Childhood abuse and adult socio-cognitive skills: Distinguishing between self and other following early trauma

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Abstract

Experience of childhood abuse impairs complex social functioning in children; however, much less is known about its effects on basic socio-cognitive processes and even fewer studies have investigated these in adult survivors. Using two behavioral tasks, this study investigated spontaneous theory of mind (ToM) and imitative behavior in 41 women with childhood abuse (CA) and 26 unaffected comparison women (UC). In the spontaneous ToM task, UCs showed a larger ToM index than CAs, indicating more facilitation by knowledge of another's false belief. In the imitation-inhibition task, CAs experienced less interference than UCs when observing another's incongruent movements. After controlling for depression, differences in ToM became marginally significant, yet remained highly significant for inhibiting imitative behavior. The findings suggest childhood abuse survivors have altered perspective-taking, and are less influenced by others' perspectives, potentially due to changes in self-other distinction. Clinical implications regarding therapeutic practice with survivors of childhood abuse are discussed.

Keywords: childhood abuse; imitative behavior; psychological trauma; self-other distinction; theory of mind.

Early life stress such as maltreatment in childhood disrupts complex cognitive, affective, and social functioning including those reliant upon self-other distinction. The ability to mentally distinguish *self* from *other* is vital for social cognition (Brass, Ruby, & Spengler, 2009; de Guzman, Bird, Banissy, & Catmur, 2016). The awareness that others have a mind distinct to one's own, with differing knowledge, beliefs, and desires (so-called theory of mind (ToM), or mentalizing; Baron-Cohen, Leslie, & Frith, 1985; Frith & Frith, 2003) is suggested to rely upon the ability to represent and distinguish between the mental states of oneself and of others (de Guzman et al., 2016; Gallese & Goldman, 1998). Possession of a healthy ToM is furthermore essential for predicting how others will act (Cicchetti, Rogosch, Maughan, Toth, & Bruce, 2003) and facilitates social interaction (Banerjee, Watling, & Caputi, 2011; Luke & Banerjee, 2013), also on a rudimentary motoric level. Neurobehavioural evidence shows that observing an action activates the corresponding representation in oneself (Prinz, 1997), and it is necessary to distinguish between one's own motor movements and perceived movements of others in order to control instinctive imitative response tendencies (Brass et al., 2009). Thus, the distinction of oneself from another occurs on multiple hierarchical levels of sociocognitive processing and is vital for appropriate interpersonal interaction.

Indeed, maltreated children demonstrably display deficits in their self-other distinction and ToM – they are less likely to pass false belief tasks (Benarous, Guilé, Consoli, & Cohen, 2015; Cicchetti et al., 2003), have poorer visual and cognitive perspective-taking abilities (“cognitive ToM”; Burack et al., 2006; Pears & Fisher, 2005), and show deficits in emotion recognition and identification (“affective ToM”; Pears & Fisher, 2005). Correspondingly, in real-life situations maltreated children show deficits in social competencies, including conflict-resolution strategies (Rogosch & Cicchetti, 1994) and prosocial behavior (Salzinger, Feldman, Hammer, & Rosario, 1993), and are consequently more likely to be rejected by their peers (Bolger, Patterson, & Kupersmidt, 1998; Rogosch & Cicchetti, 1994). This has been

hypothesized to be due to alterations in social information processing (e.g. increased hostility bias; van Reemst, Fischer, & Zwirs, 2016) as well as a decrease in interpersonal trust (Cole & Putnam, 1992), learned through interactions and consequent trust violations with their abuser who is usually an emotionally-close figure who should provide security and care (European Union Agency for Fundamental Rights, 2014).

However, how such early life stress continues to influence ToM in previously maltreated adults and impacts their interpersonal behavior has been insufficiently researched. Presently, we are aware of few studies that have specifically examined the influence of early maltreatment on later mentalizing, and only two that specifically investigated adults and cognitive ToM. Germine and colleagues (2015) documented that childhood maltreatment (CM) is associated with poorer ability to infer mental states from a pair of eyes, as well as reduced interest in social interactions over a decade later. Moreover, Nazarov and colleagues (2014) investigated ToM in women suffering from PTSD as a result of CM. Traumatized women had difficulty in correctly interpreting scenes that showed an interaction between family members, yet not in interpreting scenes depicting other social interactions. Furthermore, whereas non-traumatized controls were faster at recognizing emotionally-valenced mental states in comparison to neutral states, traumatized women showed no such differentiation. However, how early trauma and maltreatment influence self-other distinction, including ToM, on a more rudimentary level is still unknown.

