Environmental Effects on the Assessment of People With Dementia: A Pilot Study

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OBJECTIVE. The purpose of this pilot study was to use a standardized assessment of independent living skills to explore the effects of environment on functional performance of individuals with dementia.

METHODS. Twelve participants (6 males, 6 females), diagnosed with dementia, were given the Structured Assessment of Independent Living Skills (SAILS), a standardized assessment of functional motor, cognitive, instrumental, and social performance. Participants were assessed in their homes, in an adult day-services facility they regularly attended, and in an occupational therapy clinic.

RESULTS. Data were analyzed using repeated measures analysis of variance (ANOVA). There was no evidence of a learning effect from repeated assessments. Participants’ performances did not differ among the home, clinic, and adult day-services settings on the total SAILS score ($F = 1.22; df = 2,20; p = 0.3176$), nor on three of its subscales: cognitive score ($F = 0.80; df = 2,20; p = 0.4648$), instrumental activities ($F = 1.37; df = 2,20; p = 0.2777$), and social interaction ($F = 0.34; df = 2,20; p = 0.7147$). However, participants’ performance on the SAILS motor score was significantly higher in the home than in the clinic ($t = 2.925, df = 11, p = 0.0138$).

CONCLUSION. Participants’ motor performance was significantly better at home than in an unfamiliar environment. Effects of environment on motor performance, and absence of effects on cognitive, instrumental, and social performances, can be explained through ecological theory. These results suggest that the ability to adapt movement to an unfamiliar environment may decline with the onset and progression of dementia.


Dementing diseases are characterized by an insidious and progressive decline in cognitive function, communication, memory, and self-care abilities (Bonder & Goodman, 2002; Hall et al., 1995; Molloy & Lubinski, 1995). Occupational therapists working with individuals with dementia typically observe them performing functional tasks to assess skills in activities of daily living (ADL), work, and leisure, and to understand underlying components such as memory, language, problem-solving, perception, motor abilities, and attention span (Baum & Edwards, 1993; Cara & MacRae, 1998; Corcoran, 1999; Glogoski & Foti, 2001; Haworth & Hollings, 1979). Occupational therapists use these evaluations to predict clients’ occupational performances in their homes, to recommend appropriate living arrangements, and to guide caregivers’ interventions (Baum & Edwards, 1993; Cara & MacRae, 1998; Nygård, Bernspang, Fisher, & Winblad, 1994; Park, Fisher, & Velozo, 1994). Inherent in clinical evaluations and predictions is an assumption that functional performance in the clinic is a valid substitute for performance in other environments, such as home or a care facility.

Contemporary theories in both motor control and occupational therapy call that assumption into question by placing considerable emphasis on environmental factors. In the study of motor control, an ecological approach to understanding perception and movement has emerged over the past 30 years (Mathiowetz & Bass-Haugen, 2002). This model posits that movement is “geared to” specific envi-
environments, and that there is intricate interaction and influence among person, task, and environment (Shumway-Cook & Woollacott, 1995).

In occupational therapy, a perspective has emerged that occupational performance is based “on the premise that the environmental context is at least as powerful a determinant in the lives and functioning of persons with disabilities as their individual impairments” (Spencer, 1998, p. 291). The Person-Environment-Occupation Model (Law et al., 1996), the Model of Human Occupation (Kielhofner, 1985), and The Ecology of Human Performance (Dunn, Brown, McClain, & Westman, 1994) all hold that environments are uniquely comprised of cultural, socio-economic, institutional, physical, and social factors that influence behavior and facilitate or hinder occupational performance.

It would be difficult to argue that clinical and home settings are so closely matched, physically, socially, and culturally that clinicians need not consider the effects of environment on occupational performance. Even though most clinicians believe that an individual’s performance declines in unfamiliar environments (Park et al., 1994), clinical assessments are the norm instead of more time-consuming and costly home evaluations.

