Most neurobiological investigations of aggression have tended to focus on persons with antisocial personality disorder (APD), psychopathy, and violent offenders; however, little is known about the aggressive-sadistic personality disorder (SPD). SPD is a condition characterized by derivation of pleasure from another person's physical or emotional suffering, or from the control and domination of others (Meloy 1997). The Millon Clinical Multiaxial Inventory–III (MCMI–III; Millon et al. 1997) provides an assessment of APD and SPD traits, and research has largely substantiated the validity of these scales (Holt et al. 1999).

Although there exists a large neuropsychological literature examining APD and psychopathy, only limited evidence is available for SPD.

Recent findings implicate a subset of neurocognitive deficits associated with SPD traits that clearly diverge from those related to APD, and they also implicate the involvement of more anterior regions in traits associated with cruelty and aggression (Ruocco & Swirsky-Sacchetti, in press). The neuropsychological profiles of 161 patients referred for neuropsychological evaluation following closed head injury were examined in relation to their standings on MCMI–III personality scales, including APD and SPD indices. Deficits in executive function and language were associated with SPD traits, even after accounting for shared variance with other neuropsychological domains of function. APD traits, on the other hand, were solely associated with language deficits.

The findings highlight key neurocognitive differences that may exist between SPD and APD. Studies indicate that whereas MCMI–III SPD traits emphasize emotional acting out, strong-willed determination, social independence, and defensive aggression, APD is associated with social mistrust, social independence, and behavioral acting out (see Choca 2004). Compared with APD, SPD appears to be more strongly associated with overt emotional and defensive aggression, rather than psychopathic and competitive attitudes, as is more characteristic of the APD scale. Although both traits are associated with language deficits, only SPD traits are associated with poor performance on tests of executive function.

The executive functions are higher-order regulatory and supervisory functions carried out primarily by the frontal lobes (Miyake et al. 2000). Component cognitive processes considered part of the executive system are the functions of planning, mental flexibility, and inhibitory control. The observed decrement in executive function in relation to SPD traits may represent deficient functioning in any of these subdomains. Given the predominance of emotional and defensive aggression implicated in SPD traits, deficits in executive function may underlie poor self-regulatory skills in the domain of inhibitory control, whereby specific antecedent conditions (e.g., insult, perceived threat) may trigger a prepotent emotional or defensive reaction that individuals may have difficulty inhibiting. Moreover, deficits in language skills may escalate difficulties associated with executive dysfunction, whereby successful communication of emotional reactions to the perceived aggressor may be hampered and lead to further problematic interpersonal exchanges.

In contrast, no executive function deficits were associated with APD traits in the head-injured sample. This is consistent with meta-analytic findings that revealed only minor deficits in executive function for APD groups compared with larger deficits for groups with overt antisocial behavior problems, such as psychopathic offenders (Morgan & Lilienfeld 2000). The implication of language deficits in association with APD traits, even when controlling for level of education, suggests that there may be problems in the way that individuals high in APD traits communicate with others. This is a finding common to SPD traits and necessitates further exploration to examine the nature of language difficulties for persons with strong antisocial and sadistic tendencies.

These observations are intriguing because they are drawn from a sample of individuals with a wide range of functioning in neuropsychological and personality domains, from normal to impaired or disordered. The implication is that SPD traits exist along a continuum and that functioning in executive and language domains coincide with these traits across a wide range of functioning. Indeed, Nell's neurobiological account of aggression in primates does not postulate that such behavior or the underlying neural mechanisms are maladaptive; on the contrary, they are necessarily adaptive for the species. It may well be the case that maladaptive forms of aggression in humans, in the context of an orderly society, are invoked primarily by deficient regulation of more primitive subcortical systems by anterior brain regions. Certainly, the orbitofrontal and ventromedial frontal cortex play important roles in regulating key systems associated with emotional responses based on analyses of context (Ochsner & Feldman Barrett 2001). The "controlled" nature of functioning of these systems stands in contrast to the more "automatic" processing engaged by more subcortical and primitive structures of the amygdala and basal ganglia.

