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FUNCTIONAL ANALYSIS IN THE HOME SETTING  
OF AN OLDER ADULT WITH NEUROCOGNITIVE  
DISORDER

by

Emily Norton

A thesis submitted to the Graduate College  
in partial fulfillment of the requirements  
for the degree of Master of Arts  
Psychology  
Western Michigan University  
December 2019

Thesis Committee:

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Emily Norton

# FUNCTIONAL ANALYSIS IN THE HOME SETTING OF AN OLDER ADULT WITH NEUROCOGNITIVE DISORDER

Emily Norton, M.A.

Western Michigan University, 2019

Currently within the behavioral gerontology literature there are no published studies that include a functional assessment in the home setting. The primary goal of the present study was to address this gap by conducting a functional analysis on a challenging behavior of an older adult with neurocognitive disorder in the home. This study occurred in two phases. During phase one, researchers conducted an antecedent functional analysis on the bizarre speech of an 81-year-old female with suspected dementia across four conditions (television on, no interactions initiated; television on, interactions initiated; television off, no interactions initiated; television off, interactions initiated). Results from the functional analysis showed that bizarre speech occurred most frequently during the television off, interactions initiated condition and least frequently during the television on, no interactions initiated condition. During phase two, researchers implemented a brief treatment analysis in which they alternated between a DRA and control condition. The DRA condition produced the highest percentage of talking intervals with no bizarre speech than did any other condition.

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## INTRODUCTION

It is reported that around 50 million people have dementia<sup>1</sup> worldwide and that an estimated 60 to 70% of these occurrences are likely dementia of Alzheimer's Type (World Health Organization, 2017). In the US alone, there are believed to be at least 5.7 million individuals with dementia of Alzheimer's type (Alzheimer's Association, 2018). While the number of persons with dementia increases, the demand for caregivers of this population naturally increases. According to the Alzheimer's Association (2018), approximately 70% of individuals with dementia live at home, as opposed to an assisted living facility, nursing home, adult foster care, or similar setting. Of those living at home with dementia of Alzheimer's type, it is estimated that 75% of care is provided by family members or friends (Schulz & Martire, 2004). It is beneficial from a financial perspective to delay nursing home placement, as the average cost of care per resident is between \$85,775 to \$97,455 annually (Alzheimer's Association, 2018). This creates high costs for not only those with dementia and their families, but society as well, given that Medicaid currently allocates funds toward the cost of extended nursing-home stays (Alzheimer's Association, 2018). Total Medicaid and Medicare spending for persons with dementia will be \$195 billion by the end of 2019 (Alzheimer's Association, 2019).

Individuals with dementia often experience behavioral and psychological symptoms of dementia (BPSD), defined as "signs and symptoms of disturbed perception, thought, content, mood, or behavior" (Kales, Gitlin, & Lyketsos, 2015, p. 1). Some common types of BPSD include delusions, hallucinations, agitation (i.e., hoarding, crying, rejection of care, etc.), physical or verbal aggression, depression, anxiety, apathy, irritability, disinhibition, motor

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<sup>1</sup> The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013) now uses the term "neurocognitive disorder" as a substitute for "dementia." For the purposes of continuity with previous literature, these symptoms will be referred to as "dementia" during the introduction of this paper and as "neurocognitive disorder" beginning in the method section.

disturbance, and night-time behaviors (Kales et al., 2015). The most common of these symptoms include apathy, depression, irritability, agitation, and anxiety (Cerejeira, Lagarto, & Mukaetova-Ladinska, 2012). Researchers have noted that BPSD are strongly associated with caregiver stress and depression, and that they commonly “lead to early placement in a nursing home” (Kales et al., 2015, p. 2). BPSD are typically managed through the use of pharmaceuticals, however, these drugs are associated with increased risks of adverse effects (Dyer, Harrison, Laver, Whitehead, & Crotty, 2017). The American Geriatrics Society (AGS) stated that antipsychotics, a commonly prescribed pharmacological intervention for BPSD, have been shown to increase risk for stroke, accelerated cognitive decline, or even death for individuals with dementia (Samuel, 2015).

The AGS therefore advises against using antipsychotics to manage behavioral problems associated with dementia “unless nonpharmacological options (e.g., behavioral interventions) have failed or are not possible and the older adult is threatening substantial harm to self or others.” (Samuel, 2015, p. 2233). Furthermore, the estimates of effect size of functional-analysis based interventions are comparable to those of pharmacological treatments (Dyer et al., 2017). Non-pharmacological treatments for BPSD such as functional-analysis based interventions, exercise programs and aromatherapy, have been shown to have few, if any, adverse effects (Dyer et al., 2017).

Currently within the behavioral gerontology literature there are 12 studies that describe a functional behavior assessment within their methodology. The participants in these studies have ranged in age from 42 to 99 years and have varied greatly in diagnoses.<sup>2</sup> These diagnoses include: (a) Dementia (Buchanan & Fisher, 2002; Burgio, Scilley, Hardin, Hsu, & Yancey, 1996;

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<sup>2</sup> The participants who were under the age of 65 had both Down syndrome and dementia. Individuals with Down syndrome and dementia often experience cognitive decline which presents earlier and resembles that of the general population with dementia of Alzheimer’s type (Moniz-Cook et al., 2003).

Heard & Watson, 1999; Larrabee, Baker, & O'Neill, 2018; Trahan, Donaldson, McNabney, & Kahng, 2014); (b) Dementia of Alzheimer's type (Baker, Hanley, & Mathews, 2006; Baker, Leblanc, Raetz, & Hilton, 2011; Dwyer-Moore & Dixon, 2007; Trahan et al., 2014); (c) Vascular Dementia (Dwyer-Moore & Dixon, 2007; Moniz-Cook, Stokes, & Agar, 2003); (d) Mixed Alzheimer's Disease and Vascular Dementia (Buchanan & Fisher, 2002); (e) Down Syndrome and Dementia (Millichap, Oliver, McQuillan, Kalsy, Lloyd, & Hall, 2003); (f) Senile Dementia of Alzheimer's Type (SDAT; Moniz-Cook, Woods, & Richards, 2001); (g) Probable Alzheimer's Disease (Beaton, Peeler, & Harvey, 2006; Burgio et al., 1996); (h) Probable SDAT (Moniz-Cook et al., 2003; Moniz-Cook et al., 2001); (i) Probable Mixed SDAT and Vascular Dementia (Moniz-Cook et al., 2003; Moniz-Cook et al., 2001); (j) Probable Vascular/Multi-Infarct dementia (Moniz-Cook et al., 2003; Moniz-Cook et al., 2001); and (k) Dementia-like symptoms (Burgio et al., 1996). One study included a participant with no specific diagnosis other than the target behavior itself (Moniz-Cook et al., 2003). Eight of the 12 studies include individuals with a diagnosis of Alzheimer's disease or probable Alzheimer's disease. As mentioned previously, 60 to 70% of dementia diagnoses are likely dementia of Alzheimer's type, indicating that the aforementioned studies have been conducted with a representative sample of the overall population with dementia.

