American Journal of Alzheimer's Disease & Other Dementias®
Volume 24 Number 3
June/July 2009 246-257

10.1177/1533317509332627
http://ajadd.sagepub.com

Persons With Moderate Alzheimer's Disease Improve Activities and Mood via Instruction Technology

Giulio E. Lancioni, PhD, Nirbhay N. Singh, PhD, Mark F. O'Reilly, PhD, Jeff Sigafoos, PhD, Maria Teresa Pangrazio, MD, Marisa Megna, MD, Nadia Zonno, MA, Maria L. La Martire, MA, Katia Pinto, MA, and Mauro G. Minervini, MD

Background: Three studies assessed the (*a*) effectiveness of verbal instructions presented via technology in helping persons with moderate Alzheimer's disease perform daily activities and (*b*) impact of activity engagement on mood. *Methods:* The 3 studies targeted coffee preparation with 2 women, use of make-up with 2 women, and use of make-up and tea preparation with 3 women. Intervention effects on activity performance were assessed through nonconcurrent multiple baseline designs across participants or multiple baseline designs across activities. The impact of activity on mood was assessed by recording indices of happiness during activity trials and parallel nonactivity periods. *Results:* Verbal instructions presented via technology were effective in helping all participants perform the target activities. The participants also showed mood improvement (ie, increases in indices of happiness) during the activity. *Conclusion:* These results suggest that the approach reported may be a useful strategy for helping persons with Alzheimer's disease.

Keywords: Alzheimer's disease; daily activities; verbal instructions; instruction technology; indices of happiness

Alzheimer's disease is an age-related neurodegenerative condition, which brings about progressive decline in memory and higher cognitive functions, and increasing difficulty in performing daily living activities (ie, self-help and occupational or domestic activities).[1-5] The disease is also associated with negative social-emotional effects such as withdrawal or depression.[6-9] Given this serious situation and its harmful implications for the patients, their families, and the social context in general, great efforts have been made to find pharmacological and behavioral treatment solutions.[10-15]

From the University of Bari, Bari, Italy (GEL, MTP, MM, NZ, MLLaM); ONE Research Institute, Midlothian, Virginia (NNS); University of Texas at Austin, Austin, Texas (MFO); Victoria University of Wellington, Wellington, New Zealand (JS); and Alzheimer Rehabilitation Center, Bisceglie, Italy (KP, MGM).

The authors reported no conflicts of interest.

Address correspondence to: G. E. Lancioni, Department of Psychology, University of Bari, Via Quintino Sella 268, 70100 Bari, Italy; e-mail: g.lancioni@psico.uniba.it.

At present, pharmacological treatment strategies (eg, the use of antioxidants, acetylcholinesterase inhibitors, and the *N*-methyl-D-aspartate receptor-antagonist, memantine) may be seen as helpful, but can hardly be considered a definite solution to the problems.[12-18] There is great expectation that new developments prompted by the constant social and media attention on the disease's destructive impact may improve this condition in the near future.[9,17]

Behavioral treatment includes a multiplicity of strategies that for practical purpose may be divided into 2 main groups. The first group concerns those strategies that focus on reality orientation therapy and attention and memory exercises to support the overall cognitive/functional condition of the patients.[19-22] The second group concerns efforts to reestablish daily living activities. It is based on the assumption that the patients' ability to perform those activities again is a way to counter their decline, frustration, and withdrawal and to promote their self-determination, alertness, and social image.[23-28]

One of the strategies successfully used to reestablish daily living activities relied on (*a*) verbal instructions aimed at guiding the patients' performance of the activity steps and (*b*) support technology designed to help the patients manage the aforementioned instructions efficiently and with limited effort. The activities targeted included morning-bathroom routine, dressing, table setting, and coffee preparation.[29,30]

The first objective of the current 3 studies was to extend the aforementioned use of verbal instructions presented through basic technology with new participants and activities. Specifically, the 3 studies targeted coffee preparation with 2 new participants, use of make-up with 2 new participants, and use of make-up and tea preparation with 3 new participants, respectively. The activities were chosen on their presumed suitability and social relevance. The second objective of the studies was to assess whether the activity engagement improved the patients' mood compared to parallel nonactivity periods. With regard to the first objective, positive outcomes were hypothesized based on the (*a*) encouraging results of our previous efforts in this area,[29,30] (*b*) expected suitability of simple/short verbal instructions for persons with mild and moderate Alzheimer's disease,[1,31] and (*c*) successful use of verbal instructions with persons with intellectual disabilities.[32,33] With regard to the second objective, generally positive outcomes were hypothesized based on the results of (*a*) studies helping patients with Alzheimer's disease engage in preferred activities[34] or exercise[9] and (*b*) studies promoting activity engagement with persons with intellectual and multiple disabilities.[35,36]

Study I—Method

Participants

The participants, Janice and Nancy (pseudonyms), were 58 and 79 years, respectively, and were considered to function within the moderate range of Alzheimer's disease. Their scores on the Mini-Mental State Examination[37] were 15 and 12, respectively. Their scores on the Hamilton Depression Rating Scale[38] (17-item version) were 16 and 18 (indicating mild or moderate depression). They were known to be passive or erratic in relation to daily activities. However, they seemed to possess (and control) the motor schemes required for the steps of those activities and to respond to verbal instructions. Those instructions were generally effective in guiding them through the activity steps and ensuring their performance. They were temporarily residing in an Alzheimer Rehabilitation Center, in which typical behavioral intervention strategies such as reality orientation therapy were implemented together with mild forms of movement therapy. Pharmacological treatment for the Alzheimer condition was available only for Nancy and consisted of acetylcholinesterase inhibitors. The study was approved by an ethics committee and received formal consent from the participants' families.

Table 1. List of Steps (and General Instructions) for Coffee Preparation

1. Take base of coffee machine.
2. Put base on table.
3. Take the water.
4. Put the water into base.
5. Take machine filter.
6. Set filter onto the base.
7. Take coffee box.
8. Open box on table.
9. Take a spoon.
10. Put coffee into filter.
11. Take top of coffee machine.
12. Fix top and base together.

