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THE EFFECTIVENESS OF INCREASED STIMULATION IN REDUCING WANDERING BEHAVIOR IN INDIVIDUALS WITH ALZHEIMER'S DISEASE

BY

SUZANNE M. MAISEY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled AN INVESTIGATION OF WANDERING: UNDERSTIMULATION RATHER THAN OVERSTIMULATION? submitted by SUZANNE M. MAISEY in partial fulfilment of the requirements for the degree of MASTER OF ARTS.

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Abstract

Wandering behavior, characterized by excessive and seemingly purposeless walking (e.g., Dawson & Reid, 1987), is commonly associated with Alzheimer's disease (AD). It is a very prevalent behavior within the AD population and often proves hazardous to the wanderers and disruptive to the caregivers. The treatments of choice include a variety of behavioral interventions, physical restraint and chemical restraint (e.g., Namazi, Rosner, & Calkins, 1989), techniques characterized by a lack of consistent efficacy. There is a need, therefore, to determine why individuals with AD wander. Numerous putative causes have been proposed (e.g., Hussian, 1982); few have been empirically investigated. The prevailing proposal is that overstimulation leads to agitation that is behaviorally expressed as wandering. There is, as yet, little empirical support for this hypothesis. A new hypothesis, proposed by Dobbs and Andiel (1994), suggests that wandering results from a disease-induced condition of understimulation. The primary purpose of this study was to determine whether wandering behaviors could be reduced by providing wanderers with a period of systematic stimulation, and additionally, to determine whether some wanderers seek stimulation and whether some wanderers do not display agitation. The

behaviors (mobility, stimulus seeking, and agitation/aggression) of five wanderers were recorded through direct observation using a behavioral coding ethogram. The wanderers were included in both an Intervention and a Non-Intervention condition. In the Intervention condition the residents were presented with 10 minutes of systematic stimulation. Behaviors were recorded throughout the stimulation period and for 10 minutes post-stimulation. In the Non-Intervention condition the residents were simply observed for 20 minutes. The hypothesized reduction in wandering post-stimulation was not confirmed although the intervention did succeed in producing an immediate, significant increase in stimulus seeking behaviors. Consistent with the understimulation hypothesis, wanderers did spend a major proportion of their time engaged in stimulus seeking behaviors, regardless of the time they were observed, and these behaviors tended to occur concurrently with wandering. Additionally, agitation was rarely displayed and never co-occurred with wandering.

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Introduction

Alzheimer's disease (AD) is characterized by a chronic, progressive neurologic deterioration that results in impaired cognitive functioning and is commonly associated with a number of problem behaviors. Because most AD sufferers remain physically healthy, care often becomes focused upon behavior management rather than upon traditional nursing care (Dobbs & Rule, 1992). The results from recent studies investigating the behavioral changes that are commonly associated with AD lend authenticity to the frequent use of the seemingly pejorative terms (e.g., "behavioral problems") that pervade the literature. Teri, Borson, Kiyak, and Yamagishi (1989) conducted an investigation into the prevalence and severity of behavioral problems, using reports from community individuals caring for moderately cognitively impaired AD sufferers. The caregivers reported a mean of 10 different types of problem behaviors with an average of 7 of those problems occurring with a frequency of more than twice a week (Teri et al., 1989). This study, involving a community sample of moderately impaired community dwelling AD residents, is only one piece of evidence concerning the scope of AD associated behavioral problems. In longterm care facilities, the

prevalence of disruptive behaviors is even higher and, by definition, these behaviors tend to be more severe or frequent as it is these qualities that lead to institutionalization (e.g., Chenoweth & Spencer, 1986). Cohen-Mansfield (1986) found that nursing staff in a facility for cognitively impaired residents indicated a 72% prevalence of disruptive behaviors.

What behaviors are categorized as disruptive or problematic? Jackson, Drugovich, Fretwell, Spector, Sternberg, and Rosenstein (1989) report that the most prevalent forms of disruptive behaviors in longterm care facilities include abusiveness, noisiness, and wandering. Among these, wandering has been identified as one of the most important disruptive behaviors characteristic of AD (Hope & Fairburn, 1990). It is a behavioral problem that has been identified by many as requiring further investigation because of its prevalence, because it is particularly disruptive to caregivers, and because it is associated with a number of dangers to the wanderer.

Wandering is a problem that is prevalent in both the community and the institution and is cited as a significant care issue by both informal and formal caregivers. In a group of 56 moderately impaired AD patients living in the

community, wandering behaviors were reported to occur about 16% of the time (Teri et al., 1989). Similarly, in a population of 100 out-patient dementia sufferers, Teri, Hughes, and Larson (1990) found that 23% were judged by caregivers to have wandering as a problem behaviour. Given this prevalence even among the non-institutionalized AD sufferers, it is not surprising that the exhibition of wandering behaviors may be a risk factor for admittance to a longterm care facility. Rosin (1977) reported that 44% of elderly people were placed in a facility because of "aimless wandering," a finding supported by Chenoweth and Spencer (1986) who found that, in a survey of 152 families, 11% indicated that wandering behavior was the precipitating factor for institutionalization.

The situation is similar within longterm care facilities. In a survey of administrators, directors of nursing, and nursing personnel, Branzelle (1988) found that wandering was perceived to be the leading behavioral problem for longterm care, presenting both the greatest difficulty for behavioral management as well as demanding the greatest amount of staff time. Hepburn, Severance, Gates, and Christensen (1989), in a survey of over 300 longterm care facilities, found wandering to be the behavioral issue

mentioned most frequently. Cohen-Mansfield, Marx, and Rosenthal (1989) found that wandering or "pacing" was one of the most prevalent behaviours displayed by residents in care facilities, and other reports indicate that wandering behaviours may be displayed by 6% to 18% of nursing home residents (e.g., Snyder, Rupprecht, Pyrek, Brekhus, & Moss, 1978). When information is gathered about the prevalence of wandering specifically from nurses ratings (as opposed to direct observation of behavior), the frequency rises even higher. In a cross-sectional survey of 402 residents in a facility, nurses indicated that 39% of the residents were pacers (Cohen-Mansfield, Werner, Marx, & Freedman, 1991). Mann, Graham, and Ashby (1984) and Burns, Jacoby, and Levy (1990) both found a similar result, with 20% of severely demented nursing-home residents being typified as wanderers.

Not only are wandering behaviors prevalent within the AD population, but the prevalence of wandering behaviors within an individual who is known to wander may also be excessive. It is this excessive activity that is one of the hallmarks of the behavior. In a study by Cohen-Mansfield et al. (1991), 55% of the time six individuals were observed, they were pacing. Also, 77% of the time they were observed pacing, they paced constantly and not just intermittently.

Struble and Silverstein (1987) found that 7 of 23 residents wandered, and that they did so 12% of the time. Because wandering can be one of the "risk factors" prompting placement within a facility, and because the behaviour is so prevalent both within the community and within the longterm care facilities, there is an urgent need to understand the causes and consequences of wandering to facilitate the design of appropriate interventions.

Definition of Wandering

The term wandering is one that has been applied to a cluster of behaviors. The definitions given by researchers are so divergent in content as to seem almost arbitrary. Drawing an article at random from the wandering literature, though, one of four overlapping terms will likely be used: wandering (e.g., Snyder et al., 1978), pacing (e.g., Dawson & Reid, 1987), hyperactivity (e.g., Finestone, Larson, Whanger, & Cavenar, 1982), or agitation (e.g., Cohen-Mansfield & Billig, 1986). These terms, though they overlap in their description of some behaviors and uniquely refer to other behaviors, are often used interchangeably (Hope & Fairburn, 1990). Within each of these areas, though, there has been a plethora of definitions. Some restrict wandering to absconding (inappropriate or unauthorized exit from the

residence) (e.g., Namazi, Rosner, & Calkins, 1989), others include difficulty navigating within what should be familiar territory (e.g., Burnside, 1980), visual searching of the environment (e.g., Monsour & Robb, 1982; Snyder et al., 1978) and the performance of other repetitive, stereotypic behaviors (e.g., Hussian & Davis, 1983, cited in Hussian & Davis, 1985). The majority of definitions are much more broad, though, making reference to two seemingly key characteristics of wandering: first, wandering is usually defined as including a high frequency of walking behaviors (Cohen-Mansfield et al., 1991; Dawson & Reid, 1987; Hiatt, 1988) and second, the definition of wandering usually includes ar attribution of aimlessness and/or indeterminable purpose to the excessive activity (Dawson & Reid, 1987; Hussian, 1987; Namazi et al., 1989; Stokes, 1987; Snyder et al., 1978). Stokes' (1987) definition of wandering as "a tendency to keep on the move, either in an aimless or confused fashion, or in pursuit of an indefinable or unobtainable goal" (p. 36) encompasses the salient points identified by the majority of researchers.

Until recently, few researchers focused upon wandering. What has been done, though, has been primarily descriptive in nature; few have attempted any empirical investigation

into what causes wandering. A number of researchers have attempted to typify wanderers and in doing so have assigned some putative causes to the behavior. Snyder et al. (1978) described three patterns of wandering defined according to the purpose of the activity: goal-directed/searching behavior, goal directed industrious behavior, and apparently aimless, non-goal-directed behavior. More recently, Hussian (1987) identified four types of wanderers: the exit seekers, the akathesiacs (neuroleptic induced wandering), the self stimulators, and the modellers (induced through imitating others). Hussian's (1987) typology, though not empirically validated, has been referred to repeatedly in subsequent studies and has been used for post hoc analyses of previous studies. Hope and Fairburn (1990) have also proposed a typology, identifying nine types of behaviors grouped by purpose, by time of occurrence, by outcome, and by frequency. The behaviors are: checking/trailing, pottering, aimless walking, activity with an inappropriate purpose, activity with an appropriate purpose but excessive frequency, excessive activity, night time walking, need to be bought back home, and attempts to leave home. Most recently, Albert (1992), using a Gutman Scaling Analysis to analyze the many behaviors that have been associated with

wandering in the past, concluded that wandering behaviors follow a cumulative, hierarchical pattern and that some behaviors are more typical of wandering than others. He identified the central features of wandering as: "purposeless activity," "aimless walking," "excessive activity," and "purpose not appropriate activity." Although these researchers have attempted to classify different kinds of wandering behaviors, the typologies lack clarity. The categories and causes by which behaviors are classified within typologies tend to overlap and are based upon different dimensions. For example, Hope and Fairburn's (1990) typology includes categories based both on the putative purpose behind the behavior and on the frequency of the behavior. Therefore, although they may provide interesting descriptions of behaviors that could occur, the typologies should not be used as foundations for imputing the underlying cause(s) of wandering.

The final typology of wandering is rather different in the sense that it is specifically based upon a theoretical framework and does not suffer from the aforementioned lack of categorical mutual exclusivity or lack of clarity. It is not so much a typology of wandering as a typology of agitation that includes wandering as one of the three

primary components. A great deal of research conducted by Cohen-Mansfield and associates includes references to wandering behaviors (most frequently referred to as excessive motor behavior or pacing), but these behaviors are included a priori as subtypes of agitation (Cohen-Mansfield et al., 1989). If there is any underlying presumption that ties a great proportion of the wandering literature together it is the typology of agitated behavior proposed by Cohen-Mansfield et al. (1989). In the study, nurses rated the agitated behaviors displayed by 408 cognitively impaired aged residents. The analysis revealed three distinct (orthogonal) factors of agitation: aggressive-physical behaviors, aggressive-verbal behaviors, and nonaggressive-physical behaviors. It is within the final factor, nonaggressive-physical behaviors, that behaviors such as excessive activity and pacing (wandering behaviors) are included. Wandering behaviors are an inextricable part of Cohen-Mansfield's (1986) working definition of agitation, referred to as "inappropriate verbal, vocal or motor activity not explained by apparent needs or confusion per se" (Cohen-Mansfield, 1986, p. 222). It is not surprising, therefore, that in many studies wandering is simply assumed to be a behavioral expression of agitation. In fact, many

of the studies simply adopt this presumption, either explicitly or implicitly, describing wandering behaviors and proposing behavioral and pharmacological interventions based upon the conceptualization (e.g., Cleary, Clamon, Price, & Shullaw, 1988; Curl, 1989).

The urgency to understand wandering rests upon a very complex but predictable set of outcomes that are commonly associated with the behavior. First, wandering behavior is typically associated with safety issues. Rader, Doan, and Schwab (1985), in a survey of professional caregivers, found that 20-25% were aware of either serious injury or death resulting in the case of a cognitively impaired resident, presumed to be an outcome of wandering. Wandering behaviors may lead to danger if impaired individuals leave the safety of the home or the institution by themselves, may lead to an increased probability of falls or other injuries, and may lead to increased fatigue and even unwanted weight loss (Algase, 1992; Hellen, 1992; Hussian, 1987). The problem of safety due to unauthorized exit from facilities has been solved to some extent by the creation of closed units that segregate the cognitively impaired (and especially wanderers) within an area that they are unable to leave (e.g., Cleary et al., 1988; Hall & Buckwalter, 1987).

Within these units, though, the wandering behaviors continue, placing a burden upon the staff who must devote time and energy to behavior management.

Unfortunately, wanderers seem to be at additional risk. When faced with continuous wandering behaviors, the treatment of choice for both doctors and nurses is often physical or chemical restraint (Algase, 1992; Anthony, 1991; Knopman & Sawyer-DeMaris, 1990; Namazi et al., 1989; Pynoos & Stacey, 1986; Teri, Rabins, Whitehouse, Berg, Reisberg, Sunderland, Eichelman, & Phelps, 1992). In a survey of skilled nursing facilities, Cohen-Mansfield et al. (1989) found that when faced with serious behavioral problems, the management approaches included psychoactive drugs 58% of the time and restraints 47% of the time. For wanderers specifically, 68% of the nurses surveyed by Hiatt (1988) indicated that they used restraints for management even though they noted that the treatment of choice was to walk the resident.

When drugs are the treatment of choice, the neuroleptics and the benzodiazapines are the ones most frequently used (Billig, Cohen-Mansfield, & Lipson, 1991; Finestone et al., 1982; Knopman & Sawyer-DeMaris, 1990; Risse & Barnes, 1986). These drugs, though, are effective

for only a minority of patients. In an attempt to control hyperactivity in three residents suffering from dementia, Finestone et al. (1982) explored the efficacy of various drugs. The result was a great deal of very careful experimentation with a wide variety of different drugs, and an outcome where the hyperactivity of only one of the three individuals was controlled. Though intended to safeguard the wanderer, both physical and chemical restraints may also be associated with dangerous side effects (Risse & Barnes, 1986). The restricted mobility that is imposed by physical restraint can lead to physical deterioration including reduced bone mass, reduced muscle strength, impaired balance, reduced circulation, nerve damage and abrasions (Branzelle, 1988; Morishita, 1990). Chemical restraint can lead to a number of impairments including sedation, increased confusion, and increased risk of falls (Morishita, 1990). As a result, the appropriateness of these interventions is being questioned by many (Cohen-Mansfield et al., 1991; Martino-Saltzman, Blasch, Morris, & McNeal, 1991; McGrowder-Lin & Bhatt, 1988; Namazi et al., 1989; Staff, 1987) and alternative behavioral interventions are actively being sought. Successful interventions though, must be based upon more than a description of wandering.

