Alterations of the sense of self and personality in Parkinson's disease

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SUMMARY

Purpose   We hypothesized that alterations of subcomponents ('harm-avoidance') of personality and the sense of Self in patients with PD would be associated with executive cognitive dysfunction.
Methods   Thirty-four patients with PD and 17 age-matched controls with chronic disease were assessed with a set of neuropsychologic, personality and mood tests as well as an experimental assessment of the sense of Self.
Results   On personality and self tests, PD patients evidenced higher harm avoidance, lower novelty seeking scores, and lower recall rates of personally experienced events from childhood than controls and this PD personality profile was associated with poor performance on neuropsychologic tests of executive prefrontal function. PD patients, however, did not differ significantly from controls in their subjectively felt congruence between their present Selves and their hoped-for Selves.
Conclusions   We suggest that harm-avoidance personality and Self-related changes of PD are due, in part, to a memory disorder associated with frontal dysfunction. Copyright © 2007 John Wiley & Sons, Ltd.

KEY WORDS — self; temperament and character inventory; Parkinson's disease; harm-avoidance; personality; frontal lobes

INTRODUCTION

Studies of the sense of Self and personality in PD suggest that PD patients are less talkative, less flexible, suspicious and cautious compared with age-matched healthy controls as well as controls with other chronic diseases (Poewe *et al.*, 1983; Eatough *et al.*, 1990; Menza *et al.*, 1990; Glosser *et al.*, 1995; Hubble and Koller, 1995; McNamara *et al.*, 2003). In studies using the Cloninger 'tridimensional personality questionnaire', or its more recent variant, the Temperament and Character Inventory (TCI; Cloninger *et al.*, 1993), patients with Parkinson's disease show less 'novelty seeking' activity, greater 'harm-avoidance' behavior, and less consistency in performance on "reward depen-

dence" tasks than controls (Menza *et al.*, 1990; Menza *et al.*, 1993; Fujii *et al.*, 2000).

We have previously argued and presented evidence for the view that alterations in the global sense of Self are related to prefrontal dysfunction (McNamara *et al.*, 2003). PD patients, in fact, are known to exhibit evidence of prefrontal dysfunction early in the course of the disease (Lees and Smith, 1983; Levin *et al.*, 1989; Taylor and Saint-Cyr, 1991; Owen *et al.*, 1992; Lange *et al.*, 1993; Taylor and Saint-Cyr, 1995; Barkeley, 2001). If it could be established that changes in executive cognitive functioning contribute to changes in personality in PD, then the hypothesis that the sense of Self depends crucially on the frontal lobes would be strengthened. In addition, new avenues of treatment of personality changes of PD that target executive cognitive functions could potentially be established. To test the hypothesis that ECF deficits of PD contribute to personality/Self changes in PD, we examined personality, autobiographical memory and executive cognitive functions (ECFs) in patients with PD.

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METHODS

The study was approved by the VA Internal Review Board for protection of human subjects.

Participants

Thirty-four patients with PD (33 males; 1 female) were recruited from the outpatient Movement Disorders Clinic at the VA Boston Healthcare System, Boston, MA. Patients were individually diagnosed by Dr Raymon Durso, director of the clinic. All were right-handed. Fourteen patients were at Hoehn-Yahr (H-Y) Stage II, 17 at Stage III, and three at stage IV. Mean H-Y Stage score for the entire group was 2.6 (0.69). None of the patients were demented according to clinical examinations and DSM-IV criteria. All were on some form of dopaminergic medication and were tested while on medications with optimal effects (i.e. motor signs were well controlled). Patients with a history of substance abuse or head injury were excluded. Seventeen age-matched control subjects (7 female) were also recruited from the VA community. All of these control participants had some form of chronic disease with most reporting low back chronic pain syndromes.

