Descriptive Assessment and Functional Analysis of Problem Behaviour Among Individuals with Dementia

By

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Abstract

Functional analysis is a method of behavioural assessment used to determine the environmental variables maintaining a specific behaviour. While functional analysis is often used with individuals with developmental and intellectual disabilities, problem behaviours in people with dementia are rarely assessed using functional analysis methodology. The purpose of the present study was to conduct descriptive and functional analyses of problem behaviours among individuals with dementia to determine: (a) if a descriptive assessment would identify a function of the challenging behaviour assessed; (b) the extent to which stimuli identified in the descriptive assessment were needed to conduct a functional analysis; and (c) if a standard functional analysis is an effective assessment method for this population. The participants were two individuals with dementia who exhibited inappropriate vocalizations, consisting of swearing and delusional speech. For both participants, the results of the descriptive assessments suggested that the function of the behaviour was positive reinforcement in the form of attention from staff members. The findings of the descriptive analyses were confirmed in the functional analyses. The results suggest that a functional analysis informed by a descriptive analysis can identify the function of problem behaviour in individuals with dementia in a residential setting.

Keywords: functional analysis, dementia, problem behaviour, attention function, inappropriate vocalizations, conditional probability analysis.

Descriptive Assessment and Functional Analysis of Problem Behaviour Among Individuals with Dementia

Problem behaviour of an individual can be defined as disruptive performances of significant intensity that may be dangerous for the individual or for others. Problem behaviours can restrict an individual's opportunities to engage in alternative positive behaviours, such as learning new skills, engaging in self-care routines, and social interaction. Excessive engagement in problem behaviour may require restricted living arrangements (Cohen, Gold, Shuman, Wortley, McDonald & Wargon, 1993). Common topographies of problem behaviour include self-injury, aggression, bizarre vocalizations, property destruction, pica, and elopement. Problem behaviours can occur in many clinical populations such as persons with intellectual and developmental disabilities (Kang, O'Reilly, Fragale, Aguilar, Rispoli & Lang, 2011), attention deficit hyperactivity disorder (ADHD; Kodak, Grow & Northup, 2004), down syndrome (Borrero, Woods, Borrero, Masler & Lesser, 2010), traumatic brain injuries (Fyffe, Kahng, Fittro, & Russell, 2004) and dementia (Dwyer-Moore & Dixon, 2007). While the assessment of problem behaviour has been studied in depth for individuals with intellectual and developmental disabilities using functional analysis methodology, there is a lack of such studies targeting individuals with dementia (Beavers, Iwata, & Lerman, 2013; Buchanan, Husfeldt, Berg, & Houlihan, 2008; Trahan, Kahng, Fisher, & Hausman, 2011).

The present study assessed whether common observation methods used to assess problem behaviour among individuals with developmental and intellectual disabilities may be used with individuals with dementia who exhibit problem behaviour. I also explored what procedural modifications, if any, were needed to optimize the assessment of problem behaviour in this population using functional analysis methodology.

The Operant Functions of Problem Behaviour

Historically, the assessment and treatment of problem behaviours such as self-injury have focused on topographical aspects relative to the behaviour-environment relations that may control problem behaviour (Kahng, Iwata & Lewin, 2002). Functional analysis brought about an interest in behaviour function relative to topography as the basis for treatment selection (Kahng, Iwata & Lewin, 2002). Functional analysis rests upon a fundamental assumption: behaviour problems are learned performances. The primary purpose of functional analysis is to identify the antecedent and consequent variables that are maintaining the problem behaviour. A functional approach to the assessment of problem behaviour allows for the development of interventions targeting causal variables in a particular individual, preventing a mismatch in behaviour function and treatment intervention (Repp, Felce & Barton, 1988).

Functional analysis methodology consists of the manipulation of antecedent variables (events in the environment occurring before the problem behaviour) and consequent variables (events in the environment occurring after the problem behaviour). First, there are two major types of antecedent stimuli that are integrated in a typical functional analysis: discriminative stimuli and motivating operations. A discriminative stimulus (S^D) is a stimulus in the presence of which behaviour will be reinforced. A stimulus delta (S^Δ) is a stimulus in the presence of which behaviour will not be reinforced (Cooper, Heron & Heward, 2007). For example, a child engages in screaming at the grocery store each time she visits with her father but not her mother. When her father takes her to the grocery store, the child screams and her father will give her the candy that she requested. When her mother takes her to the grocery store, and she screams, she does not receive candy. Over time, the father has become the S^D, because when the child screams with her father, she gets candy. When the child screams with her mother, she gets nothing, her mother has

become the S^{Δ}. The child has learned that her father indicates access to candy if screaming occurs, but her mother does not. Michael (1982) defined motivating operations as environmental variables that temporarily change the effectiveness of a stimulus, object, or event as a reinforcer; and change the current frequency of all behaviour that has been reinforced by that stimulus, object, or event. Common motivating operations for problem behaviour include food deprivation, fatigue, pain, withdrawal of social attention, and presentation of task demands (Cooper, Heron & Heward, 2007).

A second set of stimuli that are manipulated in a functional analysis are the consequent stimuli, or simply, consequences. A consequence is an event that follows a target behaviour and may alter its future probability. Common consequent variables that maintain problem behaviour include social attention, access to tangible items, and escape from task demands. During a functional analysis the analysis of antecedent-behaviour-consequent relations (called a three-term contingency) reveals the variables maintaining the problem behaviour. The three-term contingencies included in a functional analysis are positive reinforcement and negative reinforcement. Positive reinforcement has occurred when a target behaviour is followed by the presentation of a stimulus and as a result, similar responses occur more frequently in the future. For example, in a long-term care facility staff members are often inundated with too many tasks to complete and little time to interact personally with the residents. In this environment, requests for social interaction are often ignored because the staff simply do not have enough time to spend with the residents. If an individual with dementia is non-ambulatory and attempts to leave his/her wheelchair, a staff member will rush over to have them remain in the chair and prevent potential injury. This individual may have been attempting to get out of their chair for a number of reasons, regardless, attempting to get out of his/her chair has been followed by one-on-one

attention from staff. \As this behaviour has been followed by attention previously, in the future, this individual may continue to try and leave their wheelchair in order to access attention (positive reinforcement) from staff. Several forms of positive reinforcement are frequently integrated in a functional analysis. Social, tangible, and automatic positive reinforcement occur when the target behaviour is maintained by access to social attention (e.g., praise), preferred items (e.g., candies), and the sensory products of the behaviour (e.g., stimulation caused by stereotypy (Carr, 1997)).

In a negative reinforcement contingency, the target response produces the removal, termination, reduction or postponement of a stimulus, which leads to an increase in the future occurrence of the target response. For instance, when a caregiver asks an individual with dementia to get out of bed so the bedding can be changed, an individual with dementia may strike out at that caregiver. If the caregiver leaves the room and postpones the change in bedding, the individual with dementia has learned that striking out at the caregiver when asked to get out of bed will allow him/her to postpone this. In the future, that individual may strike out at the caregiver more often as it predicts the postponement of getting out of bed or having the bedding changed. A functional analysis assesses social negative reinforcement in the form of escape from demands. Other forms of negative reinforcement such as automatic negative reinforcement (e.g., pain attenuation) are assessed indirectly (Matson & Vollmer, 1995).

Functional Analysis

There are three methods used to evaluate the function of problem behaviour: indirect assessment, descriptive assessment, and experimental functional analysis. Indirect assessments are composed of scales or questionnaires filled out by a caregiver. By contrast, both the descriptive assessment and the functional analysis are based on direct observation. During a

descriptive assessment the practitioner records a pre-established set of naturally occurring behaviours and environmental events. During a descriptive assessment antecedents and consequences are not manipulated directly. Therefore, experimental control cannot be established.

Descriptive assessments can be time consuming, depending on who is observing and recording the individual engaging in the problem behaviour. For instance, if a clinician has been hired to do observations themselves and record the data, this will be time consuming. If the clinician has trained the individual's staff to record the data (which is common place), then the clinician simply needs to compile and analyze the data. Therefore, depending on the circumstances a descriptive assessment can be quite time efficient.

Other challenges of descriptive analyses include the practical problems associated with coding naturally occurring events, such as the pace at which you can accurately record live events. In addition, the events may occur infrequently or be spuriously correlated with the target behaviour (Thompson & Iwata, 2007). Obtaining representative samples of the target behaviour and the individual's environment is an additional challenge to descriptive analysis (Anderson & Long, 2002). This is an issue because the sample observations will vary depending on when one is observing the individual, who is in the environment when one is observing, etc. For instance, if problem behaviour typically occurs with a particular staff member who works on Thursdays and observations are conducted on Monday, then the researcher is not obtaining a representative sample of the natural environment and the conditions in which the problem behaviour occurs.

Nonetheless, descriptive assessment, as well as indirect assessments such as interviews and questionnaires, can help to establish the presence of idiosyncratic variables that may otherwise be overlooked in an experimental assessment. For example, presence of a specific

caregiver may be an idiosyncratic motivating operation effecting the occurrence of problem behaviour (Ringdahl & Sellers, 2000).

Finally, functional analysis is an experimental approach to functional assessment. During a functional analysis, the individual is exposed to purposely manipulated antecedent and consequent variables in order to test their effect on problem behaviour. There are four conditions that make up a typical functional analysis: alone, play, attention, demand and tangible (an optional fifth condition). The duration of each condition is typically 10 min, with a 5 min break in between. Thus a complete functional analysis would take four to five hours for a clinician to carry out, plus the time needed to analyse the data. The function of the problem behaviour is revealed by examining the functional analysis condition with the highest level of behaviour relative to other conditions. Namely, a functional analysis allows the identification of the set of variables maintaining problem behaviour, thereby leading to function-based interventions.