What has been lacking, and is essential to building effective behavioral management techniques, is an understanding of why AD patients wander.

Causes of Wandering in AD

A number of possible causes of wandering have been proposed, but few researchers have empirically investigated the validity of the proposals. The proposals include that wandering is: a search for something or someone (Hiatt, 1988; Snyder et al., 1978); a means of relieving feelings of separation, boredom and/or loneliness (Dawson & Reid, 1987; Rader et al., 1985; Snyder et al., 1978; Stokes, 1987); a response resulting from impaired visuospatial abilities and the resulting reduction in information processing that renders the environment constantly unfamiliar (DeLeon, Potegal, & Gurland, 1984; Hiatt, 1988; Hussian, 1987); a means of relieving stress, tension, frustration or restlessness (Cohen-Mansfield, 1986; Dawson & Reid, 1987; Hiatt, 1988; Monsour & Robb, 1982; Snyder et al., 1978; Stokes, 1987); a means of escaping excessive stimulation (Dawson & Reid, 1987); and a means of generating stimulation (Branzelle, 1988; Hiatt, 1988; Hussian, 1982). All of these proposals could really be summarized within the final two statements, and most of the current behavioral and chemical

interventions are aimed at either producing or reducing stimulation.

It is the conceptualization of wandering as a behavioral response resulting from agitation due to overstimulation, though, that has received the most support both explicitly and implicitly (e.g., treatments proposed) (Cleary et al., 1988; Cohen-Mansfield, 1986; Cohen-Mansfield & Billig, 1986; Cohen-Mansfield et al., 1989; Curl, 1989; Hall & Buckwalter, 1987; Sinha, Zelman, Nelson, Bienenfeld, Thienhaus, Ramaswamy, & Hamilton, 1992; Struble & Silverstein, 1987). Cohen-Mansfield and associates are the most explicit proponents of this theory, but many of the treatments described in nursing texts also adhere to this conceptualization (e.g., Hellen, 1992). The use of neuroleptics for agitation (and therefore wandering), for example, implies the belief that wandering is associated with agitation. Few researchers, though, have attempted to verify this association. Among those who have, some focus upon the premise that overstimulation leads to agitation and that the behavioral response to the agitation is wandering (e.g., Cleary et al., 1988). Others note only the agitation and ignore the putative precipitating source, overstimulation (e.g., Cohen-Mansfield et al., 1989).

Hall and Buckwalter (1987) have developed a theory that specifies that overstimulation causes anxiety and that this anxiety manifests itself in dysfunctional behaviors which include wandering. Proponents of this conceptualization advocate decreasing environmental stimulation as a means of reducing wandering (Cleary et al., 1988; Knopman & Sawyer-DeMaris, 1990). Hall and Buckwalter (1987) and Cleary et al. (1988) suggest simplifying the external environment until the anxious behaviors (wandering) cease; Snyder et al. (1978) suggest reducing stimuli such as excessive personnel, music, and intercom activity; Curl (1989) recommends rest in a quiet area and the reduction of caffeine intake. The efficacy of these simple interventions in reducing wandering, though, has yet to be tested.

Some proponents of this agitation/overstimulation hypothesis attempt to manage wandering by alleviating agitation rather than by eliminating overstimulation (Cohen-Mansfield, 1986). For example, Rosswurm, Zimmerman, Schwartz-Fulton, and Norman, 1986 refer to wandering as a motoric coping response and suggest that the goal of intervention is not to reduce wandering but to ensure the wanderers' safety while not threatening their means of coping. Such interventions also have not been subject to

empirical investigation.

The empirical evidence for the agitation/overstimulation theory of wandering is rather sparse. Cohen-Mansfield et al.'s (1989) analysis revealed three orthogonal factors of agitation. They interpret the physically aggressive behaviors and verbally agitated behaviors as the affectively toned components of agitation and the physically nonaggressive behaviors as the motoric expression of agitation, an interpretation that would lend support to the overstimulation hypothesis. Snyder et al. (1978) also observed that wandering behaviors occurred concurrently with a number of other behaviors classified as agitation based (e.g., screaming). The results of both studies could be interpreted as evidence of a link between wandering and agitation.

The development of interventions based upon the scant information available concerning the nature of wandering has proven tedious and rather unsuccessful. Interestingly, though, case study descriptions of successful interventions reveal that the behavioral techniques are not always based upon the overstimulation hypothesis. Instead, the management possibilities range from techniques based upon an overstimulation hypothesis (e.g., removing the resident from

noise and stimulation) to techniques based upon an understimulation hypothesis (e.g., providing the resident with additional forms of stimulation). Although some individuals have experimented with behavioral management techniques that provide stimulation, the process seems to be analogous to shooting in the dark. People are experimenting with any technique that might prove successful rather than conceiving the interventions based upon a belief that wanderers need stimulation. The exception is Dobbs and Andiel (1994) who have recently proposed and conducted the first direct investigation of understimulation as the cause of wandering. It is the understimulation hypothesis that will be investigated here.

Recent evidence suggests that wandering may not be inevitably linked with agitation (Cohen-Mansfield et al., 1989; Dawson & Reid, 1987). Instead, it may be that dementia patients wander not because of overstimulation or agitation but because the disease process has created a condition of understimulation, and their wandering behaviour is a means of seeking stimulation to meet this chronic need (Dobbs & Andiel, 1994). It is possible that wandering behaviors could be typified as falling within two categories: acute, situationally induced behaviors and

chronic, biologically induced behaviors. It is not proposed that wandering is never a result of agitation. Rather, it is likely that some individuals present wandering behaviors for only a short period of time because of some external, situational factor. It is suggested that for other individuals, wandering may actually be the external expression of an internal, biological imbalance induced by AD. In this chronic condition, AD may affect both the amount and the type of stimulation that the wanderer requires, and the resulting wandering behavior is hypothesized to provide the wanderer with stimulation and/or to provide the wanderer with a means of seeking stimulation. If this understimulation hypothesis proves to be sound, and wandering behavior does not inevitably result from agitation or overstimulation but can be linked with stimulation seeking, then the preferred treatments used to reduce wandering (e.g., reducing environmental stimulation, prescribing neuroleptics) may be inappropriate for some wanderers and may exacerbate the problem.

Evidence for the Understimulation Hypothesis

The empirical evidence available for the understimulation proposal is sparse. The dearth of information, though, is not much more serious than the lack

of empirical support for the accepted overstimulation hypothesis. With the exception of one study by Andiel (1993), who directly investigated the understimulation hypothesis of wandering, most of the evidence for the understimulation hypothesis comes from post hoc interpretations of previous wandering studies. Overall, a number of kinds of evidence would be supportive of the understimulation hypothesis: evidence that agitation and wandering are separable behaviors, evidence that some wanderers do seek out stimulation, evidence that wandering is increased by neuroleptics and decreased by amphetamines, and finally evidence that wandering is increased by reducing stimulation and decreased by increasing stimulation (Dobbs & Andiel, 1994).

Evidence that agitation and pacing behaviors are separable (e.g., that they do not necessarily occur concurrently), would suggest that pacing may not be a simple behavioral expression of agitation. Cohen-Mansfield (1986) provides evidence of the separability of these behaviors through the identification of three different factors of aggressive behaviors: physically aggressive behaviors, verbally agitated behaviors, and physically nonaggressive behaviors. Although Cohen-Mansfield et al. (1989) present

these three factors as the components of aggressive behavior, the results could also be interpreted as indicative of a disassociation between agitation (the first two factors) and wandering (the third factor). Additionally, Werner, Cohen-Mansfield, Braun, and Marx (1989) noted that although pacing was a problem behavior for 50% of those individuals included in their study, in only one case was the pacing associated with another problem behavior. In fact, the pacing showed a bimodal distribution: a resident either displayed pacing behaviors very frequently or not at all whereas agitation revealed no such distribution. Dawson and Reid (1987) found no correlation between the degree of wandering and agitation/aggression. They found that wanderers were more hyperactive than nonwanderers but were no different than nonwanderers on the agitation/aggression dimension. This evidence is suggestive of a disassociation between pacing and agitation. Andiel (1993), in a study specifically designed to investigate the understimulation hypothesis (by directly observing wanderers' behaviors), found that wanderers rarely displayed agitated behaviors, a result contrary to the overstimulation hypothesis and consistent with the understimulation hypothesis.

Further support for the understimulation hypothesis would be evidence that some wanderers seek out stimulation. In the Cohen-Mansfield et al. (1989) study the most important behavior included within the physically nonaggressive factor was pacing. The factor, however, also included other behaviors consistent with stimulus seeking activity (e.g., repetitive mannerisms, general restlessness, trying to get to another place, and repetitive sentences or questions). Hussian and Hill (1980) found that about 87% of some wanderers' time was spent engaged in stereotyped, self stimulatory behaviors, leading to the inclusion of a group of "self stimulators" within their wanderers' typology. Lucero, Hutchinson, Leger-Krall, and Wilson (1993), used a videotaping procedure to achieve an intensive description of wandering behavior. When the wanderers' behaviors were recorded during unstructured times of the day, Lucero et al. (1993) documented the presence and prevalence of behaviors that could be classified as stimulus seeking activities (e.g., initiating social interaction, exploring objects in the environment both visually and tactually). The observed behaviors were interpreted as resulting from a lack of structured activity on the unit and from environmentally induced understimulation. The activities, however, could

also be interpreted as resulting from a biologically induced need for stimulation, further post hoc evidence supportive of the understimulation hypothesis. In a specific investigation of the understimulation hypothesis, Andiel (1993) found that wanderers engaged in stimulus seeking behaviors approximately half the time they were observed, evidence consistent with the understimulation interpretation of wandering. The results from all of these studies lend support to an interpretation suggesting an association between wandering and stimulus seeking.

Neurological studies of the pathology of AD provide further evidence for the understimulation hypothesis. AD is characterized by both cortical degeneration and by a reduction in the neurotransmitter norepinephrine (Rossor, Iverson, Reynold, Mountjoy, & Roth, 1984). Animal studies have revealed an association between reductions in norepinephrine and hyperactivity (Lipsey & Robinson, 1986) as well as some evidence of an association between frontal lobe damage and hyperactivity (Heilman, Voeller, & Nadeau, 1991). Evidence that similar changes occur in those suffering from AD may suggest a physiological link between specific pathological changes and wandering behaviors.

Further evidence consistent with the understimulation hypothesis would be the observation that wandering is increased by neuroleptics and reduced by amphetamines. Hussian (1982; 1987) suggests that there is a group of wanderers for whom the behavior is neuroleptically-induced (akathesiacs). There is also evidence that neuroleptic treatment for wandering is minimally effective (e.g., Finestone et al., 1982). With respect to direct intervention using stimulants, a case study by Hope, Patel, and Series (1991) specifically investigated the efficacy of amphetamines as a treatment for hyperactivity. They targeted a hyperactive dementia patient, and found that during treatment with Dexamphetamine, the woman's behavior swung from 95% wandering behaviors to 90% sitting behaviors, a change that rebounded subsequent to the cessation of the drug therapy. This evidence suggests that wandering behaviors may be responsive to amphetamine treatment, perhaps because of the action amphetamines have in increasing levels of norepinephrine (Hope et al., 1991), and further supports the understimulation hypothesis.

Other evidence for the understimulation hypothesis would be the finding that wandering is increased through the reduction of stimulation. Cohen-Mansfield (1991) found that

pacing occurred more frequently at times of low noise. There is, however, no other evidence for the claim and therefore conclusions with respect to the understimulation hypothesis remain purely speculative.

Other evidence supportive of the understimulation hypothesis would include observing a decrease in wandering behaviors in response to increased stimulation. Cohen-Mansfield, Marx, and Werner (1992) found that, during a three month observational period, repetitious mannerisms and pacing were reduced by social or structured activities. Other evidence exists in the studies investigating the efficacy of behavioral interventions for wandering. The use of stimulus objects (objects that are hypothesized to provide stimulation to the individual) is not new, nursing management texts have long suggested stimulus objects for controlling problem behaviors (e.g., Hellen, 1992). Many have targeted the nursing home population in general, and the cognitively impaired population specifically, but it is only recently that wanderers have been treated as a unique subgroup. Among those researchers who have investigated the efficacy of stimulus presentation with wanderers, there has been no attempt to place the behavioral interventions within a biological, chronic understimulation conceptualization.

The interventions are usually based upon the presumption that a longterm care facility is inherently lacking in meaningful environmental stimulation and that any provision of stimulation is bound to be useful.

Among the few who have empirically investigated the presentation of stimulus objects within a longterm care setting, Francis and Baly (1986) gave nursing home residents (not specifically AD residents) plush animals to keep for a period of eight weeks. The authors used unsystematic staff observations as well as pre- and post-test questionnaire data to investigate a number of variables including mental and psychosocial functioning. The results indicated that the residents who received plush animals showed a post-test improvement as compared with a nonrandom control group. The authors concluded that "apparently, having a new stimulus that is pleasurable to look at, touch, own, care for, and talk about makes a difference--a big difference--even when that something is a plush animal" (1986, p. 142).

In a similar study, Mayers and Griffin (1990) introduced stimulus objects to dementia patients. The authors included a range of objects from a simple, plush dog to a more complex, mechanical "transformer" toy. The

objects were given to the residents, one at a time, for 10 minutes. The authors only measured the amount of time spent with each object, but the results were positive, indicating that the residents displayed a great interest in the various objects. Mayers and Griffin (1990) concluded that the greatest preference was given to objects at around the preschool level of complexity.

In a study by Pollack and Namazi (1992), a group of eight moderate to severely cognitively impaired AD residents participated in six individual treatment sessions with a music therapist. In each session the therapist chose musical activities based upon the resident's known preferences and adapted to the individual's cognitive and motor abilities. A number of behaviors were recorded 15 minutes before and 15 minutes after the sessions. The results indicated a decrease in two types of non-social behaviors, including a decrease in active sensory behaviors (e.g., looking at and touching objects), suggesting that the sessions provided dementia-appropriate stimulation.

Specifically with respect to wanderers, Rosswurm et al., (1986) created an activity room filled with objects intended to provide stimulation. The results of before and after spot checks measuring the location, activity, and

interaction of the wanderers indicated that the wanderers were in the renovated activity room twice as often after the intervention compared to before the intervention, suggesting that the stimulation was attractive to the wanderers.

With a similar purpose, McGrowder-Lin and Bhatt (1988) created a wanderers' lounge program with group sessions including music, exercise and sensory stimulation activities. The results indicated a decrease in wandering post-intervention that the authors attributed to increased fatigue. Another explanation could be that the wanderers' internal need for stimulation was satisfied through the program, leading to reduced wandering.