Given these considerations, rehabilitation of psychopathic offenders ought to take into account the integrity of executive functions, language skill, and the presence of SPD and APD traits. Offenders who possess strong sadistic tendencies would seem to necessitate attention to deficits in both self-regulatory abilities and language skill, whereas antisocial persons who do not have sadistic qualities may benefit more from interventions aimed at improving communication abilities. Cognitive rehabilitation may be appropriate for ameliorating problems with executive function, particularly inhibitory control of emotional and impulsive behaviors, a skill crucial for successful societal engagement. Rehabilitation service delivery professionals ought to be acutely aware of the unique neurocognitive deficits associated with SPD and APD and the ways in which these might impede progress in therapy and community reintegration.

ACKNOWLEDGMENT

The first author acknowledges fellowship support from the Natural Sciences & Engineering Research Council of Canada and Drexel University College of Arts & Sciences.

Nice idea, but is it science?

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Abstract: In the target article, human cruelty is linked to intrinsic reinforcement from engaging in the behavior without any recommendations for a research program to validate or test for such reinforcement and its independence from ultimate adaptive outcomes. Suggestions are offered in this commentary for such a program.

The target article suggests that human cruelty exists to deliberately inflict pain and suffering on others because it is intrinsically pleasurable and rewarding, that is, a goal in and of itself. In principle, there is nothing intrinsically wrong with the idea of behaviors that can be intrinsically reinforcing (e.g., Harlow 1953). Play behavior, for example, seems to offer this possibility of performance without evidence of any immediate material outcome (Bekoff & Byers 1998), and Schuster and Perelberg (2004) have suggested that intrinsic reinforcement linked to the *behavior* of cooperating could explain why cooperation can persist when it is not immediately beneficial. Moreover, the existence of both play and cooperation can be linked to long-term benefits that impact on fitness. In the case of

cruelty, however, the arguments are based mostly on a flood of examples implying universality in humans, supported by evolutionary arguments about alleged links between cruelty and the normal behavior of predators. But there is no program of research with testable hypotheses for substantiating the central claim that human cruelty is a goal based on a process of intrinsic reinforcement. What remains is circularity: Cruelty exists only because it reinforces itself. This commentary will briefly suggest six possible ways for testing that human cruelty is linked to both intrinsic reinforcement and ultimately beneficial outcomes.

One test is to measure the degree of *choice between behavioral alternatives that lead to the same tangible outcome*. In the case of cruelty, it is conceivable to consider two routes available for vanquishing an enemy – defeating/killing it either *with* or *without* an excess of violence, pain, and cruelty. Which would be preferred? There are, incidentally, evolutionary reasons for arguing that excess violence and cruelty might not be adaptive because they invite retaliation and the risk of injury or death to the victor (e.g., Krebs & Davies 1993). So it is a bit odd that evolutionary arguments are used to suggest the existence of cruelty as an end in itself without considering how this could possibly be an adaptive consequence of natural selection.

A second test is to demonstrate the degree to which *cruelty might be linked to eventual outcomes that indeed are profitable and contribute to fitness*. Nell states: "These definitions of cruelty exclude pain that results from fighting, killing, and war, in which the goal is not to inflict pain but to cause the adversary's flight, submission, or death" (sect. 2) But the use of the term "goal" is inconsistent. Sometimes, "goal" is used to mean only the immediate, intentional, conscious aim of tormenting another that seems a gratuitous waste of time and energy not justified by eventual profit. A useful explanatory alternative is to distinguish between *two kinds of potential outcomes from behaving cruelly*: the immediate affective "high" from tormenting another, and the eventual profit that can be linked at least probabilistically to the use of cruelty as a product of natural selection (see Schuster & Perelberg 2004). The allegedly powerful affects associated with behaving cruelly would then be lumped with all the other kinds of immediate positive outcomes that motivate and reinforce an individual's behaviors at the time of performance. But these processes are not the same as the evolutionary processes governed by long-term outcomes – those profitable events during an individual's lifetime that eventually impact on fitness and therefore influence the operation of natural selection. This is the *ultimate process* that could determine why individuals might deliberately engage in cruelty. In fact, the target article suggests a sequential chain of events between immediate cruelty and long-range benefits such as increases in dominance, territory, and political power/control. In theory, these events are also goals but only in the sense of long-range consequences that the individual probably does not know about at the time that he or she is engaging in, and enjoying, acts of cruelty.

