

EFFECTS OF MULTI-SENSORY ENVIRONMENT ON ADULTS WITH AUTISM WHO  
EXPERIENCE REPETITIVE PATTERNS OF BEHAVIOR

By

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Autism Spectrum Disorder (ASD) is associated with a wide range of characteristics including challenges with social skills, repetitive behaviors, language and nonverbal communication. The purpose of this study was to investigate whether engagement in multi-sensory environments (MSE) decreases repetitive behaviors in adults with ASD. The study included three adults diagnosed with an intellectual disability and ASD who demonstrate repetitive patterns of behavior. A single-subject ABA withdrawal design was used to examine the effect of the MSE intervention on repetitive behaviors. There were no conclusive findings related to the effectiveness of this approach on behaviors; each participant responded in a different way to the intervention. This study addresses some of the implications and uses of MSEs as an intervention for adults with ASD who experience repetitive patterns of behavior in recreational therapy practice.



EFFECTS OF MULTI-SENSORY ENVIRONMENT ON ADULTS WITH AUTISM WHO  
EXPERIENCE REPETITIVE PATTERNS OF BEHAVIOR

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## **SECTION I: MANUSCRIPT**

### **Introduction**

There are different types of Autism Spectrum Disorder (ASD) that result as a combination of genetic and environmental factors. ASD has a wide range of associated characteristics including challenges with social skills, repetitive behaviors, language and nonverbal communication. However, individuals affected by this disorder also have unique strengths and differences (Lai, Lombardo, & Baron-Cohen, 2014). Many signs of ASD do not appear until a child is two to three years old, but this condition can be diagnosed as early as 18 months of age (Lai et al., 2014). In the United States, one in every 59<sup>th</sup> child is diagnosed with ASD; one in 42 boys and one in 189 girls under the age of 18 are affected by this disorder (Baio, Wiggins, Christensen, Maenner, Daniels, Warren, et al., 2018). It is estimated that 80% of those diagnosed with ASD are under the age of 22 (Azeem, Imran, & Khawja, 2016). The exact prevalence of ASD today among adults is unknown, although the numbers are rising steadily as individuals age with this condition. In the future, this will create what many have called the “autism Tsunami” as the number of adolescents and adults with ASD is expected to dramatically increase over the next few years (Azeem et al., 2016). Despite this expected increase, there is limited research on ASD in adulthood, and there is a need for research to better understand effective treatment interventions and approaches as this population ages.

Although ASD affects each individual differently, repetitive behaviors are a characteristic exhibited by almost all persons diagnosed with this disorder. According to the DSM-V, repetitive behaviors include at least two of the following characteristics:

stereotyped or repetitive motor movements; use of objects or speech; insistence on sameness; inflexible adherence to routines, or ritualized patterns or nonverbal behavior; highly restricted, fixated interests that are abnormal in intensity or focus;

and hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of environment (DSM-5 Diagnostic Criteria, 2013, p. 54).

Treatments and interventions are available to address repetitive behaviors among those who have ASD and include pharmacological and non-pharmacological approaches. Many families choose an intense, non-pharmacological intervention plan rather than rely on medications on behalf of their family member (Brondino et al., 2015). Parents and guardians are often worried about the adverse side effects of many pharmacological treatments and opt for alternative methods to treat repetitive behaviors (Brondino et al., 2015).

### **Repetitive Behaviors and Autism**

Most of the research to date on repetitive behaviors in ASD has focused on children with the disorder. These studies suggest that repetitive behaviors negatively affect individuals' social functioning and socializations (Nadig, Lee, Singh, Bosshard, & Ozonoff, 2010), lead to increased stress levels (Bishop, Reichler, & Lord, 2006), negatively impact learning (Pierce & Courchesne, 2001), and promote more negative parenting styles (Greenberg, Seltzer, Krauss, Chou, & Orsmond, 2006). These effects are potentially detrimental to later developmental outcomes and the individuals' well-being in adulthood. Research indicates that parents and families commonly report repetitive behaviors as one of the most difficult aspects of the disorder (South, Ozonoff, & McMahon, 2005), and these behaviors are highly related to parent stress when families have a child with ASD (Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005). Thus, if adults with ASD live in a residential facility, it is possible that these behaviors may encourage more negative caregiving styles and promote more negative interactions among residential staff and caregivers as well. Unfortunately, research suggests that the best practices to handle repetitive behaviors in

ASD lags behind research efforts on communication and social skills of this disorder (Boyd, McDonough, & Bodfish, 2012).

### **Multi-sensory Environments (MSE)**

The use of multi-sensory environments (MSE) is a common alternative therapeutic approach when working with individuals who have ASD (Brondino et al., 2015). Sensory environments provide individuals with experiences that integrate sight, touch, sound, and movement (Brondino et al., 2015). Research on multi-sensory environments, including Snozelen therapy, have found that this approach has the potential to improve communication, interaction, and behaviors of individuals with ASD after the intervention (Teodoro, Marinheiro, Rodrigues, & Picado, 2018). Other studies have noted that multi-sensory environments have the potential to increase sustained focus for youth with special needs, including individuals with ASD (Thompson, 2011). However, very little research has examined the use of this approach using samples of adults with ASD. The findings from these research studies are detailed below.

Chan, Yuen Fun, Wai Tong, and Thompson (2005) evaluated the impact of a multi-sensory environment with 89 people with developmental delays on their emotional state, level of relaxation, challenging behaviors, stereotypic self-stimulating behaviors and adaptive behaviors. MSE sessions were completed with the experimental group. Significant improvements were evident immediately following the MSE, including increased participants' relaxation levels as measured by the behavior checklist, increased positive mood with a reduction in negative mood, and a decreased in neutral mood.

Hill, Trusler, Frederick, and Giulio (2012) investigated the effects of MSE equipment on individuals with ASD. They hypothesized that the MSE would act as a motivating reinforcer by reducing the levels of behaviors in those who participated. Only two participants were included

in this study (ages 14 and 18), and both were diagnosed with a severe intellectual disability and ASD. The participants were observed in the living room of their residence as well as the MSE. For both participants, stereotypical behaviors were significantly lower in the MSE condition. These findings suggest that significant short-term behavior changes among individuals who participate in multi-sensory environment are possible.