In another music therapy interaction, Groene (1993) took 30 AD wanderers and assigned them to one of two combinations of activities. Each individual received seven one on one sessions: either five music attention sessions and two reading attention sessions or two music attention sessions and five reading attention sessions. Baseline measures of wandering were obtained using pedometers and cyclometers, and the sessions with the wanderers were videotaped. Results indicated that the wanderers remained seated longer or in close proximity to the sessions longer, when the sessions were music rather than reading oriented.

This suggests that the music was a type of stimulation that the wanderers found appealing.

The results from these studies suggest that the presentation of certain objects and certain types of activity can provide stimulation for longterm care residents in general and for wanderers in particular. Though none of the aforementioned researchers made any attempt to place the behavioral interventions with the context of a causal framework for wandering, the results can be interpreted post hoc as providing some evidence to support the understimulation hypothesis, and as evidence contrary to the overstimulation hypothesis.

If wandering is attributable to understimulation, then the behavioral and environmental interventions based upon the prevalent overstimulation theory are not only likely to be ineffective but they may also exacerbate the problem. The prevalence of wandering, the ineffectiveness of many current behavioral interventions, and the serious risks associated with preferred pharmacological interventions, all highlight the importance of understanding the cause(s) of wandering. Previous studies have attacked the problem by describing the wandering behavior and jumping immediately from behavioral descriptions to designing behavioral

interventions. The step that has been missed is verification of the many assumptions underlying the implementation of these typical physical and chemical interventions. If it can be shown that wanderers do respond positively to an increase in specific increases in stimulation (e.g., reduce wandering) and that they preferentially seek stimulation and do not display any concomitant signs of agitation (besides excessive activity), one would have a basis for beginning to understand one of the factors underlying wandering. This study was an attempt to systematically disentangle the evidence relevant to theories of wandering, and to provide evidence relevant for the foundations necessary for designing interventions that can be both appropriate to and successful for managing wandering behaviours.

Rationale

This study was specifically designed to investigate three hypotheses relevant to the understimulation conceptualization of wandering. The primary purpose of the study was to determine whether providing wanderers with stimulation leads to a reduction in wandering behaviors. The design, though, also facilitated an investigation of two broader issues: whether some wanderers actively seek out

stimulation and whether agitation and wandering behaviors co-occur or are separable behaviors. The study included both an Intervention and a Non-Intervention condition during which residents' behaviors were recorded according to a behavioral coding scheme. For both conditions, the wanderer was identified while wandering, intercepted, and seated. The first 10 minutes of the Intervention condition were devoted to systematically stimulating the wanderer and simultaneously recording behaviors both during this period (called the Stimulation period) and for 10 minutes subsequently (called the Post-Stimulation period). The Non-Intervention condition included 20 minutes of coding to record the behaviors the individual would display under conditions of non-intervention. The Non-Intervention condition was divided into two 10 minute periods (Control and Post-Control). The Control period consisted of the 10 minutes immediately following the moment the resident was seated. The Post-Control period consisted of the final 10 minutes of this condition. Throughout both conditions, coders recorded three categories of behaviors: mobility, agitation, and stimulus seeking.

For the Intervention condition, the experimenter ensured systematic stimulation by presenting the wanderers

with a series of stimulus objects that were chosen to provide visual and tactile stimulation. There is little research directly investigating the systematic use of objects either generally, with those suffering from dementia or specifically, with those who wander persistently. The objects, therefore, were chosen according to the empirical evidence available (e.g., Francis & Baly, 1987; Mayers & Griffin, 1990) and according to experiential reports given in practical care texts (e.g., Hellen, 1992). The purpose of the study was not to determine what would stimulate, but to ensure that each individual was stimulated and that each individual received the same duration of stimulation. To accomplish this, the experimenter presented a series of stimulus objects to the wanderer, one at a time, for a period of 10 minutes. A new object was presented every time the resident showed signs of attenuating attention toward the current object (defined as cessation of stimulus seeking behaviors). These 10 minutes were like a drug "treatment," with each individual receiving the same dose (e.g., an equal duration of stimulation) with the intent of systematically increasing individual levels of stimulation.

With this design, it was possible to compare the behaviors displayed during the first 10 minutes of coding

for both the Intervention and the Non-Intervention conditions (Stimulation and Control periods) to determine whether the provision of continuous stimulation had any effect upon the behavior of the individuals when compared with the behaviors they would have displayed given no intervention. It was also possible to compare the behaviors the residents displayed within the Post-Stimulation period with the behaviors they displayed within the two Non-Intervention periods. The Post-Stimulation and the Control period were compared to determine whether residents behaved any differently immediately after they interacted with the experimenter. Behaviors were also compared between the conditions but within similar time frames, 10 minutes after any observation period began (Post-Stimulation/Post-Control).

It was hypothesized, according to the understimulation hypothesis, that the systematic provision of stimulation would lead to a reduction in wandering behaviors during the period immediately post-stimulation when compared with "normal" wandering behaviors (Control and Post-Control). It was also possible to explore the more general questions of whether wanderers do actively seek stimulation and whether wandering and agitation co-occur. First, it was expected,

according to the understimulation hypothesis, that the wanderers would display stimulus seeking behaviors for a significant portion of their time and that this behavior would co-occur with wandering behavior. Second, it was expected that wanderers would not display agitated behavior and walking behaviors concurrently.

Method

Participants

The participants were residents of two longterm care facilities in Edmonton. The primary selection criterion was a diagnosis of AD, excluding those suffering from concurrent neurological disorders or acute/chronic illnesses that could impair cognition. A list was generated of those residents who met this criterion and the nursing staff were then asked to fill out a questionnaire indicating for each resident: the percent of time per day the resident spent walking, whether the resident was able to move without assistance, and the time of day the resident typically walked (e.g., morning, afternoon, evening, during meals). The ratings for each individual were averaged across staff to calculate an estimate of the mean percent of time each individual spent walking. The additional criteria for inclusion were the ability to move without assistance and a rating indicating

the resident spent 30.0% or more of his or her time walking (our operational definition of wandering).

Nine residents met the above criteria. Four of these were not included in the study. One was eliminated because the experimenter was unable to interrupt his persistent walking behavior and therefore was unable to seat him as demanded by the study design. A second individual was eliminated because she expressed emotional distress (i.e., paranoia) at the sight of the experimenter and coders, and the third resident died prior to the beginning of the study. A fourth individual was initially included but was relocated to another facility before coding could be completed. The group of five that comprised the study were all women, ranging in age from 72 to 87, all of whom had been residents in their facilities for at least one year. These residents were also administered the Mini-Mental State Examination (MMSE) according to the guidelines set out by Folstein, Folstein, and McHugh (1975). The mean score on this cognitive test was 1.4 out of a possible score of 30. Three individuals scored 0, one scored 1 and one scored 6.

Ethogram

A behavioral coding ethogram was used to record resident behaviors (see Appendix A). Three types of

behaviors were recorded: type of mobility, agitation/aggression, and stimulus seeking behaviors. Each of these three behavioral categories was further divided into a list of behaviors that enabled an exhaustive coding of possible behaviors within the category. Within the mobility category, the behaviors were mutually exclusive, only one behavior could occur, and therefore could be recorded, at any one moment. Within the agitation/aggression and the stimulus seeking categories, though, the behaviors were not mutually exclusive; multiple behaviors could occur simultaneously and the observers recorded the expression of all behaviors that were displayed. Though the behaviors within the categories of agitation/aggression and stimulus seeking were not mutually exclusive, the behaviors between the two categories were, therefore any one behavior could be coded as either an agitation/aggression behavior or a stimulus seeking behavior, but never both. Mobility was coded as: stand/lean, sit, walk, and other mobility (e.g., lying down). Agitation/Aggression was coded as: no agitation/aggression, verbal/vocal agitation/aggression, physical agitation/aggression, and other agitation/aggression (e.g., crying). Stimulus Seeking

activities was coded as: no stimulus seeking behaviors, self-oriented tactile stimulation seeking (e.g., rubbing one hand with the other), other-oriented tactile stimulation seeking (e.g., running hands over other surfaces), motor stimulation not identified with a functional instrumental act (e.g., rocking back and forth), motor stimulation identified with a non-functional or imaginary instrumental act (e.g., miming washing the table when there is no identifiable purpose behind the activity), visual stimulation seeking (e.g., focused visual attention to some aspect of the environment), auditory stimulation seeking (e.g., listening to a sound in the environment), social interaction seeking (e.g., initiating or attempting to initiate a conversation with another individual), and other stimulus seeking activities (e.g., talking to self, carrying but not tactually exploring an object). A "not available" code was included in each category of behaviors for use when a the person entered into a "private" activity (e.g., went in own room and closed the door), but this only occurred once during a coding session, and this instance occurred prior to the experimenter's approach to begin the condition. Operational definitions for the codes are available in Appendix A.

Two coders were trained to record behaviors according to this ethogram. The training process began with the intensive observation and discussion of behaviors displayed by residents. Next, coders observed and recorded behaviors for short periods of times, subsequently comparing and analyzing their results to refine categorization and improve reliability. Finally, the coders practiced recording behaviors for sessions that mimicked study procedures.

Procedure

Reliabilities. For just over one third of the coding sessions, two observers conducted simultaneous coding on the same individual in order to provide an interobserver reliability estimate. This resulted in 15 pairs of files. Reliabilities were calculated according to Lehner's (1979) method for calculating Cohen's (1960) Kappa. For each pair of files, a reliability score was calculated for each of the behavioral categories (Mobility, Stimulus Seeking, and Agitation/Aggression). Because the display of agitated/aggressive behaviors was extremely rare, a reliability was calculable for only two files. In all other cases no reliability score could be calculated for agitation/aggression because the frequency for chance agreement was 100% given that the display of behavior never

changed (there was always "no agitation/aggression" in these files). For the two files in which agitation/aggression occurred, the mean reliability of coding for those behaviors was .74. For the stimulus seeking behaviors, the mean reliability was .58, and the mean interobserver reliability for the mobility behaviors was .85.

The mean reliability for the stimulus seeking behaviors, though reflecting interobserver agreement above chance, appears quite low. Equally low reliabilities, though, have been reported by other researchers. Rabinovich and Cohen-Mansfield (1992), when they recorded similar behaviors (e.g., agitation, pacing), reported reliabilities ranging from .63 to .73. Through an examination of the coding of individual stimulus seeking behaviors, it was possible to identify two primary factors contributing to the low reliability for the stimulus seeking category. First, Cohen's kappa is a measure of observed agreement from which chance agreement has been removed. Therefore, if a behavior occurs almost constantly, the probability of chance agreement for that behavior will be very high, and the reliability score will by necessity be low. Second, the kappa calculation also depends upon second by second agreement between coders. If the coders fail to enter a

behavior simultaneously, disagreement results, even if both coders accurately record the same behavior for the same amount of time. Both of these factors played a role in the low reliability for the stimulus seeking category. Some of the individual stimulus seeking behaviors occurred almost constantly, and there was evidence of some sequential lag in behavioral coding.

Behavioral Observations. Resident behaviors were recorded using a modified version of the behavioral ethogram developed by Andiel (1993). Behaviors were recorded continuously for 20 minute sessions using a computer program designed to facilitate data entry. Each behavior observed was recorded, and the computer automatically noted the time of each code entry so that the durations of each behavior were calculable. Three individuals were involved in the study. Two people recorded behaviors (one for all of the sessions and the second for just over one third of the sessions), and the third individual interacted with the residents (the experimenter).

General Procedures. Informed consent was obtained from guardians or from close relatives for each resident who met the criteria for inclusion (see Appendix C).

The study included both an Intervention and a Non-Intervention condition during which residents' behaviors were recorded according to the behavioral coding scheme. The goal of the intervention was to systematically stimulate the wanderers for 10 minutes (Stimulation period), recording behaviors both during the stimulation period and also for 10 minutes subsequently (Post-Stimulation period). The Non-Intervention session included 20 minutes of coding to record the behaviors the individual would display under conditions of non-intervention. Prior to the study, a pilot study was conducted to ensure the feasibility of the methodology (e.g., that wanderers could be successfully intercepted and seated in the room designated for the presentation of stimuli, and to achieve high interobserver reliability) and to investigate the types of objects that would prove stimulating to AD wanderers. In both the pilot testing and in the main study, the wanderers' interactions with the stimuli, and with the person presenting the stimuli, were measured using the behavioral observation technique. Coders recorded the amount of time spent with the stimuli, as well as whether the stimuli were explored (e.g., the amount of tactile and visual searching and manipulation of the object), the variety of ways in which the stimuli were

explored, the amount of time spent in the explorations, and the amount of interaction between the resident and the presenter.

For the actual study, each wanderer was included in two conditions: Intervention and Non-Intervention. One trial consisted of one Intervention session and one Non-intervention session, and each of the five residents participated in four trials. The order of the two conditions within a trial was randomly determined prior to the beginning of a trial, and the experimenter interacting with the residents remained blind to the condition being presented until after the resident was seated. Once the first condition was determined, however, the second condition needed to complete a trial was presented at the next available opportunity.

The beginning of each behavioral coding session was identical regardless of condition. The experimenter, blind to condition, identified an individual while she was wandering and was observed for a brief 30 second coding session to verify the behavior of the individual prior to the experimenter's approach. This procedure ensured, according to the understimulation hypothesis, that residents were identified at a time when they were in "need" of

stimulation, this condition of understimulation was operationally defined as a time when the residents were wandering. Subsequent to the 30 seconds, the experimenter approached the wanderer and persuaded the individual to walk with her and to sit in a designated room. The interaction between the resident and the experimenter during this period was kept to a minimum to reduce extra stimulation. For example, the experimenter only interacted with the wanderer at the time of the initial greeting and at the point where the experimenter attempted to persuade the wanderer to sit. Otherwise, interaction only occurred in response to the wanderer's initiation (in such cases, interaction was limited to the barest response necessary to be polite, e.g., nod or acknowledgement). Once the wanderer was seated, the primary coder (the individual responsible for coding 100% of the time) notified the experimenter of the type of condition to be presented. It was at the point of seating that the structure of the two conditions diverged.

For the Intervention condition, the experimenter presented a series of stimulus objects to the wanderer, one at a time, for a period of 10 minutes. These objects included: a feather duster, a stuffed moose, a collection of fabrics (e.g., silk, velvet, sateen, terry), a piece of

fur, and a metallic ribbon. Objects were chosen to appeal to the tactile and to the visual senses, providing a variety of textures and brilliant colors. A new object was presented every time the resident showed signs of attenuating attention toward the current object (defined as cessation of stimulus seeking behaviors). After the 10 minute stimulation period, the stimulus objects were removed and the experimenter ceased initiating interaction with the resident. Coding, however, continued for another 10 minutes post-intervention. The experimenter remained seated until after the resident got up and left the room. This was in accordance with Hussian's (1987) suggestion that wandering may result from modelling. The experimenter remained seated beyond the time when the wanderer arose of his/her own initiative in order to avoid artificially prompting the behavior and to obtain a measure of the wanderer's internal desire to get up.