Two recent studies have developed tasks to measure aspects of spontaneous self-other distinction. Kovács et al. (2010) developed a visual-detection task (detecting the presence of a ball) to assess mental state representations in adults. In this task, participants watch short movies in which implicit knowledge of an onscreen agent's beliefs about said ball's location can help facilitate their response time. At no stage in Kovács' task are participants explicitly instructed to pay attention to the agent's beliefs, yet consistently Kovács and other

replications since (Bardi, Desmet, Nijhof, Wiersema, & Brass, 2017; Deschrijver, Bardi, Wiersema, & Brass, 2016; Kovács, Kühn, Gergely, Csibra, & Brass, 2014) have found that participants perform faster on the task in conditions where the agent expects to see the ball even when participants themselves know logically the ball should not be present. Another study by Brass and colleagues (2000) investigated ability to distinguish between our own and others' motor movements and to inhibit imitation by showing movies of finger movements and measuring response time in making congruent and incongruent finger movements. In a follow-up study, administration of oxytocin was found to increase difficulties in the inhibition of imitative behavior (De Coster, Mueller, T'Sjoen, De Saedeleer, & Brass, 2014), possibly due to reduced self-other distinction following increased empathy, which oxytocin has been hypothesized to boost (Bartz, Zaki, Bolger, & Ochsner, 2011). These findings seem to suggest that people constantly represent the mental and motoric states of other people and can spontaneously use these representations in order to facilitate their own behavior. However, how these basic processes are influenced by early life trauma is as yet uninvestigated.

This study investigated two aspects of self-other distinction in women with a history of childhood physical and/or sexual abuse: 1) spontaneous, or implicit, ToM and 2) the ability to inhibit imitation of perceived actions. A self-report measure of empathic responding was also collected, as empathy shows some overlap with affective ToM (Walter, 2012). For both tasks, we relied on previously validated versions (ToM: Deschrijver et al., 2016; Kovács et al., 2010; imitation-inhibition: Brass et al., 2000; De Coster et al., 2014). Based on previous findings (Germiné et al., 2015; De Coster et al., 2014; Parlar et al., 2014), we hypothesized that women with a history of childhood maltreatment would show deficits in their self-other distinction, as demonstrated through: 1) a smaller ToM index (i.e., lack of facilitated RT when detecting the ball on the implicit ToM task), and 2) reduced ability to inhibit imitation (revealed through a larger difference between congruent and incongruent trials).

Methods

Participants

Forty-six women with a history of childhood abuse and 44 women without a history of such abuse participated in exchange for 25 EUR. Inclusion criteria for CA were experience(s) of physical and/or sexual abuse occurring prior to 18 years of age. Five participants were discovered to have experienced childhood emotional abuse, yet not physical or sexual abuse – analyses were run with and without these women included as CA participants. Furthermore, because it emerged during interview/questionnaires that six participants initially recruited as UCs had experienced other non-abuse-related traumatic events in childhood, analyses were also run with and without these participants. An additional seven participants without childhood abuse were discovered to have experienced abuse in adulthood – these participants were excluded as a previous study found reduced social functioning and connectedness in women with history of intimate partner violence (IPV), suggesting similarities in the impact of childhood abuse and IPV (Bonomi et al., 2006). Thus, the final sample was comprised of 41 CA women with childhood physical and/or sexual abuse (mean age = 34.9 years, $SD = 13.00$) and 26 UC women without any history of childhood trauma/abuse-related trauma in adulthood (mean age = 38.1 years, $SD = 11.82$). Women with a history of abuse were recruited via self-help groups and the pre-screening student pool of the local university, while comparison participants were recruited by distributing flyers at public places as well as the same pool of university students. In case women were interested in participating, they could contact the experimenters by phone or e-mail to make further arrangements. CA participants did not differ from UC participants with regards to age ($F_{(1,65)} = 1.02, p = .32$) or highest level of education obtained ($\chi^2_{(2)} = 3.73, p = .15$). CAs reported significantly more symptoms of depression ($F_{(1,65)} = 23.42, p < .001, d = 1.21$) and were more trait ($F_{(1,65)} = 11.96, p = .001, d = 0.87$) and state anxious ($F_{(1,65)} = 3.45, p = .07, d = 0.47$). They did not differ with regards to