As noted earlier, BPSD are considered a hallmark of dementia and a wide variety of behaviors are included in BPSD. Within the 12 studies in behavioral gerontology that describe a functional assessment in their methodology, a number of target behaviors have been evaluated, including: (a) physical aggression (Baker et al., 2006; Moniz-Cook et al., 2001); (b) hoarding (Baker et al., 2011); (c) wandering (Dwyer-Moore & Dixon, 2007; Heard & Watson, 1999); (d) uncooperative and difficult behavior (Moniz-Cook et al., 2003); (e) refusal to enter dining room

(Moniz-Cook et al., 2001); and (f) agitated resistance (Moniz-Cook et al., 2001). A number of researchers have evaluated verbal behavior as a target behavior during the functional assessment (Beaton et al., 2006; Buchanan & Fisher, 2002; Burgio et al., 1996; Dwyer-Moore & Dixon, 2007; Larrabee et al., 2018; Millichap et al., 2003; Moniz-Cook et al., 2003; Moniz-Cook et al., 2001; Trahan et al., 2014). These have included rational/irrational statements, verbal aggression, disruptive vocalizations, and the like. Some authors chose to combine a number of dependent variables during their assessments (e.g., Millichap et al., 2003). The most common symptoms of BPSD include apathy, depression, irritability, agitation, and anxiety, which may be difficult to operationalize. Addressing target behaviors, such as verbal aggression, physical aggression, and agitation (i.e., hoarding, repetitive vocalizations, inappropriate vocalizations, resistance of care), may be good proxies for symptoms like apathy, depression, and anxiety.

While the range of diagnoses as well as target behaviors within the behavioral gerontology functional assessment literature have varied greatly, little deviation has occurred in regard to the settings where these assessments have taken place. For example, eight of these studies included assessments conducted in nursing homes (Baker et al., 2006; Buchanan & Fisher, 2002; Burgio et al., 1996; Heard & Watson, 1999; Larrabee et al., 2018; Millichap et al., 2003; Moniz-Cook et al., 2003; Moniz-Cook et al., 2001). One study took place in a residential home (Moniz-Cook et al., 2001), two in an adult day center (Trahan et al., 2014; Baker et al., 2011), one in a group home (Millichap et al., 2003), one in a respite center (Beaton et al., 2006), and one in a long-term care facility (Dwyer-Moore & Dixon, 2007). It is possible that some of these studies were conducted in similar types of facilities though the way each researcher described the facilities may have differed. For example, a “long-term care facility” may be analogous with the term “nursing home,” and an “adult day center” may be comparable with the

term “respite center.” Additional information regarding the distinctive characteristics of these settings may be useful when determining how future research may look at systematically manipulating the relevant variables of these settings when conducting assessments with this population. As noted previously, approximately 70% of individuals with dementia of Alzheimer’s type reside in a home setting. However, none of the studies were conducted in the home setting. Research is needed on the application of functional behavior assessments conducted in the home setting.

When reviewing the 12 studies in behavioral gerontology that included a functional behavior assessment, there appear to be variations in the form of functional assessment conducted. Thompson and Borrero (2011) described three types of assessments that fit within the broader class of functional assessments in the behavior analytic literature: descriptive assessment (i.e., direct observation), indirect assessment (i.e., informant methods), and functional analysis. Descriptive assessment involves direct observation of the individual in their natural environment, typically recording any antecedents and consequences of the target behavior, indirect assessment includes conducting interviews and questionnaires related to the target behavior, and functional analysis (FA) involves the direct manipulation of environmental variables presumed to be related to the occurrence of the target behavior. Hanley, Iwata, and McCord (2003) described in their review of functional analyses of problem behavior two types of functional analysis models: the AB model which involves the manipulation of antecedent events, and the ABC model which involves the manipulation of both antecedent and consequent events. Of the 12 studies, some included descriptive assessment methods (e.g., Baker et al., 2011; Heard & Watson, 1999), some included indirect assessment methods (e.g., Burgio et al., 1996; Millichap et al., 2003), some used a combination of techniques involving indirect methods as well as manipulation of

variables (e.g., Moniz-Cook et al., 2003; Moniz-Cook et al., 2001), some included AB functional analyses (Baker et al., 2006; Trahan et al., 2014) and some included ABC functional analyses (Baker et al., 2006; Beaton et al., 2006; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Larrabee et al., 2018; Trahan et al., 2014). In summary, a variety of methodologies have been used in an attempt to manage several types of BPSD.

Researchers have suggested there may be specific benefits as well as problems when extending functional behavior assessment for individuals with dementia in the home setting. Thomason-Sassi, Iwata, and Fritz (2013) suggested some potentially important issues that may arise in less- controlled vs more-controlled settings. One is that home settings may include more familiar stimuli that maybe more effective in evoking the challenging behavior. Thomason-Sassi et al. evaluated whether or not various stimuli (e.g., using staff versus caregivers as therapist and homes versus clinics as settings) affected the results of functional analyses. Studies within the autism literature have also shown the efficacy of functional analyses in the home. For example, Najdowski, Wallace, Doney, and Ghezzi (2003) demonstrated that a functional analysis conducted in the home<sup>3</sup> was effective at identifying the function maintaining food refusals of a 5-year-old boy diagnosed with autism spectrum disorder and was later used to inform a function-based treatment.

