Do violent offenders have more problems judging other's emotional bodily expression than matched controls?

Bachelorthesis Clinical Healthpsychology

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Abstract

Previous studies have shown that violent offenders have an impaired recognition of facial expressions. The goal of this study was to investigate whether similar effects could be obtained for bodily expressions. Images of emotional bodily expressions were used in different experiments. In Experiment 1 we have used a emotional facial expression matching task. In Experiment 2 we have done the same with emotional bodily expressions to check if the findings of Experiment 1 also account for emotional bodily expressions. In Experiment 3 we used body-face compound images consisting of congruent and incongruent compound images with anger, happy or fear to test the relative influence of bodily expressions on facial expressions recognition. In experiment 4, dynamic bodily expressions were used to test if results of static bodies also account for dynamic bodies. We compared angry, fearful and happy bodily expressions. In experiment 5 images of angry and happy body postures with blurred faces were briefly presented in a angry, happy or neutral context to test if a social context influences the recognition of the emotional bodily expression. Violent offenders were worse in recognizing angry faces and better in recognizing fearful faces than matched controls. There were no group differences in bodily expression recognition in Experiment 2 and 4. Violent offenders are worse in recognizing angry bodily expressions than fearful and happy bodily expressions. Controls are worse in recognizing angry bodily expression than fearful bodily expressions. Violent offenders and matched controls both benefit from congruent conditions in contrast to incongruent conditions.

Keywords Violent offenders Bodily expression Facial expression Body-face compounds Dynamic bodies Social context

Introduction

In 2008, 5% of the Dutch population of 15 year and older was victim of one or more violent crimes in the Netherlands. From the roughly 6 million crimes, 1 million were violent crimes and the amount is quadrupled in the past 25 years (Kalidien & Eggen, 2009). This is a serious amount, and a big problem. Clarifying the psychological mechanisms underlying violent behavior in violent offenders may give more insight in this issue.

Several recent studies report an impaired recognition of emotional facial expressions (Sato, Uono, Matsuura & Toichi, 2009; Dodge & Schwartz, 1997; Dolan & Fullam, 2006). Recognition of emotional facial expressions is necessary for (emotional) communication. Facial expressions indicate moment-to-moment changes in inner emotional states (Ekman & Friesen, 1975). Sometimes people use information from emotional facial expressions as cues for regulating social behaviors (Frijda, 1986). Moreover, recognition of others people's facial expressions has been shown to modulate aggressive behaviors (Savtisky, Izard, Kotsch & Christy, 1974). Otherwise, two different studies showed that distortion or misinterpretation of social cues can result in the generation of inappropriate social responses, such as reacting aggressively or violently to ambiguous social actions (Akhtar & Bradley, 1991; Dodge, Laird, Lochman & Zelli, 2002). Hoaken, Allaby and Earle (2007) found that violent offenders make a greater number of errors than non-violent offenders or controls on a facial recognition task.

Dodge and Schwartz (1997) found that aggressive children repeatedly interpret ambiguous social cues as hostile. Cadesky, Mota and Schachar (2000) investigated the recognition of facial and vocal expressions of emotion in children with conduct problems. These children had an impaired recognition of fear, happiness and sadness. Striking was their overall accuracy for recognizing anger was higher because they tended to misinterpret the other emotions as anger. In line with these findings, a recent study showed that delinquents had a

specific bias towards interpreting disgusted expressions as angry (Sato, Uono, Matsuura & Toichi, 2009). Hall (2006) indicated that individuals reporting high levels of aggression also misidentified anger from the facial expressions when this was not the emotion presented. Marsh, Kozak and Ambady (2007) found a relation between impaired fear recognition and antisocial behavior when shown emotional faces. Marsh and Blair (2008) report a link between antisocial behavior and deficits in recognizing fearful expressions. However, one study using facial stimuli failed to find related deficits in recognizing angry, fearful, happy or sad emotional expressions (Glass & Newman, 2006). It remains unclear whether there is a specific pattern of impairment. Overall, most studies find emotion recognition deficits in individuals that are characterized by aggressive behavior. This implies that one of the underpinnings of delinquency might be impaired recognition of emotional expressions. The above findings suggest that there may be a relationship between facial expression recognition and aggressive behavior in violent offenders.

There are some suggestions why these groups have more problems judging emotions. Plattner et al. (2007) compared high school students with delinquent adolescents, and found that the latter group experienced higher levels of negative state and trait emotions, experienced a wider range of emotions, and were more likely to experience a confluence of state emotions (sadness and anger) when stressed than high school students. Hoaken et al. (2007) found that (non-)violent offenders performed poorer on executive functioning than controls. They suggested that there is a close link between executive functioning and facial recognition.

Several neuropsychological studies explain emotional processing. The area mostly reported in the emotion literature is the amygdala. The amygdala is functionally coupled with prefrontal regions, crucial for the integration of emotion and cognition (Pessoa, 2008; Stein et al., 2007). Marsh and Blair (2008) report a dysfunction among antisocial individuals in the

amygdala when processing fearful facial expressions. Van Honk and Schutter (2006) concluded that testosterone level is a good predictor of the presence of an anger trait, aggressive behavior and dominance. At the neuronal level, there is a positive relation between testosterone levels and amygdala response to signals of threat (Derntl et al. 2009).

Several studies found abnormalities in the frontal lobe structure in individuals with histories of violence (Raine, Lencz, Bihrle, LaCasse & Colletti, 2000; Raine, Meloy, Bihrle, Stoddard, LaCasse & Buchsbaum, 1998; Soderstrom, Tullberg, Wikkelso, Ekholm & Forsman, 2000). These studies support the view that these individuals are less able to regulate and control aggressive impulses generated from subcortical structures due to deficient prefrontal regulation. Other factors have been reported as well: impulsivity and peer pressure (Carroll, Hemingway, Bower, Ashman, Houghton & Durkin, 2006; Bailey & Ostrov, 2008).

All above mentioned studies used facial stimuli. Bodily expressions of emotions have received only little attention. However, faces and bodies both convey information that is essential for social interaction (de Gelder et al., 2010). Whereas we are quite good in controlling our facial expression, and for example we can easily force a social smile, our body language often conveys the true message. Moreover, bodily expressions are recognized as reliably as facial expressions and focusing on facial expressions tends to make us refer to a person mental state. But focusing on bodily expressions directs attention to a person or a groups actions (de Gelder, 2009). Bodily expressions are more basic and more obvious than facial expression. That could be helpful when a violent offender tries to intimidate someone when committing a violent crime. Moreover, the perception of facial expression is influenced by whatever expression the body shows. Meeren, van Heijnsbergen and de Gelder (2005) created face-body compound images of fearful and angry expressions, with either matched or mismatched emotional expressions. When the face and body conveyed conflicting emotional information, judgment of the facial expression was hampered and became biased toward the

emotion expressed by the body. To date, it is unknown whether these findings extend to positive emotions. Furthermore, it is not known whether violent offenders may be helped by the presence of a bodily expression since all previous studies showed facial expressions in isolation. A congruent body expression may take away the difference in emotion recognition between offenders and normal controls.

Dynamic expressions of emotion

Little is known about using dynamic stimuli in studying emotion. Sato and Yoshikawa (2007) report that dynamic representation of emotional facial expressions enhance the overall emotional experience. One study using dynamic stimuli found an increasing accuracy as a function of the intensity of emotional expressions (Montirosso, Peverelli, Frigerio, Crespi & Borgatti, 2010). Recent research investigated the influence of dynamic emotional stimuli on brain activation, comparing them with static emotional stimuli (Grèzes, Pichon & de Gelder, 2007; Pichon, de Gelder & Grèzes, 2008). Differences are found in brain activation between static and dynamic emotion stimuli. It could be that these differences also account for behavioral responses in real life on facial or bodily expressions. Whereas most studies used static pictures, in real life emotions are dynamic. Maybe delinquents are better in recognizing dynamic bodily expressions.

Social scene/context

We naturally perceive another's emotion in a social and/or emotional context that can help understand the other person when congruent. There is growing evidence that context acts, often in stealth, to influence emotion perception. Joubert, Fize, Rousselet and Fabre-Thorpe (2008) reported that objects and animals in a incongruent context, caused more errors and slower reaction times as result. Descriptions of the social situation (Carroll & Russell, 1996; Fernandez-Dohls, Carrera, Barchard, & Gacitua, 2008; Trope, 1986), body postures (Aviezer et al., 2008; Meeren, van Heijnsbergen, & de Gelder, 2005; Clarke, Bradshaw, Field,

Hampson & Rose, 2005), voices (de Gelder, Bocker, Tuomainen, Hensen, & Vroomen, 1999; de Gelder & Vroomen, 2000), scenes (Righart & de Gelder, 2006, 2008a, b; Barrett & Kensinger, 2010; Kret & de Gelder, 2010), words (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006), and other emotional faces (Masuda et al., 2008; Russell & Fehr, 1987), all influence emotion perception.

