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ATTENTIONAL PROCESSES IN MILDLY DEPRESSED AND NON-DEPRESSED ABLE ELDERLY

By

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ABSTRACT

ATTENTIONAL PROCESSES IN MILDLY DEPRESSED
AND NON-DEPRESSED ABLE ELDERLY

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This investigation examined how aging and depression impact attentional performance. It was hypothesized that age and depression would have differential effects on attentional performance, depending on task complexity. A model of cognitive aging addressed attentional resources, task complexity, and efficiency of inhibitory processes. The interaction of age and depression was predicted to be more deleterious on performance of complex attentional tasks, than either age or depression alone. The sample was composed of 155 able elderly volunteers of age 55 to 93. Although both increased age and depression were associated with decreased performance on complex attentional tasks, this interaction did not explain additional variance beyond the main effects. Results revealed mood-related depressive symptoms impact performance of overlearned functions in the younger elderly, while neurovegetative depressive symptoms were related to poorer psychomotor performance of the older elderly. Implications of the findings were discussed related to attentional processes and depression in the aging population.

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INTRODUCTION

It is widely accepted that many cognitive functions, most notably memory, often decline in the later decades of adulthood (Poon, 1985). Yet, the changes in memory associated with normal aging are not easily delineated nor fully understood. Investigation of the role of attentional processes has been a worthwhile endeavor, given its function in the processing mechanisms of acquisition, encoding, and retrieval. The research literature suggests that acquisition and retrieval of new information commonly declines with age, whereas recall of remote information generally remains more stable (LaRue, 1992). However, description of the mechanisms underlying age-related changes in memory processes continues to be rather vague.

Another issue which tends to confound understanding of the role of memory decline with age is the impact of depression upon cognitive abilities. One problem is separating depressed dementia patients from psychiatrically depressed patients. Depressive symptoms are often the first indicators of a problem in those experiencing the initial subjective symptoms of dementia. Similarly, patients who are experiencing moderate to severe depression may display a pattern of behavior appearing so much like dementia that this phenomenon has been referred to as "pseudodementia" (Lezak, 1983). Both disorders are likely to manifest declines in immediate memory, attention, concentration, mental tracking, psychomotor retardation, and disorientation during testing (Wells, 1979). More relevant is the finding by Schaie (1976) that deficits in attention and motivation are the most important

variables influencing the performance of depressed patients. Thus, it appears that investigations of the role of attention in memory decline, differentiating between decrements in memory performance as a function of either increased age or clinical depression, or both combined, may be fruitful.

Aging: Impact on Attention

There has been much investigation aimed at elucidating the mechanisms responsible for memory failure with advancing age. Much of the previous research tended to restrict age-related memory decline to isolated components or stages of memory processing, such as encoding, storage, or retrieval. Several theorists have argued for more holistic explorations of memory changes associated with aging. The focus, however, continues to be on investigating components of processing, although these operations are no longer understood as separate and independent segments of memory but rather, as related, interdependent operations.

Specific definitions of attention vary across the literature. Lezak (1983) defined attention as the capacity for selective perception, and concentration as an effortful, usually intentional, and enhanced sense of attention in which irrelevant stimuli are selectively excluded from conscious awareness through inhibitory processes. She suggested that the concept of attention involves three components: a readiness to respond (becoming alert to some event), selectivity (focusing on a target), and a limited processing capacity. Plude and Hoyer (1986) viewed attention as a limited resource capacity which underlies cognitive

processing. Thus, different aspects of attentional processes are emphasized by different investigators.

Review of the literature suggests that there does not appear to be a cohesive understanding of the precise definition and role of attention in memory impairment. Initially, there is confusion about the definition of attention and the manner with which to assess the role of discrete attentional components (Salthouse, 1992). Although it is generally agreed that attentional processes are integral for optimal cognitive performance, the precise association between mechanisms of attention and memory is unclear (Lezak, 1983). This vagueness appears to have its origins in confusing or undefined usage of terminology for mechanisms of attentional processes. Unclear explanation and usage of terminology has allowed for variability in interpretations and conclusions in the investigation of attention associated with age-associated memory declines (Lezak, 1983; Salthouse, 1992).

Controversy in the literature seems to have emerged because most hypotheses concerning the relationship of attentional processes and memory have been difficult to substantiate empirically. The bulk of the research presents equivocal findings. Thus, most models of memory decline are based on a select group of findings collected to provide a foundation for one or more predictions. The model to be presented is acknowledged to be selective, for attempting to include the bulk of the relevant research would require contradicting elements.

Theories of Processes Associated with Memory Decline in Aging

Reduced Attentional Resources: Taxing by Complexity

The processing deficiency hypothesis suggests that, in regard to cognitive aging, older individuals present a globally diminished capacity to encode information efficiently (Eysenck, 1974). Craik & McDowd (1987) issued that older individuals have a diminished supply of processing resources and attentional capacities, and that more complex memory processing enlists more cognitive effort and attentional resources than are accessible. Performance on any cognitive task that taxes the available resources will be unfavorably affected. This model predicts the most significant decline on tasks dictating the greatest cognitive effort with minimal impact on less demanding processes. These authors asserted that this conceptualization may explain many of the cognitive changes associated with aging, and is not specific to memory dysfunction. Craik & McDowd (1987) suggest that memory decline associated with increased age may be one of a host of symptoms implying a more pervasive decline in processing resources.

The production deficiency hypothesis suggests that older individuals are less likely to engage in deep semantic processing strategies that will allow for the most efficient processing of new information (Burke & Light, 1981; Poon, 1980). This hypothesis suggests that older adults will employ such strategies less frequently than younger adults, or to use different, less effortful approaches. Hasher and Zacks (1979; 1989) proposed that older individuals are less likely than younger adults to employ appropriate self-initiated encoding or retrieval strategies because the aging process reduces attentional capacity, a capacity burdened by the use of strategies. Similarly, the depth-of-processing model states that deeper

and more elaborate encoding facilitates retention of material that is to be remembered, and suggests that if initial coding processes are controlled by appropriate orienting conditions, age group differences in recall and recognition performance will deteriorate (Poon, 1980).

Plude and Hoyer (1985) proposed the spatial localization hypothesis, stating that age decrements in selective attention are due to a decline in the ability to locate task-relevant information in the visual field. They offered that the operation of the selective attention mechanism is more demanding for the already limited resources of older adults. They stated that the resources available for attending are inversely related to the amount of resources demanded by the selective attention mechanism. Thus, older adults are slowed significantly when task-relevant information is not easily located.

Salthouse, Rogan, & Prill (1984) employed tasks more complex than those used in the previous work, and discovered that older adults had greater divided-attention costs when task complexity was increased. They stated that either the amount of resources available or the efficiency with which they are allocated to various processing stages seemed to decrease with increasing age. Additionally, they suggested that age-associated declines were not due to allocation of attention but, that the deficit lay in dealing with the increased complexity of the total situation. Similar decrements were reported in the literature (Baron & Mattila, 1989; Madden, 1989). Thus, with the more complex tasks, age differences in performance were evident. These results conflict with other findings of no age-related difference in vulnerability to distraction, even in the face of greater task load or complexity (Baddeley, Logie, Bressi, Dell, Salla, and Spinnler 1986; Wickens, Braune, and Stokes, 1987; Gick, Craik & Morris, 1988; Morris, Craik, & Gick, 1990).

Salthouse, Mitchell, Skovronek, & Babcock (1989) investigated the effects of aging and working memory on reasoning and spatial abilities spatial, and presented two valuable conclusions. First, older adults exhibited greater deficits in cognitive performance than did younger adults as task complexity increased, which was attributable to substantial demand placed on already limited processing resources. Second, the size of these complexity-associated declines were highly correlated across different tasks. Thus, if older adults have reduced supplies of integral processing resources than do younger adults, one would predict that older adults would suffer larger performance deficits as the demands on their more limited resources increase.

In more recent work, Salthouse (1992) continued to expand on investigation of deficits in performance of the elderly on tasks that are complex in nature and demanding of already reduced resources. First, there is support for the idea that the age-complexity effect originates because of greater involvement of the same processes required in simpler versions of a task. Secondly, as tasks become more complex, greater demands are placed on a limited processing resource, such as working memory that declines with increasing age. The older adult is less able to deal with greater demands for concurrent storage and processing. Generally, one factor contributing to the age-complexity effect is greater demands on a working-memory resource that is diminished with age. The general implication from this study is that the primary factor contributing to the age-complexity phenomenon is greater demands on a working-memory resource that diminishes with age.

