

Moral Judgment in Episodic Amnesia

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ABSTRACT: To investigate the role of episodic thought about the past and future in moral judgment, we administered a well-established moral judgment battery to individuals with hippocampal damage and deficits in episodic thought (insert Greene et al. 2001). Healthy controls select deontological answers in high-conflict moral scenarios more frequently when they vividly imagine themselves in the scenarios than when they imagine scenarios abstractly, at some personal remove. If this bias is mediated by episodic thought, individuals with deficits in episodic thought should not exhibit this effect. We report that individuals with deficits in episodic memory and future thought make moral judgments and exhibit the biasing effect of vivid, personal imaginings on moral judgment. These results strongly suggest that the biasing effect of vivid personal imagining on moral judgment is not due to episodic thought about the past and future. © 2016 Wiley Periodicals, Inc.

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episodic thinking across time is attenuated. According to Greene et al.'s dual process model of moral judgment (Greene et al., 2001, 2004; Amit and Greene, 2012; Greene et al., 2014), vivid imagining of personal and emotionally conflicting scenarios drives deontological (as opposed to utilitarian) judgments. If so, individuals with impaired ability to vividly imagine themselves in personal scenarios should make more utilitarian judgments in such scenarios than do controls. We report they do not. Thus, episodic memory and future imagining likely do not mediate the effect of personal, emotionally salient scenarios on moral judgment.

Many aspects of human *prudential* decision-making remain intact despite hippocampal damage and even profound deficits in episodic thought, past and future (Kwan et al., 2013, 2015; Palombo et al., 2015). But such episodic thought might be expected to play a greater role in *moral* decisions than in prudential decisions. The hippocampus and episodic memory figure centrally in some theories of moral decision-making (Casebeer and Churchland, 2003; Thagard, 2007) and have been implicated as part of a neural and cognitive system supporting moral decision-making and behavior. Hippocampal pathologies have been linked to moral deviance (Laakso et al., 2001) and murder (Raine and Yang, 2006; Yang et al. 2010). More fundamentally, episodic thought and its underlying brain structures have been hypothesized as essential for planning and for constructing possible, personal futures (Darwin, 1871; Schacter et al., 2007; Suddendorf and Corballis, 2007; Klein et al. 2012; Klein, 2013; Szpunar et al., 2013). So it is plausible that episodic thought plays a key role in moral decision-making.

According to Greene's dual process model of moral judgment (Greene, 2014), deontological judgments (i.e., concerning the categorical permissibility of an action, e.g., "It's always wrong to kill.") are produced when individuals vividly imagine themselves in personal scenarios. Utilitarian judgments (concerning the overall effect of an action on happiness or human preference satisfaction), in contrast, are produced when individuals consider scenarios abstractly and at some personal remove. Scenarios that provoke a high

INTRODUCTION

What, if anything, do the hippocampus and medial temporal lobes contribute to moral judgment? Individuals with episodic amnesia resulting from hippocampal damage have deficits in the abilities to recollect past events (Tulving, 1983; Rosenbaum et al., 2005), imagine future events (Rosenbaum et al., 2005; Kwan et al., 2012; Kurczek et al., 2015), and construct vivid scenes (Hassabis et al., 2007). Such individuals afford a unique opportunity to study moral decision-making when

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TABLE 1.

Amnesic Cases' Demographic and Neuropsychological Data

Case	Age	Sex	Etiology	Chronicity	Ed	FSIQ	Executive function		Verbal learning and memory		Visual learning and memory	
							WCST	LF	AQ	LDFR	C	DR
KC●	58	M	TBI	28	16	99	–	6	0	0	18	0
DA★	62	M	HSE	20	17	117	6	8	0	0	18	0
DG†	48	M	Anoxia	3	16	92	6	6	5	5	8	1
LD☒	61	M	TLR	2	19	111	6	8	3	3	3	8
BL+	52	M	Anoxia	30	13	92	6	11	8	7	2	2
SN✱	46	M	Stroke	2	12	114	3	8	3	1	8	3
1846▼	44	F	SE	15	14	84	6	6	1	1	5	5
1951+	55	M	HSE	28	16	106	6	10	8	1	10	5
2308■	51	M	HSE	9	16	98	–	7	<1	<1	10	1
2363▲	51	M	Anoxia	10	18	98	6	8	2	<1	1	4
2563✚	52	M	Anoxia	8	16	94	6	10	6	2	14	6
2571○	44	F	Anoxia	8	16	112	6	10	10	7	14	7

Notes: Age = age in years; TBI = traumatic brain injury; HSE = herpes simplex encephalitis; TLF = temporal lobe resection; SE = status epilepticus; chronicity = years since injury; Ed = education in years; FSIQ = Full Scale IQ, based on Wechsler Adult Intelligence Scale—Revised for K.C., D.A., and D.G., Wechsler Abbreviated Scale of Intelligence—IV for B.L., and Wechsler Abbreviated Scale of Intelligence—III for all others; WCST = Wisconsin Card Sort Test, number of completed categories/6.