Similar context effects have been found for bodies. Using point-light displays, Thornton and Vuong (2004) showed that the perceived action of a walker depends upon actions of nearby ‘‘to-be-ignored’’ walkers. Kret and de Gelder (2010) recently report an effect of social context when the actions in the scenes expressed an emotion congruent with the bodily expression. Kret and de Gelder concluded that when the context is incongruent with the other person’s emotion, recognition drops. This is interesting, because 30 % of public violent crimes are committed with two or more persons. 10 % of the total public violent crimes is committed in groups by violent offenders/delinquents (Moors & Bruinsma, 2005). It is interesting to investigate if the context consisting of a group showing an activity modulates the perception of another’s emotion. It could be that violent offenders are better in judging congruent conditions than incongruent conditions comparing to controls. Violent offenders could be worse in judging incongruent conditions than controls.

Violent offenders versus controls. In this research we will compare a group of 29 male incarcerated offenders with mixed nationalities who are convicted for violent crimes versus a control group consisting of 26 males with mixed nationalities without a criminal record.

We will expect that violent offenders will make more errors on the facial recognition task and score higher on angry facial expression recognition than matched controls. This due to frequent misinterpretation of other expressions by anger. Because of the better recognition of

angry facial expressions found in the literature, we will expect that violent offenders will better recognize angry bodily expressions than matched controls, but be worse in recognizing fearful bodily expressions than matched controls. Because of the fact that violent offenders are worse in recognizing fearful facial expressions, we will expect that more emotional information in the surrounding of the face or body being judged (incongruent conditions) in Experiment 3 and 5, will cause worse accuracy than matched controls. We will expect that the facial expressions in Experiment 1 will be equally well judged than the bodily expressions in Experiment 2. The expectation is that violent offenders are worse in judging dynamic bodily expressions than matched controls because of the difference in facial expression recognition in the literature.

Participants

Experimental group: Twenty-nine incarcerated male violent offenders (mean age: 31.76 years, range 19-61 years old) with normal to corrected-to-normal vision. All violent offenders were convicted for violent crimes consisting articles 312, 317, 310, 302, 242, 285, 416, 45, 311 of the Dutch Law. When they were tested, they were already 2 to 8 years in prison and were convicted for 5 to 20 years. The group consisted of 14 different nationalities and education level from primary school till university. Most violent offenders were low educated.

Matched-control-group: Twenty-six males (mean age: 32.31 years, range 17-62 years old). The control group was matched on age, education level and cultural background. Since we were specifically interested in the aggressive component of the offenders, exclusion criteria of the control group were no neurological or psychiatric history, no criminal record and normal to corrected-to-normal vision. Both groups filled out five questionnaires: Emotional Contagion, AVL (Aggression Questionnaire), STAXI, VAS + Motivation and PCL-R (partly) (see Table 1). The violent offenders scored higher on hostility and lower on general emotional contagion than controls. Violent offenders score lower on being tired than

controls but higher on Love in the Emotional Contagion questionnaire. Further no significant differences between the two groups were found.

Materials and procedure

Experiments were administered in consulting rooms in three different Dutch prisons when testing violent offenders and at the participants home or at the University of Tilburg in a separate room when testing the controls. We have used a laptop and a stimulus-response box. All the participants took part in five experiments who were randomized between subjects.

Table 1. Questionnaires

	Violent Offenders		Controls	
	Mean	*S.D.*	*Mean*	*S.D.*
AVL:	81.28	16.52	76.35	10.94
Fysical agression	3.08	0.90	2.65	0.63
Verbal agression	2.93	0.66	3.03	0.53
Anger/rage	2.47	0.82	2.79	0.65
*Hostility **	2.81	0.68	2.43	0.60
STAXI	10.93	2.40	10.68	1.31
VAS:				
Tension	4.83	5.34	4.69	3.28
*Tired **	5.28	6.25	8.62	5.98
Down/dark	4.07	4.27	3.96	3.76
Anxious	1.66	2.45	2.12	3.36
Active	9.86	6.13	11.92	5.26
Motivation	15.17	4.76	13.92	4.61
Trouble concentrating	4.41	5.42	6.20	5.06
Emotional Contagion:	43.86	4.81	44.92	5.84
Joy/Happiness	8.21	1.77	8.92	1.41
*Love **	9.96	1.45	8.88	1.92
Fear/anxiety	5.46	2.22	5.52	1.87
Anger	5.79	1.20	6.48	1.42
Sadness/depression	6.79	1.69	6.28	1.51
*General **	7.64	2.15	8.84	1.75
PCL-R	232.41	17.04	227.77	14.60

** P < .05*

Table 1. Mean and standard deviation for every questionnaire and subscale.

Experiment 1. Face recognition

Method

Participants were asked to match a validated set of facial expressions in a two-alternative forced choice task. A matching task was used instead of a naming or categorization task in order to investigate how well the different emotions are recognized on the basis of similarities with other stimuli from the same category and not mediated by the use of verbal labels.

Materials and procedure

Main and interaction effects of facial expression of the target and distracter expression for mean accuracy (ACC) and reaction time (RT) were tested in two repeated measures analysis of variance (ANOVA) with one within-subject variable "target expression" (Anger, Disgust, Fear, Happy, Sad or Surprise) or "distracter expression" (Anger, Disgust, Fear, Happy, Sad or Surprise) and "group" (Violent offender or Control) as between-subjects variable. All mean effects are followed by Bonferonni corrected pairwise comparison and all interaction effects are further explored with 2-tailed t-tests. When sphericity was violated, we applied the Greenhouse-Geisser correction. 3 faces where shown. One in the middle above, two under, one in the left down corner and the other in the right down corner. There was no time limit. When pressed the left or right button on the stimulus-response box a gray screen appeared for 500 ms and then the next trial appeared.

Results

Trials with RTs below 250 ms or above 6000 ms were discarded from the analysis. A second filter was used to exclude RTs outside the range of mean RT minus and plus two standard deviation of a participant for every target emotion condition. Trials were also excluded from the RT analyses if the response was incorrect.

Accuracy: There was a main effect of target expression [$F(1, 3.753) = 20.636$, $P < .01$, $\eta_p^2 = .28$] (see figure 1a.) and for distracter expression [$F(1, 4.104) = 19.351$, $P < .01$, $\eta_p^2 =$

.267] (see figure 1b.). The main effect of target expression revealed that happy faces were better recognized than all the other emotions except surprised faces ($P \leq .01$). Surprised faces were better recognized than angry, fearful and sad faces ($P \leq .01$). Angry and disgusted faces were better recognized than fearful faces ($P \leq .01$). The main effect of distracter expression revealed that happy faces had a less interfering effect on judging the target expression than angry, disgusted, fearful and sad faces ($P \leq .05$). Surprised faces had also less interfering effect on judging the target expression than angry, disgusted, fearful and sad faces ($P \leq .05$). Angry faces have the most interfering effect on judging the target expression than all the other distracter expressions ($P \leq .05$). An interaction effect was observed for target expression x group [$F(1, 3.753) = 9.788$, $P < .01$, $\eta_p^2 = .156$] (see figure 1e.). In the condition with target expression anger, violent offenders were worse in recognizing angry faces than controls [$t(53) = -3.694$, $P < .01$], but better in recognizing fearful faces than controls [$t(53) = 3.326$, $P < .01$]. There was no interaction of distracter expression x group [$F(1, 4.104) = .868$, $P = .486$, $\eta_p^2 = .016$].

Reaction time: There was a main effect of target expression [$F(1, 4.264) = 19.329$, $P < .01$, $\eta_p^2 = .267$] (see figure 1c.). There was no main effect of distracter expression [$F(1, 4.134) = 1.029$, $P = .394$, $\eta_p^2 = .019$] (see figure 1d.). The main effect of target expression revealed that happy faces are faster recognized than all the other facial expressions ($P \leq .01$). Disgusted faces are faster recognized than angry, fearful and sad faces ($P \leq .05$). Surprised faces are faster recognized than fearful faces ($P < .01$). An interaction effect was observed for target expression x group [$F(1, 4.264) = 2.382$, $P < .05$, $\eta_p^2 = .043$] (see figure 1f.). Follow-up comparisons showed no significant effects in the different conditions. There was no interaction of distracter expression x group [$F(1, 4.134) = .180$, $P = .952$, $\eta_p^2 = .003$].

Discussion

Happy and surprise expressions were better recognized irrespective of the distracter. It could be that these expressions are easier recognized because of the fact that they are positive emotions instead of the negative emotions anger, disgust, fear and sad. This effect is also shown when happy and surprise expressions served as distracters. Then there was less interfering effect on judging the target expression. Happy faces were recognized fastest. In contrast with our expectations, violent offenders were worse in recognizing anger than matched controls. However, violent offenders were better in judging fearful expressions than the controls. This seems strange because Marsh and Blair (2008) found an impairment in recognizing fearful faces by a meta-analysis of 20 studies with antisocial populations including psychopaths. Besides that, most of the included experiment used Pictures of the Facial Affect stimulus set from Ekman and Friesen whereby the pictures where shown for more than 2 seconds. They also used a lot of juvenile participants and all included experiments were facial emotions had to be categorized. Overall, this could influence or explain the difference in the recognition of fearful faces because we did not ask to categorized, but to match the target expression with the right same expression. Instead of concluding that violent offenders were worse in judging angry bodily expressions, we could also say that they did not misinterpret all the other emotions as anger like in the study of Cadesky, Mota and Schachar (2000) and maybe misinterpret the emotions as fearful. It is interesting to see how violent offenders pick up emotions from bodily expressions. This group is very familiar with physical aggression. Therefore, we were specifically interested if these results also account for bodily expressions.

