Does emotion mediate the relationship between an action's moral status and its intentional status? Neuropsychological evidence*

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A series of studies conducted by Knobe and collaborators (2003; 2004; this volume) suggest that the moral status of an action influences its intentional status, that is, whether the action is thought of as intentional or not. While it has long been understood that whether an action is performed intentionally or not informs our moral judgment of that action (e.g., embarrassing one's friend intentionally is morally worse than doing so accidentally), there are certain circumstances in which an action is more likely to be thought of as intentional when the action is morally bad than when it is morally good. Consider the following pair of vignettes, which serve as probes in Knobe's studies:

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Harm vignette:
The vice-president of a company went to the chairman of the board and said, "We are thinking of starting a new program. It will help us increase profits, and it will also **harm** the environment." The chairman of the board answered, "I don't care at all about **harming** the environment. I just want to make as much profit as I can. Let's start the new program." They started the new program. Sure enough, the environment was **harmed.**
Did the chairman intentionally ***harm*** *the environment?*

Help vignette:
The vice-president of a company went to the chairman of the board and said, "We are thinking of starting a new program. It will help us increase profits, and it will also **help** the environment." The chairman of the board answered, "I don't care at all about **helping** the environment. I just want to make as much profit as I can. Let's start the new program." They started the new program. Sure enough, the environment was **helped**.
Did the chairman intentionally ***help*** *the environment?*

On this pair of vignettes participants in Knobe's study make contrasting judgments about whether the chairman intentionally affected the environment. In particular, participants are inclined to say that the chairman intentionally harmed the environment but did not intentionally help the environment. Knobe and others have replicated this pattern of responses across different age ranges, cross-culturally, and over a variety of contexts for the vignette pairs (Leslie et al., in press; Knobe & Burra, this volume; Knobe & Mendlow, in press; McCann, in press). The pattern holds up within subjects as well, suggesting that participants do not find their own pair of contrasting responses to be obviously internally incoherent.

Numerous accounts of the influence of moral judgment on intentional attribution suggest a critical mediating role for emotion (Nadelhoffer, in press; Malle, this volume; Malle & Nelson, 2003). These accounts appear particularly attractive in light of recent findings that implicate emotion in tasks reflecting aspects of moral cognition (Greene, 2001; Wheatley & Haidt, 2005; Nichols, 2002). Building on a model suggesting a parallel role for emotion in mediating the relationship between judgments of moral blame and judgments of an agent's causal role (Alicke, 2000), Nadelhoffer (in press) suggests that emotional responses may be the source of the "biasing effect that moral considerations have on folk

ascriptions of intentional action". In the same vein, Malle & Nelson (2003) discuss the possibility that "negative affect toward the agent can easily bias judgments of intentionality". Appealing to anecdote as well as work in social psychology by Weiner (2001) and Tiedens (2001) on appraisal theories of emotion (particularly anger as implying the appraisal of another person's intentional agency), they offer: "When a couple fights, for example, the intense negative affect that emerges will bias each person into believing that everything the other does is intentional".

Using a neuropsychological approach, we tested the hypothesis that emotion mediates the effect of moral judgment on intentional attribution. This approach involves studying individuals with selective damage to particular cognitive functions to determine whether those functions are necessary to the task at hand. This approach has been employed with success to address questions about moral cognition, and, particularly, questions about the potential role of emotion in moral cognition (S. W. Anderson et al., 1999; Bar-On et al., 2003; Blair et al., 2000).

We tested the hypothesis that some of the key emotional processes subserved by the ventromedial prefrontal cortex (VMPC) underlie the asymmetric intentional attributions observed by Knobe (2003; 2004). We designate this hypothesis as the 'emotion hypothesis' Consistent with the known connectivity between the VMPC and structures that regulate emotion (Öngür et al., 2003), the VMPC has been implicated in emotional processing across a wide range of tasks in both functional imaging and neuropsychological studies (Ferstl et al., 2005; Vollm et al., 2005; Hynes et al., 2005) For instance, the VMPC is activated differentially by the emotional valence of basic biological stimuli (A. K. Anderson et al., 2003) and also by the administration or expectation of more abstract rewards (such as money) (Gottfried et al., 2003; Kringelbach, 2005; O'Doherty et al., 2001). These findings parallel the responses from neurons recorded in this region of the brain in animals (Rolls, 1999) and humans (Kawasaki et al., 2000). Evidence from human lesion studies corroborates that the human prefrontal cortex is critical for processing emotional information that is linked to counterfactual situations (e.g., imagining the emotional outcomes of actions not in fact taken, imagining what could happen in the future) (Camille et al., 2004), a role that is also important in guiding social behavior (Damasio, 1994) and moral judgment, especially if

the damage occurs early in life (S. W. Anderson et al., 1999; S. W. Anderson et al., in press).

