Psychopathy and the Allocation of Attentional Capacity in a Divided-Attention Situation

David S. Kocsis and Joseph P. Newman
University of Wisconsin—Madison

To investigate the hypothesis that psychopaths allocate most of their attentional capacity to stimuli and responses of immediate interest, we assessed psychopaths’ dual-task performance under two instructional sets. Using Hart’s (1980) checklist, we classified 72 white male prison inmates as psychopaths or nonpsychopaths. We predicted that psychopaths would divide attention adequately between a visual search and probe-reaction time task, but that when instructions defined the search as subjects’ primary task, psychopaths would overfocus on it and underperform nonpsychopaths at the cost of relatively poor secondary task performance. The results of our study challenge the utility of the overlapping hypothesis. Subject groups performed equally well on the search when they received instructional priority, but psychopaths made more search errors (p < .01) under divided-attention instructions. Psychopaths also responded more slowly than nonpsychopaths to auditory probes (p < .05) across conditions. The results suggest that psychopaths may incur relatively large capacity costs in attempting to shift their attentional resources between processing tasks.

Psychopaths’ proclivity for acting on what appear to be more whims or half-hearted desires (e.g., Cleckley, 1982) has prompted speculation that their impulsivity reflects an absence of cognitive controls to modulate the expression of such inclinations. For instance, Shapiro attributed psychopaths a cognitive style in which attention is easily “dominated by what is of immediate, concrete, personal relevance” (Shapiro, 1965, p. 167). As a result, he argued, psychopaths do not integrate their short-range goals with information about the needs of others or the likely long-term consequences of their actions. Empirical evidence appears consistent with an attentional explanation of psychopathic behavior. Newman (1980) and Newman, Widom, and Nathan (1985) varied the relative competition between the reward and punishment contingencies of a go/no-go discrimination task and found that psychopathic delinquents were differentially poor at learning positive avoidance when reward and punishment contingencies conflicted. They proposed that psychopaths’ responsiveness to one set of salient contingencies interferes with attending to competing contingencies. Jutai and Hare (1983) reported smaller N100 event-related potentials in psychopathic than in nonpsychopathic inmates following presentation of irrelevant 60-dB stimuli while subjects played a video game. They attributed psychopaths’ superior focusing to an ability “to allocate a relatively large proportion of their attentional resources to things of immediate interest” (p. 150). Though several authors have proposed that psychopaths attend to some environmental contingencies at the expense of attending to others, no studies to date appear to test the hypothesis that a different allocation of processing resources interferes with psychopaths’ responsiveness to important contingencies. Newman and his colleagues did not assess attention directly, whereas the information processing differences reported by Jutai and Hare occurred in a selective attention paradigm (i.e., subjects were given instructions to ignore tones). A direct test of this hypothesis requires a divided-attention paradigm, a situation in which subjects attempt to meet two or more competing processing demands.

The premise underlying dual-task methodology is that variances in subjects’ performance on each of two simultaneous processing tasks reflect the processing capacity available for each task. In particular, performing one task is said to interfere with performance on the other task in so far as the capacity demands of the two tasks exceed the supply of available capacity on a moment-to-moment basis (e.g., Kahneman, Beatty, & Pollick, 1977), and (2) cognitive resources mediate the processing required for completion of the tasks (cf. Navon & Gopher, 1979). Assuming that an attentional resource cannot be shared simultaneously by two tasks (e.g., Neave, 1967), dual-task performance requires maintenance of a joint allocation policy, in this study conducted toward partial fulfillment of the requirements for the Master of Science Degree at the University of Wisconsin—Madison. Preparation of this paper was supported in part by National Institute of Mental Health Fellowship MH 914 to the first author and Grants MH 37711 and MH 39221 to the second author.

We wish to thank Madonna Zast for invaluable assistance in completing the study, Arnold Bladnik, Pamela Waddell, and Beverly Mares and the Social Services staff at Oakhill Correctional Institution for their consistent cooperation and support of the project, Joan Chapman for statistical consultation, and Lyn Abramson, Bruce Anthony, Tim Baker, and Frances Graham for comments on a draft of the manuscript. Correspondence concerning this article should be addressed to David Kocsis, Department of Psychology, University of Wisconsin—Madison, 1202 West Johnson Street, Madison, Wisconsin 53706.