Figure 1. results Experiment 1

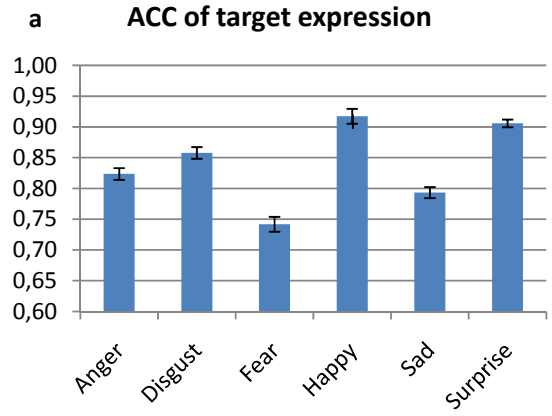

Figure 1a: ACC of target expression.

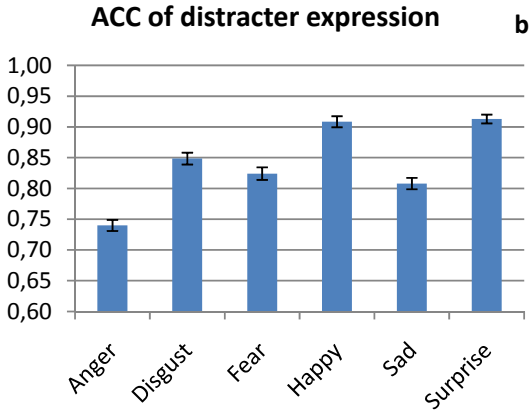

Figure 1b: ACC of distracter expression.

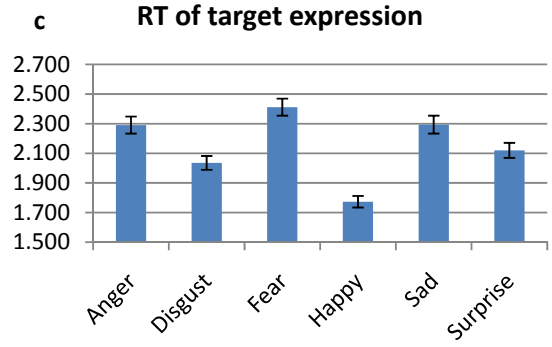

Figure 1 c: RT of target expression.

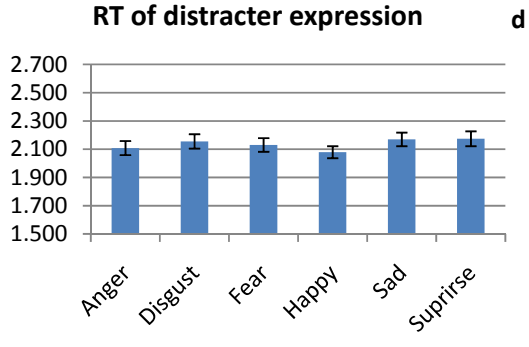

Figure 1d: RT of distracter expression.

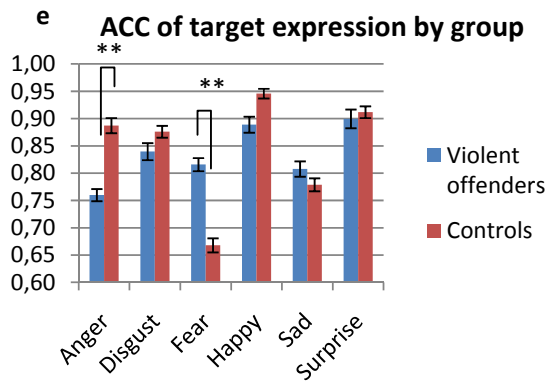

Figure 1e: ACC of target expression by violent offenders offenders and controls.

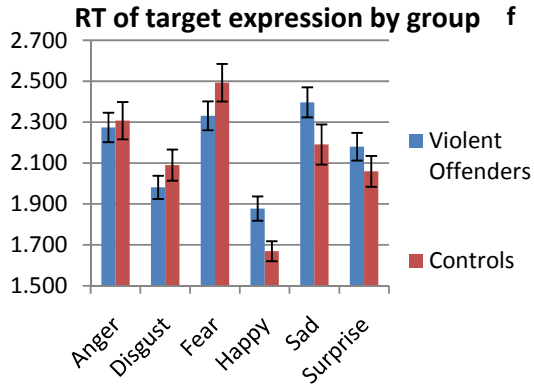

Figure 1f. RT of target expression by violent offenders and controls.

Experiment 2. Body recognition.

The goal of this experiment was to investigate whether the findings that we observed in the previous experiment hold for body expressions.

Method

Materials and procedure

Materials consisted of 72 gray-scale photographs representing semiprofessional actors (half male) expressing different emotions with their whole body (anger, fear, happiness, and sadness) but with the face blurred. Selection of materials for use in the present experiment was based on the results of a pilot study in which the images were presented one by one on a screen and shown for 4000 ms with a 4000-ms interval. Participants were instructed to categorize each stimulus in a forced choice procedure choosing one among four emotion names as quickly and as accurately as possible and indicating the response on an answering sheet. For use in the present study, we only used images recognized above 70% ACC.

A stimulus consisted of a target picture presented at the top and two probes left and right underneath.

There were always three different identities; all three of the same gender and one of the probes had the same expression as the upper one. We balanced the design in such a way that, for example, when fear was the target expression, there were two trials (one with male actors and one with female actors) with an angry distracter, two trials with a happy distracter, and two trials with a sad distracter. A total of 72 images was used, arranged in 24 trials (4 emotion categories _ 3 distracter categories _ 2 genders). To avoid identity-based matching, we used three different identities on each trial. Stimuli were presented on a computer screen, and participants were requested to match (as accurately and fast as possible) one of the bottom pictures to the one on top, based on similarity of expressed emotion. No instructions were given about which emotions could be expected on each particular trial. They responded by

pressing the corresponding button, indicating their choice for the left or right probe. The stimulus was presented until response. During the 1000-ms intertrial interval, a blank screen was shown. 3 bodies were shown. One in the middle above, two under, one in the left down corner and the other in the right down corner. There was no time limit. When pressed the left or right button on the stimulus-response box a gray screen appeared for 500 ms and then the next trial appeared.

Main and interaction effects of bodily expression of the target and distracter expression for mean ACC and RT were tested in a repeated measures ANOVA with one within-subject variable "target expression" (Anger, Fear, Happy and Sad) or "distracter expression" (Anger, Fear, Happy and Sad) and "group" (Violent offender or Control) as between-subjects variable. Unless indicated otherwise, statistical procedures were the same as in Experiment 1.

Results

Trials with RTs below 250 ms or above 6000 ms were discarded from the analysis. A second filter was used to exclude RTs outside the range of mean RT minus and plus two standard deviation of a participant for every expression. Trials were also excluded from the RT analyses if the response was incorrect.

Accuracy: There was a main effect of target expression [$F(1, 2.514) = 11.157$, $P < .01$, $\eta_p^2 = .174$] (see figure 2a.).and for distracter expression [$F(1, 2.193) = 17.183$, $P < .01$, $\eta_p^2 = .245$] (see figure 2b.). The main effect of target expression revealed that sad bodies were better recognized than angry, fearful and happy bodies ($P \leq .01$). The other main effect of distracter expression revealed that happy bodies had a less interfering effect on the target emotion than angry and fearful bodies ($P \leq .05$). Sad bodies had also less interfering effect on the target expression than angry and fearful bodies ($P \leq .01$). There was no interaction of

target expression x group [F(1, 2.514) = 2.274, P = .094, η_p^2 = .041] and no interaction of distracter expression x group [F(1, 2.193) = .318, P = .748, η_p^2 = .006].

Reaction time: There was a main effect of target expression [F(1, 2.594) = 19.689, P < .01, η_p^2 = .271] (see figure 2c.). There also was a main effect of distracter expression [F(1, 3) = 9.017, P < .01, η_p^2 = .145] (see figure 2d.). The main effect of target expression showed that sad bodies are also faster recognized than angry and fearful bodies (P < .01). This also accounts for happy bodies in contrast to angry and fearful bodies (P < .01). The main effect of distracter expression revealed that sad bodies resulted in slower RTs for a correct answer on target expression than angry, fearful and happy bodies (P < .01). There was no interaction of target expression x group [F(1, 2.594) = .037, P = .984, η_p^2 = .001] and no interaction of distracter expression x group [F(1, 3) = .633, P = .576, η_p^2 = .012].