Functional assessment methods have been used to assess problem behaviour primarily in individuals with developmental and intellectual disabilities. There is evidence to suggest that treatment interventions based on functional analysis are more successful than those based on indirect assessment or descriptive assessment methods (Campbell, 2003; Herzinger & Campbell, 2007). While this has not been proven using randomized control trials, hundreds of studies conducted over the last 30 years support the effectiveness of intervention programs targeting the function of the problem behaviour as identified in a pre-intervention functional analysis (Beavers, Iwata, & Lerman, 2013; Hanley, Iwata & McCord, 2003).

Problem Behaviour in Individuals with Dementia

Dementia is a chronic neurodegenerative condition characterized by a gradual deterioration of the motor, cognitive, and social functioning of the individual (Christenson &

O'Brien, 2000). The Diagnostic Statistical Manual of Mental Disorders Version 5 (DSM-V) describes dementia as a syndrome composed of memory impairment and related changes in other cognitive domains such as language, abstract thinking, judgment, or executive functioning (American Psychiatric Association, 2013). According to a study conducted by the Alzheimer's Society of Canada in 2008, 1.5 % of the Canadian population (480,618) were living with dementia (Smetanin, Kobak, Briante, Stiff, Sherman, & Ahmad, 2010). The same study predicted that this figure will double over the next three decades (1,125,184 people or 2.8% of the population) due to the aging population in Canada, and the improvement in diagnosing dementia (Smetanin et al. 2010).

Similar to individuals with intellectual and developmental disabilities, individuals with dementia tend to exhibit problem behaviour that can severely alter their daily functioning. Quality of life of individuals with dementia deteriorates primarily due to decreased social contact and depressive symptoms. As the severity of problem behaviours increases, individuals may become progressively isolated and dependent (Bourgeois & Hickey, 2009). In addition, problem behaviours exhibited by individuals with dementia have a negative effect on their caregivers. The type, rate and severity of problem behaviour exhibited by an individual with dementia is predictive of caregiver's depression and physical health (Hooker et al., 2002; Neundorfer et al., 2001; O'Rourke & Tuokko, 2000).

Cohen-Manfield (2000) has divided problem behaviour exhibited by individuals with dementia can into four types: verbally aggressive (e.g., cursing, strange noises, screaming, verbal sexual advances), verbally nonaggressive (complaining, negativism, repetitive questions, constant unwarranted requests for attention), physically aggressive (hurting self or others, throwing things, scratching, spitting, biting, hitting, pushing, physical sexual advances) and

physically nonaggressive (repetitious mannerisms, inappropriate robing and disrobing, wandering, intentional falling, hoarding things, hiding things, eating inappropriate substances). Problem behaviours in dementia vary in frequency, intensity and topography as the disease progresses (Bourgeois & Hickey, 2009). In the initial and central stages of the disease, problem behaviours tend to become repetitive (e.g., repetitive questioning). Hoarding, hallucinations, and angry outbursts may also occur (Bourgeois & Hickey, 2009). In the later stages of the disease, the agitated responses tend to subside and all behaviour becomes progressively slow and repetitive (Bourgeois & Hickey, 2009).

Gruber-Baldini, Boustani, Sloane, and Zimmerman (2004) estimated the prevalence of problem behaviour of nursing home residents. They found that individuals with dementia exhibited significantly more problem behaviours overall than nursing home residents without dementia. In addition, they also exhibited significantly more aggressive, non-aggressive, bizarre vocalizations and verbalizations as well as problem behaviours in the form of resisting treatment and hygiene routines (Gruber-Baldini, et al., 2008). Unfortunately, functional analysis and treatment of problem behaviour are used less often with individuals with dementia, who frequently receive more invasive methods, such as physical restraints and psychopharmacological treatment (Bourgeois & Hickey, 2009). This is suboptimal as functional analysis and behavioural intervention are minimally invasive relative to physical restraints and psychopharmacological treatment. In addition, behaviour interventions lack the side effects associated with medication, or restricted mobility.

Functional Analysis of Problem Behaviour in Individuals with Dementia

Research on the function of problem behaviour in those with dementia is still relatively uncommon (Buchanan, et al., 2008; Trahan et al., 2011). Indirect assessments (interviews and

questionnaires) have often been used (Bakke et al., 1994; Feliciano & Steers, 2009; Horovitz, Kozlowski & Mason, 2010), followed by descriptive assessment (Heard & Watson, 1999; Millichap et al., 2003; Moniz-Cook, Woods & Stevens, 2001; Baker, LeBlanc, Raetz & Hilton, 2011). Finally, functional analyses have been used with a limited number of individuals (Baker, Hanley & Matthews, 2006; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Locke & Mudford, 2010).

Horovitz, Kozlowski, and Mason (2010) used the Functional Assessment Interview, and the Questions About Behaviour Function scale as well as informal observations to evaluate the function of non-compliance of one individual with Down syndrome and Alzheimer's disease. The indirect assessments suggested the problem behaviour was maintained by positive reinforcement in the form of access to social attention and tangibles. These anecdotal assessment methods informed a subsequent baseline followed by an intervention study. The introduction of physical contact, verbal praise, and edibles contingent on compliance reduced noncompliance by 61%.

Heard and Watson (1999) conducted a descriptive assessment of participants with dementia who exhibited wandering behaviour. According to the descriptive assessment, two participants had problem behaviour maintained by access to attention, the problem behaviour of a third participant was likely maintained by access to tangible reinforcers, and sensory stimulation seemed to be the factor responsible for maintenance for the fourth individual. They used differential reinforcement of other behaviour as part of an ABAB treatment evaluation. The results showed an 80% reduction in problem behaviour.

Finally, a study by Dwyer-Moore and Dixon (2007) illustrated the use of functional analysis among individuals with dementia. The participants in the study exhibited problem

behaviours including wandering and inappropriate vocalizations. A standard functional analysis was conducted indicating that for two participants, problem behaviour was maintained by access to attention, and for one participant problem behaviour was maintained by escape from demands. Different treatment interventions were implemented based on the function of the problem behaviour, including differential reinforcement of appropriate behaviour, non-contingent reinforcement in the form of access to attention, and functional communication training with extinction. These interventions induced reductions in problem behaviour ranging from 40% to 85% across participants.

The popular use of indirect and descriptive assessments of individuals with dementia over the use of functional analysis is very different than what one would see with individuals who have ASD or an intellectual disability. Functional analysis is a very common method used to assess problem behaviour in those populations, but not with individuals who have dementia. This raises an important question: does the frequent use of indirect and descriptive assessments of individuals with dementia indicate a lack of effectiveness of functional analysis as a behaviour assessment method for this population? In order to address this question, we should explore the potential adjustments of functional analysis methodology that may be necessary in order to increase its usability among individuals with dementia. For example, during a functional analysis it is not always possible to screen all relevant aspects of the controlling environment (Hanley et al., 2003). In other words, a typical functional analysis assesses only three forms of the environmental contingencies that could be maintaining the problem behaviour, while many other environmental events could be contributing to maintenance. These factors include idiosyncratic variations of known reinforcers and motivating operations (e.g., type of social attention). Also physiological or internal states related to illness, medication, fatigue, or hunger may alter the

relation between the behaviour and the environment (Carr, 1994).

It has been suggested that indirect and descriptive assessments can provide supplementary information that could be later integrated into an idiosyncratic functional analysis (Carr, 1994; Horner, 1994; Mace, 1994; Repp, 1994). An idiosyncratic functional analysis, is the same type of assessment as a standard functional analysis, except that the conditions used during the assessment differ in some way. These specific stimulus variables are called idiosyncratic stimuli (Carr, Yarbrough, & Langdon, 1997). For instance, an idiosyncratic functional analysis would involve antecedents and consequences that might be only relevant to an individual client (e.g. reprimands from a specific caregiver).

Many studies have indicated that informal observations have been helpful in identifying the contingencies maintaining the problem behaviour after they were incorporated into a functional analysis (Fisher, Adelinis, Thompson, Worsdell, & Zarcone, 1998; Richman & Hagopian, 1999). For example, Richmand & Hagopian (1999) reported that informal observations and discussions with caregivers of persons with dementia helped to identify specific types of attention as reinforcers for these persons, which were not apparent in the standard functional analysis. Subsequently, the authors implemented an idiosyncratic functional analysis in which typical conditions (alone, attention, play, demand) were replaced with three modified conditions: physical attention, verbal attention, and a control condition. The integration of these observations into an idiosyncratic functional analysis allowed the researchers to identify variables maintaining the problem behaviour.

There is evidence to suggest that a stepwise approach to the addition of idiosyncratic components to a functional analysis may help to improve assessment efficiency. For example, Hanley et al. (2003) suggested that tangible reinforcement should only be integrated in a

functional analysis when "preliminary [descriptive or anecdotal] information suggests a relation might exist" (p. 178). Subsequent analyses have shown that including a tangible condition as a default feature of a functional analysis may result in false-positive identification of a tangible function (Rooker, Iwata, Harper, Fahmie, & Camp, 2011).

Another aspect that may impact the implementation of functional analysis in those with dementia is fatigue and the overall drop in behaviour that parallels the evolution of the disease (Bourgeois & Hickey, 2009). Specifically, fatigue could limit the length of the sessions, or the number of sessions that can be conducted. In addition, a low rate of problem behaviour may be difficult to assess using the typical duration of a functional analysis.

Another important reason that indirect and descriptive assessments may be used over a functional analysis as an assessment of problem behaviour for individuals with dementia is the resources needed to conduct such assessments. A functional analysis can only be conducted by a highly trained clinician. This clinician must personally conduct the functional analysis sessions and record the problem behaviour data or be directly supervising the individual doing so. In addition, the clinician will have to analyse the data to find the function of the problem behaviour. Whereas, how to conduct and record the data for indirect and descriptive assessments can be taught to caregivers or staff after brief training by a clinician, then the clinician would simply analyse that data. Therefore, indirect and descriptive assessments require substantially less time and financial resources to administer than a functional analysis, which may explain why functional analyses are used infrequently with this population of individuals.