The same resident was also included in a Non-Intervention condition. In the same manner as in the Intervention condition, the wanderer was identified while wandering, intercepted, and seated. The experimenter sat and remained seated with the wanderer as in the Intervention condition. She did not, however, provide any stimulation,

nor did she promote any interaction with the resident. Minimal responses were made to interactions initiated by the wanderer so as not to provide aversive stimulation. The Non-Intervention session began at the moment of seating and continued for the next 20 minutes. The first 10 minutes corresponded to the 10 minute Stimulation Period of the Intervention condition and the final 10 minutes corresponded to the Post-Stimulation period of the Intervention condition.

These observation sessions, running from the first 30 second confirmation of wandering until the completion of the 20 minute Intervention or Non-intervention conditions, constitute what will be referred to as the full Intervention and full Non-Intervention sessions. Data from these full observations sessions were included in the analyses investigating the two most general hypotheses: a) that some wanderers actively seek stimulation and, b) that agitated or aggressive behaviors do not co-occur with wandering behaviors. These full sessions were later truncated and further subdivided by time to facilitate the analyses relevant to the primary hypothesis: namely, that systematically providing stimulation to wanderers would result in a reduction in wandering. The full session data

were reduced to include only the observations from the moment the resident was seated, eliminating the data gathered prior to that moment. For the truncated data sets of the Intervention condition, the 20 minute observation sessions were divided into the Stimulation period (the first 10 minutes of coding subsequent to seating) and the Post-Stimulation period (the final 10 minutes of coding). The Non-Intervention condition was partitioned into the Control period (the first 10 minutes of coding after the resident was seated) and the Post-Control period (the final 10 minutes of coding).

Results

By including the five subjects in four trials (with each trial including an Intervention/Non-Intervention pair), there were 40 data files available for analysis. Each file was converted into a file where each behavior recorded throughout the coding session was displayed second by second. Two summary variables were created through recoding. The first variable, Total Stimulus Seeking, summarized the data to indicate only the presence or absence of any stimulus seeking behavior for each second, regardless of the particular type of behavior or combination of behaviors being displayed. Through the same process, a

second variable, Total Agitation/Aggression, was created to indicate the presence or absence of any agitated or aggressive behaviors.

Do Some Wanderers Seek Stimulation?

The full data set was analyzed to determine whether the wanderers did actively seek out stimulation. To do so, Total Stimulus Seeking behavior was calculated for each individual (for each of the full Intervention and Non-Intervention sessions) and was then converted into the percent of time each individual spent engaged in stimulus seeking behaviors. To determine whether some wanderers actually sought stimulation, the Non-Intervention session was of primary interest, representing a period of observation when "normal" resident behavior was only minimally interrupted. As shown in the second column of Table 1, wanderers spent an average 86.6% of their time engaged in stimulus seeking behaviors during the Non-Intervention sessions.

The data were also analyzed to determine whether stimulus seeking activity co-occurred with wandering behaviors. Again looking at the non-intervention sessions, the residents spent less than a quarter of their time walking (see Table 1). During the times that they were

walking, though, the residents also spent an average of 77.9% of their time concurrently stimulus seeking. These results indicate that when left on their own, wanderers did display stimulus seeking behaviors for a major proportion of the time that they were observed. Additionally,

Table 1

Percent of Time Wanderers Displayed Stimulus Seeking Behaviors, Walking Behaviors, Concurrent Walking and Stimulus Seeking Behaviors, and Agitated Behaviors

Behavior	Intervention Condition	Non-Intervention Condition
Stimulus Seeking	87.50	86.60
Walking	15.50	23.50
Concurrent Stimulus Seeking and Walking	63.00	77.90
Agitated Behaviors	0.06	0.00

Note. These percents were calculated from the full session data: including all coded behaviors from the beginning of the 30 second wandering check through to the end of the 20 minute coding sessions.

approximately three quarters of the time that they walked they also engaged in simultaneous stimulus seeking behaviors.

Does Agitation Co-occur with Walking?

The full data set was also analyzed to determine whether there was any support for the second general hypothesis: that agitated behaviors would not occur concurrently with wandering behaviors. Regardless of condition, agitated behaviors only occurred 0.06% of the time. This 0.06% was made up of only 18 seconds of observation time, and was always "Other Agitation/Aggression" (e.g., crying). Although residents were observed walking for 23.5% of the time in the Non-Intervention sessions and for 15.5% of the time in the Intervention sessions, agitation never co-occurred with walking. According to the overstimulation/agitation hypothesis of wandering, overstimulation leads to agitation which is expressed behaviorally as wandering, therefore, agitation and wandering behaviors are expected to occur together. The results from this study, though, are indicative of a disassociation between wandering and agitation behaviors, further supporting the argument that wandering is not necessarily linked with agitation.

Can Wandering be Reduced by Providing Stimulation?

The primary hypothesis and focus of the study was that the systematic provision of stimulation to wanderers would lead to a reduction in wandering behavior (the targeted stimulus seeking behavior) post-stimulation. Implicit was the expectation that other forms of stimulus seeking behavior would also be reduced post-stimulation. These hypotheses were investigated through three planned time-based comparisons. The mobility and stimulus seeking behaviors were compared between: the Stimulation and Control time periods, the Post-Stimulation and Control time periods, and the Post-Stimulation and Post-Control time periods. Within each of these comparisons, two different kinds of information were examined. First, the percent of time each individual spent displaying each behavior (e.g., the percent of time spent walking) was analyzed. Second, the frequency with which each individual displayed each of the behaviors (e.g., the number of times an individual started walking) was analyzed. Subsequent to these specific analyses, one final broad analysis was done using latency data (how long it took each individual to get up and start walking in the Intervention versus (vs.) the Non-Intervention conditions) to investigate whether the

intervention reduced the resident's overall desire to walk.

Multivariate Anal ,is of Variance (MANOVA) was used to analyze these data through a repeated measures, within-subjects design. For the MANOVA analyses on the percent of time spent engaged in behaviors, three different analyses were done. First, resident Mobility was examined, including only the variables "sit" and "walk," second, resident Stimulus Seeking Type was examined including the stimulus seeking variables: "self," "other-oriented tactile," "motor non-instrumental," "visual," "social," and "other" stimulation seeking. Finally, a more broad investigation of Total Stimulus Seeking included only the recoded "total stimulus seeking" category of behavior. The "other" mobility and the "motor instrumental" and "auditory" stimulus seeking behaviors were eliminated from the analyses because they never occurred. Additionally, the "stand" behavior was excluded from the mobility analysis because the behaviors within the mobility category were mutually exclusive. Including all behaviors that had occurred would have created a condition of no variability; the percents for the behaviors displayed would have summed to 100. This problem did not exist for the analysis of Stimulus Seeking Type because the behaviors within this behavioral category

were not mutually exclusive. Multiple types of stimulus seeking behavior could occur simultaneously therefore the percents for each behavior did not sum to 100, in fact when summing across all types of stimulus seeking behaviors displayed it was possible to achieve numbers greater than 100.0% given that multiple behaviors occurred concurrently. This created an interpretation problem. It did not make sense to refer to numbers exceeding 100 as percents. To avoid this problem, the percents included here were divided by 10 (each measurement period was 10 minutes long) to obtain a measure of duration (in minutes) for each type of stimulus seeking behavior. This measure reflected the total duration for which all types of stimulus seeking behaviors were displayed without regard for whether they occurred sequentially or concurrently. For the frequency data only the first two analyses were done (Mobility, Stimulus Seeking Type), the investigation of Total Stimulus Seeking was eliminated.

Stimulation vs. Control: Did Behavior Change?

The first analysis compared the Stimulation and the Control time periods to determine whether the provision of continuous, systematic stimulation for 10 minutes (the intervention) had any effect upon the behaviors of the

individuals relative to the behaviors that they would have normally displayed given no intervention. Mobility and Stimulus Seeking Type were subjected to a 2 x 4 x 2 and a 2 x 4 x 6 (Period x Trial x Behavior) within-subjects repeated measures MANOVA, respectively. Total Stimulus Seeking was subjected to a 2 x 4 (Period x Trial) within subjects, repeated measures MANOVA.

Percent of time spent: Mobility behaviors. When mobility was analyzed, the Between Subjects effect was significant, $F(1,4) = 1655.69$, $p<.001$, indicating that mobility behaviors varied significantly from resident to resident. The predicted Period by Mobility interaction, was nonsignificant, $F(1,4) = 5.77$, $p=.074$. This variation in the display of sitting and walking behaviors within different periods did, however, approach significance as can be seen in the first column of Table 2. The main effect of Mobility was significant, $F(1,4) = 166.49$, $p<.001$, indicating that sitting and walking behaviors were not displayed for equal amounts of time. Averaged across the Stimulation and the Control periods, residents sat 87.0% of the time and walked only 6.2% of the time. The Trial by Mobility, $F(3,12) = 1.56$, $p=.251$, the Trial by Period by Mobility, $F(3,12) = 1.66$, $p=.229$, and the Trial by Period,

$F(3,12) = 1.07$, $p=.399$, interactions were all nonsignificant.

Table 2

The Percent and Frequency of Mobility Behaviors Displayed

Intervention Condition				
Mobility Behaviors	Stimulation		Post-Stimulation	
	Percent	Frequency	Percent	Frequency
Sit	97.68	1.00	74.40	1.05
Walk	0.18	0.10	15.04	2.00
Non-Intervention Condition				
Mobility Behaviors	Control		Post-Control	
	Percent	Frequency	Percent	Frequency
Sit	76.22	1.25	62.98	1.20
Walk	12.38	1.95	22.06	3.75

Both the main effect of Trial, $F(3,12) = 1.43$, $p=.282$, and the main effect of Period, $F(1,4) = 3.46$, $p=.137$, were also nonsignificant, indicating that regardless of trial or of time period the percent of time spent either sitting or walking (mean of 97.9% in the Stimulation period and 88.6% in the Control period) did not change significantly.

The Mobility by Period interaction was expected given that the design of the study demanded that residents remain seated for 10 minutes of stimulation (Stimulation), a period of seating that was expected to differ significantly from their normal, wandering behavior (Control). This expectation was not met. There was no significant variation in sitting and walking behaviors when the Stimulation and Control periods were compared. Overall, mobility behaviors varied significantly among residents and sitting and walking behaviors were not displayed equally often, regardless of the observation period.

Frequency of mobility behaviors. When the individuals were compared on the frequency with which they displayed the mobility behaviors in the Stimulation and the Control periods, the picture shifted somewhat. Again, the Between Subjects effect was significant, $F(1,4) = 50.66$, $p=.002$. However, unlike the previous analysis, the main effect of

Mobility was nonsignificant, $F(1,4) = 0.11$, $p=.753$, but the main effect of Period was significant, $F(1,4) = 11.45$, $p=.028$. Summed across periods, residents sat (2.25) as frequently as they walked (2.05), but the frequency of both sitting and walking behaviors was significantly different across the Stimulation and the Control periods (1.10 and 3.20 respectively). The Period by Mobility interaction was also significant, $F(1,4) = 7.94$, $p=.048$, indicating that the frequency of sitting and standing varied according to the period within which the residents were coded (see Table 2). The main effect of Trial was nonsignificant, $F(3.12) = 0.35$, $p=.793$ as were all of the other interactions (all F's < 1.04).

Summary. The significant main effect of Period and significant Mobility by Period interaction found in the frequency analysis seem to confirm one of the premises of the intervention methodology: that seating the residents and involving them in an intense period of stimulation would significantly alter their normal mobility behavior. This finding must be interpreted in light of the percent data, though, where the main effect of Mobility was significant and the Mobility by Period interaction was nonsignificant. Although the residents did display a significantly lower

frequency of sitting and walking behaviors in the Stimulation period when compared with the Control period, they did not spend a significantly greater percent of their time sitting and walking during the Stimulation period when compared with the Control period. More informative overall, the main effect of Mobility indicated that sitting behaviors were displayed for a much greater proportion of time than walking behaviors, regardless of observation period.

Percent of time spent: Stimulus seeking behaviors. When Stimulus Seeking Type was compared between the Stimulation and the Control periods, the Between Subjects effect was significant $F(1,4) = 363.94$, $p<.001$. The main effect of Period was also significant, $F(1,4) = 277.02$, $p<.001$. Summing across the different types of behaviors, stimulus seeking behaviors were displayed for a total of 17.92 minutes in the Stimulation period and 8.33 minutes in the Control period, irrespective of whether the behaviors occurred simultaneously or sequentially. The statistically reliable main effect of Stimulus Seeking Type, $F(5,20) = 10.60$, $p<.001$, indicated that the different behaviors were also not displayed for the same duration. Summed across observation periods, "self," "other tactile," "motor non-instrumental," "visual," "social," and "other" stimulus

seeking behaviors were displayed: 1.37, 1.93, 0.46, 0.43, 5.51, and 3.42 minutes respectively. The Period by Stimulus Seeking Type interaction was also significant, $F(5,20) = 12.56$, $p<.001$, indicating that the display of the different behaviors varied significantly depending upon the period within which the resident was coded, as indicated in the first columns of Tables 3 and 4. There was also a three way Trial by Period by Stimulus Seeking Type interaction, $F(15,60) = 2.18$, $p=.017$, indicating that the display of behaviors varied not only according to the period but also according to the trial within which the residents were coded within a period. As can be seen, though, in Appendix B (Tables I and II), this variation was not according to any apparent pattern. Finally, the main effect of Trial was nonsignificant, $F(3,12) = 0.18$, $p=.907$, as were the Trial by Stimulus Seeking Type, $F(15,60) = 1.29$, $p=.238$, and the Trial by Period, $F(3,12) = 1.14$, $p=.373$, interactions.

Frequency of stimulus seeking behaviors. When the frequency data were analyzed (Stimulation vs. Control) the Between Subjects effect was significant, $F(1,4) = 128.92$, $p<.001$. The main effect of Stimulus Seeking Type was also significant, $F(5,20) = 5.46$, $p=.003$, indicating that the

Table 3

The Percent and Frequency of Different Stimulus Seeking Behaviors in the Intervention Condition

	Intervention Condition			
Stimulus Seeking Behaviors	Stimulation		Post-Stimulation	
	Percent	Frequency	Percent	Frequency
Self	10.40	1.95	21.64	3.70
Other Tactile	31.12	5.10	13.66	2.40
Motor N-I[1]	5.50	1.10	5.82	1.15
Visual	4.00	0.55	1.94	0.45
Social	82.64	2.70	28.88	3.10
Other	45.50	2.10	25.18	2.55

[1]Motor Non-Instrumental

Table 4

The Percent and Frequency of Different Stimulus Seeking Behaviors Within the Non-Intervention Condition

	Control Condition			
Stimulus Seeking Behaviors	Control		Post-Control	
	Percent	Frequency	Percent	Frequency
Self	17.08	3.00	13.64	2.90
Other Tactile	7.38	1.95	10.18	2.55
Motor N-I[a]	3.76	0.55	2.14	0.40
Visual	4.64	0.55	4.44	0.40
Social	27.58	3.85	12.06	2.25
Other	22.86	2.10	24.14	2.20

[a]Motor Non-Instrumental

frequency with which the different stimulus seeking behaviors occurred was not equal. The average frequency of "self," "other tactile," "motor non-instrumental," "visual," "social," and "other" stimulus seeking behaviors (regardless of observation period) was: 2.48, 3.53, 0.83, 0.55, 3.28, and 2.10 respectively. Not expected, there was also a Trial by Stimulus Seeking Type interaction, $F(15,60) = 2.12$, $p=.021$, indicating that the frequency with which different stimulus seeking behaviors occurred varied according to the trial within which the residents were coded. As can be seen in Tables III and IV of Appendix B, though, this variation did not form any apparent pattern. Neither the main effect of Trial, $F(3,12) = 0.73$, $p=.551$, nor the main effect of Period, $F(1,4) = 1.03$, $p=.368$, was significant. Additionally, the Period by Stimulus Seeking Type interaction, $F(5,20) = 2.22$, $p=.093$, the Trial by Period interaction, $F(3,12) = 1.17$, $p=.361$, and the Trial by Period by Stimulus Seeking Type interaction ($F < 1.00$), were all nonsignificant.

