

An Investigation of Moral Judgement in Frontotemporal Dementia

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Objective: To investigate the basis of disturbed moral judgment in patients with frontotemporal dementia (FTD).

Background: FTD is characterized by difficulty in modulating social behavior. Patients lack social propriety and may perform sociopathic acts. In addition, FTD patients often lack empathy for others. These findings suggest alterations in the nature of morality in patients with FTD.

Method: We administered an inventory of moral knowledge and two moral dilemmas to 26 patients with the frontal variant of FTD, 26 patients with Alzheimer disease (AD), and 26 normal control subjects. The FTD patients met Consensus Criteria for FTD and had corroborative frontal abnormalities on functional neuroimaging. The FTD and AD patients were comparably impaired on dementia measures.

Results: All these groups showed the retention of knowledge for moral behavior and the ability to make “impersonal” moral judgments. In contrast, the FTD patients were impaired in their ability to make immediate, emotionally based moral judgments compared with the patients with AD and the normal control subjects.

Conclusions: These findings are consistent with an attenuation of the automatic emotional identification with others that is part of the innate moral sense. Such a disturbance may result from neurodegenerative disease affecting the ventromedial frontal cortex.

Key Words: frontotemporal dementia, neurobehavior, morality, empathy

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Frontotemporal dementia (FTD) is a progressive neurodegenerative disorder that affects the frontal lobes, temporal lobes, or both. Unlike patients with Alzheimer disease (AD), patients with FTD present with greater social and personality

changes than with cognitive or neuropsychological deficits.^{1,2} The alterations in social behavior usually involve a loss of social tact and propriety, but may include frankly sociopathic acts such as unsolicited sexual behavior, traffic violations, physical assaults, stealing, breaking and entering, and even paraphilias.^{3–5}

Patients with FTD have disturbances of moral behavior or the ability to follow ethical and accepted rules and norms. The transgression of social norms is a core diagnostic feature of FTD. It is part of an impairment in the ability to modulate social behavior.⁶ Another core behavioral feature is “emotional blunting,” a term that includes a loss of empathy or appreciation of the feelings of others.¹ Moreover, patients with FTD have a loss of insight for their behavior and its consequences. Together, these core behavioral features of FTD suggest a disturbance in the neurobiological substrate of morality.

In FTD, different mechanisms could account for defective moral judgment. It could result from a loss of the knowledge of right or wrong or a “moral agnosia.” It could result from an alteration in the ability to reason as applied to moral judgments. Alternatively, it could result from poor emotional responsiveness to moral dilemmas. To dissect these possibilities, this study used a moral behavior inventory and two vignettes previously shown by Greene et al to distinguish between emotionally based and impersonal moral judgments.^{7,8}

METHODS

Subjects

All participants in this study presented for evaluation to university-affiliated specialty clinics in dementing disorders. The patients were community-based, moderately impaired patients who underwent a comprehensive neurobehavioral evaluation, laboratory assessment, and magnetic resonance imaging (MRI). The study excluded patients on medications, particularly antipsychotic drugs, or with medical, neurologic, or psychiatric disorders that could otherwise account for stereotypical movements. Study participation included written informed consent according to institutional review board guidelines.

All 26 FTD patients included in this study presented with progressive behavioral changes consistent with a decline in social interpersonal conduct, impairment in regulation of personal conduct, emotional blunting, and loss of insight for their disease.¹ The clinical diagnosis of FTD was based on Consensus Criteria for FTD.¹ The clinical diagnosis of FTD required further confirmation with the presence of frontally predominant changes on single photon emission computer tomography or positron emission tomography.

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An additional 26 patients with clinically probable AD were included as a comparison group. The AD patients met National Institute of Neurological and Communication Disorders and Stroke/Alzheimer's Disease and Related Disorders Association criteria for clinically probable AD after completing a diagnostic evaluation.⁹ To match the FTD patients, an effort was made to select AD patients who had an early age at onset and who were only mildly impaired.

Twenty-six normal individuals participated in this study as an additional comparison group. The normal control subjects were recruited primarily from spouses of patients. They were chosen so as to correspond with the overall age, gender, and education of the FTD and AD patients. None of the control subjects had a history of neurologic or psychiatric disease.