Dementia and Stimulus Control

Some of the aforementioned limitations may be exacerbated due to the decline in the cognitive functioning of individuals with dementia. For example, cognitive decline may

deteriorate the stimulus control of an individual's behaviour or may diminish the ability of environmental consequences to control an individual's behaviour. For example, behaviour may become less sensitive to stimuli that are less salient or that occurred in the recent past. Moreover, while individuals with dementia may be intellectually disabled currently, they have a background of typical development during which they might have developed a range of idiosyncratic stimulus relations. For example, "engaging others in conversations", "reading mystery novels", and "watching science-fiction movies" are all examples of behaviours paired with idiosyncratic reinforcers that are likely to be established among individuals with typical development. Likewise, access to these reinforcers may have been paired with specific stimulus relations likely to be also idiosyncratic (e.g., reading mystery novels while being alone on Friday nights).

There is a small body of research investigating the altered stimulus relations among individuals with dementia. Specifically, this literature has examined the role of stimulus control with individuals who have dementia. These studies found that stimulus control interventions reduce wandering behaviour (Bird, Alexopoulos & Adamowicz, 1995; Hussian & Brown, 1987; Mayer & Darby, 1991; Namazi, Rosner & Calkins, 1989). Bird et al. (1995) reported that antecedent control in the form of cued recall reduced inappropriate urination and excessive demands to go to the bathroom. Interventions based on antecedent and consequent events have also been effective for various problem behaviours such as disruptive use of a telephone, physical aggression, verbal aggression, shower refusal (Boehm et al., 1995), and stereotypy (Hussian, 1982). Combined interventions for these behaviours included the use of antecedent control and differential reinforcement (Boehm et al., 1995; Hussian, 1982). Token economies have also been used to decrease the level of staff support for activities of daily living (Mishara, 1987).

A review by Spira and Edelstien (2006) supports a distinct role of altered stimulus control as the basis for problem behaviour among individuals with dementia. In fact, Fisher and Buchanan (2000) suggested that antecedent interventions may be particularly useful for individuals with dementia because target skills may be already in the individuals' repertoire but under inadequate stimulus control.

Goals of the Study

The purpose of the present study was to assess the general feasibility of typical functional analysis methodology with individuals who have dementia. In Study 1 a descriptive assessment was conducted with individuals who exhibit problem behaviour. This allowed us to determine the topography, baseline frequency, and potential idiosyncrasies of antecedent and consequent variables that ought to be incorporated into a functional analysis. This was completed by analyzing the data using a conditional probability procedure. Following the descriptive assessment, in Study 2 we conducted a series of functional analysis sessions based on the results of the descriptive assessment. This allowed us to determine if a functional analysis was an effective assessment method for this population.

Methods

Participants and Setting

Participants were recruited through a long-term care residential facility for individuals with dementia in Winnipeg, Manitoba after receiving ethics approval from the University of Manitoba and from the long term care residential facility. In order to be eligible for the study, prospective participants had to engage in a problem behaviour on a daily basis. Participants were referred to the study through their case managers at the long-term residential care facility. An individual began the study after we received assent from the individual and informed consent

from his/her proxy decision maker. Two individuals with a clinical diagnosis of dementia as informed by their medical or nursing records participated in Study 1 and Study 2. We use fictional names to identify the participants throughout the studies.

The target responses were operationally defined for each individual participant. Susan was a 75 year-old, English speaking, non-ambulatory woman with a diagnosis of Dementia with behavioural psychological symptoms and with anxiety features (diagnosis November 2012); with a score of 23/30 on the Mini Mental State Examination and a score of 13/30 on the Montreal Cognitive Assessment in January 2013. She was referred to the study for inappropriate vocalizations. These inappropriate vocalizations were defined as any instance of vocal behaviour in which she requested staff to call her parents that were separated by at least 1 second, for example "Call my mother, please, call my mom!"

Bob was a 92 year-old, English speaking, non-ambulatory man, with a diagnosis of Vascular Dementia with behavioural psychological symptoms of Dementia (diagnosis January 2013); with a score of 7/30 on the Montreal Cognitive Assessment in January 2013. He was referred to the study for inappropriate vocalizations, and inappropriate touching. Inappropriate vocalizations were defined as any instance of vocal behaviour in which curse or swear words were exhibited. An example of inappropriate vocalizations would be something like "Get me the hell out of here!" and a non-example would be "Get me water nurse!" Inappropriate touching was defined as any instance where the individual physically touched another person (other than their arm or hands). The observations conducted during the descriptive assessment indicated that inappropriate vocalizations occurred frequently, whereas inappropriate touching did not. The contrasts in frequency of these problem behaviours lead us to choose inappropriate vocalizations as the problem behaviour to assess during the functional analysis.

Study 1: Descriptive Assessment

The purpose of Study 1 was twofold: first, to conduct a descriptive assessment for each participant using conditional probability analysis, in order to determine the function of the problem behaviour; and second, to inform if procedural changes to functional analysis conditions in Study 2 would be necessary to determine the function of the problem behaviour.

1.1 Procedure

After consent was received from a participants' legal decision maker and assent from the participant themselves, a brief unstructured interview was conducted with a staff member to obtain some background information about the problem behaviour that prompted referral to the study. This background information included the topography of the problem behaviour, its approximate frequency, and where, when and with whom it typically occurred.

Informal observations of each participants' behaviour were conducted for two to three hours to allow researchers to create observation codes of the probable antecedents, behaviours, and consequences occurring in the environment. The informal observations did not interfere with the participants' daily activities or schedule. The researchers were distanced from the participants when collecting observational data and were careful to remain as unnoticeable as possible. If the researchers were noticed by the participants and behaviour directed toward them, the session ended and the data collected was not used for the study. These preliminary observations were used to develop a comprehensive set of observation codes for all relevant events in the individuals' environment (described in the next subsection). Subsequently, a descriptive assessment using these observations codes was completed. Participants were observed for one hour at a time, for a total of ten hours each over multiple weeks. The descriptive assessment observations were conducted in the space where problem behaviours

typically occurred (e.g., public living area). The periods of observations sampled the common daily activities of participants. We recorded antecedents, problem behaviours, and consequences in real time using a handheld computer equipped with the behaviour observation software ABC Data Pro® (Romanczyk. R. G., Gillis, J. M., & Callahan, E. H). Observation templates are available in Appendix A.

Event Measurement and Interobserver Agreement.

The informal observations provided enough information to decide which antecedents, behaviours and consequences to collect data on during the descriptive assessments. For both participants, the antecedents and consequence events on which data were collected were the same (see Table 1). The target problem behaviours recorded for both participants differed. See Table 2 and Table 3 for details on the target behaviours for Susan and Bob. Interobserver agreement (IOA) was calculated by taking the smallest count of behaviour, divided by the largest count of behaviour and multiplying by 100 to calculate a percentage of agreement. Interobserver agreement was collected for 44% of Susan's descriptive assessment. The mean IOA was 97% (range, 95% to 98%), for inappropriate vocalizations and for social staff attention 97% (range, 95% to 98%). For Bob, IOA was collected for 37.5% of his descriptive assessment. The mean IOA was 96% (range 93 to 99%) for inappropriate vocalizations and 100% for social staff attention.

1.2 Calculation of Conditional Probabilities

The results of the descriptive assessment were calculated in terms of conditional probabilities (Lerman & Iwata, 1993). Specifically, we computed $p(T|E)$: the probability of the problem behaviour or target (T) given each potential antecedent or consequent event (E). We then compared $p(T|E)$ with $p(T|\sim E)$: the probability of the target given the absence of each antecedent

or consequent event and with *p*(T): the unconditional probability of the target. Subsequently, we computed *p*(E|T): the probability of each antecedent and consequent event given the target. We then compared *p*(E|T) with *p*(E|~T): the probability of each antecedent or consequent event given the absence of the target and with *p*(E): the unconditional probability of each antecedent or consequent event.

Table 1

Antecedents and Consequence Events Monitored During Descriptive Assessment

Event	**Operational definition**
Demand or Instruction	Staff or resident asked participant to do something, or issues an instruction to the participant through verbal behaviour, gestures, or physical prompting. This was a frequency button.
Social Staff Attention	Staff spoke verbally to the participant. The attention does not include physical attention, reality orientation, or redirections. This was a duration button.
Social + Physical Staff Attention	Staff spoke verbally to the participant and also engage in another form of attention such as physical attention (hug, handshake). This was a duration button.
Reality Orientation	Staff or resident verbally explained to resident what year it is and the date, also explains that their delusion is not real. This was a duration button.
Activity/ item	Participant engaged in an activity or item independently outside of bedroom, such as watching tv, playing a game, etc. This was a duration button.

Table 2

Susan's Target Behaviours Monitored During Descriptive Assessment

Target Behaviour	**Operational Definition**
Wandering	Participant is walking outside of personal bedroom. This was a duration button.
Inappropriate Vocalizations	Participant engages in stereotypic statement "Call my mother or I will call the police on you". This was a frequency button.