The seven brain-damaged individuals selected for participation in the current study had damage to the ventromedial prefrontal cortex and/or its connections, as well as impaired performance on a range of tasks associated with emotional processing. Of the seven VMPC participants, four had adult onset bilateral damage to the VMPC region, and three had developmental onset unilateral right damage to the VMPC region and/or its connections. All but one of the VMPC participants were studied during adulthood; the one exception was a participant who was 16 years old at the time of the current experiment. We included both adult onset and developmental onset cases because the principal hypothesis does not stake any claims as to differential effects of developmental as opposed to adult onset damage (although this is an interesting issue for follow-up work). Also, we included cases with unilateral right-sided damage because all of them were male, and it has been shown that right-sided VMPC damage in men causes a relatively full-blown syndrome of "acquired sociopathy", along with a full array of emotional processing defects (Tranel et al., 2002; 2005). Detailed information about the lesion cases is provided in Tables 1-4. Specifically, there is information about demographics (Table 1), neuroanatomical status (Table 2), neuropsychological profiles (Table 3), and emotional processing and personality (Table 4).

Table 1
Demographic Data

SUBJECT	AGE	EDUCATION (years)	SEX	HANDEDNESS[1]	CHRONICITY[2] (years)
0318	64	14	M	+100	29
1584	62	8	M	+100	14
2046	30	12	M	-100	30
2097	29	16	M	+100	21
2391	58	13	F	+100	5
2990	16	9	M	+10	11
3032	48	12	M	+100	2

[1] Handedness was measured with the modified Oldfield-Geschwind questionnaire, which provides an index ranging from full right-handedness (+100) to full left-handedness (-100).

[2] Chronicity refers to the length of time between lesion onset and execution of the current experiments.

Table 2
Neuroanatomical Characterization

SUBJECT	LESION SITE	ETIOLOGY
0318	Bilateral ventromedial prefrontal	Meningioma resection
1584	Bilateral ventromedial prefrontal anterior communicating artery	Subarachnoid hemorrhage, aneurysm clip
2046	Right medial and dorsolateral prefrontal	Astrocytoma resection
2097	Right dorsolateral prefrontal	Abscess resection
2391	Bilateral ventromedial prefrontal	Meningioma resection
2990	Right anterior orbital, dorsolateral prefrontal	Traumatic brain injury
3032	Bilateral anterior prefrontal	Meningioma resection

Table 3
Neuropsychological Data

	WAIS-III			WMS-III		VRT				
SUBJECT	VIQ	PIQ	FSIQ	GMI	WMI	#C	#E	Speech	TT	FRT
0318	142	134	143	109	124	9	1	Normal	44	43
1584	89	97	91	59	102	7	6	Normal	44	45
2046	111	109	110	109	93	6	5	Normal	44	45
2097	138	106	125	100	99	6	5	Normal	44	49
2391	110	107	109	105	102	8	2	Normal	43	49
2990	105	107	106	100	90	9	2	Normal	44	43
3032	94	113	102	108	99	9	1	Normal	44	49

WAIS-III, Wechsler Adult Intelligence Scale-III (VIQ, Verbal IQ; PIQ, Performance IQ; FSIQ, Full Scale IQ); WMS-III, Wechsler Memory Scale-III scores (GMI, General Memory Index; WMI, Working Memory Index); VRT, Benton Visual Retention Test (#C, number correct; #E, number of errors); TT, Token Test (from the Multilingual Aphasia Examination), a measure of auditory attention and comprehension; FRT = Benton Facial Recognition Test, a measure of visuoperceptual discrimination. For the WAIS-III and WMS-III, scores are standard scores where the mean is 100 and the standard deviation is 15. For the VRT, the scores are raw scores, and defective scores are underlined. For the Token Test, the maximum score is 44; all patients were normal. For the Facial Recognition Test, the scores are raw scores, and all patients were normal.