Summary. Regardless of whether the residents were observed in the Stimulation or the Control periods, the percent of time that they spent engaged in and the frequency with which they engaged in different stimulus seeking

behaviors varied significantly within the behavioral category. The top four ranked stimulus seeking behaviors (both according to percent of time and frequency) were: "self," "other tactile," "social," and "other" behaviors. Although there was no difference in the frequency of different behaviors as a function of the period within which residents were coded, there was a significant main effect of Period for the duration of stimulus seeking behaviors. The amount of time residents spent in different stimulus seeking behaviors (regardless of whether those behaviors occurred concurrently or sequentially) was significantly higher in the Stimulation period when compared with the Control period. Additionally, for the percent data, there was an interaction between Period and Stimulus Seeking Type: the amount of time spent stimulus seeking altered as a function of Period. These findings suggest that the intervention was successful in facilitating a significant increase in the amount of time spent stimulus seeking when compared with the stimulus seeking voluntarily engaged in during a non-intervention period.

Percent of time spent: Total stimulus seeking. When overall stimulus seeking activity was analyzed disregarding the different kinds of stimulus seeking behavior, and

focusing on the total amount of time spent in any stimulus seeking activity (Stimulation vs. Control), the Between Subjects effect was significant, $F(1,4) = 776.87$, $p<.001$ as was the main effect of Period, $F(1,4) = 37.47$, $p=.004$. The Trial by Period interaction was nonsignificant, $F(3,12) = 1.11$, $p=.385$, as was the main effect of Trial ($F < 1.00$). As seen in the first and third columns of Table 5, the amount of time residents spent engaged in any type of stimulus seeking activity was significantly raised through the intervention. Even given the high percent of time residents normally spent engaged in stimulus seeking behaviors, the intervention was successful in significantly increasing the total amount of activity.

Summary. The intervention of systematic stimulation was successful both in increasing the amount of time residents spent stimulus seeking, regardless of whether the different behaviors were displayed simultaneously or sequentially, and in increasing the total amount of time residents spent engaged in any type of stimulus seeking activity. The intervention met its mandate to increase stimulation, both quantitatively and qualitatively changing stimulus seeking behaviors.

Table 5

Percent of Time Spent Engaged in Any Type of Stimulus Seeking Activity (Total Stimulus Seeking)

Intervention Condition		Non-Intervention Condition	
Stimulation	Post-Stimulation	Control	Post-Control
97.06	71.52	69.88	55.34

Post-Stimulation vs. Control: Did Behavior Change?

The second investigation of the primary hypothesis compared the behaviors displayed within the Post-Stimulation period with those displayed in the Control period. The goal was to compare the residents' behaviors immediately subsequent to the cessation of the experimenter-resident interaction. For the Intervention condition this period began 10 minutes after the residents were seated (Post-Stimulation period), for the Non-Intervention condition this period began immediately after the residents were seated (Control period). The Mobility and Stimulus Seeking Type data were subjected to a 2 x 4 x 2 and a 2 x 4 x 6 (Period x Trial x Behavior) within-subjects repeated measures MANOVA, respectively. Total Stimulus Seeking was subjected to a 2 x

4 (Period x Trial) within-subjects, repeated measures MANOVA.

Percent of time spent: Mobility behaviors. When mobility behaviors were analyzed, the Between Subjects effect was significant, $F(1,4) = 1643.21$, $p<.001$, as was the main effect of Mobility, $F(1,4) = 15.67$, $p=.017$. Regardless of period, the residents spent a greater percent of their time sitting (mean, 75.31%) than they spent walking (mean, 13.71%). The interaction of Trial by Mobility was also significant, $F(3,12) = 12.57$, $p=.001$, indicating that the percent of time spent sitting and walking varied significantly among trials. There was, however, no apparent pattern to this variation (see Appendix B, Table V). The main effect of Period and the Period by Mobility interaction were both nonsignificant, F's < 1.00. The main effect of Trial was nonsignificant, $F(3,12) = 2.31$, $p=.128$, as were the Trial by Period and Trial by Period by Mobility interactions (both F's < 1.00).

Frequency of mobility behaviors. The frequency analysis of the mobility behaviors (Post-Stimulation vs. Control) revealed a significant Between Subjects effect, $F(1,4) = 45.62$, $p = .003$. As in the percent analysis, the Trial by Mobility interaction, was significant, $F(3,12) =$

4.00, p=.035 indicating that the frequency of the different mobility behaviors varied according to the trial within which the residents were coded. Again, however, there was no apparent pattern to this change (see Appendix B, Table VI). The main effect of Mobility, though, was not significant as it was in the percent analysis. It did, however, approach significance, $F(1,4) = 6.35$, p=.065. All other main effects and interactions were nonsignificant (all F's < 1.00).

Summary. The hypothesis most basic to this investigation was that providing individuals with systematic stimulation would lead to a post-stimulation reduction in wandering behavior. This hypothesis was not confirmed, there was no significant change in either the amount of time or the frequency with which the residents engaged in sitting and walking behaviors when the Post-Stimulation and Control periods were compared. As can be seen in Table 2, regardless of period, the residents spent the majority of their time sitting.

Percent of time spent: Stimulus seeking behaviors. Comparing the Post-Stimulation and the Control periods, the Between Subjects effect was significant, $F(1,4) = 130.96$, p<.001, indicating a significant variation in the individual

display of behaviors. The main effect of Stimulus Seeking Type was also significant, $F(5,20) = 3.89$, $p=.013$, indicating that the different types of stimulus seeking behaviors were not displayed for equal portions of time, an effect similar to that described previously in the comparison between the Stimulation and the Control periods. Neither the Trial by Stimulus Seeking Type, the Period by Stimulus Seeking Type, nor the Trial by Period by Stimulus Seeking Type interactions were significant (all F's < 1.00). The main effect of Trial was also nonsignificant as were all other interactions (all F's < 1.00).

Frequency of stimulus seeking behaviors. The Between Subjects effect (Post-Stimulation vs. Control) was significant, $F(1,4) = 53.84$, $p=.002$. The main effect of Trial was also significant, $F(3,12) = 6.24$, $p=.008$. Although the frequency of different stimulus seeking behaviors varied significantly from trial to trial, it did not do so according to any discernible pattern (see Appendix B, Table VII). The Trial by Period and Trial by Period by Stimulus Seeking Type interactions were not significant (both F's < 1.00). Nor was the Trial by Stimulus Seeking Type interaction, $F(15,60) = 1.70$, $p=.075$. The main effect of Period, though, was significant, $F(1,4) = 8.68$, $p=.042$,

indicating that the frequency with which the different stimulus seeking behaviors were displayed varied significantly between the Post-Stimulation (sum=13.35) and the Control (sum=12.00) periods. The main effect of Stimulus Seeking Type and all other interactions were nonsignificant (all *F*'s < 1.00).

Summary. The percent of time that the residents spent engaged in different stimulus seeking behaviors was not significantly altered in the Post-Stimulation period when compared with the behaviors displayed in the Control period. The frequency with which the residents engaged in the various stimulus seeking behaviors, though, was significantly higher in the Post-Stimulation period than in the Control period. Although this result seems to confirm a change of behavior in the Post-Stimulation period, given the lack of any significant change in the percent data the interpretation suggested is that individuals simply started and stopped the various stimulus seeking behaviors more frequently although they showed no increase or decrease in the amount of time they actually spent displaying such behaviors. Regardless of the interpretation, the change was not consistent with that which was hypothesized.

Percent of time spent: Total stimulus seeking. When total stimulus seeking activity was analyzed (comparing Post-Stimulation and Control), only the Between Subjects effect was significant, $F(1,4) = 248.37$, $p<.001$. Residents displayed significantly different amounts of stimulus seeking activity. The main effect of Period, $F(1,4) = 1.44$, $p=.297$, was nonsignificant, as were all other results (all F's < 1.00).

Summary. The intervention had no significant effect upon the total amount of stimulus seeking in which the residents engaged Post-Stimulation when compared with the total amount of stimulus seeking behavior in which they engaged normally during the Control period (see Table 5).

Post-Stimulation vs. Post-Control: Did Behavior Change?

The third investigation of the primary hypothesis compared the Post-Stimulation and the Post-Control periods, to determine whether the behaviors displayed were significantly different when they were compared within identical timeframes: 10 minutes after the residents were seated. As previously, Mobility and Stimulus Seeking Type were subjected to a 2 x 4 x 2 and a 2 x 4 x 6 (Period x Trial x Behavior) within-subjects repeated measures MANOVA, respectively. Total Stimulus Seeking was subjected to a 2 x

4 (Period x Trial) within-subjects, repeated measures MANOVA.

Percent of time spent: Mobility behaviors. The only significant result (Post-Stimulation vs. Post-Control) was a Between Subjects effect, $F(1,4) = 819.92$, $p<.001$, indicating that the percent of time spent in the different behaviors varied significantly among residents. The main effect of Mobility was not significant, though it approached significance, $F(1,4) = 6.38$, $p=.065$. The Trial by Mobility interaction was also non-significant, $F(3,12) = 1.27$, $p=.330$, as were all other main effects and interactions (all F's < 1.00).

Once again, the primary hypothesis was not confirmed. The hypothesized decrease in walking behavior post-stimulation did not materialize. Although sitting and walking behaviors were not reliably different, nor were they displayed equally. Sitting behavior occurred for a mean of 68.69% of the time and walking behavior occurred for a mean of 18.55% of the time (across periods). There was also no differential change in the display of sitting and walking behaviors according to the period within which the residents were observed as can be seen by comparing the Post-Stimulation and Post-Control periods in Table 2.

Frequency of mobility behaviors. Once again there was a significant Between Subjects effect (Post-Stimulation vs. Post-Control), $F(1,4) = 27.60$, $p=.006$. The main effect of Mobility was also significant, $F(1,4) = 7.40$, $p=.053$, indicating that the overall frequency of sitting behaviors (sum=2.25) and walking behaviors (sum=5.75) varied significantly. The Period by Mobility interaction, though, was nonsignificant, $F(1,4) = 1.32$, $p=.315$, as was the Trial by Period by Mobility interaction, $F(3,12) = 1.39$, $p=.292$. Additionally, the main effect of Trial, the main effect of Period, the Trial by Mobility interaction and the Trial by Period interaction were all nonsignificant (all F's < 1.00). Although sitting and walking behaviors did not occur equally frequently when summed across periods, the predicted reduction in the frequency of walking behaviors Post-Stimulation was not confirmed.

Summary. Based on the primary hypothesis, a decrease in walking behavior subsequent to the intervention as compared with normal walking behavior, was predicted. As in the previous comparison (Post-Stimulation vs. Control), the hypothesis was not confirmed. Sitting and walking behaviors did not alter as a function of observation period for either the duration or the frequency data (Mobility by Period

interaction). The residents did display a significantly different frequency of sitting and walking behaviors, displaying walking behaviors much more frequently overall than sitting behaviors. This finding is, however, misleading, because although the percent of time the residents spent sitting and walking did not differ reliably, it approached significance with the residents actually spending more time sitting than walking in both the Post-Stimulation and the Post-Control periods. The residents must have walked more often but for shorter periods of time Post-Stimulation, a result not consistent with the hypothesis.

Percent of time spent: Stimulus seeking behaviors. As in all other cases, the Between Subjects effect (Post-Stimulation vs. Post-Control) was significant, $F(1,4) = 84.83$, $p=.001$. This effect, however, was the only significant result. The main effect of Stimulus Seeking Type, $F(5,20) = 2.45$, $p=.069$, was nonsignificant, as were all the remaining main effects (all F's < 1.00). Additionally, the Period by Stimulus Seeking Type, $F(5,20) = 1.54$, $p=.224$, the Trial by Stimulus Seeking Type, $F(15,60) = 1.07$, and all other interactions (all F's < 1.00) were nonsignificant. When the Post-Stimulation and Post-Control

periods were compared, only the interindividual variability was significant.

Frequency of stimulus seeking behaviors. The results here were much the same. Analyzing the various stimulus seeking behaviors (Post-Stimulation vs. Post-Control), only the Between Subjects effect was significant, $F(1,4) = 32.26$, $p=.005$. The main effect of Trial was nonsignificant, $F(3,12) = 1.49$, $p=.268$, as were all of the remaining main effects (all F's < 1.00). The main effect of Period approached reliability, $F(1,4) = 5.99$, $p=.071$, with the different stimulus seeking behaviors summing to 97.12 in the Post-Stimulation period and to 66.60 in the Post-Control period. The Trial by Period interaction, $F(3,12) = 1.22$, $p=.345$, was nonsignificant as were all of the remaining interactions, (all F's < 1.03).

Summary. Neither the percent of time spent nor the frequency with which the different stimulus seeking behaviors were displayed varied reliably between the Post-Stimulation and the Post-Control periods, although the frequency data approached significance. The types of stimulus seeking behaviors displayed Post-Stimulation were also not significantly different from those engaged in naturally.

Percent of time spent: Total stimulus seeking. Comparing the Post-Stimulation and the Post-Control periods, the Between Subjects effect was significant, $F(1,4) = 106.91$, $p<.001$, indicating that the residents spent significantly different amounts of their time stimulus seeking. The main effect of Period, $F(1,4) = 4.93$, $p=.91$, was nonsignificant as was the main effect of Trial and the interaction of Trial by Period (both F's < 1.00).

Summary. When the total amount of stimulus seeking behavior was considered, there was no significant variation in behavior Post-Stimulation. As found in the Post-Stimulation/Control analysis, the 10 minute period of systematic stimulation that was expected to reduce the residents' subsequent need to seek stimulation did not do so (as measured here); the total amount of stimulus seeking activity did not vary significantly from that displayed in the Post-Control period, as can be seen from the second and last columns of Table 5.

Latency: How Long Did The Residents Wait to Get Up and Walk?

None of the previous results supported the primary hypothesis that a period of intense stimulation would reduce walking behavior immediately Post-Stimulation. One final

piece of evidence would support the effectiveness of the intervention: if the residents remained seated longer in the Intervention condition when compared with the Non-Intervention condition. To examine this hypothesis, the data were used to calculate the time from the moment the resident was seated until the first moment the resident began walking (latency to first walk). For this one analysis the different time periods were no longer of concern. Instead, the 10 minute Stimulation and Post-Stimulation periods were summed to become the Intervention condition; the 10 minute Control and Post-Control periods were summed to become the Non-Intervention condition.