Thomason-Sassi et al. (2013) note that the extent to which an individual correctly implements FA procedures may influence subsequent results, highlighting the importance of procedural integrity. Although not conducted in a home setting, Larrabee et al. (2018) recently reviewed the functional assessment literature on language disruptions among older adults. Larrabee et al. found that when conducting functional analyses on language disruptions in older

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<sup>3</sup> It is important to note that it is not completely clear whether all sessions were conducted in the home, as the authors report that sessions took place, “either in their home or in a restaurant” (Najdowski et al., 2003, p. 383).

adults with dementia, sessions including condition-specific discriminative stimuli (e.g., colored shirts, bandanas, poster boards, and vocal statements of whichever color each condition was associated with) produced either immediate or eventual differentiated results across two participants. Comparatively, conditions which did not incorporate condition-specific discriminative stimuli yielded greater overlap between test and control conditions (Larrabee et al., 2018). The authors noted that, because procedural integrity measures never fell below 98%, we can be confident that the only difference between the conditions that incorporated discriminative stimuli (leading to undifferentiated results) and those that did not were the discriminative stimuli themselves.

In summary, the functional assessment literature has been conducted with a broad range of examples of the overall population with dementia in regard to both the diagnoses and target behaviors of the participants. In contrast, the literature has been less representative for setting. As noted, though the majority of people with dementia reside at home, there are currently no published studies in behavioral gerontology that include a functional assessment in this setting. It is important that researchers pay special attention to treatment integrity, not only in general (Larrabee et al., 2018), but in particular when conducting functional analyses in the home. The purpose of this study was to extend the current literature by conducting a functional analysis on a challenging behavior of an older adult with neurocognitive disorder in the home setting. Procedural integrity measures were incorporated throughout this process.

## METHOD

### Participants and Setting

Harold was an ambulatory 89 year-old Dutch male with suspected dementia. He was referred for the study by his wife and primary caregiver, Laura, due to challenging behaviors she was experiencing at home. Laura's primary concern was Harold's refusal to participate in certain morning-time activities on Tuesday and Thursday mornings, days he attended an adult day program. Specifically, Laura reported that her husband would oftentimes make statements such as "I don't want to go" and "I can't go" throughout their morning routine (e.g., during tasks such as getting out of bed, showering, getting dressed, etc.). The researcher conducted two cognitive screeners with the participant as an additional means to verify the presence of cognitive impairment. Harold scored a 39 out of 100 on the Modified Mini-Mental State Examination (Teng & Chui, 1987), and a 3 out of 30 on the Saint Louis University Mental Status Exam (Tariq, Tumosa, Chibnall, Perry, & Morley, 2006), both indicating cognitive impairment with lower scores indicating more severe impairment. All observations occurred in Harold's home. Unfortunately, due to challenges surrounding operationally defining the target behavior, not observing the target behavior frequently enough, and medication changes, we chose to move forward with a different participant for the study. Specific details concerning these challenges are described in the discussion section below.

Margaret was an ambulatory 81 year-old female with suspected dementia. She had been reported by her husband and primary caregiver, Peter, as engaging in multiple challenging behaviors at home, one of which included bizarre speech. Margaret had been prescribed a variety of medications, including Trazadone, Rivastigmine Tartrate, and Quetiapine Fumarate, an antipsychotic. Margaret scored a 26 out of 100 on the Modified Mini-Mental State Examination



and a 1 out of 30 on the Saint Louis University Mental Status Exam, both of which indicated cognitive impairment. All sessions occurred in Margaret's home. Baseline sessions took place in either the kitchen, the dining room, or the living room, whereas all functional analysis and treatment sessions occurred in the living room.

#### Response Measurement and Data Collection

The researcher and two independent observers collected data via audio recordings using 15-second partial interval recording on bizarre speech and talking. Bizarre speech was defined as sentences, phrases, or utterances not connected to one another, to topics being discussed, or to questions being asked. It also included speech that lacked a specified goal or purpose and included illogical or ambiguous speech or incorrect placement of words within a sentence (i.e., grammatically incomplete sentences or sentences that have unclear subjects). This definition was modified from the definition of bizarre speech in Trahan et al., 2018. Talking was defined as any spoken statements or words and included bizarre speech. That is, any interval with bizarre speech was also an interval with talking. However, it was possible to have an interval with talking but not also have bizarre speech.

Two trained observers collected interobserver agreement (IOA) data via audio recordings. One observer was able to achieve a preset criterion of agreement (80%) when provided definitions and opportunities for remote practice. The other observer required an additional one-hour in-person training which consisted of reviewing scoring discrepancies from remote practice samples as well as a thorough review of the operational definitions. Following the in-person training, the second observer was able to achieve the preset criterion of agreement (80%) when provided new audio samples for remote practice.

Observers collected IOA during 22.22% of baseline sessions, 33.33% of functional analysis sessions, and 25% of treatment analysis sessions. The researcher calculated percentage of agreement using the scored interval, unscored interval, and interval-by- interval methods. Interval-by-interval IOA for bizarre speech averaged 92.50% across baseline sessions, 90% across FA sessions, and 90% across treatment sessions. Interval-by-interval IOA for talking averaged 97.50% across baseline sessions, 100% across FA sessions, and 97.50% across treatment sessions. For a more detailed account of scored, unscored, and interval-by-interval IOA, see Table 1 below.