Measures

Mood tests. We assessed depression, stress and anxiety with the Depression Anxiety and Stress Scale (DASS) developed by Lovibond and Lovibond (1995). Crawford and Henry (2003) and Antony et al. (1998) have reported excellent reliability, validity and other psychometric properties for the three subscales of the DASS. The test includes 21 questions, seven in each of the depression, anxiety and stress subscales with higher scores indicating greater impairment.

The Temperament and Character Inventory (TCI; Cloninger et al., 1993). The TCI was based on the Cloninger Personality Inventory, sometimes called the Tri-dimensional Personality Questionnaire or TPQ (Cloninger, 1987). We chose the TCI by Cloninger over similar personality assessment instruments like the NEO-PI because the TCI grew out a synthesis of the literature on neurobiologic correlates of personality traits (Cloninger, 1987; Cloninger et al., 1993) and thus may articulate more easily with neuropsychologic changes induced by PD. Three basic personality dimensions, 'novelty-seeking', 'harm avoidance' and 'reward dependence' are measured along with 4 characterological scales:

'Persistence', Self-directedness', 'Cooperativeness' and 'Self-transcendence'. The TCI scales exhibit satisfactory psychometric properties, are very widely used in studies of clinical populations and have been used successfully with PD patients (Menza et al., 1990; Cloninger et al., 1993; Menza et al., 1993; Fujii et al., 2000).

Self. To measure memory-related aspects of the sense of Self, we used a variant of a procedure commonly used to elicit recall from autobiographical memory stores. Participants were asked to recall significant personally experienced events from each of three life periods: early life, childhood and recent. They had 90 sec to recall as many events as they could from each period. After autobiographical recall was assessed, we next asked participants to imagine a 'hoped-for or possible positive Self' – the kind of person they would like to become. We used the scale developed by Hooker (1999). The higher the score, the closer the felt congruence between present and possible selves.

Stroop color-word interference procedure. This test requires the subject to name the color of the ink or to name the word of a color-word that is printed. An 'interference' test card consists of rows of color words printed in ink colors incongruent with the word represented, with the task being to name the ink colors as quickly as possible. Kerns et al. (2004) showed that performance of Stroop tasks activates the anterior cingulate cortex (ACC) and that ACC conflict-related activity predicts both greater prefrontal cortex activity and engagement of cognitive control systems.

Verbal fluency. In this task, participants are asked to generate words to a stimulus and have one minute to produce as many words as they can. The stimuli are letters and then categories. The three letters are F, A, and S. The category stimulus was 'animals'. In the alternating condition, subjects are asked to alternate between letter and category generation. Numerous investigations have shown that poor performance on verbal fluency tasks is reliably associated with frontal dysfunction (Henry and Crawford, 2004).

RESULTS

Preliminary analysis revealed that the Stroop interference measures departed from normality. Accordingly, a Mann-Whitney U-test was used instead of the two-sample t-test to quantify the statistical significance of group differences, and Spearman correlation was used instead of Pearson correlation for bivariate

Table 1. Demographic and neuropsychological variables on PD subjects and controls

	PDs (SD)	Controls (SD)	p-value
Age	70.6 (11.1)	65.6 (7.4)	0.07
Education (years)	13.3 (2.8)	15.2 (2.0)	0.01**
H-Y stage	2.6 (.69)	—	—
Stress	6.0 (4.6)	2.2 (1.9)	0.002**
Anxiety	5.1 (3.4)	1.5 (1.5)	0.001**
Depression	4.4 (3.8)	1.9 (2.5)	0.01*
MMSE	26.1 (2.5)	27.8 (1.5)	0.02*
Stroop interference	117.7 (45.1)	80.9 (33.1)	0.001** (Mann–Whitney U)
FAS letter fluency	28.1 (12.3)	43.6 (11.7)	0.0001**
Category fluency (animals)	13.2 (4.3)	18.2 (5.5)	0.001**
Alternating fluency	9.5 (4.4)	13.8 (2.8)	0.0001**

$*p < 0.05$; $**p < .01$.
Fluency = number of words produced in letter, category and alternating conditions; H-Y stage = Hoehn-Yahr (higher score indicates greater disease severity); MMSE = Mini Mental Status Exam; PDs = Parkinson's disease patients; SD = Standard Deviation; Stroop interference time = total time (sec) taken to read through the interference card of the Stroop test (higher scores indicate greater impairment).

relationships involving these variables. For all other comparisons, Bonferroni-corrected two-sample t-test was used to assess group differences and Pearson's r for bivariate correlations.