Latency was analyzed through a 2 x 4 (Condition by Trial) within-subjects repeated measures MANOVA. As was the trend previously, the Between Subjects effect was significant, $F(1,4) = 99.79$, $p=.001$, the residents varied significantly in the time they took to get up after being seated. The main effects of Trial and Condition were nonsignificant (both F's < 1.00) as was the Condition by Trial interaction ($F < 1.00$). Although the residents remained seated for an average of 16.7 minutes in the Intervention condition, they also remained seated for an average of 11.7 minutes in the Non-Intervention condition.

There was no reliable difference between the Intervention and Non-Intervention conditions in the latency to first walk. The hypothesis was not confirmed.

Interesting Behavioral Patterns

Throughout the analyses, one result stands out among all others: the residents included in this study varied significantly on every type of behavior measured. Some of these variances are worthy of note. Among the behaviors recorded, it was the behavior of primary interest, mobility, that revealed the greatest interindividual variation. For the five residents, the percent of time that they spent walking ranged from 0.0% to 0.9% in the Stimulation period, from 0.0% to 51.9% in the Post-Stimulation period, from 0.0% to 31.6% in the Control period, and from 0.0% to 54.9% in the Post-Control period. Among residents whose primary criterion for inclusion in the study was a rating indicating that they wandered 30.0% of more of their time, only two residents approached or met the criterion during the measurement period. When wandering behavior was examined during the periods of non-interference, Control and Post-Control, one resident walked an average of 24.0% of her time, the other walked an average of 43.3% of her time. The other three residents walked an average of 0.0%, 9.5%, and

9.4% of their time respectively.

The latency data also revealed significant interindividual variation. In the Non-Intervention condition, latency to first walk ranged from 5.98 minutes to 20.00 minutes, with a standard deviation of 5.40 minutes. In the Intervention condition, latency to first walk ranged from 14.48 minutes to 20.00 minutes with a standard deviation of 2.30 minutes. Again, the same two residents stood out, presenting a different pattern from the other three residents. These two residents showed a pattern with a high latency to first walk in the Intervention condition (20.00 minutes and 14.48 minutes respectively) and a much shorter latency to first walk in the Non-Intervention condition (8.26 minutes and 5.98 minutes respectively). The other three individuals did not show such a clear trend, sitting for an average of 18.19 minutes, 15.65 minutes, and 15.40 minutes respectively within the Intervention condition and an average of 20.00 minutes, 10.97 minutes, and 13.19 minutes respectively within the Non-Intervention condition. It is interesting to note that the two residents who displayed a tendency to walk closest to the criterion were also the two who showed the greatest change in latency, sitting an average of 11.74 and 8.5 minutes longer

(respectively) in the Intervention condition than in the Non-Intervention condition. It is possible that the interindividual variability displayed here was not simply an expression of random variation among wanderers but was indicative of systematic differences among the individuals which, if identified, might prove informative in developing an intervention that would significantly reduce latency to first walk.

Interindividual variation in the display of stimulus seeking behaviors was not as extreme as that for the display of mobility behaviors. Regardless of observation period, residents spent a great amount of time engaged in stimulus seeking activities. In the Stimulation period the total amount of stimulus seeking among the five individuals ranged from 92.5% to 100.0%, in the Post-Stimulation period it ranged from 60.9% to 84.8%, in the Control period it ranged from 56.0% to 87.1%, and in the Post-Control period it ranged from 31.5% to 88.8%. For each of the five residents, the percent of time spent in any stimulus seeking behavior varied within the different periods, but remained high (see Appendix B, Table VIII). In the three observation periods where there was no prolonged interaction with the experimenter (Post-Stimulation, Control, and Post-Control

the total amount of time each resident spent in some kind of stimulus seeking activity was 49.6%, 44.2%, 52.6%, 53.1%, and 62.2% respectively.

Also of note, the main effect for stimulus seeking behaviors was almost always significant among the MANOVA analyses. What is of interest is the different types of stimulus seeking behaviors that were displayed by residents who clearly spent a significant proportion of their time engaged in such behaviors. Motor instrumental and auditory stimulus seeking behaviors (as defined) simply never occurred. Among the other stimulus seeking behaviors, though, four were consistently the most common regardless of observation period: "self," "other tactile," "social," and "other" stimulus seeking behaviors (see Tables 3 and 4). Also worthy of note, within this final category of "other" stimulus seeking the behaviors displayed were almost exclusively either "carrying an object" or "talking to oneself". Finally, although the residents varied in their display of these different types of stimulus seeking behaviors, the behavioral pattern did not vary greatly from resident to resident, each preferentially displayed the aforementioned behaviors, though they perhaps varied in rank order. Regardless of how the data are broken down, it is

impossible to escape the conclusion that all of these wanderers consistently engaged in stimulus seeking behaviors.

Discussion

The overall goal of this study was to determine whether individuals wander because they are understimulated rather than overstimulated; to determine whether they wander because they are seeking stimulation or because a condition of overstimulation has led to agitation that is expressed in the form of wandering. The specific goal, though, was to determine whether providing systematic stimulation to wanderers for a period of time would reduce the subsequent display of wandering and stimulus seeking behaviors.

The Understimulation Hypothesis: Is There Any Evidence?

The proponents of the agitation/overstimulation hypothesis of wandering (e.g., Cohen-Mansfield et al., 1989) suggest that a condition of overstimulation leads to agitation which is expressed behaviorally as wandering. Within this conceptualization, wandering is a priori assumed to be a manifestation of agitation and, as such, an episode of wandering is interpreted as a display of agitation. The empirical evidence for this assumption, however, is sparse (Cohen-Mansfield et al., 1989; Snyder et al., 1978). There

is, in fact, a body of evidence that could be interpreted post hoc to support the contrary hypothesis (Branzelle, 1988; Dawson & Reid, 1987; Hiatt, 1988; Hussian, 1987; Lucero et al., 1993; Rosswurm et al., 1986; Werner et al., 1989). In accordance with this evidence, Dobbs and Andiel (1994) have proposed that wandering may not be a form of agitation resulting from overstimulation but may instead be a means of seeking stimulation to meet a need for stimulation that is biologically induced through the disease process. The current study investigated the understimulation hypothesis by examining two corresponding premises. The first premise, predicted by the understimulation hypothesis, was that wandering and stimulus seeking behaviors would be associated. The second premise, contrary to the agitation/overstimulation hypothesis, was that wandering and agitated behaviors would not be associated.

The current study provides strong empirical support for the understimulation rather than for the agitation/overstimulation conceptualization of wandering. When wanderers were observed during times of non-interference, they spent a great proportion of their time (86.6%) engaging in stimulus seeking behaviors.

Additionally, much of the stimulus seeking behavior co-occurred with wandering: when residents were walking they spent approximately three quarters of their time concurrently engaged in stimulus seeking behaviors.

The finding that wandering behavior is associated with stimulus seeking activity is consistent with some previous descriptions of wandering behavior. In this regard, Hussian (1987) proposed a typology of wandering that included a separate category of wanderers characterized by the display of "self stimulatory" behaviors. The evidence is also consistent with Lucero et al. (1993) who observed wanderers and recorded their daily activities and behaviors, reporting that wanderers voluntarily engaged in a wide variety of behaviors consistent with stimulation seeking (as defined here), and that these behaviors were observed to occur for a major portion of the wanderers' unstructured time. Rosswurm et al. (1986) filled a room with objects to provide the opportunity for stimulation. The authors recorded the residents' use of the room, both prior to and subsequent to the inclusion of the stimulus objects, noting that wanderers were found in the room twice as frequently subsequently. Most notable, though, the results reported in the current study replicate those of Andiel (1993). Andiel (1993)

systematically recorded the behavior of wanderers at regular intervals throughout the day and found that wanderers spent a great deal of their time stimulus seeking (40.0% to 54.0%) and concurrently stimulus seeking and walking (33.0% to 55.0%). These percents are lower than those recorded in the current investigation. The differential findings, though, may be explained by a difference in methodology. The current study was designed not just to describe the behavior of wanderers but to test the understimulation hypothesis. This test began with the identification of wanderers while they were "in need" of stimulation. This time of "need" was identified as a time when the individuals were actually walking, in accordance with the framework of the understimulation hypothesis. It is not surprising, therefore, that the residents displayed stimulus seeking behaviors for such a high percent of the time they were observed in that these observation times were designed to coincide with a need for stimulation. The study by Andiel (1993) had prescheduled times for observation which were independent of the participants' behaviors. Nevertheless, the evidence that wanderers do actively seek out stimulation is building, providing support for an understimulation conceptualization of wandering.

The other type of evidence explored here was whether wandering and agitated behaviors were associated. According to the agitation/overstimulation hypothesis, wandering is classified as one behavioral manifestation of agitation (e.g., Cohen-Mansfield et al., 1989) However, empirical evidence supportive of this is meagre. Snyder et al. (1978) did report the co-occurrence of wandering behaviors and agitated behaviors. The primary evidence, though, comes from Cohen-Mansfield et al. (1989) who identified three orthogonal factors of agitated behavior, including one labelled "physically nonaggressive behaviors," which included wandering behaviors. As one factor of this tripartite breakdown of agitated behaviors, wandering was assumed to be a behavioral expression of agitation and/or aggression. The results of the current investigation, though, do not confirm this inference.

Verification of the agitation/overstimulation hypothesis would include empirical evidence that wanderers display agitated behaviors and that some displays of agitation co-occur with episodes of wandering. In the current study, wanderers rarely displayed agitated behaviors (0.06% of the time they were observed) but when they did display agitation, it never co-occurred with wandering.

This result is consistent with the understimulation hypothesis, but is inconsistent with the overstimulation hypothesis.

Instead, the results provide some evidence supportive of a disassociation between agitation and wandering. The observed lack of concurrence between wandering and agitated behaviors is consistent with the findings of some previous studies. Werner et al. (1989) observed a group of individuals who paced over 50.0% of the time that they were observed. Within this group, however, only one individual displayed any other concurrent problem behavior (not identified necessarily as agitation). The results are also consistent with those of Dawson and Reid (1987) who reported no correlation between the degree of wandering and agitated behaviors, and with Andiel (1993) who recorded agitated behaviors in wanderers less than 1.0% of the time they were observed. There is strong support for the conclusion that there is not a necessary association between wandering and agitation. Wandering does not inevitably result from agitation or overstimulation but is instead strongly linked with understimulation and by implication with stimulation seeking behaviors.

Did Stimulation Reduce Wandering?

Essentially, it was predicted (according to the understimulation hypothesis) that by identifying wanderers at a time when they were in need of stimulation (actively wandering) and by providing them with systematic stimulation for a period of time, it would be possible to reduce wandering and other stimulus seeking behaviors immediately subsequent to the Stimulation period. The corresponding expectation was that, contrary to the agitation/overstimulation hypothesis, this systematic provision of stimulation would not increase wandering behaviors.

To explore whether walking behavior was affected by systematic stimulation, the wanderers' behaviors were analyzed in a number of ways. The behaviors displayed in the Post-Stimulation period were compared with the behaviors displayed in the two non-intervention periods (Control and Post-Control). It was proposed that successful stimulation through the intervention could affect walking behaviors in three ways. First, it was expected that stimulation would lead to a reduction in the amount of time that the residents spent walking Post-Stimulation when compared with the amount of time that they spent walking during periods of non-

intervention. Second, it was expected that the effect of the stimulation might not lead to an overall decrease in the amount of time spent walking, but it might lead to a reduction in the number of times the wanderers were motivated to get up and wander Post-Stimulation when compared with the number of times they got up and walked in non-intervention periods. Finally, it was proposed that if the intervention was successful and reduced the residents' need to seek stimulation post-intervention, then this reduction of need would also be revealed through an increased latency to first walk (a measure of how long it took them to get up) in the Intervention condition when compared with the Non-Intervention condition. In essence, it was expected that each of these analyses would reveal a significant Mobility by Period interaction consistent with the primary hypothesis. This did not occur. Regardless of the type of behavioral measure analyzed, the sitting and walking behaviors of the residents were not altered as a function of the intervention.

It was also expected that the systematic provision of stimulation would reduce other forms of stimulus seeking behavior. To examine this proposal, the stimulus seeking behaviors displayed in the Post-Stimulation period were

compared with those behaviors displayed in the two non-intervention periods (Control and Post-Control). As with the mobility behaviors, it was proposed that the intervention could affect stimulus seeking behaviors in three ways. First, it was expected that the percent of time that the residents spent in different stimulus seeking behaviors Post-Stimulation would be reduced compared to the percent of time they spent displaying such behaviors during the non-intervention periods. Second, it was expected that the frequency with which the residents displayed these different behaviors Post-Stimulation would be reduced when compared with those behaviors displayed in the non-intervention periods. Finally, it was expected that the total amount of time that the residents spent in any type of stimulus seeking behavior (without regard for the type of behavior) would be reduced Post-Stimulation when compared with the total amount of stimulus seeking displayed during times of non-intervention. Again, as in the analysis of the mobility behaviors, a Stimulus Seeking by Period interaction was predicted according to the primary hypothesis. Once again, regardless of the type of behavioral measure analyzed, there was no reduction in the display of stimulus seeking behaviors in the Post-Stimulation period. The

hypothesis was not confirmed.

Although these results indicate that the provision of stimulation was an unsuccessful intervention when evaluated by its efficacy in reducing wandering and stimulus seeking behaviors post-intervention, the picture is incomplete. It was proposed that evidence indicative of a post-stimulation reduction in wandering would be supportive of the understimulation hypothesis. The corresponding expectation was that the systematic provision of stimulation would not increase wandering behaviors. The lack of any significant change actually provides evidence consistent with the complementary hypothesis. Wandering and stimulus seeking behaviors were not significantly reduced subsequent to the stimulation, but they were not increased either.

A comparison of the behaviors displayed in the Stimulation and the Control periods revealed that the intervention was successful in altering the residents' stimulus seeking behaviors. The residents spent significantly more time engaged in stimulus seeking behaviors during the intervention than they normally engaged in during periods of non-intervention. The proponents of the overstimulation/agitation hypothesis of wandering assert that it is overstimulation that leads to agitation which is

expressed behaviorally as wandering. If so, significantly increasing residents' stimulus seeking behaviors above their normal levels of stimulus seeking should have led to an increase in wandering. This did not happen, a finding that provides additional support for the understimulation hypothesis.

The results of this study indicate clearly that wanderers do display stimulus seeking behaviors and do not display agitated behaviors concurrently with wandering behaviors, two complementary pieces of evidence consistent with the understimulation hypothesis. Specifically, the provision of systematic stimulation does not reduce walking or stimulus seeking behaviors post-stimulation, contrary to expectations based upon the understimulation framework. Consistent with the understimulation hypothesis, however, the provision of systematic stimulation does not increase wandering or stimulus seeking behaviors post-stimulation.

Why No Reduction in Wandering or Stimulus Seeking?

