a friendly child ('positive' stimulus), one an unfriendly child ('negative' stimulus), and the third provided neutral ('neutral' stimulus) biographical information. Descriptions were matched on length. A photo displaying a young person with a neutral facial expression was paired with each profile so the emotional salience of each identity was via the description. Images were presented in colour, and counterbalanced across profile condition. The three images and accompanying descriptions were presented on a single A4 sheet of paper.

After reading each profile, participants completed a computer task (see **Figure 3.1**) based on the cards task reported by Lau and Viding (2007) which asked participants to select from two decks of cards, marked with either a circle or a triangle. Participants were told they would receive points for the deck that they selected and were encouraged to discover which deck provided the most points by sampling from each, before picking consistently from whichever deck they felt gave the most points. The mechanics of this task including dependent variables and inclusion criteria is as described above (**section 3.2.1.1**), however face stimuli associated with each deck were both displaying a neutral expression. Rather, the valence associated with each profile photo (negative or neutral) was provided by the profile information describing that adolescent's character, with one paired with the negative profile, and the other with the

neutral profile. Therefore, the emergence of avoidance on this task would rely on participants viewing the adolescent paired with the aggressive profile as aversive, with the deck associated with that adolescent's profile picture coming to serve as a conditioned stimulus predicting the onset of that aversive stimulus.

As this pilot was focused on whether this paradigm could effectively produce conditioned avoidance, analysis involved a one-sample t-test was used to compare overall preference score against the hypothetical chance (0.5) level, in order to establish whether there was any apparent avoidance of any particular stimuli.

A1.3: Results

It was noted that a large proportion of participants had a high rate of invalid trials. Participants with fewer than 50% valid trials in any given Block were excluded from analysis, on the basis that this reflects lack of engagement with the task. 32 participants were excluded as a result, producing a final sample of 53 participants (62%).

A one-sample t-test compared overall Preference scores against the hypothetical chance level (0.5). Scores significantly lower than 0.5 would reflect general avoidance of the deck associated with the negative peer. The observed mean Preference (Mean=0.49, SD=0.27) did not significantly differ from chance ($t(53)=-0.239$, $p=0.812$), suggesting that there was no evidence of avoidance observed in this task.

A1.4: Discussion

This pilot sought to explore conditioned avoidance in a sample of adolescents drawing on two previous conditioning paradigms (Field and Lawson, 2003, Lau and Viding, 2007). Given the importance of social cues, and social threat cues, in adolescence (Steinberg and Morris, 2001), social information was used to provide information about

fictional “peers”, drawing on previous research demonstrating the effectiveness of threat-related information in subsequent behavioural avoidance (Field and Lawson, 2003). Negative information describing a fictional adolescent as aggressive and antisocial therefore would imbue that adolescent (and the associated profile photo) as an aversive stimulus. The cards paradigm developed by Lau and Viding (2007) was used to test the emergence of conditioned avoidance of the profile picture paired with a negative profile relative to another profile photo paired with neutral information. Each profile photo was consistently paired with a specific deck, designated by a geometric shape, which would become conditioned stimuli predicting the onset of either the aversive or neutral profile photo. This task differed from that of Lau and Viding (2007) in that neutral facial expressions were associated with both decks, relying instead on the information provided as per Field and Lawson (2003). This pilot found no evidence of conditioned avoidance in a community sample of adolescents, suggesting that this hybrid paradigm was not effective in producing conditioned avoidance. This could be due to the stimuli used in this pilot not having sufficient emotional salience for adolescents, relative to previous studies using threat related information regarding animals that later asked children to approach a box said to contain this animal (Field and Lawson 2003), or the use of important social cues, specifically emotionally salient facial expressions (Lau and Viding, 2007). It is also possible that participants saw through this task and the fact that the “peers” were fictional and not likely to be encountered, and therefore was not sufficiently emotionally provocative. Further, this pilot suffered from unusually high rates of apparent disengagement, with more than a third of participants excluded as a result of RTs quicker than 200ms, and therefore were unlikely to be responding to the location of the particular deck of their choice which might change

from trial to trial, but rather responding as quickly as possible regardless of the position of each deck to complete the task. It is likely that this was driven by the classroom approach, and a lack of interest in the task more generally.