resilience ($F_{(1,65)} = 0.92, p = .34, d = 0.24$). Additionally, CAs suffered from a significantly higher number of current psychological disorders than UCs ($F_{(1,65)} = 35.60, p < .001, d = 1.43$). After Bonferroni correction for multiple testing, differences in number of depression and trait anxiety symptoms, and number of psychological disorders remained significant. Including CA participants with only emotional abuse and UC participants with non-abuse-related childhood trauma did not substantially alter group differences. The study was granted ethical approval by the local ethical committee and all participants provided written informed consent beforehand.

Stimuli and apparatus

Implicit ToM task. An adapted version (Deschrijver et al., 2016) of the implicit ToM task (Kovács et al., 2010) was used in which all properties were identical to the original task, save for the use of Buzz Lightyear (Toy Story, 1995) as the agent. The movies were animated using Studio 3D MAX software, and presented using Presentation (NeuroBehavioral Systems, Inc.). The implicit ToM task consists of 8 different conditions in the form of short movies, in which the beliefs of the onscreen agent (A) and the participant (P) about the presence of a ball behind an occluder (“+” for “believes present”, “-” for “believes absent”) are manipulated.

At the beginning of the movie, Buzz Lightyear enters the scene and rolls the ball behind an occluder, before leaving the scene and subsequently returning (Figure 1a). During this initial phase, 4 different scenarios are possible. In the $P+A+$ condition, the ball stays behind the occluder while the agent is present. The agent then leaves the scene and the ball remains behind the occluder. Hence, after the agent re-enters, both participant and agent believe the ball to be behind the occluder. In the $P-A-$ condition, the ball rolls offscreen while the agent is present. Again, when the agent returns, both participant and agent thus believe that the ball is not behind the occluder. In the $P-A+$ condition, the agent leaves the scene

while the ball is present behind the occluder. However, after the agent leaves, the ball rolls from behind the occluder to offscreen. Thus, when the agent re-enters the scene, he falsely believes the ball to be present behind the occluder. Finally, in the $P+A-$ condition, the reverse occurs. The ball rolls offscreen while the agent is present but after the agent leaves the scene, the ball rolls back behind the occluder. As such, when the agent returns, he falsely believes the ball to be offscreen. At the end of each movie, the occluder falls. Each of the four conditions was created with both a “ball absent” and “ball present” condition, resulting in 8 different movies.

Participants’ task was to press a button with their right index finger as quickly and as accurately as possible when the occluder fell and the ball was present. In reality, the ball was present on 50% of trials, independent of either the agent’s or participant’s belief. Furthermore, to ensure that participants paid attention for the entire duration of the movie, they were required to press another button with their left index finger when the agent left the scene.

***** Insert figure 1 about here *****

Imitation-inhibition task. The imitation-inhibition task (Brass et al., 2000) consisted of images depicting a hand in third person perspective, either in resting position or lifting either the index or middle finger (Figure 1b). The number ‘1’ or ‘2’ was presented in the center between the index and middle finger, signaling that participants had to perform either an index (‘1’) or middle finger (‘2’) movement respectively. As such, three types of trials were possible: 1) baseline trials in which a number was presented without a finger movement of the onscreen hand, 2) congruent trials in which the number signaled a movement that corresponded to the movement observed on screen, and 3) incongruent trials in which the number signaled the opposite movement.

Participants' task was to respond as quickly and as accurately as possible to the number onscreen with the corresponding finger lifting movement. These responses were recorded using a custom-built response device with light sensors.

Questionnaires.