Discussion

The same main effects appear as in the previous experiment with the facial expressions. Happy bodies are better and faster recognized. They also have less interfering effect as distracter expression than the other emotions anger and fear in particular, and are faster recognized. It seems that for recognizing the expression sad, the bodily expression is the most important and obvious. We have not found any group differences between violent offenders and controls. In the third experiment we will combine the face and body in to a compound image. By doing this, we investigate the relative influence of body expressions on the recognition of facial expression.

Figure 2. Results Experiment 2

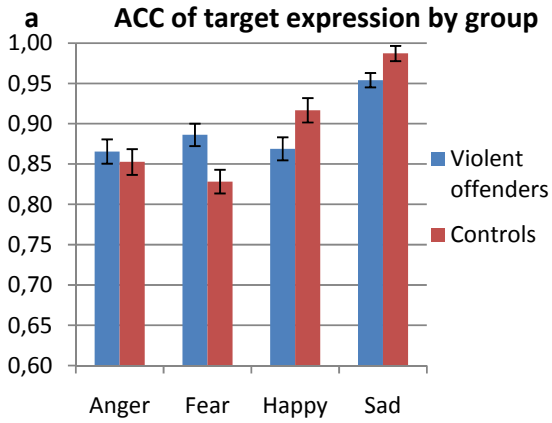

Figure 2a: ACC of target expression by group.

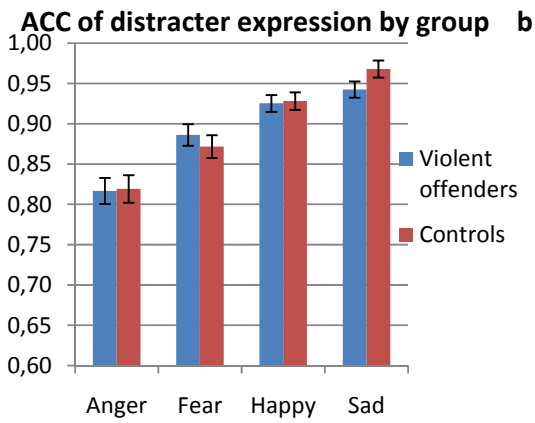

Figure 2 b: ACC of distracter expression by group.

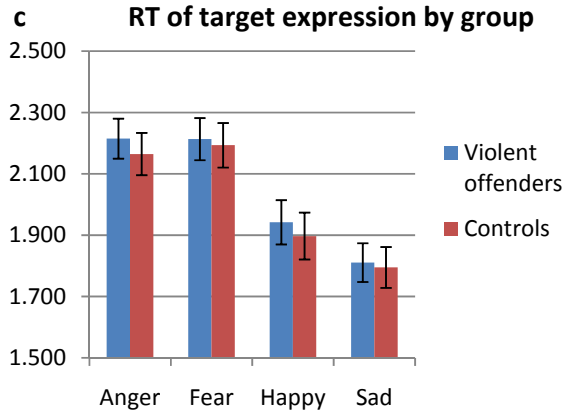

Figure 2c: RT of target expression by group.

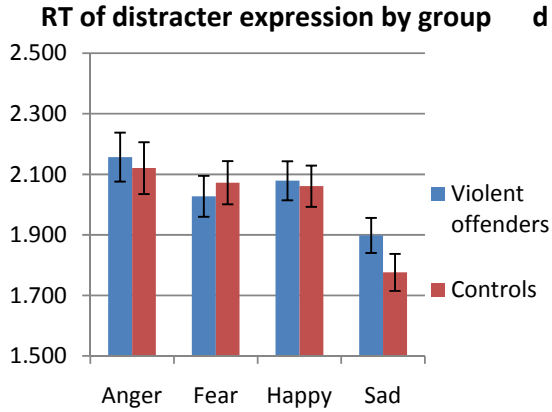

Figure 2d: RT of distracter expression by group.

Experiment 3. Body face compound. Judging facial expression.

Method

Bodily expressions with congruent or incongruent facial expression were shown. Participants were asked to categorize the facial expression. The body-face compounds where shown in gray tints. The background consisted also of a gray tint. The picture was shown for 100 ms. When the choice was made, a gray screen appeared for 5700 ms and then a fixation cross was shown for 300 ms before a new picture was presented. The picture and fixation cross were shown in the center of the screen. Participants had to choose between angry, fearful or happy face categories. In total 72 pictures were shown. We counterbalanced the order of facial

expressions buttons. We only used male actors in forming body-face compounds because of the more threatening appearance of males.

Main and interaction effects of facial and bodily expression for mean ACC and RT were tested in a 3 x 3 repeated measures ANOVA with two within-subject variable "facial expression" (Anger, Happy or Fear) and "bodily expression" (Anger, Happy or Fear) and "group" (Violent offender or Control) as between-subjects variable. Unless indicated otherwise, follow up statistical analyses where the same as in experiment 1 and 2.

Materials and procedure

Body pictures were taken from our own database. We briefly recall the construction of the body stimuli. A group of 38 male and 46 female amateurs was recruited. Before the photography session, they were instructed with a standardized procedure and received a payment. As part of the instructions, the actors were familiarized with a typical scenario corresponding to each emotion. For example, the fearful scenario was an encounter with a large dangerous dog and the happy scenario was an encounter with a dear friend. Other expressions, such as angry, sad, disgusted and neutral (without performing an action), were also obtained for use in the validation procedure. For the validation of 869 body stimuli (consisting of the emotions mentioned and instrumental actions) were included, which used a total of 120 participants. Face and body stimuli were presented for 4 sec. with an inter-stimulus interval of 7 s. Participants were instructed to categorize the emotion displayed by circling on an answer sheet one of seven (face stimuli) or six (emotional body stimuli) response alternatives, or were instructed to categorize the instrumental action displayed by choosing out of six response alternatives. Stimuli that were recognized above 75% were candidates for inclusion in the stimulus set of the experiment.

Faces were used from the NimStim Set of Facial Expressions (672 images; http://www.macbrain.org/resources.htm), which consisted of naturally posed photographs

(e.g., with hair, make-up) of 43 professional actors (18 female, 25 male; 21 years old–30 years old) in New York City. Actors were African- (N = 10), Asian- (N = 6), European- (N = 25), and Latino-American (N = 2). Actors were instructed to pose eight expressions: happy, sad, angry, fearful, surprised, disgusted, neutral, and calm. For each expression, separate open- and closed-mouth versions were posed, except for surprise, which were only posed with an open mouth. Negatively valenced faces typically differ from faces like happy in terms of valence, but also are higher in arousal level. Therefore, three versions of happy were obtained (closed-mouth, open-mouth, and high arousal open-mouth/exuberant). All stimuli were included in this validation paradigm regardless of the quality of acting. Actors were instructed to pose a particular expression (e.g., "Make a happy face") and produce the facial expression as they saw. Once one version of the facial expression (e.g., closed mouth) was created and photographed, the other version (e.g., open mouth) was prompted and photographed. To create the calm faces, actors were instructed to transfigure their neutral face into a more relaxed one, as if they were engaged in a calming activity or otherwise pleasantly preoccupied. Therefore, the calm faces were essentially neutral faces with less overall muscle tension in the face. Actors were paid for their time. Stimuli that were recognized above 80 % were candidates for inclusion in the stimulus set of the experiment. At the end we have chosen 6 male bodies and faces with angry, happy and fearful expressions. We have selected them based on how obvious and realistic the bodies and faces were judged by four raters.

Results

Trials with RTs below 200 ms or above 2500 ms were discarded from the analysis. A second filter was used to exclude RTs outside the range of mean RT minus and plus two standard deviation of a participant for every expression. Trials were also excluded from the RT analyses if the response was incorrect. Because of these filters, two mean ACC (one by violent offenders and one by controls) and 37 RTs (twenty by violent offenders and seventeen

by controls) were missing. Instead of the missing means we have filled in group means of the condition. Main and interaction effects of facial emotion and bodily emotion for mean ACC and RT were tested in a 3 x 3 repeated measures ANOVA with two within-participant variables “facial expression” (Anger, Happy or Fear) and “bodily expression” (Anger, Happy or Fear) and “group” (Violent offender or Control) as between-subjects variable. Unless indicated otherwise, follow up statistical analyses are the same as in the previous experiments.

Accuracy: There was a main effect of facial expression [$F(1, 2) = 15.942$, $P < .01$, $\eta_p^2 = .231$] (see figure 3a.) and of bodily expression [$F(1, 1.473) = 10.360$, $P < .01$, $\eta_p^2 = .164$] (see figure 3c.). The main effect of facial expression revealed that happy faces were better recognized than angry and fearful faces ($P \leq .01$). The other main effect of bodily expression showed that happy bodies interfere less with the categorization of the facial expression than angry and fearful bodies ($P \leq .01$).