Table 3

Bob's Target Behaviours Monitored During Descriptive Assessment

Target Behaviour	**Operational Definition**
Request For Help (appropriate)	Participant verbally asks staff or a resident for help to fulfill an unmet need they cannot physically complete on their own such as help moving to another room, getting out of bed, help going to the bathroom, etc. "Help me get out of bed!" This was a frequency button.
Requests (inappropriate)	Participant verbally asks staff or a resident for help doing something or acquiring something tangible that they cannot have, they have limited access to, or can access on their own. For example "Get me a coffee now!" This was a frequency button.
Inappropriate vocalizations	Participant makes verbal statements that include curse or swear words, such as "shit," "fuck," "hell." This was a frequency button.
Sexually inappropriate vocalizations	Participant makes verbal statements of a sexual nature that are inappropriate, or vulgar, such as "Lay down in bed with me," or "I love you." This would be a frequency button.
Sexually inappropriate touching	Participant will reach out with his hand and touch, slap with an open hand, or grasp flesh of female staff on their buttocks, breasts, or genitals. This would be a frequency button.
Strike out	Participant will quickly move his fist toward another individual, as if to hit them. This would be a frequency button
Hitting	Participant will strike another individual with a closed fist or open hand. This would be a frequency button.

Events were selected as potential antecedents or consequences when (a) the probability of the target given the antecedent or consequent event was higher than the probability of the target given the absence of the event and the unconditional probability of the target and (b) the probability of the antecedent or consequent event was higher than the probability of these very events given the absence of the target and the unconditional probability of these events. Formally, we selected events as the probable function of the target behaviour when the following

two conditions were met:

(a) $p(T|E) > p(T|\sim E)$ and $p(T|E) > p(T)$, and

(b) $p(E|T) > p(E|\sim T)$; $p(E|T) > p(E)$.

The formulas of the conditional probability analysis are defined in Table 4 (adapted from Fritz, Iwata, Hammond, & Bloom, 2013). An important aspect of these formulas is the calculation intervals, which we will call the time window for the remainder of these studies. The Time window is the length of time that the formula considers two events to be coincided or related in time. We speculated that the length of the time window may need to be increased for analysis of the data due to the overall decline in cognitive domains of individuals with dementia. These cognitive domains such as language, abstract thinking, judgment, or executive functioning are often affected among individuals with dementia (Smetanin et al. 2010).

One of the facets of cognitive decline is a longer response time to stimuli in the environment, which may require adjustments in the length of the time window for the conditional probability calculations. If the time window is too long, events that are not related may appear as though they are related. In contrast, if the time window is too short, events that are related, may appear as though they are not related. In sum, if the time window is not chosen carefully we may draw conclusions from the data that are false, leading to the inaccurate identification of the function of the target behaviour. For example, if your time window is 10 seconds, and two events occur 5 seconds apart from each other, they will fall within the time window, and the formula may consider them temporally related. However, if your time window is 4 seconds, they may be considered independent events and not temporally related.

Table 4

Probability analysis formulas.

Probability type	Formula
Conditional probability of the target (T) given the antecedent or consequent event (E)	*p*(T|E) = 10-s time window with E that also contain T divided by 10-s time window with E
Conditional probability of T given the absence of E	*p*(T|~E) = 10-s time window with T without E divided by 10-s time window with T
Unconditional probability of T	*p*(T) = 10-s time window with T divided by Total 10-s time window
Conditional probability of E given T	*p*(E|T) = 10-s time window with T that also contain E divided by 10-s time window with T
Conditional probability of the E given the absence of T	*p*(E|~T) = 10-s time window with E without T divided by 10-s time window with E
Unconditional probability of E	*p*(E) = 10-s time window with E divided by Total 10-s time window

The conditional probabilities were calculated using a complex spreadsheet created by Dr. Javier Virues-Ortega, please see Appendix C for a copy of the spreadsheet used. The spreadsheet allowed us to copy and paste in data taken using ABCdatapro. The individual events and behaviours of interest could be selected, as well as the time window for the conditional probability calculations. This allowed for easy manipulation and comparison of both behaviours and events, as well as how these probabilities changed with a change in the length of the time window since the observation time was consistent across sessions.

1.3 Results

When analysing the data using the conditional probability formulas, we first had to determine what time window we would use for the analysis. Figure 1 presents a depiction of the changes in conditional probability values as the time window used to calculate the data were manipulated for Susan. As the time window increased from 15, 30, 45 and finally to 60 seconds

the probability of the occurrence of the target, given the event, and the probability of the event, given the target, increased. In addition, the probability of the target, given the absence of the event, and the probability of the event, given the absence of the target, decreased. In other words, a 60 second time window during the descriptive assessment maximized the conditional probability values for Susan. Thus, we computed conditional probabilities on the basis of a 60 second time window. This suggests that the events temporally related occurred up to a maximum of 59 seconds apart, or that the first event occurred for some time before the second event began.

The results of the descriptive assessment conditional probabilities for both participants can be found in Figure 2. For Susan, two different target behaviours were recorded, wandering and inappropriate vocalizations (see Table 2). Wandering occurred at a low rate, whereas the inappropriate vocalizations occurred frequently and intensely. In addition, inappropriate vocalizations were of increased clinical importance as the behaviour would agitate residential staff, residents in the facility, and agitate the participant herself. Wandering was not as clinically relevant as the participant was not wandering into restricted areas or attempting to leave the facility. Therefore, we decided to use inappropriate vocalizations as the target behaviour for the conditional probability analysis. As is visible in Figure 2, only two consequences fulfilled the requirements to be selected as potential antecedents or consequences maintaining the target behaviour.

Susan’s inappropriate vocalizations occurred both prior to and subsequent to staff attention, but typically occurred prior to receiving attention from the staff. This suggests that the staff attention was reinforcing the inappropriate vocalizations. Examining the data further, the inappropriate vocalizations were more likely to occur in the presence of social staff attention. By contrast, inappropriate vocalizations were less likely to occur in the presence of physical staff

attention. In addition, the probability of social staff attention was higher given the occurrence of inappropriate vocalizations than the probability of the social staff attention given the absence of inappropriate vocalizations and the unconditional probability of social staff attention. This relationship was inversed with social and physical staff attention. These conditional probabilities indicate that social staff attention was, among the variables evaluated, the most promising as a possible maintaining variable for inappropriate vocalizations. This suggests that Susan's inappropriate vocalizations were reinforced by access to social staff attention.

For Bob, seven different target behaviours were recorded, appropriate requests for help, inappropriate requests for help, inappropriate vocalizations, sexually inappropriate vocalizations, sexually inappropriate touching, striking out and hitting (see Table 3). All of the target behaviours occurred at a low rate or not at all, except inappropriate vocalizations which occurred at a moderate rate. Therefore, inappropriate vocalizations were chosen as the target behaviour and used for the conditional probability analysis as they occurred most often, even though it was not the most clinically significant behaviour to caregiving staff at the long term care facility. As illustrated in Figure 2, only two consequences met the required criterion for antecedents or consequences possibly maintaining the target behaviour.

Bob's inappropriate vocalizations occurred both prior to and following social staff attention but typically occurred prior to receiving attention from staff, whereas inappropriate vocalizations exclusively occurred prior to access to an activity or leisure item. The probability of Bob's inappropriate vocalizations were more likely to occur in the presence of social staff attention. By contrast, inappropriate vocalizations were less likely to occur in the presence of an activity or leisure item. In addition, the probability of social staff attention was higher given the occurrence of inappropriate vocalizations than the probability of the social staff attention given

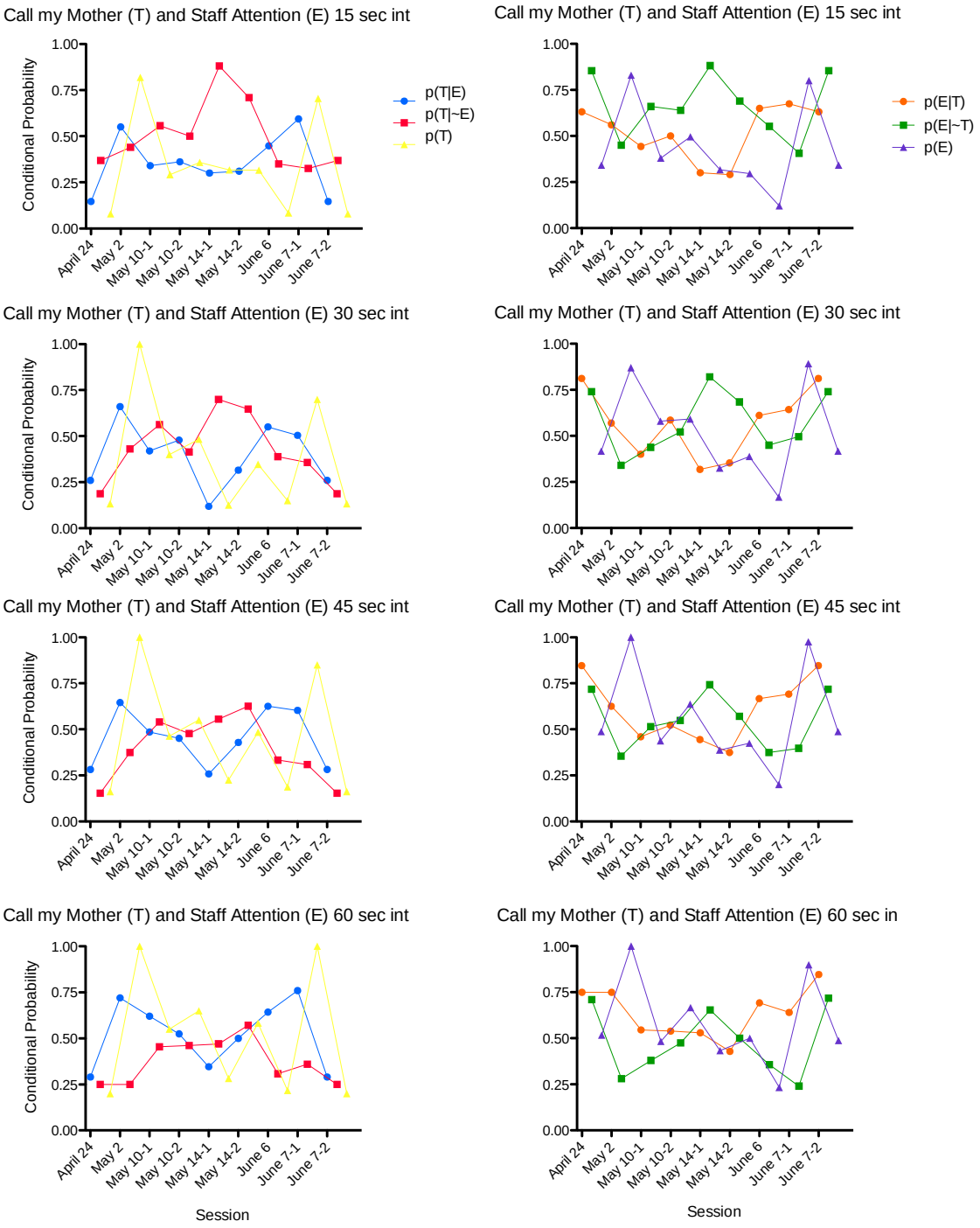

Figure 1: Changes in conditional probability values as calculation intervals were manipulated across 60 minute observation periods.