All other measures are reported in scaled scores: LF = COWA verbal fluency; Verbal Learning and Memory, AQ = acquisition, LDFR = long delay free recall, based on California Verbal Learning Test-II for K.C., D.A., D.G., and B.L., Hopkins Verbal Learning Test – Revised for L.D., Kaplan Baycrest Neurocognitive Assessment, Word List Learning for S.N., and Rey Auditory Verbal Learning Test for all others; ROCF = Rey Osterrieth Complex Figure, C = copy, DR = delayed recall.

degree of personal involvement have been reported to elicit more deontological judgments than do impersonal scenarios (Amit and Greene, 2012). Further, individuals with visual cognitive styles tend to make more deontological judgments than do people with verbal cognitive styles (Amit et al., 2014).

Individuals with deficits in episodic thought following hippocampal lesions have been described as unable to project themselves into personal futures (Tulving, 1985; Addis et al., 2007). They are said to lack mental time travel (Suddendorf and Corballis, 2007), to have deficits constructing imaginary future scenes and events (Hassabis et al., 2007; Kurczek et al., 2015) about both the past and the future (e.g., Rosenbaum et al., 2009; Race et al., 2013), and to be confined in a “permanent present tense.” If episodic thought is the capacity by which humans imagine personal, emotionally charged scenes and events (as hypothesized by Buckner and Carroll, 2007), individuals with deficits in episodic thought should make more utilitarian moral judgments in those cases than do controls. Individuals with episodic amnesia, in other words, should display a similar pattern of moral judgment behavior to that seen in individuals with damage to the ventromedial prefrontal cortex (Koenigs et al., 2007).

To test this prediction, and to explore the role of episodic thought in decision-making generally, we presented Green et

al.’s battery (2004) of moral scenarios to twelve individuals with bilateral hippocampal damage and deficits in episodic memory and future imagining (see Table 1 for demographic and neuropsychological information) and 22 middle-age controls (age, $M = 55.9$, $SD = 2.83$). The neuroanatomical characterization of these individuals, with detailed documentation of hippocampal and other neural pathology, is available in the literature (e.g., Rosenbaum et al., 2005; Allen et al., 2006; Kwan et al., 2013; Kurczek et al., 2015; Kwan et al., 2015). Participants made judgments on hypothetical scenarios that were either impersonal ($n = 14$) or personal ($n = 19$). Among personal scenarios, 8 were low-conflict scenarios (killing a misery-inducing boss to promote the collective happiness of your coworkers), and 11 were high-conflict scenarios (e.g., smothering a baby to save five people). Test items were treated as personal/impersonal and high/low conflict as described in, respectively, Green et al. 2001 and Koenigs et al., 2007). Participants read each scenario at his/her own pace and indicated (“yes”/“no”) whether the described action was morally acceptable. They were told not to think of their answers as “written in stone” and to provide their first, thoughtful response. As presumed in previous research (Greene et al., 2004; Koenigs et al., 2007), “yes” responses are taken to reflect utilitarian judgments, and “no” responses are taken to reflect deontological

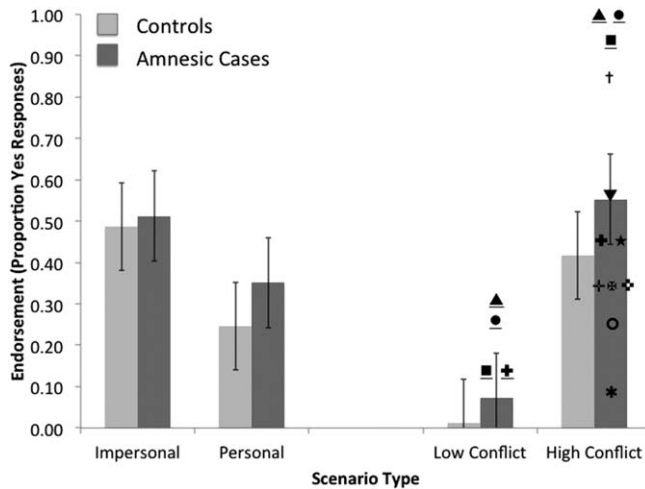


FIGURE 1. Proportion of “yes” responses as a function of group. (A) Compares amnesic and control answers to impersonal (left) and personal (right) scenarios. (B) (Right) compares amnesic and control answers to the low (left) and high (right) conflict scenarios among the personal scenarios. Error bars represent standard error. Individual data points for amnesia participants (symbols representing each case found in Table 1) were plotted for both low and high conflict personal scenarios. For the low conflict scenarios, only four amnesia participants endorsed any scenarios. Underlining represent cases that are significantly different from comparison performance as determined by individual comparisons between the amnesic cases and controls using the clinical case adjusted t test (Crawford and Garthwaite, 2002).

judgments (though see Kahane and Shackel, 2008). For each participant, we scored the proportion of “yes” to “no” responses endorsed.