1 Recognizing that there are probably several distinct pools of processing resources, we restrict our use of the term capacity to the supply of attentional resources that is appropriately applied to (i.e., relevant for) particular information-processing tasks.
which resources are shifted from task to task in accord with priorities and changes in task demands (Kahne\nman, 1973). Indi\nvidual differences in allocation policies should produce differences in the frequency with which resources are\ndistributed to tasks and if psychophysics allocate a greater proportion of their capacity to one task, their performance on a concurrent task should reveal relatively greater interference.

However, individual differences in the magnitude of interfer\ence observed may reflect at least two of the factors: differences in the overall processing capacity invested in a situation, and differences in attention allotted to the superordinate task of "or\nganizing, coordinating, scheduling, and allocating resources" (Navon & Copher, 1979, p. 225) among the demands of two or more tasks. Relatively poorer performance across several task conditions suggests that less capacity has been applied to a situa\ntion. To investigate differences in the allocation of attentional capacity Navon and Copher advocated the use of dual-task situa\ntions differing only in task demands. Shifts in subjects' dis\tribution of on-task resources should result in performance trade-offs between two tasks with changes in their relative priority, wherein allocating attention to the management of a joint allocation policy should produce concurrence costs, dual-task performance impairments that appear to exceed the sum of the capacity demands of the tasks individually (Navon & Copher, 1979).

In the present study, task priority was manipulated instru\ntionally. Subjects in a focus-of-attention condition were told that their performance on one task was more important than the\nother; those in a divided attention condition were told that performance on both tasks was equally important. All sub\jects were expected to perform both tasks in the condi\ntion in which its priority was relatively higher. Given that psy\nchophysial perform as well as psychophysics in many situations (Scott, Archer, & Kilpatrick, 1982), we assumed that psycho\nphysist and nonpsychophysist have access to equal supplies of at\ntentional capacity and that they would perform equally well on both tasks in Condition D (divided attention). However, we pre\dicted that psychophysist would focus on Condition F (fu\ncused attention) and therefore outperform nonpsychophysist on the task emphasized at the cost of relatively inferior perform\ance on the other task.

Method

Subjects

Subjects were 72 white male inpatients at Oskilllur Con\cuctional Institution, a minimum-security state prison. Candidates for participation were\nwere selected from the institution roster; males were excluded and females described as \n50 or older, currently psychotic or taking psy\nchotropic medication or if test scores indicated borderline (or lower) intelligence or academic achievement below the fifth-grade level. The remaining subjects candidates were waiting to participate in a memory re\\ncurrence study designed for this research. Interview and selection pro\\ncedures are described in some detail by Koss\n, Nichols, and Newman (1986). Following interviews, we gave the interview and an ob\servatory-researcher portions of each participant's institution file. Each\ner then completed Hart's 22-item Psychopathy Checklist (Hart, 1984), made a global estimate of psychopathy based on Cleckley's, 1982, criteria for the disorder), and selected the diagnosis from the Di\nagnostic and Statistical Manual of Mental Disorders (DSM-III) of the American Psychiatric Association (1980) that best described the sub\ject's antecedent behavior (see p. 245).

Subjects were selected on the basis of their approved checklists scores. Checklist scores correlate tightly (.76-.85) with global ratings of psy\nchopathy (Schoenfeld, Schondorf, and Hare, 1983). Moreover, checklist raters are internally consistent (a of .82-.92) and reliable across scores (cf. 84 to .93; Schoenfeld et al., 1983; Koss et al., 1986). In the ab\\nse of formal cutoffs for using the instrument to select psychopa\nths, cutoffs were based on the informal recommendations of Hart (personal communication, March, 1983). Subjects whose averaged ratings equaled .31 or higher were classified as psychopaths, and those with mean ratings of 0.0 or lower were classified as nonpsychopathic con\\tsolls.

Both black and white inmates participated in this research. However, questions have been raised about the appropriateness of using the Hare checklists for selecting black psychopaths (Koss et al., 1986), and therefore this article reports data for white subjects only. Mean check\nlist scores for the two subject groups were 34.94 (psychopaths) and 13.69 (nonpsychopaths). These means are similar to those reported by Hart and Hare (1983), who selected subjects on the basis of global ratings of psychopathy. The two groups were comparable in mean age (23.9 and 25.4 years for psychopaths and controls, respectively) and in mean IQ (103.8 and 98.2 for psychopaths and controls) as measured by the Shipley Institute of Living Scale (Shipley, 1940).