Effortful vs. Automatic Processing:

Hasher and Zacks (1979) noted that information-processing operations often vary in their attentional requirements. Some operations (automatic) exhaust little of the person's limited capacity for attention. Automatic processes, usually occurring without intention, generally do not interfere with other ongoing cognitive operations. Other operations (effortful) require much more attentional capacity, usually are initiated by intention, and may interfere with simultaneous cognitive activity also requiring capacity. They issued that only those operations that are effortful (capacity demanding) are impaired in old age, while those that are automatic (demand little or no attentional capacity) are spared. For example, depression and old age, variables thought to deplete attentional capacity, lead to decrements in performance on effort-requiring tasks.

Macht & Buschke's (1983) finding that recall task took longer for older adults indicated that they found free recall more demanding, or cognitively effortful. Similarly, Craik & McDowd (1987) also demonstrated that recall (effortful) requires more processing resources than recognition (less effortful), which is apparent in their finding greater absolute costs for the old associated with cued recall than with recognition. Evidence supporting the notion that automatic processes are relatively preserved with increasing age has come from work by Light & Singh (1987) who found no age differences in performance on an implicit memory task that theoretically requires little or no conscious-effort processing. McDowd and Craik (1988), examining the effects of task complexity on age differences, offered that an age-related decrements in divided attention appear consistently in all but the simplest of tasks.

Burke and Light (1981) suggested an impairment in the use of contextual information and semantic processing, both intentional and nonintentional, that is associated with age-associated memory decrements. A number of investigators have suggested that older adults tend not to process material in a semantically elaborate manner, and, if asked to do so, their recall and recognition may improve (Macht & Buschke, 1983; Craik & McDowd, 1987). There does exist conflicting evidence with the processing deficiency hypothesis (Light & Anderson, 1985; Cohen, 1988). These and other researchers suggest that encoding or retrieval conditions that serve the young serve the old in approximately the same way (Arbuckle, Vanderleck, Harsany, Lapidus, 1990; Bringham & Pressley, 1988; Puglisi & Park, 1987).

Inhibition:

The filtering function of attention is necessary for behavior to be efficiently goal-directed. An individual must filter out irrelevant information available in the environment to select or focus on information that is useful, and that information needed will be encoded and available for retrieval.

Hasher & Zacks (1979) and Hasher, Stoltzfus, Zacks & Rympa (1991) stated that older adults may not simply have reduced working-memory capacity, but rather, reduced efficiency of inhibitory processes. Hasher et al. (1991) found that older adults show reduced ability to efficiently use inhibitory processes that permit selective attention. This supports earlier research that found older individuals more likely to be distracted by both external stimuli and internal thoughts than are younger individuals (Layton, 1975; Madden, 1983;

Plude and Hoyer, 1985). Thus, as found by Gerard, Zacks, Hasher, and Radvansky et al. (1992), older adults may be more susceptible to competition effects between goal-directed and interfering stimuli, and between retrieval of desired and undesired information. Hasher et al. (1991) offered the explanation that mechanisms involved in increased distractibility for older individuals may result from a reduction in the effectiveness of inhibitory processes that should, under normal conditions, encourage selective attention. This inhibition is necessary to ignore irrelevant stimuli and to attend to that which is relevant.

Similarly, Rabbitt (1965) earlier demonstrated that older adults were more slowed on a task involving target detection by the presence of irrelevant information, and became increasingly slower as the number of distracting items increased. Thus, they showed more difficulty ignoring irrelevant stimuli than do younger adults. Farkas & Hoyer (1980), conducting filtering-search distinction tasks, found that elderly adults were significantly slowed by the presence of 'contrasting and irrelevant-to-target' and 'similar to but irrelevant-to-target' information. They suggested that irrelevant information may have different age-associated consequences depending on the nature of the attention demands of the task. On the other hand, Plude & Doussard-Roosevelt (1989), found no special decrement with increasing number of distractors for older adults. Hence, it is not yet clear how general a problem older adults have with respect to inhibitory processes.

Hasher and Zacks (1988) proposed a model that views inhibition as a central mechanism determining the components of working memory, such that it may then influence diverse cognitive operations. Since older individuals show decrements in inhibition, an enriched memory is permitted because fewer distractions are excluded from encoding.

These unsuppressed irrelevant stimuli will be processed, and can be integrated with a more efficient suppression system. Hence, when attempting to retrieve information, inefficient inhibition will prevent the suppression of instigation of irrelevant retrieval pathways. The authors suggested that decrements in inhibitory processing may be at fault in the increased distractibility and poor recall seen with older adults.

In summary, a picture of cognitive aging develops, showing that older adults may experience a global reduction in attentional resources that in turn reduces the efficiency of their cognitive operations. Any demand on such a limited supply of resources, especially that which is effortful, would increase impairment. Additionally, there appears to be reduced efficiency of inhibitory processes. It follows that older individuals may present diminished attentional resources, difficulty handling effortful processing, and reduced ability to suppress irrelevant and distracting stimuli. (Craik & McDowd, 1987; Hasher et al, 1979, 1989, 1991; Salthouse, 1984, 1989, 1992).

In general, the findings with respect to attentional capacity and mechanisms of processing is at best mixed. Most importantly, attempts to evaluate the attentional capacity hypothesis have also been hampered by the lack of clarity as to the nature of the concepts of attention or effort, making it difficult to develop individual-difference measures of this alleged processing resource (Salthouse, 1988; 1992). The precise manner in which attention might affect the operation of mechanisms responsible for storage and retrieval of information has not yet been specified, making resolution of conflicting findings difficult. Decrements in attentional capacity may be inherent in the aging process itself, thereby considered part of

"normal aging". Thus, the implications for its further study are directly related to the construct of age-associated memory 'decline', as opposed to 'impairment'.

Depression: Impact on Attention and Cognition

An additional complexity is the impact of depression upon cognitive ability. It is well known that depressed individuals often have difficulties in attending, focusing, and concentrating on attentional tasks (Lezak, 1983; Beck, 1964; 1979). There is an apparent preoccupation with material other than what the person desires to concentrate on. It has been stated that the automaticity and rumination involved with depressive thinking may have reached those levels by virtue of a repetitive or habitual process (Bargh & Tota, 1988), or by internal processes that drive one toward that which is opposite from the state intended (Wegner, 1994). It remains unclear exactly what the precise mechanisms are that are involved in the etiology and course of depression.

One of the diagnostic problems is differentiating depressed demented individuals from nondemented depressed patients. Depressive symptoms are often the first indicators of a problem in persons who are experiencing the initial subjective symptoms of dementia. Similarly, depressed persons may present a pattern of impaired behavior appearing much like dementia ("pseudodementia") (Lezak, 1983). Both disorders may present declines in immediate memory, attention, concentration, mental tracking, psychomotor retardation, and disorientation during testing (Wells, 1979). Deficits in attention and motivation appear to be the key variables influencing the impaired performance of depressed persons (Schaie, 1976). Thus, to allow for a more precise investigation of the role of attention in memory decline

associated with increasing age, it is essential to elucidate the memory decrements associated with aging and/or depression.

Distinguishing between functionally related (i.e., depression) cognitive decline and symptoms presented by persons with dementing disorders is difficult with older adults. Distinguishing between dementing disorders and functional disorders has been highlighted in the clinical research literature as being most imperative. Prompt diagnosis and treatment of depression in older adults can prevent unnecessary suffering and neglect as a result of being diagnosed with a progressive dementing disorder (Lezak, 1983). Kaszniak (1987) addressed complicating factors when distinguishing between dementia and depression. First, cognitive changes in older adults blur the distinction between relatively normal aging and initial signs of dementia. Secondly, cognitive deficit often coincides with depression and can be severe enough to confuse further distinction. Thirdly, many individuals with progressive neurological disorders present symptoms that overlap with depression. Lastly, depression and dementia can co-exist.

In a review of the pertinent literature, Lamberty & Bieliauskas (1993) reported about 12-15% of older adults have depressive symptoms, although this figure varies with the method of assessment. The rate appears markedly higher (30%) in institutionalized older adults, than for "normal" community dwellers (Parmalee, Katz, & Lawton, 1989). The distinctions in these rates within various sub-populations are important because they are more likely to be representative of those that are evaluated for cognitive dysfunction (Lamberty & Bieliauskas, 1993). Thus, the need to target those with mild symptoms or

changes associated with aging is apparent, in that they are unlikely to seek help when the initial signs of decline or distress occur.