PD vs control differences on demographic and neuropsychologic function (see Table 1)

While the two groups did not differ significantly in terms of age [PD mean = 70.6 (11.1)], controls mean = 65.6 (7.4), $p = 0.07$), the controls reported higher levels of education (PD mean = 13.3 (2.8) years, controls mean = 15.2 (2.0) years, $p = 0.01$). Mean Mini Mental State Exam (MMSE) score was 26.1 (2.5) for PD patients and 27.8 (1.5) for controls ($p = 0.02$). Patients with PD were also more stressed, more anxious and more depressed than

controls (all p-values < 0.01; see Table 1). PD participants were also significantly more impaired on the frontal tasks (Stroop and verbal fluency; PD mean Stroop = 117.7 (45.1), controls mean = 80.9 (33.1), $p = 0.001$; PD mean verbal fluency = 28.1 (12.3), controls mean = 43.6 (11.7), $p = 0.0001$)) than were the controls (Table 1).

PD vs control differences on the TCI scales (Table 2)

PD patients were significantly more likely to evidence harm avoidance than controls (PD mean = 15.1 (6.0), controls mean = 10.4 (5.4), $p = 0.01$). PDs were also marginally less likely to be self-directed (PD mean = 32.2 (5.5), controls mean = 36.0 (8.7), $p = 0.07$) or persistent (PD mean = 5.2 (1.9), controls

Table 2. PDs vs controls on personality subscales

	PDs (SD)	Controls (SD)	p-value
TCI Subscales			
Novelty seeking	17.6 (6.1)	15.1 (4.8)	0.13
Harm avoidance	15.1 (6.0)	10.4 (5.4)	0.01*
Reward dependence	14.5 (4.4)	15.4 (5.0)	0.50
Perseverance/persistence	5.2 (1.9)	4.2 (2.1)	0.07
Self-directedness	32.2 (5.5)	36.0 (8.7)	0.07
Cooperativeness	33.0 (5.2)	34.5 (5.7)	0.34
Self-transcendence	14.1 (5.5)	14.5 (7.6)	0.83
Harm Avoidance Subscales			
HA anticipatory worry vs uninhibited optimism	3.9 (2.3)	2.4 (2.4)	0.04*
Fear of uncertainty	3.6 (1.5)	3.4 (1.3)	0.63
Shyness with strangers	3.2 (2.4)	2.5 (2.0)	0.31
Fatigability and asthenia	4.3 (1.9)	2.0 (1.8)	0.001**

$*p < 0.05$; $**p < 0.01$.
HA = Harm avoidance; PDs = Parkinson's disease patients; SD = Standard Deviation; TCI = Temperament and Character Inventory.

Table 3. Subjective felt congruence between present self and hoped-for self

	PDs	Controls	p-value
Number of Early events recalled in 90 sec	7.3 (4.2)	11.1 (5.7)	0.04*
Number of Childhood events recalled in 90 seconds	6.8 (4.0)	11.7 (5.6)	0.01*
Number of Recent events recalled in 90 seconds	6.7 (3.4)	9.6 (5.3)	0.08
Felt congruence between present and possible 'hoped for' Self	28.5 (9.1)	25.7 (13.1)	0.45

*$p < 0.05$; **$p < 0.01$.
PDs = Parkinson's disease patients; SD = standard deviation.

mean = 4.2 (2.1), $p = 0.07$) than controls. The 'anticipatory worry' (PD mean = 3.9 (2.3), controls mean = 2.4 (2.4), $p = 0.04$) and the 'fatigability' subscales (PD mean = 4.3 (1.9), controls mean = 2.0 (1.8), $p = 0.001$) of the Harm avoidance scale seemed to drive the overall harm avoidance effect among PD patients (Table 2).