SLESQ. The Stressful Life Events Screening Questionnaire (SLESQ; Goodman, Corcoran, Turner, Yuan, & Green, 1998) assesses the history of traumatic experiences, measuring Criterion A associated with posttraumatic stress disorder (DSM-IV). Thirteen items are used, of which 11 examine specific experiences such as life-threatening accidents, witnessing murder, physical or sexual abuse, etc. If participants answer "yes" to any of these items, sub-items assess their age at the time of the experience, as well as the frequency and duration of the experience. Since there is no Dutch translation available, the English version was used. Participants were classified as having experienced childhood abuse if they answered affirmatively to items 5 (rape), 6 (sexual assault), and/or 7 (childhood physical abuse), and if their age at the time of the experience was below 17 years. Test-retest reliability for this measure is good for items relevant to our study (Goodman et al., 1998) and Cronbach's alpha for the present sample was .80, indicating high internal consistency.

IRI. The Interpersonal Reactivity Index (IRI; Davis, 1984; Dutch translation by De Corte, Buysse, Verhofstadt, Roeyer, Ponet, & Davis, 2007) measures empathic responses using 28 items. This questionnaire was included due to the overlap between (affective) ToM and empathy. Cronbach's alpha for the present sample was .81. There are four subscales: perspective-taking ($\alpha = .70$), empathic concern ($\alpha = .46$), fantasy ($\alpha = .60$), and personal distress ($\alpha = .72$).

BDI. The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996; Dutch translation by Van der Does, 2002) measures depression in adults and adolescents according

to DSM-IV criteria. Twenty-one items measure affective, somatic, and cognitive dimensions of depression. Cronbach's alpha for the present sample was .95.

STAI. A Dutch translation of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used (Van der Ploeg, Defares, & Spielberger, 2000). Both anxiety as a state (STAI-state) and as a trait (STAI-trait) were measured, using 20 items for each scale. In the present sample, Cronbach's alpha for the STAI-state was .92 and for the STAI-trait .84.

RS. The Resilience Scale (RS; Wagnild & Young, 1993; Dutch translation by Wagnild & Portzky, 2008) measures mental resilience in adults and adolescents using 25 statements. Cronbach's alpha was .84.

MINI. The Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1992; translated by Van Vliet, Leroy, & van Megen, 2000, into Dutch), is a structured diagnostic interview of axis 1 pathologies and antisocial personality disorder (DSM-IV).

Procedure

Participants were seated in front of a computer screen at arm's length. Subsequently, they performed the imitation-inhibition and implicit ToM tasks (in counterbalanced order), each with a duration of approximately 20-30 minutes.

For the implicit ToM task, participants were asked to place their right index finger on the "b" button and their left index finger on the "v" button. They were told they would perform a visual detection task. More specifically, they were required to respond quickly and accurately when Buzz Lightyear left the scene with the "v" button and as quickly and accurately as possible with the "b" button when the ball was present when the occluder fell down. There were four practice trials, on which feedback was given on the accuracy of both responses. Following this, six trials of each movie were presented, resulting in 40

experimental trials. Each trial had a duration of 18,000 ms, with the occluder falling at 17,625 ms in all conditions. Importantly, no instructions were given to pay attention to the agent's beliefs during the experiment.

For the imitation-inhibition task, participants were asked to place their right-hand index and middle finger on the custom-built response box. After 24 practice trials, three blocks of 50 experimental trials were presented, with a total of 150 trials (50 trials for each condition: baseline, congruent, and incongruent). Trials were presented in randomized order. Each trial started with a black screen (2000 ms) followed by a hand in resting position (2000 ms), then finally a movement and number were shown (1300 ms). During this final frame, participants were required to lift their index or middle finger in response to the number "1" and "2" respectively. Importantly, it was communicated to participants that the observed hand movements were irrelevant for task performance.

Following the two tasks, participants completed the questionnaires and lastly the MINI (Van Vliet et al., 2000). Participants were then thanked, paid, and debriefed.