Fava and Strauss (2010) investigated whether a multi-sensory environment and a stimulus preferred environments had differential effects on the disruptive behaviors and prosocial behaviors of 27 adults ages 30 to 48 with profound intellectual disabilities or ASD. Three treatment settings were used in this study (i.e., the living room, the MSE room, and the stimulus preference room), and each client was exposed to only one of these environments. The common area in the group home served as the control environment for this study. They found that the group exposed to the MSE room had a significant decrease in aggressive and stereotyped behaviors, and this carried over to the control environment. Specifically, there was a significant decrease in stereotyped behaviors when engaging in this environment among the clients with profound intellectual disabilities who had limited motor and linguistic abilities. There was a significant increase in the frequency of behaviors for individuals without motor and linguistic abilities, which may be due to greater limitations in terms of mobility and communication with the direct caregiver. Based on their findings, the researchers suggested that the multi-sensory approach should be intense and frequent (e.g., three times a week for seven weeks) to lead to significant changes in behavior.

Kaplan, Clopton, Kaplan, Messbauer, and McPherson (2006) also examined whether observed changes in engagement in a MSE environment carried over to a post-session activity, and whether the frequency of participants' behaviors was reduced during the hours/days

following their multi-sensory sessions. Three adults with a diagnosis of ASD, moderate/severe intellectual disability, and severe challenging behaviors were included in this study. Two of the three participants had a significant change in their engagement level immediately following the MSE sessions as evidenced in the post-session activity/environment. For the third participant, there was no systematic pattern of response across the conditions during the study. These research findings provide further support that MSEs have the potential to positively influence the behavior and engagement of some adults with ASD.

While research has found that MSEs have potential in this area, individuals' responses vary significantly. McKee, Harris, Rice, and Silk (2006) investigated the effects of exposure to a MSE room on the aggressive and destructive behavior of three adult clients with severe developmental disabilities. They found that all three participants had different responses to the room, and none of these individuals demonstrated a decrease in disruptive behaviors while in the MSE compared to baseline. The participants in this study seemed to enjoy the MSE room; however, daily exposure did not produce lasting changes in their behaviors.

Chan et al. (2010) conducted a systematic review of studies that investigated the effects of multi-sensory therapy on the behavior of adult clients with developmental disabilities. While not all of the studies in this review included adults with ASD, the review focused on studies with samples of adults who received care in institutional settings. The authors grouped findings into four key areas: frequency of challenging behaviors, stereotypic self-stimulating behaviors, positive behaviors; and the changes of physiological measures (Chan et al., 2010). This review demonstrates the beneficial effects of multi-sensory therapy on the positive emotions of participants, and suggests that there is more positive behavior exhibited after multi-sensory

therapy; however, there was not any strong evidence supporting that multi-sensory therapy can reduce challenging behaviors or stereotypic self-stimulating behaviors.

Thus, although current research related to the use of MSEs is minimal among adults with ASD, the findings of the studies that have been conducted are mixed. In addition, not all of these studies explore the effects of these environments on repetitive behaviors of adults with ASD. Therefore, the purpose of this study was to investigate whether engagement in a MSE decreased repetitive behaviors in adults with ASD. Two hypotheses guided this study: (1) the occurrence of repetitive behaviors would decrease when adults engaged in the MSE compared to the baseline condition, and (2) there would be a trend of decreasing repetitive behaviors across the sessions when adults engaged in the MSE.

## **Method**

### **Research Design**

A single-subject ABA withdrawal design was used to study the effect of the MSE intervention on repetitive behaviors. In this design, A<sub>1</sub> represented the baseline condition, B represented the MSE intervention, and A<sub>2</sub> represented the follow-up condition. The ABA research design was chosen because behaviors can be specifically analyzed while other extraneous variables are controlled at the greatest extent possible in an applied setting. The design also allows participants to begin the study at different times and has individuals serve as their own controls in the study (Dattilo, Gast, Loy, & Malley, 2000). Thus, using an ABA design allowed the researcher to examine the effects of the intervention on each individual participant and adjust to their specific needs.

This study was conducted over a three-month period during the spring of 2018. The intervention start dates were staggered based on when the individuals were enrolled in the study and cleared to participate. Institutional review board approval was received from the researcher's university as well as the research committee affiliated with the residential facility where the data were collected. Informed consent for this study was provided by the legal guardians of the adults who participated in this study.

### **Study Participants and Facility**

The study took place at a residential facility in the southeastern United States for adults with intellectual disabilities that has a maximum capacity of 350 residents. This facility provides services and supports for individuals with intellectual disabilities and developmental disabilities who have complex behavioral issues and/or medical conditions that exceed the level of care the community can provide. This facility is a certified ICF-IID, providing 24-hour residential

services. Criteria for admission into this facility include: at least 18 years old, have an intellectual disability and/or developmental disability, have complex behavior or medical problems, and community placement is not available.

To be included in this study, individuals must have met the following criteria: (a) reside at the facility, (b) be 18 years of age or older and diagnosed with an intellectual disability, (c) have a diagnosis of ASD, (d) experience consistent patterns of behaviors as determined by staff and physician notes, and (e) have informed consent to participate in the study by their guardian. Participants were excluded from the study if the physician or treatment team determined that the intervention would be potentially harmful or stressful to the individual. It should be noted that the primary researcher in this study was also a recreational therapist employed by the cooperating agency and knew of the staff and selected participants.

### **Sample**

A non-probability, purposive sampling technique was used in this study. The sampling frame included all individuals at the residential facility who had a diagnosis of ASD and who had documented experiences of repetitive patterns of behaviors in addition to the other inclusion criteria stated earlier. Two units on campus, identified as having the highest population of individuals with autism, were used to recruit participants for this study. The researcher met with staff on the unit to present details of the study and the criteria required for individuals to participate. The team members within these units then discussed which individuals would be the most appropriate for the study and chose three individuals to participate. The staff determined that the individuals selected had a high occurrence of repetitive behaviors and would potentially benefit from the intervention.