To assess whether the proportion of “yes” responses varied between groups and levels of personal involvement, we conducted a 2x2 mixed factorial ANOVA with group (amnesic, control) as the between-subjects variable and level of personal involvement (impersonal, personal) as the within-subjects variable. There was no significant main effect of group ($F(1, 32) = 2.89, P = 0.099, \eta^2 = 0.083$) as individuals with amnesia gave a similar proportion of “yes” responses (Personal mean = 0.35, SD = 0.22; Impersonal mean = 0.25, SD = 0.14; Impersonal mean = 0.49, SD = 0.11). Replicating the finding of Koenigs et al. (2007), we found a significant main effect of level of personal involvement [$F(1, 32) = 32.30, P < 0.001, \eta^2 = 0.502$]: “yes” responses were more frequent in impersonal scenarios ($M = 0.50, SD = 0.11$) than personal scenarios [$M = 0.28, SD = 0.17$; Fig. 1(A)]. There was no significant group by level of personal involvement interaction ($P = 0.274, \eta^2 = 0.037$).

To assess whether the proportion of “yes” responses varied between groups and level of moral conflict within personal moral scenarios, we conducted a 2 × 2 mixed factorial ANOVA with group (amnesic, control) as the between-subjects variable and level of conflict (low conflict, high conflict) as the within-subjects variable. There was a significant effect of level of conflict [$F(1, 32) = 284.07, P < 0.001, \eta^2 = 0.899$]; “yes” responses were more frequent in high-conflict scenarios ($M = 0.47, SD = 0.26$)

than in low-conflict scenarios ($M = 0.03, SD = 0.09$). There was also a significant effect of group ($F(1, 32) = 4.29, P = 0.046, \eta^2 = 0.118$) whereby individuals with amnesia gave a higher proportion of “yes” responses (low conflict mean = 0.07, SD = 0.12; high conflict mean = 0.55, SD = 0.30) than did controls (low conflict mean = 0.01, SD = 0.05; high conflict mean = 0.42, SD = 0.22). The group by level of conflict interaction was non-significant [$P = 0.497, \eta^2 = 0.015$; Fig. 1(B)].

Individual comparisons between the amnesic cases and controls using the clinical case adjusted t test (Crawford and Garthwaite, 2002) revealed substantial variation across the group. Three amnesic patients (KC, 2308 and 2363) made a higher proportion of “yes” judgments than did controls in the high-conflict scenarios (KC - 1.0, $t = 2.61, P = 0.016, z_{cc} = 2.648$); 2308 - 0.91, $t = 2.20, P = 0.039, z_{cc} = 2.233$; 2363 - 1.0, $t = 2.61, P = 0.016, z_{cc} = 2.648$) and a higher proportion of “yes” judgments than controls in low-conflict scenarios (KC - 0.25, $t = 4.38, P < 0.001, z_{cc} = 4.528$; BL - 0.13, $t = 2.09, P = 0.049, z_{cc} = 2.17$; 2308 - 0.13, $t = 2.09, P = 0.049, z_{cc} = 2.17$; 2363 - 0.38, $t = 6.67, P < 0.001, z_{cc} = 6.887$), driving the group difference in the effect of level of conflict (without those participants, the effect of conflict remains significant, $F(1, 29) = 217.09, P < 0.001, \eta^2 = 0.882$), but there was no significant difference in group, $F(1, 29) = 0.02, P = 0.901, \eta^2 = 0.001$). In order to investigate the relationship between moral judgments and episodic thinking, the proportion of “yes” responses in each moral scenario condition was related to both past and future thinking. Consistent with the broader literature, to assess past and future thinking, we calculated the proportion of internal (i.e., episodic) to total (i.e., episodic and nonepisodic) details as a measure of episodic re-experiencing irrespective of the total verbal output (Levine et al. 2002). This proportion was calculated on previously obtained narratives from all the participants in the current study and reported in Kurczek et al., 2015 and Kwan et al., 2015 (with the exception of 2571, who was not in the previous report and whose data are thus not included here). Critically, as reported in Kurczek et al., 2015 and Kwan et al., 2015, the participants with severe episodic amnesia were significantly impaired relative to healthy control performance of both past and future thinking, as measured by the proportion of internal-to-total details. There were no significant correlations between proportion of “yes” responses for personal scenarios combined and deficits in episodic memory ($r = -0.094; P = 0.784$) or future imagining ($r = -0.015; P = 0.966$), between the proportion of “yes” responses in high-conflict personal scenarios and the extent of deficits in either episodic memory ($r = -0.150; P = 0.643$) or future imagining ($r = 0.010; P = 0.985$), or between the proportion of “yes” responses in low conflict personal scenarios and deficits in episodic memory ($r = 0.097; P = 0.776$) and future imagining ($r = -0.118; P = 0.729$).