Data analyses

Univariate analyses of variance (ANOVAs) with and without covariates were used to compare effects between both groups and η^2 or Cohen's d were used as measures of effect size, as appropriate. As participants differed on depressive symptoms and trait anxiety scores, these two variables were used as covariates in all subsequent analyses. Analyses were run with depression and trait anxiety scores separately as these measures were highly correlated ($p < .001$, $r = .804$). Participants were excluded from covariate analyses if they scored more than 2.5 standard deviations away from the group mean on the relevant measure. This resulted in 2 participants excluded for extreme depression scores ($n_{CA} = 1$; $n_{UC} = 1$) and 0 participants excluded on trait anxiety. Error data were analyzed only for the imitation-inhibition task

(none of the findings were significant and will not be further discussed) but not for the ToM task since the percentage of errors here was very low. Alpha was set at .05 (two-tailed) for all analyses.

As in previous work (Bardi et al., 2017; Deschrijver et al., 2016; Kovács et al., 2010), for the implicit ToM task, the critical *ToM index* was calculated by subtracting response times (RT) in the P-A+ condition (in which the agent believes that the ball is there while the participant does not) from RT in the P-A- condition (in which both agent and participant believe the ball to be absent), since ball detection latencies should be faster in the former condition if the agent's belief is taken into account thus resulting in a positive ToM index. Participants were excluded if their ToM index was more than 2.5 standard deviations away from the group mean ($n_{CA} = 2$; $n_{UC} = 0$).

For the imitation-inhibition task, calculating the difference between RT in baseline and congruent trials (*facilitation effect*) and between baseline and incongruent trials (*interference effect*) allows for exploring whether a possible difference between both groups is due to facilitation on congruent versus interference on incongruent trials (Brass et al., 2000; De Coster et al., 2014). Due to equipment failure, data from four CA participants was lost for the imitation-inhibition task. Participants were excluded if their RT for either effect was more than 2.5 standard deviations away from the group mean ($n_{CA} = 4$; $n_{UC} = 1$). Correlations between questionnaire variables, ToM index, and congruency effects were performed using Pearson's r and Bonferroni corrected for multiple testing. All analyses were performed using IBM SPSS Statistics 25 (SPSS Inc., Chicago, IL, USA).

***** Insert table 1 about here *****

Results

Implicit ToM task

As expected, the *ToM index* was significantly lower in the CA group relative to the UC group ($\text{mean}_{(\text{CA})} = 22.28$, $SD = 46.36$; $\text{mean}_{(\text{UC})} = 64.01$, $SD = 49.82$; $F_{(1,63)} = 11.91$, $p = .001$, $\eta^2 = .16$), indicating that maltreated women were less facilitated by knowledge of the agent's false belief (Figure 2). When depression was added as a covariate (after removing the two participants with extreme scores), this effect was reduced to trend level ($F_{(1,60)} = 3.34$, $p = .07$, $\eta^2 = .05$), **while** depression by itself also predicted the *ToM index* at trend level ($F_{(1,60)} = 3.75$, $p = .06$, $\eta^2 = .06$). By contrast, adding trait anxiety as a covariate did not remove the significant effect of group ($F_{(1,62)} = 7.18$, $p = .01$, $\eta^2 = .11$), nor was trait anxiety a significant predictor by itself ($F_{(1,62)} = 1.20$, $p = .28$, $\eta^2 = .02$).

***** Insert figure 2 about here *****

Imitation-inhibition task

Also as anticipated, statistically significant differences between groups for the *facilitation* and *interference effects* in the imitation-inhibition task emerged (Figure 3). Importantly, the group by effect interaction was significant ($F_{(1,56)} = 18.23$, $p < .001$, $\eta^2 = .25$). Importantly, when depression and trait anxiety were added as covariates, the interaction remained highly significant ($F_{(1,52)} = 11.08$, $p = .002$, $\eta^2 = .17$) and the main effect of group became statistically significant ($F_{(1,52)} = 4.27$, $p = .04$, $\eta^2 = .07$). When split by group, follow-up tests of the interaction revealed in UCs a very large difference between *interference* and *facilitation effects* ($t_{(24)} = 3.58$, $p = .002$, $d = 1.01$), with the interference from the incongruent finger movement slowing responses (one sample *t*-test: $t_{(24)} = 6.94$, $p < .001$, $d = 1.96$) yet conversely no facilitation from seeing a congruent finger movement (one sample *t*-test: $t_{(24)} = 1.52$, $p = .14$, $d = 0.43$). By contrast, CAs exhibited a smaller difference between the