For the purpose of anonymity, this study uses pseudonyms to refer to each participant. The first participant was Tony, who is male and over 40 years old. He has lived at the facility for more than 20 years and has a diagnosis of bipolar disorder due to seizures, ASD, insomnia, and a profound intellectual disability. The second participant, Ron, is in his mid twenties, male, and has resided at this facility for over five years. He is diagnosed with ASD with behavior disorder, intermittent explosive disorder, and a severe intellectual disability. The third participant, Jeff, is a male in his early twenties who has resided at this facility for just over a year. He is diagnosed with ASD, moderate intellectual disability, and anxiety.

### **Repetitive Behaviors**

The outcome variable in this research was the *occurrence of repetitive behaviors* demonstrated by the participants. In this study, repetitive behaviors were conceptualized and defined based on the categories and domains identified and described in the *Repetitive Behavior Scale-Revised* (RBS-R, Bodfish, Symon, & Lewis, 1999) and included stereotyped behaviors, self-injurious behaviors, and compulsive behaviors (see Table 1). A recording sheet based on these repetitive behaviors was developed and utilized by the researcher (Appendix A).

**Measurement of repetitive behaviors.** As noted above, the occurrence of repetitive behaviors was assessed in this study. This allowed the researcher to examine the trends in behavior occurrence among each participant, but does not reflect the frequency of the behavior that was demonstrated. During the sessions, a time interval application was used to record the behaviors each individual exhibited during a 15-minute session. Each session was divided into 30-second intervals indicated by an electronic device that notified the researcher at the beginning and end of each session. Based on these parameters, 30 observations per session per individual were recorded. All behaviors had to be exhibited for a minimum of 3 seconds to be recorded in

this study (Bodfish et al., 1999). Occurrence or non-occurrence of repetitive behaviors was recorded as “observed” or “not observed” during each interval; a sum score of all occurrences of repetitive behavior was computed for each session the participant attended, and this data was used in the analysis. The type of behavior first demonstrated in each interval – if any – was also noted in the research log. The types of behaviors were later categorized as stereotyped, self-injurious, or compulsive and examined in a secondary analysis to determine whether the intervention influenced the *types* of repetitive behaviors exhibited by each participant. A second observer was present during a third of all sessions, and inter-rater reliability of the observed behaviors was calculated for the recorded behaviors.

Table 1

*Types of Repetitive Patterns of Behaviors*

	Specific Examples
Stereotyped Behaviors	Whole body behaviors (e.g., rocking, swaying) Head behaviors (e.g., rolls head, nods head, turns head) Hand/Finger behaviors (e.g., flaps hands, wiggles fingers, claps hands) Locomotion (e.g., turns in circles, whirls) Object usage (e.g., spins objects, twiddles objects) Sensory (e.g., covers eyes, covers ears, sniffs items)
Self-Injurious Behaviors	Hits self with body parts (e.g., hits or slaps head / body) Hits self against surface or object (e.g., hits or bangs head or other body part on object) Bites self (e.g., bites hand, wrist, arms, lips, or tongue) Pulls on self (e.g., pulls hair or skin) Rubs or scratches self (e.g., rubs or scratches marks on body) Inserts finger or object (e.g., eye-poking, ear-poking) Skin picking (e.g., picks at skin on face, hands, arms, or legs)
Compulsive Behaviors	Arranging/ordering (e.g., arranging objects) Completeness (e.g., must have doors opened or closed) Checking (e.g., checking doors, clocks, drawers) Counting (e.g., counting items, counts to certain number) Repeating (e.g., repeating routine events, in/out door) Touch/tap (e.g., need to touch, tap, or rub items)

*Note.* Based on the descriptions and categories used by Bodfish, Symon, & Lewis, 1999.

**Inter-observation reliability.** Interrater agreement was used to examine the reliability of the two observers' measures of repetitive behaviors in this study (Dattilo et al., 2000). Dattilo et al. (2000) indicated that observations of the researcher and a second observer should meet at least an 80% agreement rate to provide confidence in the interrater reliability. One month prior to the study, three training sessions were set up to examine the consistency in recognizing and recording behaviors among the researcher and second observer. During this period, a total of three individuals were observed during 10-minute increments in their daily environment, and a 90% agreement rate of observed repetitive behaviors was achieved between the researcher and the secondary observer over the three sessions. For the study, the same secondary observer was present for approximately a third (32%) of the sessions to further confirm the reliability of the recorded behaviors. The occurrence agreement rate between the researcher and secondary observer during the study sessions was 82.3%. This was determined by comparing the number of intervals with occurrence and non-occurrence *agreements* between the two observers (237) and dividing it by the total number of intervals (300) observed by both recorders.

### **Intervention Facilitation**

The independent variable in this study was the intervention condition MSE environment. Both baselines (A<sub>1</sub>, A<sub>2</sub>) and the intervention condition (B) occurred in the MSE room for each participant. The MSE room consisted of black lights, fibroptics, bubble column, music, water bed, sensory board, bean bag chair, a swing, and a bouncing chair. The size of the MSE room was 16 x 12 feet. Once beginning the study, participants were scheduled to attend two sessions per week with the intent of keeping the session times consistent across the study period. These times were chosen based on the individuals's personal schedule and when the individual would be most engaged. If an individual was unable to attend a session during their allotted time, the

researcher attempted to schedule another time during that week for the individual to complete a makeup session. If this could not be arranged during that week, no data were collected for that session, and it was marked as a missed session; the reason for the missed session was then recorded in the researcher's notes.

**Puzzle condition.** In the baseline condition ( $A_1$ ,  $A_2$ ), puzzles were used to provide a non-sensory type of baseline activity. Including an activity within the baseline conditions would help control for the mere presence of an activity in the MSE room as opposed to the multi-sensory, inter-active nature within the condition (B). The participant entered the room with an assigned staff member, and the researcher instructed them to sit down at the table and chairs. Four puzzle activities were provided to the individuals during these sessions. The researcher explained the process to the staff member, and the participant engaged in 15 minutes of structured puzzle activities. The staff member sat with the participant and helped the individual when needed. The researcher and second observer sat away from the participant and staff member, and they observed the session. The researcher let the participant and staff member know when they were halfway through the 15-minute session. If the staff member was not assisting the participant, the researcher provided minimal instruction to help the staff member engage the participant in the activities provided.