Cognitive Performance with Depression

The impact of depression and aging on cognitive functioning has most commonly been investigated by examining memory (Lamberty & Bieliauskas, 1993). Many studies have investigated cognitive performance by comparing normal, depressed and demented individuals on similar tasks (Geffen, 1993; La Rue, 1989; LaRue, D'Elia, Clark, Spar, & Jarvik, 1986; Weingartner, Cohen, Murphy, Martello, & Gerdt, 1981). With respect to immediate memory, depressed individuals presented "mild attentional difficulties", shallow encoding of information, and decreased response latency, as compared to normal individuals. Demented individuals presented moderate to severe attentional difficulty and lack of ability to systematically encode information. Similarly, there were relatively smaller differences between depressed and "normals" on general neuropsychological performance, with the greatest differences on motor-related tasks (speed) and attention. Although demented individuals exhibited substantial deficits as compared to normals, there was less differentiation between demented and depressed individuals on attentional and psychomotor tasks.

The nature of many of the differences between depressed and mildly demented individuals in their memory deficits may be attributed to varied response strategies. Whitehead (1973) and Miller & Lewis (1977) found that depressed persons tend to exhibit less random variation and more conservative strategies in their responses, while mildly

demented individuals committed more random and false positive errors. On tests assessing episodic, semantic, and constructive memory, Niederehe (1986) found few significant discrepancies between depressed and normal subjects, except for the tendency of depressed individuals to show conservative response strategies and mild attentional deficits (e.g. distractibility). Additionally, the performance of demented individuals was found to be at a qualitatively poorer plane than for depressed individuals.

It has also been posited that depressed individuals may not encode information with the same depth and efficiency as normal individuals (Craik & Lockhart, 1972; Hasher & Zacks, 1979; Weingartner, 1981, 1986). With regard to ability to employ elaborate encoding strategies when learning new information, Weingartner (1981) found that depressed individuals did not use encoding strategies likely to increase the chances of subsequent recall, as compared to normal individuals. Yet, depressed individuals benefited from material previously presented in an organized manner. Weingartner (1986) investigated Hasher & Zacks' (1979) assertion that the elderly use less effortful approaches (self-initiated encoding strategies) on attentional tasks, such that, as aging assumes reduced attentional capacity, the capacity is burdened by use of such strategies. In doing so, Weingartner (1986) found that depressed individuals were less efficient than normals when performing tasks which required increased encoding effort.

Hart, Kwentus, Taylor, & Hammer (1988) found that both depressed and demented individuals showed reduced verbal fluency. Although depressed persons performed better on a word fluency test involving production of words belonging to a particular semantic category (animals), there was similar performance for both groups on a word fluency task

involving producing words beginning with a specific letter (F-A-S). The authors offered the explanation that reduction in psychomotor speed influenced performance.

On measures involving psychomotor speed, Hart & Kwentus (1987) found that although depressed individuals' reaction time was significantly slowed (like demented individuals), incidental memory and informational processing capacity were not (unlike demented individuals), as compared to normal individuals. Thus, the authors suggested that impaired psychomotor speed may be due more to motivational factors. Similarly, Gray, Rattan, & Dean (1986) found that depressed patients were less impaired than demented and other neurologically impaired groups in neuropsychological performance. Depressed individuals were superior to all other groups, except on measures tapping perceptual acuity and psychomotor speed.

Overall, Lamberty & Bieliauskas (1993) found that the research literature shows that the neuropsychological performance, more specifically performance on attentional tasks, of depressed and normal individuals is more qualitatively similar, but frequently different quantitatively. There appears to be a consistent relationship, wherein depressives performed more like normals, as opposed to the demented. Experimental and clinical studies have placed the memory and attentional performance of depressed individuals between that of normal and demented individuals. The subtle differences found between normal and depressed individuals represents more general cognitive inefficiency and attentional difficulties, rather than the demented person's basic lack of ability due to structural deficits.

Lamberty and Bieliauskas (1993) stated that the literature suggests that depressed elderly individuals lacking in significant cognitive deficit are essentially normal upon

neuropsychological evaluation, as compared normal elderly adults. The only exception appears to be the presentation of depressive symptomatology, such as distractibility and psychomotor retardation. Individuals exhibiting "pseudodementia" present motor slowness and weakness, poor attentional ability, and decreased immediate recall abilities. These deficits are significantly worse than normal older adults and depressed individuals without cognitive deficits, but more easily distinguishable from dementing individuals. Thus, the need for thorough and objective cognitive and emotional assessment of patients presenting deficits or concerns in these areas appears vital, especially for accurate diagnosis and beneficial treatment where possible.

In summary, based on this picture of decline in the attentional processing of both older persons and older depressed persons, the current investigation intended to elucidate how impairment is manifested in a sample of able elderly individuals. It aimed to add information about the role of attention in memory decline associated with aging and depression. The role of attentional processes in memory and memory decline has been debated throughout the literature. The precise manner in which attention might affect mechanisms of processing has not yet been specified, with conclusions remaining conflicting and vague. The involvement of attentional capacities in memory is unclear, with equivocal findings pervasive. Therefore, further research examining the relationship among attention, depression, and memory appears likely to be fruitful.

Attentional Processes in Aging and Depression: A Model

Given that many of the conclusions with respect to attentional processes in memory performance in older adults are mixed, a model was constructed integrating applicable theories that allowed for specific predictions to be tested. The most applicable research stems from the integration of the concepts of reduced processing resources (Craik & McDowd, 1987; Salthouse, 1988; 1992), the age-complexity phenomenon (Salthouse, 1988, 1992), inhibition (Hasher et al, 1991), and automatic vs. effortful processing (Hasher & Zacks, 1979).

Potentially reduced attentional capacities in the elderly population serve as a foundation for declines in performance on tasks requiring attentional processing. When this already diminished supply of resources is taxed by effortful tasks, the performance of the elderly is further reduced. It appears that the ability to engage in successful performance on effortful tasks is compromised in old age. Simple, automatic processing is considered to be quite stable, as it imposes only minimal demands on already spent processing capacities. Depression in the elderly adds another burden to partially exhausted attentional resources, such that depression provides for further cognitive load. As depressed elderly individuals are less efficient during performance on effortful tasks, we see potential support for the results of added taxing of already reduced attentional capacities.

Specifically the more complex and effortful a task is, the more difficult it will be for older adults to engage efficient strategies to process information. With an reduced resource store, the older person employs less productive and efficient strategies when engaging in effortful, complex tasks. This is particularly troublesome, given that with more complex

tasks, one must not only attend to stimuli and develop strategies which are goal-directed, but must also juggle different levels of thought and potential responses, while simultaneously inhibiting irrelevant stimuli and non-goal-directed responses. This involves elaborate processing. Additionally, when more considerations, strategies, and inhibitory mechanisms are necessary to engage in more complex tasks, older persons who experience depression are even further compromised. Conversely, when tasks are less complex or demanding (automatic), and generally able to be carried out without intention and contemplation, the older person's performance is generally intact.

It seems though, that both elderly depressed and nondepressed adults, experience trouble inhibiting intruding or irrelevant thoughts or stimuli. Older individuals experience more distraction on tasks when irrelevant stimuli is presented. Additionally, they are more distracted than younger adults by both environmental stimuli and internal thoughts. It has been posited, as mentioned earlier, that the reduced inhibitory mechanisms of older adults plays a role in the inability of these individuals to efficiently suppress distracting stimuli or thoughts. Similarly, given that depressed individuals already have internal thoughts that seem to be serving consistently as distractors during performance on tasks, it appears that they also have difficulties intentionally suppressing these distractions. When older adults present depression, a further imposition on already reduced attentional resources and diminished inhibitory mechanisms is hypothesized. Hence, engagement in effortful, demanding tasks, which further taxes the ability to suppress distracting stimuli, should instigate more impairment for depressed older individuals than for non-depressed older

individuals. Both groups should present greater declines than younger individuals who are either mildly to moderately depressed or non-depressed.

Wegner (1994) developed a model of processes involved with mental control that may help to integrate some of these ideas. His model attempts to account for intentional and counterintentional effects that emerge as a result of efforts of mental control. He introduced two processes: the first, an operating process, that seeks thoughts, feelings, sensations consistent with some desired state or goal; the second, a monitoring process, simultaneously searches for those mental contents inconsistent with the state or goal that is intended, to help ensure that the operating system is working toward its intended end. The operating process requires greater cognitive resources and intention (effortful) and tends to have more pronounced effects than the non-intended monitoring system (automatic). Under normal conditions, the two work cooperatively to achieve the desired effect.