Given that the intervention was not effective as predicted (reducing wandering and other stimulus seeking behaviors), two questions arise. Did the lack of hypothesis confirmation result because the intervention was unable to fulfil its mandate to stimulate the wanderers? If not, was

there some other factor that mitigated determination of any significant effect? Two conclusions are inevitable: a) the intervention was successful and b) at least two other factors mitigated against the effect of the intervention.

The intervention was successful. First, the intervention was basically effective, but not in the manner that was predicted. The effectiveness of the intervention was determined by comparing the behaviors displayed during the Stimulation period with those displayed in the Control period. Through a one on one systematic presentation of stimulation it was possible both to significantly increase the amount of time the residents spent in different stimulus seeking behaviors (main effect of Period when Stimulus Seeking Type was analyzed) and to significantly increase the total amount of time that the residents spent engaged in any stimulus seeking behavior (main effect of Period when Total Stimulus Seeking was analyzed). Even though the residents spent, on average, 69.88% of their time engaged in stimulus seeking behaviors during the Control period, the intervention was successful in significantly raising the total amount of stimulus seeking to 97.06%. Additionally, for both the percent and the frequency data, there was also a significant difference in the types of behaviors that the

residents displayed (main effect of Stimulus Seeking Type). Not only was the intervention successful in quantitatively altering stimulus seeking behavior, it was also successful in qualitatively altering the expression of different types of behaviors.

The intervention was also successful in a much simpler but no less important way. Even though the design of the study dictated that the wanderers were intercepted at a time of high need, the experimenter was not only able to intercept and seat the residents, but she was also able to sufficiently stimulate them so that they remained seated with her for 97.68% of the Intervention sessions. Even beyond the Stimulation period, though not a significant effect, the latency data reveal that residents actually remained seated for an average of 4.7 minutes into the Post-Stimulation period (the final 10 minutes of the Intervention session coding) compared with an average of 1.7 minutes into the Post-Control period (the final 10 minutes of Non-Intervention coding). To the extent that the intervention was successful in raising the amount of stimulus seeking behavior, however, the effect was immediate and not persistent. There was no significant carryover that reduced

mobility or stimulus seeking Post-Stimulation as was predicted.

Other factors mitigated change. Because the intervention was successful, did some other factor mitigate against the effect of the intervention? Yes. Once the residents were seated, 97.68% of the time they remained seated throughout the intervention. This propensity to sit, however, proved not to be endemic to the Stimulation period (nor to the Post-Stimulation period as was predicted). Instead, even in the Control and the Post-Control periods, the residents almost always spent more time sitting than walking, a finding that was certainly contrary to the most basic expectation upon which the study was constructed. The basic premise was that these individuals were wanderers who would, on average, spend 30.0% or more of their time walking. This expectation was woven into the study from the beginning when nursing staff were asked to rate the residents' wandering behavior as part of the inclusion criteria. Looking at the observational data, only one resident actually met this criterion (during the coding sessions), walking 43.3% of the time she was observed during the Control and the Post-Control periods, and only one other individual approached the criterion, walking an average of

24.0% of her time. Of the other three residents, two walked an average of 9.5% of the time and one never walked subsequent to being seated (0.0% of the Control and Post-Control periods). This was one factor that could have mitigated the determination of any significant effect: interindividual variability was the rule and not the exception, with any predictability favouring a behavior opposite to the behavioral trend expected by the choice of wanderers. For future investigations, it might be possible to more closely analyze individual behavior and to develop a method of rating wandering that will ensure the selection of a more homogenous population of wanderers that displays a consistently higher frequency and lower variation in behavior.

It is also possible that another factor was confounded with the residents' tendency to walk. The experimenter remained seated with the residents throughout all of the sessions in order to avoid artificially prompting the wanderers to get up and walk according to Hussian's (1987) modelling hypothesis of wandering. Given that social stimulation seeking was one of the most predominant of the different types of stimulus seeking behaviors displayed here, it is possible that the simple presence of another

individual, however unresponsive, was stimulating in a way that encouraged the residents to remain seated rather than to get up and walk as they might normally have done.

Finally, and perhaps most likely, the residents continued to perform stimulus seeking activities subsequent to the Stimulation period. The residents became their own "intervention," engaging in stimulus seeking behaviors for a total of 71.52% of the time in the Post-Stimulation period, 69.88% of the time in the Control period, and 55.34% of the time in the Post-Control period. All of these factors, the interindividual variability in behaviors, the continued presence of the experimenter, and the ongoing stimulation activities of the residents outside of the Stimulation period, could have mitigated against the effect of the intervention. It is undoubtedly true that interindividual variability among residents was a significant factor within the study. The interindividual consistency in the display of any stimulus seeking behaviors, though, suggests that the many non-significant results arising from this investigation have important implications for our conceptualization of the understimulation hypothesis.

Revising the Understimulation Hypothesis: A New Analogy

The disconfirmation of the primary hypothesis has significant implications for our conceptualization of wandering. When conceived, this study was based upon the notion that wandering was a form of stimulus seeking behavior that was driven by a disease-induced condition of understimulation. The condition of understimulation was conceptualized as analogous to the need an organism has for food. Food is demanded in order to survive but, once fed, the organism is satiated for a period of time while the stored fuel is used. The original understimulation hypothesis of wandering proposed that a condition of biological understimulation created by the disease process could be temporarily satisfied by stimulating and thus "filling up" the person. It was proposed that it would be possible to fill this need through a period of intensive stimulation (the intervention), creating a store of stimulation, and resulting in the cessation of stimulus seeking activities post-intervention while the individual used the accumulated reserves of stimulation.

Given that the wanderers included in this study did not reduce their stimulus seeking behaviors significantly Post-Stimulation even though the intervention was successful in

significantly increasing the amount of time the residents spent stimulus seeking, the original analogy seems insupportable. This test of the understimulation hypothesis was originally designed to occur at a time when the wanderers were maximally "in need" of stimulation, defining this period of need as a time when the residents were actually wandering and thus presumably seeking stimulation. We proposed to provide stimulation to the wanderers and to fill that need for understimulation, thereby reducing their immediate requirement to seek further stimulation throughout the period of time it would take for the stored up stimulation to dissipate. This simply did not happen. Although the intervention was successful, the period of concentrated stimulation produced no carryover effect indicative of a reduced requirement for stimulation. The need for stimulation persisted regardless of the period within which the residents were observed.

It seems appropriate, therefore, to revise the analogy, shifting from an analogy based upon an organism's intermittent need for food to an analogy based upon an organism's ceaseless need for oxygen. An organism's need for oxygen is one that must be met continuously. A particular amount of oxygen must be taken in at a regular

rate; the organism is unable to "store up" oxygen for later use. Even if presented with an oxygen rich environment, the organism will adapt and regulate breathing so that just the required amount of oxygen is taken in to satisfy its needs. The amount of oxygen required, however, may fluctuate across time. When the organism is extremely active, it will require greater amounts of oxygen; when at rest, lesser amounts. This analogy, when applied to the understimulation hypothesis of wandering, seems to be consistent with the pattern of behaviors observed. The need for stimulation may be a persistent, regular need analogous to the body's need for oxygen: a need for a continuous, ongoing supply of stimulation that cannot be stored up and "saved" for later use but must be used as it is received by the wanderer. The need, although continuous, may also fluctuate. Different amounts of stimulation may be required at different times. Further research into the understimulation hypothesis should include investigations to determine whether the need for stimulation does fluctuate over time and, if so, to determine the factors (biological and/or environmental) that mediate this change. Intensive intraindividual observation across time would be necessary to investigate these issues.

According to this shift in the working analogy for the understimulation hypothesis, and the evidence garnered in the current study that is consistent with the new analogy, it no longer makes sense to try to stimulate wanderers for a particular period of time in order to produce a level of stimulation that will persist and thus lead to a reduction in wandering post-stimulation. This does not mean, however, that the design of the intervention should be abandoned. Rather, it is the goal of such interventions that should be revised: instead of aiming for persistent changes in behaviors the goal should be to alter immediate behaviors.

Implications

This study was only the second known empirical investigation of the understimulation hypothesis of wandering. The first, by Andiel (1993), discovered evidence that some wanderers do actively seek stimulation and that some wanderers do not display agitation and wandering concurrently, conclusions consistent with the understimulation hypothesis. The investigation of wandering has passed through a number of phases so far, from studies identifying the prevalence and disruptiveness of wandering behavior (e.g., Teri et al., 1990), to descriptive studies of wandering behavior (e.g., Hope & Fairburn, 1990), to

behavioral investigations of wandering structured upon the a priori assumption that wandering is a form of agitation rather than directly investigating the cause of wandering (e.g., Cohen-Mansfield, 1986), to the current empirical investigation into the cause of wandering based upon the understimulation hypothesis, a study following in the footsteps of the one previous investigation by Andiel (1993). Unique to this study, is the attempt to identify individuals during a time when they were perceived to be in need of stimulation; when they were wandering. Also unique, this study is the first to actually empirically test the understimulation hypothesis of wandering (and perhaps among the first to empirically test any hypothesized cause of wandering) not just by observing but by actually interacting with and attempting to intervene and interrupt the wandering behavior. The results definitely support both the finding that wandering is linked with stimulus seeking and the finding that wandering is not inevitably linked with agitation. Without assuming a priori that wandering is a display of agitation (e.g., Cohen-Mansfield, 1986; Cohen-Mansfield et al., 1989), there is really little evidence to support the agitation theory. In fact, when combined with the results from this study, there is a growing body of

evidence that contradicts the agitation hypothesis (Andiel, 1993).

Because wandering does not inevitably result from agitation or overstimulation but can be directly linked with stimulus seeking, the preferred treatments (e.g., reducing environmental stimulation, prescribing neuroleptics) may be inappropriate for some wanderers and may in fact lead to an exacerbation of the problem. It is likely that behavioral management techniques that attempt to reduce wandering behavior by reducing environmental stimulation are doomed to fail given the robust nature of the wanderers' stimulus seeking behavior. Given the opportunity (e.g., the intervention), wanderers will engage in a different amount and variety of stimulus seeking behaviors than normal. In the absence of provided stimulation, though, they will simply resume their explorations to achieve a regular input of stimulation. By reducing the available stimulation, therapists may simply exacerbate the problem.

The evidence revealed in the current study also strongly suggests that we will likely not be able to reduce wandering or stimulus seeking behaviors (for an extended period of time) through the presentation of stimulation as it was originally conceived. It may be impossible to

effectively reduce wandering by operating according to the food analogy. It may, however, be possible to effectively reduce wandering according to the oxygen analogy, by treating the need for stimulation as a continuous (though perhaps fluctuating) need that precludes the storage of stimulation. It was not true here that wandering behavior could not be interrupted. Rather, the experimenter was successful in seating wanderers during a period of need, in keeping them seated throughout the intervention, and in significantly stimulating them above what they normally achieved during the Non-Intervention periods. The most important conclusion, perhaps, is that the effect of the stimulation did not persist. The storage of stimulation is insupportable in light of these results. Therefore, it no longer makes sense to create interventions designed to "fill up" a wanderer with "stored" stimulation. This does not mean, however, that there is anything inherently lacking in the intervention design, and that such interventions should be abandoned. Rather, it is the goal of such interventions that should be revised: instead of aiming for persistent changes in behaviors the goal should be to aim for immediate changes in behaviors. Thus, if you want to stop wanderers, it will be necessary to provide them with continuous

stimulation. The intervention used in this study successfully produced immediate behavioral change and could be used as the cornerstone for future interventions.

To facilitate the design of efficient and successful behavioral and/or environmental interventions, it will be necessary to refine our understanding of stimulus seeking behavior. Future studies should focus upon discovering the best stimulations for wanderers. A number of researchers have begun very general investigations into the types of objects and activities that attract the attention of wanderers (McGrowder-Lin & Bhatt, 1988; Pollack & Namazi, 1992). Rosswurm et al. (1986) were successful in attracting wanderers into a room "interesting" objects, however no effort was made to determine which objects were explored preferentially. Lucero et al. (1993), through intensive observation, described a plethora of different objects and activities that engaged wanderers' attention, but no effort was made to determine whether the wanderer-object and wanderer-activity preferences were dictated by environmental availability or by wanderer preference. Mayers and Griffin (1990) measured the amount of time individuals spent with different objects and reported a preference for manipulable objects and objects of a low level of complexity.

The current intervention was very grossly designed, with no attempt to investigate the "effectiveness" of the various stimuli included. Given that the intervention was successful, though, it would be very interesting to discover why it was successful. It might be possible to categorize stimuli according to the sense to which they appeal, according to level of complexity, according to meaningfulness (e.g., cohort or gender specificity), or according to familiarity (e.g., individual music preferences) (Groene, 1993; Lucero et al., 1990; Mayers & Griffin, 1990). By categorizing and systematically presenting a variety of stimuli to wanderers, it might be possible to determine whether wanderers prefer particular types of stimulation, and if so whether these preferences are mediated by other factors such as cognitive status (Lucero et al., 1993). Knowing these preferences would certainly aid in the effective design of behavioral interventions. Additionally, such information would also be invaluable to the design of longterm care facilities; the environments within which many wanderers will live and explore. By altering the environment to appeal to the types of stimulation that wanderers prefer we might be able to attract the wanderers into certain areas where safety can be

ensured, where interaction can be promoted, and where staff are comfortable with the display of behaviors.

Conclusions

There is strong support for the understimulation hypothesis of wandering. First, the results of this study indicate that wanderers generally spend a major proportion of their time stimulus seeking and specifically spend a major proportion of their walking time concurrently stimulus seeking; evidence consistent with the understimulation hypothesis. Additionally, agitated behaviors occur only rarely in some wanderers, and when agitation does occur it does not necessarily co-occur with wandering behaviors, a result contrary to the agitation/overstimulation hypothesis but consistent with the understimulation hypothesis of wandering. Third, providing wanderers with a period of systematic stimulation is unsuccessful in altering either the walking or the other stimulus seeking activities of wanderers post-stimulation. There is no evidence to suggest that increasing stimulation leads to either a post-stimulation reduction or a post-stimulation increase in the display of these behaviors. Fourth, some wanderers can be successfully interrupted while wandering, seated, and kept seated through a period of intense stimulation. Finally, a

stimulation intervention can successfully increase wanderers' stimulus seeking behaviors significantly above those displayed normally, this immediate success is consistent with a revised conceptualization of the understimulation hypothesis.

Both the success of the intervention and the lack of any persistent effect of stimulation (the lack of hypothesis confirmation) strongly suggest that wandering is not, as originally conceptualized, an intermittent need for stimulation (analogous to an organism's need for food) but is rather a consistent, ongoing need for stimulation (analogous to an organism's need for oxygen). Accordingly, it no longer makes sense to design behavioral interventions to meet the understimulation need by creating a store of stimulation that will persist and thus reduce wandering and other stimulus seeking behaviors post-stimulation. The goal of such behavioral interventions should be revised. Instead of aiming for persistent changes in behavior the goal should be to aim for immediate changes in behavior.