interference and *facilitation effects* ($t_{(32)} = -2.15, p = .04, d = 0.53$), but both effects were significantly larger than zero (*interference effect*: $t_{(32)} = 5.26, p < .001, d = 1.30$; *facilitation effect*: $t_{(32)} = 10.42, p < .001, d = 2.57$). When directly contrasted, CAs showed more facilitation when seeing a congruent finger movement relative to UCs ($t_{(56)} = 4.93, p < .001, d = 1.31$), and conversely less interference ($t_{(56)} = -2.13, p = .04, d = 0.57$), i.e. being less affected by seeing an incongruent finger movement from another agent.

***** Insert figure 3 about here *****

Empathy

CAs revealed differences on the empathy subscales but did not differ in overall empathy from UCs ($F_{(1,65)} = 0.36, p = .55, d = 0.15$). Specifically, CAs scored *higher* on empathic concern ($F_{(1,65)} = 6.43, p = .01, d = 0.63$) and *lower* on personal distress to others' pain ($F_{(1,65)} = 5.47, p = .02, d = 0.59$), with no significant difference on scores of perspective-taking or fantasy ($ps > .30$).

Relationships with CA and psychopathology

Participants' *ToM index*, *facilitation effect*, and *interference effect* were not related to each other and showed no association with overall empathy, depression, or trait anxiety. This was true for both groups (separately) (all $ps > .05$, Bonferroni-corrected). In addition, controlling for level of education as a proxy for IQ did not change 1) the relationship between abuse history and *ToM index* or 2) the interaction between abuse history and the *facilitation/interference effects* (all $ps < .001$). Resilience did not correlate with *ToM index* when either assessed for each group individually or when both groups were combined. Moreover, an initial positive correlation between age at onset of abuse and *ToM index* did not

survive Bonferroni correction. When we compared CA survivors with relative to without PTSD (as per MINI) there were no significant group differences suggesting a general effect of early stress experience rather than PTSD diagnosis.

Discussion

This study investigated the relationship between experience of childhood physical and/or sexual abuse and basic social cognitive processes such as spontaneous theory of mind (ToM), inhibition of spontaneous imitative behavior, and empathy, commonly falling under the umbrella of “self-other distinction”. We predicted that women who were abused as children would display changes in their self-other distinction, as shown through: 1) a lower ToM index on an implicit ToM task, and 2) poorer ability to inhibit imitation on a motor simulation task, in comparison to non-maltreated controls. Consistent with the hypothesis, previously maltreated women were significantly slower than non-maltreated comparisons in conditions where knowledge of the agent’s false belief might facilitate responding. This resulted in a lower ToM index indicating that they considered the other person’s perspective to a lesser degree. Secondly, against expectations but consistent with findings from the first task, group differences in the *facilitation* and *interference effects* showed that maltreated women were also less influenced by another person’s incongruent response at the motoric level than non-maltreated women.

Based on prior work (Germine et al., 2015; Nazarov et al., 2014), we had hypothesized that maltreated women would show reduced perspective-taking on an implicit ToM task. Indeed, while non-maltreated women’s RT was aided by an agent’s false belief, women with a personal trauma history showed a much weaker effect, thus indicating reduced ToM. However, covarying for depressive symptoms reduced (but not abolished) this group effect whilst depressive symptomatology was also a marginally significant predictor of the ToM

index. Although depression has been linked to alterations in ToM, results are currently disparate showing either that depressed persons performed worse (Lee, Harkness, Sabbagh, & Jacobson, 2005) or better (Wolkenstein, Schönenberg, Schirm, and Hautzinger, 2011) at identifying mental states from the eyes. Moreover, in the current study's comparison sample, depression scores were uniformly particularly low (after excluding an extreme score, the range of scores was 0 to 6), whilst maltreated women's scores showed much more variability. Furthermore, it is difficult to disentangle experience of child abuse from depression symptomatology, as higher likelihood of psychopathology is a core characteristic of this group (Green et al., 2010). Thus, whilst it appears that depression levels could play a role in impairing ToM, it appears that childhood abuse leads to altered perspective-taking in adulthood when a belief of another agent is concerned.