Based on the results of this pilot, it was decided to utilise the conditioning paradigm developed by Lau and Viding (2007) in the subsequent study of avoidant conditioning in maltreated adolescents. This task has previously proven effective in eliciting conditioned avoidance (Lau and Viding, 2007), and utilises socially relevant cues (facial expressions of anger) as the UCS. Social cues are likely to be particularly salient to adolescence (Steinberg and Morris, 2001). This task would also be more time efficient, and less fatiguing for participants, and therefore more likely to hold their attention within the larger experimental battery.

Appendix 2: Selective Attention Pilot Study:

A2.1: Comparison of Task with Different Versions of the Low Load Condition

A.2.1.1: Methods

Participants

Nineteen female participants aged 15-18 years recruited from schools in the UK participated in an initial pilot. In particular, two versions of the low perceptual load manipulation were trialled: one involving a uniform string of targets (XXXXX) offset by a uniform string of non-targets (OOOOO), and another in which the target was included in a string of dissimilar non-targets (OXOOO) against a string of non-targets (OOOOO). While both versions are appropriate to the essential features of the dot probe task, the latter is most similar to the attention control task in that it includes a target search, facilitating direct comparisons. However, I first wanted to examine which of the two approaches would maximise differences relative to the high load condition. Participants were randomly allocated to complete one of two versions of the task, creating two

groups. Both Low and High perceptual load conditions were created. This study was reviewed and approved by the Oxford University Human Research Ethics Committee.

Dot Probe Task

The dot probe was conducted as outlined above (**section 4.2.2**). In this pilot, only angry emotional stimuli (facial expressions) were used, leading to a total of 160 items (**see Figure A2.1**).

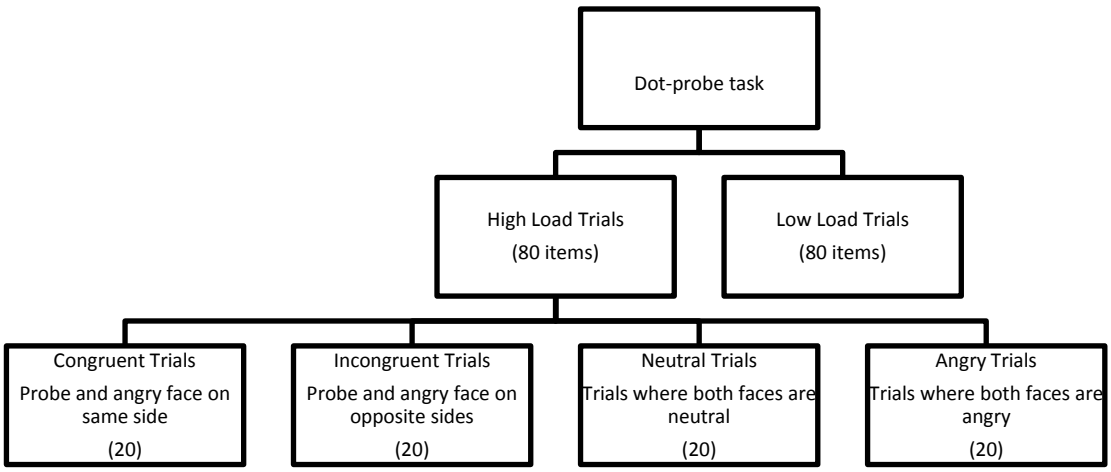

Figure A2.1: Design of the dot-probe task - pilot

Procedure

Prior to the sessions, adolescents and their parents received information about the study and were asked to provide written consent. In the session, there was an opportunity for participants to ask further questions. Participants then completed questionnaire measures of anxiety using the STAI-T detailed previously. All participants then completed the dot probe task, before being debriefed about the nature of the study. Participants completed the pilot study in their school classroom on uniform laptop computers running E-Prime 2.0 software.

Analysis

The main variables of interest were **Accuracy** and **RT** data within each trial type. With respect to **RT** data, only those trials in which the location was accurately reported, or where RTs were slower than 200ms and not more than two standard deviations beyond that participant's mean were included, consistent with other similar studies (Pine et al., 2005).

As the purpose was to compare to two version of Low Load, Accuracy scores and RTs in each of the Low Load conditions were compared across the two versions used. Two mixed measures analyses were used, with Condition (Congruent/Incongruent) and Load (Low/High) as within subject variables and Group (Version 1, Version 2) as a between subject variable. First, independent sample t-tests examined group differences in Age and Anxious Symptoms.

