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Music Listening for Maintaining Attention of Older Adults with Cognitive Impairments

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Twelve older adults with cognitive impairments who were participants in weekly community-based group music therapy sessions, 6 older adults in an Alzheimer's caregivers' group, and 6 college student volunteers listened to a 3.5 minute prepared audiotape of instrumental excerpts of patriotic selections. The tape consisted of 7 excerpts ranging from 18 s to 34 s in duration. Each music excerpt was followed by a 7–9 s period of silence, a "wait" excerpt. Listeners were instructed to move a Continuous Response Digital Interface (CRDI) to the name of the music excerpt depicted on the CRDI overlay when they heard a music excerpt. Likewise, they were instructed to move the dial to the word "WAIT" when there was no music. They were also instructed to maintain the dial position for the duration of each music or silence excerpt. Statistical analysis indicated no significant differences between the caregivers' and the college students' group means for total dial changes, correct and incorrect recognitions, correct and incorrect responses to silence excerpts, and reaction times. The mean scores of these 2 groups were combined and compared with the mean scores of the group of elderly adults with cognitive impairments. The mean total dial changes were significantly lower for the listeners with cognitive impairments, resulting in significant differences in all of the other response categories except incorrect recognitions. In addition, their mean absence of response to silence excerpts was significantly higher than their mean absence of responding to music excerpts. Their mean reaction time was significantly slower than the comparison group's reaction time. To evaluate training effects, 10 of the original 12 music therapy participants repeated the listening task with assistance from the therapist (treatment) immediately following the first listening (baseline). A week later the

order was reversed for the 2 listening trials. Statistical and graphic analysis of responses between first and second baseline responses indicate significant improvement in responses to silence and music excerpts over the 2 sessions. Applications of the findings to music listening interventions for maintaining attention, eliciting social interaction between clients or caregivers and their patients, and evaluating this population's affective responses to music are discussed.

Listening to music provides pleasurable and purposeful distraction for most people. Although musicians and nonmusicians probably focus on different music elements while listening (Madsen & Geringer, 1990; Rentz, 1992) research suggests that affective responses to music are highly similar for both groups (Brittin, 1996; Frego, 1999; Lychner, 1998; Madsen, Byrnes, Capperella-Sheldon, & Brittin, 1993). This relatively recent finding, the similarity of affective responses, partially clarifies well-established documentation of effective contingent music applications in education and therapy (Standley, 1996). It also relates to the beneficial effects of *active* listening, or mentally tracking music through time, that has been documented as a therapeutic intervention in potentially aversive situations (Smith, Casey, Johnson, Gwede, & Riggin, 2001), physically painful procedures (Hauser, Larson, & O'Connell, 1983), and anxiety-producing settings (Allen et al., 2001). Are similar pleasurable and distraction benefits of music listening available to people with cognitive impairments?

While efforts to map specific brain activity of persons with dementia during music listening (Gunther et al., 1993; Halpern & Zatorre, 1999) are ongoing, it is safe to say that maintaining attention to music through time is a cognitive process that supersedes perception of sound. Active listening may be required for most music behaviors, such as singing and dancing, but any related cognition is inferred and observed through the overt response. When active listening is isolated as *the* music response and has no motor performance correlates, its occurrence can only be inferred from the absence of incompatible, interruptive, or extra-musical responses during the presence of music (Madsen & Wolfe, 1979). It can only be observed behaviorally by the occurrence of simultaneous and af-

ter-the-fact discriminative responses related to music. For example, a person identifying music elements or recalling a title after a brief excerpt probably listened to the music in question. Does the listener continue to attend to the music after recognition or discrimination? Maintaining attention to longer music selections, particularly with a less-directed focus (such as "listen to the music"), approximates reality-based pleasurable experiences and therapeutic distraction applications of music listening. A less directed task implies the listener's self-imposed selective focus and maintenance of attention to music through time—a cognitive process. Is sustained active listening therefore problematic for people with cognitive impairments?