Setting, Coffee Preparation, Data Recording, and Reliability

The study was carried out in a dining room, in the Alzheimer Rehabilitation Center that the participants attended. The coffee-preparation activity consisted of 12 steps. Table 1 reports the list of steps and general instructions that were available for them. The instructions (recorded on tape by research assistants) involved some variations in the terminology used for the participants as well as repetitions, that is, they were uttered twice in succession.[29]

Data recording concerned the participants' performance of the activity steps (see Table 1) and their indices of happiness (ie, smiling, laughing, and/or excited vocalization).[39] The activity steps were recorded by research assistants during the baseline and intervention trials. A step was recorded as "correct" if it matched the description of that step (and the instruction available for it during the intervention) and occurred independent of prompting by research assistants (see below). The indices of happiness were recorded from the videotapes of the intervention/activity trials (which also allowed to ascertain the duration of those trials) and of parallel nonactivity trials. The recording occurred according to a partial interval system, in which 10-second

observation intervals were followed by 5-second scoring periods. The 10-second intervals were scored positive as long as any of the expressions identified as indices of happiness appeared, regardless of their duration. Interrater agreement was checked over 20% of the baseline and intervention trials for activity steps and 30% of the intervention and nonactivity trials for indices of happiness. The percentages of interrater agreement were computed by dividing the number of activity steps or recording intervals with agreement by the total number of steps or intervals, and multiplying by 100. The percentages were within the 80 to 100 range, with means exceeding 93.

Activity Material and Technology

The activity material involved the items required for coffee preparation (including the base and the top part of a traditional Italian coffee machine), which were displayed on a serving cart, and a little table next to the cart. The technology, which matched that used by Lancioni et al,[29,30] consisted of battery-powered, radio-frequency photocells, light-reflecting paper, a Walkman with the recording of the verbal instructions related to the coffee-preparation steps (see Table 1), and a microprocessor-based electronic control unit. This unit was fitted with specifically developed software and included (*a*) a radio-frequency receiver that responded to photocell inputs and (*b*) a programmable command function that regulated the Walkman and, thus, the presentation of the verbal instructions and the time intervals occurring between them (see below). The photocells and light-reflecting paper were arranged in front (at the opposite sides) of the serving cart containing the items for coffee preparation, so that the participants would interrupt the photocells' light beam when they reached for an item.

The coffee preparation activity started with the control unit triggering the Walkman that presented the first instruction (ie, take base of coffee machine). In taking the base, the participant broke the photocells' light beam. This started a programmed, brief interval (eg, 4 seconds) at the end of which the control unit triggered the Walkman that presented the next instruction (ie, put base on table). After a programmed, longer interval (eg, 15 seconds), the control unit activated the Walkman and the third instruction occurred (ie, take the water). In taking the water, the participant broke the photocells' light beam and started a new programmed, brief interval followed by the next instruction (ie, put the water into base). This instruction started another programmed interval at the end of which the control unit triggered the Walkman for a new instruction (ie, take machine filter). In taking the machine filter, the participant broke the photocells' light beam and the process continued like above for this step and the next ones of the sequence. Brief intervals were programmed after the responses of taking objects and longer intervals after the instructions of using/placing those objects (see Table 1). The intervals were programmed by the research assistants based on previous observations of the participants through the activity.[40]

Experimental Conditions

Intervention on coffee preparation occurred according to a nonconcurrent multiple baseline design across participants[41] (ie, their intervention phases started after baselines of different lengths). Verbal and physical prompting by a research assistant occurred if the participants remained passive or wandered around for about 30 seconds, or failed to perform a step appropriately (during both baseline and intervention), or failed to respond to an instruction for 10 to 20 seconds (during intervention). At the end of the sequence, the research assistant expressed social appreciation (ie, 2 or 3 sentences underlining the participants' good effort). To assess the impact of activity on indices of happiness, nonactivity observation trials were conducted parallel to the intervention trials (ie, 15 to 40 minutes before or after these trials), according to an alternating treatments design.[41]

Baseline. The baseline phase included 7 and 11 coffee-preparation trials for Janice and Nancy, respectively. During baseline, the participants were to perform the coffee-preparation sequence without the help of the technology and related verbal instructions.

Intervention. This phase was preceded by familiarization (practice) with the technology and instructions during 3 coffee-preparation trials. The intervention phase per se included 52 and 51 trials for the 2 participants, respectively. During each trial, the participants performed all coffee-preparation steps with the help of the technology and related instructions as described above.

Nonactivity observation trials. During these trials, the participant was sitting in the living room with the television on. The duration of a nonactivity trial