The FTD and AD patients underwent two scales of dementia severity: the Mini-Mental State Examination (MMSE) and the Clinical Dementia Rating Scale (CDR).^{10,11} The global CDR score was calculated using the recommended Washington University scoring rules.¹¹ To ensure the ability to comprehend the moral dilemmas, inclusion criteria were limited to patients' mild dementia based on MMSE scores of >20 and CDR scores of ≤ 1.5 .

The FTD and AD patients underwent a series of neuropsychological measures. Tests from the Consortium to Establish a Registry in Alzheimer's Disease (CERAD) included verbal fluency, Boston Naming Test (short 15-item version), constructions (copy of a circle, rhombus, overlapping rectangles, cube), and memory tests (word list memory for 10 words on Trials I–III, word list recall, and a true–false memory recognition test).¹² The CERAD memory measures were abbreviated to two scores: the Savings Score (Delayed Recall Learning/Learning Trial III as proportion of 10 words) and the accurate Yes answers on Recognition.¹² The study included the six-item auditory comprehension questions from the Neurobehavioral Cognitive Status Examination.¹³ Finally, the study used the Frontal Assessment Battery (FAB) to further evaluate the FTD and AD patients. The FAB included six items rated on scales of 0–3 and encompassing similarities, “S” word fluency, alternate programs, alternate tapping, the Go/No-Go Test, and grasp reflex testing.¹⁴

Procedures

Part 1

Participants were administered the Moral Behavior Inventory, a questionnaire consisting of 24 items originally based on the Moral Behavior Scale (Table 1).¹⁵ This instrument minimizes cultural and religious influences and maximizes the content validity of empathy and the sense of fairness. The individual items are simple and have been previously administered to a series of normal young and older adults (unpublished data). To facilitate administration and comprehension in dementia patients, the items were read aloud to the participants. The items were repeated as many times as necessary to ensure comprehension. The participants were then asked if the item was “not wrong,” “mildly wrong,” “moderately wrong,” or “severely wrong,” a 4-point Likert Scale. The split-half reliability (Cronbach coefficient α) for all

TABLE 1. Moral Behavior Inventory

This questionnaire presents acts for you to evaluate in terms of right or wrong. Please answer to the best of your ability. Choose 1 if the item seems Not Wrong. Choose 4 if the item seems Severely Wrong. Use 2 and 3 for in-between degrees of wrongness.

How wrong is it if you:

1—Not Wrong; 2—Mildly Wrong; 3—Moderately Wrong; 4—Severely Wrong

1. — Fail to keep minor promises
2. — Take the last seat on a crowded bus
3. — Sell someone a defective car
4. — Drive after having one drink
5. — Cut in line when in a hurry
6. — Don't give blood during blood drives
7. — Are mean to someone you don't like
8. — Say a white lie to get a reduced fare
9. — Drive out the homeless from your community
10. — Always let others pay at a restaurant
11. — Not help someone pick up their dropped papers
12. — Keep over-change at a store
13. — Not offer to help after an accident
14. — Ignore a hungry stranger
15. — Fail to vote in minor elections
16. — Keep money found on the ground
17. — Temporarily park in a handicap spot
18. — Cut off drivers on the freeway
19. — Take the largest piece of a pie
20. — Falsely get out of jury duty
21. — Ask others do some of your homework
22. — Take credit for others' work
23. — Refuse to help people who don't deserve it
24. — Get more time off than your co-workers

78 participants was $r_{kk} = 0.73$ (0.72–0.76 for the individual groups).

Part 2

Participants were read two moral dilemmas in the form of vignettes. To facilitate administration to dementia patients, these vignettes were read slowly and the responses were not timed. The vignettes could be reread, if necessary, and the participants could ask for clarification, if desired.