Table 1

*Average IOA and IOA Ranges for Bizarre Speech and Talking Across Baseline, Antecedent Analysis, and Treatment Analysis Sessions*

Phase		<u>Bizarre Speech</u>			<u>Talking</u>	
		Average IOA	Range		Average IOA	Range
Baseline	Scored	85%	70-100%	Scored	96%	92-100%
	Unscored	88.46%	76.92-100%	Unscored	94.12%	88.24-100%
	Interval-by-Interval	92.50%	85-100%	Interval-by-Interval	97.50%	95-100%
Functional Analysis	Scored	79.60%	66.67-90.63%	Scored	100%	--
	Unscored	72.71%	44.44-90.32%	Unscored	100%	--
	Interval-by-Interval	90%	87.5-92.5%	Interval-by-Interval	100%	--
Treatment Analysis	Scored	50%	N/A	Scored	90.91%	N/A
	Unscored	88.89%	N/A	Unscored	96.77%	N/A
	Interval-by-Interval	90%	N/A	Interval-by-Interval	97.50%	N/A

## Functional Assessment

The researcher used both indirect and descriptive methods to help aid in the design of appropriate functional analysis conditions. Margaret's husband was given the Questions About Behavioral Function (QABF; Matson, J. L., & Vollmer, T. R., 1995), a 25-question rating scale,

as well as an open-ended functional assessment interview (Hanley, 2012) to identify target behaviors and commonly observed antecedents and consequences of said behaviors. The researcher then used narrative recording (Thompson & Borrero, 2011) with time-stamping to operationally define target behaviors, make hypotheses about behavioral function, and inform subsequent functional analysis conditions.

The researcher collected baseline data for nine 10-minute sessions across four days. During baseline sessions, the researcher, Margaret, and Peter were present. The researcher did not initiate interactions with Margaret and attempted to interact minimally if Margaret spoke to the researcher. The researcher also attempted to interact minimally with Peter during sessions. Prior to each baseline session, the researcher asked Peter to engage in his normal routine with Margaret, as if the researcher were not present.

Due to the fact that we observed much variation in antecedent and consequent stimuli during these sessions, our initial goal was to conduct an AB functional analysis followed by an ABC functional analysis on Margaret's bizarre speech. Before manipulating the wide range of consequences that appeared to have differential effects on her behavior, we chose to first manipulate the clearer antecedent variables. Unfortunately, as described in detail below, after conducting an antecedent functional analysis we were unable to move forward with a consequence-based functional analysis as intended, due to Margaret moving.

### Experimental Design

This study included two phases. Phase 1 included a functional analysis to evaluate the effects of antecedent variables on the occurrence of bizarre speech and talking. We used a multielement design during Phase 1, alternating between four test conditions. Phase 2 included a treatment analysis to evaluate the effects of a subsequently derived DRA procedure on the

occurrence of bizarre speech and talking. We used a multielement design for Phase 2, alternating between a singular test and control condition.

### Phase 1: Functional Analysis

We hypothesized, based on the results of descriptive assessment, that the noise from the television and researcher-initiations may have had abative and evocative effects on bizarre speech and talking respectively. An antecedent analysis with four conditions was conducted to evaluate the combined and isolated effects of the television and researcher-initiations on bizarre speech and talking. All conditions lasted a duration of 10 minutes and took place in the participant's living room, with Margaret and the researcher sitting adjacent to one another in chairs facing the television. For sessions where Margaret's husband chose to be present, the researcher trained him on the protocol for that given condition.

*Television on, no interactions initiated:* During this condition, the television was on and the researcher did not initiate interactions with the participant. If the participant spoke to the researcher, the researcher responded with short responses (i.e., short statements or utterances such as “yeah,” “mhm,” and “ooo” and brief answers to questions such as “I’m warm enough, thank you”). The researcher provided no differential consequences contingent on bizarre speech or non-bizarre speech. The session ended after 10 minutes or if 1) the participant fell asleep, 2) the participant left the living room area, 3), another person (i.e., the participant's husband) spoke to either the researcher or the participant, or 4) the participant showed any signs of distress (e.g., crying, yelling, statement of displeasure regarding the interaction, raised voice).

*Television on, interactions initiated:* During this condition, the television was on and the researcher interacted with the participant in one of four ways at least once during every 30-s interval. The session included at least one (but usually many more) occurrence of each type of

interaction. The four types of interaction were 1) Yes/no questions (e.g., “did you have a nice supper?”), 2) Open-ended questions (e.g., “what is your favorite thing to watch on television?”), 3) Comments/statements (e.g., “I had a great weekend. I went to the park with my family.”), and 4) Short responses (e.g., “yeah,” “mhm,” and “I’m warm enough, thank you.”). The researcher provided no differential consequences contingent on bizarre speech or non-bizarre speech, but rather continued to engage with Margaret in one of the four ways described above. The session ended after 10 minutes or if 1) the participant fell asleep, 2) the participant left the living room area, or 3) the participant showed any signs of distress (e.g., crying, yelling, statement of displeasure regarding the interaction, raised voice).

*Television off, no interactions initiated:* This condition was identical to the “Television on, no interactions initiated” condition, with the exception that the television was off for the entirety of the session.

*Television off, interactions initiated:* This condition was identical to the “Television on, interactions initiated” condition, with the exception that the television was off for the entirety of the session.

### Procedural Integrity

Two independent observers collected procedural integrity measures via audio recordings during 33.33% of functional analysis conditions. This was done to ensure that the researcher manipulated all variables correctly and as stated in the protocol. Specific criteria for each condition are listed in Appendix A. Procedural integrity was 100% for each condition.

### Phase 2: Treatment Analysis

Due to participant time constraints, we made the decision to conduct a brief treatment analysis where a treatment condition was rapidly alternated with a control condition. The control

condition was based on the results of the previously conducted functional analysis, whereas the treatment component included a DRA procedure based on descriptive assessment. The control condition looked identical to the Television off, interactions-initiated condition from the antecedent analysis. The treatment condition was conducted as described below.

*TV off, DRA:* The television was off and the researcher did not initiate interactions with the participant. If the participant spoke to the researcher using bizarre speech, the researcher did not respond and waited for the participant to engage in non-bizarre speech. If the participant spoke to the researcher using non-bizarre speech, the researcher responded with high quality attention in the form of questions, comments/statements, and short responses.

#### Procedural Integrity

Two independent observers collected procedural integrity measures via audio recordings during 25% of treatment analysis sessions. This was done to ensure that the researcher manipulated all variables correctly and as stated in the protocol. The criteria for the TV off, DRA condition are listed in Appendix B. Procedural integrity was 100%.