the absence of inappropriate vocalizations and the unconditional probability of social staff attention. The probability of accessing a social activity or leisure activity was higher following the occurrence of inappropriate vocalizations than the probability of accessing a social or leisure activity given the absence of inappropriate vocalizations. Also, the probability of accessing a social activity or leisure activity was higher than the unconditional probability of accessing an activity. This suggests that Bob's inappropriate vocalizations were reinforced by access to social staff attention.

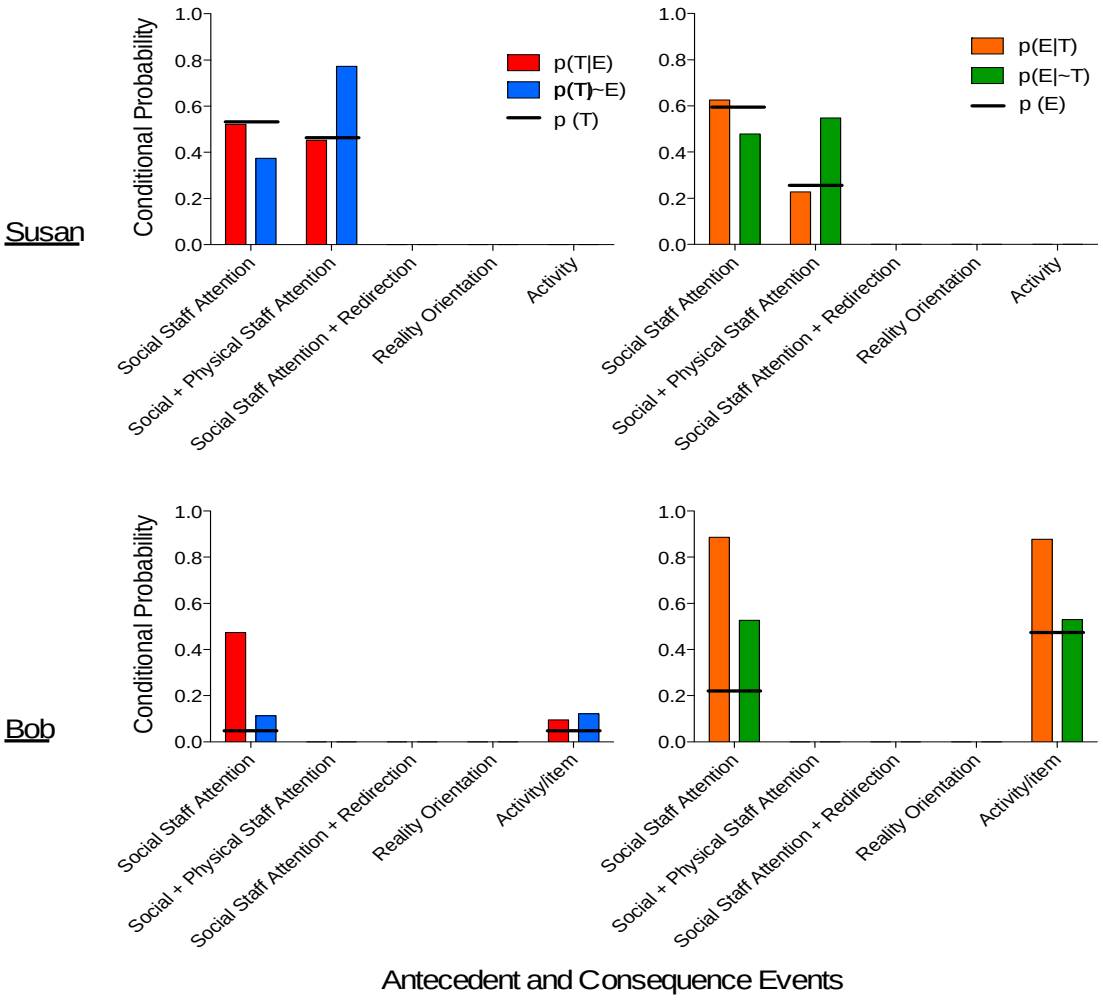

Figure 2: Conditional probability calculations for Susan and Bob.

1.4 Discussion

Descriptive assessments have been used often to identify the function of problem behaviour among individuals with dementia (Heard & Watson, 1999; Millichap et al., 2003; Moniz-Cook, Woods & Stevens, 2001; Baker, LeBlanc, Raetz & Hilton, 2011). In Study 1 we investigated whether a descriptive assessment and conditional probability analysis would correctly identify the function of inappropriate vocalizations in two participants with dementia. Study 1 also helped to determine whether procedural changes in the functional analysis were needed. Our results indicated that the function of the inappropriate vocalizations for both Susan and Bob were staff's social attention, and that no distinct idiosyncrasies were observed during the descriptive assessment that would warrant procedural changes to the functional analysis conditions in Study 2.

Study 1 suggests that a conditional probability analysis on the basis of descriptive data can help to ascertain probable functions of problem behaviour in individuals with dementia. Our findings indicate that the time window and event duration present in the conditional probability analyses can change the resulting conditional probabilities dramatically. Thus, these parameters ought to be set carefully in order to maximize conditional probabilities without adding unnecessary subjectivity to the analysis.

As a result of our analysis, it became apparent that low-frequency behaviours (occurring less than once a day) are very difficult to assess as the observer is likely to miss the occurrence of the behaviour. In addition, with very few instances of observed events and behaviours, it would be difficult to obtain any interpretable conditional probabilities. Thus, this assessment and analysis are limited to frequently occurring behaviours (occurring at least once a day) which may not carry the same clinical significance as other less frequent but yet socially important

maladaptive problem behaviours.

Study 2: Functional Analysis

The purpose of Study 2 was to conduct a Functional Analysis with each participant, based on the results of the descriptive assessment, to determine if a function of the problem behaviour could be identified using this behaviour assessment methodology.

2.1 Procedure

Preference Assessment

A multiple stimulus without replacement (MSWO) preference assessment was conducted with both participants individually to identify items to be used during the functional analysis (DeLeon & Iwata, 1996). A participant sat at a table, on which six items were placed approximately two inches apart. The researcher first encouraged the participant to pick up each item for at least 30 seconds to interact with the stimuli. Then the preference assessment began. The researcher would say “pick one” and wait for the participant to touch an item. That item would then be removed from the array and given to the participant (if they had not already picked it up). The participant had access to the item for one minute. After one minute elapsed, the item would be removed from sight, and the remaining items in the array would be rotated in placement. The instruction was then repeated. This process occurred five times until the last item remained. The order in which the items were selected was independently recorded by the researcher and research assistant on a computer spreadsheet.

Functional Analysis

A functional analysis was conducted based on the results of the descriptive analysis. The functional analyses were conducted in a visitation room that the participants regularly visited for recreation activities as there were environmental variables (frequent interruptions from other

residents) that prevented the sessions from taking place in the public living areas of the facility. All sessions were 10 min in duration, with 5-10 minute breaks between sessions.

During the functional analysis, the four standard conditions were alternated in a multi-element design in the following order: alone, attention, play, and demand for Susan. A functional analysis was also conducted with Bob, with the addition of the tangible condition following the demand condition. This particular order has been shown to maximize the likelihood of obtaining distinct results more quickly than a random alternation of conditions (Hammond, Iwata, Rooker, Fritz & Bloom, 2013).

The functional analysis evaluated behavioural functions: automatic reinforcement, positive reinforcement, and negative reinforcement. The assessment continued until the function of the behaviour was clear according to the criteria by Hagopian, Fisher, Thompson, Owen–DeSchryver, Iwata & Wacker (1997) with the exception of the 10 sessions per condition criterion (see Appendix D).

The functional analysis conditions were as follows:

Alone. During this condition, a participant was seated alone, without any leisure items, activities, or people to interact with. If the observer or any staff members were nearby, they were instructed to avoid any form of social interaction with the participant for the duration of the session. All behaviour exhibited by the participant was ignored. The experimenter observed and recorded the target behaviour of the participant from a safe distance.

Attention. During the attention condition, a participant was seated at a small table. Different activities and leisure items were placed on the table in front of the participant. The experimenter told the participant that they could "try any of the activities," while the experimenter "does some work". The experimenter sat in a chair across the room and looked

through a book or magazine. Contingent upon every occurrence (or burst of occurrences) of the target behaviour, attention was provided as a statement of concern or disapproval, similar to what was observed when the behaviour occurred in the natural environment, such as "Whoa, that is too loud." The attention was paired with brief physical contact, such as a touch on the shoulder or arm. All other behaviours or responses emitted by the participant were ignored.