A third test is to *measure and validate the kinds of behaviors that can serve as markers for positive affect associated with acts of cruelty*. For example, rats emit 50 KHz ultrasound calls associated with positive affect (Panksepp & Burgdorf 2003). Such behavioral markers of underlying states can be compared when individuals defeat others either with or without cruelty, and when acting alone or cooperatively.

A fourth test arises from the author's suggestion that the *reinforcement for cruelty arises from the same general process responsible for any so-called conditioned reinforcer*: Pavlovian associations between an initially neutral stimulus and a *primary natural reinforcer* such as food (Schuster 1969). The target article suggests that there is a set of linked conditioned stimuli that reliably accompany the successful end of a predator's hunt and precede the beginning of feeding: the pain-blood-death (PBD) complex. The target article also implies that this PBD complex can acquire an independent capacity to reinforce, thereby explaining the powerful effects of the PBD complex in humans. The first question is to ask whether the conditioned PBD stimuli in an animal can provide *additional reinforcement* on top of the primary reinforcer. This is testable in principle by again using a choice procedure: comparing choices between two routes to bringing down the same prey: one accompanied by the PBD conditioned stimuli and one without them (see, e.g., Schuster 1969). It is not obvious, for example, that a predator prefers hunting and killing over the easier and less dangerous alternative of stealing prey item killed by another. The second question is whether a conditioned reinforcer can continue to provide motivation and reinforcement after it is disconnected from its original primary reinforcer. This is also testable by measuring how long the PBD complex is capable of reinforcing behavior by itself after the final event in the chain – the food – is no longer available. The answer from animal research in the laboratory is that the efficacy of a conditioned reinforcer usually dissipates rather rapidly when disconnected from the primary reinforcer. This is because the reinforcing value of a conditioned reinforcer is usually linked to the positive information it provides about gaining a real, tangible and immediate profit such as food (Schuster 1969). In terms of cognitive expectancies, the conditioned reinforcer seems to be effective as long as it continues to evoke an expectancy of food. The conditioned reinforcer therefore does not in itself add to the economic value an alternative that leads to food. Instead, the food is in fact the only real event of value. In animals at least, a preference for the PBD route should eventually become negligible.

So why did modern humans supposedly evolve with a unique sensitivity to the PBD complex that makes it independently motivating and reinforcing for engaging in acts of cruelty? The fifth test is therefore to determine *whether cruelty exists in other animal species*, and *why*. Assuming agreement on how to identify cruelty, there is suggestive evidence (Schaller 1972, pp. 273–74, and in the National Geographic documentary film *Eternal Enemies*) that lions and hyenas sometimes act as if they are sworn enemies, mauling and killing each other on sight without any goal of eating the vanquished target. But this cruelty is not gratuitous: These species are intensely competing for food and regularly kill each other's offspring. And the "territorial warfare" of chimpanzee males is marked by continued beating, biting, and pounding that do not always end with the death of the victim. Instead, the attacks continue and even include ripping the testicles off the battered corpse (Watts & Mitani 2001; Wrangham & Peterson 1996). Again, there are long-range benefits from expanding territory and increasing access to females. If these are markers of hate and cruelty, then chimpanzees, lions, and hyenas seem to show them. Perhaps lions and hyenas, as cooperating social carnivores, also share the rudiments of a theory of mind that has been associated mainly with chimpanzees and other apes (e.g., Byrne 1995).

Finally, the sixth test concerns *the likelihood that any given human is fully capable of the kinds of extreme cruelty described in the target article*. Some people are clearly cruel, even to their own kin. But the target article implies that the human potential for cruelty lies dormant in all of us and has not changed much over the millennia. Thus, the Caligulas, Saddam Husseins, and Abu Ghraib Prison guards in Iraq would be the rule and not the exception. But is this a valid claim? Surely more information is needed to validate the author's sweeping claims that there is a potential in *all of us* to be readily energized and rewarded just by the opportunity to torment others. Or is there something about particular individuals or their histories that predisposes them to cruelty? Without any of this information, the article risks being a polemic. And that is unfortunate because the subject is interesting and important.