Is There a “Subcortical” Profile of Attentional Dysfunction? A Comparison of Patients with Huntington’s and Parkinson’s Diseases on a Global-Local Focused Attention Task*

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ABSTRACT

This study investigated focused attention in two subcortical degenerative disorders by examining the performance of patients with Huntington’s disease (HD) and Parkinson’s disease (PD) on a task utilizing global-local stimuli. Participants were presented with global-local figures and were instructed to focus their attention on either the global or local level. Stimuli were either “consistent”, with the same form at the global and local levels, or “inconsistent”, with different forms at the global and local levels. It was found that response times (RTs) of patients with PD were comparable to those of similarly-aged controls regardless of stimulus consistency. In contrast, patients with HD demonstrated disproportionately longer RTs to inconsistent stimuli relative to their age-matched control group. Difference scores between RTs for inconsistent versus consistent stimuli were not correlated with overall level of dementia or disease severity for either the HD or PD group. These results provide further evidence for the heterogeneity of attentional dysfunction among subcortical degenerative illnesses.

“Subcortical” degenerative disorders such as Huntington’s (HD) and Parkinson’s (PD) diseases, which arise from predominantly striatal or white matter degeneration, have been associated with a profile of cognitive changes, including bradyphrenia, mild executive functioning deficits, and impaired memory retrieval, with intact semantic knowledge (Butters, Wolfe, Granholm, & Martone, 1986; Cummings, 1986, 1990; Cummings & Benson, 1984; Massman, Delis, Butters, Levin, & Salmon, 1990). This contrasts with the profile observed in “cortical” degenerative disorders such as Alzheimer’s disease, which often affect mesial temporal structures and temporoparietal association cortices; such disorders may result in impaired memory encoding and storage, aphasia, apraxia, and agnosia (Butters, Delis, & Lucas, 1995; Cummings & Benson, 1992; Delis et al., 1991; Fuld, Katzman, Davies, & Terry, 1982; Martone, Butters, & Trauner, 1986; Moss, Albert, Butters, & Payne, 1986; Terry & Katzman, 1983; Tröster, Butters, et al., 1993; Wilson, Bacan, Fox, & Kasznia, 1983).

A common assumption of past research on subcortical dementing illnesses is that patients with predominantly subcortical neuropathology have similar cognitive profiles despite differences in the mechanism and location of the subcortical involvement (e.g., see Cummings, 1990). Consistent with this assumption, some studies that have directly compared patients with subcortical degeneration on cognitive tasks have found group differences which seemed to differ

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more in degree than in quality of the impairment (Lundervold, Karlson, & Reinvang, 1994; Massman et al., 1990; Rosser & Hodges, 1994). However, Pillon, Dubois, Ploska, and Agid’s (1991) comparison of patients with HD, PD, and progressive supranuclear palsy revealed heterogeneous profiles of cognitive impairment among these subcortical degenerative groups. Thus, there is some evidence that subcortical degenerative illnesses may result in different patterns of cognitive deficits.

One area of cognition in which subcortical groups differ may be attention. Studies that have used traditional clinical measures of attention have provided initial evidence that patients with different forms of subcortical neuropathology can be dissociated on these measures. For example, Tröster, Jacobs, Butters, Cullum, and Salmon (1989) found that patients with HD exhibited greater levels of impairment than age-matched controls on the Attention/Concentration Index of the Wechsler Memory Scale-Revised (Wechsler, 1987). In addition, individuals with HD have displayed deficient digit span performance (Lundervold et al., 1994). In contrast, patients with PD did not differ from controls on similar measures (Hietanen & Teräväinen, 1988; Levin, Llabre, & Weiner, 1989; Lundervold et al., 1994; Pillon, Dubois, Lhermitte, & Agid, 1986). A study directly comparing patients with HD and PD found that they performed similarly on a task of mental control, but a subgroup of individuals with HD exhibited worse digit span performance than subjects with PD (Pillon et al., 1991). It should be noted that these investigations identified quantitative differences in subject performance, but did not examine possible qualitative differences that may have elucidated which components of attentional functioning were spared versus impaired across groups.