**MSE condition.** In the intervention condition (B), the participant and staff member came to the sensory room specifically for multi-sensory stimulation. When the participant and staff member arrived, the researcher greeted them and explained that in this session they would engage in the MSE. The researcher then showed them into the room, which was dark with only a dim light on. The researcher slowly started to turn on various items in the multi-sensory room. This first started with the black lights, then the fiberoptics, bubble column, and background noise.

The researcher was attentive to the emotions/reactions of the participant while turning on various items. A water bed (which vibrated to any base noise), a sensory board, bean bag chairs, a swing, and bouncing chair were also available in the MSE. The participant was allowed to interact with any items of their choosing. The staff member stood by to provide any assistance the participant needed. The researcher and second observer actively observed the participant. The researcher only intervened if an item needed to be turned on/off or moved.

**Transitioning between conditions.** Once the individual's behavior demonstrated a stable trend for at least three consecutive sessions in A<sub>1</sub>, the participant moved to the intervention phase, or B. In the intervention (B), the researcher introduced the multi-sensory items and observed the individual's responses for a 15-minute period. Once a trend of stability was established for at least three consecutive sessions in the B intervention condition, the participant transitioned back to the baseline measure (A<sub>2</sub>) to determine whether a change in repetitive behaviors occurred when the intervention was withdrawn and the puzzle condition was reintroduced. Because there were constraints on the amount of time available to conduct the study, the decision was made to move a participant to the next condition if his behavior did not demonstrate stability during a specific conditions (A<sub>1</sub>, B, or A<sub>2</sub>). While not traditionally the method used in ABA designs, this data collection constraint was implemented due to agency requirements.

**Control variables.** A few control variables were also collected in this study. Individuals participating in this study were monitored daily by nursing staff. Any changes in the adults' health status or environmental factors at the facility were recorded during the study period by the researcher in her log. The researcher also took observational notes regarding the participants'

responses to the session and other related information during each session. These notes were used to help further explain or irregularities of behaviors in the study.

### **Data Analysis**

There are several ways to evaluate the effectiveness of an intervention in research utilizing single-subject designs. In general, data are graphed and an effect is demonstrated when there is a change in participant's performance when they change from one condition to another, and this effect is able to be replicated within and between participants. Four criteria were used to evaluate the participants' behaviors including changes in: (a) level, (b) trend, (c) variability, and/or (d) a combination of these changes (Holcombe, Wolery, & Gast, 1994). A *change in level* is exhibited when the participant's data demonstrates an *immediate* change that is either higher or lower on the variable being measured in one condition when compared to the other condition. An immediate change in level in a therapeutic direction provides support of the strength of an intervention in changing a behavior (Holcombe et al., 1994). *Changes in trend* are evident in the data when the direction of the data – whether the occurrence of the targeted behavior increased or decreased – vary from one condition to the other (Holcombe et al., 1994). When data for the dependent variable demonstrates inconsistency during measurements within a condition, this is described as a *change in variability*. Data that are non-variable, or better referred to as “stable,” provide further evidence that the effect of the intervention is consistent (Holcombe et al., 1994). For the purpose of this study, the data analysis investigated whether there were changes in the participants' level, trend, and variability of repetitive behaviors across the study conditions/phases.

To help interpret the results, the data collected on each participant's repetitive behavior patterns during each of the phases of this study (A<sub>1</sub>, B, A<sub>2</sub>) were plotted and graphed during the

study period. Based on the collected data, the researcher made decisions about when to transition participants to the next condition (e.g.,  $A_1$  to B; B to  $A_2$ ). The occurrence of intervals that included repetitive behavior were plotted and graphed using Excel software for each participant across the sessions and study conditions. Results were then examined.

## Results

All three participants in this study completed the baseline condition (A<sub>1</sub>); however, only two of the participants completed the intervention (B) and second baseline (A<sub>2</sub>) conditions due to agency and participation complications. The participant who did not complete the study personally advocated to not attend sessions, as demonstrated through nonverbal communication and physical aggression when the researcher came to take him to the sessions. Due to the small sample size in this study, the comprehensive findings for each individual participant were described separately, with the means and occurrence of repetitive behavior types for the baseline, intervention period, and second baseline periods.

### **Participant #1: Tony**

Overall, the MSE intervention had a relatively weak and inconsistent effect on the target behavior. In fact, this intervention environment, at times, appeared to actually increase the repetitive behaviors that he demonstrated. He also had an increase in behaviors during his first session in the week, and his occurrence of behaviors would always decrease the second session. During the A<sub>1</sub> baseline phase, the target behavior occurrence demonstrated a range of 11-16 intervals in a slight decreasing trend. Upon introducing the B condition (i.e., MSE intervention), there was a slight decrease (1 interval) indicating the target behavior was headed in a therapeutic direction. However, sessions 8, 10, and 11 indicated a non-therapeutic spike, or increasing trend, in target behaviors at levels at or higher than the baseline A<sub>1</sub> condition levels (range = 16-19 intervals). Upon a decreasing trend in sessions 8-11, the individual was moved to A<sub>2</sub> condition with the puzzles where the individual demonstrated an immediate change in level (reduction of 5 intervals) and a decreasing trend in the occurrence of the target behavior. The variability of the target behavior was also high indicating an inconsistent effect. In summary, the MSE

intervention had only a small effect, if any effect, in the initial decrease in the target behavior. See Figures 1 and 2 for a visual illustration of the repetitive behaviors demonstrated by Tony during the study. The blank spaces in the graph represent missed sessions.

In the session notes, the researcher noticed that the items and equipment in the MSE made Tony excited and aroused. This participant attended almost all of his sessions, unless he was restricted for medical reasons (e.g., conjunctivitis) and unable to leave his home. When he would get to the MSE, Tony would jump out of his transport wheelchair and lay in the water bed as soon as he arrived. He seemed to enjoy the lights in the MSE, vocalizing louder and more often when he was in this study condition. There was also a light projector in the room that he followed with his eyes. The engagement in the MSE seemed to be positive for this client, and he clearly enjoyed this intervention; however, his repetitive behaviors did not consistently decrease when in the sensory environment.

