Would you? Effects of oxytocin on moral choices in forensic psychopathic patients[☆,☆☆,☆☆☆]

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A B S T R A C T

Psychopaths are suggested to be more likely to favor utilitarian outcomes over non-utilitarian (i.e., deontological) choices. Here we re-test this hypothesis and investigate whether oxytocin, a hormone associated with empathy, can counter this utilitarian effect. Forensic psychopathic patients and non-psychopathic controls participated in a sacrificial moral decision-making paradigm. Psychopathic patients performed the task in a double-blind cross-over placebo-controlled oxytocin administration paradigm. We found no evidence for psychopathic patients to act more utilitarian (or sacrificial) or any effect of oxytocin administration. Psychopathic traits within the control group, particularly traits associated with lack of empathy and failure to consider consequences, were however associated with more utilitarian choices, but only when these actions were low in emotion. In contrast, psychopathy severity in psychopathic patients, particularly impulsivity-related traits, predicts deontological choices, but only in highly emotional actions. Thus, although psychopathic traits do predict utilitarianism when emotional investment is low, this is not the case in full-blown psychopathy. Instead, there is a link between impulsivity and deontological choices in psychopathic patients, but only when emotional investment is high, and self-interest is not at stake. These preliminary results are discussed to whether utilitarian outcomes align with the personal goals of psychopathic individuals.

2. Introduction

Psychopathy is a lifelong personality disorder characterized by deficits in interpersonal, emotional and behavioral functioning. Among other clinical features, psychopathic individuals exhibit a tendency to disrespect personal boundaries of others, are prone to antisocial behavior and instrumental aggression, and are known for their high criminal recidivism rates [1–6]. The estimated lifetime prevalence of psychopathy worldwide in the general population would range from 0.5 % to 1 % [4,7], although a recent meta-analysis estimated a higher prevalence rate in the general adult population of 4.5 %, albeit only 1.2 % when the Psychopathy Checklist-Revised (PCL-R; [8]) was used as a diagnostic tool [9]. The disruptive behaviors of psychopathic individuals, such as disrespecting the boundaries of others, make them disproportionately common among forensic patients and in prison populations [4,10–15]. Psychopathic individuals constitute 27.8 %–34.4 % of homicide offenders [16]. Given the extreme societal costs associated with this forensic overrepresentation [5], it is crucial to better

understand why psychopaths violate social and legal norms and whether this can be treated. To that end, it is important to study how psychopathic individuals cope with situations in which their sense of morality is called upon.

In the most basic sense, morality can be described as reasoning about what is considered right and wrong, involving intuitive and emotional processes and taking calculative and social consequences into account [17]. Moral reasoning is often studied through so-called moral dilemmas, i.e., specific situations in which the morality of an action is not evident (Whiteley, 1970). Moral dilemmas are typically defined in terms of mutually exclusive choices where an assumed rational response to maximize total welfare (i.e., the utilitarian judgment) is pitted against an emotional aversion to harm (i.e., the non-utilitarian or deontological judgment) [18]. Sex differences exist, as women make fewer utilitarian decisions than men, thus favoring deontological choices, but only in cases of personally inflicting harm, not when the harm is indirectly inflicted [19,20]. Harm avoidance in women might possibly be driven by a combination of lessened disposition to risky behavior and less venturesomeness compared to men [21]. We emphasize that utilitarian decisions should not be considered morally superior to deontological choices, and vice versa. Both mutually exclusive phenomena are rooted in distinct paradigms, each of which may have evolutionary benefits in different contexts.

The dual-process theory of moral judgment [17] proposes that controlled cognitive and automatic emotional processes are normally competing while making moral judgments [17,22]. In general, these cognitive processes are reflected by deliberate cost-benefit analyses, resulting in utilitarian decisions (John Stuart [23]) that violate societal norms "for the greater good". In other words, the calculated outcome of an action that harms others determines whether that action is considered right or wrong.

In contrast, emotion is reflected by an automatic aversive emotional reaction that results in deontological decisions (Immanuel [24]) that avoid actively and intentionally inflicting harm [25,26]. In other words, the nature of the action itself determines whether that action is considered right or wrong. In this case, the aversive emotional reaction to the utilitarian action would result in a passive stance, since it is wrong to intentionally harm people regardless of the outcome. Due to emotional deficits (e.g., Ref. [27,28]), in psychopathic individuals such moral dilemmas arguably evoke only little emotional aversion against inflicting harm, so their focus would predominantly be on achieving positive net outcomes. Less empathic concern leads to making more utilitarian than deontological decisions [18].

Psychopathic individuals exhibit emotional deficiencies (e.g., Ref. [27]) that disturb these processes. It is argued that these deficiencies diminish the automatic emotional processes, causing a bias towards the controlled cognitive processes, favoring utilitarian choices. This is however only confirmed in relation to psychopathic traits in community samples [29–31] while studies in confirmed psychopathic individuals show mixed results [32,33], which is arguably due to the different levels of emotion associated with utilitarian behavior in these studies.