Past selves: Autobiographical memory recall (Table 3)

In terms of total events recalled across each 90-sec session, PD patients performed significantly more poorly on recall of early events [PD mean = 7.3 (4.2) *vs* controls mean = 11.1 (5.7); $p = 0.04$]; and of childhood events [PD mean = 6.8 (4.0) *vs* controls mean 11.7 (5.6)] but not of recent events (PD mean = 6.7 (3.4); controls mean = 9.6 (5.3), $p = 0.08$). This pattern of PD *vs* control differences on recall tasks was maintained with respect to the initiation stage (the first 15-sec interval). While PD patients were slower to initiate recall of distant long-term memories [early and childhood events, see Figure 1; early event PD mean = 1.7 (1.1), controls mean = 2.6 (0.9), $p = 0.01$] childhood event PD mean = 1.7 (1.0), controls mean 2.7 (1.5), $p = 0.01$); PD patients did not differ significantly from controls in the mean number of *recent* events recalled in the first 15-sec interval [PD mean = 1.8 (1.1); control mean = 2.1 (1.0), $p = 0.37$]. Inspection of recall rate curves (see Figure 1) for PD vs. control participants across each of the six 15-sec intervals reveals a monotonically decreasing performance curve for PD patients while controls tended to exhibit a strong start and finish but approached the performance curve of PD patients in between the first and last 15-sec intervals.

Finally, PD patients did not differ significantly from controls in their subjectively felt congruence between their present Selves and their hoped-for Selves [PD mean = 28.5 (9.1); Control mean 25.7 (13.1); $p = 0.45$].

Correlations between personality scales and the two frontal tests

Bivariate correlational analyses between the two prefrontal test scores and the three main personality scores (harm avoidance, novelty seeking and reward dependence) revealed a significant and inverse Pearson $r = -0.30$, $p = 0.04$, between the verbal fluency FAS score and the overall Harm Avoidance scale score among PD patients, indicating that the higher the harm avoidance score the poorer performance on the letter verbal fluency task. No significant correlations were obtained between mood, H-Y severity ratings and any of the TCI personality subscales.

DISCUSSION

In this study of personality and self-related changes in PD, we found that PD patients evidenced significantly elevated 'harm avoidance' scores and significantly poorer retrieval of autobiographical memory episodes. The harm avoidance profile among PD patients seemed to be driven by high PD scores on the 'fatigability' and the 'anticipatory worry' items on the harm avoidance subscale. While PD recall rates for long-term autobiographical memories (early and childhood events) were below those of controls, PD recall rates for recent episodic memories did not differ from control recall rates. PD patients did not differ from controls when asked to reflect on their current selves and imagined future possible selves. These alterations in personality and Self-related functions, however, were not related to stress, anxiety or depression. Instead, we found a strong relationship between 'harm avoidance' scores and performance on the letter/phonemic verbal fluency task. The higher the harm avoidance score, the lower the verbal fluency performance. All of these data confirm McNamara *et al.* (2003) and suggest that: (1) the harm avoidance subcomponent of the Self in PD is significantly altered relative to age-matched controls; (2) this alteration is