While some evidence suggests that environment is a factor in performance on functional assessments for older individuals with and without dementia, the effect of the test environment has not been investigated in depth. Ward et al. (1990) administered the Mini-Mental State Exam (MMSE) to 116 geriatric patients (mean age 75.5 years) at their residences and in the clinic. The cognitive functioning of these patients ranged from no impairment to severely impaired. The investigators considered a difference of at least five points between settings to be clinically meaningful, and found that difference in 29 of the 116 patients (25%). Of this group, 22 (76%) tested better in their residences, leading to the conclusion that in-home assessments more effectively determine optimal cognitive function of geriatric patients.

Park et al. (1994) investigated differences between home and clinical settings in the performance of instrumental activities of daily living (IADL) by older adults. Twenty older adults (mean age 82.2 years) were evaluated in their homes and in an occupational therapy clinic with the Assessment of Motor and Process Skills (AMPS). Many participants in this study had chronic physical conditions (macular degeneration, bilateral hip replacement, low-back pain, etc.), but none was identified as having a cognitive deficit. The AMPS is an observation-based assessment used to test IADL performance while identifying underlying causes of deficits. The AMPS yields a rating in two domains: IADL motor and IADL process. The IADL motor score addresses individuals’ abilities to move their bodies and objects during performance, while the process score represents the ability to organize and adapt actions to complete a task. The investigators found no difference in motor scores between the home and clinic, but found a difference in the process scores. Ten of the 20 participants performed better in the home than clinic on the latter measure, leading the investigators to conclude that therapists should assess IADL performance in the environment in which the client will be functioning.

Nygard et al. (1994) also used the AMPS to compare the abilities of individuals with dementia to perform IADL in the home and clinic. Nineteen participants first performed two or three tasks in a clinic, then performed one or two tasks in their homes 5 to 22 days later. Subjects’ overall mean performances did not differ on motor or process scores. However, Nygard et al. found, after calculating standard errors for each subject, that the motor performance of 6 of the 19 individuals differed between the home and clinic. Four subjects scored higher at home, and two others scored higher in the clinic. These findings support the assertion by Park et al. (1994) that if a therapist wishes to determine how a client will perform in a specific environment, assessment should be conducted in that environment.

Not only has previous research arrived at different conclusions about the environment’s effect on assessment of functional skills in older adults, but little research focuses on the issue among older adults with dementia. The environment’s effect on performance is particularly important for individuals with dementia and their families because the ability to adapt to change and unfamiliar stimuli is impaired with dementia (Nygard et al., 1994; Painter, 1996; Roberts & Algase, 1988; Skolaski-Pelliteri, 1983). Additionally, accurate assessment of independent living skills is central to selecting appropriate living arrangements for elders with dementia (Mahurin, DeBettignies, & Pirozzolo, 1991; Tullis & Nicol, 1999).

These considerations led to the current pilot study with this research question: Do individuals with dementia perform differently on a standardized assessment of independent living skills administered in three environments: clinic, adult day-services facility where they regularly attend, and home? The answer to this question is clinically important because, if evidence indicates that environment does not influence assessment of independent living skills, then clinical assessments are valid for recommending relocation to a nursing home. If evidence indicates that environment is a factor, clinicians would be compelled to assess performance in nonclinical environments before making recommendations.
Methods

Study Design

This pilot study used a quasi-experimental design to explore the effects of environment on the assessment of people with dementia. The independent variables were the three settings of the assessment, and the dependent variables were participants’ performances of functional tasks, as represented by scores on the Structured Assessment of Independent Living Skills (SAILS) (Mahurin et al., 1991).

Participants

The study’s 12 participants (6 males, 6 females) had been diagnosed with dementia within the last year and regularly attended adult day-services. All participants lived with family members in the community. The mean age of participants was 80.5 years with a range of 72 to 88 years. The average score on the MMSE (Folstein, Folstein, & McHugh, 1975) was 18.7, with a range of 9 to 28. Participation in the study was voluntary, and informed consent (as approved by an Institutional Review Board) was obtained from caregivers and participants prior to the study.