An interaction effect was observed for body x face [$F(1, 3.144) = 53.192$, $P < .01$, $\eta_p^2 = .501$] (see figure 3f.). Congruent conditions (body and face same expression) anger, fear and happy are better recognized than incongruent conditions (body and face different expression) body anger-face happy, body anger-face fear, body happy-face anger, body happy-face fear, body fear-face anger and body fear-face happy ($P \leq .01$). Condition congruent happy is better recognized than congruent anger ($P = .05$) and congruent fear ($P < .01$). There was also a interaction effect for body x face x group [$F(1, 4) = 2.753$, $P < .05$, $\eta_p^2 = .049$] (see figure 3h.). Follow-up comparisons showed no significant effects in the different conditions. In order to investigate whether the two groups differ on overall face-body congruence and incongruence, another ANOVA was performed including two within-subject factors: congruent and incongruent conditions (all specific emotion conditions pooled) and one between-subjects factor (group). There was a main effect of congruent versus incongruent conditions [$F(1, 1) = 108.165$, $P < .01$, $\eta_p^2 = .675$]. Congruent conditions were better judged than incongruent

conditions (see figure 3e). There was no interaction of congruent/incongruent x group [F(1, 1) = 3.484, P = .068, η_p^2 = .063]. Finally we conducted a independent samples t-test between violent offenders and controls in ACC difference score of congruent minus incongruent conditions. Violent offenders ACC difference score was not significant higher or lower than the ACC difference score of matched controls [t(53) = 1.673, P = .1]

Reaction time: There was a main effect of facial expression [F(1, 2) = 44.298, P < .01, η_p^2 = .455] (see figure 3b). There was a main effect of bodily expression [F(1, 1.769) = 8.418, P < .01, η_p^2 = .137] (see figure 3d.). Main effect of facial expression revealed that happy faces are faster recognized than angry and fearful faces ($P \leq .01$). Main effect of bodily expression showed that happy bodies in contrast to angry bodies interfere more in RT causing slower RTs ($P < .01$). There was also a interaction effect for body*face [F(1, 4) = 9.981, $P < .01$, η_p^2 = .158] (see figure 3g.). Congruent happy condition causes faster RTs than congruent angry [t(54) = 8.852, $P < .01$], congruent fear [t(54) = -6.952, $P < .01$] and incongruent fearful body with happy face [t(54) = -2.476, $P < .05$]. Congruent angry condition causes faster RTs than incongruent happy body with angry face [t(54) = -6.156, $P < .01$] and incongruent fearful body with angry face [t(54) = -3.788, $P < .01$]. Congruent fear condition causes faster RTs than incongruent happy body with fearful face [t(54) = -4.244, $P < .01$].

Discussion

In this experiment happy faces and bodies are also more accurately and faster recognized like in the two previous experiments. Happy bodies interfere less with the target, just like in the two previous experiments. Happy bodies do not interfere much but it takes more time for the participants to respond. Congruent conditions in comparison to incongruent conditions are better recognized and also faster. It looks like that body-face compounds expressions should be best judged when seen a congruent compound of body and face. There is a difference in group ACC, independent of condition. In figure 3g is seen that the conditions happy-fear and

fear-happy show the biggest differences in ACC. In every condition controls score higher on ACC than violent offenders. In experiment 4 we will test if results of static bodies also account for dynamic bodies.

Figure 3. Results Experiment 3

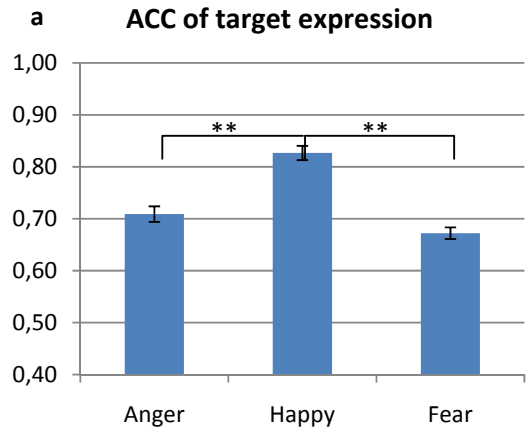

Figure 3a: ACC of target expression.

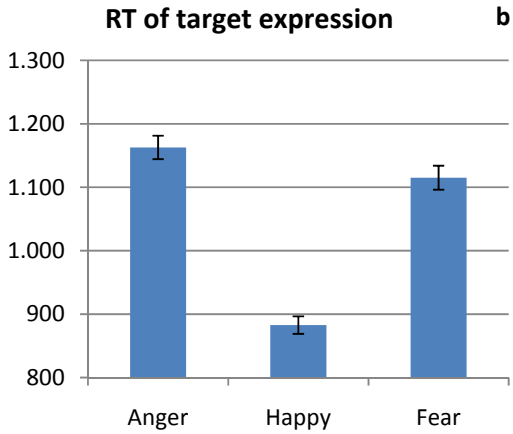

Figure 3b: RT of target expression.

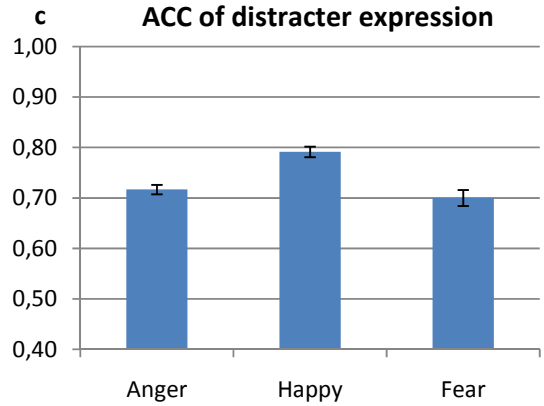

Figure 3c: ACC of distracter expression.

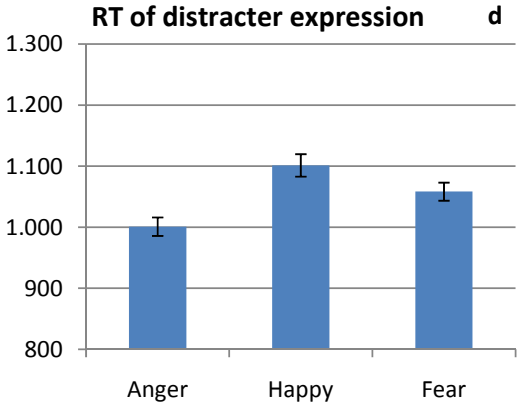

Figure 3d: RT of distracter expression.