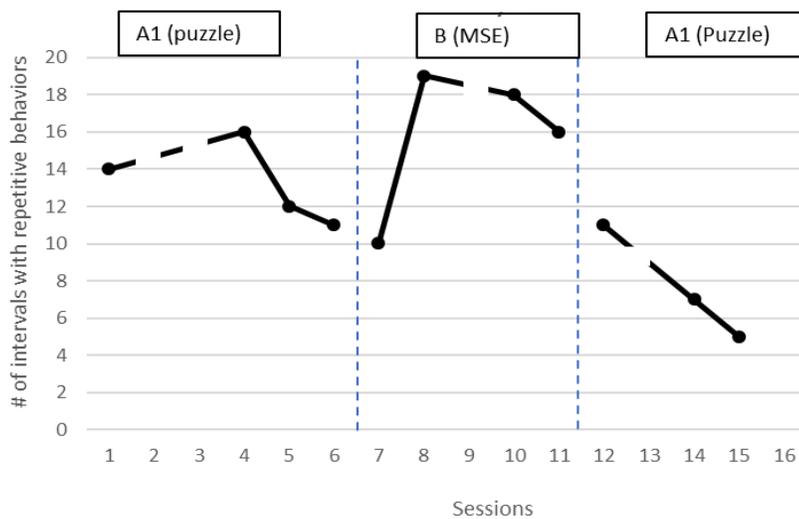
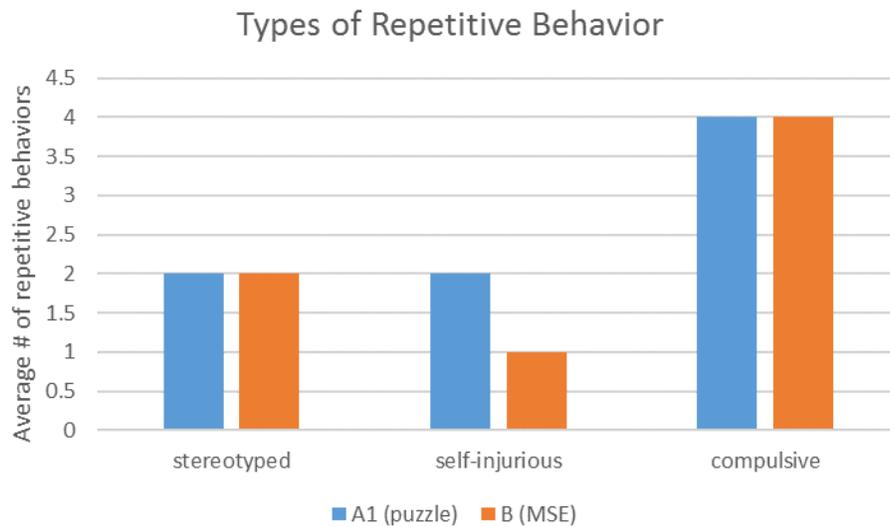


Figure 1. The occurrence of repetitive behaviors by Tony across sessions.



*Figure 2.* Mean occurrence of repetitive behavior types demonstrated by Tony.

### **Participant #2: Ron**

Overall, the MSE intervention had some evidence, although a weak effect, on the occurrence of his repetitive behaviors. In the A<sub>1</sub> baseline phase, his behaviors increased over the sessions from 13-19 intervals; however, he should have transitioned to the intervention condition (B) a session earlier. In session six his behaviors decreased to an occurrence of 5, which differed and was significantly lower. Once in the MSE condition, Ron's behavior initially increased 5 intervals to a total of 11 occurrences in session 6; however, he demonstrated fewer behaviors in the MSE environment overall. In condition B, his behaviors continued to increase to 16 intervals during session 10, but then showed a decreasing trend and gradually dropped to 8 intervals during session 13. When he transitioned back to the puzzle condition (A<sub>2</sub>) in session 14, occurrences increased back to an interval of 13, similar to the levels seen in the baseline A<sub>1</sub>. There continued to be an increasing trend across the two sessions in A<sub>2</sub>. Figures 3 and 4 portray a visual illustration of the repetitive behaviors demonstrated by Ron during the study.

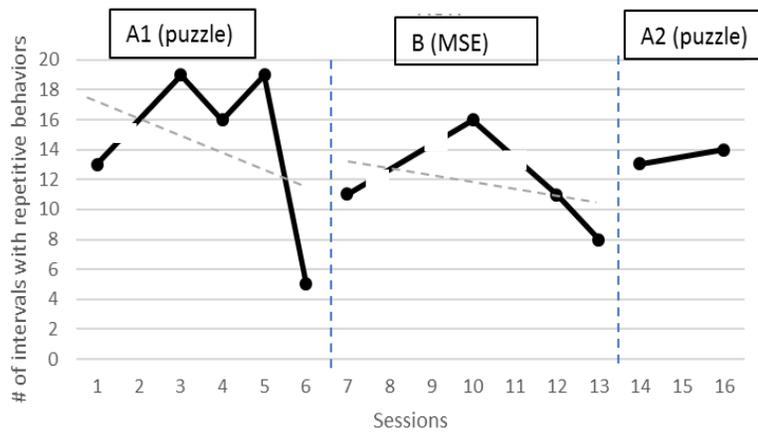


Figure 3. The occurrence of repetitive behaviors by Ron across sessions.

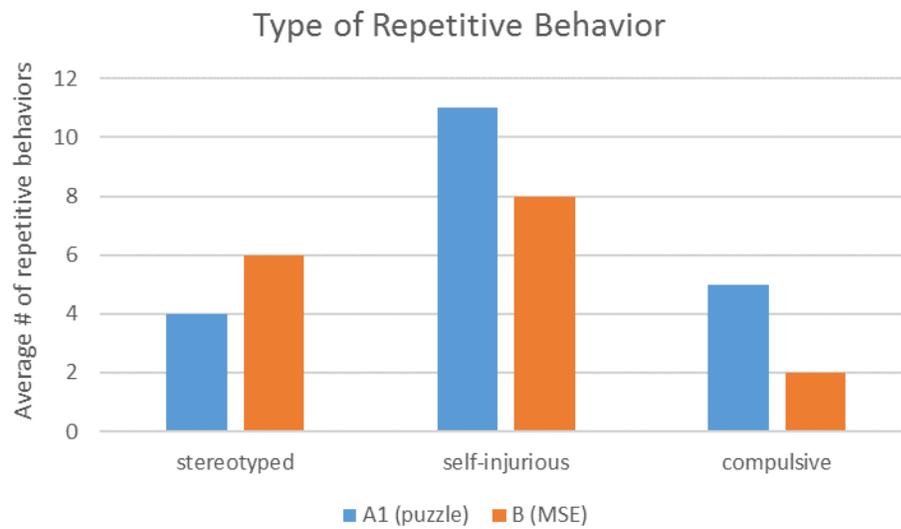


Figure 4. Mean occurrence of repetitive behavior types demonstrated by Ron.