Apparatus and Tasks

The information-processing tasks were a visual search and a go/no go probe-reaction-time tasks (probe-RT) tasks. These \tasks were selected to ensure that dual-task performance demanded effortful processing and reflected differences in the distribution of attentional resources, and to ensure that performance differences could be attributed to processing inter\\nference, rather than competition at the level of sensory masking or overt response competition. Presentation and pacing of both tasks were con\\\ned by an Apple II Plus computer.

Visual search. The visual search was modeled after Schneider and Shiffrin's (1977) multiple-frame visual search with variable mapping. It required subjects to monitor a visual display for the occurrence of elements from a specified target set and maintain a running count of the number of targets present during the trial. The target set varied from trial to trial, the same letters could serve as targets in one trial and as nontargets (or distractors) in the next. Under these condi\\ntions, accurate tracking of the number of targets presented appears to require the use of limited-capacity attentional resources (Schneider and Shiffrin, 1977).

Each trial began with presentation of the current target set for \n3, followed by eight test frames each of 1800-ms duration. All target set\nand frame elements were uppercase consonants. Target sets consisti\\ning of three different letters per trial were displayed in the center of a Sandy 13-4c (33-cm) monitor screen. Test frames consisted of 8 test displays; each test display contained four letters and one of the four correct elements of the monitor screen. Each target and test frame element subtended approximately 10.8 min of visual angle. The number of targets actually presented per trial varied randomly from one to four, and at the end of every trial, each subject present a button to indicate the total number of targets he had seen. The response panel was a rectangular black, plastic \box (15.5 × 9.5 × 5.5 cm) with four push buttons numbered from one to four.

Each subject received the same fixed sequence of target sets and test frames. This sequence of stimuli was randomly determined within the following constraints; no more than three target elements we
test frame, no test frame element is the same corner of the x-ray on successive frames, no two identical target sets, and no letter is a target element in three consecutive trials.

The task consisted of 12 trials preceded by practice trials. The par- ticipation of trials performed correctly was recorded for each subject. In addition, the absolute difference between the number of target elements actually presented per trial and each subject's report of that number was summed across trials to form a weighted sum of visual search er- rates. This weighted sum of errors took into account not only the num- ber of trials on which the subject erred but also the size of dispersion between the actual and reported number of targets.

Goto go probe RT trial. This task required subjects to respond as quickly as possible to low-passed but not high-passed targets which were broadcast through headphones they wore. Several authors have reported that both auditory displays (Korsmee, 1982) and probe-RT (Latham and Hunt, 1982) secondary tasks impair performance on a concurrent primary task, such tasks therefore appear to require effortful processing (R. (Hudson and Zuck, 1979).

Tones were generated by the Apple II Plus computer and low-passed through two 727-B headphones at an intensity of approximately 62 dB (low) and 72 dB (high) as measured by a General Radio 1551-A sound level meter (LM-80). Headphone couplings, P, and d, were selected to make the tones of brief duration and ensure discrimina- tion. A Eutectics 45A oscilloscope was used to estimate the pitches of the low and high tones at 441 Hz and 476 Hz, respectively, and duration at 127 ms. At the rate, determined, fixed sequence of 18 low tones and 20 high tones was distributed through the 12 trials of the visual search, with no two tones occurring within a 3,13 interval. Within each test frame, tones occurred equidistantly at three locations from the onset of the frame: 0.6 ms, 450 ms, and 900 ms.

Each subject sat with the target's fingers of his dominant hand on the left button of the response box. Responses to low-passed tones within 0.9 ms were recorded and median reaction times com- puted. Responses slower than 50 ms were designated anticipatory re- sponses and eliminated from analysis; when responses had not oc- curred within 900 ms, values of 900 were entered. These were included in the initial computation of medians for their relevance to attentional interferences and, to examine more specifically the reasons for any performance differences, data bearing on the speed versus accuracy of probe-RT performance were also analyzed separately. Reaction times longer than 900 ms were designated misses, and the percentage of probes missed was computed for each subject. Speed was estimated by compari- son of median reaction times i.e., faster than 900 ms and less than twice as fast.