*Vignette No. 1: The Standard Trolley Car Dilemma*⁷

A runaway trolley is headed for five people who will be killed if it proceeds on its present course. The only way to save them is to hit a switch that will turn the trolley onto an alternate set of tracks where it will kill one person instead of five. This dilemma was read aloud to participants. The instructions were as follows: “Imagine that you are at the wheel of a runaway trolley quickly approaching a fork in the tracks. On the tracks going to the left is a group of five railway workmen. On the tracks going to the right is a single railway workman. If you do nothing, the trolley will proceed to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is to hit a switch on your dashboard that will cause

the trolley to proceed to the right, causing the death of the single workman.”

The participants were required to repeat back the dilemma in their own words. If unable, the dilemma was repeated, explained, or clarified as necessary. The participants were then asked: “Would you hit the switch in order to avoid the deaths of the five workmen? Answer ‘yes’ or ‘no’.” The participants were given as much time as they needed to think about the dilemma but were required to commit to either a yes or no response.

Vignette No. 2: The Footbridge Dilemma⁷

After completing vignette no. 1, the participants were administered a second vignette. As before, a trolley threatens to kill five people. This time the participant is standing next to a large stranger on a footbridge that spans the tracks, in between the oncoming trolley and the five people. In this scenario, the only way to save the five people is to push this stranger off the bridge, onto the tracks below. He will die, but his body will stop the trolley from reaching the others. This dilemma was read aloud to the participants. The instructions were as follows: “Imagine that a runaway trolley is heading down the tracks toward five workmen who will be killed if the trolley keeps going. You are on a footbridge over the tracks, in between the approaching trolley and the five workmen. Next to you on this footbridge is a stranger who happens to be very large. The only way to save the lives of the five workmen is to push this stranger off the bridge and onto the tracks below where his large body will stop the trolley. The stranger will die if you do this, but the five workmen will be saved.”

The participants were required to repeat back the dilemma in their own words. If unable, the dilemma was repeated, explained, or clarified as necessary. The participants were asked: “Would you push the stranger onto the tracks in order to save the five workmen? Answer ‘yes’ or ‘no’.” The participants were given as much time as they needed to think about the dilemma but were required to commit to either a yes or no response.

Data Analysis

The three groups were compared on basic characteristics, dementia measures, and the outcome measures using one-way analysis of variance for parametric and χ^2 for responses to the two dilemmas. The two dementia groups were compared on neuropsychological measures with *t* tests. Further analysis between FTD patients with yes versus no responses on the Footbridge Dilemma also employed *t* tests.

RESULTS

There were no statistically significant differences between the FTD patients, AD patients, and normal control groups on age, sex ratio, and education. The two dementia groups did not differ statistically on the MMSE and the global CDR; both were mildly impaired on these measures (Table 2). The FTD and AD patients did have differences on the neuropsychological measures, consistent with their diagnoses (Table 3). The FTD patients were significantly worse on the Go/No Go Test, a frontal executive measure, and the AD patients

TABLE 2. FTD vs AD: Patient Characteristics

	FTD	AD	Normal Controls
No.	26	26	26
Sex (M/F)	12/14	12/14	12/14
Age (y)	60.8 ± 7.6	64.3 ± 9.1	62.3 ± 9.1
Education (y)	14.1 ± 4.8	14.6 ± 4.6	14.6 ± 4.2
MMSE*	24.77 ± 2.23	22.78 ± 1.96	29.6 ± 1.10
CDR†	1.06 ± 0.38	1.17 ± 0.34	N/A
Moral Behavior Inventory			
Inventory	62.34 ± 11.24	66.21 ± 8.77	64.13 ± 9.23
Trolley Car Dilemma (yes/no)	21/5	23/3	26/0
Footbridge Dilemma (yes/no)‡	15/11	6/20	5/21

*No difference between the two dementia groups.

†Global Clinical Dementia Rating scores based on Washington University scoring rules.¹¹

‡Significant differences: $\chi^2 = 10.50$, $df = 2$, $p < 0.01$; FTD vs other two groups: $\chi^2 = 8.83$, $df = 1$, $p < 0.01$.

were significantly worse on Savings Score (memory) and Constructions.

On the Moral Behavior Inventory, the three groups did not show significant differences in their overall ratings of the items (see Table 2). The results on this instrument were consistent with intact knowledge of right or wrong among the FTD patients. Although the AD patients scored higher than the other groups, this difference did not reach statistical significance (see Table 2).