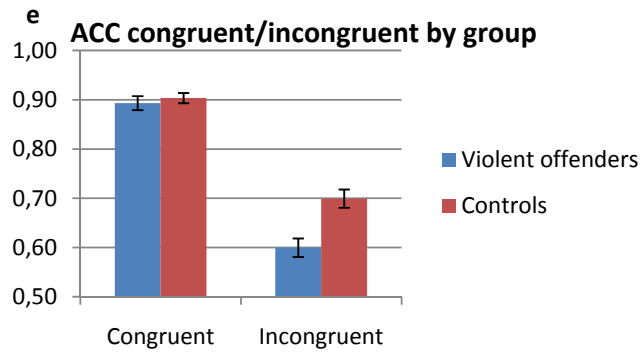

*Figure 3e: ACC Congruent/incongruent * group.*

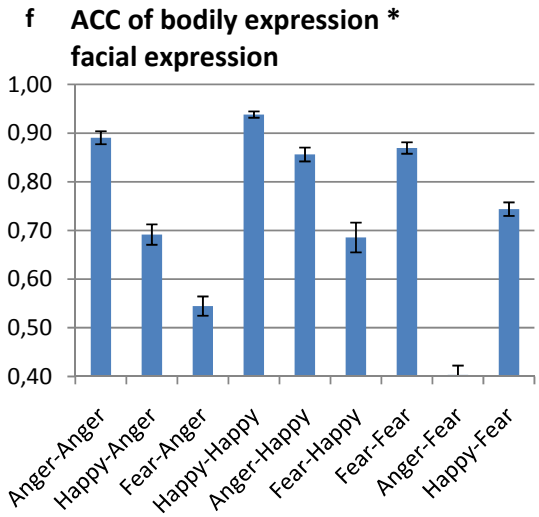

*Figure 3f: ACC of bodily expression * facial expression.*

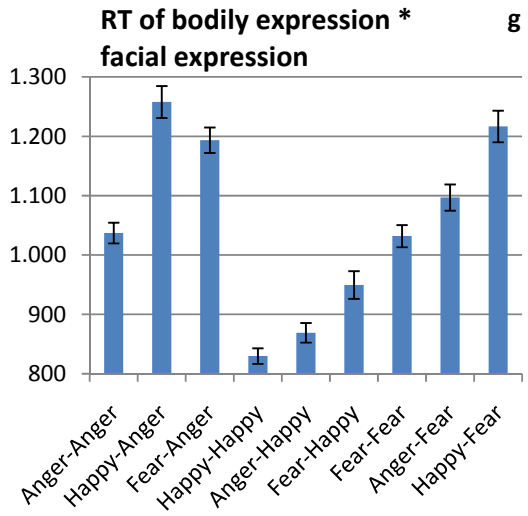

*Figure 3g: RT of bodily expression * facial expression.*

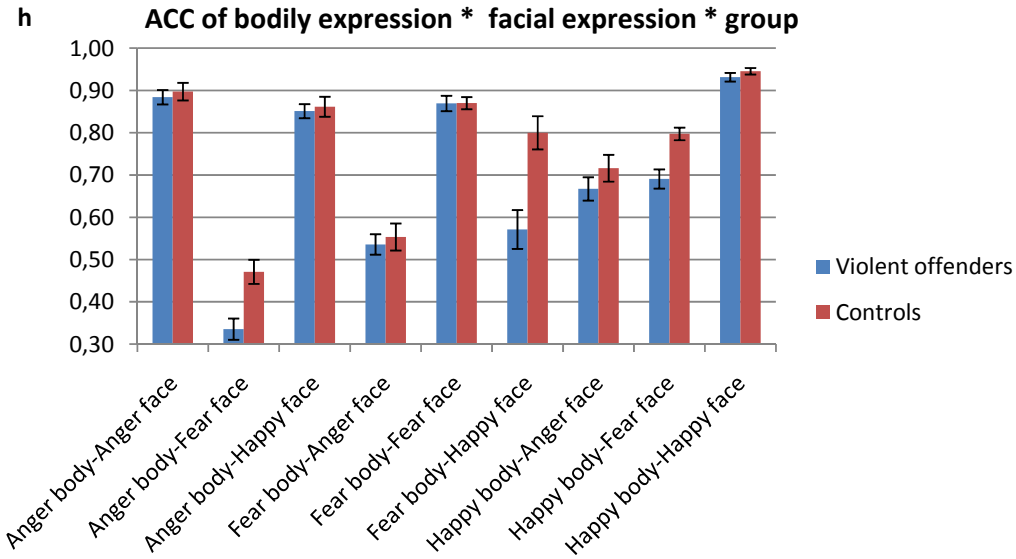

*Figure 3h: ACC of bodily expression * facial expression * group.*

Experiment 4. Judging dynamic bodily expression.

Method

Movie clips of 2 sec. are shown where a body with blurred faces showed an emotion.

Participants were asked to judge which bodily expression is seen. Participants had to press on

the buttons 1, 2, 3 and 4 of the keyboard representing angry, fear, happy and neutral. Main and interaction effects of bodily expression for mean ACC were tested in a repeated measures analysis of variance (ANOVA) with one within-participant variable "body expression" (Anger, Fear or Happy) and "group" (Violent offender or Control) as between-subjects variable. Unless indicated otherwise, follow up statistical analyses are the same as in the previous experiments.

Materials and procedure

Video recordings were made of 26 actors expressing six different facial and bodily emotions. For the body video sessions all actors were dressed in black and filmed against a green background. Recordings used a digital video camera under controlled and standardized lighting conditions. To coach the actors in order to achieve a natural expression, pictures of emotional scenes were presented with a beamer projecting on the wall in front of the actor and a short emotion inducing story was read out by the experimenter. Additionally, the stimulus set included four emotional bodily expressions (Anger, Fear, Happy and Neutral). Distance to the beamer screen was 600mm. The stimulus was centered on the display screen and subtended 11.4° of visual angle vertically and 10.0° horizontally for the body stimuli and 7.9° of visual angle vertically and 9.7° horizontally for the face stimuli. All video clips were computer-edited using Ulead and After Effects, to a uniform length of 2 seconds (50 frames). We filmed several versions per actor and condition. Based on results from five independent raters, the five best male and five best female actors were included in the experiment. Later on, these videos were included in two different validation studies where they were, along with 320 other face and body videos, presented twice to 20 independent raters. Bodily expressions above 80% correct answered were used in further research. Actor's mean age was 21.7 years old, range 19-27 years old. The faces of the body videos were masked with Gaussian masks so that only information of the body was perceived. To check whether there were quantitative

differences in movement between the movies, we estimated the amount of movement per video clip by quantifying the variation of light intensity (luminance) between pairs of frames for each pixel. For each frame (50 in total), these differences were averaged across pixels that scored (on a scale reaching a maximum of 255) higher than 10, a value which corresponds to the noise level of the camera. These estimations were then averaged for each movie. Student's two-tailed t-tests were conducted to check whether the amount of movement differed between neutral and threatening movies and male and female actors. Angry and fearful expressions contained equal movement (M = 30.64, SD 11.99 vs. M = 25,41, SD 8.71) [$t(19) = 0.776$, *ns*] but significantly more movement than neutral expressions (M = 10.17, SD 6.00) [$t(19) = 3.78$, $p \leq 0.005$, $d = 2.14$] and [$t(19) = 4.093$, $p \leq 0.005$, $d = 2.04$] male and female emotional video clips did not differ in the amount of movement (M = 29.89, SD 10.58 vs. M = 27.34, SD 10.36) [$t(19) = 2.849$, *ns*]. In addition, by using Matlab software, we generated scrambled movies by applying a Fourier-based algorithm onto each movie, a technique that has been used before for pictures (Hoffman et al, 2007). This technique scrambles the phase spectra of each movies frames and allows to generate video clips served as low level visual controls and to prevent habituation to the stimuli. For this experiment 75 dynamic bodily expressions (25 of the three emotions anger, fear and happy) were validated separately. Angry bodily expressions were 77,78% correct recognized as anger, fearful bodily expressions were 94,33% correct recognized as fear and happy bodily expressions were 90% correct recognized as happy. All 75 movie clips were judged by 12 raters.

Results

Accuracy: There was a main effect of bodily expression [$F(1, 2) = 14.295$, $P < .01$, $\eta_p^2 = .212$] (see figure 4a.). Main effect of bodily expression revealed that angry bodily expressions were worse recognized than fearful and happy bodily expressions ($P < .01$).

An interaction effect was observed for body expression x group [F(1, 2) = 3.648, $P < .05$, η_p^2 = .064] (see figure 4b.). Follow-up comparison showed no significant effects between the groups in the recognition of the different bodily expressions. In order to know if there were differences in recognition of the bodily expressions in violent offenders and in controls, we conducted a repeated measures ANOVA on ACC of violent offenders and separately for controls, with bodily expression as within-subject variable (Anger, Fear and Happy). There was a difference in recognition in violent offenders in ACC in the three different bodily expressions F(1, 2) = 12.686, $P < .01$, η_p^2 = .312] (see figure 4b.). Violent offenders were worse in recognizing angry bodily expressions than fearful ($P < .01$) and happy ($P < .01$) bodily expressions. Also controls ACC on recognizing the three different bodily expressions was significant F(1, 2) = 5.585, $P < .01$, η_p^2 = .183] (see figure 4b.). Controls were worse in recognizing angry bodily expressions than fearful bodily expressions ($P < . 01$). Finally we conducted a independent samples t-test between violent offenders and controls in ACC difference score of happy minus angry bodily expressions. Violent offenders ACC difference score of happy minus angry bodily expressions was significant higher than the ACC difference score of controls [t(53) = 2.069, $P < .05$] (see figure 4b).

Discussion

Dynamic angry bodies were worse recognized than fearful and happy dynamic bodies. Remarkable here was that fearful dynamic bodies were better recognized than angry dynamic bodies. Again happy was recognized very well. The interaction effect showed no significant effects in the different conditions. But, violent offenders were worse in recognizing angry bodily expressions than fearful and happy bodily expressions. Controls were also worse in recognizing angry bodily expressions than fearful bodily expressions. Violent offenders ACC difference score of happy minus angry bodily expression was higher than the ACC difference

score of controls. In experiment 5 we will test if a social context influences the recognition of bodily expression.

Figure 4. Results Experiment 4

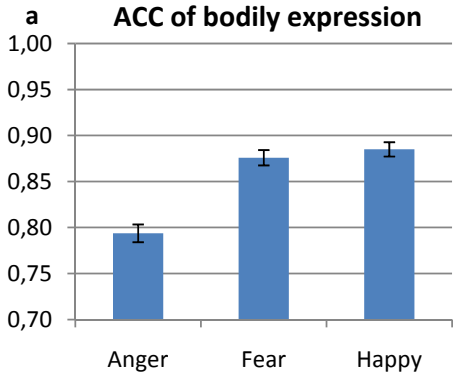

Figure 4a: ACC of bodily expression.

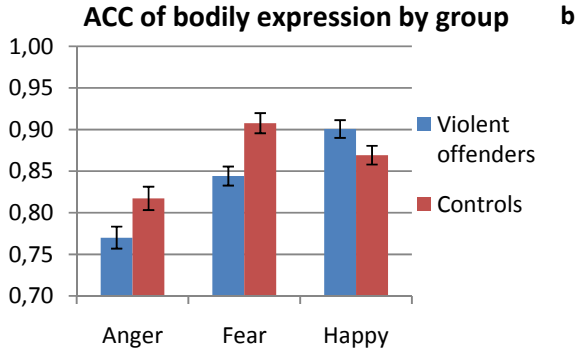

*Figure 4b: ACC of bodily expression * group. In this figure the main effect of bodily expression for violent offenders and controls is seen.*

Experiment 5. Judging bodily expression in context.