To reiterate, an abnormal pattern of intentional attributions presented by participants with VMPC lesions, that is, no differentiation between morally bad and morally good action, would lend support for the emotion hypothesis, while a normal asymmetric pattern would invite further investigation into the underlying psychological mechanism.

Table 4
Personality and Emotional Functioning

SUBJECT	MMPI-2[1]	Acquired Sociopathy[2]	Iowa Gambling Task[3]	SCRs[4]	Emotional Quotient[5]
0318	Normal	Yes (3)	Impaired (3)	Impaired	Impaired
1584	Abnormal	Yes (3)	Impaired (3)	Impaired	Impaired
2046	Abnormal	Yes (3)	Impaired (3)	Impaired	Impaired
2097	Abnormal	Yes (3)	Impaired (3)	Impaired	Impaired
2391	Abnormal	Yes (2)	Impaired (2)	Impaired	Impaired
2990	N/A	Yes (3)	Impaired (3)	Impaired	N/A
3032	Abnormal	Yes (1)	Impaired (1)	Impaired	Normal

[1] MMPI-2 = Minnesota Multiphasic Personality Inventory-2. "Abnormal" refers to significant elevations (i.e., T-scores above 65) on one or more of the 10 clinical scales. "Normal" denotes no clinical scale elevations above T = 65. [2]Acquired Sociopathy refers to whether or not the participant met criteria for Acquired Sociopathy (or Developmental Sociopathy, in the case of the three patients with childhood-onset lesions), as derived from data from the Iowa Rating Scales of Personality Change and/or from interviews and medical records. The numbers in parentheses denote degree of severity, where 1 = mild, 2 = moderate, and 3 = severe. [3]Performance on the Iowa Gambling Task was classified as normal or impaired using standard criteria. The numbers in parentheses denote magnitude of impairment, where 1 = mild, 2 = moderate, and 3 = severe. [4]SCRs = skin conductance responses to emotionally-charged stimuli (e.g., pictures of mutilations, nudes), using the procedures described in Damasio et al. (1990). [5]Emotional Quotient = Total EQ score from the EQ-i scales (Bar-On et al., 2003). Impaired denotes that the patient's total EQ score was 15 or more points below their Full Scale IQ score. N/A = not administered.

We presented both the help and harm vignettes (as shown above) to the seven VMPC participants. According to the procedure described in the Appendix, VMPC participants were logged onto a website by an experimenter where they were able to read and record responses to experimental stimuli. To ensure the validity of this procedure, we tested a large sample of neurologically healthy individuals as well, using a website nearly identical to the one designed for use by the VMPC participants (see Appendix). Normal participants (N = 936) showed the same basic pattern of response as found by Knobe (2003; 2004; this volume). Specifically, 80.2% of normal participants judged that the chairman intentionally harmed the environment, compared with 9.4% of normal participants who judged that the chairman intentionally helped the environment. These proportions were significantly different ($c^2(1, N = 936) = 949.4$, $p < 0.001$).