Play. A participant was seated at a small table across from the experimenter. Different activities and leisure items were placed on the table in front of the participant. The experimenter offered activities to the participant periodically throughout the session without presenting any demands independent of the target behaviour. Contingent upon appropriate behaviour and in the absence of the target behaviour, the experimenter provided social praise and brief physical contact at least once every 30 sec. All instances of the target behaviour were ignored.

Demand. A participant was seated at a small table across from the experimenter. Different activities were placed on the table in front of the participant. The activities were self-care or daily living tasks that the participant were physically capable of performing. Examples of such activities include: combing hair, folding clothes, buttoning a shirt, tying a shoelace, zippering a zipper, etc. Tasks were difficult for the participant to complete and were chosen based on reports by facility staff. These activities were presented using a three step prompting procedure. The experimenter gave a verbal instruction, followed by 5 seconds for the participant to initiate a response. When that time elapsed, the experimenter repeated the instruction, modeled the response, and waited 5 seconds. If no response occurred, the experimenter repeated the instruction and physically guided the participant through the response. Social praise was delivered contingent upon successful completion of the response (e.g., "Thank you!"). Contingent upon the target behaviour, the activity was terminated and the experimenter turned

away from the participant for 30 s and a new trial begin immediately after the escape period.

*Tangible***.** A participant was seated at a small table across from the experimenter. The experimenter gave the participant a highly preferred activity or leisure item for 1 minute. The activity or leisure item was then removed and placed out of reach of the participant. At this time data collection began. Contingent upon the target behaviour, the participant would be given access to the activity or leisure item for 30s. After the 30 s elapsed, the activity or leisure item was again removed and placed out of reach of the participant.

2.2 Response Measurement, Interobserver Agreement, and Procedural Integrity

The dependent variables were the frequency, measured in responses per minute of the inappropriate vocalizations. Interobserver agreement was calculated by dividing the smallest count of behaviour by the largest count of behaviour and multiplying by 100 for a percentage of agreement. For Susan, IOA was collected for 50% of the functional analysis sessions. The mean IOA was 98% (range, 94% to 100%) across conditions for the inappropriate vocalizations. For Bob, IOA was collected for 50% of functional analysis sessions. The mean IOA was 98% (range, 90% to 100%) for inappropriate vocalizations.

The procedural integrity for the functional analysis was calculated as a percentage for each condition reflecting the accuracy of procedure implemented. See Table 5 for the procedural integrity percentages for both Susan and Bob. Procedural integrity was calculated for 100% of Susan and Bob's sessions. The mean procedural integrity of Susan's sessions was 98% (range, 94% to 100%) and Bob's sessions was 99% (range, 95% to 100%). Procedural integrity was the lowest during the control conditions for both Susan and Bob, due to the non-contingent contingent attention portion of the procedure. The lower procedural integrity was due to late

delivery of attention (should be delivered every 30 seconds), there were three of these occurrences in total across participants.

Table 5

Functional Analysis Procedural Integrity

FA Condition	Susan	Bob
Alone	100%	100%
Attention	94%	100%
Control	98%	95%
Demand	100%	100%
Tangible	N/A	100%

2.3 Results

Prior to the functional analysis, multiple stimulus without replacement preference assessments were conducted for both Susan and Bob to determine which activities and leisure items should be used for each condition. See Table 6 for the results of each preference assessment.

As can be seen in Figure 3, Susan's inappropriate vocalizations varied greatly across conditions, with 0.0-1.8 responses per minute. During Susan's first alone and control sessions inappropriate vocalizations occurred over one standard deviation above the mean. The control and demand conditions exhibited downward trends, with less than or equal responses per minute occurring across all sessions. The inappropriate vocalizations during the control condition peaked during session three, decreased in session seven, decreased further in sessions eleven and

then increased slightly in session fifteen. During the attention condition inappropriate vocalizations occurred at 1.8 responses per minute, decreased to 0.9 responses per minute in

Table 6

Multiple Stimulus Without Replacement Preference Assessment

	Susan			**Bob**	
Item / Activity	**Rank**	**FA Condition**	**Item / Activity**	**Rank**	**FA Condition**
Bingo Set	1	Control	Bingo Set	1	Control
Gardening Magazines	3	Attention	Weather Magazines	3	Attention
Puzzle	5	N/A	Puzzle	4	Attention
Chatelaine Magazines	2	Control	Car Magazines	2	Control
Beads and String	6	N/A	Music	6	N/A
Crossword Puzzle	4	Attention	Crossword Puzzle	5	N/A

session six. It increased to 1.1 during session three and back down again to 0.6 in session fourteen Susan's inappropriate vocalizations occurred the most in the attention conditions, with all data points over one standard deviation above the mean of the control condition and fewer responses per minute across all other conditions. These data indicate that attention from staff was the reinforcer maintaining Susan's inappropriate vocalizations.

Bob's inappropriate vocalizations occurred at a much lower rate than Susan's, overall across conditions 0.0-0.5 responses per minute. Bob's inappropriate vocalizations did not occur in the alone, control and demand conditions. During the tangible condition, inappropriate vocalizations occurred at zero responses per minute for sessions five, ten and twenty. Inappropriate vocalizations occurred at a rate of 0.1 responses per minute in session twenty of the tangible condition, this data point was one standard deviation above the mean of the control

condition. Finally, in the attention condition, there was an upward trend, during each session responses per minute increased. All data points in the attention condition were one standard deviation above the mean of the control condition. In sum, these data indicate that attention from staff was also the reinforcer maintaining Bob's inappropriate vocalizations**.**

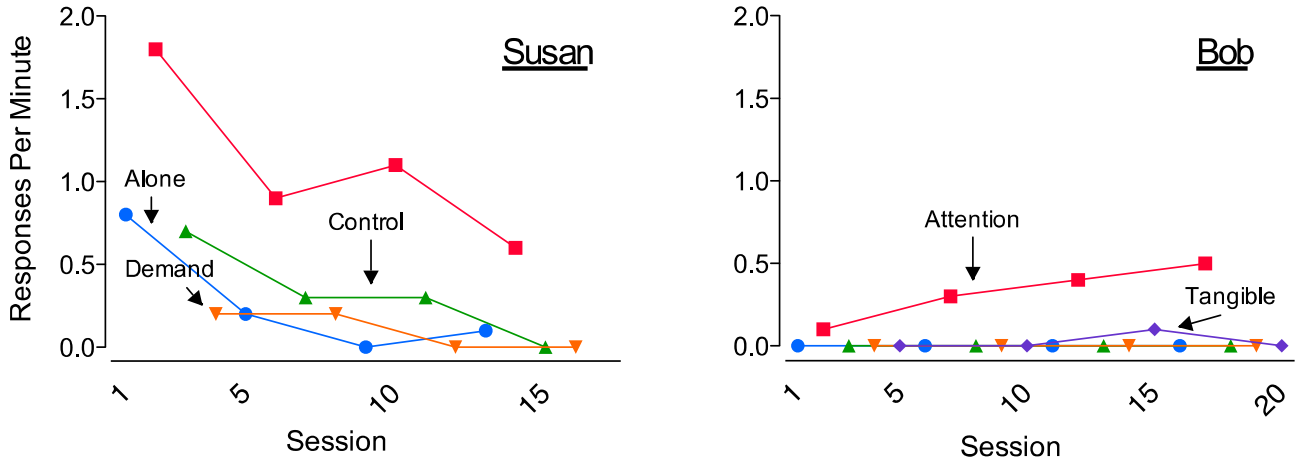

Figure 3: Functional Analyses Results for Susan and Bob.

2.4 Discussion

There are few studies assessing problem behaviour of individuals with dementia using functional analysis (Baker, Hanley & Matthews, 2006; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Locke & Mudford, 2010). In Study 2 we conducted a functional analysis with two participants with dementia to determine the function of their inappropriate vocalizations.

Our results showed that the function of inappropriate vocalizations could be easily identified in both participants. Specifically, access to attention from staff in a long term care facility was the reinforcer for inappropriate vocalizations in both individuals. This finding is consistent with the small body of literature reporting similar results (Baker, Hanley & Matthews,

2006; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Locke & Mudford, 2010). Interestingly, we evaluated two individuals with the same problem behaviour topography, which also happened to be maintained by the same behaviour function. While this does not lend to the generalizability of our findings, it does provide a small basis for the systematic replication of attention-maintained problem behaviour among individuals with dementia.

Finally, we found that it was not necessary to modify the typical functional analysis procedure in order to identify the function of the problem behaviour. Specifically, the descriptive analysis did not point to specifying activities or stimuli to be used as part of the attention, demand and play conditions. By contrast, the typical procedures sufficed to produce a differentiated outcome during the experimental functional analysis.

General Discussion

The primary purpose of the present study was to conduct descriptive assessments and functional analyses of problem behaviours among individuals with dementia to determine if one or both are effective assessment methods for this clinical population. A secondary purpose was to investigate whether any modifications to a standard functional analysis protocol are helpful to improve the identification of the function of problem behaviour within this population.

Two individuals with dementia who exhibited inappropriate vocalizations participated. For both Susan and Bob, the results of the descriptive and functional analyses indicated that positive reinforcement in the form of social attention from staff was the cause of the problem behaviour, supporting the hypothesis supported in the descriptive analyses. This is consistent with previous research that has found that descriptive assessment (Heard & Watson, 1999; Millichap et al., 2003; Moniz-Cook, Woods & Stevens, 2001; Baker, LeBlanc, Raetz & Hilton, 2011) and standard functional analysis as effective and appropriate functional behavioural

assessment methods for individuals with dementia (Baker, Hanley & Matthews, 2006; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Locke & Mudford, 2010). In addition, this study aligns well with the empirical evidence of widespread use and effectiveness of standard functional analysis in other populations including people with autism spectrum disorders and intellectual disabilities (Beavers et al., 2013; Hanley, Iwata & McCord, 2003).