Researchers focusing on diagnoses have assessed this population's attention to nonmusic auditory stimuli such as audiotapes of speaking voices (Koff, Zaitchik, Montepare, & Albert, 1999) and tone variations (Gordon-Salant & Fitzgibbons, 1999). Others interested in basic music research have assessed their discrimination of music elements (Bartlett, Halpern, & Dowling, 1995; Clair, 1983; York, 1994). From a music therapy clinical research perspective, sustained attention to music, a functional behavior, has received very little attention. A meta-analysis of effective music therapy research with the elderly with cognitive impairments (Koger, Chapin, & Brotons, 1999) ranked performance-based interventions such as movement, dancing, and rhythmic instrumental techniques, followed by singing as effective techniques for generating attentive, communicative, and social responses. Listening, as an isolated activity, was rarely mentioned. In fact, only two studies in an earlier extensive review of literature (Brotons, Koger, & Pickett-Cooper, 1997) addressed cognitive skills as a therapeutic objective. A review of 120 data-based music therapy studies with the elderly (Prickett, 2000) indicates a very small portion devoted to cognitive skill preservation. Motor capabilities generally deteriorate more slowly than verbal and cognitive skills with this population (Howieson et al., 1997) and it is only reasonable that therapeutic efforts are usually directed toward maintaining and preserving existing abilities. The question seems even more pertinent: Can active music listening interventions be designed to maintain purposeful selective attention for people with potentially debilitating diagnoses that effect cognitive processing?

Divergent definitions of listening contribute to less-developed ac-

tive listening interventions. References are made to passive listening in investigations of background music and its effect on this population during a variety of situations: clinical evaluations (Silber, 1999), recreational tasks (Otto, Cochran, Johnson, & Clair, 1999), and bathing procedures (Thomas, Heitman, & Alexander, 1997). Quick acclimation to the presence of music is assumed, if not encouraged, in passive listening applications. In these and similar implementations such as music with guided imagery and relaxation techniques, the intentional background application of music, though widely and effectively used in therapy for many valid purposes, is the opposite of active listening, the focus of this project. Examples of active listening in the literature include listening games in which participants identify names or music elements after hearing brief excerpts. In fact, the games are highly effective generators of group participation and short-term attention and recall with this population (Brotons & Pickett-Cooper, 1994). Yet listening games of this nature provide little opportunity for practicing and evaluating uninterrupted, attentive listening of individuals through extended periods of time. More importantly, improving mindful attention, particularly for affective and distraction purposes, may not necessarily involve memory or recall (Levy, Jenning, & Langer, 2001).

The absence of therapeutic listening applications may also be related to the problematic nature of observing selective attention to music. As mentioned previously, the motor responses in dancing, instrumental, and singing interventions function as "attention to the here-and-now" feedback for therapists, caregivers, staff, and participants. Therapists use the music responses to practice extramusic objectives such as recall (Carruth, 1997), memory (Prickett & Moore, 1991), social interaction (Clair & Ebberts, 1997), alertness (Clair, 1996), and sensory stimulation (Groene, 1993). Active listening, however, provides minimal overt, simultaneous feedback, particularly during group applications. Attempts to evaluate selective attention have included delayed verbal responses such as "yes-no" recognition after hearing a melody (Halpern & O'Connor, 2000), and naming an excerpt after a brief presentation of a melody line played on a keyboard (Brotons & Pickett-Cooper, 1994). A pictorial Likert-type preference scale designed by other researchers (Otto et al., 1999) requires delayed motor responses. After hearing a brief excerpt, listeners pointed to one of four large pictures of

faces expressing different degrees of preference. In all of theses examples the delay between music presentation and listeners' response was brief and very practical for the intended purposes. Delayed responding after longer excerpts may be questionable with this population particularly from a therapeutic perspective. Reinforcement of continuous "here and now" responses during sustained listening seems more functional and beneficial.

The Continuous Response Digital Interface (CRDI) is one of many devices that record nonverbal, simultaneous, real-time focus-of-attention responses of individuals and small groups (Fredrickson, 1994; Gregory, 1995; Madsen & Geringer, 1990). Researchers design CRDI visual overlays with words or images relevant to a research question and participants move a dial to various points on the overlay to register their responses while attending to selected material. Researchers who have used the CRDI in music listening research suggest that, in addition to the advantage of collecting data *while* listening (rather than "after-the-fact"), the device functions for some individuals as an aid to maintaining auditory attention (Lychner, 1998). The relevance to therapy applications, particularly active music listening, is apparent. The earliest CRDI application in a therapy setting involved pairs of preschool children indicating their preference of brief examples of music by moving a CRDI lever (Madsen, Capperella, & Johnson, 1991). In a later application, Byrnes (1997) investigated the use of an original visual overlay depicting degrees of preference, and compared affective responses of students with developmental disabilities with those of other students. The CRDI was a reliable instrument in both applications.