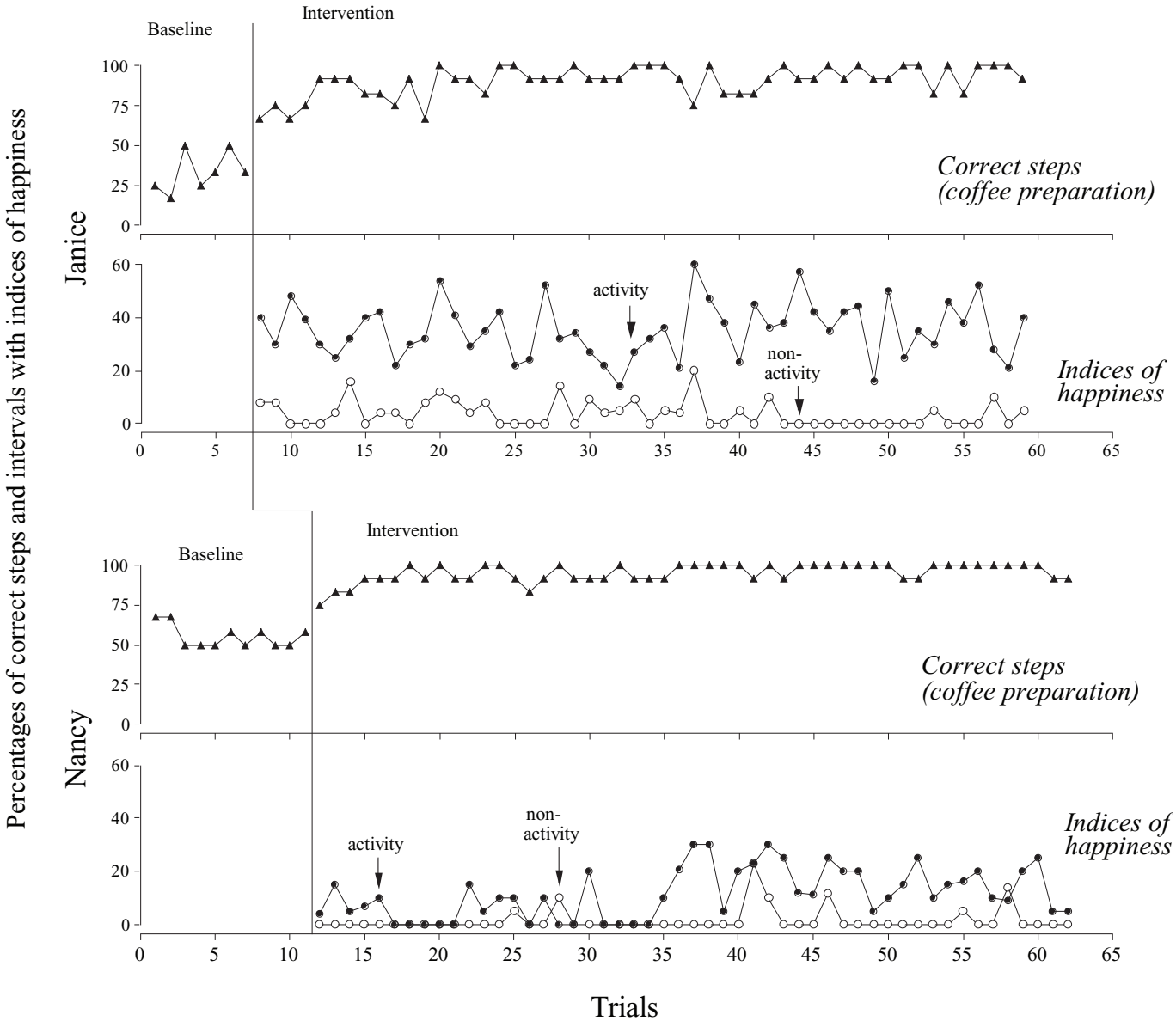

Figure 1. The upper 2 graphs summarize Janice's activity and mood data; the lower 2 graphs Nancy's activity and mood data. The black triangles represent percentages of correct coffee-preparation steps across trials; the black dots percentages of intervals with indices of happiness during those trials; and the empty circles percentages of intervals with indices of happiness during parallel non-activity trials.

matched the length of the previous intervention (activity) trial. Moreover, the research assistant could make a number of brief (physical and verbal) contacts so as to match the number of prompts occurred during the previous intervention trial.

Results

The upper 2 graphs of Figure 1 summarize Janice's data, the lower 2 graphs Nancy's data. The data concern correct activity steps and indices of happiness. During baseline, the participants' mean percentages of activity steps carried out correctly were 33 and 55. During the intervention, their overall mean percentages of correct steps exceeded 90. The mean duration of the intervention trials for the 2 participants was either above or just below 5 minutes. The participants' mean percentages of intervals with indices of happiness were about 35 and 11 during those trials and 4 and 2 during the parallel nonactivity trials. The Kolmogorov-Smirnov test showed that

the increases in correct responding from baseline to intervention were significant ($P < .01$) for both participants.[42] Similarly significant ($P < .01$) at the same test were the differences in indices of happiness between intervention/activity trials and nonactivity trials.

Study II—Method

Participants

The participants, Lucy and Mabel (pseudonyms), were 59 and 73 years, respectively, and were considered to function within the moderate range of the Alzheimer's disease. Their scores on the Mini-Mental State Examination[37] were 17 and 18, respectively. Their scores on the Hamilton Depression Rating Scale[38] (17-item version) were 18 and 13 indicating moderate and mild depression, respectively. Like the participants of Study I, they had problems in carrying out daily activities but seemed to (*a*) possess and control the motor schemes required for the activity steps and (*b*) respond to verbal instructions related to them. They were attending a day center for patients with Alzheimer's disease where they received some supervised activity engagement and mild movement opportunities. Pharmacological treatment for the Alzheimer condition was available for both participants and consisted of acetylcholinesterase inhibitors. The study was approved by an ethics committee and received formal consent from the participants' families.

Setting, Use of Make-up, Data Recording, and Reliability

The setting for the use of make-up was a sitting room of the day center the participants attended. The activity consisted of 18 or 20 steps. Table 2 reports a list of 20 steps and the instructions that were available for them. Use of instructions, data recording, and interrater reliability matched those of Study I.

Activity Material and Technology

The make-up items were displayed on a little table next to the one at which the participant sat. The technology was an upgraded version of that described in Study I, with an amplified MP3 player with USB pen drive connection replacing the Walkman.

Table 2. List of Steps (and General Instructions) for Use of Make-up

1. Take the mirror.
2. Put the mirror before you.
3. Take the cream.
4. Put the cream on face.
5. Take face powder.
6. Open the container.
7. Take the large brush.
8. Brush powder on face.
9. Take the eyeshadow.
10. Open the container.
11. Take the small brush.
12. Put eyeshadow on.
13. Take the lipstick.
14. Put lipstck on.
15. Take the comb.
16. Comb your hair.
17. Take the perfume.
18. Put perfume on.
19. Take eyeglasses.
20. Put eyeglasses on.

Experimental Conditions

Intervention on the use of make-up occurred according to a nonconcurrent multiple baseline design across participants.[41] Baseline, intervention with preceding familiarization conditions, and nonactivity observation trials were comparable with those reported in Study I.

Results

The upper 2 graphs of Figure 2 summarize Lucy's data, the lower 2 graphs Mabel's data. The data concern correct activity steps and indices of happiness. During baseline (7 and 10 sessions), the participants' mean percentages of activity steps carried out correctly were 63 and 30. During the intervention (44 and 47 sessions), their overall mean percentages of correct steps exceeded 90. The mean duration of the intervention trials was 5.3 and 6 minutes for the 2 participants, respectively. The participants' mean percentages of intervals with indices of happiness were 19 and 14 during those trials and about 2 during the parallel nonactivity trials. Data were missing for 3 trials (see Figure 2) due to video-recording problems. The Kolmogorov-Smirnov test showed that the increases in correct responding from baseline to intervention were significant ($P < .01$) for both participants.[42] Similarly significant ($P < .01$) at the same test were the differences in indices of happiness between intervention/activity trials and nonactivity trials.