Under conditions that exhaust processing capacity, the monitor may become more pronounced than the operator, thus enhancing those aspects of mentation that are irrelevant, inconsistent, or even opposite of the intended goal. Thus, when efforts toward the intended goal are compromised in any way, the monitoring process may supersede and yield that change which is opposite to the intended goal. This provides some direct relevance to the model presented earlier. The central aspect of this theory that divides goal attainment from its ironic opposite is availability of mental processing capacity. When the resources are adequate, control may be maintained. When the resources are diminished, as with additional cognitive loads such as distraction, stress, depression, reduced mental capacities, or time constraints, ironic effects (those opposite from the goal) will surface.

Now one can apply Wegner's (1994) theory to the aforementioned model. The reduction of attentional resources may be similar to that suggested by compromised 'mental capacity'. The resources of the elderly are taxed when they engage in more complex and more effortful tasks, adding to the demand on an already diminished capacity. When an older person is depressed, there is additional demand on resources from engagement in any task requiring attention, but more impairment on complex, effortful as opposed to automatic tasks. These are parallel to the 'cognitive load' on mental capacity suggested by Wegner (1994). Additionally, older depressed and non-depressed persons have reduced inhibitory efficiency, which allows for irrelevant and distracting stimuli to be processed at the expense of that which may be relevant and goal-directed, further impairing accurate retrieval of desired information. Likewise, Wegner (1994) stated that suppression of undesired thoughts, states, stimuli was more cognitively demanding, with efforts at suppression rather unsuccessful when there is a cognitive load or tax on inadequate or reduced resources or capacities. Both models suggest that, given reduced attentional processing capacities and diminished ability to inhibit efficiently, when there is a taxing of these resources through increased complexity, effortfulness, or various cognitive loads (unwanted thoughts or states, time pressures, stress, distraction), one will see impairment.

It is proposed that increased age and even mild depression in this population may impact performance on attentional measures differentially, as a function of reduced attentional resources, task complexity, required effort, and diminished inhibitory efficiency.

Dependent Measures

The dependent measures used were the subtests Mental Control, Trails A, and Word Fluency, from the Senile Dementia of the Alzheimer's Type (SDAT) battery (Storandt et al, 1984).

Mental Control and Trails A

Mental Control assesses automatisms (alphabet) and simple conceptual tracking (counting backwards, add 3s in serial) and stands as a rough indicator of attention and concentration. This task is usually difficult only for individuals with more advanced dementing processes (Skillbeck & Woods, 1980; Storandt & Hill, 1989). Trails A consists of connecting a sequence of numbered circles at maximum speed and involves important attentional components (concentration, search, and tracking) (Storandt & Hill, 1989; Lezak, 1983). Mental Control and Trails A are both simple, direct attentional measures that aid in distinguishing demented individuals from normal controls. Both are relatively uncomplicated tasks for healthy individuals and tax global attentional processes. Among the able elderly, Mental Control and Trails A are usually not greatly affected by increased age even when there exists significant depression (Botwinick, Storandt & Berg, Lezak, 1983). This is because they are generally stable and unaffected in individuals who are becoming older or having some depression.

Word Fluency

Word Fluency is an indirect measure of attention which assesses organizational activity through timed word production. It involves the generation of words according to the initial letter, all produced within a restricted time frame. This test gives the greatest scope to the subject seeking a strategy for guiding his search for words and is most difficult for subjects who cannot develop strategies of their own (Spreen & Benton, 1969; Lezak, 1983). In order to choose seemingly correct responses, an individual must have the capacity to initiate and generate responses. Attention depends on the individual's ability to generate a response and to sustain responding, in accordance with feedback regarding the outcome of the response. Estes (1974) stated that successful performance partly relies on the subject's ability to organize output in terms of clusters of meaningfully related words. This task indirectly involves short-term memory in keeping track of what words have already been offered. Words that do not begin with the goal letter at hand, phonetically similar words, goal-directed words previously produced, and words that were appropriate for a previous letter must be inhibited or supressed to achieve successful performance. Age and sex have been found to influence performance on these tests (Benton et al., 1983), with women's performance holding up increasingly better than men's after age 65.

Although the subject must access attentional resources, Word Fluency stands as a more indirect measure of attention by providing a means of finding out how efficiently the subject organizes his/her thinking. As this test was not originally designed as a measure of attention, it is an indicator of language fluency shown to be sensitive to the broader range of response generation capacity. Yet, it is often difficult to extract the contribution of attention

on tasks that were not developed to directly measure attentional dysfunction. Performance on this measure has been found to progressively decline with age (Axelrod, 1991; Hultsch & Hertzog, 1992). Reduced capacity to generate words has also been associated with Alzheimer's-type dementia (Miller & Hague, 1975). Although, verbal fluency was reported to be rather stable when symptoms of depression mimic organic deterioration (Kronfol et al., 1978), others have found declines in word fluency performance with depression (Hart, Kwentus, Taylor & Hammer, 1988; Geffin, 1993).

The tests used differ in complexity of task, and tax attentional resources in differential fashion. It is not until Word Fluency, when more complex demands are presented to the subject, that age and depression are purported to make an impact on attentional performance. It is hypothesized that attentional performance will begin to deteriorate, especially when there is the influence of the interaction between age and depression. Word Fluency, requiring more effortful, demanding organizational strategy will tax attentional resources in addition to that demand placed on resources by increased age or depression. Yet, Mental Control and Trails A, requiring less demand on attentional resources as a function of their simplicity, should show less differentiation either as a function of age or depression. Thus, the implication being asserted by this author is that attentional performance will not be impaired until increased demand and complexity is added to the equation. As other researchers have suggested, complexity may be the key to the variability in age and emotional status influence of the dependent measures. These considerations are further supported by previously cited literature indicating a decline in memory and attention with increased age as a function of more taxing, effortful tasks requiring more elaborate

strategy creation, inhibition of irrelevant stimuli, and increased demand on attentional resources (Hasher & Zacks, 1979; Hasher et al, 1991; Plude & Hoyer, 1986; Salthouse, 1984, 1989, 1992; Craik & Simon, cited in Poon, 1980).

Review of this literature suggests that the role of attention in memory is relatively equivocal, and the following formulation is suggested: Simple attentional processing accounts for relatively little of the variance with regard to aging and depression in the able elderly. However, it is suggested that age and depression in this population will impact performance on Word Fluency, because it presents more complexity, requires more effort and inhibitory processes, and demands using a strategy for improved success. These requirements are believed to tax already reduced attentional processing capacities and diminished inhibitory efficiency. It is recognized that Word Fluency is only partially related to attention and is more specific to overall cognitive and memory functioning. This author hoped to find further support for the aforementioned model of attention capacity decline in aging. This study investigated how performance on these three measures relates to age, depression, and overall functioning. This was conducted using tests of direct and indirect attention, with varying complexity and task demand, that may account for variance in attentional performance with regard to aging and depression.

Hypotheses

The global assumption is that simple automatic attention, in itself, will account for little of the variance with regard to aging and depression among the able elderly. These two variables will impact performance on attentional measures differentially, with the complexity

of the task and its potential for taxing of attentional resources being the key to understanding the interaction of these variables.

It is assumed that as age or depression increase, performance on tasks requiring only simple and automatic attentional processing, such as Mental Control and Trails A, will remain stable and relatively unimpaired. Similarly, as age increases, performance on Mental Control and Trails A will neither increase nor decrease. As depression scores (BDI) increase, performance scores on Mental Control and Trails A will remain unaffected.

Specifically, it is hypothesized that:

1. As age or depression increase, performance on tasks requiring effortful attentional processing will be impaired.

   a) As age increases, Word Fluency performance will decrease.

   b) As depression scores (BDI) increase, Word Fluency performance will decrease.

2. Age and depression, when considered together, will influence performance differentially on attentional tasks which vary in complexity (simple versus complex).

   a) As age and depression increase together, performance on Trails A and Mental Control (simple attentional measures) should remain generally stable.

   b) As age and depression increase together, performance scores on Word Fluency (complex attentional measure) should decrease. The interaction of both variables will impair performance significantly more than either variable's separate effect.