Method

Different bodies than in the previous experiments with blurred face were shown in the middle of a photo with a context of people around it (see picture 1). The context was either happy, angry or neutral. The target body in the middle was happy or angry. Participants were asked to judge which bodily expression was seen. Every picture was shown 100 ms. After the picture the screen appeared gray for 5700 ms, followed by a fixation cross for 300 ms before the new picture was presented. The picture and fixation cross were presented in the middle of the screen. Main and interaction effects of bodily expression and context expression for mean ACC and RT were tested in a 2 x 3 repeated measures ANOVA with two within-subject variables “body expression” (Anger or Happy) and “context expression” (Anger, Happy or Neutral) and “group” (Violent offender or Control) as between-subjects variable. Unless indicated, follow up statistical analyses are the same as in the previous experiments.

Picture 1.

Picture 1. Left: shows a congruent situation angry, with body and context angry. Right: shows an incongruent situation with body angry and context happy.

Materials and procedure

We did not opt for sad bodies and scenes since these contain less action than happy bodies and scenes, whereas angry and happy stimuli contain comparable action intensity. Whereas disgust can be expressed very clearly via the face, the body expressions are more ambiguous and resemble fearful expressions (de Gelder, 2006).

We briefly describe the construction and validation of the target body stimuli. 38 male and 46 female amateur actors were recruited. Prior to the photography session, they were instructed with a standardized procedure and received payment. As part of the instructions, the actors were familiarized with a typical scenario corresponding to each emotion; the fearful scenario was an encounter with an aggressive dog and the happy scenario was an encounter with a friend. A total of 869 body stimuli (consisting of fearful, happy, angry, sad, disgusted and neutral instrumental actions) were included in the validation study and were shown to 120 participants. Stimuli were presented for four seconds with an inter-stimulus interval of seven seconds. Participants were instructed to categorize the emotion displayed by circling the correct answer on an answer sheet. Eight happy and fearful body images, correctly recognized

on average for 91% (SD 10), were included in the experiment.

Scenes were selected from the internet. We took care to make them gender-balanced (for example, the neutral condition included a soccer field with male players; therefore, we also included a female hockey team playing). In a separate validation study we measured affective gist recognition by presenting each image twice for 100 ms in random order. Fearful (people running away for danger), happy (people dancing at a party) and neutral scenes (people involved in sports) were correctly recognized for 87%, 97%, and 92% respectively. Scenes showing bodies involved in neutral actions served as baseline.

We also validated the stimuli as they were used in the experiments described in this paper. The selected bodies were pasted on fearful, angry, happy and neutral scenes. These were presented with unlimited duration to 24 participants who had to categorize the emotion of the middle target body. The mean recognition rates and standard deviations (SD) were as followed: angry bodies in angry scenes (M = 91%, SD 8), angry bodies in happy scenes (M = 89%, SD 11), angry bodies in neutral scenes (M = 91%, SD 9), fearful bodies in fearful scenes (M = 97%, SD 6), fearful bodies in happy scenes (M = 98%, SD 4), fearful bodies in neutral scenes (M = 96%, SD 8), happy bodies in happy scenes (M = 75%, SD 21), happy bodies in fearful scenes (M = 73%, SD 23), happy bodies in angry scenes (M = 75%, SD 22) and happy bodies in neutral scenes (M = 77%, SD 21). Body expressions were not better or worse recognized in a congruent versus incongruent or in a congruent versus neutral scene when stimuli were presented with unlimited presentation duration.

Results

Trials with RTs below 200 ms or above 2500 ms were discarded from the analysis. A second filter was used to exclude RTs outside the range of mean RT minus and plus two standard deviation of a participant for every expression. Trials were also excluded from the RT analyses if the response was incorrect. Because of these filters twelve RT (nine by violent

offenders and three by controls) were missing. Instead of the missing means we have filled in group means of the condition.

Accuracy: There was a main effect of bodily expression [F(1, 1) = 11.015, $P < .01$, $\eta_p^2 = .175$] (see figure 5a.). Main effect of bodily expression revealed that happy bodies were better recognized than angry bodies ($P < .01$). There was also a main effect of congruent condition (body and context same expression, both happy or angry) versus incongruent condition(body and context different expression, happy and angry combined) [F(1,1) = 32.938, $P < .01$, $\eta_p^2 = .388$] (see figure 5d.). In the same figure the interaction effect for congruent x incongruent x group [F(1,1) = 6.391, $P < .05$, $\eta_p^2 = .109$] is shown. Violent offenders are worse in judging incongruent conditions than controls [t(52) = -2.037, $P < .05$]. There was also an interaction effect for bodily expression x context expression [F(1, 1.212) = 28.237, $P < .01$, $\eta_p^2 = .352$] (see figure 5b.). Congruent condition (body and context same expression) angry is better recognized than neutral condition (body angry with context neutral) [t(53) = 4.246, $P < .01$] and incongruent condition (body angry with context happy) [t(53) = 5.097, $P < .01$). This also accounts for congruent condition happy that's better recognized than neutral condition (body happy with context neutral) [t(53) = -3.784, $P < .01$] and incongruent (body happy with context angry) [t(53) = -5.524, $P < .01$]. Congruent happy is better recognized than congruent angry [t(53) = -2.655, $P = .01$].

There was also a interaction effect of bodily expression x context expression x group [F(1, 1.212) = 5.224, $P < .05$, $\eta_p^2 = .091$] (see figure 5c.). Follow-up comparison showed no significant effects in the different conditions. More interesting was testing if violent offenders had more profit from congruent condition versus incongruent condition than controls. Violent offenders are better in judging congruent conditions versus incongruent conditions than controls [t(51.898) = 2.518, $P < .05$].

Reaction time: There were no main or interaction effects of RT.

Discussion

Also in this experiment happy bodies are better recognized than angry bodies. This finding is found in all previous experiments with bodies. Just like in experiment 3 congruent conditions are better recognized than incongruent conditions. Interesting fact in figure 5d. shows that the congruent conditions are better recognized than incongruent conditions irrespective of group. On the other hand, violent offenders are worse in judging incongruent conditions than controls. Violent offenders seem to have more benefit from congruence than controls. Violent offenders are more influenced by incongruence.

Figure 5. Results Experiment 5

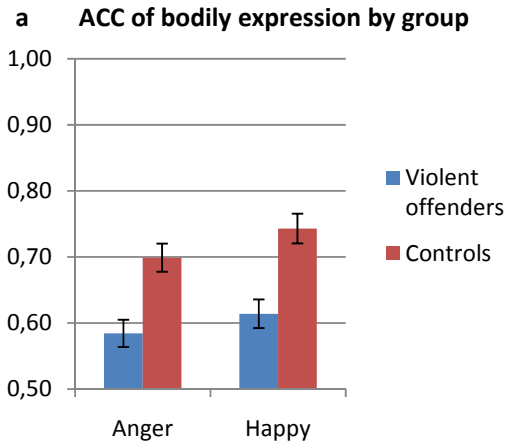

Figure 5a: ACC of bodily expression by group.