Interestingly, the emotionality of the utilitarian action in moral dilemmas can be varied in a controlled manner. Moral dilemmas are classified as either personal or impersonal. The former describes acts where harm is caused by direct physical contact and the latter where harm is inflicted in an indirect, non-physical way. In this classification the utilitarian actions in personal dilemmas are associated with a stronger emotional value. Personal dilemmas are further divided into dilemmas in which the victim's harm is either inevitable or evitable [34]. Inevitable harm assumes that regardless of whether and what action is taken, the person involved will eventually suffer harm, whereas the latter is not the case with evitable harm if the action is waived. For example, in the submarine dilemma, a personal inevitable dilemma is given. In this dilemma, you are the captain of a military submarine traveling underneath an immense iceberg. An onboard explosion has

caused you to lose most of your oxygen supply and has injured one of your crew who is quickly losing blood. This injured crew member is going to die from his wounds no matter what happens. The remaining oxygen is not sufficient for the entire crew to make it to the surface. The only way to save the other crew members is to sacrifice the injured crew member so that there will be just enough oxygen for the rest of the crew to survive. Is it appropriate for you to kill the fatally injured crew member in order to save the lives of the remaining crew members? [17]. Would you? In comparison, in personal-evitable dilemmas, the victim will not suffer harm or die unless the utilitarian action is performed, giving that action an even stronger emotional response. In general, actions such as the captain's in the latter personal inevitable dilemma are considered more morally permissible compared to harm inflicted in personal evitable dilemmas [35]. Therefore, moral dilemmas can be ordered from impersonal to personal-inevitable to personal-evitable in terms of increasing emotionality of the utilitarian action (e.g., Ref. [36, 37]). Fig. 1 depicts both the distinction in moral dilemmas and the distinction in assumed emotionality.

In the present study we will therefore explore moral decision-making in psychopathic patients and healthy controls using a strict separation of moral dilemmas based on the emotional value of the utilitarian action. We will thereby focus on the question whether moral choices in psychopathy can be altered by administration of oxytocin (OT). This neuropeptide is a logical research candidate for influencing moral choices, as it is known for its role in empathy processing [38,39], in generosity [40] and in social understanding and interpersonal behavior ([41–43]; Meyer-Lindenberg et al., 2011). Furthermore, OT is involved in discriminating between outgroup and ingroup members [44]. Effects of OT administration on moral decision-making are however mixed, possibly due to not taking account of the emotionality of the utilitarian actions ([45–47]; see for an overview [48]). Whether genetic factors contribute to moral judgment is not yet clear and certainly not unequivocal. However, some studies do suggest a possible positive link. A common variation of the OT gene, namely a functional polymorphism (rs2268498) in the promoter region, was found to be significantly related to harsher moral judgment of individuals who caused unintentional harm [49]. Another polymorphism (rs237889) of the OT receptor gene (OXTR) was negatively associated with utilitarian responses to high-conflict dilemmas [50]. Palumbo and colleagues [51] found no association in male insurance brokers between types of moral dilemmas and individual polymorphisms of the OT receptor (i.e., rs53576, rs2268498 and rs1042770). However, they did find that a composite genetic profile of the three aforementioned polymorphisms was associated with more utilitarian choices. A word of caution is in order. Studies of candidate gene effects often use samples of relatively small magnitude and therefore run the risk of reporting positive associations that are likely to be false positives [52]. According to the social salience hypothesis or OT, attention modulation in interpersonal relationships changes under the influence of OT as this neuropeptide affects social salience of external social cues, although individual aspects such as gender and psychological factors (e.g., character traits) remain important [53].

To the best of our knowledge this is the first study in PCL-R-confirmed psychopathic individuals to investigate the influence of OT on moral choices. We hypothesized that OT will reduce psychopathic patients' choice of more utilitarian than deontological choices (hypothesis 1). We further hypothesized that psychopathic patients make more utilitarian choices compared to normal controls (hypothesis 2). In hypothesis 3, we stated that the percentage of utilitarian choices is positively related to psychopathy severity in both groups [32,54].

3. Methods and materials

3.1. Participants

In this study among psychopathic patients, we used a within-subjects
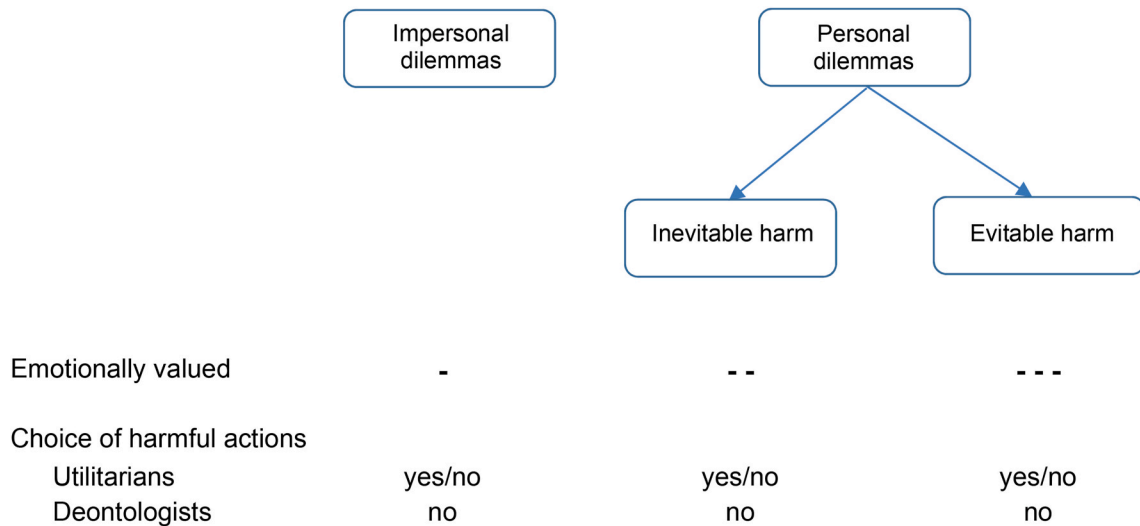
Fig. 1. Various choices in moral dilemmas and their assumed emotional burden

Following considered cost-benefit analyses, utilitarians decide to act or not to act depending on their assessment of whether a harmful action imposed on (an)other individual(s) is for "the greater good of all". Deontologists, on the other hand, choose not to act because they believe no intentional harm should be inflicted on (an) other individual(s), regardless of the (expected) outcome. The - sign symbolizes the assumed negative value related to the decision being asked to make.

design. It was calculated that a sample size of 19 patients or higher was sufficient for 80 % power to find a medium effect-size difference between OT and placebo on the three measures of moral decision making. Because of balancing between OT and placebo as well as task conditions, a final sample size of 24 psychopathic patients was chosen. The group of normal controls who did not administer OT or placebo was considered the reference population.