Throughout the research study, Ron had various moods during the sessions. The type of day he was having, and the direct care staff that brought him to the MSE, appear to have affected his participation and repetitive behaviors. He also advocated for himself a few times that he did not want to participate in the sessions and chose to leave. His favorite equipment in the MSE was

the bubble columns, which he always went straight to during the sessions and would engaged with consistently. The direct care staff member who accompanied him to the intervention appeared to have a strong influence on his response; this participant seemed to have an enjoyable experience in the MSE when he was accompanied by direct care staff member with whom he had a closer relationship.

### **Participant #3: Jeff**

Overall, Jeff did not participate in many sessions throughout this study. It was determined that the MSE did not decrease the occurrence of his repetitive behaviors, and there were no consistent trends in his behavior. During A1, Jeff participated in two sessions, showing an increasing trend from 9 to 13 intervals. The intervention environment (B) appeared to actually increase his repetitive behaviors by 2 units to 15 intervals initially, although these did decrease to a low of six intervals during his last session (session 10). In session 7, his behaviors were completely different, and he seemed to be enjoying the experience. He was twirling in circles, flapping his hands, smiling, and laughing. However, during the next session, he sat there with a flat affect and turned his back to the researcher and direct care staff. See Figures 5 and 6 for a visual illustration of the repetitive behaviors demonstrated by Jeff during the study.

His mood changed often during all of the sessions. The type of day he was having and the direct care staff that brought him to the MSE also appeared to significantly affect his participation and repetitive behaviors. Many times this participant advocated for himself to not attend the study sessions. He was physically aggressive toward staff on multiple occasions during the study period. Jeff did not seem to have a specific piece of equipment he enjoyed while in the MSE, but the lowered lights and humming of the lights and bubble column seemed to calm him down. With a more consistent staff and schedule, he might have had a more stable response to the MSE.

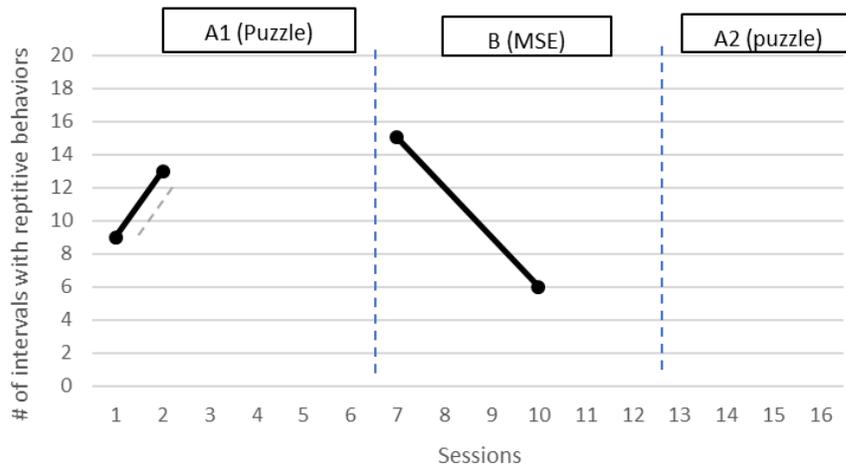


Figure 5. The occurrence of repetitive behaviors by Jeff across sessions.

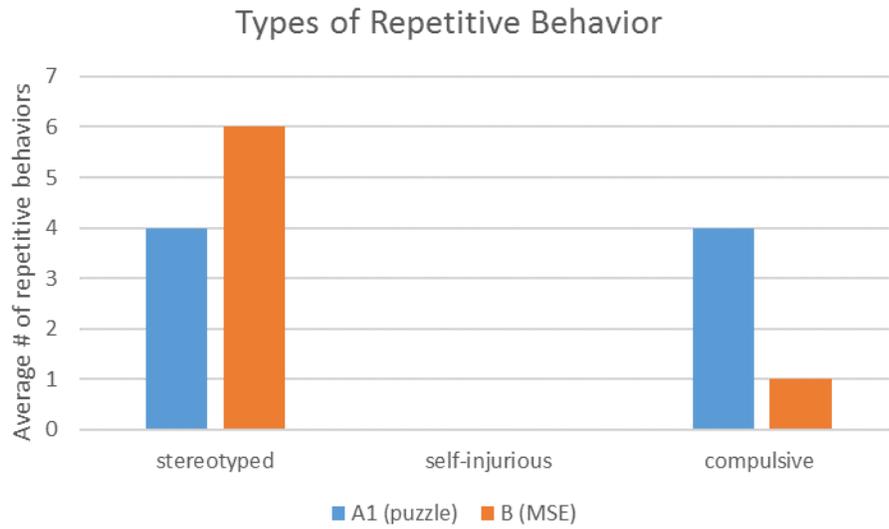


Figure 6. Mean occurrence of repetitive behavior types demonstrated by Jeff.

## Discussion

The current study examined whether engagement in MSE interventions decreases repetitive behaviors in adults with ASD. Neither of the hypotheses for this study were supported. Across all three participants, there was no consistent evidence that the MSE intervention reduced the occurrence of repetitive behaviors compared to the baseline/control conditions. In addition, there was no consistent evidence of a decreased change in level of behaviors when the individuals transitioned into the MSE room. For the most part, the data supported that there were inconsistencies in the participants' responses within the different study conditions. From the findings, it appeared that the MSE intervention may have had a weak effect in reducing the repetitive behaviors for Ron; however, the repetitive behaviors of Tony increased in the MSE. Due to his refusal to attend the intervention, there were not enough data collected on Jeff due to determine how the MSE affected his repetitive behaviors.