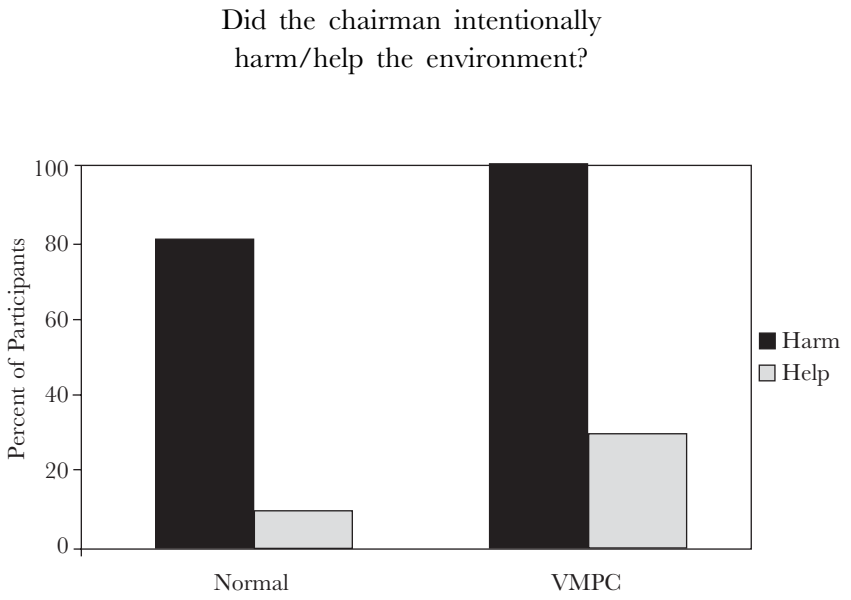

Figure 1. Proportions of normal participants and VMPC participants judging actions as intentional

Contrary to the emotion hypothesis, we found that the intentional attributions made by the VMPC participants conformed to the same basic pattern of intentional attributions made by normal participants (Figure 1). All seven VMPC participants judged that the chairman intentionally harmed the environment, whereas only two out of the seven judged that the chairman intentionally helped the environment (Table 5). These proportions were significantly different ($c^2(1, N = 7) = 7.8$, $p = 0.005$; $p = 0.021$, Fisher's exact test, two-sided). Not only did patients show the asymmetry between help and harm cases, virtually identical proportions of patients and normal subjects showed the asymmetry. Five out of seven lesion cases, that is, 71.4%, showed the effect, while 72.1% of the normal participants showed the effect; the difference between these proportions was not significant ($c^2(1, N = 943) = 0.002$, $p = 0.968$; $p = 1.000$, Fisher's exact test, two-sided).

Table 5
Response Data

SUBJECT	Harm Vignette	Help Vignette	Normal Response Pattern
0318	Yes	No	Present
1584	Yes	No	Present
2046	Yes	Yes	*Absent*
2097	Yes	No	Present
2391	Yes	No	Present
2990	Yes	Yes	*Absent*
3032	Yes	No	Present

Based on these results, we conclude that the emotional processes subserved by the VMPC are not necessary for mediating the effect of an action's moral status on its intentional status. Furthermore, the hypothesized role of emotion is to increase attribution of intent in the harm case, suggesting that patients should show deficits in judging the harm case, in particular, by judging the featured action in the harm case as non-intentional, and yet every one of the patients judged it as intentional. The two patients who did not show the normal response pattern did the opposite in judging the featured action in the help case as intentional.

We acknowledge a potential limit on the external validity of this finding, given the skewed gender makeup of the brain-damaged group; six out of the seven VMPC participants were male. The one woman participating in this study (case 2391) had bilateral ventromedial prefrontal damage and did show the normal pattern of intentional attributions, but since she is only one case, a question remains for follow-up work as to whether the finding will generalize to women with VMPC lesions.

The finding is, of course, not decisive in showing that emotion plays no role at all in mediating the effect of moral judgment on intentional attribution for at least two reasons. First, the VMPC participants might show differences from normal participants on vignette pairs that depict very weakly emotional events. Perhaps the help and harm vignettes were just so strongly emotional that they triggered an emotional response even in the participants with compromised emotional processing. We do not find this explanation very plausible, however, in light of the fact that most of the brain-damaged participants in our sample have profound

defects in emotional processing (cases 318 and 2046, for example, being paradigmatic in this regard); extensive studies in our laboratory have documented that even potent emotionally charged stimuli are not processed normally by these patients (e.g., Tranel, 2002). Second, the VMPC is not the only brain region involved in processing emotion, as borne out by the fact that individuals with lesions to the VMPC are certainly not devoid of all emotion. Thus, it is possible that aspects of emotional processing that operate independently of the VMPC play some role, for example, along the lines suggested by the emotion hypothesis (Nadelhoffer, in press; Malle & Nelson, 2003). However, we should reiterate that several of the brain-damaged participants in our study had severe impairments in processing emotion across multiple domains of cognition and behavior. We thus believe that the finding does allow us to reject the strong hypothesis that any kind of compromise in emotional processing should influence intentional attributions in the task at hand.