Initially, 24 male forensic psychiatric patients and 28 normal male controls were included in the current study. Patients were recruited from five maximum-security forensic psychiatric hospitals in the Netherlands. Compared with the diagnostic cut-off score of 30 in North America, lower cut-off scores for psychopathy are used in various European countries [55–60]. We selected patients if their PCL-R total score was 26 or higher. As this study was part of a larger study that also focused on empathy processing in psychopathy, the maximum score (i.e., 2) of PCL-R item "callousness/lack of empathy" [8] was required. The normal controls were male security guards or nursing staff members recruited from two forensic psychiatric hospitals. Similar inclusion and exclusion criteria applied to these participants, except that they could not be diagnosed with the PCL-R. Instead, to check for psychopathic features, they completed the Psychopathic Personality Inventory-Revised [61]. Their raw scores were linearly converted into standardized T-scores allowing comparison with norm groups. T-scores were calculated for the two PPI-R factors, i.e., Fearless Dominance and Impulsive Antisociality as well as for the PPI-R subscale Coldheartedness that does not load on either of the two PPI-R Factors [62].

As the current study was part of a larger study in this group of psychopathic patients, we refer for an extensive description of additional requirements for participation in this larger study to Rijnders and colleagues [63]. In short, inclusion criteria were male sex, good physical health, age between 18 and 60 years, and a total IQ of 80 or above. A current severe psychiatric disorder like a psychotic disorder, a depressive disorder, or a severe anxiety disorder, the current use of selective serotonin reuptake inhibitors, selective norepinephrine reuptake inhibitors, antipsychotics, and hormonal libido inhibitors as well as the current use of alcohol or recreational drugs constituted a contraindication to participation in this study. Of the 24 patients with PCL-R cut-off scores of 26 or higher who were enrolled in this OT study, three were eventually excluded from analysis due to their co-morbid DSM-IV-TR [64] Pervasive Developmental Disorder Not Otherwise Specified. In addition, two normal controls were excluded from analysis as well. One

was excluded because of a total score of ≥2SD above average on the PPI-R total score, indicating a psychopathic tendency. The second was excluded as he turned out to be deficient in describing, identifying and processing emotions according to the Toronto Alexithymia Scale [65].

The group of the remaining 21 psychopathic patients that complied with all inclusion and exclusion criteria was tested with OT vs. placebo. The 26 remaining normal controls did not applicate either placebo or OT and were therefore tested in one session only. Seven normal controls participated only in this morality study and thus not in the larger study. There was no difference in mean age between the other 19 normal controls and this subgroup of seven ($t(24)$ - 1.698, $p = 0.102$), nor did their ethnic-cultural and national origins differ. Exclusion of these seven in preliminary analyses yielded the same results. Therefore, we decided to fully include this subgroup in the final analyses. It was concluded that there were no cultural barriers in either group that could eventually interfere with test instructions or test attitudes. Detailed sample characteristics are presented in Table 1.

Participants provided written informed consent prior to their participation. The study was approved by the Medical Research Ethics Committee of the University Medical Centre Utrecht, The Netherlands (protocol number 12/056), and was carried out in accordance with the guidelines of the Declaration of Helsinki [66]. The participants received a monetary compensation of 30 Euros.

3.2. Study design

The 21 psychopathic patients of the intervention group followed a within-subject, double-blind, counterbalanced, placebo-controlled, cross-over design, which was in line with previous studies (e.g., Ref. [67–69]). Thus, they completed two test sessions, one in which they self-administered a nasal spray with 24 IU of the synthetic version of OT (registered product name Syntocinon®). This product is identical to the human pituitary version of OT. In the other test session, they received a placebo nasal spray consisting of a solution of physiological saline (NaCl; quality label PH.EUR; BUFA, Spruyt Hillen, the Netherlands). The mean time interval between the two sessions was 12.3 ± 3.6 days (range 7–21 days). Starting times at which the nasal spray was administered on the two test days, was 1:14 p.m. ± 2.16 h and 1:17 p.m. ± 2.1 h, respectively. The participants were instructed to refrain from cigarette smoking and caffeine consumption at least 1 h before the start of the test session. During the wash-in period of OT to act in the central nervous

Table 1
Demographic information.