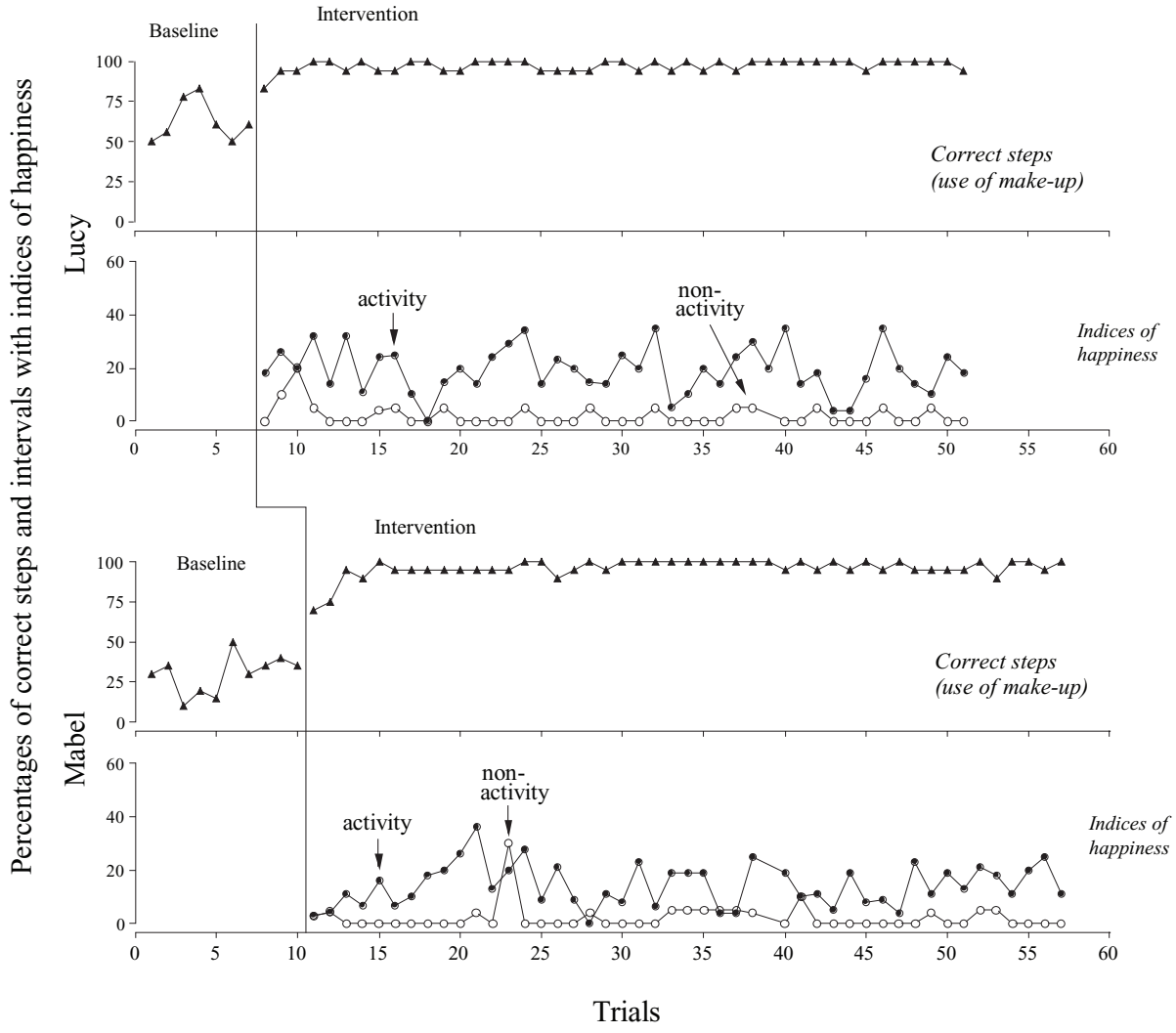

Figure 2. Activity (use of make-up) and mood data for Lucy and Mabel plotted as in Figure 1.

Study III—Method

Participants

The participants, Janice, Grace, and Alice (pseudonyms), were 58, 69, and 72 years, respectively. Janice had participated in Study I. They were considered to function within the moderate range of the Alzheimer's disease, with scores on the Mini-Mental State Examination[37] of 15, 17, and 13, respectively. Their scores on the Hamilton Depression Rating Scale[38] (17-item version) were 16, 10, and 13 indicating mild depression. They had problems in carrying out activities, but were able to follow verbal instructions related to them, and attended a day center for patients with Alzheimer's disease. Pharmacological treatment for the Alzheimer condition was available for Grace and Alice and consisted of acetylcholinesterase inhibitors. The study was approved by an ethics committee and received formal consent from the participants' families.

Setting, Make-up and Tea Activities, Data Recording, and Reliability

The setting and steps for the use of make-up were the same as in Study II. Tea preparation, which was carried out in a kitchen area, involved 16 steps. Table 3 reports a list of the steps and the instructions that were available for them. Use of instructions, data recording, and interrater reliability matched those of Study I.

Table 3. List of Steps (and General Instructions) for Tea Preparation

1. Take the container.
2. Put container on table.
3. Take the water.
4. Put water into container.
5. Take tea solution.
6. Pour solution into container.
7. Take the spoon.
8. Steer solution in container.
9. Take a glass.
10. Fill the glass with tea.
11. Take another glass.
12. Fill this glass with tea.
13. Take the tray.
14. Place the glasses on tray.
15. Take napkins.
16. Call for tea.

Activity Materials and Technology

The activity materials included the make-up items (see Study II) as well as the tea items. The latter items were on a small table next to a regular table where tea was prepared. The technology was the same as in Study II.

Experimental Conditions

A multiple baseline design across activities[41] was applied for each participant. Intervention started on the use of make-up and was then extended to tea preparation. Baseline, intervention with preceding familiarization conditions, and nonactivity observation trials were comparable with those reported in Study I.

Results

Figures 3-5 summarize the data for Janice, Grace, and Alice, respectively. The upper 2 graphs of each figure show (*a*) the baseline and intervention data on the use of make-up and (*b*) the indices of happiness during the intervention/activity trials and parallel nonactivity trials, respectively. The lower 2 graphs mirror the top graphs but the activity involved is tea preparation. During baseline (6 and 10 sessions), Janice's mean percentages of correct steps for the 2 activities were below 40. Intervention (44 sessions per activity) increased those mean percentages to about 90 (see Figure 3). Similarly high intervention percentages were also obtained for Grace and Alice (see Figures 4 and 5). The duration of the intervention trials for the 3 participants averaged around 6 or 7 minutes on the use of make-up and 5 or 6 minutes on tea preparation. The participants' mean percentages of intervals with indices of happiness ranged from 16 to 30 during the intervention trials on the use of make-up and from 4 to 8 during the parallel nonactivity trials. Similar percentages were recorded during the intervention trials on tea preparation and the parallel nonactivity trials. Data were missing for a few trials (see Figures 4 and 5) due to video-recording problems. The Kolmogorov-Smirnov test showed that the increases in correct responding from baseline to intervention were significant ($P < .01$) for all participants on both activities.[42] Similarly significant ($P < .01$) at the same test were the differences in the participants' indices of happiness between the intervention trials on the 2 activities and the parallel nonactivity trials.