Even though each participant in this study was male and diagnosed with ASD and an intellectual disability, they each demonstrated a unique qualitative response to the MSE intervention. This is similar to the findings reported by McKee and colleagues (2006). These researchers also noted that participants seemed to enjoy the MSE room, but daily exposure did not produce lasting changes in the participants' behaviors. The findings were similar to Fava and Strauss (2010) who stated there was a significant increase in the frequency of behaviors for the participants, particularly in the case of Tony. Fava and Strauss suggested that MSE interventions need to be intense and frequent (i.e. three times a week for seven weeks) to lead to significant change (Fava & Strauss, 2010). This study provided sessions twice a week for a period of eight weeks; thus, future research should increase the participants' weekly exposure to the MSE environment to at least three times a week to see if this would have a different effect on their

response. Based on Fava and Strauss' (2010) suggestions, it is also possible that a longer duration of exposure to the MSE environment was needed to observe a significant change in repetitive behaviors, given that the total involvement of the participants in this study was only eight weeks across all treatment conditions.

As stated in the results, the participants in this study seemed to enjoy the MSE. This suggests that MSEs do have the potential to positively influence behavior and engagement for some adults with ASD, even if it does not result in a significant change in their repetitive behaviors. This correlates with the research by Chan and colleagues (2010) where participants displayed more positive behavior in the MSE, but it did not necessarily decrease their more challenging behaviors.

Future research should consider assessing repetitive behaviors in a different way. Instead of examining the occurrence of behaviors, it might be more beneficial to categorize by types of repetitive behavior (e.g., stereotyped, self-injurious, compulsive) as some of the more "negative" types of behaviors might decrease in the MSE condition, while "positive" or "neutral" behaviors might increase as an excitatory response. An attempt was made to categorize the behaviors of the participants this study as stereotyped, self-injurious, or compulsive, but there were not enough data to statistically explore whether there were significant differences in the demonstration of these behaviors by the participants across study conditions.

There are several limitations of this study that need to be taken into consideration. Due to facility policy, the participants had one direct care staff with them for each session they attended in the study. This staff member changed multiple times throughout the eight weeks, which may have influenced the participants' response to the different environments. The participants in this facility have different relationships with each staff member, and it is believed that this had an

effect on their behaviors during this study. If the participant was closer to a direct care staff member, they typically exhibited fewer behaviors than if they were with a staff member with whom they did not have as close of a relationship. Procedural reliability would have helped with this limitation in the study and led to greater consistency in how staff interacted with participants in the study. The way that staff interacts with the client – and their relationship with them – has the potential to influence the occurrence and types of repetitive behaviors the client demonstrates. More consistent facilitation is necessary so that the researcher does not need to come out of the role during the study and confound the findings. Training on how to engage with clients with ASD and intellectual disabilities is critical for persons working with these individuals; an activity engagement training has since been planned and will be administered in the future at the facility where the data for this study were collected.

Another limitation in this study was the medical status and health of the participants. Multiple sessions had to be canceled for the participants due to mild colds and conjunctivitis. The inability of the participants to continue the interventions in a consistent manner most likely influenced the potential effects. The participants were cleared relatively quickly for participation, but this still may have affected their behaviors during sessions.

There was also a small sample size of only three individuals in this study, and the study participants were chosen randomly by the administrative staff at the facility. The researcher met with two teams on campus to explain the research study, and the team members chose which individuals to recruit as participants in the study. Even though the individuals met all of the study criteria, having a larger sample size or recruiting individuals who had more prominent repetitive behaviors would have been more ideal in this study. For the individuals who were chosen to participate, there was a long process of approval as the guardians were contacted and all of the

appropriate paperwork signed. Communication between the facility and guardian took longer than anticipated, and this restricted the study from starting for over a month. In addition, the staff in the two units used for study recruitment had multiple responsibilities, and identifying potential study participants and making the initial contact with the guardians might not have been their priority. This may have contributed to a lower number of participants being enrolled in the study than was originally planned. A different sampling strategy might have resulted in more study participants and potentially a different sample of adults might have responded more positively to the MSE intervention environment.

Another limitation of this study was the established duration of the study by the facility. During the presentation to the facility's research committee, it was determined that the research study would occur over an eight-week period. The facility required the research to stay within this study period, which violated some of the ABA design principles and restricted the researcher from completing the study with Ron (i.e., completed only 2 sessions in the A<sub>2</sub> condition). Extending the study period and having the participants attend at least three sessions during the week may have resulted in clearer trends or different findings.

Finally, all individuals at the residential facility have the opportunity to attend multi-sensory interventions on a weekly basis, but attendance is limited due to lifestyle schedules and limited direct care staff in the homes. Thus, it is possible that the residents in this study have utilized the multi-sensory room on previous occasions, and this may have confounded their response to the MSE during this study period. However, it is unlikely that the adults have had continuous, structured interactions in this environment similar to their engagement in the MSE for this study.

Anecdotally, the researcher and second observer noted that the participants seemed to enjoy the multi-sensory environment, even though their behaviors did not necessarily decrease. While in the MSE, the participants were typically more engaged with items, smiled, laughed, and explored their surroundings. This suggests that it might be important for future research to further examine the types of repetitive behaviors that individuals demonstrate, rather than relying solely on the occurrence of these behaviors exhibited by participants. For example, behaviors could be examined by type (e.e., stereotyped, self-injurious, and compulsive) or even classified as “positive” or “negative”. A “positive” behavior is more stereotyped and compulsive behaviors such as hand flapping, spinning in circles, counting, tapping items, vocalizing. A “negative” behavior is in the category of self-injurious behaviors which include biting, hitting, picking, hurting oneself.

Based on this study, it is recommended that practitioners in recreational therapy find ways to engage individuals with autism and intellectual disabilities in multi-sensory environments and other sensory activities. Even though their behaviors may not decrease, based on the findings of this study and others, the participants’ behaviors have the potential to change to be more positive and their negative behaviors may decrease. As long as a “positive” repetitive behavior is not injuring the individual or others, an increase in their repetitive behavior could be an indication of their excitement and engagement in the MSE.

If a facility does not have an MSE available, small sensory activities can easily be made to engage individuals in sensory activities. Many people with ASD have deficits in sensory stimulation and should be provided activities to help them cope with the world around them. Educating the community and families/caregivers of adults with ASD about the effects of these environments would also be beneficial, as this population only continues to grow. In addition,

more research on the effects of nonpharmacological interventions with adults with ASD is needed to further understand the most effective treatment approaches and modalities to use with these individuals in recreational therapy practice.