PD = Parkinson's Disease Patients
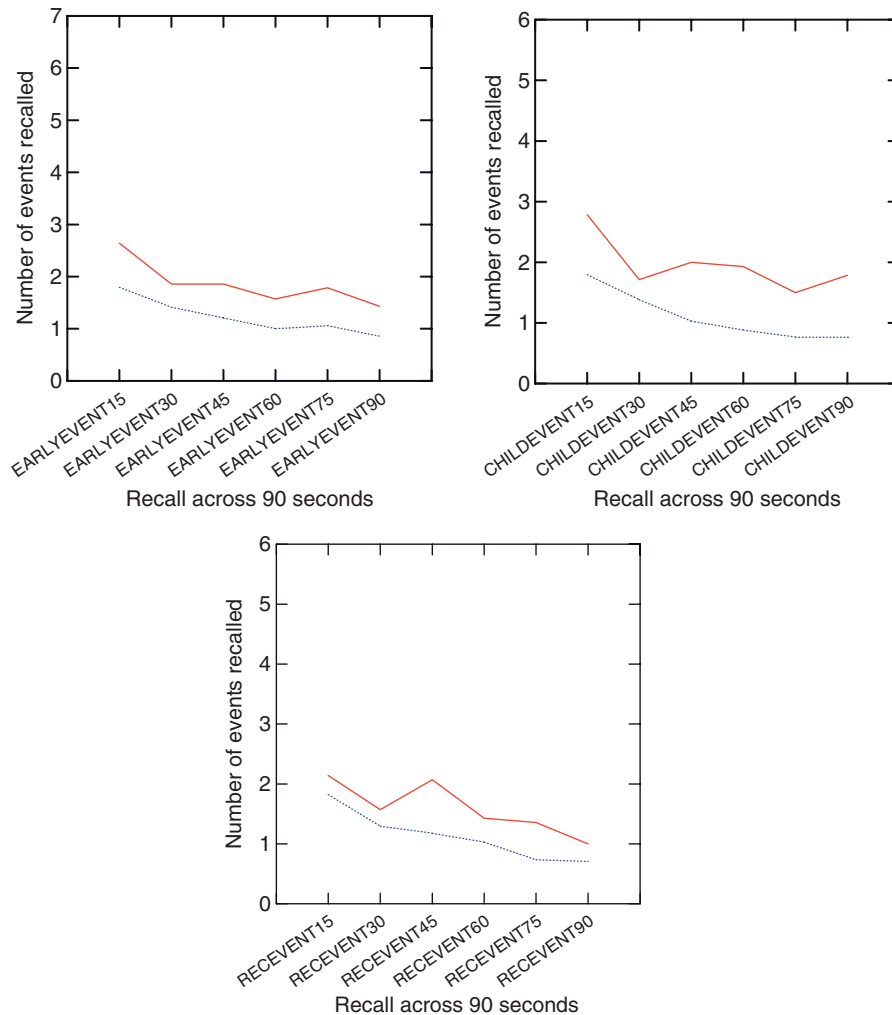PDs = ...
Controls = ———

Figure 1. Autobiographical memory rates of recall per 15-sec intervals for early, childhood, and recent events in PD *vs* control groups.

related more strongly to frontal dysfunction than to mood function.

We also found that PD patients recalled fewer autobiographical memories in a 90-sec interval than did controls. This difference in recall between patients and controls could not be due to psychomotor slowing among the PD patients. When we plotted the recall curve as a function of 15-second intervals, we found that PD patients recalled roughly similar number of *recent* events in the first time interval as did controls. PD patients did not seem to have inordinate difficulty

initiating recall or rapidly retrieving *recent* events relative to controls. This was not the case when patients attempted to retrieve long-term autobiographical memories. Here initiation was significantly slower relative to controls. PD patient performance, furthermore, declined steadily across the time intervals while controls exhibited a similar gradual decline and then a sudden increase during the final time intervals—at least on the long-term memory tasks (early and childhood recall). These recall results indicate that PD patients have relatively normal access

to the 'current Self' and relatively poor access to memory-based aspects of the Self.

Limitations of our study should be kept in mind. While our sample size ($n = 34$ patients) was comparable to similar published studies of personality in PD this number is still relatively small, so statistical power was limited. Our control group of patients with other chronic diseases may have also suffered from declines in cognitive function not assessed in this study. Our measures of personality and the sense of Self do not capture all aspects of the Self or personality.

CONFLICT OF INTEREST STATEMENT

No financial or personal relationships exist.

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