	Psychopathic patients (N = 21)	Normal controls (N = 26)
Age in years[a] (range)	39.5 ± 9.3 (23.7–54.9)	36.7 ± 8.0 (24.5–51.9)
Ethnic-cultural and national origin (all participants currently had a Dutch nationality)	19 Caucasians (viz 16 Dutch, 1 Belgian, and 2 Turks), 1 African-Surinamese, and 1 Chinese-African Surinamese	24 Caucasians (viz 20 Dutch, 3 Moroccans, and 1 Turk), 1 Dutch Antillean, and 1 Hindustan-Surinamese
Duration of mandatory treatment in months	112 ± 82	n.a.
PCL-R total score (range)	31.1 ± 2.9 (26–36)	n.a.
PCL-R facets (ranges)		
Facet 1: Interpersonal facet	5.8 ± 1.3 (3–8)	
Facet 2: Affective facet	7.4 ± 0.8 (5–8)	
Facet 3: Lifestyle facet	7.8 ± 1.3 (5.5–9.5)	
Facet 4: Antisocial facet	8.3 ± 1.4 (5–10)	
Category "Other" (two items that do not load on any of the four facets)	2.0 ± 1.5 (0–4)	
PPI-R total score (range)	n.a.	287.3 ± 28.1 (243–336)
T-scores (ranges)		
PPI-R total		47.7 ± 10.3 (29–65)
PPI-R factor Fearless Dominance		54.6 ± 9.8 (31–68)
Social potency		55.4 ± 11.3 (19–78)
Fearlessness		52.1 ± 13.0 (25–80)
Stress immunity		56.1 ± 8.5 (44–82)
PPI-R factor Impulsive Antisociality		42.3 ± 9.5 (26–61)
Machiavellian egocentricity		39.5 ± 12.8 (4–61)
Rebellious nonconformity		48.3 ± 9.8 (34–74)
Blame externalization		44.5 ± 8.3 (34–64)
Carefree nonplanfulness		47.6 ± 10.3 (27–65)
Coldheartedness		50.7 ± 11.5 (24–70)

For all variables the means ± standard deviations are reported. PCL-R = Psychopathy Checklist-Revised; PPI-R = Psychopathic Personality Inventory-Revised (with two Factors and eight subscales, including the subscale Coldheartedness that does not load on the two PPI-R factors).

[a] No significant group differences in age ($t(45) = 1.130$, $p = .264$).

system [70,71] the participants of the intervention group watched stress-free fragments of the documentary Planet Earth [72]. The overall test procedure for the normal controls was similar, except that they were tested on one day only, as they did not use OT. The clips from the BBC documentary were therefore not presented to them. All participants completed the entire test procedure.

In order to control for blindness of drug administration, the psychopathic patients gave their estimate of the order of drug allocation at the end of the second test procedure. In line with reviewed placebo-controlled OT studies with OT doses ranging from 18 to 40 IU [73] it was expected that participants would not be able to accurately indicate when they had received OT and placebo.

3.3. Moral dilemmas task

Greene and colleagues (2001, 2004) previously described the moral dilemmas used in this study. The texts of 24 moral dilemmas were translated from English to Dutch, and then translated back from Dutch to English and checked for consistency by a native English speaker (see Ref. [74]). Two sets of twelve different moral dilemmas were created that were similar in emotional intensity and content [32]. The proportions of impersonal, personal evitable and personal inevitable were also similar across the two sets. The text of the dilemmas was displayed on a computer screen with the text read aloud through headphones. For each dilemma, participants were asked to indicate the moral permissibility of the proposed action which were presented in forced-choice

questions (i.e., "Would you … ?") that could only be answered "yes" or "no" via a key on the keyboard. Participants who were tested twice (i.e., the psychopathic patients) answered two sets of twelve different dilemmas each whereas the normal control group answered one randomly assigned set of twelve dilemmas. The English and Dutch texts of all 24 moral dilemmas are listed in Table S1 in Supplementary Information.

3.4. Statistical analyses

Statistical analyses were performed using IBM SPSS statistics version 27. Before testing the hypotheses, data were checked for outliers and missing data. Data of one healthy control were incomplete (i.e., only nine out of twelve dilemmas were answered). Therefore, it was decided to use the percentage of utilitarian choices for every participant, which meant that the data of this participant could still be used. The data showed no outliers. Independent sample *t*-tests were conducted to determine whether there were significant differences in demographic variables between the psychopathic patients and normal controls. Descriptive and exploratory analyses were conducted to test the normality of all continuous variables. To analyse whether participants knew whether they were receiving OT or a placebo, a Fisher's exact test was conducted.

To test our first hypothesis that OT will reduce utilitarian moral decision-making in psychopathic patients, we performed a 3 (Dilemma type) x 2 (Drug) repeated-measures ANOVA. Our second hypothesis that psychopathic patients make more utilitarian moral choices than normal controls was tested using a 3 (Dilemma type) x 2 (Group) repeated-measures ANOVA, in which we compared psychopathic patients in placebo condition with normal controls. Finally, our third hypothesis about a positive relationship between psychopathy severity and the percentage of utilitarian choices was tested using Spearman's one-tailed correlational analyses. Moreover, for the third hypothesis, we also conducted correlation analyses in both groups separately. In the post-hoc analysis, we applied a Bonferroni correction based on the number of moral dilemmas (division by 3).

4. Results

4.1. Demographic information

The final sample consisted of 21 psychopathic patients and 26 normal controls. The mean age of the psychopathic patients (39.5 ± 9.3 years) and the normal controls (36.7 ± 8.0 years) did not differ significantly ($t(45) = 1.130$, $p = 0.264$). For the psychopathic patients, the mean time interval between self-administration of the intranasal spray and the start of the moral dilemmas task on both test days was 77.8 ± 6.5 min and 81.5 ± 5.5 min, respectively. These time intervals were considered adequate, as in most human intranasal OT studies the time window for measuring OT-related neurobehavioral effects varies between 20 and 90 min after OT administration [75]. It was expected that the psychopathic patients could not accurately report in which session they received OT or placebo. Thirteen participants (61.9 %) correctly assigned the correct drug to the session. The difference from chance was not significant (Fisher's exact test, $p = 0.656$).