General Discussion

The data from the 3 studies support the notion that the use of verbal instructions and basic technology to control their presentation may be effective in helping persons with moderate Alzheimer's disease perform daily activities. Specifically, the first study successfully replicated the outcome of a previous study targeting the same activity with 2 participants.[30] The second and third studies extended the range of daily activities that may be feasible for patients to recapture with the help of verbal instructions and technological support. All 3 studies also suggested that activity engagement can improve the patients' mood.

The performance improvement reached by the participants seems to counter their increasing activity failure, frustration, and withdrawal, and simultaneously promotes their self-determination, alertness, and social image.[25,29,30,43] Such an achievement may also provide family and caregivers (*a*) some (momentary) respite as to the level of direct assistance that they need to supply, (*b*) a more positive image of the person they care for with the possibility of improving their emotional ties with that person, and (*c*) new, positive expectations and new motivation to extend the intervention to other daily activities.[28-30]

From a treatment standpoint, these results together with those of our previous studies[29,30] indicate that the strategy reported (ie, verbal instructions managed through basic technology) is suitable for persons with mild or moderate Alzheimer's disease who can understand instructions and plan/perform the related responses.[44] From a practical standpoint, the suitability of the strategy finds additional support in the simplicity and economical affordability (with a cost estimated at about US$750) of the technology

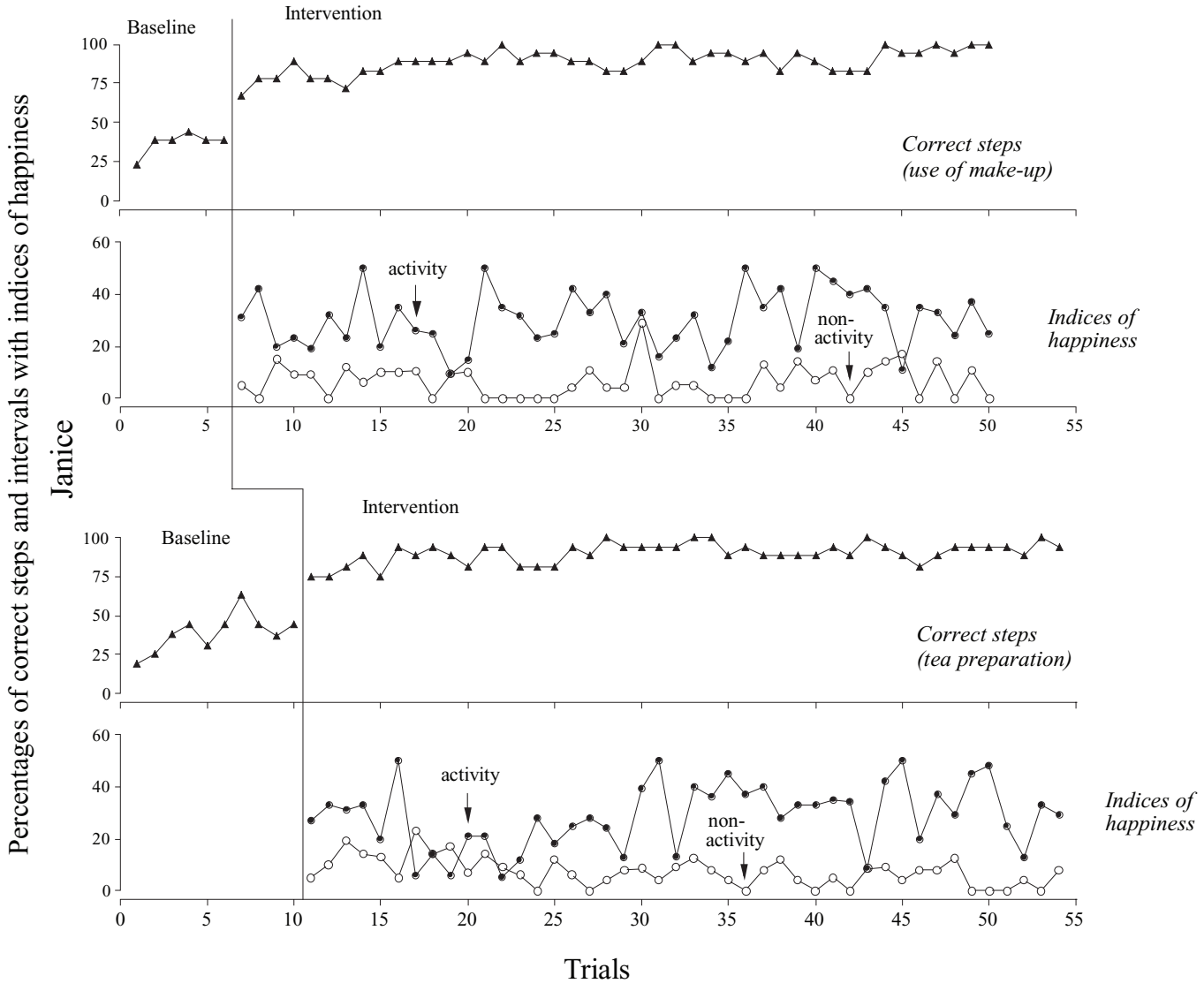

Figure 3. The upper 2 graphs summarize Janice's data on the use of make-up and mood; the lower 2 graphs Janice's data on tea preparation and mood. The data are plotted as in Figure 1.

used for presenting the instructions. Its general simplicity would allow caregivers to arrange its use with minimal time investment or procedural difficulties; its low cost would allow many rehabilitation contexts and families to acquire it.[30] In spite of the apparent suitability and affordability of the strategy reported, one should not discount the importance of testing other strategies, such as computer-based pictorial instructions.[32] Such strategies could provide fitting new options for a number of patients.