One of the secondary purposes of this pilot project was to investigate the applicability of the CRDI as an alternative device for structuring meaningful (Law & O'Carroll, 1998) and functional (Gelb, 2000) active listening interventions for elderly people with cognitive impairments. Criteria for the listening intervention in this project included: (a) approximating sustained listening while adapting documented effective non-CRDI applications using briefer active listening interventions; (b) including a broad assessment range for the probable highly variable responses of individuals in this population; (c) incorporating a means for successive approximation using longer presentations of music for future applications, (d) selecting music that resembled typical listening

experiences from available, unaltered, transferable music; and (e) verifying *individuals'* focus of attention while using music familiar for *groups* of listeners. In other words, the listening intervention required motor responses related to cognitive processes that would provide a means of observing and teaching self-direction of sustained attention for groups of elderly listeners.

Active listening provides a potential method for engaging cognitive skills for most clients in this population. For clients whose motor capabilities make performance-based music interventions impossible or improbable, active listening may be the only access to music. The purpose of this exploratory project was to answer two fundamental questions: (a) Can elderly people with cognitive impairments maintain attention to music in an intervention specifically designed to promote active listening for this population? How do their responses compare to responses of younger and well-elderly listeners? and (b) What are short-term effects of attention training with elderly listeners who are cognitively impaired?

Method

The main group of participants included 12 clients who were regular participants in group music therapy sessions in community-based day care programs for older adults with cognitive impairments. The criteria for participation included alertness during music therapy sessions, the ability to read large print, and the ability to grasp a 1″ dial with one hand and move it around a 180-degree arc. The group consisted of 6 males ranging from 72 to 87 years of age and 6 females ranging from 70 to 95 years of age. Three of the participants were diagnosed with probable Alzheimer's disease, four of the participants were diagnosed with dementia, four were diagnosed with complications from strokes, and one was diagnosed with depression. Two comparison groups were also included in the first phase of the project. A well-elderly group included 6 females ranging in age from 55 to 79 who attended an Alzheimer's Caregivers Support group meeting. A second comparison group consisted of 6 college students, 4 females and 2 males ranging in age from 22 to 48, who volunteered to participate.

Music selection was based on (a) music recognition and preference data about elderly listeners and (b) the practicality of instrumental over vocal music to minimize additional cues from song lyrics. Three instrumental selections from the *Sing America Patriotic*

TABLE 1
*Sequence of Presentation and Description of Music Excerpts**

Title	Duration**	Description
1) Yankee Doodle	18 s	Verse and chorus: melody only, played by piccolo, with simple percussive background
2) Battle Hymn	22 s	Verse: full band, trumpets—melody, homophonic
3) America	24 s	Verse: full band, trumpets—melody, countermelodies
4) Battle Hymn	22 s	Chorus: full band, lower brass—melody, occasional countermelody
5) America	23 s	Chorus: full band, lower brass then trumpet—melody, countermelodies
6) Yankee Doodle	18 s	Verse and chorus: full band, trumpets—melody
7) Battle Hymn	34 s	Chorus: full band, lower brass—melody, countermelodies, with finale

* Selections from Compact Disc: 1997 Music Educators National Conference: *"The Sing America! Patriotic Collection*—20 Beloved Favorites Performed by the Nation's Military Bands." ** Each excerpt was followed by 7–8 seconds of silence.

Collection compact disc produced by the Music Educators National Conference (1997) included "Yankee Doodle" and "Battle Hymn of the Republic," both of which were recognized by 87% of elderly listeners (Bridges & Prickett, 2000), and "America the Beautiful" which was included in a similar list by Moore, Brotons, and Staum (1992). In order to repeat the selections but to change the music content, 2 different excerpts from "Yankee Doodle" and "America" were selected and 3 different excerpts from "Battle Hymn of the Republic" were included in the tape. The duration and relevant descriptions of each excerpt are listed in the taped sequence of presentation in Table 1. Each excerpt was separated on the prepared audiotape by a 7–8 s period of silence. The total duration of the tape was 3.50 minutes.

All participants, except the college group, completed the listening task during a regularly scheduled group session. They left the ongoing session in pairs to participate in the listening. The caregivers and participants from one therapy group used headphones to prevent distraction from the session that continued in the same room for the other group members. In the second therapy facility, listening occurred in a separate room from the music session and headphones were not used. The college volunteers did not use head-

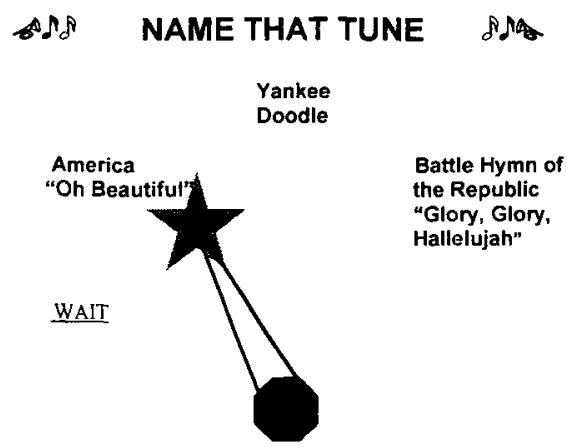

FIGURE 1.
Continuous Response Digital Interface overlay.

phones. Other equipment included a portable Compaq computer, a portable Sony tape player, and CRDI dials for each participant.