METHOD

Participants

The participants are 155 older adult volunteers recruited from senior citizen groups, senior nutrition programs, and faculty and staff retiree groups from Michigan State University and other Lansing area locations. Of the subjects, approximately 72% were female, and 28% were male. The mean age of the subjects was 71 years, with a standard deviation of 8.95. Approximately 96% of the subjects were caucasian, 4% were African-American, and 0.6% were of other ethnic backgrounds. On the average, at least 25% of the subjects were employed in some capacity. Of the subjects, 50% were married, 32% widowed, 1% separated, and 17% widowed. The mean years of education for the sample was 14.4 years, while the range was 7 to 26 years.

Procedure

Individuals were assessed at MSU's Psychological Clinic or visited at their homes. All gave written informed consent, but had the option of dropping out of the research at any time. The entire assessment for each participant, including other measures unrelated to this study, lasted approximately 1.5 to 2 hours.

Measures

Mental Control, Trails (Part A), and Word Fluency Subtests from the Senile Dementia Alzheimer's Type (SDAT) Battery (Storandt, Botwinick, Danziger, Berg, and Hughes, 1984). This battery consists of Mental Control and Logical Memory sections from the Wechsler Memory Scale (Wechsler, 1955), Trail Making Test (Part A) from the Halstead-Reitan Battery (Reitan & Wolfson, 1985), and a Word Fluency Test (P-S), (Benton & Hamsher, 1976). In the initial standardization, 84 older persons, (38 men; 46 women), half of whom were diagnosed as having SDAT and half normal controls, were recruited from local physicians or from the community. There was successful classification of 98% of patients with mild dementia of the Alzheimer's type and healthy older persons matched for age, sex, and social status. The sample was separated into two subsamples by choosing every other matched pair in their order of enrollment in the study. An initial discriminant analysis was performed on one subsample and regression weights were applied to the second subsample. The first analysis correctly classified all individuals on the four previously described variables. The second analysis misclassified only 2 of 84 individuals (one healthy, one demented). Standardized coefficients were used for the final analysis. Canonical scores larger than or equal to 0 were classified as demented; normals achieved scores greater than 0. This measure meets the criteria of the NIMH task force on age associated memory impairment. Later investigations using this battery found similar validation. (Botwinick, Storandt, Berg, 1986; Storandt & Hill, 1989).

Beck Depression Inventory (BDI). The BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) provides for reliable and valid assessment of depression in the elderly. This measure rates the severity of depressive symptoms on a 4-point discrimination scale. It also appears to have respectable internal consistency and stability in testing elderly individuals (Beck, Steer, & Garbin, 1988). It has a high detection rate for major and minor depressive disorders, with a misclassification rate of approximately 16-17% using customary BDI cutoff scores (Gallagher, 1983). Thus, it appears useful as a screening instrument for identification of clinically depressed elderly. This measure also meets criteria of the NIMH task force.

Since its development, the BDI has been subjected to extensive psychometric evaluation. Meta-analyses of these evaluations cited internal consistency to be in the range of .73 to 92 with a mean of .86 (Beck, Stern, & Garbin, 1988). This review showed concurrent validity by finding moderate to high correlations with clinical ratings for psychiatric patients (r = .55 to .96, M = .72). Moderate correlations were also found with other depression assessment scales, such as the MMPI Depression Scale (.76). The BDI was also shown to discriminate psychiatric and nonpsychiatric populations (Byerly & Carlson, 1982; Petrowsky, Sherry, & Keller, 1985). Additionally, factor analytic investigations supported the BDI's measurement of a general factor of depression, as well as other specific factors of depression (Tanaka & Huba, 1984).

Geriatric Depression Scale. (GDS) The GDS is a valid and reliable screening instrument specifically designed for the assessment of depression in the elderly. This self-administered instrument consists of 30 yes/no questions, where the subject circles yes or no according to

how appropriate the answer describes the subject's feelings at that time. The item-total correlations range from .32 to .83 (M = .56), while internal consistency and split-half reliability were both .94, and retest reliability was .85 (Koenig, 1988).

Factor analysis showed a major factor of dysphoria, and minor factors of worry/obsessive thought, and apathy/withdrawal (Parmalee, 1989). Good concurrent validity was found with several other depression scales, including the Hamilton Scale (.83) and the Zung Scale (.86) (Yesavage, 1986). Criterion validity measured with the Research Diagnostic Criteria was found to be .82. Parmalee (1989) found good agreement with clinical diagnoses and symptom checklists for ratings of minor, major, and no depression. The GDS has been reported to successfully discriminate between mildly demented depressed and nondepressed individuals (Stebbins & Hopp, 1990; Yesavage, 1987).

Mini-Mental State Examination. (MMSE)(Folstein, Folstein, & McHugh, 1975). The MMSE was created as a brief screening of cognitive functioning. The test assesses orientation, immediate recall, attention and calculation, intermediate recall, and language abilities and the maximum score obtainable is 30 points. The standardization sample consisted of sixty-three healthy elderly control subjects (mean age = 74). The scores obtained by both elderly controls and younger psychiatric patients were in the range between 24.6 to 27.6, while demented subjects scored between 9.6 to 12.2. There was no overlap between the performances of demented subjects and elderly controls was produced. Additionally, a cut-off score of 26 is often applied to discriminate those scores that are more suggestive of impairment.

RESULTS

The MMSE provided a cognitive screening of the subjects. The mean MMSE score for the sample was 28.2 with a standard deviation of 1.6. These findings are relatively comparable to the age and scores of those healthy adult controls in the standardization sample (range of MMSE scores = 24.6 to 27.6; mean age = 74). Additionally, while the range of scores is from 21 to 30, 92% of the sample equaled or surpassed the previously cited cutoff score of 26.

The mean scores of the depression measures suggest that, overall, the sample was not experiencing severe levels of depression. The mean score and standard deviation for the BDI was 7 and 5.35, while the mean and standard deviation for the GDS was 6.6 and 5.19. As measured by the BDI, 73% of the subjects scored within the normal range, 25% presented mild depression, and 2% presented at least moderate levels of depression. Scores on the GDS indicated that 75% of the sample were within normal limits, 23% displayed mild depression, and approximately 2% scored within the moderate-to-severe range of depression. For the most part, the sample was relatively healthy in terms of depressive symptomatology. The intercorrelations for each of the variables in the analyses in the present study are provided in Table 1.

Table 1
Means, Standard Deviations, and Variable Intercorrelations

	X	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
Demographic Variables															
1. Age	70.79	8.95	1.00	.06	-.10	.02	-.17	.41	-.46	-.14	-.55	-.17	.13	.08	.11
2. Sex	1.72	.45		1.00	.10	.32	-.29	.15	.00	-.18	-.08	-.10	.02	.06	.04
3. Ethnicity	1.07	.44			1.00	-.07	.09	-.16	-.03	-.08	-.01	.02	-.03	-.02	-.03
4. Marital Status	2.85	1.08				1.00	-.17	-.06	.07	.00	-.03	-.12	.11	.08	.10
5. Education	14.36	3.06					1.00	-.19	.20	.28	-.14	.26	-.19	-.15	-.19
6. Work Status	1.75	.43						1.00	-.21	-.21	-.24	-.24	.18	.15	.18
7. MMSE	28.22	1.60							1.00	.36	.42	.21	-.12	-.19	-.17
Attention Variables															
8. Mental Control	7.30	1.51								1.00	.24	.40	-.12	-.13	-.13
9. Trails A	146.78	24.92									1.00	.31	-.24	-.13	-.20
10. Word Fluency	28.32	9.43										1.00	-.16	-.13	-.16
Depression Variables															
11. BDI	6.99	5.35											1.00	.71	.93
12. GDS	6.57	5.19												1.00	.92
13. Composite DEP	13.56	9.74													1.00

Hypothesis 1:

As age or depression increase, performance on tasks requiring effortful attentional processes will be impaired.

a)As age increases, Word Fluency performance will decrease.

b)As depression scores increase, Word Fluency performance will decrease.

Overall, both hypotheses were supported. Pearson-product moment correlations revealed that as age increased, performance on Word Fluency decreased ($r = -.17$, $p < .05$). The zero-order correlation between the composite depression variable and Word Fluency was significant ($r = -.16$, $p = .05$). Although the correlation between BDI scores and Word Fluency scores was also significant ($r = -.16$, $p = .05$), the relationship between GDS scores and Word Fluency scores was not significant ($r = -.13$, $p > .05$). In order to control for the effects of depression, hierarchical regression was used. In the first step, Word Fluency was regressed onto depression($R = .15$ ($F(1,146) = 3.83$, $p = .05$). In a second step, age was entered into the regression equation. The change in R^2 (0.02) was not significant (F_{chg} $(1,145) = 3.13$, $p > .05$), suggesting that age did not explain additional variance over that accounted for by depression. A similar analysis was conducted in order to control for the effects of age. In the first step, Word Fluency was regressed onto age($R = .16$ ($F(1,146) = 3.86$, $p = .05$). In a second step, depression was entered into the regression equation. The change in R^2 (0.02) was not significant ($F_{chg}(1,145) = 3.10$, $p > .05$), suggesting that the depression did not explain additional variance over that accounted for by age. Similar analyses were conducted using the BDI and GDS, and results were comparable.