Studies examining patients with HD and PD on experimental tasks have better delineated component processes of attention in these groups. The findings from these studies suggest greater heterogeneity of impairment across subcortical degenerative illnesses. For example, recent investigations that directly compared patients with HD and PD on visual shifting of attention revealed qualitatively distinct patterns of performance (Filoteo et al., 1994; Filoteo et al., 1995). In these studies, subjects with HD and PD were presented with global-local figures (e.g., a large “3” made up of smaller “1s”), each of which had a target stimulus (“1” or “2”) appearing at either the global or local level. Subjects were required to divide their attention across the two hierarchical levels in order to identify the target stimulus. Results indicated that patients with PD responded more slowly than age-matched controls to the second of two stimuli when the target remained at the same level across consecutive trials, but more rapidly than controls when the target changed levels. This suggests a deficit in maintaining attention to, or in inhibiting movement of attention away from, the previous global-local level. In contrast, the HD group performed similarly to age-matched controls on this task; that is, they appeared unimpaired in their maintenance and shifting of attention. Similar patterns of performance have also been demonstrated in previous studies of HD and PD that examined shifts of attention using a spatial orienting task (Filoteo et al., 1996; Tsai, Lasker, & Zee, 1995; Wright, Burns, Geffen, & Geffen, 1990).

It would not be surprising for attentional profiles to differ across subcortical dementing disorders, given the heterogeneity of the neuropathological features of these diseases. HD results in severe caudate nucleus cell loss, and PD primarily involves degeneration of dopaminergic cells in the substantia nigra (Bruyn, Bots, & Dom, 1979; Cummings & Benson, 1992; Hornykiewicz, 1982; Martin & Gusella, 1986; VonSattel et al., 1985). Interestingly, dopamine-depleting lesions in the striatum of rats have been shown not to result in attentional shifting deficits (Ward & Brown, 1996), a finding consistent with caudate degeneration and intact attentional shifting in patients with HD (but see Kermadi & Boussaoud, 1995). There is also interesting evidence that dopaminergic depletion, as is found in patients with PD, is associated with impairment in maintaining attention. For instance, Clark, Geffen, and Geffen (1989) found that normal subjects who had been administered a dopamine agonist tended to display an impairment in maintaining attention, suggesting that
loss of this neurotransmitter may underlie the pattern of attentional impairment in patients with PD.

Although previous work suggests that patients with HD and PD can be dissociated on tests of attentional shifting, it is less clear whether another component of attention, focused attention, also differs between these groups. Individuals with HD have demonstrated impairment in ignoring distracting stimuli, as evidenced by a decreased ability to suppress saccades to peripherally flashing visual stimuli when instructed to maintain a central focus (Tsai et al., 1995). Similarly, in studies of focused auditory and visual attention, several researchers have found that patients with early PD had more difficulty than controls in ignoring distracting stimuli (Maddox, Filoteo, Delis, & Salmon, 1996; Sharpe, 1990, 1992). On various versions of the Stroop task (Stroop, 1935), which requires subjects to focus attention on one stimulus feature while ignoring another, more salient feature, patients with both HD and PD have generally demonstrated greater susceptibility than controls to interference from the competing feature (Brown & Marsden, 1991; Henik, Singh, Beckley, & Rafal, 1993; Hietanen & Teräväinen, 1988; Swerdlow et al., 1995). It would therefore seem that focused attention is deficient in both HD and PD. However, these studies did not directly compare the performance of HD and PD groups on the same focused attention task. In addition, task complexity varied widely among the various methodologies employed; for example, Brown and Marsden (1991) and Sharpe (1990) required subjects to focus attention while performing a secondary task simultaneously.

The purpose of the present study was to further examine possible differences in components of attentional functioning in patients with HD and PD. We administered a global-local focused attention task to patients with HD or PD. Stimuli consisted of global-local forms that were either consistent at the global and local levels (e.g., a large “1” made up of smaller “1s”) or inconsistent at the two levels (e.g., a large “1” made up of smaller “2s”). In one group of trials, subjects were required to focus their attention on and identify the local-level form; in another group of trials, they focused on and identified the local-level form. The variable of interest was susceptibility to interference from competing forms at the unattended level, as measured by relative performance on trials of consistent versus inconsistent stimuli. It was hypothesized that both HD and PD groups would perform disproportionately worse than nonneurological control subjects on inconsistent global-local stimuli relative to consistent stimuli.