Similarly, based on prior work (Brass et al., 2009), the second core hypothesis was that previously maltreated women would demonstrate a reduced ability to inhibit imitation of an agent's observed action. As expected, differences in the present study emerged for the *facilitation* and *interference effects*. Maltreated women had a significantly larger facilitation effect and a significantly smaller interference effect compared to women with no history of trauma. In other words, maltreated participants were significantly aided in their reaction times in performing a movement when seeing a congruent movement being performed, whereas comparison participants were not (facilitation effect). Conversely, comparison participants found it much more difficult, relative to maltreated participants, to perform an action when simultaneously seeing an incongruent action being performed (interference effect). De Coster and colleagues (2014) recently found that oxytocin, linked to improved social perspective-taking, led to increased difficulties in imitation-inhibition whereas placebo did not. Our results are in line with their finding and – as with the finding for the implicit ToM task – suggest that reduced interference from observing another's action could again be evidence for

stronger self-other distinction in maltreated women. Importantly, and in contrast to findings from the implicit ToM task, covarying for depression did not affect the significant effects found for this task suggesting that the present effect was unlikely to be driven by current mood state.

We also explored empathic responding of maltreated women relative to non-maltreated women using a self-report measure. Contrary to previous findings such as those of Parlar and colleagues (2014), in the present study CA women reported higher levels of empathic concern and less personal distress in situations that might induce empathy. Moreover, overall levels of reported empathy were similar across groups. However, Parlar and colleagues investigated empathy in women who had been diagnosed with PTSD following experience of childhood abuse, rather than women who had experienced childhood abuse regardless of clinical status. Therefore, it may be that their findings are being driven by the presence of PTSD, rather than experience of childhood maltreatment *per se*. Interestingly, others (de Guzman et al., 2016; Smith, 2009) speculate that heightened personal distress in response to others' suffering is linked to poorer self-other distinction, whereby the person is less able to separate the other's emotions from their own, and feels distress more in accordance with the experience being "personal". As we found that our sample had low personal distress in response to others' suffering, and higher self-other distinction on our tasks, this would support their speculation and again suggest that maltreated women have generally stronger self-other distinction.

Our study has important clinical implications. There is evidence that reduced ToM and hyperimitation signpost real world deficits such as difficulties in social relationships (Bosacki & Wilde Astington, 1999; Slaughter, Imuta, Peterson, & Henry, 2015; Spengler, Bird, & Brass, 2010). Such difficulties may also pose a problem to satisfactory engagement with and eventual completion of therapy (Martin, Garske, & Davis, 2000), as well as to creating good

and non-rejecting peer and partner relationships. A meta-analysis by Martin and colleagues (2000) found that there is a consistent link between strength of the therapist-patient relationship and positive therapeutic outcome, such as successful therapy completion and alleviation of symptoms. Furthermore, studies show that individuals with decreased perspective-taking abilities are likely to respond less harshly in a trust game when playing with an unfair opponent (Fett et al., 2014). Taken together, such findings may suggest one potential (cognitive) mechanism by which previously maltreated women are at risk of exploitation and further revictimization from unscrupulous individuals, whilst simultaneously lacking the strong social relationships necessary to protect them, due to reduced ToM. Our findings would therefore suggest that maltreated women require a unique approach during therapy in order to guard against poor outcome and drop-out, and at the same time to boost their perspective-taking abilities. Yet, further confirmatory evidence is urgently needed.

Despite these intriguing findings, the study has two important limitations. First, due to the extremely high prevalence of abuse in women (EU Agency for Fundamental Rights, 2014), the present study focused on a wholly female sample, thus making generalization to male adult survivors of child abuse difficult. However, this was done for three reasons; (1) in addition to neurological developmental differences between males and females (Lenroot & Giedd, 2010; Pechtel & Pizzagalli, 2011), (2) there is evidence that males and females can have different reactions to experience of child abuse as well as different rates of exposure to subtypes of abuse (Heim, Shugart, Craighead, & Nemeroff, 2010), which would increase heterogeneity in a mixed sex sample, and (3) due to evidence that women are more likely to disclose their abuse to others (e.g. Ullman & Filipas, 2005), it was thought to be more feasible to focus on a female sample for recruitment purposes. The second limitation of this study is that it used only a self-report measure of empathy, which may be vulnerable to participants' subjective assessment of their own empathic abilities combined with a desire to appear

socially desirable. However, this can still reveal important information regarding maltreated women's own perspectives on their empathic responding. Further research could seek to use an experimental paradigm in order to compare empathic responding.