The CRDI overlay (see Figure 1) provided the titles of the three selections and additional names for "America" and "Battle Hymn of the Republic." Spacing of the titles on the overlay, including the word "WAIT," corresponded to discrete zones of CRDI digital information from "0"–"255." The CRDI program collected data corresponding to the placement of the pointer anywhere on the overlay at the rate of 2 samples per second for the duration of the tape.

Participants in the comparison groups were directed to (a) listen to a music excerpt and move the CRDI pointer to the name of the tune and (b) return the pointer to WAIT during the silence excerpts. Participants in the therapy group were introduced to the "Name That Tune" game by requesting them to read aloud the words on the CRDI overlay that was placed either in their laps or directly in front of them on a table. They were then directed to move the pointer to the different titles on the overlay and to the word "WAIT." Directions continued with telling them they would hear some taped music and to move the dial to the name of the tune when they heard the music. They were instructed to move the pointer to WAIT when there was no music on the tape. After a review of the directions, the tape was played and participants moved the dial while listening. Possible anxiety-producing "test" cues were

reduced for the therapy participants by placing small flags at the top of the CRDI board and engaging in casual conversation with some participants before and after participation about the approaching patriotic holidays—Memorial Day and Independence Day. A large red plastic star was attached to the end of the CRDI pointer to facilitate comprehension of the directions to "move the red star" rather than the more abstract "pointer."

The duration of the listening game was 3.5 minutes, the equivalent or longer for single recordings of popular music. A task analysis included seven repetitions of the following sequence: (a) presentation of music, (b) recognition of music, (c) movement of CRDI dial to the name of the excerpt, (d) presentation of silence, (e) recognition of silence, and (f) movement of dial to WAIT. The silence excerpts were designed to function as attention "checkpoints" and facilitated comparing reaction times for two types of cognitive processes—information-recognition (the third step in the sequence) and no information-recognition (the sixth step in the sequence).

All participants in the therapy group and comparison groups completed the first listening trial without assistance. This was the only trial completed by the well-elderly participants and the college students. Ten clients in the therapy group immediately repeated the listening activity after the first trial and received assistance from the therapist. Assistance during this second trial was individualized and included verbalizing prompts like "listen," "move the dial now," or pointing to the star on the CRDI dial when music or silence began. In some cases when the music changed to silence and the prompts did not produce a "WAIT" response, the dial was moved to the word WAIT for the listener. Verbal encouragement was presented during treatment sessions. No prompts or cues were given for correct titles of the excerpts. During a second music therapy session approximately a week later, the same ten clients completed two trials—the first trial with assistance and the second trial without assistance, the second baseline measure.

The therapy participants were observed during and after the listening for spontaneous affective responses. Participants in the caregivers' group completed a questionnaire about the applicability of the game for their patients and the possibility of piloting an interactive format with their patient and other family members.

Results

The CRDI program collected 2 samples per second for the 3.5 minutes music listening tape resulting in 420 CRDI samples for each listener's output file. Each data file, which contained the sequence of samples collected through time with designations for each music and silence excerpt, was examined to locate where changes in the samples occurred. There were 7 music excerpts each followed by a silence excerpt. If a change occurred during a music excerpt and the samples indicated the corresponding CRDI zone for the title, the change was categorized as "correct." Likewise, if the sample change during a music excerpt indicated the incorrect music title the change was categorized as "incorrect." The silence excerpts were categorized similarly. If a CRDI change occurred during a silence excerpt and the samples indicated a "return" to the "wait" zone, the change was categorized as "correct." If the samples indicated movement to a music title zone during a silence excerpt, the change was categorized as "incorrect." If all of the samples during a music or silence excerpt indicated no movement *from* the previous excerpt zone, the excerpt was categorized as "no response." In addition, the number of seconds from the beginning of a music or a silence excerpt to the listener's first movement of the dial during the excerpt was collected across the 14 possible excerpts to determine reaction times to music and to silence.