The array of activities targeted in our present and previous studies is still quite narrow. Moreover, one of the activities (ie, use of make-up) is exclusively suitable for women. One could imagine that the same intervention strategy and technology could be easily adapted to other activities such as preparing the items required for a physical-fitness session, sorting/storing grocery items, preparing ingredients/tools for a snack (ie, glasses, drinks, and foods), preparing ingredients for a fruit salad or a cold dessert, and cleaning or ordering a room.[30,45] Extending the range of activities programmed would augment the opportunities of constructive occupation available for both women and men.[28,32] Regarding this point, one may add that the intervention strategy used in our studies and strategies such as computer-based pictorial instructions appear equally suitable for female and male patients.[29,30,32]

The increase in indices of happiness observed during activity engagement can lead to several considerations. First, any such increase can be considered a

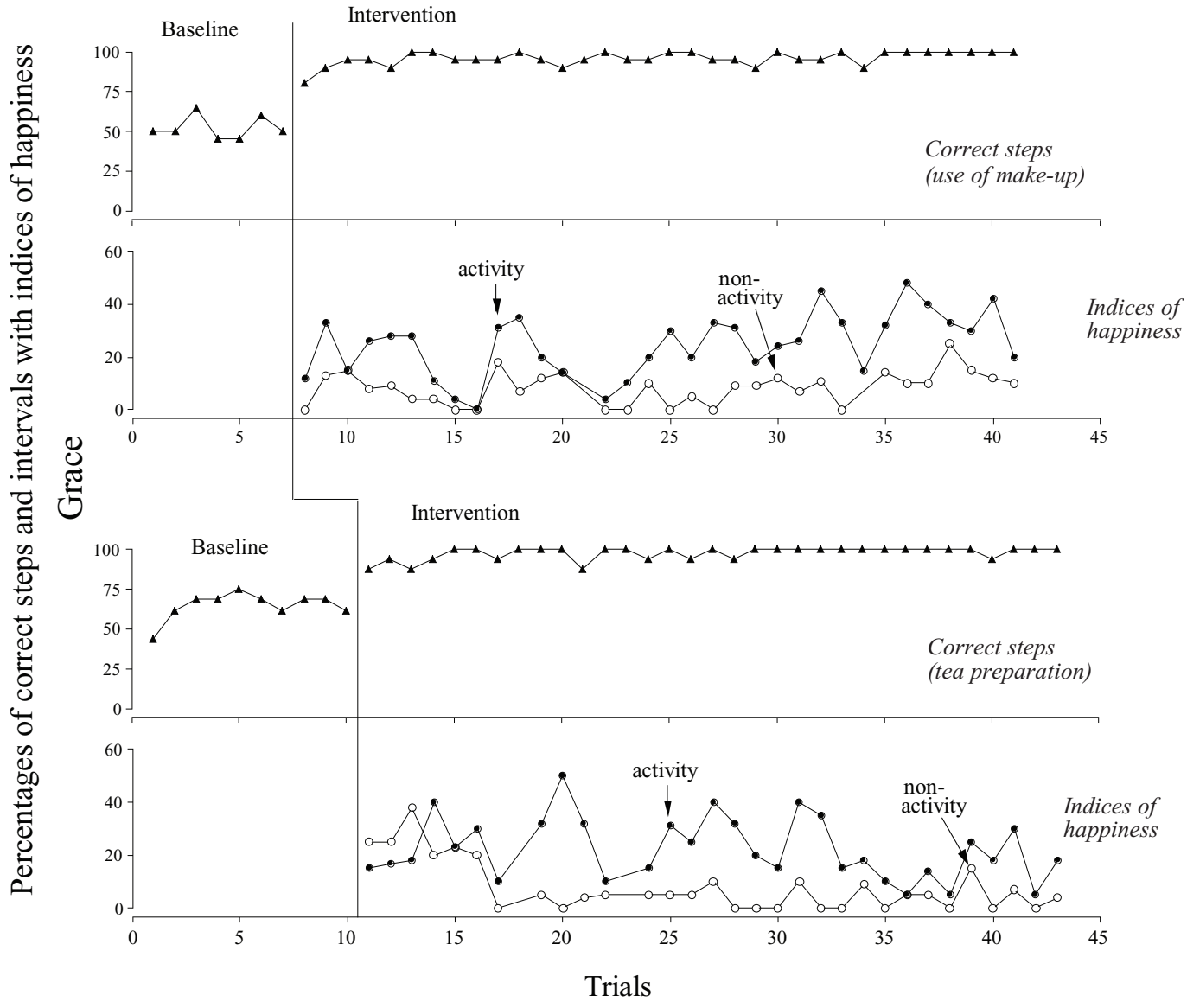

Figure 4. Grace's data corresponding to those plotted in Figure 3.

sign of improvement in quality of life. In fact, happiness can be viewed as a most distinctive feature of the whole concept of quality of life.[34,39] Second, an enhancement in indices of happiness (quality of life) can have positive implications also for the participant's caregivers and social context, providing some reassurance over the intervention approach being applied and alleviating the burden of the care and the anxieties linked to it.[46] Third, the reasons for the increased indices of happiness during the activity are not known. It might be that (*a*) engagement is preferable to nonengagement, (*b*) the ability to follow verbal instructions and manage the activity steps provides positive personal feelings and a level of self-confidence, and (*c*) successful activity performance rekindles a sense of social fitness and increases the level of wellbeing.[30-32,34,35] Fourth, the data collected in the studies showed mood improvement during the activity time. Nonetheless, one could not exclude that the improvement lasted beyond that time. A clarification of this point (by continuing the observation and data recording beyond the activity) would be very relevant.

In conclusion, verbal instruction strategies supported by technology may be used to help persons with mild or moderate Alzheimer's disease recapture daily activities and improve their mood. Although very encouraging, the data available present clear limitations in terms of participants involved, extension of evidence on mood benefits, and activities targeted. Each of these points calls for new research