Concurrent load. Assessing that attention is allocated in accord with current task demands (Kalmus, 1973), all subjects were expected to alter additional capacity to such task as he demands in that task en- creased. Consequently, performance on each task was predicted to vary inversely with the concurrent processing requirements or load imposed by the other task.

Baseline measures. The amount of processing capacity each subject applied to the dual-task situation was estimated from his performance on each of the two tasks attempted by trial. The visual search baseline consisted of practice trials and 12 test trials equated to the dual-task visual search. The probe-RT baseline consisted of six probes similar to their dual-task counterparts but with two differences; because they were not concurrent with the visual search task, subjects were not indi- cated by the warning Be Ready; and the eight test frames within each trial passed unpresented.

Procedures

During their first day of participation, subjects filled out the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1973) before complet- ing the structured interview already described. Over the next 6 weeks, subjects were recontacted and invited to participate in behavioral test- ing. In the first such session, each subject worked for 10 to 12 min at a learning task prior to administration of the information-processing tasks just described. The first task closely resembled the passive avoid- ance task used by Newman and Fisk (1985) and is described elsewhere (Newman & Keenan, 1984). Subjects completed the information-pro- cessing tasks in the following order: (a) the visual search baseline, (b) the probe-RT (baseline), and (c) one of the two concurrent task con- ditions. The administration of the information-processing tasks took about 21 min. Afterwards, each man completed the Shipley Institute of Living Scale, a self-administered IQ test (Shay, 1940).

In the focused attention condition (Condition F), subjects were told that the visual search was their primary task. They were instructed to respond as quickly as possible to low-passed but not to "let the tones distract them from their [primary] task." In the divided attention condition (Condition D), instructions emphasized that performance on both tasks was usually important; subjects were explicitly cautioned, "It is not easy to get absorbed in the visual search at the expense of your performance in responding to the tones. Concentrate on both of the tasks equally." Subjects also added a fixed sequence of false perfor- mance feedback presented at the end of each task practice trials and every four trials thereafter. To inhibit the instructional manipulation, subjects in Condition D received "information" about their perfor- mance on both tasks, whereas those in Condition F received "informa- tion" regarding only their search performance. False feedback was fail- ure to approximate subjects' mean performance.

Over the course of the study, one woman and two men administered the information-processing tasks. For purposes of analysis, data col- lected by male experimenters were coded, and sex of experimenter was entered as a between-subjects factor. Overall, 36 subjects particip- ated in each condition: the female experimenter administered each condition to 6 psychopaths and 6 neurotics, and the male experi- menter administered each condition to 10 psychopaths and 10 neuropsy- chotics.

Results

Because the two measures of visual search performance yielded similar findings, only the analysis of (weighted) search errors are reported here.

Baseline Measures

Subjects' performance on each of the baseline tasks was ana- lyzed by means of a 2 X 2 (Group X Condition) analysis of variance (ANOVA). As expected, tri- bable baseline condition differentiated between psychopaths and neuro- psychotics. Means for psychopathic and neuropsychotic subjects were 0.53 and 0.51 visual search errors (weighted) per trial, respectively, and 249.3 and 237.6 ms for median probe- RTs. Analysis of the probe-RT baseline data revealed a signifi- cant effect for condition, F (1, 64) = 5.41, p < 0.05, with median probe-RTs. Analysis of the probe-RT baseline data revealed a signifi- cant effect for condition, F (1, 64) = 5.41, p < 0.05, with median probe-RTs.
the baseline measure most similar to the dual-task dependent variable of interest. The weighted sum of search baseline errors served as the covariate for the weighted sum of dual-task search errors; baseline median probe-RT, as the covariate for dual-task probe-RT ANCOVA. Preliminary analyses indicated no violations of the ANCOVA assumption of parallel regression slopes between any covariate and the appropriate dependent variable across group, condition, and sex of experimenters.

The analyses reported here provide some support for predictions. They also reveal several performance differences associated with psychopathology that do not appear consistent with predictions.

Visual search performance. Dual-task search errors were submitted to a 2 x 2 x 2 x 3 (Group x Condition x Sex of Experimenter x Probe-RT Load) mixed-model ANCOVA. Three levels of concurrent probe-RT load were distinguished on the basis of the maximum depths of processing of auditory information required during presentation of search targets; trials in which no auditory information was presented constituted the control condition with search targets (three trials); trials in which identification of an auditory distractor required pitch discrimination (three trials); and trials requiring responses to probes (six trials).