Comparisons Between Groups

Results of the data file analysis for the elderly, the caregivers, and the college students are provided in Table 2. The elderly group standard deviations suggest a very wide range of responses within this small group of listeners, particularly when compared to the younger and the well-elderly responses. A one-way ANOVA of group means for each category response followed by a Scheffe test indicates no significant differences between the caregivers and college students mean responses. Scores from these groups were combined into one comparison group ($n = 12$). *T*-tests on all scores of the elderly listeners ($n = 12$) and the comparison group, resulted in significant differences for all but one response. The main finding was that the elderly group did not move the CRDI dial as often as the comparison group; the mean total changes of the two groups

TABLE 2

Mean Number of Responses of Three Listener Groups

Responses	Elderly		Caregivers		Students	
	M	*SD*	*M*	*SD*	*M*	*SD*
Total changes	9.67*	4.42	14.00	1.41	14.00	.00
Music excerpts						
Correct	4.67	1.61	6.67	.82	7.00	.00
Incorrect	.92	1.31	.67	.82	.00	.00
No response	1.67	1.67	.17	.41	.00	.00
Silence excerpts						
Correct	3.33	2.64	6.67	.52	7.00	.00
Incorrect	.83	.94	.00	.00	.00	.00
No response	2.83	2.55	.17	.41	.00	.00

*The underline indicates significant difference between and the elderly mean and the combined means of the caregivers and students.

were significantly different ($t(22) = -3.322$, $p = .003$). This difference influenced other comparisons. The elderly group had fewer correct responses to both music ($t(22) = -4.378$, $p = .000$) and silence excerpts ($t(22) = -4.543$, $p = .000$). They had more "misses" (or absence of response) to both music ($t(22) = 3.237$, $p = .004$) and silence excerpts ($t(22) = 3.709$, $p = .001$). The difference between the incorrect responses to the silence excerpts means was significant ($t(22) = 3.079$, $p = .005$). The difference between the incorrect responses to music excerpts means was not significant.

Given that listeners had equal chances to respond to both music and silence, an analysis of the "no response" category among the elderly listeners provides additional information. The elderly listeners' absence of response to silence excerpts was significantly higher than their absence of response to music excerpts ($t(11) = -2.646$, $p = .023$). The correlation between music and silence excerpt "misses" among the elderly listeners was .81 ($p = .001$).

Two listeners in the elderly group and one listener in the caregivers group had two changes during some of the music excerpts—an incorrect title and a correct title. By extending the total responses to include changing the title (which truly indicates maintenance of attention) the extra dial changes increased the maximum changes to 16 for the elderly group and 15 for the caregivers and changed the response rates of these two groups. Revised

means of total changes during *music* excerpts for the elderly, caregivers, and student group were 5.58 (SD = 1.88), 7.33 (SD = 1.03), and 7.00 (SD = .00) respectively. These means are significantly different ($F(2, 21) = 3.648$, $p = .044$) but a post hoc Scheffe test revealed no separation between the three groups. The students and caregivers may be more accurate in their first identification of the music, but listening responses as defined by moving the CRDI dial to a title while listening to a music excerpt are not significantly different.

A comparison of mean reaction times to music and silence revealed that all subjects responded more slowly when processing music information. Mean number of seconds of reaction from the onset of music excerpts for the elderly, caregivers, and college student groups were 5.69 (SD = 2.99), 2.41 (SD = 1.59), and 1.40 (SD = .91), respectively, and were significantly different ($F(2,19) = 8.10$, $p = .002$). Post hoc analysis indicates the elderly listeners' mean reaction time to music was slower than either of the other two groups. The mean number of seconds of reaction to silence by the elderly (M = 1.22, SD = .84), caregivers (M = .37, SD = .33), and college students (M = .21, SD = .17) were significantly different ($F(2, 19) = 6.449$, $p = .007$). Post hoc analysis indicates the elderly listeners' response to silence was slower than either of the other two groups.

The results suggest that elderly people with cognitive impairments can sustain attention to music across a 3.5 minutes listening activity designed for the population. They responded more accurately to music excerpts than to silence excerpts and their responses to both music and silence were slower than responses of younger and well-elderly listeners.