PCL-R scores of all psychopathic patients, including the PCL-R facet scores, are presented in Table 1. Among normal controls, mean T-scores of the combined PPI-R subscales and mean T-scores for the higher-order PPI-R factors Fearless Dominance and Self-Centered revealed no indication of psychopathic personality (Table 1).

4.2. Utilitarian choices in psychopathic patients and effect of OT on dilemma type

To test our first hypothesis that OT reduces utilitarian choices in psychopathic patients, a repeated-measures ANOVA was first conducted using a 3 (Dilemma type) x 2 (Drug) design. Mauchly's test indicated

that the assumption of sphericity had been violated for the dilemma type effect, $\chi^2(2) = 6.52$, $p = 0.038$, therefore the Huynh-Feldt correction was applied to the degrees of freedom ($\varepsilon = 0.83$). No corrections were made on the tests for the main effect of drug as well as the interaction effect. There was a significant main effect of dilemma type on utilitarian choices, $F(1.66, 33.11) = 50.19$, $p < 0.001$. Post-hoc contrasts revealed a significant difference in utilitarian choices between the impersonal and personal inevitable dilemmas. Specifically, utilitarian choices were more frequent (i.e., less deontological moral choices) for impersonal dilemmas than for personal inevitable dilemmas ($F(1, 20) = 45.44$, $p < 0.001$; Fig. 2). There was also a significant difference between personal evitable and personal inevitable dilemmas, the psychopathic patients made more utilitarian choices in personal inevitable dilemmas ($F(1, 20) = 5.69$, $p = 0.027$; Fig. 2). The main effect of drug on utilitarian choices was not significant, $F(1, 20) = 0.14$, $p = 0.715$. The interaction effect between dilemma type and drug was also not significant, $F(2, 40) = 1.29$, $p = 0.286$.

4.3. Utilitarian choices in psychopathic patients and normal controls

To analyse any differences in utilitarian choices between normal controls and psychopathic patients in the placebo condition (second hypothesis) we performed a repeated-measures ANOVA with dilemma type as the within-subjects factor and group membership as the between-subjects factor. Mauchly's test indicated that the assumption of sphericity had not been violated, $p = 0.091$, therefore no corrections were applied. The results show a main effect of dilemma type, $F(2, 90) = 42.46$, $p < 0.001$. Post-hoc comparisons indicated significant differences between impersonal and personal evitable ($p < 0.001$) and impersonal and personal inevitable ($p < 0.001$) dilemmas. Specifically, utilitarian choices were more frequent (less deontological moral choices) in impersonal dilemmas than in personal evitable dilemmas across the two groups. For all dilemma types, no significant differences existed between psychopathic patients in the placebo condition and the normal controls ($F(1, 45) = 0.63$, $p = 0.435$; see Fig. 2).

4.4. Correlations between psychopathy severity and utilitarian choices

We used Spearman's correlations to test our third hypothesis that the percentage of utilitarian choices is positively related to psychopathy severity. Because of multiple measurements, we adjusted the significance interval so that $\alpha = 0.05/3 = 0.0167$. A significant negative correlation existed between the PCL-R total score and the percentage of utilitarian choices when assessing personal evitable dilemmas in the placebo condition ($r = -0.54$, $p = 0.011$; see Fig. 3). For this dilemma type, highly psychopathic patients in the placebo condition showed fewer utilitarian choices (i.e., more deontological moral choices).

Further exploration of this unexpected finding that contrasted sharply with our third hypothesis, revealed that PCL-R facet 3 was negatively correlated with the percentage of utilitarian choices in personal evitable dilemmas ($r = -0.60$, $p = 0.005$; see Fig. 3). PCL-R facet 3 includes the lifestyle items stimulation seeking, impulsivity, irresponsibility, parasitic orientation, and lack of realistic goals [8]. A higher score on this PCL-R facet was thus correlated with more deontological (i.e., less utilitarian) choices. No significant correlations were found between the other PCL-R facets including Category "Other" and the three types of moral dilemmas (all ps > 0.133).