METHOD

Participants

Fourteen patients with HD and 14 patients with PD participated in this study. Because HD generally afflicts patients earlier in life than PD, two separate control groups were employed in this study: 13 middle-aged normal control subjects (MNC) to compare with the HD group, and 14 elderly normal control subjects (ENC) to compare with the PD group. Individuals with a history of stroke, head injury with loss of consciousness exceeding 1 min, or current substance abuse were excluded from study. Persons selected for study were drawn from a larger pool of individuals completing the experimental task described below. Only those who attained an acceptable level of accuracy (80%) on the task were included, due to potential speed-accuracy tradeoffs. Consequently, 1 of 15 patients with PD who completed this task was not included in this study; however, all HD, MNC, and ENC subjects tested met the 80% accuracy inclusion criterion.

Patients with HD were recruited from the Genetically Handicapped Persons’ Program at the University of California, San Diego (UCSD). The diagnosis of HD was made by a senior staff neurologist (M.S.), based on a positive family history of HD and observation of choreiform movements. As indicated by the Shoulson and Fahn (1979) functional disability rating scale, 2 patients with HD were functioning in Stage 1 (mildest level of disability), 4 in Stage 2, 4 in Stage 3, 3 in Stage 4, and 1 in Stage 5 (greatest level of disability). At the time of testing, consistent with the typical clinical presentation of HD, 3 of the 14 individuals with HD carried diagnoses of depression, one was being treated for a depressive phase of a bipolar disorder, and one was diagnosed with a personality change due to HD, aggressive type. Medications taken by patients with HD included antidepressants (4 subjects), neuroleptics (5 subjects), and anxio-
lytics (3 subjects). Four individuals with HD were unmedicated. One had chronic obstructive pulmonary disease and another had diabetes; these disorders were successfully controlled by medications.

Patients with PD were recruited from the UCSD Movement Disorders Clinic. Idiopathic PD was diagnosed in our patients by a staff neurologist (C. S.). All patients were otherwise judged to be in good health. According to Hoehn and Yahr’s (1967) scale of motor impairment severity, which ranges from 1 (mild) to 4 (severe), 1 patient with PD was in stage 1, 5 were in stage 2, 5 were in stage 3, and 3 were in stage 4. Tremor was the predominant symptom for all 14 patients with PD. At the time of testing, 12 patients were receiving dopaminergic medication, 1 was taking dopaminergic and anticholinergic medication, and 1 patient was taking dopaminergic medication plus bupropion for symptoms of depression. However, no patients with PD were formally diagnosed with a depressive disorder.

The MNC and ENC groups were recruited from the community. In addition to the exclusion criteria noted above, individuals in the control groups had no history of serious psychiatric illness or neurologic disease. MNC participants were selected if their age and education were comparable to those of patients in the HD group. ENC participants were selected if their age and education were similar to those of patients in the PD group.

Demographic and psychometric information for the patient and control groups are presented in Table 1. For most of the analyses which follow, same-aged groups (PD and ENC; HD and MNC) were compared to each other with t tests. We chose this method of analysis as it has been shown that it can be misleading and inappropriate to compare groups mismatched on demographic variables such as age, using those demographic variables as covariates (Adams, Brown, & Grant, 1985). The older groups did not differ from each other in age or education, nor did the younger groups (p > .05). Analyses of Mattis Dementia Rating Scale scores (DRS; Mattis, 1988) indicated that the PD and ENC groups had comparable DRS scores (p > .05), whereas the younger control group differed from the HD group on this measure, with the HD group having lower scores, t (14.10) = –3.29, p = .002. Participants were considered demented if their DRS score fell more than 2 SDs below the normative mean (Montgomery, 1982; Mattis, 1988); as can be seen in Table 1, only the HD group had individuals falling into the demented range. A comparison of the HD and MNC groups indicated a significant difference in the proportion of demented subjects, χ² (1) = 4.36, p = .037. Lower DRS scores were expected in the HD group relative to the other groups (e.g., see Pillon et al., 1991), and as a result, steps were taken to offset this difference: (1) Only individuals whose performance accuracy was 80% or better were included in the study; (2) We examined a contrast measure of attentional performance that corrects for overall slowness; and (3) We examined relationships between DRS scores and attentional task performance. The percentages of male participants and right-handers in each group is also listed in Table 1. The two older groups were comprised entirely of

Table 1. Demographic and Psychometric Data.