A2.1.2: Results

T-tests revealed that groups did not differ significantly in terms of Age (t(17)=-0.513, p=0.615), however there was a significant difference of Anxious Symptoms (t(17)=2.475, p=0.024) (see **Table A2.1**). As such, Anxious Symptom scores were included as a covariate in subsequent analyses.

Table A2.1: Descriptive data for Attention Pilot

Table 4.4	Version 1	Version 2	Significance
N (all female)	9	10	
Age	16.67	16.50	p=0.615
STAI	28.44	19.20	p=0.024

Accuracy showed no significant main effect of Load ($F(1,16)=0.903$, $p=0.356$, partial $\eta^2=0.053$), Congruence ($F(1,16)=3.014$, $p=0.102$, partial $\eta^2=0.159$), Version ($F(1,16)=0.835$, $p=0.375$, partial $\eta^2=0.05$), or Anxious Symptoms ($F(1,16)=0.669$, $p=0.426$, partial $\eta^2=0.04$). However there was a significant Condition X Anxious symptoms interaction ($F(1,16)=5.400$, $p=0.034$, partial $\eta^2=0.252$), with correlations revealing that Anxious Symptoms were significantly negatively correlated with accuracy in the incongruent condition ($r=-0.504$, $p=0.028$) but not the congruent condition ($r=0.291$, $p=0.227$). No other effects were significant (all p's>0.31).

RTs showed a significant main effect of Load ($F(1,16)=10.223$, $p=0.006$, partial $\eta^2=0.390$), with participants responding significantly more quickly when the perceptual load was low. There were no main effects of Version ($F(1,16)=0.703$, $p=0.414$, partial $\eta^2=0.042$), Congruence ($F(1,16)<0.001$, $p=0.998$, partial $\eta^2<0.001$), or Anxious Symptoms ($F(1,16)=1.672$, $p=0.214$, partial $\eta^2=0.095$), nor any interactions thereof (all p's>0.42). Importantly for the purpose of this analysis, neither Accuracy nor RTs showed any significant difference between different approaches to the Low Load task.

A2.1.3: Discussion

The goal of this initial pilot was to explore the use of two different versions of the Low Load condition for both the dot probe and emotional attention control tasks. In a small sample of female adolescents there was no observed main effect of Group in this task, demonstrating no significant difference between the two versions tested. That is, including the target probe (X) within a string of dissimilar distractors (O's) was operationally equivalent to using a uniform string of targets (XXXXX) in the dot probe task. As such, it was reasoned that the former (OOXOO) is most conceptually similar across tasks and load conditions as the fundamental task of locating a target within a

string is retained across all conditions. Given there was no significant difference between the different versions of the Low Load condition, it was decided that for all future tasks, the target letter would be included in a string of dissimilar distractors (for example, OOXOO).

A2.2: Pilot Study

Having established the low load version of the dot probe task, a pilot was conducted to explore whether a sample of adolescents were adequately able to complete both the dot probe and emotional attention control tasks as a reaction time task. A significantly larger sample of young adolescents of a similar age-range of our main study was recruited for this purpose.

A2.2.1: Methods

Participants

Eighty-five students from a secondary school in New South Wales, Australia, completed both the Dot Probe and Emotional Attention Control task.

Dot Probe

The dot probe used was as described above (**see Figure A2.1**), with similar Congruent, Incongruent, Neutral only and Angry only conditions, as well as high and low perceptual load conditions. As above, High perceptual load involved the target probe (X) being "hidden" amongst a string of similar distractors (H, K, M, W or Z). The Low perceptual load condition involved the target probe (X) being placed within a string of dissimilar, uniform distractors (O's), leading to a target string such as (OOXOO) and a non-target string of (OOOOO). The position of the target letter within the target string

was randomly generated in each trial. The Load condition was presented block-wise, with order (High Load first or Low Load first) counterbalanced across participants.

Emotional Attention Control Task

In this task, participants are required to determine which of two target letters is present in a visually presented string of five letters. If the letter 'X' is present, participants are asked to press the letter 'X' on the keyboard. If the letter 'N' is present, participants are asked to press the letter 'N' (**see Figure 4.5**). As with the dot probe task, this basic procedure formed the basis of the task, which then included manipulations of Perceptual Load and Emotion. This task involved the same High and Low Perceptual Load conditions as the dot probe task.