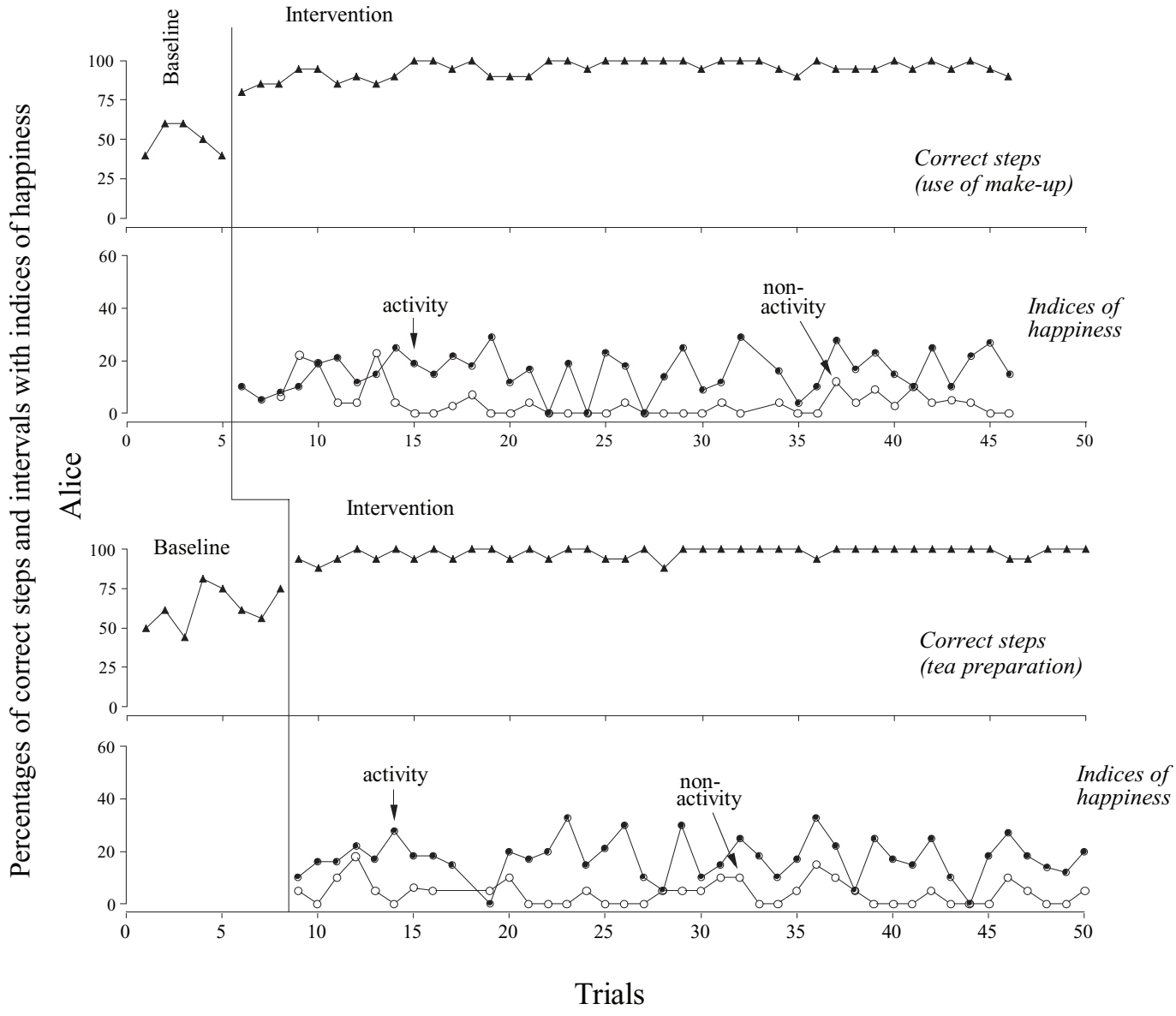

Figure 5. Alice's data corresponding to those plotted in Figure 3.

efforts and clarifications that would determine the generality of the current data. Two additional research issues may concern (*a*) maintenance and generalization of activity and mood changes[29,30] and (*b*) social validation of activity and mood data with family members and staff personnel as raters.[47]

Acknowledgment

The Alzheimer Rehabilitation Center, Bisceglie (Italy) funded the acquisition of the technology for the presentation of the verbal instructions.

References

1. Arkin S. Language-enriched exercise plus socialization slows cognitive decline in Alzheimer's disease. *Am J Alzheimers Dis Other Demen*. 2007;22:62-77.
2. Fernandez AL, Mainoiloff LM, Monti AA. Long-term cognitive treatment of Alzheimer's disease: a single case study. *Neuropsychol Rehabil*. 2006;16:96-109.
3. Labelle KL, Mihailidis A. The use of automated prompting to facilitate handwashing in persons with dementia. *Am J Occup Ther*. 2006;60:442-450.
4. Raggi A, Iannacone S, Marcone A, et al. The effects of a comprehensive rehabilitation program of Alzheimer's disease in a hospital setting. *Behav Neurol*. 2007;18:1-6.