<table>
<thead>
<tr>
<th></th>
<th>PD (n = 14)</th>
<th>ENC (n = 14)</th>
<th>HD (n = 14)</th>
<th>MNC (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>68.6 (6.0)</td>
<td>67.9 (3.3)</td>
<td>49.1 (14.2)</td>
<td>44.8 (12.7)</td>
</tr>
<tr>
<td>Educ. (years)</td>
<td>15.6 (2.5)</td>
<td>14.0 (2.2)</td>
<td>13.4 (2.4)</td>
<td>14.2 (1.9)</td>
</tr>
<tr>
<td>DRS score</td>
<td>139.4 (3.5)</td>
<td>140.5 (2.4)</td>
<td>129.4ᵃ (11.7)</td>
<td>141.8ᵃ (2.3)</td>
</tr>
</tbody>
</table>

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<tr>
<th></th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>79</td>
<td>79</td>
<td>50</td>
<td>54</td>
</tr>
<tr>
<td>Right hand dominant</td>
<td>100</td>
<td>100</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>DRS scores below dementia cutoff</td>
<td>10</td>
<td>10</td>
<td>29ᵇ</td>
<td>0ᵇ</td>
</tr>
</tbody>
</table>

Note. PD = Parkinson’s disease; ENC = Elderly normal controls; HD = Huntington’s disease; MNC = Middle-aged normal controls. DRS = Dementia Rating Scale.

ᵃ Means are significantly different according to t test, p < .01.
ᵇ Percentages are significantly different according to chi-square test, p < .05.
right-handers, whereas one individual was left-handed in each of the two younger subject groups. Neither the ratio of right- to left-handers nor the gender composition of the groups differed significantly across groups, according to chi-square tests ($p > .10$).

**Stimuli and apparatus**

Four global-local stimuli were presented in this task, two consistent stimuli and two inconsistent stimuli (see Fig. 1). The consistent stimuli were a large “1” composed of smaller “1s” and a large “2” composed of smaller “2s.” The inconsistent stimuli were a large “1” composed of smaller “2s” and a large “2” composed of smaller “1s” (see Fig. 1a and 1b). The large form subtended approximately 6.75 degrees of vertical visual angle, whereas the small form subtended approximately 0.38 degrees of vertical visual angle. The stimuli were presented centrally on a Macintosh SE computer screen and were viewed by participants from a distance of approximately 19 inches.

**Procedure**

Each trial was initiated by a key press from the experimenter. A trial began with a warning signal consisting of a tone and a square presented for 500 ms, followed by a blank screen for 500 ms. A single stimulus was then presented until the subject responded or until 4 s had elapsed.

Global-local stimuli were presented in a block of 64 trials. Each of the four global-local stimuli were presented on 16 of the 64 trials in this block. The block of stimuli was presented twice, once in

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**Fig. 1.** Example of (a) consistent and (b) inconsistent global-local stimuli.
a globally directed condition and once in a locally directed condition. The order of conditions was counterbalanced across subjects. Target stimuli in both conditions were the numbers “1” and “2.” In the globally directed condition, individuals were asked to focus on the “large part of the picture” (the global level). They were instructed to press a computer key marked ‘1’ with their left index finger if they observed a “1” at the global level, and to press another key marked ‘2’ with their right index finger if they observed a “2” at that level. In the locally directed condition, instructions were to focus on the “small part of the picture” (the local level) and to press the ‘1’ key with the left index finger if a “1” was observed at the local level or to press the ‘2’ key with the right index finger if a “2” was observed at that level. Participants’ index fingers were positioned over the designated response keys during each block of trials. The examiner did not start a trial until the participant’s fingers were appropriately positioned and he/she appeared ready to respond. The word “large” or “small” was displayed above the computer monitor as a reminder of the task requirements during each block of trials. Participants were asked to respond to the stimuli as accurately and quickly as possible.

Prior to administration of the global and local conditions, participants were given extensive instructions and 16 practice trials with feedback regarding their accuracy. Experimental trials were not administered until the experimenter was certain that the individual understood the task, as indicated by accurate responding on practice trials. Only results from the experimental trials were utilized in the data analyses. Accuracy and reaction time (RT) for correct responses were recorded by the computer.

RESULTS

Participants’ median RTs for correct responses were computed, and group means of these median RTs were examined in the following analyses. Median RTs, rather than mean RTs, were used to reduce the impact of outlier RTs on analyses.