## RESULTS

### Baseline

Figure 1 depicts the percentage of 15-second intervals containing bizarre speech and talking across baseline sessions. Talking occurred on average during 36.44% of intervals (range, 0-77.50%) and bizarre speech occurred on average during 12.50% of intervals (range, 0-45%). Of the sessions that included talking, the average percentage of talking intervals with no bizarre speech was 78.10% (range, 25-100%). It is important to note that, because there was no systematic instruction given to the caregiver regarding which room they should be in, what they

should be doing, or how they should be interacting, we cannot account for which specific variables were being manipulated at any given time, within or between sessions. For example, during some sessions we observed the caregiver initiate conversation with the participant, while during others he might assist the participant with a care task, initiate conversation with the researcher, or watch television with the participant.

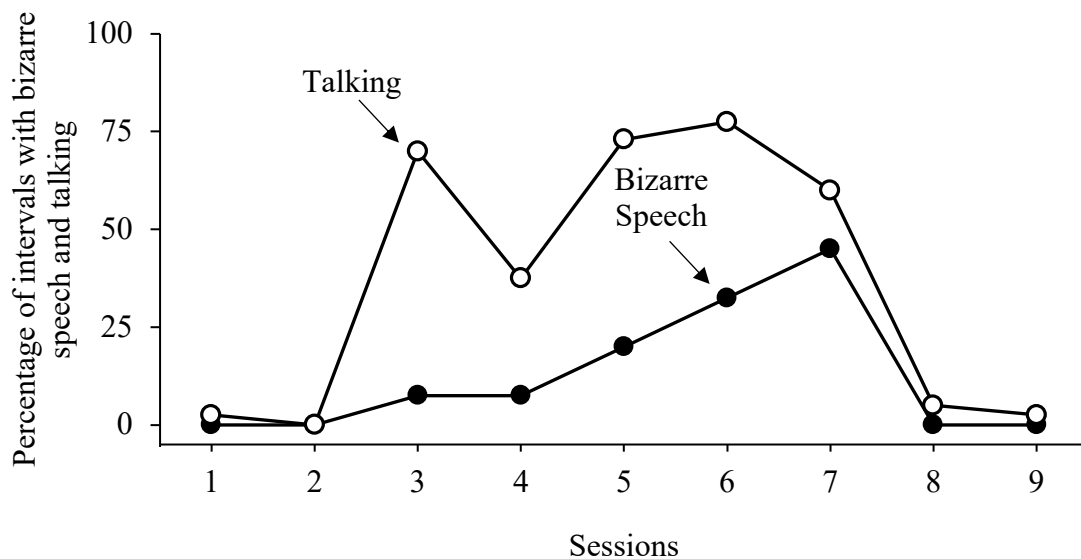


Figure 1. Percentage of 15-Second Intervals with Bizarre Speech and Talking Across Baseline Sessions.

### Functional and Treatment Analyses

Figure 2 depicts the percentage of 15-second intervals containing bizarre speech across functional analysis and treatment conditions. Across the four functional analysis conditions (television on, no interactions initiated; television on, interactions initiated; television off, no interactions initiated; television off, interactions initiated), bizarre speech occurred during an average of 15.33% (range, 8-28%), 71% (range, 63-75%), 35% (range, 25-45%), and 80% (range, 58-90%) of intervals, respectively. Across the two treatment analysis conditions

(television off, DRA and the control condition), bizarre speech occurred during an average of 18% (range 13-23%) and 70% (range 60-80%) of intervals, respectively.

Figure 3 depicts the percentage of 15-second intervals containing talking across functional analysis and treatment conditions. Across the four functional analysis conditions (television on, no interactions initiated; television on, interactions initiated; television off, no interactions initiated; television off, interactions initiated), talking occurred during an average of 25.83% (range, 15-45%), 93.33% (range, 90-100%), 46.67% (range 32.50-67.50%), and 97.50% (range, 92.50-100%) of intervals, respectively. Across the two treatment analysis conditions (television off, DRA and the control condition), talking occurred during an average of 40% (range, 27.50-52.50%) and 96.25% (range, 92.50-100%) of intervals respectively.

During functional analysis sessions, conditions involving researcher initiations (i.e., television on, interactions initiated and television off, interactions initiated) consistently resulted in higher levels of talking and bizarre speech than those that did not (i.e., television on, no interactions initiated and television off, no interactions initiated). Additionally, conditions where the television was off (i.e., television off, no interactions initiated and television off, interactions initiated) resulted in higher overall averages of talking and bizarre speech than their television-on counterparts (i.e., television on, no interactions; initiated and television on, interactions initiated).



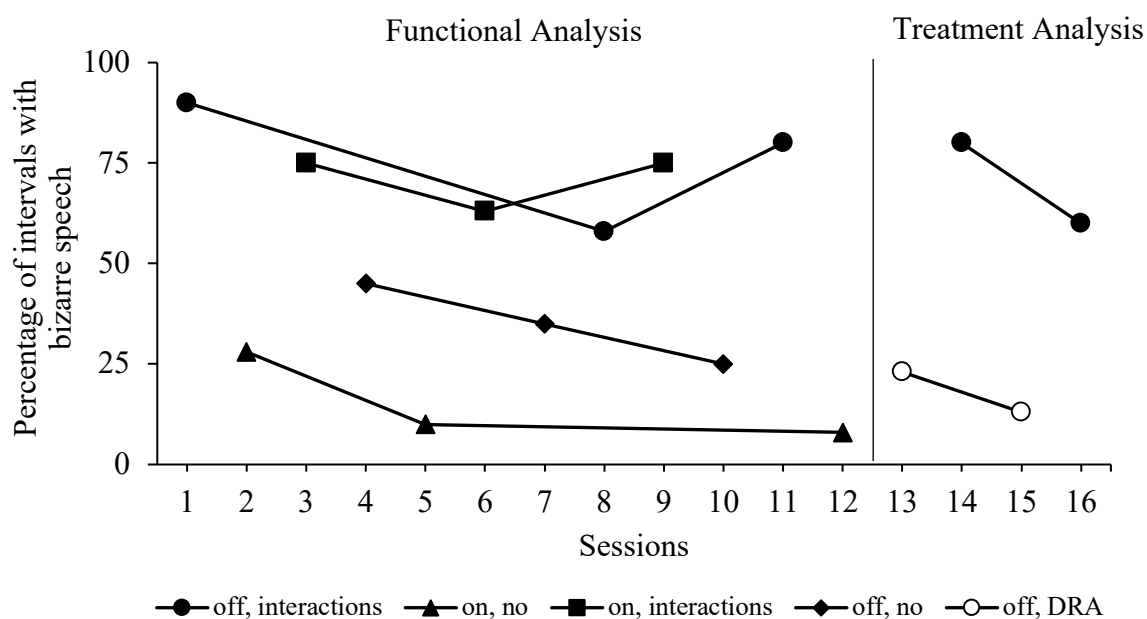


Figure 2. Percentage of 15-Second Intervals with Bizarre Speech Across Functional Analysis and Treatment Analysis Sessions.