Analysis of the weighted sum of search error per trial yielded several significant differences. Main effects were obtained for group, F(1, 63) = 4.59, p < .05, for sex of experimenter, F(1, 63) = 7.21, p < .01, and for probe-RT load, F(2, 128) = 4.02, p < .025, and the covariate was significant, F(1, 63) = 86.0, p < .01. The condition effect approached significance, F(1, 63) = 3.40, p < .07. As predicted, the Group x Condition interaction was significant, F(1, 63) = 6.70, p < .025. A significant interaction of Group x Sex of Experimenter was also obtained, F(1, 63) = 5.26, p < .05. There were no three-way interactions of interactions between probe-RT load and any other variables.

The group effect reflects that psychopathics performed on average worse than nonpsychopathics. However, the two interactions involving group indicate that this performance difference depends upon both the experimental condition and the sex of the experimenter. Duncan's multiple-range test was employed in order to evaluate the Group x Sex of Experimenter effect, and for all post hoc comparisons of treatment means to be discussed, across conditions, psychopathics tended by a female experimenter performed significantly worse than all other combinations of subject group and sex of experimenter, which were not significantly different from each other.

To evaluate the hypotheses of principal interest, the Group x Condition interaction, planned comparisons were conducted on covariate adjusted means. These data are depicted in Figure 1. Collapsing across sex of experimenter, psychopathics made fewer errors than nonpsychopathics in Condition F (0.64 vs. 0.68 errors per trial for psychopathics and controls), but this difference was not significant, F(1, 63) = 1. Contrary to predictions, psychopathics made significantly more errors per trial than nonpsychopathics (0.77 vs. 0.56) in Condition D, F(1, 63) = 10.59, p < .01.

The main effect for load reflects superior visual search performance for trials in which no targets were presented concurrently with targets (0.51 errors per trial) than for trials in which other distractors (0.67) or probes (0.81) competed for attention. The differences between all three levels of probe-RT load were statistically reliable (all p < .05).

Because sex of experimenter and condition represent independent sources of variance, an interaction between one of these factors and psychopathology does not affect the occurrence of an interaction between psychopathology and the other. At the same time, the effect of each factor on the performance of psychopathics exerts a systemic effect on the shape of the other group effects. More concretely, psychopathics' inferior performance when tested by a female experimenter appears to work against the possibility of demonstrating superior visual search performance in psychopathics.

Planned comparisons were therefore repeated for the 40 subjects divided by sex of experimenters, that is, a subset of psychopathic and control subjects whose overall performance appeared comparable. Both comparisons resulted in trends toward significant results: Psychopathics tended to make fewer errors per trial than nonpsychopathics (0.53 vs. 0.70) in Condition F, F(1, 63) = 3.71, p < .06, and more errors than nonpsychopathics (0.72 vs. 0.57) in Condition D, F(1, 63) = 2.98, p < .09 (see Figure 7).

Probe-reactive time performance. Probe-RT medians were evaluated through a 2 x 2 x 2 x 3 (Group x Condition x Sex of Experimenter x Visual Search Load x Position of Probe) mixed-model ANCOVA. The two levels of visual search load specify whether the visual display contained any targets when the auditory probe occurred (6 probes) or whether all test frame elements were distractors (12 probes). The three probe positions corresponded to the 0.450, or 0.900 ms that elapsed between onset of search test frame and presentation of probe (6 probes in each position).

This analysis yielded significant effects for the covariate, F(1, 63) = 10.17, p < .005, and for group, F(1, 63) = 5.26, p < .05. Neither the condition effect, F(1, 63) = 2.25, p < .14, nor the Group x Condition interaction (F < 1) was statistically significant; however, there was a trend toward a Group x Condition x Sex of Experimenter interaction, F(1, 63) = 2.90, p < .10. The effect of concurrent visual search load, F(1, 63) = 8.38, p < .01, and the Visual Search Load x Position of Probe interaction, F(1, 128) = 4.21, p < .025, were also significant. Pairwise comparisons suggest that RTs were significantly slower to probes presented concurrently with search targets only when probes were presented 900 ms into the test frame. Unfortunately, search load and probe position had not been counterbalanced, and the two turned out to be substantially confounded. Consequently, some of the median RTs in this analysis were more reliable than others, and interpretation of the load and probe position effects may therefore remain tentative.