Reaction Time Analyses for PD and ENC Groups

The means of PD and ENC groups’ median RTs were examined using a 2 (Group; PD vs. ENC) × 2 (hierarchical level; Global vs. Local) × 2 (stimulus consistency; consistent vs. inconsistent) repeated measures ANOVA, with subject group as a between-subject variable and hierarchical level and stimulus consistency as within-subjects variables. The ANOVA yielded a significant main effect of stimulus consistency, (F [1, 26] = 12.07, p = .002), with the expected finding that both subject groups responded more slowly to inconsistent than to consistent stimuli. No other main or interaction effects attained significance. Thus, patients with PD did not appear to differ significantly from controls in their RT performance. The effect of stimulus consistency was also examined by deriving RT difference scores for each subject, calculated as the difference between inconsistent and consistent stimulus RTs. A t test comparing these RT difference scores by group was not significant, t(26) = .34, p > .10, and yielded a small effect size, d = .13. Group means of median RTs for consistent and inconsistent stimuli are listed in Table 2, and group RT difference scores are presented in Figure 2.

<table>
<thead>
<tr>
<th></th>
<th>PD</th>
<th>ENC</th>
<th>HD</th>
<th>MNC</th>
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<tbody>
<tr>
<td>Consistent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (SD)</td>
<td>602.29 (204.34)</td>
<td>640.55 (176.81)</td>
<td>1165.17 (680.39)</td>
<td>485.01 (119.29)</td>
</tr>
<tr>
<td>Inconsistent</td>
<td>Median (SD)</td>
<td>650.66 (195.18)</td>
<td>680.23 (193.63)</td>
<td>1290.29 (674.39)</td>
</tr>
</tbody>
</table>

Note. PD = Parkinson’s disease; ENC = Elderly normal controls; HD = Huntington’s disease; MNC = Middle-aged normal controls.
Fig. 2. Mean reaction time difference scores (a) for Parkinson’s disease (PD) and elderly normal control (ENC) groups and (b) for Huntington’s disease (HD) and middle-aged normal control (MNC) groups. (Error bars indicate the standard error of the mean).
Reaction Time Analyses for HD and MNC Groups

Means of HD and MNC groups’ median RTs were analyzed with a 2 (Group; HD and MNC) × 2 (hierarchical level; Global vs. Local) × 2 (stimulus consistency; consistent vs. inconsistent) repeated measures ANOVA, with subject group as a between-subject variable and hierarchical level and stimulus consistency as within-subjects variables. A main effect of group was found, \( F[1, 25] = 14.51, p = .001 \), with the HD group responding significantly more slowly than age-matched controls. In addition, as with the older subject groups, there was a main effect of stimulus consistency, \( F[1, 25] = 24.52, p < .001 \); overall, all groups responded more slowly to inconsistent than consistent stimuli. Most importantly, a group by consistency interaction was found, \( F[1, 25] = 7.65, p = .011 \). Follow-up analyses indicated that the difference between consistent and inconsistent stimulus RTs was significantly greater for the HD group \( (p < .05; \text{see Table 2}) \). Thus, the HD group’s RTs increased disproportionately relative to those of controls when inconsistent global-local stimuli were presented. A \( t \) test comparing the HD and MNC groups’ RT difference scores was significant, \( t(14.74) = –2.72, p = .016 \), with subjects with HD obtaining significantly greater \( z \) scores than did subjects with PD (HD \( z \) score mean = 4.32, \( SD = 5.54 \); PD \( z \) score mean = .16, \( SD = 1.43 \)). Thus, relative to the PD group, the responses of the HD group were disproportionately slower with inconsistent global-local stimuli.