Hypothesis 2:

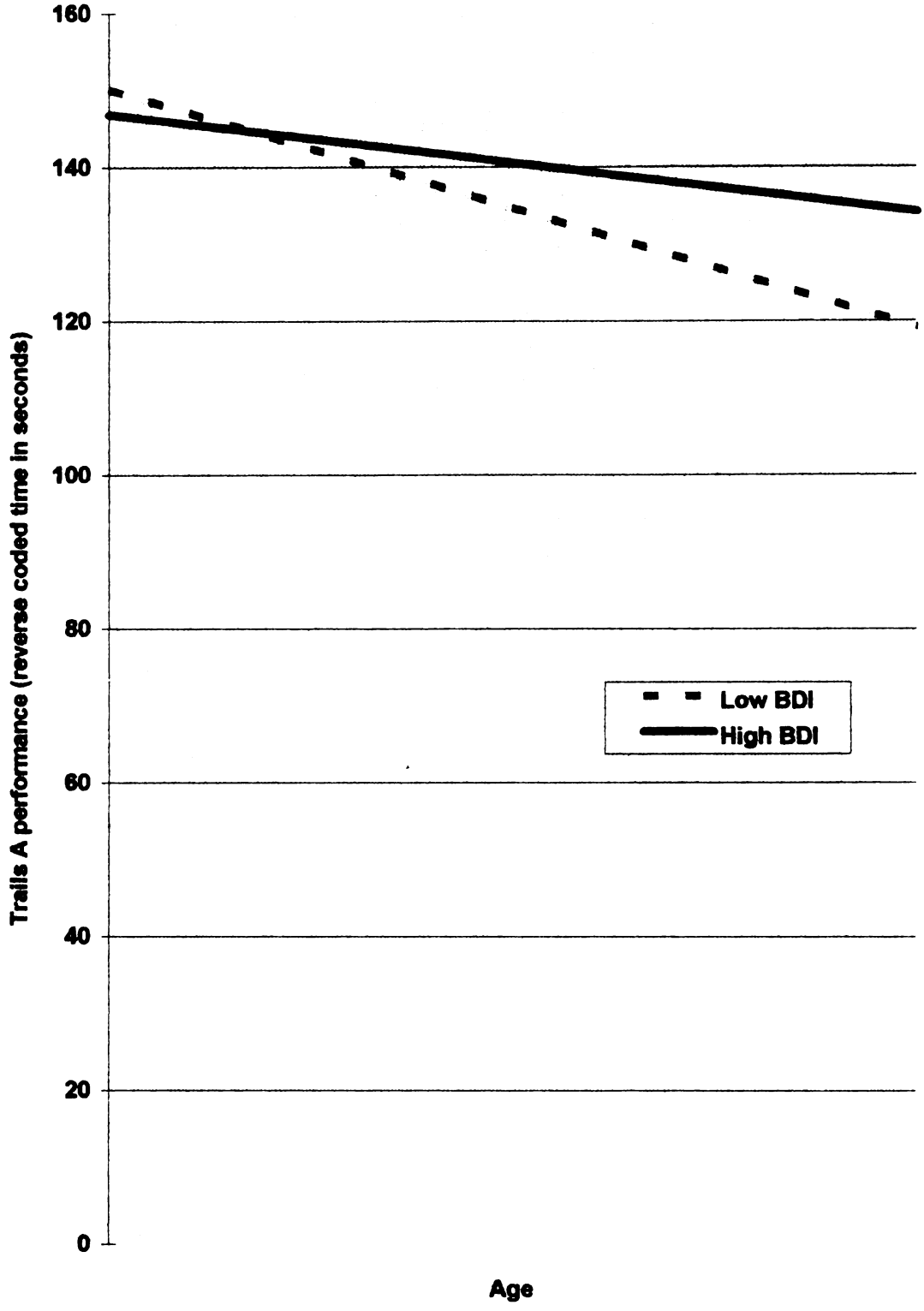
Age and depression, when considered together, will influence performance differentially on attentional tasks which vary in complexity (simple versus complex).

Effects on Simple Tasks (Trails A and Mental Control)

In order to test this hypothesis, Trails A was initially regressed upon age and depression. Contrary to this hypothesis, as age and depression increased, performance on Trails A decreased ($R = .57$ ($F(2,145) = 35.49$, $p < .01$). In the second step, the age by depression interaction was entered into the regression equation. The change in R^2 (0.01) was not significant ($F_{chg}(1,144) = 3.04$, $p > .05$), suggesting that the interaction did not explain additional variance over that accounted for by the main effects. A similar analysis conducted using the GDS provided comparable results.

Different results were found when Trails A was regressed upon age and depression as measured by the BDI. As age and depression increased, performance on Trails A decreased ($R = .58$ ($F(2,145) = 36.85$, $p < .01$). In a second step, the age by depression interaction was entered into the regression equation. The change in R^2 (0.03) was significant ($F_{chg}(1,144) = 6.31$, $p < .05$), suggesting that the interaction was able to explain some additional variance over that accounted for by the main effects. The results of this analysis are presented in Figure 1.

Figure 1:
Interaction of BDI and Age with Trails A



When Mental Control was regressed upon age and depression, as age and depression increased, performance on Mental Control remained stable ($R = .20$ ($F(2,145) = 2.91$, $p > .05$). Next, the age by depression interaction was entered into the regression equation. The change in R^2 (0.02) was not significant ($F_{chg}(1,144) = 3.07$, $p > .05$), with the interaction failing to account for additional variance above that of the age and depression main effects. A similar analysis performed using the BDI produced comparable results.

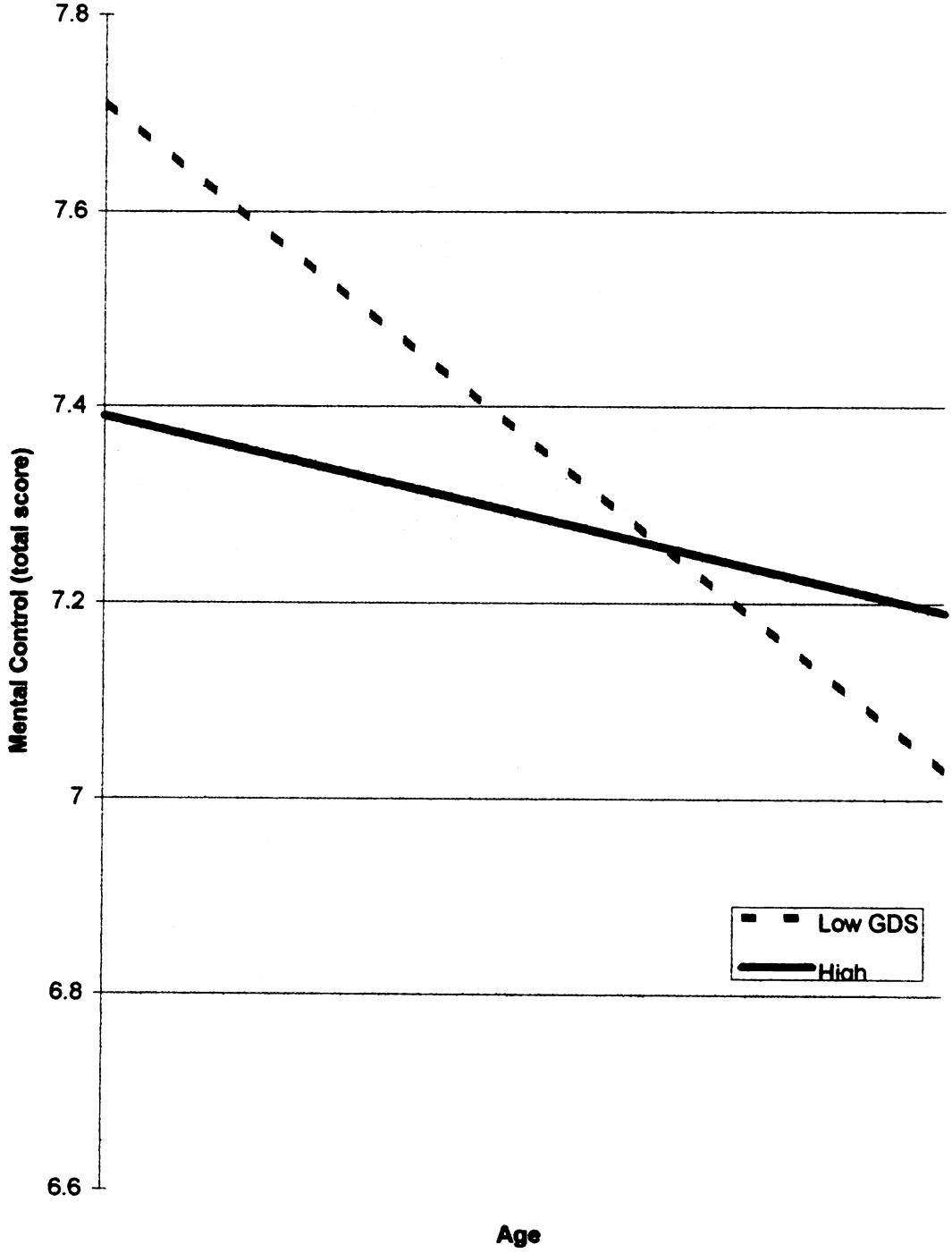
When Mental Control was regressed upon age and depression as measured by the GDS, as age and depression increased, performance on Mental Control remained stable ($R = .20$ (F 2,145) = 2.91, $p > .05$). In the second step, the age by depression interaction was entered into the regression equation. The change in R^2 (0.03) was significant ($F_{chg}(1,144) = 4.21$, $p <$ .05), with the interaction accounting for some of the additional variance than that explained by the main effects of age and depression. The results of this analysis are presented in Figure 2.