Despite a main effect for load reflecting that psychopathics responded slower on average, than nonpsychopathics, planned comparisons failed to support hypotheses neither the difference between psychopathics and nonpsychopathics at probe-RTs in

---

1 Three separate hierarchical regressions of each covariate on dual-task performance examined the proportion of variance in dual-task scores accounted for by the covariate, by group, condition, or sex of experimenters, and by the interaction of each between-subject factor with the covariate.
the assumption that the joint demands of the dual-task situation were sufficient to interfere with subjects' performance on each task. Moreover, the fact that increases in the attentional demands of one task impaired performance on the other suggests that the processing required for performing the two tasks was mediated in part by common resources.

Because the effects of experimental condition failed to achieve statistical significance, the strength of the instructional manipulation used is open to question. Therefore, it might be argued that psychopaths' slower probe-RTs across conditions reflect their adoption of a similar mode of the visual search regardless of instructions. However, such an explanation cannot account for the significant Group × Condition interaction obtained for search performance. In particular, psychopaths' differentially poor search performance under divided-attention instructions argues against such an extrapolation.

Assuming, then, that group differences in the amount of attention allocated to the probe-RT task do not account for the results obtained, these differences in the extent of interference may be attributed either to differences in the overall capacity invested in the task situation or to differences in the proportion of that capacity allocated to the superordinate task of managing a joint allocation policy.

First, we consider the possibility of similar differences in the net capacity psychopath and controls applied to the dual-task situation. This perspective follows from the hypothesis that psychopaths are psychologically undersocialized (see, Chen & Kilman, 1975) and Fisher and Zach's (1979) proposal that underutilization of attentional capacity. A relatively generalized performance deficit is also predicted by the similar hypothesis that psychopaths are undermotivated to perform well in the absence of concrete tangible rewards. However, the absence of group differences on baseline tasks argues against such an interpretation. The substantial variance in dual-task performance accounted for by baseline scores suggests that these tasks were sensitive to individual differences in subjects' capacities, and individual differences manifest by baseline scores were extracted prior to considering group effects.

By contrast, individual differences in the capacity costs of managing a divided joint allocation policy appear to provide a plausible account of the pattern of group differences observed. Psychopaths performed the visual search as well as nonpsychopaths in Condition F but significantly poorer than nonpsychopaths in Condition D, suggesting that they had less capacity available for the search in this condition. If this capacity had been allocated to the probe-RT task, it could have been expected to lead to improved probe-RT performance in Condition D, yet psychopaths' probe-RT deficit was comparable in the two conditions. This absence of a trade-off in psychopaths' relative performance on the two tasks implicates congruence costs in the explanation of their data. Given that the most obvious difference between Conditions F and D is the greater emphasis on switching attention between tasks in Condition D, psychopaths' apparently greater congruence costs in this condition may reflect greater difficulty in attempting to switch attention from one set of processing demands to another.

Several aspects of the current study suggest the need for further investigation. First, it could be argued that our failure to obtain clearer evidence of psychopathic overcongruence is attributable to specific parameters of the tasks we chose (e.g., the frequent presentation of auditory stimuli) or the weakness of the focusing manipulation employed. It is of some importance to discover whether psychopaths will display secondary task inferiority and/or primary task superiority in different divided-attention situations and how more powerful focusing manipulations. Second, the divided-attention deficit observed was unexpected and requires replication. Third, this study was not designed to assess individual differences in the magnitude of congruence costs. Replicating these results with an increased number of dual-task conditions would permit determination of performance operating characteristics. Nevertheless, the various performance deficits displayed by psychopaths indicate impairment in their information processing that may have important implications for their apparent mismatching to environmental contingencies as well as their reputed tendency to overfocus on immediate goals.

Although probe-RT data did not yield evidence of split-plant comparisons for these subjects tested in a male experimenter, the cm means for this value of subjects in Condition F suggest a group difference in median probe-RT (559.9 vs. 525.6 ms for psychopaths and controls). The apparent superiority of these psychopaths' search performance, without a corresponding deficit in probe-RT, also appears to contradict any generalized deficit hypothesis.

References


Received July 26, 1985
Revision received February 28, 1986