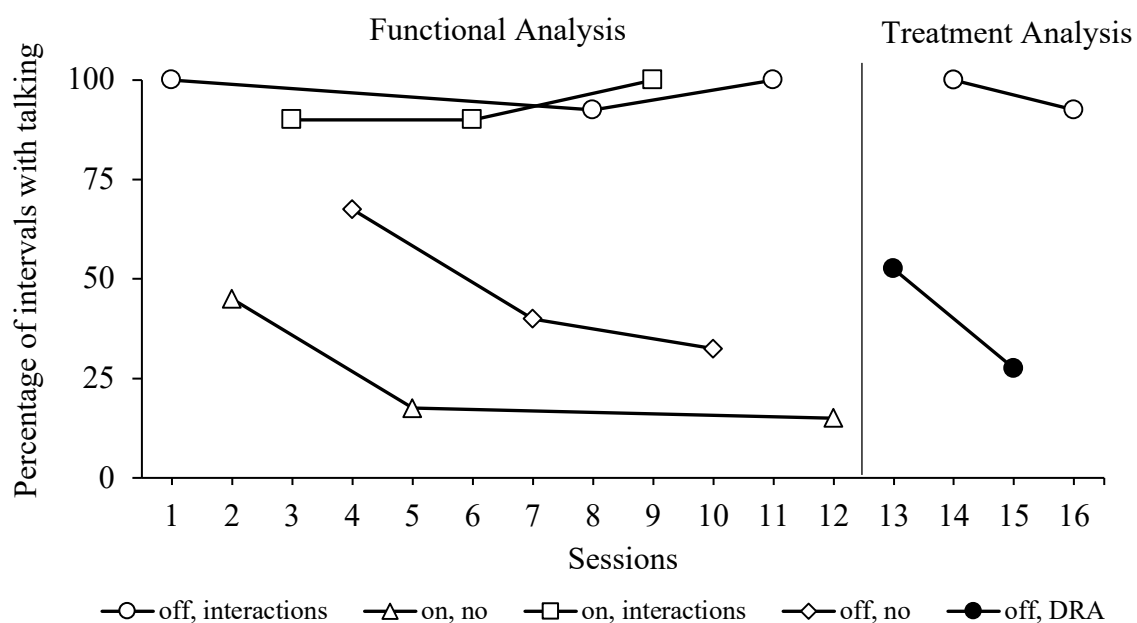


Figure 3. Percentage of 15-Second Intervals with Talking Across Functional Analysis and Treatment Analysis Sessions.

Table 2 displays the number of intervals with talking, the percentage of talking intervals with bizarre speech, and the percentage of talking intervals with no bizarre speech for all functional analysis and treatment sessions. Table 2 also displays the average of each of these three measures for each condition. The average percentage of talking intervals with bizarre speech was 56.08% (range, 50.00-61.11%) for the television on, no interactions conditions, 75.93% (range, 69.44-83.33%) for the television on, interactions condition, 77.03% (range, 66.67-87.50%) for the television off, no interactions (i.e., control) condition, 75.41% (range 62.16-90.00%) for the television off, interactions condition, and 44.16% (range, 42.86-45.45%) for the television off, DRA condition. The condition that produced the lowest average percentage of talking intervals with bizarre speech was the television off, DRA condition (44.16%), followed by the television on, no interactions condition (56.08%). It is important to note, however, that during the television on, no interactions condition, talking occurred on average for the fewest number of intervals (10.33) compared to all other conditions. Not only did the television off, DRA condition produce the lowest average percentage of talking intervals with bizarre speech, but it also was the only condition in which the percentage of talking intervals without bizarre speech exceeded 50%. That is, this condition was the only one in which more than half of the participant's speech did not include bizarre speech.

Table 2

*Number of Intervals with Talking, Percentage of Talking Intervals with Bizarre Speech, and Percentage of Talking Intervals with no Bizarre Speech for all Functional Analysis and Treatment Analysis Conditions.*

Condition	Session	Number of intervals with talking	Percentage of talking intervals with bizarre speech	Percentage of talking intervals with no bizarre speech
TV on, no interactions	2	18	61.11%	38.89%
	5	7	57.14%	42.86%
	12	6	50.00%	50.00%
Average		<b>10.33</b>	<b>56.08%</b>	<b>43.92%</b>
TV on, interactions	3	36	83.33%	16.67%
	6	36	69.44%	30.56%
	9	40	75.00%	25.00%
Average		<b>37.33</b>	<b>75.93%</b>	<b>24.07%</b>
TV off, no interactions	4	27	66.67%	33.33%
	7	16	87.50%	12.50%
	10	13	76.92%	23.08%
Average		<b>18.67</b>	<b>77.03%</b>	<b>22.97%</b>
TV off, interactions	1	40	90.00%	10.00%
	8	37	62.16%	37.84%
	11	40	80.00%	20.00%
(Control)	14	40	80.00%	20.00%
	16	37	64.86%	35.14%
Average		<b>38.8</b>	<b>75.41%</b>	<b>24.59%</b>
TV off, DRA	13	21	42.86%	57.14%
	15	11	45.45%	54.55%
Average		<b>16</b>	<b>44.16%</b>	<b>55.84%</b>

## DISCUSSION

Around 70% of individuals with dementia of Alzheimer's type currently reside at home, however, no previous studies within the behavioral gerontology functional assessment literature have been conducted in the home setting. In the present study, we extended the current literature by conducting an antecedent functional analysis with an older adult in her home, producing differentiated results between conditions. This information, coupled with the results of descriptive assessment, led us to then conduct a treatment analysis to evaluate the effects of a DRA procedure on bizarre speech and talking. Our DRA procedure was effective at producing

the lowest average percentage of talking intervals with bizarre speech compared to all functional analysis and control conditions. As the population of older adults with dementia steadily increases, researchers such as Trahan et al. (2011) have called for additional research in home settings. This study provides several implications to consider when making this extension in our literature and research, including recruitment considerations and data collection considerations. Additionally, the antecedent functional analysis provided an opportunity to further explore aspects of the environment that could influence speech beyond Burgio et al. (1996).