Effect on Complex Task (Word Fluency)

As age and depression increase together, performance scores on Word Fluency (complex attentional measure) should decrease. The interaction of both variables will impair performance significantly more than either variable's separate effect.

Word Fluency was regressed upon age and depression. In accordance with this hypothesis, as age and depression increased together, performance on Word Fluency decreased ($R = .21$ ($F(2,145) = 3.51$, $p < .05$). In the second step, the age by depression interaction was entered into the regression equation. Contrary to prediction, the change in R^2

Figure 2:
Interaction of GDS and Age with Mental Control



(0.001) was not significant ($F_{chg}(1,144) = 0.20$, $p > .05$, indicating that the interaction of age and depression did not account for more than each independent variable's main effect. Comparable results were also produced when similar analyses were conducted using the BDI and GDS separately.

DISCUSSION

Implications of Results

The findings from the MMSE screening suggested that the sample did consist of non-demented, able elderly individuals who appeared to be functioning at a cognitive level that was comparable to their same aged peers. Subjects in this sample displayed a performance level that was slightly better than those subjects in the standardization sample for the MMSE. Additionally, an overwhelming majority (92%) of the subjects surpassed a commonly used MMSE cutoff employed to separate those more likely to be either dementing or non-dementing. The depression measures also supported that the sample was relatively healthy, given that approximately 73 - 75% of the sample presented scores that were within normal limits. Thus, the impact of age and depression on attentional tasks was able to be investigated using relatively healthy, non-dementing, older adult subjects.

Findings from previous research support the assertion of there being several factors subsumed under these two measures (Parmalee, 1989; Tanaka & Huba, 1984). Prior factor analyses revealed that each of the depression measures appear to be comprised of underlying factors. The BDI includes factors that can be characterized as disappointment in self, neurovegetative symptoms, and despair, while the GDS presents factors that can be labeled as rumination and apathy. As several measures are usually employed to assess depression in the elderly, and different measures are reportedly assessing different

aspects of depression (i.e. somatic versus mood symptoms), it seemed logical to investigate what each test actually measured. The analyses in this study were run separately for the composite depression variable, the BDI, and the GDS to observe whether the results would be different. Results suggested that it is important to separate the depression measures, such that rather compelling findings would have been blurred.

The results of this study indicate that, as expected, both age and depression are related to performance on more complex attentional tasks. When age increased, performance on Word Fluency decreased. Similarly, as depression increased, Word Fluency decreased. However, depression as measured by the GDS, was not significantly related to performance on Word Fluency. It is notable that mood-related symptoms as measured by the GDS don't appear to relate to performance on more complex tasks. Thus, it appears that those reporting neurovegetative symptoms associated with depression may perform more poorly on more complex tasks (Word Fluency), than are those with symptoms that are more mood-related. When age was controlled to observe how depression and Word Fluency relate to each other, depression alone did not seem to afford explanations that surpassed that accounted for by age. The same was found when the relationship between age and Word Fluency was examined after controlling for depression. Thus, they both have an effect on Word Fluency, but neither explains more of the variance than the other.

Simple attentional tasks were not expected to be adversely impacted by increasing age or depression. That expectation was not borne out. As age and depression increased, performance on Trails A, a simple attentional task, decreased. Similarly, the interaction

of age and depression, as measured by the GDS or composite variable, did not explain any additional variance above that accounted for by the independent effects of either variable. Conversely, the interaction of depression, as measured by the BDI, and age had a differential effect on Trails A performance. With decreasing age, depression marked by more somatic symptoms, had no significant impact on Trails A performance. However, with increasing age, performance on Trails A is significantly poorer with increasing levels of depression involving somatic symptoms. Thus, it is not until age increases that depression as measured by the BDI has a significant impact on Trails A.

Somewhat surprisingly, when age and depression increased, performance on Mental Control decreased; this finding was produced only when depression was measured by the BDI or the composite variable. The interaction between age and depression revealed no more explanation of the variance than that accounted for by the independent effects alone. However, when depression was measured by the GDS, the interaction between depression and age presented a differential impact on Mental Control performance. With increased age, depression did not significantly influence performance on Mental Control. Conversely, younger subjects with increased mood-related symptoms of depression performed significantly poorer than younger subjects with less depression. This is an interesting finding given past research that has found that Mental Control is not greatly impacted by increased age, as it taps overlearned material (alphabet), and is performed reasonable well even by those with mild to moderate dementia (Storandt et al., 1989). Additionally, there is some research that suggests that depression in the able elderly may

be overrated as a factor impinging on cognitive impairment (Lamberty & Bielauskas, 1992).

These interactions have important implications, such that the impact of age and depression on the cognitive functioning of older adults may vary depending on the quality of the symptoms endorsed. Thus, it is important to separate mood-related symptoms from neurovegetative symptoms. Additionally, it is compelling that decrements in attentional performance are related to age and depression even in a relatively healthy, able elderly sample. This suggests that it may be fruitful to continue investigating the effects of aging and depression on attention, before severe depressive symtpmatology or dementia appears, to facilitate appropriate diagnosis and treatment as early as possible.

The interaction of age and depression did not account for any additional variance explaining the decrease in Word Fluency performance above and beyond that explained by the independent effects. Thus, increased age and depression seem to impair attentional performance on tests considered to be simple or complex in their cognitive demand. However, contrary to the expectation, the interaction of age and depression does not account for any more of the variance regarding decreased performance on complex tasks than do the independent effects alone. The interaction does not explain differential performance on simple versus complex tasks.

Limitations:

The hypothesis that older and depressed individuals would perform more poorly on tasks that were more complex was not clear cut. One reason that the expected results

were not found may stem from the inability of the tests to provide differential levels of complexity. It is possible that Word Fluency is not that much more complex than Trails A or Mental Control to produce the expected effect. Perhaps with the use of several tests that vary from simple to most complex in their demand on attentional resources, degree of cognitive effort required, and level of requisite inhibitory abilities, more clear differences would emerge. It is possible that the measures selected here do not adequately address those areas.

A potential confounding variable is that of psychomotor speed. Trails A requires intact psychomotor speed, in addition to visual scanning and tracking abilities. Increased depression involving the types of symptoms that are more neurovegetative or somatic in nature may directly affect psychomotor speed. This is important as higher levels of depression involving neurovegetative symptoms (fatigue and decreased motivation) have the greatest impact on attentional performance with increasing age. Similarly, mood-related symptoms tapped by the GDS may compromise an individual's ability to perform overlearned tasks at younger ages; examples of symptoms include rumination, impinging and bothersome thoughts, and perceived decreased mind clarity. However, it is unlikely that the mild depression displayed by this sample was at a level that would significantly effect psychomotor speed or performance of overlearned tasks. Again, the differences observed in a relatively healthy, elderly sample such as that used in this study, may imply that cognitive deficits seen with aging may be rather subtle and insidious. This is problematic, as individuals often do not seek assistance until cognitive or emotional changes are quite obvious and debilitating.