Training Effects

Ten of the original 12 participants in the therapy groups repeated the listening task during the first listening session and completed a second listening session a week later. In order to compare the relationship between different diagnostic categories and training effects with repeated listening, participants were grouped according to diagnostic categories: dementia (n = 4), stroke (n = 4), Alzheimer's (n = 1), and depression (n = 1). Statistical data for the two groups of 4 participants are provided in Table 3. Graphic data for the two individual clients are provided in Figure 2. Treatment 1 is an assisted listening trial that immediately followed the first base-

TABLE 3
Mean Responses Across Repeated Baseline and Treatment with Elderly Listeners

Response		Dementia ($n = 4$)			Stroke ($n = 4$)	
		M	*SD*		*M*	*SD*
Total changes	B1	10.75	4.57	B1	11.75	2.06
	T1	12.75	2.22	T1	13.00	1.41
	T2	14.25	1.50	T2	14.00	.00
	B2	13.00	2.16	B2	13.00	1.15
Music excerpts						
Correct	B1	4.75	1.26	B1	5.25	1.50
	T1	5.75	1.50	T1	5.75	1.26
	T2	4.75	.50	T2	5.75	1.50
	B2	5.25	1.71	B2	5.50	2.38
Mean reaction time	B1	4.62	1.50	B1	5.45	4.48
	T1	5.52	2.91	T1	7.03	3.79
	T2	5.88	2.93	T2	6.39	4.48
	B2	4.41	3.37	B2	6.96	5.64
Silence excerpts						
Correct*	B1	3.50	2.08	B1	4.25	2.75
	T1	6.25	.96	T1	6.00	1.41
	T2	6.25	.96	T2	6.75	.50
	B2	4.50	3.00	B2	6.25	.96
Mean reaction time	B1	2.00	1.66	B1	.70	.71
	T1	1.02	.68	T1	1.08	1.34
	T2	1.15	1.00	T2	1.58	2.02
	B2	1.76	1.69	B2	1.92	1.23

* $p = .041$ across time.

line trial. Treatment 2 occurred a week later and was immediately followed by the second baseline trial.

Increases between first and second baseline trials were evident in total number of CRDI dial movement changes for both diagnostic groups. Baseline 2 means for both groups was 13 out of a possible 14. The increases were a result of correct responses to silence excerpts. A repeated measures ANOVA *between* diagnostic groups across the four listening trials revealed no significant differences between the diagnostic groups but the difference in the mean correct responses to silence across trials for all listeners was significant ($F(3) = 3.366$, $p = .041$). Changes in incorrect responses to music excerpts were not significantly different.