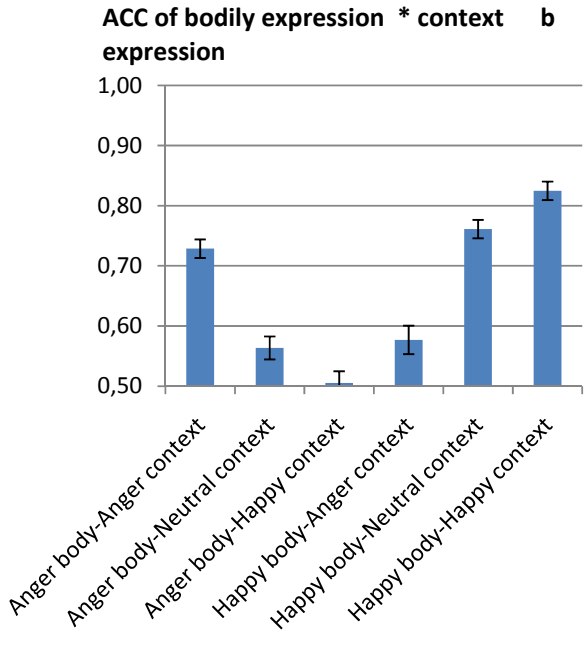

*Figure 5b: ACC of bodily expression * context expression.*

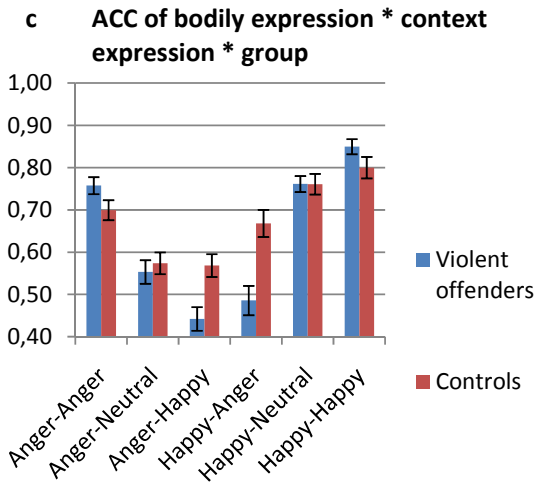

*Figure 5c: ACC of bodily expression * context expression * group.*

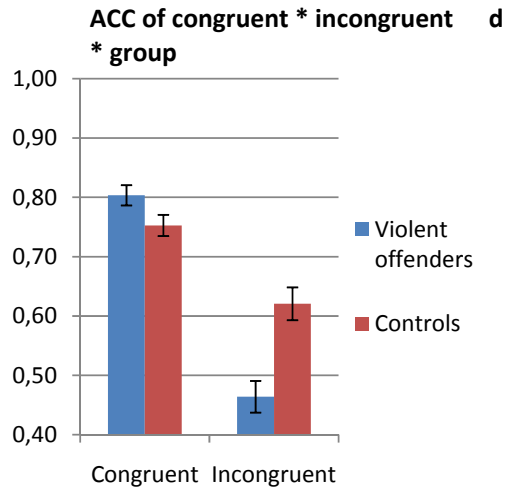

*Figure 5 d: ACC of congruent * incongruent * group.*

General discussion

The aim of this study was to investigate the importance and influence of emotional facial expression recognition and in particular emotional bodily expression recognition in violent behavior in violent offenders. The effect of emotional facial expression and emotional bodily expression were investigated using validated sets of faces and bodies in a series of experiments. The effect of emotional bodily expression was tested when combined with an emotional facial expression, an emotional dynamic bodily expression without emotional facial expression and emotional bodily expression with blurred face in a social context. In the first experiment, participants categorized as fast as possible the emotional facial expression of the target with one of the two other emotional facial expressions. In the second experiment, the task was similar, but we have used emotional bodily expressions instead of emotional facial expressions. The third experiment combined emotional bodily and facial expressions into a compound where facial expressions were categorized. Angry, happy and fearful expressions were used to form congruent (bodily and facial expression the same) and incongruent (bodily and facial expressions different) compounds. In the fourth experiment,

movie clips of 2 sec. with angry, happy or fearful bodily expressions and blurred face were shown. In the final experiment the effect of emotional bodily expression was tested by placing a angry, or happy bodily expression with blurred face in a angry, happy or neutral social context. In all five experiments ACC was tested and in all experiments except experiment four, RTs were tested. In the literature, there is little known about the psychological mechanisms underlying violent behavior in violent offenders.

Most research in human emotion literature focused on emotional facial expression. Only a few studies have been done for emotional facial expressions and emotional bodily expressions recognition. There seems to be patterns in emotional facial expression recognition. Several studies found a better recognition of angry facial expressions because antisocial behavior populations tend to misinterpret other emotions as anger (Mota & Schachtar, 2000; Sato, Uono, Matsuura & Toichi, 2009; Hall, 2006). Instead of concluding that violent offenders were worse in judging angry bodily expressions, we could also say that they did not misinterpret all the other emotions as anger like in the study of Cadesky, Mota and Schachar (2000) and maybe misinterpret the emotions as fearful. When facial expressions were presented in a context of other expressions, we showed in Experiment 1 that violent offenders were worse in recognizing anger than matched controls and better in judging fearful facial expressions than matched controls. This is also different than previous research, that showed deficits in fearful facial recognition (Marsh, Kozak & Ambady, 2007; Marsh & Blair, 2008). The task in Experiment 1 is different from the tasks in previous research. In previous research participants had to label an facial expression image with one of six basic emotions. In Experiment 1, participants had to match the target facial expression with one of two other facial expressions. These findings partly confirmed our expectation that violent offenders would make more errors on a facial recognition task. Beside angry and fearful facial expressions, there were no group differences in recognizing disgusted, happy, sad and

surprised facial expressions. Interesting to report is that happy and surprised facial expressions were best recognized irrespective of the distracter and had less interfering effect as a distracter on the target facial expression. A possible explanation could be that happy and surprise are two positive emotions versus four negative emotions anger, disgust, fear and sad.

Because of the lack of research about emotional bodily expression recognition we have based our expectations on literature about emotional facial expression recognition. We expected that violent offenders were better in judging angry bodily expression than matched controls, but worse in judging fearful bodily expressions than matched controls. None of both expectations were confirmed in Experiment 2. We did not found any differences between the two groups. This could implicate that violent offenders had more problems judging angry facial expressions than angry bodily expressions but less problems with judging fearful facial expressions than fearful bodily expressions. We found the same effects for happy bodily expressions as for happy facial expressions. More striking was the finding that sad bodily expressions were just like happy bodily expressions better recognized than angry and fearful bodily expressions.

Because of the literature about emotional facial expression recognition we expected that violent offenders would have more problems judging incongruent conditions in Experiment 3 and 5 than matched controls. Our expectations were confirmed in Experiment 5, because violent offenders were worse in judging incongruent conditions than matched controls. This implied that violent offenders had more problems judging emotional bodily expressions when the social context showed a different emotion than the body, than matched controls. It could be that violent offenders were more confused by conflicting emotional information and were more influenced by the conflicting emotional information. The task in Experiment 5 went very fast because the image was only presented for 100 ms. So unconsciously, violent offenders were more effected by the incongruent emotional social

context when judging the emotional bodily expression. In experiment 3 and 5, both violent offenders and controls were better in judging congruent conditions than incongruent conditions. This finding corresponds to the findings of Meeren, van Heijsbergen and de Gelder (2005), who found that when the face and body conveyed conflicting emotional information, judgment of the facial expression was hampered and became biased toward the emotion expressed by the body. Also Kret and de Gelder (2010) found that, when the context is incongruent with the other persons emotion, recognition drops. Both violent offenders and matched controls had benefit from congruent conditions versus incongruent conditions.

In Experiment 3, happy faces and bodies were also more accurately and faster recognized like in the two previous experiments. Happy bodies interfere less with the target, just like in Experiments 1 an d 2. Happy bodies do not interfere much but it takes more time for the participants to respond. Also in Experiment 4, happy was recognized very well.

Dynamic angry bodies were worse recognized than fearful and happy dynamic bodies. Remarkable here is that fearful dynamic bodies were better recognized than angry dynamic bodies. The interaction effect bodily expression x group showed no significant effects in the different conditions. But violent offenders were worse in recognizing angry bodily expressions than fearful and happy bodily expressions. Controls were also worse in recognizing angry bodily expressions than fearful bodily expressions. Violent offenders ACC difference score of happy minus angry bodily expression was higher than the ACC difference score of controls. Violent offenders and controls recognize fearful bodily expressions better than angry bodily expressions. This is not in line with our expectation that violent offenders would be better in recognizing angry bodily expressions than matched controls and worse in recognizing fearful bodily expressions than matched controls.

In Experiment 5 we found the same effects as in the previous four experiments where happy bodies were best recognized.

The findings of this research are in contrast with several findings in existing literature about emotional facial expression recognition in antisocial populations. The effect of congruence versus incongruence supports recent findings of Kret and de Gelder (2010). By this study we know that violent offenders have more problems judging incongruent conditions than matched controls. When conflicting emotional information arises, violent offenders score worse in judging emotional bodily and facial expressions. Not only body and face give us information about emotional expression, but also the social context around the person. Striking was the good and fast recognition of happy faces and bodies irrespective of possible conflicting emotional information.

Using bodies in this research has given more insight in the differences between emotional facial and bodily expressions, where emotional facial expression recognition is something different than emotional bodily expression recognition for violent offenders. The impaired emotion recognition accounts only for static faces and not for static bodies. Using dynamic bodies was useful, but conflicts with the findings of static emotional bodies. Using static bodies as distracter for judging static faces, showed that both groups had problems when face and body did not show the same emotional expression. This finding implied that the body gives unconsciously emotional information when judging the facial expression when only presented for 100 ms. Also Experiment 5 showed that unconsciously, the emotional social context influenced judging which emotional bodily expressions was seen. This finding also suggests that when there are several emotional queues, they all get attention, conscious or unconscious and influences the emotional expression asked. Using dynamic bodies gave other results than static bodies. The similarity was, that there were no group differences. The difference was, that when using static bodies, the bodily expressions anger, fear and happy were judged correct equally. When using dynamic bodies, violent offenders were worse in judging angry bodily expressions than fearful and happy bodily expressions. Also controls

were worse in judging angry bodily expressions than fearful bodily expressions. This suggests that fearful dynamic bodies were easier judged correct and angry dynamic bodies were more difficult to judge correctly. Using static and dynamic bodies has given more insight in how judging emotional expressions works and what the differences are in emotion recognition between violent offenders and controls.

To compare the facial recognition task with the bodily recognition task, it would be better to use the same six emotions in the bodily recognition task as in the facial recognition task. It could be an option in Experiment 3 by also giving the same experiment by judging bodily expression instead of facial expression. Beside dynamic bodies in Experiment 4, it would be nice to compare these results with dynamic faces. This also accounts for Experiment 5, where we have used bodies in a social context, where we could also test faces in a social context. Further research could test these suggestions to make a good comparison between the two groups and between the different conditions in a group.

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