For the normal controls, we further performed Spearman's correlation analyses for the PPI-R total score and the percentage of utilitarian choices on the three dilemma types. Because of multiple measurements, we also adjusted the significance interval so that $\alpha = 0.05/3 = 0.0167$. A significant positive relation existed between PPI-R total T-score and the percentage of utilitarian choices when answering impersonal dilemmas ($r = 0.47$, $p = 0.016$; see Fig. 4). Further exploration showed that only PPI-R factor Impulsive antisociality was significantly correlated with the percentage of utilitarian choices ($r = 0.59$, $p = 0.002$). Within this PPI-R factor Impulsive antisociality (see Table 1), the subscale Machiavellian egocentricity (i.e., willingness to exploit others for personal gain and a lack of empathy [61]) showed a significant correlation with the percentage of utilitarian choices ($r = 0.50$, $p = 0.010$). The subscale Carefree nonplanfulness, which is the lack of long-term planning and lack of consideration of consequences [61] was also significantly positively correlated with the percentage of utilitarian choices ($r = 0.53$, $p = 0.006$). However, this was not the case with the other two subscales of PPI-R factor Impulsive antisociality, i.e., Rebellious nonconformity and Blame externalization ($p = 0.045$ and $p > 0.100$, respectively). No follow-up correlation analyses were performed for the other dilemma types and the PPI-R subscales as these variables did not correlate with
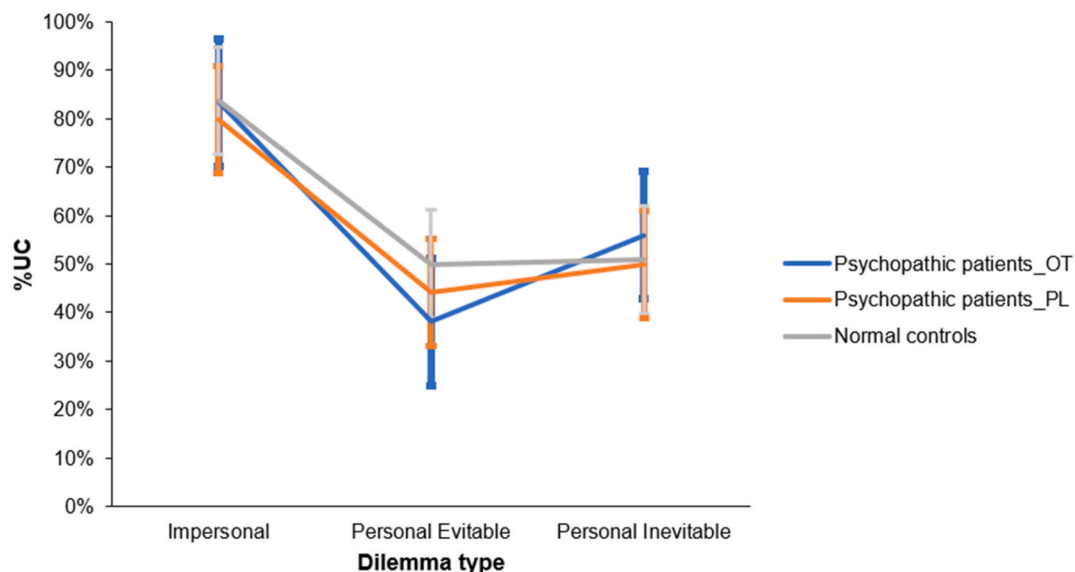
Fig. 2. The main effect of moral dilemma type on the percentage utilitarian choices for both normal controls and patients in the OT and placebo conditions. Using drug condition as a covariate in the psychopathic patient group, significant differences existed between impersonal and personal inevitable dilemmas, $F(1, 20) = 45.44$, $p < 0.001$ and between personal evitable and personal inevitable dilemma types, $F(1, 20) = 5.69$, $p = 0.027$.
There were no significant differences between normal controls and psychopathic patients in the placebo condition for all dilemma types ($F(1,45) = 0.63$, $p = 0.435$).
%UC: percentage of utilitarian choices.
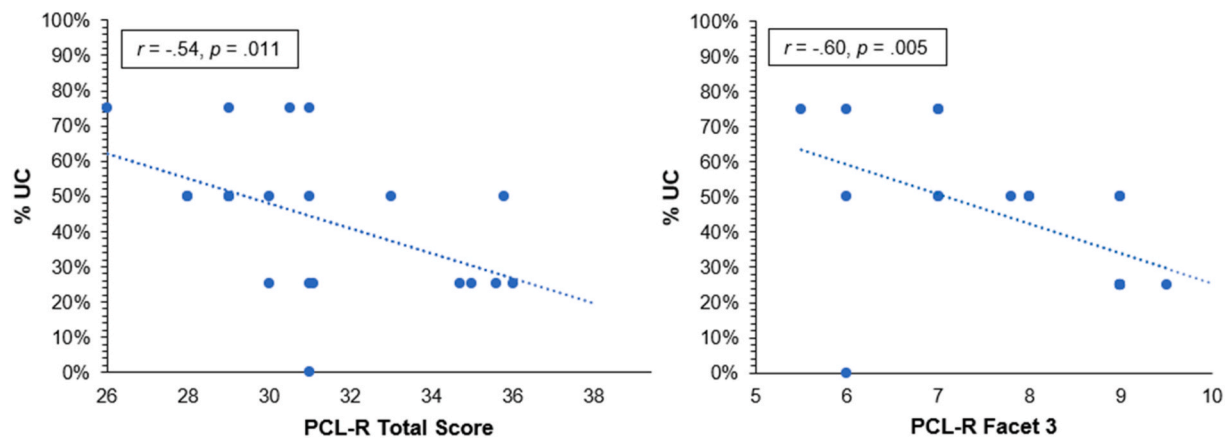
Fig. 3. Relationship between PCL-R scores and the percentage of utilitarian choices for personal evitable dilemmas in psychopathic patients in the placebo condition. The PCL-R Total Score was significantly negatively correlated with the percentage of utilitarian choices ($r = -0.54$, $p = 0.011$). This significance was driven by the PCL-R facet 3 score ($r = -0.60$, $p = 0.005$), not by the other PCL-R facets (all $ps > 0.266$). PCL-R facet 3 encompasses lifestyle items such as stimulation seeking, impulsivity, irresponsibility, parasitic orientation, and a lack of realistic goals. %UC: percentage of utilitarian choices.
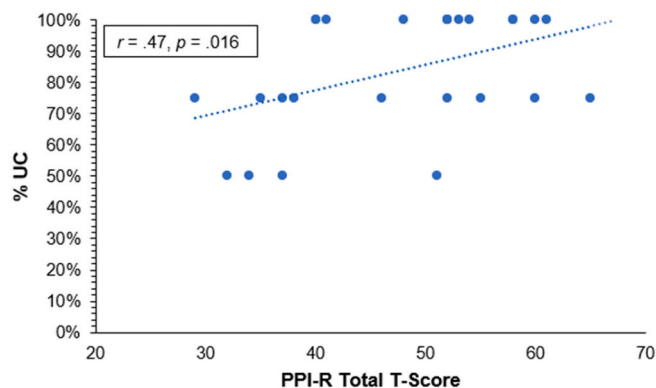
Fig. 4. Relationship between the PPI-R Total T-score and the percentage of utilitarian choices for impersonal dilemmas in normal controls.
The PPI-R total T-score was significantly positively related with the percentage of utilitarian choices ($r = 0.47$, $p = 0.016$. The raw PPI-R scores were linearly converted into standardized T-scores allowing comparison with norm groups. T-scores have a mean of 50 and a standard deviation of 10.
%UC: percentage of utilitarian choices.

the PPI-R total T-score.