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Appendix A

Behavioral Ethogram

I. Ethogram Rationale

1. The goal of this study is to determine whether wanderers engage in stimulus seeking behaviors, whether they display agitated behaviors, and whether the systematic provision of stimulation will reduce walking immediately post-stimulation.

2. To accomplish this goal, the ethogram was altered from one designed by Andiel (1993).

3. The ethogram enables the recording of mobility behaviors, agitation/aggression behaviors and stimulus seeking behaviors.

II. Behavioral Catalogue Characteristics

1. Codes have been defined operationally to ensure a high level of interobserver reliability

2. The list of codes is exhaustive within each category. that is, all possible behaviors of interest to this study can be classified into one of the behavior codes.

3. Codes within the location and mobility categories are mutually exclusive, therefore, only one code can be selected for each of these categories per line of data.

4. Codes within the agitation/aggression and stimulus seeking behavioral categories are not mutually exclusive, and therefore the observer is required to enter as many appropriate codes as apply within each of these two categories.

5. Although codes <u>within</u> the agitation and stimulus seeking behavioral categories are not mutually exclusive, mutual exclusivity does exist <u>between</u> these categories. Thus, a behavior may be coded as an instance of agitation/aggression or stimulus seeking, but never both.

6. For some stimulus seeking behaviors more than one type of stimulus seeking code may apply for the same behavior.

For example, if a resident is interacting with another resident s/he may also be attending to him/her visually and auditorially. In these instances, the coder should code only the primary behavior, and when it is not evident which behavior is primary the coder should code all of the behaviors that apply.

III. Data Collection and Coding Procedures

1. If a resident enters his/her own room s/he must be considered and coded as unobservable by entering "Not Available."

IV. Sample Line of Data

MOB	AGIT	SS	COMMENT	PHASE
___	_____	___	_____	_____

V. Ethogram

1. Mobility

Note that the coder is required to make a comment when the resident is travelling (or simulating travel) at an unusually fast pace. However, because residents typically travel (or simulate travel) at an unusually slow pace, no comment is required to note when this occurs.

Note also that to maintain the manageability of the coding scheme when the resident vacillates between a stationary position and mobile behavior, the coder should nct indicate that the resident has stopped the mobility behavior until this behavior has ceased for at least three seconds.

Not Available = The resident is out of the coder's visual contact and therefore no decision can be made regarding "mobility."

Stand/Lean = The resident is stationary and upright on his/her feet. S/he is maintaining this stance either without assistance with his/her weight centrally distributed around his/her mass, or s/he is leaning against a wall, walker, etc... In either case, the stance has a steady and reliable quality, taking age into account.

Sit = The resident is stationary and his/her body rests

upright on the buttocks. His/her weight is more or less centrally distributed around his/her mass. This category includes slouching in a chair, but not lying down in a bed.

Walk = The resident is traversing a distance by him/herself or with others in either a typical upright manner or s/he is using his/her hands or feet to locomote in a wheelchair. The resident may also simulate ambulation or wheelchair locomotion. This is simulated locomotion because the resident does not actually traverse from one point to another. However, s/he is making the motions of walking in a typical upright manner or of locomoting in a wheelchair using his/her feet or hands. Note that the coder should make a comment if the resident is travelling at or is engaging in simulated locomotion at an unusually fast pace.

Other Mobility = A distinct form of mobility or immobility not specified in the above codes that may require further description, in which case the coder should make a comment. Some examples of other types of mobility and immobility include lying down, falls or near falls, and an atypical walk (such as festination, shuffling, or limping).

2. Agitation/Aggression

Not Available = The resident is out of the coder's visual contact and therefore no decision can be made regarding "agitation/aggression."

No Agitation/Aggression = The resident is not engaged in any agitated or aggressive behaviors, or there is no clear indication as to whether the resident's behavior should be coded as an agitated behavior.

Verbal/Vocal Agitation/Aggression = The resident is exhibiting agitated or hostile verbalizations or vocalizations. Agitated behaviors are not directed toward anyone. Agitated behaviors include words or vocalizations that are expressions or emotional disturbance (such as anxiety, tension, or irritability), and/or words or vocalizations that would have had the potential to result in physical or mental harm had they been directed toward someone. Verbal aggression occurs when the resident is exhibiting provoked or unprovoked hostile verbal behavior directed toward another person and which has the potential to result in physical or mental harm. Examples of verbal

aggression include swearing, screaming or making hostile sexual remarks at another person.

Physical Agitation/Aggression = The resident is exhibiting physical agitation/aggression if s/he is expressing emotional disturbance (such as anxiety, tension, or irritability) through non-hostile behaviors and/or is exhibiting provoked or unprovoked hostile nonverbal behavior which is aggressive behavior directed toward another person and has the potential to result in physical or mental harm. Physical agitation includes fidgeting behaviors, defined as motoric restlessness or an assortment of small scale body movements that may be repetitive. To distinguish physically agitated behaviors from stimulus seeking behaviors, the resident must also appear to be either experiencing mental of physical discomfort, or s/he must be executing the behaviors with an unusually high intensity or vigour to be considered physical

agitation. Mental or physical discomfort is indicated by one or more of the following characteristics: (1) facial expression indicative of negative affect, such as sadness, anger, or fear (2) tense body posturing, or (3) negative vocalizations, such as moaning, groaning, or crying. Note that if mental or physical discomfort is indicated by negative vocalizations, the coder would select both the "verbal/vocal agitation" key and the "physical agitation" key. Crying while rocking back and forth, and kicking the table with an angry expression are examples of physical agitation. Physical aggression includes striking, tripping, spitting at, or directing hostile sexual behavior toward another person.

Other Agitation/Aggression = The resident is exhibiting distinct agitated or aggressive behavior not specified above that may require further description, in which case the coder should make a comment. In addition, the resident must either appear to be experiencing mental or physical discomfort, or he must be executing the behavior with an unusually high intensity or vigour to be coded as instance of "other agitation." Mental or physical discomfort is indicated by one or more of the following characteristics: (1) facial expression indicative or negative affect, such as sadness, anger, or fear (2) tense body posturing, or (3) negative vocalizations, such as moaning, groaning, or crying. Note that if mental or physical discomfort is

indicated by negative vocalizations, the coder would select both the "verbal/vocal agitation" key and the "other agitation/aggression" key. Attempting to leave the unit is included in this category.

III. Stimulus Seeking

Note that for some of the following stimulus seeking categories the behaviors must be of at least three seconds duration in order to be recorded. To maintain the manageability of the coding scheme when the resident vacillates between engaging and not engaging in these stimulus seeking behaviors, the coder should not indicate that the resident has stopped the stimulus seeking behavior until this behavior has ceased for at least three seconds.

Not Available = The resident is out of the coder's visual contact and therefore no decision can be made regarding "stimulus seeking."

No Stimulus Seeking Behaviors = The resident is not engaged in any stimulus seeking behaviors, or there is no clear indication as to whether the resident's behavior should be coded as a stimulus seeking behavior.

Self-Oriented Tactile Stimulation Seeking = The resident is feeling one part of the body with another part of the body, presumably resulting in proprioceptive stimulation. Note that behaviors in this category must be of at least three seconds duration. This category includes, but is not limited to, repetitive behaviors such as rubbing one's own arm, hand clapping, or finger snapping.

Other Oriented Tactile Stimulation Seeking = The resident is in continuous physical contact with or is repeatedly touching something in the environment for at least three seconds, presumably resulting in proprioceptive stimulation. Note that if the resident is continuously touching some surface s/he must be manipulating it in some way, rather than simply touching it. This category includes stroking another person, finger tapping, running a hand over a handrail or window sill, and manipulating clothing that is not pressed against his/her skin.

Motor Stimulation not Identified with a Functional Instrumental Act (Motor Non-Instrumental) = The resident is

engaged in motor movements that do not appear to be miming any recognizable instrumental activity pattern, and are presumed to result in kinaesthetic stimulation. These motor movements must persist for at least three seconds. Examples include shaking a foot, rocking back and forth, and distorting one's face without any indication that this behavior is an expression of an emotion.

Motor Stimulation Identified with a Non-Functional or Imaginary Instrumental Act (Motor Instrumental)= The resident is engaged in motor movements that appear to be miming or mimicking a recognizable pattern of activity or involve performing a non-functional act. The resident must engage in these motor movements for at least three seconds. Examples include miming and mimicking activities such as sewing, washing a table with or without a cloth when there are no spills or crumbs on the table, and attempting to unscrew screws from a wall, as well as performing non-functional activities such as moving furniture or pushing a laundry cart when there is no recognizable purpose to performing these activities.

Visual Stimulation Seeking = The resident is either (a) obviously orienting to a visual stimulus in his/her environment for at least three seconds duration or (b) is continuously scanning or searching the environment for at least three seconds duration with no obvious purpose (i.e., wayfinding). Examples of focused visual stimulation seeking include looking at a flashing control panel or watching a verbal interaction between two other people while not actually participating in the interaction.

Auditory Stimulation Seeking = The resident is obviously orienting to auditory stimulation for at least three seconds duration. For example, a resident may stop walking and cock his/her head toward a speaker while a message is being presented over the intercom system. Listening to music as a part of an organized activity would be included in this category as well.

Social Interaction Seeking = The resident is interacting with or attempting to interact with one or more persons. The interaction may include one or more of the following behaviors: touching (but not stroking) one or more persons, visually attending or listening to someone who is communicating with him/her, verbalizing, vocalizing or

gesturing to someone, or cooperating in a community activity such as a group sing-a-long. This category would not be selected if the resident appears to be listening to a conversation between two or more people who are not acknowledging the resident (i.e., they are orienting away from him/her). Instead, the coder should select "auditory stimulation seeking" and/or "visual stimulation seeking." In addition, if someone is attempting to interact with the resident and there are no signs that the resident is acknowledging the initiatory of the interaction (i.e., the resident does not orient toward the person and does not respond to the person's questions), this would not be coded as an
instance of social interaction. In some cases, the resident may make a delayed response, indicating that he was attending to the person. In this case the coders should make a comment that this occurred. Note, the coder should make a comment if the resident is interacting with someone who is "novel" (such as a visitor).

Other Stimulus Seeking = The resident is exhibiting other forms of stimulus seeking not included in the above categories, such as singing to him/herself.

Appendix B

Trial and Individual Data

Table I

Percent of Time Different Stimulus Seeking Behaviors were Displayed During the Stimulation Period by Trial

Stimulus Seeking Type	Stimulation Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Self	19.40	24.70	15.02	2.16
Other Tactile	22.34	30.42	27.02	44.66
Motor N-I[a]	1.24	9.56	5.84	5.38
Visual	0.00	2.54	1.48	11.90
Social	95.00	78.74	77.90	78.82
Other	54.22	38.10	64.35	34.10

[a]Motor Non-Instrumental

Table II

Percent of Time Different Stimulus Seeking Behavior were Displayed During the Control Period by Trial

Stimulus Seeking Type	Control Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Self	15.94	22.54	23.56	8.40
Other Tactile	13.74	2.76	5.04	8.34
Motor N-I[1]	3.00	9.80	0.00	2.20
Visual	6.38	2.24	8.20	1.64
Social	11.56	4.84	38.90	18.84
Other	33.10	14.10	5.00	39.12

[1]Motor Non-Instrumental

Table III

Mean Frequency of Different Stimulus Seeking Behaviors During the Stimulation Period by Trial

Stimulus Seeking Type	Stimulation Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Self	4.00	1.00	2.00	0.80
Other Tactile	5.75	3.60	6.00	6.20
Motor N-I[1]	0.20	2.80	0.80	0.60
Visual	0.00	0.20	0.60	1.40
Social	1.40	2.80	3.40	3.20
Other	2.60	2.20	2.20	1.40

[1]Motor Non-Instrumental

Table IV

Mean Frequency of Different Stimulus Seeking Behaviors During the Control Period by Trial

Stimulus Seeking Type	Control Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Self	3.40	4.0	3.20	1.40
Other Tactile	3.00	1.40	1.20	2.20
Motor N-I[1]	0.40	1.40	0.00	0.40
Visual	0.80	0.20	1.00	0.20
Social	2.20	5.6	4.20	3.40
Other	3.20	2.2	1.20	1.80

[1]Motor Non-Instrumental

Table V

Percent of Time Spent in Mobility Behaviors by Trial

Mobility Behaviors	Post-Stimulation Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Sit	54.34	74.28	77.72	91.36
Walk	31.50	16.80	9.98	1.86
Mobility Behaviors	**Control Period**			
	Trial 1	Trial 2	Trial 3	Trial 4
Sit	50.88	90.82	83.14	80.02
Walk	25.18	3.32	6.28	14.64

Table VI

Mean Frequency of Mobility Behaviors by Trial

Mobility Behaviors	Post-Stimulation Period			
	Trial 1	Trial 2	Trial 3	Trial 4
Sit	0.80	1.00	1.20	1.20
Walk	3.40	2.20	1.80	0.60
Mobility Behaviors	**Control Period**			
	Trial 1	Trial 2	Trial 3	Trial 4
Sit	1.00	1.20	1.20	1.60
Walk	3.40	1.20	1.80	1.40

Table VII

Mean Frequency of Different Stimulus Seeking Behaviors (Across Post-Stimulation and Control Periods) by Trial

Trial 1	Trial 2	Trial 3	Trial 4
12.2	16.1	11.3	11.1

Table VIII

Percent of Time Each Resident Spent in Any Stimulus Seeking Behavior (Total Stimulus Seeking)

	Observation Periods			
Residents	Stimulation	Post-Stimulation	Control	Post-Control
1	96.6	72.7	72.6	48.7
2	96.5	70.0	69.0	31.5
3	100.0	69.2	64.7	53.2
4	92.9	60.9	56.0	54.5
5	99.3	84.8	87.1	88.8

Appendix C

Consent Form

Title: Neurocognitive Research Program
Investigators: Dr. Allen R. Dobbs
Explanation:

We are doing research to better understand why some residents show excessive amounts of pacing whereas others do not. We are interested in what causes the pacing and ways to reduce it. In order to accomplish this, we will carefully observe and record the public behavior of selected residents. The observer is always at a distance and non-intrusive. No observations will occur when the resident is engaged in private activities (dressing, bathing). Sometimes materials will be made available for the person to touch and manually explore.

Consent:

I agree to my relatives' participation in the research project. I understand that the results are confidential, to be used for research reporting, and that no information by which the person can be identified will be published. the results can be used for treatment and care by the medical team. I understand that no one is required to enter this study and that if I agree to the participation of my relative, it will be a voluntary decision. I understand that I am free to withdraw his/her participation at any time without prejudice to ongoing care and treatment. I understand that the public activities will be recorded but that the observations will not interfere with scheduled activities of the unit.

I understand that if any knowledge gained from this study is obtained that could influence my decision to continue, I will be promptly informed. I will receive a copy of this form.

_____ _____

Signature of patient guardian | Signature of relative or

_____ _____

Date | Signature of witness

If you have any questions concerning the project or procedures, please call Suzanne M. Maisey at 492-5846 (University of Alberta) or call Dr. A. Dobbs at 492-5850 (University of Alberta) or at 482-8624 (Edmonton General).