Our secondary goal could not be investigated fully as we did not need to make any extraneous modifications to the typical functional analysis in order to identify the function of the inappropriate vocalizations. Nonetheless, the descriptive analysis helped to identify the topographical dimensions of social stimuli in the natural environment that were later incorporated in the experimental functional analysis as consequent events for problem behaviour during the attention condition. Targeted functional analyses evaluating specific forms of attention have shown dramatic changes in responding for attention-maintained problem behaviour (see for example Kodak et al., 2007).

It is important to note the clinical implications of these two studies. We found that behaviour analytic assessments methods were capable of identifying why the individuals were engaging in problem behaviour. From a clinical perspective this is incredibly important, as finding methods that are successful in identifying why an individual with dementia is engaging in a particular problem behaviour is the first step in treating and reducing problem behaviour within this population. In addition, as behaviour assessment methods were effective in identifying a function of the problem behaviour in this study and others, it suggests that function based behaviour interventions would likely be helpful in reducing the problem behaviour. This has been confirmed in the limited studies published on assessing and treating problem behaviour of individuals with dementia using a behaviour analytic framework (Baker, Hanley & Matthews,

2006; Baker, LeBlanc, Raetz & Hilton, 2011; Bakke et al., 1994; Buchanan & Fisher, 2002; Dwyer-Moore & Dixon, 2007; Feliciano & Steers, 2009; Heard & Watson, 1999; Horovitz, Kozlowski & Mason, 2010; Locke & Mudford, 2010; Millichap et al., 2003; Moniz-Cook, Woods & Stevens, 2001).

Based on the results of this study, an intervention targeting reduction of the inappropriate vocalizations could contain a few different clinical recommendations such as non-contingent reinforcement, functional communication, and differential reinforcement of other behaviour due to the function of the behaviour. The purpose of these recommendations would be twofold; to teach the individuals that they need to engage in appropriate vocalizations and behaviour to get attention from staff, and that engaging in inappropriate vocalizations will no longer result in the same amount or type of attention that the individuals were seeking.

In order to prevent inappropriate vocalizations, staff of long term care facilities would benefit from presenting non-contingent attention to residents. In addition, staff could be trained in order to present differential reinforcement in the form of contingent attention for appropriate behaviour such as daily living tasks, recreational activities, and appropriate conversations or vocalizations. Attending to an individual more often when they are engaging in inappropriate behaviours may accidentally teach the individual that they get more attention from staff when engaging in inappropriate or unacceptable behaviour, rather than receiving attention for appropriate or acceptable behaviour. The aforementioned recommendations try to prevent this behaviour contingency from developing.

There are several limitations to the current study. First, the number of participants included in the study is too limited to evaluate several dimensions of the proposed approached to assessment. Specifically, assessment acceptability, success rate (relative number of assessments

producing an identifiable outcome), and generalizability across problem behaviour topographies and behaviour functions can not be evaluated on the basis of two datasets. The current study adds to the small body of literature on the functional analysis of problem behaviour among individuals with dementia. We are hopeful that future reviews will incorporate the cases reported here as part of the effort of achieving the necessary between-subject replication by which behaviour-analytic interventions achieve a degree of generality (Sidman, 1960).

A second limitation to the current study is the absence of a treatment analysis. While a treatment evaluation was not needed as per the goals of the study, a function-driven intervention would have provided supplementary evidence in support of the validity of the results of the functional analysis. It might have also been beneficial to the participants and caregivers involved.

Finally, the descriptive analysis involved complex conditional probability analyses that could easily become unmanageable. Naturalistic observations can easily result in countless two-term combinations of behavioural and environmental events. In the current analysis we focused our descriptive assessment on the most prominent environmental events and reported a full conditional probability analysis for both. However, future studies should implement a more formal set of clinical decision-making criteria to guide the process for selecting environmental events thought to be functionally related with the problem behaviour. Fritz et al. (2013) have presented and validated a scheme for the identification of precursors of problem behaviour. Similar efforts could result in clear guidelines for the use of descriptive analysis with individuals with dementia engaging in problem behaviour.

The current study supplements the behaviour assessment literature of problem behaviour of individuals with dementia, especially considering the scarce literature on functional analysis.

In general, behavioural gerontology is an understudied area of applied behaviour analysis and the present study adds to the literature base informing function-based behaviour assessment and treatment in this clinical population. Accurate functional behaviour assessments might be the key to effective behavioural interventions. A functional analysis is instrumental to identify the treatment components that are likely to be effective for a given behaviour function (Beavers, Iwata, & Lerman, 2013).

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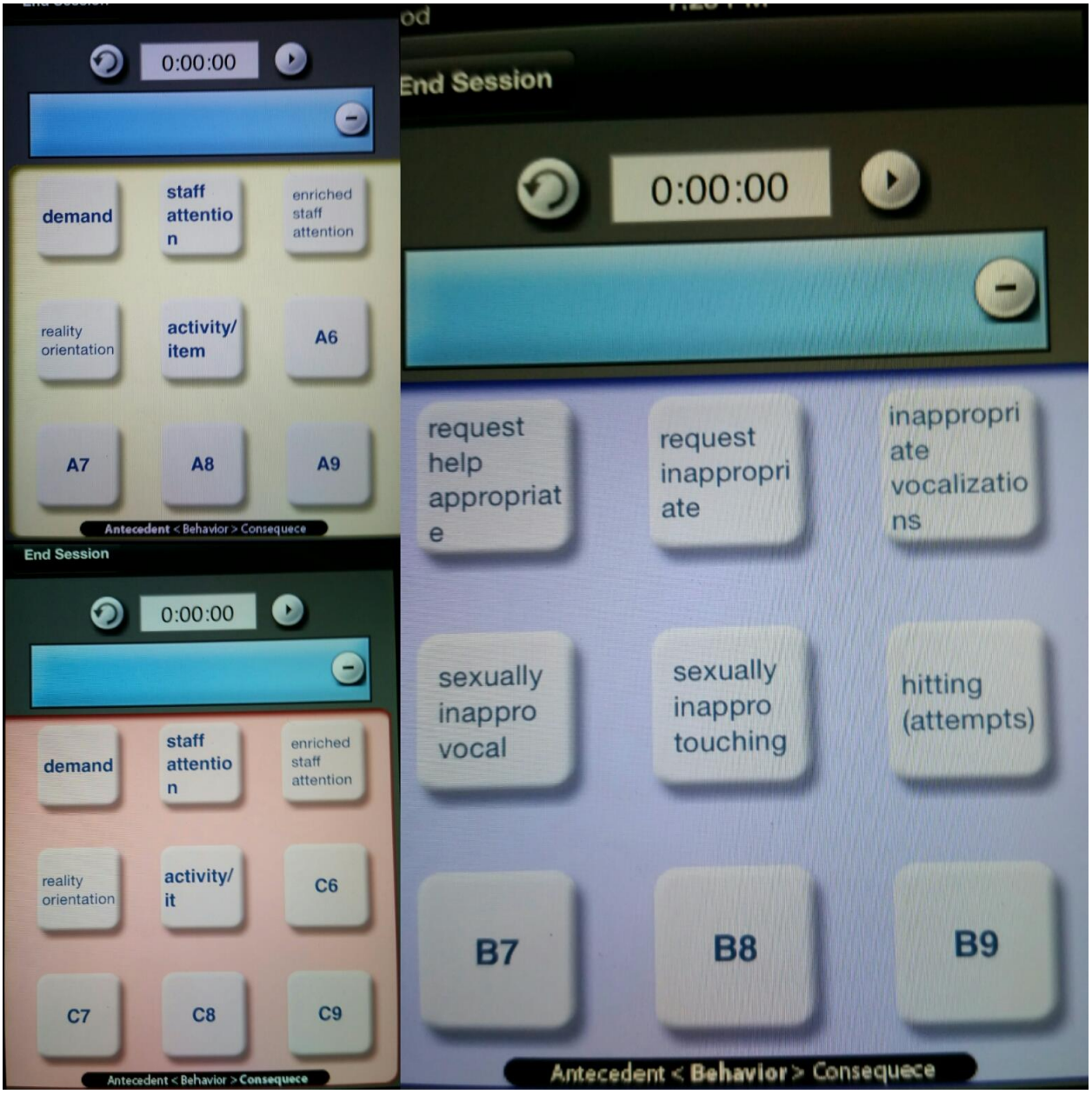
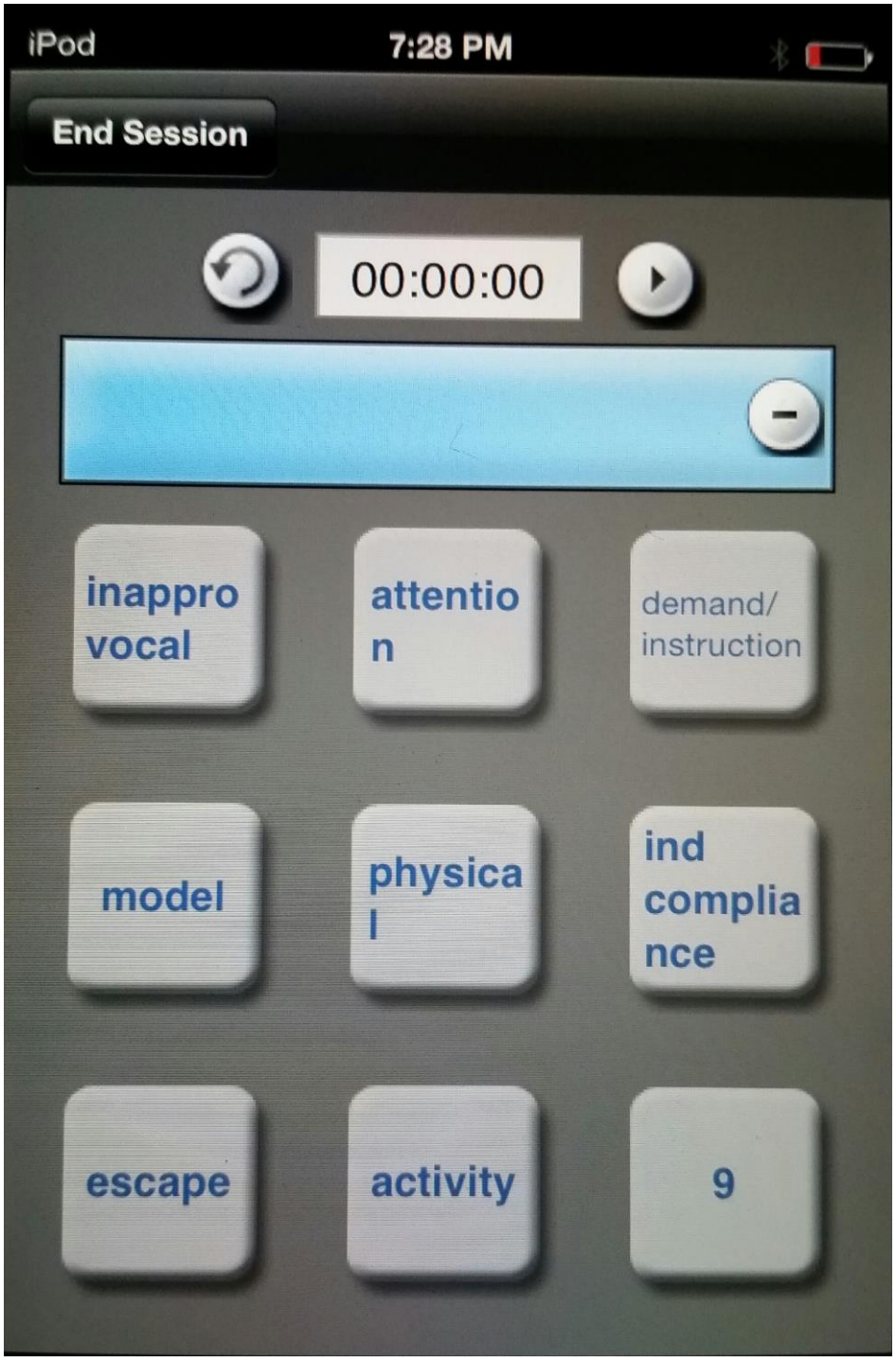
Appendix A: Example Descriptive Assessment Observation Templates