The FTD patients diverged from the other groups on the Footbridge Dilemma but not on the Standard Trolley Car Dilemma. On the Standard Trolley Car Dilemma, the majority of FTD patients, similar to the AD and control groups, answered that they would pull the switch and trade one death for five. On the Footbridge Dilemma, however, most (57.7%) of the FTD patients responded that they would push the large stranger onto the tracks to save the five workmen. In comparison, only 23.1% of the AD patients and 19.2% of the normal control subjects would push the large man to his death. Although the responses were not evaluated timed, the FTD patients expressed little hesitation in responding to either dilemma. There were no statistically significant differences on the neuropsychological measures or functional neuroimaging between the FTD patients who would push the large stranger onto the tracks and those who would not.

After completion, there was a debriefing session. The participants were asked their impressions of the study and the rationale for their answers. No participant objected to any part of the study. The participants who responded “yes” on the Footbridge Dilemma explained that they were actually saving more lives, whereas those that responded “no” described it as wrong or had various feelings that it was unacceptable. The FTD patients did not express any discomfort or emotional conflict with their decisions on either dilemma.

DISCUSSION

This study examined the question of alterations in moral judgment in dementia. The FTD patients differed in the way

TABLE 3. FTD vs AD

	FTD	AD	Significance
Verbal Digit Span	6.17 ± 1.10	6.11 ± 0.99	NS
Verbal Fluency—"animals"	14.20 ± 5.64	12.71 ± 6.61	NS
Mini-Boston Naming Test	13.25 ± 3.41	13.62 ± 3.44	NS
NCSE* Auditory Comprehension	5.42 ± 0.70	5.04 ± 0.82	6.0
CERAD† Savings Score†	6.45 ± 1.61	5.65 ± 1.21	$t = 2.03, p < 0.05$
CERAD ¹² Recognition	7.93 ± 1.43	7.39 ± 2.72	NS
Constructions Score	10.00 ± 1.89	8.60 ± 1.71	$t = 2.80, p < 0.01$
Total FAB ¹⁴ Total Score	12.04 ± 2.61	13.10 ± 2.88	NS
Similarities	1.98 ± 0.77	2.03 ± 0.84	NS
Fluency—"S" words	2.15 ± 0.56	2.10 ± 0.68	NS
Alternate Program	1.80 ± 0.84	1.95 ± 0.81	NS
Alternate Tapping	1.61 ± 1.12	2.06 ± 0.72	NS
Go/No Go Test	1.70 ± 1.00	2.20 ± 0.75	$t = 2.04, p < 0.05$
Grasp Reflex	2.80 ± 0.66	2.76 ± 0.59	NS

*Neurobehavioral Cognitive State Examination.¹³

†Savings Score (Delayed Recall Learning/Learning Trial III as proportion of 10 words) and the accurate Yes answers on Recognition.¹²

they responded to an emotionally based "personal" moral dilemma compared with the AD patients and normal control subjects. The FTD patients retained knowledge of moral rules and norms and could reason about the right and wrong of a situation. In contrast, they appeared to have diminished emotional identification with others and solved moral dilemmas in an impersonal fashion.

FTD patients manifest violations of moral rules or norms early in their disease.¹ Most commonly there is a loss of social tact and propriety, unacceptable physical contact, and improper verbal or nonverbal communication.² Prior research indicates that sociopathic acts are prominent among patients with FTD.^{3,4} Antisocial behavior occurs in more than half of patients with FTD and includes unsolicited sexual acts, traffic violations, stealing, and physical assaults.^{3,4} Other investigators have also described shoplifting,^{16,17} inappropriate sexual behavior,^{4,18} acts of violence,¹⁶ and even pedophilia.⁵ These reports implicate decreased emotional concern for the consequences of their acts as part of the reason for their sociopathy.