5. Discussion

In this study of PCL-R confirmed psychopathic patients admitted to forensic psychiatric hospitals and normal controls, we examined their willingness to make utilitarian choices, i.e., assumed rational responses to maximize well-being for all, as opposed to deontological choices, i.e., an emotional aversion to harming other people. Contrary to our first hypothesis, a single nasal administration of OT did not reduce utilitarian moral decision-making in psychopathic patients. Moreover, contrary to our second hypothesis, we found no differences in the percentage of utilitarian choices between psychopathic patients and normal controls. There is a history of conflicting results on this topic, as several other studies similar to the current study reported no differences between psychopathic individuals and normal controls ([27]; Cima et al., 2010; [76]). However, other studies showed a positive association between psychopathy severity and utilitarian decision-making as opposed to deontological choices [29,30,32,33]. A recent meta-analysis revealed a small to moderate positive relationship between psychopathy and utilitarian choices [77]. One possible explanation for the mixed results is

the way psychopathy is measured and in which populations the research is conducted. For example, Bartels and Pizarro [29] and Glenn et al. [30] used self-report instruments in their non-forensic samples, while in our study we identified our clinically admitted group of forensic psychopathic patients by deploying the PCL-R, as is common in forensic and clinical settings. Furthermore, the use of different diagnostic cutoffs of psychopathy may partially explain the contrasting results. Koenigs and colleagues (2012) used a PCL-R cutoff of 30 points, while the cutoff in our study was 26 points, as is common in European countries.

Our third hypothesis stated that in both groups psychopathy severity was positively related to the percentage of utilitarian choices. This could not be confirmed for the group of psychopathic patients. In contrast, we found that psychopathy severity was negatively related to the percentage of utilitarian choices, meaning that the higher the PCL-R total score, the more non-utilitarian (i.e., deontological) responses the psychopathic patients gave. This unexpected finding was observed only in the case of personal evitable dilemmas (i.e., where one can choose to waive action to avoid harm). Understandably, because of the direct physical action to be taken, a personal evitable moral choice carries a greater emotional burden than a personal inevitable dilemma, and probably even much more than an impersonal dilemma. Follow-up analyses revealed that PCL-R facet 3 specifically was negatively associated with the percentage of personal evitable choices. This PCL-R facet 3 encompasses lifestyle items such as stimulation seeking, impulsivity, irresponsibility, parasitic orientation, and a lack of realistic goals [8]. There is no reason to believe that psychopathic individuals a priori choose to inflict harm, especially in situations where their self-interest is not at stake. PCL-R facet 3 reflects high levels of impulsivity. It is conceivable that high PCL-R facet 3 scoring psychopathic individuals, due to their high impulsivity, may be inclined to make a harm-aversive choice in the personally evitable dilemma, more so than is the case in the less emotion-laden personally inevitable and impersonal dilemmas. This inclination seems to contradict what has been described above about the dual-process theory of moral judgment [17,22] in which psychopathic individuals, who are known to have disturbed emotional processing [27,28], tend to choose utilitarian solutions. The question is whether increased social desirability in the psychopathic patient could explain the negative correlation between PCL-R facet 3 scores and utilitarian choices. In other words, were they faking a more humane response? If so, one would expect this faking to occur in other answer categories as well, for example in the less emotionally charged inevitable dilemmas, which was not the case in this study. We believe that the combination of high impulsivity, absent self-interest, an emotionally charged decision that is harmful to the other person and must be carried out by direct physical

force can tilt the response toward a deontological choice. Choosing the emotion-laden use of evitable harm may immediately be considered "too hot" and then impulsively rejected.

The above relationship may well be a chance finding not previously discovered in other studies. Therefore, a replication study is warranted. Nevertheless, we believe that the relationship is interesting enough to further explore this deontological preference. We hypothesize that an explanation can be found when comparing highly impulsive psychopathic individuals and subjects with Urbach-Wiethe disease (UWD) in which a genetic mutation causes selective bilateral calcification of the basolateral amygdala (BLA), while the central-medial amygdala (CMA) remains functional and intact [37]. UWD subjects make impulsive social-emotional decisions due to the loss of the regulatory effects of the BLA on structures required for moral decision-making, namely the CMA, nucleus accumbens and ventral medial prefrontal cortex (vmPFC) [78]. As a result, they lack outcome-oriented decision-making, preventing them from making instrumental utilitarian decisions in conflict situations. Therefore, they impulsively and rigidly tend strongly toward deontological choices [37]. In violent and high-risk to violence psychopathic individuals, regional reductions in gray matter were demonstrated in several paralimbic and limbic regions, including the bilateral amygdala [79], with up to 30 % reduction in BLA tissue and a 10 %–30 % enlargement of the central and lateral nuclei of the amygdala [80], while amygdala volume reductions showed significant correlations with PCL-R scores with the strongest correlations with PCL-R facets 1 and 2 scores, i.e., the interpersonal and affective facets, respectively [81]. These findings indicate abnormal functioning of the amygdala in psychopathy, as was found by Glenn and colleagues (2009) who showed reduced activity specifically in the amygdala during emotional moral decision-making. These abnormal amygdala findings have also been associated with motivational aspects [82]. BLA input is mandatory for the vmPFC to acquire motivational value in decision-making [78]. Moreover, the CMA promotes automatic emotional reactivity and general motivation, while these processes can be inhibited by the BLA, resulting in more instrumental goal-directed motivation and behavior [83,84]. In short: the BLA is fueling instrumental (i.e., utilitarian) decisions by suppressing the automatic affective processing from the CMA. We hypothesize that when their self-interest is not at stake, highly impulsive psychopathic individuals tend to respond impulsively deontologically to strong aversive dilemmas due to BLA deficits. In terms of moral decision-making, the difference between impulsive psychopathic individuals and UWD subjects may be that the former may reach an instrumental decision when contextual information favorable to them prompts them to do so. Of course, a time factor is involved in considering this contextual information that is at odds with the high levels of impulsivity of the psychopathic individual. Future research should ask high PCL-R factor 3 scoring psychopathic subjects whether they stand by their choice after further consideration and reflection.