Procedure

This study was conducted using the same procedure as the initial pilot reported above, however participants completed these tasks at desktop computer terminals.

Analysis

Dot Probe

Accuracy scores were calculated for each condition across both levels of perceptual load. Similarly, mean **RT**s for each condition across both levels of perceptual load were calculated, using only valid trials as described previously. For both **Accuracy** and **RT**s a 2x2 ANCOVA was conducted with Condition (Congruent/Incongruent) and Load (Low/High) as within subject factors.

Observed Condition effects with respect to **RT**s would then be examined by calculating an **Attention Bias** difference score (**Incongruent RTs** minus **Congruent RTs**), such that scores significantly greater than 0 reflect an attention bias towards the angry

facial expression. Where **Attention Biases** were observed, subsequent analyses of **Vigilance** and **Delayed Disengagement Scores** (as described above in **Section 4.2.6.1**) were also planned in order to identify the apparent mechanism of this attention bias.

Emotional Attention Control Task

Accuracy scores and mean **RT**s were calculated for each Emotion (Angry/Neutral) and across each level of perceptual Load (Low/High). This was followed by a pair of 2x2 mixed measures ANCOVAs, with Emotion (Angry/Neutral) and Load (Low/High) as within subject factors, with first **Accuracy** and then **RT**s as dependent variables. Where Emotion effects were observed, an **Emotion Attention Control score** was planned (Angry RT minus Neutral RT) such that scores significantly greater than 0 reflect relative interference of the emotional distractor.

A2.2.2: Results

Table A2.2: Descriptive data and tasks performance for attention tasks

Variable	Mean (SD)
N	85 (38.8% male)
Age	14.55 (0.88)
Dot Probe Accuracy (Low Load Congruent)	0.98 (0.03)
Dot Probe Accuracy (Low Load Incongruent)	0.98 (0.05)
Dot Probe Accuracy (High Load Congruent)	0.96 (0.06)
Dot Probe Accuracy (High Load Incongruent)	0.94 (0.06)
Dot Probe RT (Low Load Congruent) (ms)	498.21 (79.11)
Dot Probe RT (Low Load Incongruent) (ms)	504.15 (88.63)
Dot Probe RT (High Load Congruent) (ms)	846.04 (206.81)

Dot Probe RT (High Load Incongruent) (ms)	853.61 (208.98)
Emotional Attention Control Accuracy (Low Load Angry)	0.91 (0.07)
Emotional Attention Control Accuracy (Low Load Neutral)	0.91 (0.09)
Emotional Attention Control Accuracy (High Load Angry)	0.91 (0.09)
Emotional Attention Control Accuracy (High Load Neutral)	0.93 (0.09)
Emotional Attention Control RT (Low Load Angry) (ms)	653.48 (112.50)
Emotional Attention Control RT (Low Load Neutral) (ms)	654.54 (109.84)
Emotional Attention Control RT (High Load Angry) (ms)	1110.41 (316.54)
Emotional Attention Control RT (High Load Neutral) (ms)	1072.42 (266.41)

Eighty-five participants recruited from a school in NSW, Australia, completed both the Dot Probe and Emotional Attention Control tasks (see **Table A2.2**). It was observed that some participants had unexpectedly high rates of invalid trials (as high as 78%). As such, it was decided to enforce a minimal level of valid trials in order to ensure confidence in the measures derived thereby.

Dot Probe Task

Eighty-one participants were included in the analysis of the Dot Probe task. Four participants were excluded due to having less than 75% valid data.

Accuracy scores were entered into a mixed measures ANCOVA, with Load (Low/High) and Congruence (Congruent/Incongruent) as within subjects factors, with Age included as a covariate. There was no significant main effect of Load ($F(1,79)=0.075$, $p=0.785$, partial $\eta^2=0.001$), Congruence ($F(1,79)=0.502$, $p=0.481$, partial $\eta^2=0.006$) nor any interactions (all p's > 0.39). However there was a main effect of Age ($F(1,79)=6.019$,

p=0.016, partial η^2=0.071), with Age significantly positively correlated with **Accuracy** (r=0.292, p=0.008).

A similar repeated measures design was used to explore differences in **RT**s, with Load (Low/High) and Congruence (Congruent/Incongruent) as within subject factors. Log transformed **RT**s were used as a result of skewed data. There was a significant effect of Load (F(1,79)=5.896, p=0.017, partial η^2=0.069), with **RT**s being significantly quicker in the Low Load condition. There were no other significant main effects or interactions (all p's > 0.07).