Our findings show that individuals with hippocampal damage and deficits in episodic imagining can make moral decisions. Like controls, they gave more utilitarian responses in personal scenarios than in impersonal scenarios. Finally, there was no correlation between deficits in episodic thought and utilitarian response rate. The biasing effect of personal, high-

conflict scenarios on moral judgment thus appears to be independent of episodic memory and prospection.

All individuals with amnesia answered all the questions. Though this finding is unsurprising, given that many individuals with amnesia retain most of their cognitive capacities, it undermines the intuitive idea that episodic thought is necessary for making moral judgments (e.g., Darwin, 1871).

Like controls, amnesics as a group gave more deontological (“no”) responses in personal scenarios than in impersonal scenarios. Yet they did not give more utilitarian answers in personal scenarios than did controls. Moral judgment in individuals with episodic amnesia thus exhibits a well-known and curious feature of human moral judgment, characterized by Greene (2014) as a bias toward deontological judgments in personal scenarios. This provides some evidence that amnesic individuals enlist the same neurocognitive mechanisms in making moral judgments as do controls.

Among personal scenarios, the influence of episodic thought should be most evident in high-conflict scenarios, where deontological judgments are pitted against heavy utilitarian costs. Episodic memory and imagining are commonly associated with emotional cognition (Boyer, 2008; De Steno, 2009; Rubin and Umanath, 2015). Greene’s (2001, 2014) model predicts that individuals with deficits in the ability to imagine such emotional, personal scenes should make more utilitarian judgments than do controls, especially in high conflict scenarios. Indeed, as a group, amnesics made more utilitarian judgments in both low and high-conflict scenarios than did controls. This finding is consistent with a modulatory role for hippocampally mediated episodic thought in deontological moral judgment.

Closer scrutiny, however, reveals that three high-utilitarian amnesic individuals (KC, 2308 and 2363) drive this apparent effect. All others were within the range of controls. The three high-utilitarian responders fall across the spectrum of deficits in both episodic memory and future imagining; indeed, two such individuals have the least (2363) and the greatest (KC) impairment in both episodic memory and future imagining. Furthermore, one amnesic individual (SN) made more deontological responses than anyone while being among the most impaired in both episodic memory and future imagining. Perhaps these outliers held conservatively to a single answer for most of the questions. Regardless of the explanation, impairments in neither episodic memory nor episodic future thought correlate with the proportion of deontological judgments in amnesic individuals.

These findings argue that mechanisms of episodic memory and future imagining likely do not mediate the effect of personal involvement on moral judgment (Greene et al., 2001). This conclusion fits with emerging evidence that many aspects of prudential decision-making are preserved even in individuals lacking episodic memory and future imagining (i.e., KC). Individuals with episodic amnesia know they have personal futures and care about them (Craver et al., 2014). They value future rewards and, like controls, systematically discount the value of those rewards with time (Kwan et al., 2013). They are neither impulsive nor prone to risk (Rosenbaum et al., 2015). Such findings

independently suggest that many mechanisms contribute to future decision-making.

How personally salient, high-conflict scenarios influence these mechanisms in individuals with episodic amnesia remains to be determined. One possibility is that personal scenarios elicit an emotional response at the core of Green et al.’s (2001) model via a pathway independent of episodic memory. Indeed, patients with severe episodic amnesia are capable of seemingly normal emotional processing and experience in the absence of declarative memory for the event that initially caused the emotion (e.g., Feinstein et al., 2010). Such an interpretation warrants further attention.

While we have shown that some aspects of moral judgment are spared even in severe episodic amnesia, episodic memory might have a more subtle effect on moral decision-making over time. Although individuals with amnesia (including many in this study) can assess others’ character as “good,” “bad,” and “neutral” based on scenarios, their judgments change more dramatically in response to individual scenarios than do controls (Croft et al., 2010). Individuals with amnesia might have difficulty updating overall character judgments on the basis of single scenarios and might have difficulty comparatively assessing the moral status of one kind of act relative to other kinds of acts (e.g., stealing vs. murder). They might also exhibit greater difficulty if the moral dilemmas involve people who are personally familiar, as this might place demands on episodic simulation (e.g., Rabin et al., 2013; De Brigard et al., 2015).

We have shown that, in contrast to what Greene’s (2001, 2014) model and a common understanding of mental time travel jointly predict, individuals with hippocampal damage and profound deficits in episodic memory and future imagining show no deficit-dependent tendency to make more utilitarian judgments in personal high-conflict moral scenarios than do controls.

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