We initially attempted to recruit four participants for our study. Two of the individuals moved forward in at least some facet of the study, whereas the other two's spouses chose not to participate for individual reasons. The first caregiver who chose not to move forward with their spouse's participation in the study was a woman who, although eager to help when first contacted, decided she did not feel she needed help managing her husband's behaviors. The second caregiver who chose not to move forward with their spouse's participation in the study was a man who struggled to understand the consent form, recalling important information about the study incorrectly. For example, he had a difficult time understanding that we would be taking a non-pharmacological approach to the assessment and treatment of challenging behaviors and continued to express concerns about our use of medications even when our approach was thoroughly explained to him.

Another important consideration of the current study was related to challenges with both participants was surrounding our baseline data collection methodology. For Harold, the target behavior we chose was morning-time refusals (i.e., a vocal, verbal behavior); this behavior was of importance to Harold's wife. Because Harold was multilingual (his primary language being Dutch) we asked his wife to interact with Harold in English during their morning routine.

However, we found great difficulty when attempting to operationally define and take data on his behavior as he continued to speak predominantly in Dutch regardless of how his wife interacted with him. We attempted to have his wife translate his Dutch following sessions by listening to audio recordings, but it meant that we could not collect data in the moment and that his wife would have to listen some portion of every session. Though the challenges that arose with a language-barrier between data collectors and a participant are not unique to the home setting, it is possible that this challenge was made more substantial because we were in the home setting. That is, it is possible that we consistently observed him speaking primarily in Dutch rather than in English because we were collecting data during interactions with Harold and his multilingual wife. We hypothesize that this could be due largely in part to the tight stimulus control that may take place in a familiar context such as the home. Because of this challenge, along with medication changes and an overall decrease in the frequency of the target behavior, we decided to move forward with another participant as Harold no longer met the inclusionary criteria for the study.

For Margaret, we wanted to collect baseline data in as naturalistic of an environment as possible. As noted previously, during these sessions we did not provide specific instructions to Margaret's husband regarding which room they should be in, which activity they should be engaging in, or whether or not they should be interacting. We decided to do this because, at the time, we had not chosen specifically which independent variables to manipulate during the functional analysis. Since we initially intended to conduct both an antecedent-based and consequence-based functional analysis, we decided that, due to the difficult nature of differentially responding to a behavior as complex as speech, the researcher would be the one to conduct the functional analyses rather than Margaret's spouse. Because of this, however, we

could not directly compare baseline data to the subsequent analysis for experimental control. It is also important to note that while bizarre speech was identified as a behavior of concern for Margaret's husband, his primary behavior of concern was her agitated refusals surrounding various activities (e.g., care tasks, going to bed, buckling her seatbelt). We did not select these behaviors because they occurred too infrequently to collect adequate baseline data and were not conducive to a functional analysis. Unfortunately, this meant that in an effort to evaluate a phenomenon experimentally we had to sacrifice clinical relevance, an important consideration as not only research but actual treatment for older adults moves toward an in-home focus.

One significant aim in the present study was to investigate aspects of the environment that may influence the occurrence of bizarre speech. Burgio et al. (1996) observed a phenomenon in which verbal agitation occurred less often in the nursing home salon during times when the hair dryers were running. Burgio and colleagues attempted to test a hypothesis that "'white noise,' produced by the hairdryer, might, through some unknown mechanism, be related to reduction in verbal agitation" (p. 365). They therefore used two environmental "white noise" audiotapes, gentle ocean and mountain stream, on the verbal agitation of 13 cognitively impaired nursing home residents. Researchers collected data on the mean percentage of verbal agitation during each audiotape condition and found an overall decrease in the average verbal agitation of the 13 residents when the audiotapes were on versus when they were off. The authors suggested in the discussion section that their study provided preliminary data to support the use of environmental "white noise" in the treatment of verbal agitation for cognitively impaired individuals.

In the present study, we found results that were similar to those described by Burgio et al. (1996); reductions for bizarre speech during one of two conditions where the television was on.

Specifically, the television on, no interactions condition resulted in a low average number of talking intervals with bizarre speech (approximately 3 – 11 intervals across the three sessions). Although a TV may not be an environmental white noise, it was a noise that resulted in a reduction in bizarre speech. However, when taking into account the total number of intervals with talking, this condition resulted in an overall suppression of speech (an average of 10.33 intervals, the lowest of any condition). Proportionally, Margaret was still engaging in bizarre speech more than half of the intervals in which she talked, she was just not talking as much. By holding the presence of the TV constant and adding interactions (television on, interactions), we saw an increase in bizarre speech (and overall talking). Additionally, when we removed the TV and interactions (TV off, no interactions), we saw similarly low levels of bizarre speech compared to the TV on, no interactions condition. This systematic manipulation suggested that the TV was not the critical component, but rather the listener-initiated interactions. We further replicated this by showing that TV off, no interactions resulted in lower bizarre speech than TV off, interactions. These results call into question whether the key variable in Burgio et al. was the presence of the white noise, or the absence of interaction opportunities. Unfortunately, because the authors did not report any data on speech other than verbal agitation during the analyses, we cannot make a direct comparison or statements of exactly why problem behavior decreased in Burgio et al. (1996). Future research on the impact of antecedent stimuli on the occurrence of bizarre speech should consider examining the impact of these stimuli not only on the occurrence of bizarre speech, but on the occurrence of other speech as well.