Sociopathy and violations of moral rules may result from damage to the capacity for deliberate moral reasoning.²⁴ Greene et al used functional MRI data to indicate that "cognitive" processes, such as working memory and abstract thought, drive reflective moral reasoning, which they termed "impersonal" judgments.^{7,23} Typical responses to the Standard Trolley Car Dilemma involve impersonal moral judgment and can be impaired from damage to dorsolateral frontal regions.⁷

Sociopathy and violations of moral rules may also result from damage to emotionally based moral judgments.¹⁹⁻²¹ Greene et al found that socioemotional dispositions, such as discomfort at the prospect of causing direct harm to a specific person, drive automatic moral responses, which they termed "personal" judgments.^{7,23} Studies with apes and other animals describe aspects of morality guided by socioemotional responses such as empathy, gratitude, jealousy, a sense of fairness, and feelings of reciprocity.^{22,23} Many of these moral behaviors result from clearly evident emotional reactions, for

example, outrage at perceived unfair or unequal treatment. Morality particularly includes emotional empathy that models what other people might be feeling in a given situation. Moral judgments that involve this type of personal identification with others are rapid and involuntary and, when violated, elicit negative emotional reactions. In humans, however, these reactions can be overridden by subsequent impersonal moral reasoning and rational justifications.^{23,24}

Typical responses to the Footbridge Dilemma invoke a personal moral judgment and can be impaired from damage to ventromedial frontal cortex.⁷ The Footbridge Dilemma requires emotionally based moral judgment more than the Standard Trolley Car Dilemma. Most people would turn the trolley to save five people at the expense of one but would not save the five others by pushing a stranger to his death. The thought of pushing a stranger to his death presumably elicits an automatic emotional identification with the stranger, which is not elicited by the thought of hitting a switch that will cause a trolley to produce similar consequences. This emotionally based morality accounts for people's tendency to respond differently to the Footbridge Dilemma as compared with the Standard Trolley Car Dilemma.^{7,23}

Early FTD affects the ventromedial frontal cortex more than dorsolateral regions and can disproportionately impair emotionally based personal moral judgments. The ventromedial frontal cortex, which has rich interconnections with limbic and other structures,²⁷ guides social behavior by re-experiencing previously learned emotional responses and computing shared representations.²⁸⁻³¹ Patients with ventromedial frontal lesions have a diminished emotional experience with loss of concern and empathy and decreased autonomic responsiveness.^{28,32,33} Other investigations also indicate that insensitivity to personal moral dilemmas results when this system is disturbed from focal lesions or FTD.^{29,30,34}

The underlying mechanism for this ventromedial frontal system involves the activation of one's representations of the state and situation of others.²⁵ People understand the mental

and emotional state of another by representations that simulate the same emotional state in themselves, for example, of the large man's fear of falling to his death. These emotional responses may be learned or may be innate response tendencies. Some theories, such as the Perception–Action Model of Empathy and the Damasio Somatic Marker Theory, postulate that perception of another activates one's stored representations and that these representations are linked to one's associated feeling states.²⁶ Unless actively inhibited, activation of these shared representations through mirror neurons automatically primes the associated autonomic and somatic responses.

This preliminary study does not address several concerns about moral behavior and dementia. First, there is a large network involved in moral behavior, more than just ventromedial frontal cortex. Altered moral judgments may result from disturbances in the dorsolateral frontal cortex, anterior cingulate, posterior cingulate, temporal poles, and the superior temporal sulcus.^{7,20,21} In particular, the amygdalae play a role in moral behavior through passive avoidance learning and the retrieval of socially relevant knowledge.³⁵ Second, there are other potential explanations for the findings of this study. For example, some FTD patients may have impairments in the basic ability to appreciate the thoughts or actions of others (Theory of Mind).^{36,37} Finally, other cognitive deficits could have intruded in the performance on these vignettes. The study, however, made efforts to administer the inventory and vignettes in ways that would maximize interpretable responses from dementia patients.

Despite the limitations noted above, this study strongly suggests impairments in emotionally based moral behavior in FTD. Investigations of the behavioral consequences of FTD can elucidate the relationship of moral decision making and the brain. Much more work is needed to clarify the nature of alterations in moral judgment among patients with brain disorders. For example, future studies could explore additional measures of emotional concern and automatic emotional identification among patients with FTD.

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