The question of whether emotion mediates the effect of moral judgment on intentional attribution may have important implications for determining whether moral blame is a fundamental constituent of intentional attribution or merely a superficial bias. It has been suggested that research on the extent to which emotion biases intentional attribution may help evaluate these competing claims (Knobe, 2005). Some proponents of the emotion hypothesis dismiss the putative effects of an emotional 'bias' as exterior to the fundamental process of intentional attribution (Malle & Nelson, 2003; Nadelhoffer, in press). In particular, emotion is discussed as having 'biasing' or 'distorting' effects, resulting in the tendency to 'exaggerate' attributions of intent. Thus, insofar as the effect of moral blame on intentional attribution appears not to be mediated by emotional processes, this line of reasoning will not suffice.

Future research drawing from diverse perspectives will provide further insight into the psychological mechanisms at hand, and the point in processing at which emotion plays a causal role. One approach, extending methodology employed by Knobe & Mendlow (in press) and Knobe (in press), is to manipulate the emotional valence of the stimuli by using detail-rich versus detail-poor descriptions of actions and their effects or by using methods of hypnosis to load up stimuli with specific emotion as employed by Haidt & Wheatley (2005) to study the role of disgust in moral judgment. Testing clinical populations with generally shallow

or flattened affect as well as patients with deficits corresponding to specific emotions will enable a more in-depth exploration of a range of emotion-related functions. For example, do psychopaths (who show little or no empathy) (Blair, 1995) or patients with Huntington's disease (who show impaired disgust processing) (Sprengelmeyer et al., 1996) nonetheless make asymmetric intentional attributions? Furthermore, interesting comparisons can be made between developmental and adult onset cases, provided there are sufficient numbers of each for these comparisons to be meaningful. These comparisons may help determine whether emotion, even if not required for the online appraisal of intentional action, may be necessary for the original acquisition of intentionality concepts. Finally, functional neuroimaging may shed light on which regions of the brain are engaged during moral blame-driven intentional attribution, and in what sequence.

Based on neuropsychological evidence, this study demonstrates that asymmetric intentional attributions emerge despite dysfunctional emotional processing. The finding thus refutes the strong hypothesis that the asymmetry in intentional attributions can be explained entirely by the emotional responses we have to actions with moral value.

Appendix

We provide more detailed methodological information about the experiment.

VMPC Participants

The seven VMPC participants were instructed about the nature of the experiment, and informed consent was obtained according to institutional and federal guidelines. The experimenter emphasized to the participants that they could discontinue the experiment at any time, if they so desired. After detailed verbal instruction regarding the test, the experimenter logged participants onto a secure website designed specifically for this experiment. The experimenter was blind to the hypothesis of the current study and also to the neurological status (e.g., lesion location, nature of behavioral syndrome) of the patients.

Participants were presented with the help and harm vignettes, as shown above. During the same session, participants also saw 19 other scenarios with moral content, including three 'control' scenarios for which only one answer was considered appropriate. Scenarios were separated into three blocks of seven questions each. The order of scenario presentation was counterbalanced between subjects.

All participants had the opportunity to exit the testing session after any number of blocks. We analyzed data only from participants who successfully completed all three blocks. All participants completed all three blocks. Participants were omitted from all analyses if they failed any one of the three control scenarios (by judging that it is not morally permissible to save a person with no apparent cost to any person or property or that it is morally permissible to act in a such a way that brings harm to a group of people for no morally good reason). All participants passed all three controls.

Normal Participants

Normal participants (N = 936) voluntarily logged on to a website identical to the one designed for the patients except for two additional pages soliciting demographic information. Participants logged on between the dates 7/28/04 and 11/29/04. Ranging from 18 to 88 years old, participants averaged 35 years old, with a small male bias (54%). Participants were instructed to take the test only if fluent in English; 84% listed English as their primary language. Seventy-five percent claimed the United States as their primary national affiliation, and an additional 9% affiliated with Canada or the United Kingdom. Education levels ranged from elementary school to graduate school, and thirty percent claimed to have been exposed to formal education in moral philosophy.

All participants had the opportunity to exit the testing session after any number of blocks. We analyzed data only from participants who successfully completed all three blocks. Five percent of all participants were omitted from analyses for failing one or more of three control questions. Twenty-one percent of all participants were eliminated for completing any of the scenarios in fewer than 4 seconds, deemed in pilot research to be the minimum possible comprehension and response time.

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