It is also possible that Word Fluency did not require a significant amount of effort and was not the best representation of a task requiring inhibition of non-task thoughts or stimuli. Perhaps if there were other non-target tasks required to be conducted simultaneously, it could represent a more effort-demanding, complex taxing of attentional resources as non-task stimuli must be inhibited. Additionally, a wide range of tasks that increase in complexity would help to elucidate the degree of effort that serves to tax the attentional resources of the elderly.

It is also acknowledged that this sample may not be fully representative of the majority of the older, healthy population. The mean level of education being 14 years may be somewhat elevated as compared to the education level of most individuals over 55. For example, several subjects were retired faculty from a major university. Thus, several subjects were professionals and had an education surpassing the average level of their same aged peers. This was also an able elderly group, a quarter of which were still employed. As many live independently, they may represent a sample that is more intact than the average population. However, given that decreased performances were found as a function of age and depression, the findings may be even more pronounced in a less intact sample. Although there were significantly more females than males in the sample, this distribution mirrors the approximate ratio of males to females in this age group. Hence, it would be an overrepresentation of males if the distribution of the sample, with respect to gender, were equivalent.

Future Research Directions:

Further research would benefit from the use of several tests which increase in complexity. A range of attentional measures which vary in complexity would provide for more precise understanding of the nature of tasks which tax the resources of the elderly. It would also be useful to include measure of intelligence, given that individuals functioning at different intellectual levels may also differ in their ability to attend to important and essential information. Additionally, the tests used are not considered to solely be attentional tests. In fact, they are likely to require other cognitive functions in addition to attention. A sample with more diverse ethnic backgrounds and a wider variety of education levels would be beneficial.

This study highlights the need for ongoing research investigating the sometimes subtle effects of aging and depression on attentional processing. Understanding the role of attention in the processes of acquisition, storage, and retrieval involved in memory, may help to differentiate between those showing depressive symptoms, those displaying dementing symptoms, and those that appear to present an overlapping of symptoms from both disorders. This has direct implications for appropriate diagnosis and treatment, as well prevention methods for the future.

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APPENDIX A

BECK DEPRESSION INVENTORY (BDI)

APPENDIX A

BDI

Directions: This questionnaire consists of 21 groups of statements. After reading each group of statements carefully, circle the number (0, 1, 2, 3) next to the one statement in each group which best describes the way you have been feeling the past week, including today. If several statements within a group seem to apply equally well, circle each one. besure to read all the statements in each group before making your choice.

1.	0	I do not feel sad.
	1	I feel sad.
	2	I am sad all the time and I can't snap out of it.
	3	I am so sad or unhappy that I can't stand it.
2.	0	I am not particularly discouraged about the future.
	1	I feel discouraged about the future.
	2	I feel I have nothing to look forward to.
	3	I feel that the future is hopeless and that things cannot improve.
3.	0	I do not feel like a failure.
	1	I feel I have failed more than the average person.
	2	As I look back on my life, all I can see is a lot of failures.
	3	I feel I am a complete failure as a person.
4.	0	I get as much satisfaction out of things as I used to.
	1	I don't enjoy things the way I used to.
	2	I don't get real satisfaction out of anything anymore.
	3	I am dissatisfied and bored with everything.
5.	0	I don't feel particularly guilty.
	1	I feel guilty a good part of the time.
	2	I feel quite guilty most of the time.
	3	I feel guilty all of the time.
6.	0	I don't feel I am being punished.
	1	I feel I may be punished.
	2	I expect to be punished.
	3	I feel I am being punished.

7.	0	I don't feel disappointed in myself.
	1	I am disappointed in myself.
	2	I am disgusted with myself.
	3	I hate myself.
8.	0	I don't feel I am any worse than anybody else.
	1	I am critical of myself for my weaknesses or mistakes.
	2	I blame myself all the time for my faults.
	3	I blame myself for everything bad that happens.
9.	0	I don't have any thoughts of killing myself.
	1	I have thoughts of killing myself, but I would not carry them out.
	2	I would like to kill myself.
	3	I would kill myself if I had the chance.
10.	0	I don't cry anymore than usual.
	1	I cry more now than I used to.
	2	I cry all the time now.
	3	I used to be able to cry, but I can't cry even though I want to.
11.	0	I am no more irritated now than I ever am.
	1	I get annoyed or irritated more easily than I used to.
	2	I feel irritated all the time now.
	3	I don't get irritated at all by the things that used to irritate me.
12.	0	I have not lost interest in other people.
	1	I am less interested in other people than I used to be.
	2	I have lost most of my interest in other people.
	3	I have lost all of my interest in other people.
13.	0	I make decisions about as well as I ever could.
	1	I put off making decisions more than I used to.
	2	I have greater difficulty in making decisions than before.
	3	I can't make decisions at all anymore.
14.	0	I don't feel I look any worse than I used to.
	1	I am worried that I am looking old or unattractive.
	2	I feel that there are permanent changes in my appearance that make me look old or unattractive.
	3	I believe that I look ugly.

15.	0	I can work about as well as before.
	1	It takes an extra effort to get started at doing something.
	2	I have to push myself very hard to do anything.
	3	I can't do any work at all.
16.	0	I can sleep as well as usual.
	1	I don't sleep as well as I used to.
	2	I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
	3	I wake up several hours earlier that I used to and cannot get back to sleep.
17.	0	I don't get more tired than usual.
	1	I get tired more easily than I used to.
	2	I get tired from doing almost anything.
	3	I am too tired to do anything.
18.	0	My apppetite is no worse than usual.
	1	My appetite is not as good as it used to be.
	2	My appetite is much worse now.
	3	I have no appetite at all anymore.
19.	0	I haven't lost much weight, if any, lately.
	1	I have lost more than 5 pounds.
	2	I have lost more than 10 pounds.
	3	I have lost more than 15 pounds.
20.	0	I am no more worried about my health than usual.
	1	I am worried about physical problems such as aches and pains; or upset stomach; or constipation.
	2	I am very worried about health problems and it's hard to think of much else.
	3	I am so worried about my physical problems that I cannot think about anything else.
21.	0	I have not noticed any recent change in my interest in sex.
	1	I am much less interested in sex than I used to be.
	2	I am much less interested in sex now.
	3	I have lost interest in sex completely.

APPENDIX B

GERIATRIC DEPRESSION SCALE (GDS)

APPENDIX B

GDS

Directions: Choose the best answer for how you felt over the past week.

1. Are you basically satisfied with your life?.....Yes/No
2. Have you dropped many of your activities and interests?.....Yes/No
3. Do you feel that your life is empty?.....Yes/No
4. Do you often get bored?.....Yes/No
5. Are you hopeful about the future?.....Yes/No
6. Are you bothered by thoughts you can't get out of your head?.....Yes/No
7. Are you in good spirits most of the time?.....Yes/No
8. Are you afraid that something bad is going to happen to you?.....Yes/No
9. Do you feel happy most of the time?.....Yes/No
10. Do you feel helpless?.....Yes/No
11. Do you often get restless and fidgety?.....Yes/No
12. Do you prefer to stay at home, rather than going out and doing new things? .....Yes/No
13. Do you frequently worry about the future?.....Yes/No
14. Do you feel you have more problems with memory than most?.....Yes/No
15. Do you think it is wonderful to be alive now?.....Yes/No
16. Do you often feel downhearted and blue?.....Yes/No
17. Do you feel pretty worthless the way you are now?.....Yes/No

18. Do you worry a lot about the past?.....Yes/No

19. Do you find life exciting?.....Yes/No

20. Is it hard for you to get started on new projects?.....Yes/No

21. Do you feel full of energy?.....Yes/No

22. Do you feel that your situation is hopeless?.....Yes/No

23. Do you think that most peopel are betteroff than you are?.....Yes/No

24 Do you frequently get upset over little things?.....Yes/No

25. Do you frequently feel like crying?.....Yes/No

26. Do you have trouble concentrating?.....Yes/No

27. Do you enjoy getting up in the morning?.....Yes/No

28. Do you prefer to avoid social gatherings?.....Yes/No

29. Is it easy for you to make decisions?.....Yes/No

30. Is your mind as clear as it used to be?.....Yes/No