Correlations of RT with Level of Dementia, Illness Severity, and Overall RT

To address the issue of whether the HD group’s pattern of performance could be attributed to level of dementia, Pearson correlations between RT difference scores and DRS scores indicated that for the HD group, level of dementia and RT difference scores were not significantly associated \( (r = .35, p > .05) \); it was notable that the obtained correlation was positive, suggesting that in the HD group, those patients with larger RT difference scores were less impaired overall. Similarly, a nonsignificant, positive correlation was obtained for the PD group’s RT difference scores and DRS scores \( (r = .41, p > .05) \), again suggesting that patients with PD who had larger RT difference scores were somewhat less impaired overall. Thus, for both groups, more severe levels of dementia did not appear to be associated with disproportionate slowing of performance in response to inconsistent stimuli. It should be noted that when RTs for consistent and inconsistent stimuli were correlated separately with DRS scores, the obtained correlations were very low and nonsignificant for subjects with PD \( (r = –.11 \text{ for consistent stimuli and} .05 \text{ for inconsistent stimuli}) \), and were of greater magnitude and significant in the expected direction for subjects with HD \( (r = –.86 \text{ for consistent stimuli and} –.80 \text{ for inconsistent stimuli, both } p > .01) \). That is, greater cognitive impair-
ment in the HD group was associated with slower RTs when consistent and inconsistent stimulus RTs were examined independently.

An additional consideration was whether the HD group’s pattern of performance could be accounted for simply by their slower overall RTs. The correlation between the HD group’s RT difference scores and the overall means of their median RTs (averaged across consistent and inconsistent trials) was nonsignificant ($r = -0.05, p > .05$), as was the correlation between the PD group’s RT difference scores and overall mean RTs ($r = -0.12, p > .05$). Thus, overall speed of responding did not appear to be related to the magnitude of the RT difference scores for either patient group.

To examine the relationship between disease severity and susceptibility to interfering stimuli, Spearman correlations were obtained between RT difference scores and standardized disease severity measures for HD and PD. For the HD group, the correlation between RT difference scores and Shoulson and Fahn scale scores of functional severity was nonsignificant ($r_s = 0.14, p > .05$). The correlation between the PD group’s RT difference scores and Hoehn-Yahr scale scores of motor severity also was not significant ($r_s = -0.20, p > .05$). Therefore, focused attentional impairment appeared to be fairly independent of functional disease severity in HD and of motor severity in PD.

DISCUSSION

In the present study, we administered a global-local focused attention task to patients with Huntington’s disease and Parkinson’s disease. In this task, stimuli consisted of global-local forms that were either consistent (e.g., a large “1” made up of smaller “1s”), or inconsistent (e.g., a large “1” made up of smaller “2s”). Findings indicated that, overall, all subject groups responded more slowly to inconsistent than consistent stimuli, an expected result that has been found in normal subjects and suggests that the task used in this study did in fact place demands on focused attentional abilities. Individuals with PD performed similarly to elderly controls in their RTs to both consistent and inconsistent stimuli; that is, compared to the elderly control group, the patients with PD were not disproportionately slower in responding to inconsistent stimuli relative to consistent stimuli. In contrast, patients with HD had greater increases in their RTs to inconsistent relative to consistent stimuli, compared to middle-aged controls. Thus, regardless of group membership, participants experienced some degree of vulnerability to distraction from dissonant figures at the unattended level of global-local stimuli, but this vulnerability was more pronounced in individuals with HD.

This finding is consistent with past research examining focused attention in patients with HD. For example, individuals with HD have demonstrated deficits in suppressing saccades toward randomly flashing peripheral visual stimuli when instructed to maintain their attention on a central fixation point (Tsai et al., 1995). They have also shown difficulty in maintaining focus on one stimulus feature while inhibiting attention to other features (Bamford, Caine, Kido, Plassche, & Shoulson, 1989; Swerdlow et al., 1995), as revealed by a disproportionate slowing on the interference condition of the Stroop task. Taken together, these findings suggest problems with inhibitory attentional processes in individuals with HD.

This study’s finding that patients with PD have intact focused attention on a global-local task differs from past research. Several previous studies have suggested increased susceptibility to distraction by unattended features of stimuli in patients with PD (Brown & Marsden, 1991; Henik et al., 1993; Hietanen & Teräväinen, 1988; Sharpe, 1990, 1992). In addition, recent research by Maddox, Filoteo, Delis, and Salmon (1996) found that patients with PD were impaired on a perceptual decision task requiring them to attend to and classify one feature of a stimulus while ignoring another, but were unimpaired in their perceptual decisions when integrating the two stimulus features or making judgments of single features presented alone.