Performance Instruments

The study employed the MMSE (Folstein et al., 1975) and the SAILS (Mahurin et al., 1991). The MMSE was given initially to establish each participant’s degree of dementia. This assessment was given at the adult day-services facility prior to administration of the SAILS. The MMSE was selected because of its demonstrated reliability and validity in quantifying cognitive function. The MMSE is widely used and accepted as a screening tool for dementia (Tombaugh & McIntyre, 1992). A number of studies have found coefficients for test–retest reliability of the MMSE between .80 and .95 (Anthony, LeResche, Niaz, von Korff, & Folstein, 1982; Folstein et al., 1975; Pfeffer, Kurosaki, Chance, Filos, & Bates, 1984).

The SAILS is designed to measure functional abilities of individuals with dementia and assesses skills such as mobility, dressing, eating, use of language, and money-related skills. The test contains 50 items and is organized into motor, cognitive, instrumental, and social interaction sections. The motor section consists of four subdomains of five items each, the cognitive section consists of four subdomains of five items each, and the instrumental and social interaction sections each consist of five items (see Table 1). The SAILS is not a timed test overall although specific motor items such as putting on gloves or picking up coins are timed. All tasks are rated on a 0–3 scale, and a higher score reflects greater functional independence. Elders with no cognitive impairment served as a control group in development of the SAILS, and they achieved a group mean of 148 of a possible score of 150 on this test. The control group’s score differed (p < 0.001) from the mean of 115.8 for the experimental group, comprised of individuals with a diagnosis of probable Alzheimer’s disease (Mahurin et al., 1991).

Inter-rater reliability for this instrument has been established by the original authors (r = .99) with test–retest reliability of r = .81 for Total Score and r = .97 for Motor Time (Mahurin et al., 1991). Sanford, Guyatt, Law, and Swanson (1994) tested the SAILS, finding inter-rater reliability of r = 0.99 and test–retest reliability of r = 87. Mahurin et al. evaluated the SAILS’ validity by comparing its total scores with those of three other cognitive status tests taken by individuals with dementia. The scores correlated highly, indicating that the SAILS is valid because its scores parallel those of established measures. In our pilot study, sample correlations

Table 1. Items and Organization of the Structured Assessment of Independent Living Skills (Mahurin et al., 1991)

<table>
<thead>
<tr>
<th>Section</th>
<th>Items and Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Tasks</td>
<td>Scores from this section comprise the Motor Score.</td>
</tr>
<tr>
<td>Fine Motor Skills</td>
<td>• Pick up coins, remove wrappers, cut with scissors, fold letter and place in envelope, use key in lock.</td>
</tr>
<tr>
<td>Gross Motor Skills</td>
<td>• Stand up from sitting, open and walk through door, regular gait (10 feet), tandem gait (6 feet), transfer objects across room.</td>
</tr>
<tr>
<td>Dressing Skills</td>
<td>• Put on shirt, button cuffs of shirt, put on jacket, tie shoelaces, put on gloves.</td>
</tr>
<tr>
<td>Eating Skills</td>
<td>• Drink from glass, transfer food with spoon, cut with fork and knife, transfer food with fork, fork liquid with spoon.</td>
</tr>
<tr>
<td>Cognitive Tasks</td>
<td>Scores from this section comprise the Cognitive Score.</td>
</tr>
<tr>
<td>Expressive Language</td>
<td>• Quality of expression, repetition, object naming, write legible note, complete application form.</td>
</tr>
<tr>
<td>Receptive Language</td>
<td>• Read and follow printed instructions, understand written material, understand common signs, follow verbal directions, identify named objects.</td>
</tr>
<tr>
<td>Expressive Language</td>
<td>Time and Orientation • State time on clock, calculate time interval, state time of alarm setting, locate current date on calendar, correctly read calendar.</td>
</tr>
<tr>
<td>Receptive Language</td>
<td>Money-Related Skills • Count money, make change, understand monthly utility bill, write check, understand checkbook.</td>
</tr>
<tr>
<td>Social Interaction</td>
<td>Instrumental Activities. Scores from this section comprise the Instrumental Activity Score. • Use telephone book, dial telephone number, understand medication label, open medication container, follow simple recipe.</td>
</tr>
<tr>
<td>Interpersonal Interaction</td>
<td>Social Interaction Scores: Scores from this section comprise the Social Interaction Score. • Respond to greeting and farewell, respond to request for information, respond to social directives, understand nonverbal expression.</td>
</tr>
</tbody>
</table>