Appendix B: Functional Analysis Templates



Appendix C: Copy of Spreadsheet used for Conditional Probability Analysis of Descriptive Assessment Data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	PASTE RAW DATA IN RED CELL, GREEN CELLS OUTPUT, GREY CELLS NOT EDITABLE, SHEET FOR UP TO 500 EVENTS, AND UP TO										Wandering		60	<-- Int dur		
2									Event no.			Int start	first int	last int		
5	"3	5.3	11	"Call my mother"	Count	S			3	1000	0	0	0	0	1	10
6	"4	9.2	12	Staff attention	Duration	S	5.1		4	1000	0	0	0	0	1	10
7	"5	29.4	18	Other Area	Duration	S	27.1		5	1000	0	0	0	0	1	10
8	"6	29.8	17	Common Area	Duration	S	start		6	100	0	0	0	0	1	10
9	"7	31.7	10	Wandering	Duration	S	start		7	100	0	0	0	0	1	10
10	"8	46.9	12	Staff attention	Duration	S	start		8	100	0	0	0	0	1	10
11	"9	48	12	Staff attention	Duration	S	1.1		9	1000	0	0	0	0	1	10
12	"10	147.3	11	"Call my mother"	Count	S			10	1000	0	0	0	0	1	10
13	"11	148.5	10	Wandering	Duration	S	116.8		11	1000	1	1.5283333	2	4	1	10
14	"12	154.8	12	Staff attention	Duration	S	start		12	100	0	0	0	0	1	10
15	"13	164	12	Staff attention	Duration	S	9.1		13	1000	0	0	0	0	1	10
16	"14	175.6	11	"Call my mother"	Count	S			14	1000	0	0	0	0	1	10
17	"15	197.4	10	Wandering	Duration	S	start		15	100	0	0	0	0	1	10
18	"16	203.3	11	"Call my mother"	Count	S			16	1000	0	0	0	0	1	10
19	"17	217.2	11	"Call my mother"	Count	S			17	1000	0	0	0	0	1	10
20	"18	260.8	11	"Call my mother"	Count	S			18	1000	0	0	0	0	1	10

Q	R	S	T	U	V	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE
Staff attention							Start	End	Call my Mother (T)	Start	End	Staff Attention (E)						
	Int start	first int	last int			interval no.			0	0	0	0	E|T / T|E	T|~E	E|~T			
0	0	0	0	1	10	3	0	0	1	0	10	0	0	1	0		p(T|~E)	0.50
1	1.068333333	1	3	1	10	4	1	10	1	1	10	1	1	0	0		p(T)	0.33
0	0	0	0	1	10	5	0	0	0	1	10	1	0	0	1		p(E|T)	0.50
0	0	0	0	1	10	6	0	10	1	0	0	0	0	1	0		p(E|~T)	0.71
0	0	0	0	1	10	7	0	0	0	0	0	0	0	0	0		p(E)	0.58
0	0	0	0	1	10	8	1	0	1	1	10	1	1	0	0		Interval dur (editable)	60
1	1.781666667	2	2	1	10	9	0	10	1	0	0	0	0	1	0		Sheet usability	Usable
0	0	0	0	1	10	10	1	0	1	0	0	0	0	1	0			
0	0	0	0	1	10	11	1	10	1	1	10	1	1	0	0			
0	0	0	0	1	10	12	0	10	0	1	10	1	0	0	1			
1	3.581666667	4	4	1	10	13	0	0	0	1	0	1	0	0	1			
0	0	0	0	1	10	14	0	0	0	0	0	1	0	0	1			
0	0	0	0	1	10	15	0	0	0	0	0	1	0	0	1			
0	0	0	0	1	10	16	0	0	0	0	0	1	0	0	1			
0	0	0	0	1	10	17	0	0	0	0	0	1	0	0	1			
0	0	0	0	1	10	18	0	0	0	0	0	1	0	0	1			
0	0	0	0	1	10	19	0	0	0	0	10	1	0	0	1			

Appendix D: Structured criteria for visual inspection of multi-element functional analysis data for analyses with 10 points per condition (Hagopian et al., 1997).

General Procedure

An upper criterion line (CL) and a lower CL are drawn to approximately 1 *SD* above and below the mean of the control condition (play). The lines are drawn based on the number of data points that would hypothetically fall beyond 1 *SD,* assuming a normal distribution of the play data points. Thus, the upper CL for 10 points is drawn between the second and third highest points, and the lower CL is drawn between the second and third lowest points. Criterion for differentiation is based on the number of data points for each condition that fall beyond the CLs. Differentiation is said to occur if at least five more data points from a test condition fall above the upper CL than fall below the lower CL. If the lower CL is zero, count each zero point as below the lower CL. Note that the minimum upper CL is drawn at 0.5 responses per minute.

Rules for Automatic Reinforcement

Score functional analysis as automatic only if (a) alone is the highest condition and is significantly higher than play; (b) the rates of behavior tend to be higher (across most sessions) in conditions with less external stimulation (alone, social attention, and tangible) and lower in the conditions with higher external stimulation (demand and play); or (c) all conditions are high and relatively stable with no overall trends (the mean of all conditions is greater than or equal to approximately 1.5 per minute), and there are less than five zero points. Note that if Condition c criteria are met, further analysis is recommended.

Rules for Trends

Downward trends. At least two of the data points above the upper CL must occur in the second half of the assessment; otherwise there is a downward trend and the condition is not

differentiated. *Exception:* For the demand and tangible conditions, do not apply the differentiation rules for downward trends if there is a decreasing trend to an efficient rate of responding (e.g., if escape or tangible items are provided for 30 s contingent on behavior, an efficient rate of responding would be two per minute).

Upward trends. If all five data points that are above the upper CL occur in the second half of the assessment, this is an upward trend, and data points that fall below the lower CL for the first half of the assessment should be ignored (i.e., the condition is differentiated). Also, the upper CL should not be adjusted in this case (see rules for low magnitude of effects).

Overall trends. If there is an overall trend across most of the conditions (including play), any condition that is consistently higher than play over the course of the assessment meets criterion for differentiation.

Rules for Low-Rate Behavior

In cases in which most of the data points are low, the condition in which all or most of the higher rate behavior occurs is considered to be differentiated (i.e., more than half of the higher rate sessions occur in one condition *and* more than half of the total number of behaviors in the higher rate sessions occur in that same condition). However, one of those high points must occur in the last half of the assessment.

Rules for Low Magnitude of Effects

In cases in which a condition meets criteria for differentiation but more than one of the points are above the upper CL *by only a small amount* (i.e., the magnitude of differentiation is relatively low), raise the upper CL by 20% (for the condition with the low magnitude of effects). Use this adjusted upper CL for determining differentiation for that condition instead of the regular upper CL. *Exception:* If there are five points above the upper CL in the last half of the assessment (i.e.,

the condition meets criteria for an upward trend), do not apply the differentiation rules for low magnitude (do not adjust the upper CL).

Multiple Maintaining Variables

In cases in which more than one condition meets criteria for differentiation, score the analysis as multiply maintained (unless the highest is alone; then score it *only* as automatic). If there are three differentiated conditions and the alone condition is not the highest among those, ignore the alone condition (e.g., do not score it as automatic, attention, and tangible; score it as attention and tangible). If there are two differentiated conditions and the alone is the lower of the two, score it as both automatic and the other condition.