Emotional Attention Control Task

Eighty participants were included in the analysis of the Emotional Attention Control task, with 5 participants excluded due to having less than 75% valid data.

Accuracy scores were included in a 2x2 repeated measures design with Load (Low/High), Emotion (Neutral/Angry) as within subject factors. Age was included as a covariate. There were no significant main effects of Load (F(1,78)=0.151, p=0.699, partial η^2=0.002), Emotion (F(1,78)=0.116, p=0.735, partial η^2=0.001), or Age (F(1,78)=3.597, p=0.062, partial η^2=0.044) nor any interactions (all p's >0.6).

Log transformed **RT**s were entered into a similar repeated measures design with Load (Low/High) and Emotion (Neutral/Angry) as within subject factors. There were no significant main effects of Load (F(1,78)=3.376, p=0.070, partial η^2=0.041), Emotion (F(1,78)=3.727, p=0.074, partial η^2=0.04) or Age (F(1,78)=0.002, p=0.965, partial η^2<0.001). There were significant Load X Emotion (F(1,78)=6.288, p=0.014, partial η^2=0.075) and Load X Emotion X Age (F(1,78)=6.627, p=0.012, partial η^2=0.078).

Difference scores were calculated to explore these interactions (RT when Angry face present minus RT when Neutral face present), such that positive scores reflect greater distraction of the angry facial expression relative to the neutral expression. One-sample t-tests examined difference scores in each level of perceptual load against the hypothetical "no difference" level (0). Difference scores did not significantly differ from 0 for either the low ($t(79)=-0.123$, $p=0.903$) or high ($t(79)=1.311$, $p=0.194$) condition, suggesting that participants **RT**s did not significantly differ when the task-irrelevant distractor was an angry face relative to a neutral face. Correlations revealed that Age was significantly positively correlated with difference scores in the high load condition ($r=0.263$, $p=0.018$) but not the low load condition ($r=-0.065$, $p=0.564$).

A2.2.3: Discussion

This pilot utilised a considerably larger sample of young people in our target age range, with the aim of ensuring the appropriate operation of each condition. This study examined response accuracy and RTs in each condition across each level of perceptual load. Importantly, in both the dot probe and emotional attention control tasks there were no significant Load or Condition effects with respect to Accuracy scores. Mean Accuracy scores were above 90%, suggesting that participants were able to accurately identify the target location (dot probe) or identify the target (emotional attention control task). Participants maintained this level of performance even when the perceptual load of the task was relatively high.

With respect to the dot probe task, RTs showed a significant main effect of Load. That is, participants were significantly quicker when the perceptual load of the task was low. However there was no evidence that RTs were affected by the location of angry

facial expressions relative to the location of the probe, at either high or low levels of load, in this non-selected community sample.

RTs on the emotional attention control task did not differ significantly with respect to the level of perceptual load or the emotional expression displayed. There was no evidence that the presence of an angry facial expression affected participants RT, relative to when a neutral expression was present. There was however evidence that older participants tended to show more positive difference scores. That is, older participants tended to be faster in the presence neutral relative to angry expressions.

Of note, this study found that some participants struggled to respond accurately or within the expected timeframes (slower than 200ms or within two standard deviations of their own mean RT), raising questions about the validity of their data. A criterion was therefore established such that participants required at least 75% "valid" data in order to be included. Within this sample, approximately 5-6% of participants were excluded from the analysis on this basis.

Overall, the results of this study suggest that, in general, young adolescents are able to adequately complete both the novel dot probe paradigm and the emotional attention control (Bishop et al., 2007), with acceptable accuracy and RT performance. However, a small proportion of this sample showed some difficulty in either maintaining their accuracy (1 of the 4 excluded from the dot probe, and 4 of the 5 excluded from the emotional attention control task failed to achieve 75% accuracy), or acceptable RTs, suggesting that care must be taken to ensure that participants have sufficient valid data. As such, the criterion established here will also be applied to the later study of maltreated adolescents. Further, Age was identified as an important factor, significantly

affecting performance in both the dot probe and emotional attention control tasks. This finding reinforces the importance of considering the role of Age in the study of maltreated adolescents, and the need to include Age as a covariate in those analyses.