Total Score is comprised of Motor Score, Cognitive Score, Instrumental Activities Score, and Social Interaction Score. All items are scored on a scale from 0 to 3. Although scoring of items varies, generally 3 represents typical performance, 2 represents performance that is slow or with a minimal error, 1 represents performance with significant errors, and 0 represents inability to perform the given task.
were also high between cognitive status, as defined by the MMSE, and each of the various SAILS scores (total score and its subscores), except for the motor score (see Table 2).

**Procedures**

MMSE scores for participants were obtained from testing at an adult day-services center prior to administration of the SAILS. SAILS assessments occurred in participants’ homes, in the adult day-services center that participants regularly attended, and in an occupational therapy laboratory at a Midwestern university. Ten participants in the study were assessed in all three environments; two participants were assessed in the clinic and home settings only. Of the latter two participants, one did not regularly attend adult day services, and one experienced an illness that prevented the third assessment.

Four raters conducted the assessments, and no rater assessed an individual participant more than once. Raters were blind to participants’ previous results on the SAILS in different environments and to overall results of the pilot study until all assessments were completed. The order of the environments and raters performing the assessments was randomized for each participant, and raters were blind to results of assessments done by other members of the team during the study. Assessments in the three environments for each individual were administered at least a week apart to limit participants’ recall of test items. The length of each assessment varied depending upon the individual; the average assessment session lasted 1 1/2 to 2 hours.

**Inter-Rater Reliability**

Several measures were taken to establish inter-rater reliability within the team. The standardized administration and scoring procedures established by Mahurin et al. (1991) for the SAILS were followed. Additionally, each of the test items was reviewed verbally and procedures for administering the items agreed upon by the raters. The raters practiced administering the SAILS on each other and on healthy controls. When concerns occurred in scoring test items over the course of the research project, researchers met as a group and reached consensus on the procedure for administration.

**Results**

There was no evidence of a learning effect from repeated assessments. The mean total scores on the SAILS did not differ across the three repeated assessments ($F = 0.86; df = 2.18; p = 0.4384$), as determined by a repeated measures analysis of variance. No order or learning effect for the mean scores on four SAILS subscales (see Table 3) was detected.

Table 4 summarizes mean SAILS scores across three settings. Participants’ performances did not differ among the home, clinic, and adult day-services settings on the total SAILS score ($F = 1.22; df = 2.20; p = 0.3176$), nor on three of its subscales (cognitive [$F = 0.80; df = 2.20; p = 0.4648$], instrumental activities [$F = 1.37; df = 2.20; p = 0.2777$], and social interaction [$F = 0.34; df = 2.20; p = 0.7147$]). However, analysis of variance indicated that participants’ mean SAILS motor scores differed among the three settings. Post hoc, pair-wise comparisons revealed that participants’ mean motor scores were 3.5 points higher at home than in the clinic ($t = 2.925, df = 11, p = 0.0138$).