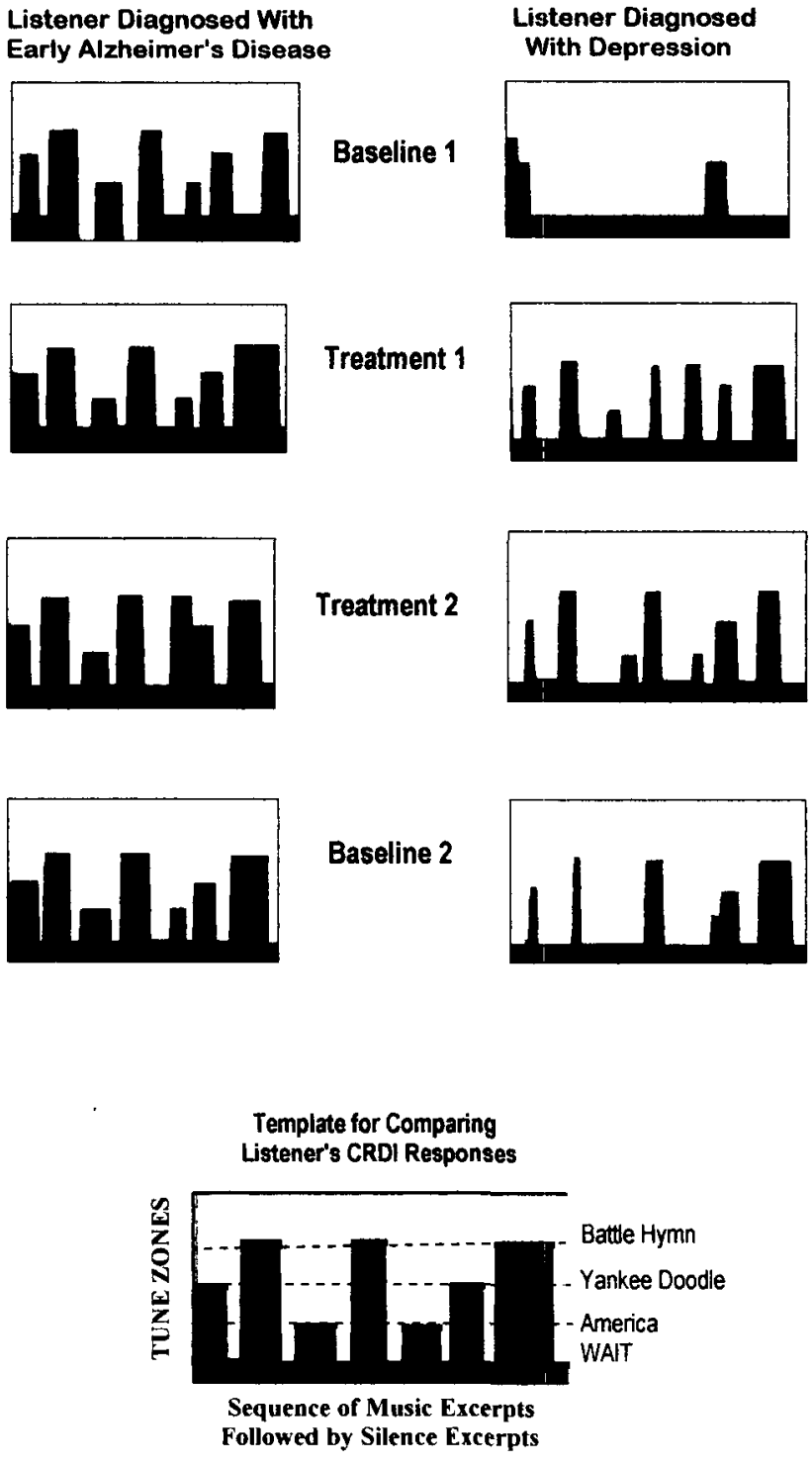

FIGURE 2.
Timelines of baseline and treatment listening responses of two individual listeners and a comparison template of accurate responding.

Increases in total dial changes and responses to silence resulted in slower reaction times to the music excerpts during treatment for both groups. Reaction times to music and silence excerpts increased across the four trials for the listeners diagnosed with stroke compared to the relatively stable reaction times of listeners diagnosed with dementia. A repeated measures ANOVA of mean reaction times revealed no significant differences between the two groups or among the groups across trials.

Graphic displays of the responses of a listener diagnosed with early Alzheimer's disease and a listener diagnosed with depression are provided in Figure 2. Comparing the timelines for each of the trials with the template of CRDI dial movement across time indicates that sustained listening was not a problem for the listener with Alzheimer's disease. Baseline 1 responses show only relatively slower reaction times after the fourth excerpt. During this first trial the listener recognized all of the excerpts, kept the CRDI dial on the name during the duration of the music and returned the dial to the wait zone during the silence between excerpts. The timeline for Treatment 1 indicates faster reaction times on the last three excerpts. Treatment 2 timeline shows some confusion during the 5th and 6th excerpts with an incorrect name and an absence of response to the 5th silence excerpt. Baseline 2 indicates accurate and timely responses. Sustained attention is well documented across all four trials. The timelines for the listener diagnosed with depression indicate progress in learning the attention response. Baseline 1 timeline indicates the listener moved the dial to the wait zone after changing his response from "Battle Hymn" to "Yankee Doodle" in the middle of the first excerpt. The listener did not respond to any of the other selections until "Yankee Doodle" was presented again as the 6th excerpt. During Treatment 1 the listener responded to all 7 excerpts while the music was presented and correctly identified all but one of the excerpts. The 5th excerpt was identified as "Battle Hymn" instead of "America." The timeline shows slow reaction times but sustained listening occurred with verbal encouragement and cues "to listen and move the dial" for each music and silence excerpt. Treatment 2 timeline, a week later, indicates that the listener retained the required responses for the game and correctly identified the excerpts. Responses to music were delayed and a response to the last silence excerpt was early. Baseline 2 timeline indicates substantial improvement over Baseline 1. The listener re-

sponded to two selections, "Yankee Doodle" and "Battle Hymn" every time they were presented. Reaction times did not improve but the listener's responses indicate that responses for this "listening game"—moving the CRDI dial to specified zones on the visual overlay to indicate discriminative responses during sustained listening—improved with training.

Casual observations of the elderly listeners' responses during and after the intervention suggested a neutral response from some and a positive response from most. No one indicated that they recognized the same sequence of excerpts from one trial to the other or from one session to the next. The majority of listener's indicated they enjoyed playing the game. None of the listeners responded in any way to indicate they were experiencing stress or anxiety. Many of the participants verbalized reminiscence remarks while returning to the therapy session. The caregivers were given a paper-pencil response form and asked to rate their perceptions of enjoyment and difficulty after completing the listening game. All caregivers responded positively to the enjoyment question. They perceived the game as "very easy." A third question asked them, "May we contact you again to try 'Name That Tune' with you and your patient?" Three of the 6 caregivers replied "yes" without reservation and provided contact information. Three responded "no" with reasons for their reservations referring to their patient's inability to move the dial.