Similar correlation analyses using the PPI-R total score were performed for the normal controls. We emphasize that none of the normal controls reached the clinical level of psychopathy; on the contrary, one of them was excluded from analysis because of a total score of >2SD above average on the PPI-R total score, indicating a psychopathic tendency. Here, a positive relationship was found between psychopathy severity and the percentage of utilitarian choices ($r = 0.47$), which was consistent with our third hypothesis. This moderate effect was only present in case of impersonal dilemmas (i.e., where harm is inflicted in an indirect, non-physical way). As can be inferred from the definition, impersonal dilemmas, because of the non-physical contact with the other person during the chosen action, presumably bear less burden than personal evitable and personal inevitable dilemmas. These findings were consistent with both a meta-analysis [77] and recent research by Paruzel-Czachura and Farny [85]. In conclusion, psychopathic patients showed an unexpected preference for nonutilitarian choices in dilemmas with greater emotional strain, while the responses of normal controls were in line with previous research. This study shows that

high-impulsive psychopathic patients tend to opt for a deontological choice in cases of evitable dilemmas in which immediate harm is inflicted, possibly due to their impulsive rejection of the emotionally charged consequences of harming others while their self-interest is not at stake. Further investigation of this issue is warranted. Although we point out the emotionality involved in making moral choices, future studies should also consider the possible self-interest of the person who must make either a utilitarian or non-utilitarian decision. If that person himself experiences the consequence of his choice, for example the submarine captain mentioned earlier, then self-interest may be a factor of significance.

Our sample size N = 21 is sufficient to detect a medium-to-large effect size (Cohen's d = 0.56) of OT administration on moral decision making with a power of 0.80. Therefore, we can neither identify nor reject small effect sizes of OT administration in this sample of psychopathic patients. Furthermore, the correlational effects should be considered preliminary. A few limitations to the current study should be mentioned. First, due to practical reasons the group of normal controls did not administrate OT. As a result, it was not possible to analyse whether OT has different effects in psychopathic patients compared with normal controls. In addition, since the normal controls did not use a nasal spray themselves, there is a potential risk in comparing this group with psychopathic patients in the placebo condition, as the placebo effect of an intervention on outcome measures may be significant. Second, Koenigs and colleagues (2012) included anxiety levels in their analysis and found that only psychopaths with low anxiety responded significantly more utilitarian than normal controls. In our study, anxiety was not measured directly, so it is unknown whether anxiety levels may have affected the results. Third, psychopathic participants underwent a single administration of 24 IU of OT, which is considered an adequate dose in human research [73,86]. However, a single nasal administration may be too little or too occasional to induce detectable behavioral changes. Perhaps repeated administration of OT over several days or even weeks could result in OT-induced differences in moral choices. In this regard, we refer to a recent study in autistic children [87] in which such a study design showed behavioral changes up to months afterwards.

Notwithstanding these limitations, the current study provides insight into the relationship between psychopathy and moral decision-making. A unique point of this study is that we investigated a clinically identified and PCL-R confirmed group of forensic psychopathic patients who were not treated with medication like selective serotonin reuptake inhibitors, selective noradrenaline reuptake inhibitors, antipsychotics, or hormonal libido inhibitors. This study showed no effects of the neuropeptide OT on moral decision-making and we further could not demonstrate a significant difference between psychopathic patients and normal controls in their moral choices. However, we found an intriguing association between highly impulsive psychopathic traits and an aversion to make utilitarian choices in a dilemma type that is thought to be more negatively emotion-laden than other dilemma types.

Future research on moral decision-making in psychopathy should measure reaction time to questions so that it can be used to determine a proxy measure of impulsivity. Moreover, the question is whether forced choice questions as used in our paradigm may yield differences in utilitarian outcome compared to questions that make use of a continuous scoring approach. Future research may be able to formulate an answer to this; the question being which answer mode will increase or decrease the difference. Future research should also focus on the distinction between moral choices and moral judgments, since while psychopathy may predict utilitarian choices, it does not predict utilitarian judgment per se, the latter being a self-assessment of morality. In this sense, psychopathic individuals tend not to differ from normal people [76].

Clinical trial

Original title of the study: 'Social-emotional behaviour in male psychopaths after double-blind placebo-controlled administration of

intranasal oxytocin'

CRediT authorship contribution statement

Ronald J.P. Rijnders: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sophie van den Hoogen:** Writing – original draft, Formal analysis, Data curation. **Jack van Honk:** Writing – original draft, Resources, Methodology, Conceptualization. **David Terburg:** Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Maaike M. Kempes:** Writing – original draft, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cpnec.2024.100245.

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Further reading

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