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**Table 3. Order and Learning Effects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1st Assessment</th>
<th>2nd Assessment</th>
<th>3rd Assessment</th>
<th>Order/Learning Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>F (df)</td>
</tr>
<tr>
<td>Total Score</td>
<td>93.5 (21.51)</td>
<td>95.9 (23.22)</td>
<td>95.6 (23.92)</td>
<td>0.86 (2,18)</td>
</tr>
<tr>
<td>Motor Score</td>
<td>45.1 (7.38)</td>
<td>45.6 (6.67)</td>
<td>44.1 (7.46)</td>
<td>0.36 (2,18)</td>
</tr>
<tr>
<td>Cognitive Score</td>
<td>29.8 (10.25)</td>
<td>32.0 (12.71)</td>
<td>31.8 (13.85)</td>
<td>2.38 (2,18)</td>
</tr>
<tr>
<td>Instrumental Activity</td>
<td>6.4 (4.40)</td>
<td>6.7 (3.13)</td>
<td>7.3 (4.32)</td>
<td>0.70 (2,18)</td>
</tr>
<tr>
<td>Social Score</td>
<td>12.2 (3.01)</td>
<td>11.6 (3.27)</td>
<td>12.4 (3.60)</td>
<td>0.60 (2,18)</td>
</tr>
</tbody>
</table>

*Note. Means (and standard deviations) of SAILS total scores and subscores, according to the sequence of testing. N = 10. The table’s rightmost column reports the results of a repeated measures analysis of variance that found no order effect for any SAILS score.*

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**Table 2. Correlations (Pearson r) between MMSE and SAILS Total Score and Subscales, in Three Assessment Environments**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clinic (n = 12)</th>
<th>Adult Day-Care Facility (n = 10)</th>
<th>Home (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Score</td>
<td>0.84661</td>
<td>0.85004</td>
<td>0.88928</td>
</tr>
<tr>
<td>Motor Score</td>
<td>0.32785</td>
<td>0.30608</td>
<td>0.52748</td>
</tr>
<tr>
<td>Cognitive Score</td>
<td>0.93059</td>
<td>0.89486</td>
<td>0.92246</td>
</tr>
<tr>
<td>Social Score</td>
<td>0.74287</td>
<td>0.80688</td>
<td>0.73588</td>
</tr>
<tr>
<td>Instrumental Activities</td>
<td>0.89280</td>
<td>0.83345</td>
<td>0.81654</td>
</tr>
</tbody>
</table>
Table 4. Summary (Descriptive) Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clinic N = 12</th>
<th>Adult Day Facility N = 10</th>
<th>Home N = 12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Total Score</td>
<td>95.58 (25.25)</td>
<td>94.90 (20.53)</td>
<td>98.25 (22.69)</td>
</tr>
<tr>
<td>Motor Score</td>
<td>43.67 (8.17)</td>
<td>44.90 (5.57)</td>
<td>47.17 (6.39)</td>
</tr>
<tr>
<td>• Fine motor</td>
<td>9.50 (2.61)</td>
<td>9.60 (2.13)</td>
<td>10.83 (2.71)</td>
</tr>
<tr>
<td>• Gross motor</td>
<td>10.17 (2.72)</td>
<td>11.10 (2.13)</td>
<td>10.92 (2.71)</td>
</tr>
<tr>
<td>• Dressing</td>
<td>10.42 (3.50)</td>
<td>10.20 (3.46)</td>
<td>11.42 (2.71)</td>
</tr>
<tr>
<td>• Eating</td>
<td>10.75 (0.97)</td>
<td>11.10 (0.74)</td>
<td>11.08 (1.08)</td>
</tr>
<tr>
<td>Cognitive Score</td>
<td>32.75 (13.25)</td>
<td>30.70 (10.44)</td>
<td>31.67 (12.92)</td>
</tr>
<tr>
<td>Instrumental Activity Score</td>
<td>7.00 (4.33)</td>
<td>7.50 (4.38)</td>
<td>6.83 (3.51)</td>
</tr>
<tr>
<td>Social Score</td>
<td>12.17 (3.38)</td>
<td>11.80 (3.43)</td>
<td>12.58 (2.75)</td>
</tr>
</tbody>
</table>

Note. Means and standard deviations of SAILS total scores and subscores, by setting.