The impairments that individuals with PD have displayed in several of these studies may be explained in terms of task complexity. For
example, in studies by Brown and Marsden (1991) and Sharpe (1990), patients with PD were required to focus attention in the presence of distracting stimuli while performing a secondary task, such as generating random numbers; unfortunately, there are no directly comparable studies for patients with HD. Other discrepant findings, however, may relate to the duration of attentional focus required by the task. Investigations of attentional shifting in patients with PD have varied the interval between presentation of a cue and the onset of a target, and demonstrated normal performance at shorter cue-target intervals but deficient performance at longer cue-target intervals (Bennett, Waterman, Scarpa, & Castiello, 1995; Filoteo et al., in press; Wright et al., 1990). Such results suggest that mechanisms that inhibit movement away from a target may degrade over time, such that inhibitory deficits appear only when a task requires a longer period of attention before a response can be produced. Task duration may similarly influence focused attention. Indeed, in the Maddox (1996) et al. study, the PD group’s RTs were in the 1000 ms range for the condition in which they were deficient (PD group mean of median RTs = 1019 ms; unpublished data, Filoteo, 1997). In contrast, the current study’s RTs fell in the 600 ms range for the PD group. It is, therefore, possible that no increased distractibility was observed in this sample of patients with PD because they were able to respond before their inhibition degraded. Had the task required more processing time, they might have demonstrated difficulty inhibiting attention to dissonant global-local figures.

Interestingly, the HD group’s observed deficit in focused attention could not be attributed to overall reaction speed, nor did it seem to be due to level of dementia. The correlations between overall dementia as assessed by the DRS and difference scores between consistent and inconsistent stimulus RTs were not significant for either PD or HD groups, suggesting that the HD group’s deficit in focused attention is not directly related to the level of general cognitive impairment in these individuals. Unexpectedly, higher DRS scores were associated with greater interference effects in the patient groups. A similar relationship was not observed between DRS scores and RTs in general: correlations between DRS scores and RTs for either consistent or inconsistent stimuli were nonsignificant for subjects with PD, and were significant for subjects with HD, such that patients with HD who had lower DRS scores had longer RTs to either stimulus type. It may be useful to explore further the association between interference effects and level of dementia; however, the meaningfulness of this association is questionable as the obtained correlations were not significant. Certainly, these nonsignificant findings do not invalidate the use of our directed attention task as there is substantial research supporting its use as a measure of attention.

With regard to illness severity, RT difference scores were not significantly correlated with Hoehn-Yahr scale (1967) scores for patients with PD or with Shoulson and Fahn (1979) scale scores for patients with HD. These findings indicate that, for patients with PD, the ability to focus attention was not related to degree of motor dysfunction, and that, for patients with HD, focused attention was independent of level of functional disability. Thus, the focused attentional deficits displayed by patients with HD appear to be present even in earlier stages of cognitive decline and/or functional disability.

As this study did not examine the clinical validity of the global-local task, it is unclear how this measure of focused attention relates to clinical measures of attention or to other neuropsychological abilities. It will certainly be useful for future research to determine the relationship between traditional clinical neuropsychological tasks and experimental measures which more clearly delineate the spared and impaired components of attentional function.

Nonetheless, these results, viewed in concert with past research directly comparing these subject groups, suggest a double dissociation between focused and shifting attention on global-local tasks in patients with HD and PD. We had previously observed that individuals with PD evidenced an attentional deficit when they were required to shift their attention across the two levels of global-local stimuli to locate a target stimulus (Filoteo et al., 1994, 1995). When the
target remained at the same level across consecutive trials, patients with PD responded disproportionately slower than age-matched controls, and they responded disproportionately faster than controls when the target changed levels across consecutive trials, suggesting a deficit in maintaining attention to, or inhibiting movement of attention away from, the previously attended stimulus or stimulus feature. Individuals with HD, in contrast, performed similarly to controls and evidenced no abnormalities in attentional shifting. In the present study, which utilized global-local stimuli to examine focused rather than shifting attention, patients with HD manifested a deficit in focusing attention in the presence of distracting stimuli, whereas patients with PD exhibited no such impairment. These data contribute to the growing body of research with PD exhibited no such impairment. These manifestations of attention away from, the previously attended stimulus or stimulus feature. Individuals with HD, in contrast, performed similarly to controls and evidenced no abnormalities in attentional shifting. In the present study, which utilized global-local stimuli to examine focused rather than shifting attention, patients with HD manifested a deficit in focusing attention in the presence of distracting stimuli, whereas patients with PD exhibited no such impairment. These data contribute to the growing body of research with PD exhibited no such impairment. These

REFERENCES