In sum, we were able to demonstrate that maltreated women appear to exhibit stronger self-other distinction at different levels of socio-cognitive processing. Within a clinical context, these findings highlight the importance of therapies designed specifically for adult survivors of child abuse, especially important considering the complexity of symptom presentation in such individuals and the paucity of randomized controlled trials assessing such treatments (Ehring et al., 2014). Furthermore, our findings emphasize that it is essential to focus on social functioning in trauma-related therapies. Indeed, being able to take the perspective of another has repercussions for social relationships, an area which could be assisted through therapy, as well as for successful completion of psychological treatment.

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Table 1. Sample demographics, abuse histories (SLESQ), and psychopathology for the abuse group (CA) and the non-maltreated controls (UC).

Demographic information	CA (<i>n</i> = 41)		UC (<i>n</i> = 26)		<i>p</i> value	Effect size (<i>d</i>)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Current age	34.90	13.00	38.08	11.82	.32	0.25
Number of abuse types experienced as a <i>child</i> [†]	2.07	0.76	0	0	<.001***	3.47
Age at onset of abuse	7.59	4.49	-	-	-	-
Depression ¹	14.07	12.25	2.23	2.75	<.001***	1.21
Trait anxiety ²	47.34	9.34	40.54	4.54	.001**	0.87
State anxiety ²	35.29	10.77	40.04	9.19	.07	0.47
Resilience ³	76.24	10.36	73.92	8.38	.34	0.24
Empathy ⁴	71.68	14.48	73.85	14.38	.55	0.15
Perspective-taking	19.27	5.64	20.50	4.05	.34	0.24
Fantasy	17.66	5.64	17.88	4.78	.87	0.04
Empathic concern	21.02	3.71	18.62	3.92	.01*	0.63
Personal distress	13.73	5.41	16.85	5.14	.02*	0.59
Current psychopathology						
Number of psych. disorders ⁵	1.73	1.50	0.04	0.20	<.001***	1.43
Mood disorder (<i>n</i> /%)	12	29.3%	0	0%	.002**	0.80
Anxiety disorder (<i>n</i> /%)	18	43.9%	1	3.8%	<.001***	1.10
PTSD (<i>n</i> /%)	10	24.4%	0	0%	.006**	0.71
Other disorder (<i>n</i> /%)	17	41.5%	1	3.8%	.001**	0.91

[†] There were three types of abuse measured; namely physical, sexual, and emotional.

¹ BDI-II ² STAI ³ RS ⁴ IRI ⁵ MINI (current psychopathology only) * *p* < 0.05 ** *p* < 0.01 *** *p* < 0.001

Figure 1a (upper panel). Implicit ToM task – the agent enters the scene and rolls the ball behind an occluder (this scene occurred in all four conditions). *Figure 1b (lower panel).*

Stimuli for imitation-inhibition task (last frame of the video sequence). When participants saw a ‘1’, they were required to lift their first finger. When participants saw a ‘2’, they were required to lift their middle finger. From left to right: baseline condition (no movement from the onscreen hand); congruent condition (finger movement required matches onscreen hand); incongruent condition (finger movement required does not match onscreen hand).

Figure 2. Mean response times (ms) with 95% confidence intervals for abuse and comparison groups in detecting the presence of a ball when neither participant nor agent expect to see the ball (P-A-) and when participants do not expect to see the ball but know that the agent does (P-A+). Computing the difference between these two conditions produces the *ToM index*, with a greater index indicating more facilitating use of the agent's perspective.

Figure 3. Mean *interference* and *facilitation* effects on the imitation-inhibition task with 95% confidence intervals. The *interference effect* was calculated by the difference in mean response times (measured by movement onset; ms) between baseline and incongruent trials. The *facilitation effect* was calculated by the difference in mean response times between congruent and baseline trials.

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