Discussion

Data from this pilot study indicated that participants with dementia performed better on motor tasks in a familiar environment (their homes) than in an unfamiliar environment (a clinic). The difference of 3.5 points in participants' motor scores means that they performed markedly better at home on three or four of the SAILS' 20 motor tasks (Table 1). For cognitive, instrumental, and social tasks, no significant differences emerged among the three settings. These data differed from previous studies (Nygard et al., 1994; Park et al., 1994; Ward et al., 1990), indicating a need to pursue this line of inquiry with a larger sample. Are there explanations for (1) why a familiar environment may be more conducive to the performance of motor skills than an unfamiliar one, and (2) why this advantage would not extend to cognitive, instrumental, and social skills?

A possible explanation centers on an understanding of perception. Perception is “the ability to transform information from the senses and then use it to interact appropriately with the environment” (Unsworth, 1999). This ability is often impaired in individuals with Alzheimer’s disease (Ashford, Schmitt, & Kumar, 1998; Unsworth, 1999; Wheatley, 2001). Unsworth divided perception into two main categories: (1) Problems with cognitive or metacognitive performance components, including problems with concentration, memory and learning, and executive functions, and (2) Problems with perceptual (sensorimotor) performance components, including apraxia, agnosia, spatial relations, and unilateral neglect.

In the pilot study, participants performed similarly in three environments on the SAILS tasks—including those subsumed under the cognitive, instrumental activities, and social subscales—that required skills in Unsworth’s first perceptual category. However, their performances declined in an unfamiliar environment (the clinic) on motor tasks that required skills in Unsworth’s second category. Perhaps changes in environment affect sensorimotor perception and performance more than cognitive perception and performance among individuals with dementia.

Moreover, the processes of dementia may have different influences on different skills. In this pilot study, motor performance was not only more sensitive to setting than other skills, but correlated less strongly with the level of dementia (as measured by the MMSE) than performance on social, cognitive, or instrumental activities.

Ecological theory provides an explanation of environment’s differential effect on motor and cognitive tasks (Gibson, 1979; Reed, 1982). This model suggests that motor control evolved as a coping mechanism in response to environmental demands, so that humans could move effectively for functional tasks such as gathering food, building shelter, caring for self and others, and engaging in play. Understood ecologically, movement is a specific, goal-directed response to specific environmental demands, based on perceptual information. Humans evolved, according to ecological theory, with specific abilities to detect environmental affordances (the functional utility of specific objects in specific contexts, given individuals’ capabilities) (Shumway-Cook & Woollacott, 1995; Wu, Trombly, Lin, & Tickle-Degnen, 1998). It seems logical that this ability may decline with the progression of dementia, making all movement more difficult and the adaptation to unfamiliar environmental factors particularly problematic. Further research is needed to confirm this pilot study’s suggestion that environment affects cognitive and motor perception differently in individuals with dementia.

The limitations of this pilot study are as follows:

Although the sample of this pilot study was large enough to detect differences in motor performance between home and a clinical environment, further research, with a greater number of participants, is recommended to detect other differences that may exist.

Although inter-rater reliability was addressed, assessments were not double-scored among examiners across environments due to time constraints. High inter-rater reliability for the SAILS has been established, and further research should include inter-rater reliability testing.

Participants had lived with family members for varying lengths of time, resulting in varying familiarity with home environments. If participants experienced their families’
homes as unfamiliar environments, contrasts between home, clinic, and adult day-care facility would not be expected. Further research should consider length of time in the home.

### Conclusion

This pilot study investigated the performances of individuals with dementia in a variety of functional tasks in three different environments. The results of this study suggest that the ability to adapt movement to an unfamiliar environment may decline with the onset and progression of dementia. Findings also suggest that clinical assessments of cognitive, instrumental, and social activities may accurately reflect performances in more familiar environments but should not be used to predict motor performances in the home.

The validity of assessment tools used with individuals with dementia in familiar and unfamiliar settings should be explored further. Previous studies offer conflicting conclusions about the effects of environment on functional performance with various populations. However, a growing body of evidence, with solid theoretical support, indicates that therapists must be sensitive to environmental effects on performance. While it can be time consuming to assess clients in specific settings of interest, this may be the only valid way to determine abilities to function in those settings.

### Acknowledgments

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### References


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