Trahan et al. (2014) found, when comparing the effects of antecedent and consequent stimuli on the bizarre speech of three women with dementia, antecedent manipulations consistently resulted in greater response differentiation than did consequent manipulations. The

present study provides further data to support the importance of antecedent stimuli on the occurrence of bizarre speech. We combined both antecedent and consequent manipulations during our functional analysis conditions. Though we did not hold all consequences consistent between conditions, all consequences were held constant within each type of condition and no *differential* consequences were provided contingent on bizarre speech or non-bizarre speech. Perhaps one of the most significant findings from the present study was that our treatment condition was effective at producing the highest percentage of talking intervals with no bizarre speech compared to other conditions despite the fact that we were unable to proceed with an experimental manipulation and subsequent evaluation of consequences. While these findings are significant, there were also some limitations to the present study that should be noted.

One potential limitation during our analysis was that due to scheduling concerns we chose to have all IOA and procedural integrity data collected remotely via audio recordings. Though we do not have data to support which specific effects our methodology had on data collection, we suspect that, because the primary data collector was exposed to stimuli that the IOA data collectors were not (e.g., gestures made by the participant, visual stimuli on the television, sounds that were difficult to hear via audio recordings), this may have impacted the efficacy of IOA data collection. Even so, interval-by-interval IOA never dropped below 85% during all baseline, functional analysis, and treatment analysis sessions.

Another significant limitation of the present study was that, after our first analysis, we were unable to move forward with a consequent functional analysis as intended. During the antecedent functional analysis portion of the study, the participant and her husband were preparing for a move and decided that, post-move, they no longer would participate in the study. For these reasons, we chose to allocate our time towards completing the antecedent functional



analysis as well as running a brief treatment analysis. Because we were unable to move forward with a systematic manipulation of consequent variables, our treatment component was based primarily on hypotheses derived from our baseline sessions. Specifically, we hypothesized that during those sessions Margaret's bizarre speech may have been maintained in some part by her husband's attention. Therefore, during treatment sessions we provided high-quality attention (i.e., differential reinforcement) contingent on non-bizarre speech and did not respond when Margaret engaged in bizarre speech.

Lastly, because of time constraints towards the end of the study, we were forced to terminate sessions before we could train the caregiver on our treatment component. Despite our efforts and availability, the caregiver chose not to move forward with the study following the treatment analysis. We suspect that while this may in part have been due to the time-consuming process of moving, motivation to move forward with subsequent analyses and caregiver trainings may have also been lower as bizarre speech was not the primary behavior of concern for Peter.

In summary, we were able to extend the behavioral gerontology functional assessment literature by conducting a functional analysis on a challenging behavior in the home of a community-dwelling older adult with cognitive impairment. Not only did our functional analysis produce differentiated results between conditions, but we were able to implement a treatment component which led to the highest percentage of talking intervals with no bizarre speech compared to all other conditions. As the population of older adults with dementia continues to increase, and as care for these individuals begins to shift more and more towards the home setting, we find this extension of literature and practice to be of utmost importance for behavior analysts in the coming years.

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## Appendix A

## Procedural Integrity (Functional Analysis)

Condition	Criteria (scored every 30 seconds)	Criteria (scored once per session)
<b>Television on, no interactions initiated</b>	<ul style="list-style-type: none"> <li>• The television was off</li> <li>• The researcher did not initiate interactions</li> <li>• If spoken to, the researcher responded with short responses</li> </ul>	<ul style="list-style-type: none"> <li>• The session was terminated after 10 minutes</li> </ul>
<b>Television on, interactions initiated</b>	<ul style="list-style-type: none"> <li>• The television was on</li> <li>• The researcher interacted with the participant in <u>at least one</u> of the four ways specified in the protocol</li> </ul>	<ul style="list-style-type: none"> <li>• The researcher asked at least one yes/no question during the session</li> <li>• The researcher asked at least one open-ended question during the session</li> <li>• The researcher made at least one comment/statement during the session</li> <li>• The researcher responded with a short response at least once during the session</li> <li>• The session was terminated after 10 minutes</li> </ul>
<b>Television off, no interactions initiated</b>	<ul style="list-style-type: none"> <li>• The television was off</li> <li>• The researcher did not initiate interactions</li> <li>• If spoken to, the researcher responded with short responses</li> </ul>	<ul style="list-style-type: none"> <li>• The session was terminated after 10 minutes</li> </ul>
<b>Television off, no interactions initiated</b>	<ul style="list-style-type: none"> <li>• The television was off</li> <li>• The researcher interacted with the participant in <u>at least one</u> of the four ways specified in the protocol</li> </ul>	<ul style="list-style-type: none"> <li>• The researcher asked at least one yes/no question during the session</li> <li>• The researcher asked at least one open-ended question during the session</li> <li>• The researcher made at least one comment/statement during the session</li> <li>• The researcher responded with a short response at least once during the session</li> <li>• The session was terminated after 10 minutes</li> </ul>

## Appendix B

## Procedural Integrity (Treatment Analysis)

Condition	Criteria (scored every 30 seconds)	Criteria (scored once per session)
<b>Television off, DRA</b>	<ul style="list-style-type: none"> <li>• The television was off</li> <li>• The researcher did not initiate interactions</li> <li>• If participant engaged in bizarre speech, the researcher did not respond</li> <li>• If participant engaged in non-bizarre speech, the researcher responded with high-quality attention</li> </ul>	<ul style="list-style-type: none"> <li>• The session was terminated after 10 minutes</li> </ul>



## Appendix C

## HSIRB Approval Form

WESTERN MICHIGAN UNIVERSITY



Institutional Review Board  
FWA00007042  
IRB00000254

Date: January 8, 2019

To: Janet Hahn, Principal Investigator  
Jonathan Baker, Co-Principal Investigator  
Emily Norton, Student Investigator for thesis  
Student Investigators: Sydney Bullock, Sandra Garcia, Andrea Perez, Brian MacNeill,  
Minyoung Kim, Haley Hughes, Jordan Bailey

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 16-09-07

This letter will serve as confirmation that the changes to your research project titled "Implementing Behavior Analysis and Intervention for Individuals with Cognitive Impairment in Skilled Nursing Facilities" requested in your memo received January 7, 2019 (to add implementation of project within in-home services; all materials, recruitment materials, and consent documents revised to reflect this change; to add student investigator Emily Norton with the home version data used for her thesis) have been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

**Approval Termination:**

**September 20, 2019**

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