5. Sitzer DI, Twamley EW, Jeste DV. Cognitive training in Alzheimer's disease: a meta-analysis of the literature. *Acta Psychiatr Scand*. 2006;114:75-90.
6. Appleby BS, Roy P, Valenti A, Lee HB. Diagnosis and treatment of depression in Alzheimer's disease: impact on mood and cognition. *Panminerva Med*. 2007;49:139-149.
7. Onor ML, Trevisiol M, Negro C, Signorini A, Saina M, Aguglia E. Impact of a multimodal rehabilitative intervention on demented patients and their caregivers. *Am J Alzheimers Dis Other Demen*. 2007;22:261-272.
8. Williams CL, Tappen RM. Effect of exercise on mood in nursing home residents with Alzheimer's disease. *Am J Alzheimers Dis Other Demen*. 2007;22:389-397.
9. Williams CL, Tappen RM. Exercise training for depressed older adults with Alzheimer's disease. *Aging Ment Health*. 2008;12:72-80.
10. Bayles KA, Kim ES. Improving the functioning of individuals with Alzheimer's disease: emergence of behavioral interventions. *J Commun Disord*. 2003;36: 327-343.
11. Bottino CM, Carvalho IA, Alvarez AM, et al. Cognitive rehabilitation combined with drug treatment in Alzheimer's disease patients: a pilot study. *Clin Rehab*. 2005; 19:861-869.
12. Doody R, Wirth Y, Schmitt F, Mobious HJ. Specific functional effects of memantine treatment in patients with moderate to severe Alzheimer's disease. *Dement Geriatr Cogn Disord*. 2004;18:227-232.
13. Farlow MR, Cummings JL. Effective pharmacological management of Alzheimer's disease. *Am J Med*. 2007; 120:388-397.
14. Kurz A, Farlow M, Quarg P, Spiegel R. Disease stage in Alzheimer disease and treatment effects of rivastigmine. *Alzheimer Dis Assoc Disord*. 2004;18:123-128.
15. Saddichha S, Pandey V. Alzheimer's and non-Alzheimer's dementia: a critical review of pharmacological and nonpharmacological strategies. *Am J Alzheimers Dis Other Demen*. 2008;23:150-161.
16. Molinuevo JL, Liadó A, Rami L. Memantine: targeting glutamate excitotoxicity in Alzheimer's disease and other dementias. *Am J Alzheimers Dis Other Demen*. 2005;20:77-85.
17. Moretti R, Torre P, Antonello RM, Cazzato G, Pizzolato G. Different responses to rivastigmine in subcortical vascular dementia and multi-infarct dementia. *Am J Alzheimers Dis Other Demen*. 2008;23:167-176.
18. Rozzini L, Vicini Chilovi B, Bertoletti E, et al. Cognitive and psychopathological response to rivastigmine in dementia with Lewy bodies compared to Alzheimer's disease: a case control study. *Am J Alzheimers Dis Other Demen*. 2007;22:42-47.
19. Clare L, Wilson BA, Carter G, Hodges JR. Cognitive rehabilitation as a component of early intervention in Alzheimer's disease: a single case study. *Aging Ment Health*. 2003;7:15-21.
20. Farina E, Fioravanti R, Chiavari L, et al. Comparing two programs of cognitive training in Alzheimer's disease: a pilot study. *Acta Neurol Scand*. 2002;105:365-371.
21. Grandmaison E, Simard M. A critical review of memory stimulation programs in Alzheimer's disease. *J Neuropsychiatry Clin Neurosci*. 2003;15:130-144.
22. Hochhalter AK, Stevens AB, Okonkwo O. Structured practice: a memory intervention for persons with dementia. *Am J Alzheimers Dis Other Demen*. 2007;21:424-430.
23. Boger J, Hoey J, Poupart P, Boutilier C, Fernie G, Mihailidis A. A planning system based on Markov decision processes to guide people with dementia through activities of daily living. *IEEE Trans Inf Technol Biomed*. 2006;10:323-333.
24. Engelman KK, Altus DE, Mosier MC, Mathews RM. Brief training to promote the use of less intrusive prompts by nursing assistants in a dementia care unit. *J Appl Behav Anal*. 2003;36:129-132.
25. Engelman KK, Mathews RM, Altus DE. Restoring dressing independence in persons with Alzheimer's disease: a pilot study. *Am J Alzheimers Dis Other Demen*. 2002;17: 37-43.
26. Mihailidis A, Boger J, Canido M, Hoey J. The use of an intelligent prompting system for people with dementia. *ACM Interactions*. 2007;14:34-37.
27. Rogers JC, Holm MB, Burgio LD, et al. Improving morning care routines of nursing home residents with dementia. *J Am Geriatr Soc*. 1999;47:1049-1057.
28. Wood W, Harris S, Snider M, Patchel SA. Activity situations on an Alzheimer's disease special care unit and resident environmental interaction, time, use, and affect. *Am J Alzheimers Dis Other Demen*. 2005;20:105-118.
29. Lancioni GE, Pinto K, La Martire ML, et al. Helping persons with mild or moderate Alzheimer's disease recapture basic daily activities through the use of an instruction strategy. *Disabil Rehabil*. 2009;31:211-219.
30. Lancioni GE, La Martire ML, Singh NN, et al. Persons with mild or moderate Alzheimer's disease managing daily activities via verbal instruction technology. *Am J Alzheimers Dis Other Demen*. 2008/2009;23:552-562.
31. Welland RJ, Lubinski R, Higginbotham DJ. Discourse Comprehension Test performance of elders with dementia of the Alzheimer type. *J Speech Lang Hear Res*. 2002;45:1175-1187.
32. Lancioni GE, O'Reilly MF. Self-management of instruction cues for occupation: review of studies with people with severe and profound developmental disabilities. *Res Dev Disabil*. 2001;22:41-65.
33. Post M, Storey K. Review of using auditory prompting systems with persons who have moderate to severe disabilities. *Educ Train Ment Retard Dev Disabil*. 2002; 37:317-327.
34. Moore K, Delaney JA, Dixon MR. Using indices of happiness to examine the influence of environmental enhancements for nursing home residents with Alzheimer's disease. *J Appl Behav Anal*. 2007;40:541-544.
35. Yu DCT, Spevack S, Hiebert R, et al. Happiness indices among persons with profound and severe disabilities during leisure and work activities: a comparison. *Educ Train Ment Retard Dev Disabil*. 2002;37:421-426.

36. Reid DH, Green CW, Parsons MB. A comparison of supported work versus center-based program services on selected outcomes for individuals with multiple severe disabilities. *J Assoc Pers Sev Handicaps*. 1998;23:69-76.
37. Folstein M, Folstein SE, McHugh PR. "Mini-Mental State" a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12: 189-198.
38. Bagby RM, Ryder AG, Schuller DR, Marshall MB. The Hamilton Depression Rating Scale: has the golden standard become a lead weight? *Am J Psychiatry*. 2004;161: 2163-2177.
39. Lancioni GE, Singh NN, O'Reilly MF, Oliva D, Basili G. An overview of research on increasing indices of happiness of people with severe/profound intellectual and multiple disabilities. *Disabil Rehabil*. 2005;27:83-93.
40. Cohen-Mansfield J, Creedon MA, Malone T, Parpura-Gill A, Dakheel-Ali M, Heasley C. Dressing of cognitively impaired nursing home residents: description and analysis. *Gerontologist*. 2006;46:89-96.
41. Barlow DH, Nock M, Hersen M. *Single-case Experimental Designs*. 3rd ed. New York, NY: Allyn & Bacon; 2008.
42. Siegel S, Castellan NJ. *Nonparametric Statistics*. 2nd ed. New York, NY: McGraw-Hill; 1988.
43. Missotten P, Ylieff M, Di Notte D, et al. Quality of life in dementia: a 2-year follow-up study. *Int J Geriatr Psychiatry*. 2007;22:1201-1207.
44. Swanberg MM, Tractenberg RE, Mohs R, Thal LJ, Cummings JL. Executive dysfunction in Alzheimer disease. *Arch Neurol*. 2004;61:556-560.
45. Gitlin LN, Corcoran M, Winter L, Boyce A, Hauck WW. A randomized controlled trial of a home environment intervention: effect on efficacy and upset in caregivers and on daily functioning of persons with dementia. *Gerentologist*. 2001;41:4-14.
46. Singh NN, Matson JL, Lancioni GE, et al. Questions about behavioral function in mental illness (QABF-MI): a behavior checklist for functional assessment of maladaptive behavior exhibited by individuals with mental illness. *Behav Modif*. 2006;30:739-751.
47. Lancioni GE, O'Reilly MF, Singh NN, et al. Social validation assessment of microswitch-based programs for persons with multiple disabilities employing teacher trainees and parents as raters. *J Dev Phys Disabil*. 2006;18: 383-391.