Discussion

The results suggest that a highly structured sustained listening intervention was not problematic for some elderly people with cognitive impairments and can be learned relatively quickly by others. It seems apparent that active music listening interventions can be designed to maintain purposeful selective attention for people with potentially debilitating diagnoses that affect cognitive processing. The results also suggest that elderly people with cognitive impairments can recognize melodies when they occur in high and low registers, in simple and complex arrangements, and from various starting points within a single selection. The first excerpt was intentionally simple, a single melody line with percussive background and may have primed the listeners for the following excerpts that varied in degrees of music complexity. The Bridges and Prickett (2000) list proved to be an excellent resource for music selections. Baseline recognition of the excerpts by the elderly listeners was

consistently accurate. Incorrect response means did not differ significantly from the comparison group means. During treatment trials, no hints or cues about titles were given. Listeners who became more attentive during treatment also recognized the music without assistance.

During the first baseline trial two listeners began singing the melody of the music, which seems at first glance to be an obvious recognition-attention response. Singing quickly became a distraction and an incompatible response to active listening for these particular participants. Fixation on one melody regardless of changes occurring in the audiotape prevented them from participating in most of the game. During the first treatment trial these clients were given the option of singing the songs together after listening to the entire tape, which was successful, and the attention response was learned.

The similarity of responses, particularly the reaction times, between the younger college students and the older caregivers suggest that age does not impair perception or motor abilities required to play a simple listening game. According to recent research, age related cognitive changes are more pronounced between the ages of 70 and 80 than between 49 and 70 (Rabbitt, Diggle, Smith, Holland, & Innes, 2001). The caregivers' group age (M = 68.8) was approximately 10 years younger than the elderly group of listeners (M = 79) and therefore may not have been a true age-related comparison group. Whether the slower response of the elderly with cognitive impairments was learned, pharmaceutically induced, or related to medical diagnoses, is not clear. The increase in reaction times associated with an increase in accuracy between the two baseline trials for listeners diagnosed with stroke complications compared to the absence of change in either measure for listeners diagnosed with dementia is of practical interest. Sustained listening interventions may function differently for people with cognitive impairments resulting from different medical diagnoses. The small number of participants in the project prevents generalization but the finding warrants clarification of diagnoses in similar active listening interventions.

The CRDI dial movement allowed for systematic timing measurements consequential to continuous response analysis. If timing is not an issue, however, replications of the CRDI overlay without the computerized attachments are applicable in many clinical set-

tings. The results of this study suggest that the addition of a wait zone with the requisite motor response systematically associated with a "get ready to listen" cognitive response is either immediately understood or quickly learned. Once that response is stable, increasing the duration of music excerpts will increase the maintenance of attention. To prevent the predictable learned response of merely waiting for silence during the music excerpts, purposeful music distraction could be taught by pairing cogent elements of preferred recognizable music with visual images or words on the CRDI overlay for overt responding *during* longer excerpts of music. Group applications with interactive cooperative game formats are limited only by selecting recognizable age-appropriate music content.

The possibility of using active listening games to promote interaction between listeners became apparent during this project. Listeners participated in pairs but did not spontaneously acknowledge or interact with each other during or between trials. Using one dial for each pair of listeners and structuring the intervention to include taking turns or helping each other move the dial would provide a social setting for active listening. Some of the caregivers reported an interest in using the game with their patients. In that case, audiotapes and CRDI overlays could be prepared to include very personalized and immediately recognizable music for repeated applications at home with family members.

The systematic use of reinforcements for increasing response rates and intervals of attentive listening may be another option (Plaud, Gillund, & Ferraro, 2000). If intrinsic motivation is more important to older adults than extrinsic motivation (Tomporowski & Tinsley, 1996), applications of contingent music applications may be more effective in shaping sustained attention.

The results of this study suggest that less-directed active listening interventions with this population, either for pleasure or distraction therapeutic applications, may initially require artificial structure and/or training. The simple addition of attention "checkpoints"—the silence breaks between excerpts in this application—provided an effective means of documenting listeners' focus of attention through time. Likewise, CRDI dial movement to verifiable content such as music identification, whether correct or incorrect, seemed to function as a purposeful response for elderly listeners. Because cognitive impairments, such as Alzheimer's disease, often affect

emotion processing (Cadieux & Greve, 1997; Halpern & O'Connor, 2000), it may be necessary to use checkpoints and purposeful response elements to elicit and maintain abstract affective responses while listening to music. Successive approximations beginning with music identification, the verifiable response used in this study, to a happy-sad dichotomous mood selection followed by a preference or interest continuum would be a possible strategy. In any event, therapeutic applications of music listening for preserving cognitive abilities of elderly people with debilitating diagnoses are not only possible but also highly practical.

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