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## **SECTION II: EXTENDED LITERATURE REVIEW**

Autism Spectrum Disorder (ASD) has a wide range of associated characteristics including challenges with social skills, repetitive behaviors, speech and nonverbal communication, but individuals affected by this disorder also have unique strengths and differences (Lai, Lombardo & Baron-Cohen, 2014). There are a variety of different types of autism that result as a combination of genetic and environmental factors. Many signs of ASD do not appear until a child is two to three years old, but it can be diagnosed as early as 18 months of age (Lai et al., 2014). In the United States today, one in every 68<sup>th</sup> child is diagnosed with ASD, with one in 42 boys and one in 189 girls under the age of 18 affected by this disorder (Data & Statistics, 2016). It is estimated that 80% of those diagnosed with autism are under the age of 22 (Azeem, Imran & Khawja 2016). The exact prevalence of ASD today among adults is unknown, but the numbers are rising steadily as individuals age with this condition. In the future, this will create as many say the “autism Tsunami”, as the number of adolescents and adults with ASD is expected to dramatically increase over the next few years (Azeem et al., 2016).

There are three classifications of diagnosis with ASD. These three groupings are based on the levels of support required by that individual as described in the DSM-V. The first level is “requiring support,” and this is defined as difficulty initiating social interactions, decreased interest in social interactions, and problems organizing and planning independent activities. Level two, “requiring substantial support,” implies that someone with autism has deficits in verbal and nonverbal social communication skills, and limited social communication. They have difficulty coping with change and have repetitive patterns of behavior. The third level, “requiring very substantial support,” indicates a severe deficit in verbal and nonverbal social communication skills, minimal response to others, and extreme difficulty with coping with

change. There is also significant distress when changing focus and/or activities (DSM-5 Diagnostic Criteria, 2013).

### **Repetitive Behaviors in Autism**

Although ASD affects each individual differently, repetitive behaviors are a characteristic that are exhibited by almost all persons who are diagnosed with autism. Repetitive behaviors include at least two of the following characteristics:

stereotyped or repetitive motor movements, use of objects or speech, insistence on sameness; inflexible adherence to routines, or ritualized patterns or nonverbal behavior; highly restricted, fixated interests that are abnormal in intensity or focus; and hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of environment (DSM-5 Diagnostic Criteria, 2013, p. 54).

Research is currently being conducted to better understand repetitive behaviors and how new interventions and treatments can address repetitive behaviors in ASD.

Most of the research to date on repetitive behaviors in ASD has focused on children with the disorder. These studies suggest that repetitive behaviors affect individuals' social functioning and socializations (Nadig, Lee, Singh, Bosshart, Ozonoff, 2010), lead to increased stress levels (Bishop, Reichler, & Lord, 2006), negatively impact learning (Pierce & Courchesne, 2001), and promote more negative parenting styles (Greenberg, Seltzer, Krauss, Chou, & Orsmond, 2006). These effects may potentially be detrimental to later developmental outcomes and wellbeing in adulthood. Research indicates that parents and families commonly report repetitive behavior symptoms as one of the most difficult aspects of the disorder to cope with (South, Ozonoff, & McMahon, 2005), and these behaviors are highly related to parental stress when families have a child with ASD (Gabriels et al., 2005). Thus, it is possible that these behaviors may encourage

more negative caregiving styles and promote more negative interactions among residential staff and caregivers as well, if adults with ASD live in a residential facility. Research has suggested that the best practices to handle repetitive behaviors in ASD lags behind research efforts on some of the other core features of this disorder (Boyd, McDonough, & Bodfish, 2012).

There are several treatments and interventions available to address repetitive behaviors among those with ASD. These include pharmacological and non-pharmacological approaches and treatments. Many families choose an intense intervention plan, rather than medications, for their family member (Brondino et al., 2015). Parents and guardians are often worried about the adverse side effects of many pharmacological treatments and opt for alternative approaches to treat repetitive behaviors, including the use of intense intervention plans (Brondino et al., 2015). Applied behavior analysis incorporates several techniques and is often the therapeutic approach implemented when working with clients who are autistic.

### **Applied Behavior Analysis**

Applied behavior analysis (ABA; Baer et al., 1968) attempts to understand why individuals engage in challenging behaviors, such as repetitive behaviors. It applies the principles of learning and motivation from behavior analysis, as well as the procedures emerging from those principles, to find solutions to problems of social significance (Center for Autism & Related Disorders, n.d.). The purpose of these approaches and principles is to elicit meaningful and positive behavior change. Research has suggested that ABA techniques are effective when working with individuals with autism and can produce improvements in communication, self-care, and social relationships (Fisher, Groff, & Roane, 2011).

ABA may incorporate many different types of therapy, including sensory therapy and sensory stimulation. Sensory therapy involves providing the individuals with ASD experiences

that integrate sight, touch, sound and movement (Brondino et al., 2015). ABA can be incorporated in multi-sensory environments to provide stimulation and encourage exploration, which has the potential to reduce repetitive behaviors in adults with ASD and other developmental disabilities. Research utilizing this approach suggests that forms of sensory stimulation provide reinforcement for individuals who are engaging in repetitive behaviors (Rapp, 2006; Rapp, 2007). A few studies on multi-sensory interventions have used ABA as the conceptual framework for their research (Hogg et al., 2001). Hogg and colleagues report that there are a wide range of positive outcomes using ABA techniques with sensory interventions, but not all results are positive because of the diversity of the participants.

### **Multi-Sensory Environments**

A multi-sensory environment (MSE) is intended to help an individual relax and promote intellectual activity (Messbauer, 2010). The multi-sensory environment can be completely controlled to provide safe, yet stimulating, interactions for the client. The stimulation in the environment can be intensified or reduced to promote passive or active participation, and it can be altered to fit the specific needs of an individual. Multi-sensory environments often include lighting effects, sensory activities, tactile experiences, cause and effect, soft items, sound effects, rhythmical music, tasting experiences, and motion stimulation. Research has shown that MSEs benefit many different populations, including ASD, Post-Traumatic Stress Disorder, anxiety, dementia, developmental disabilities, ADD and ADHD (Messbauer, 2010). Several benefits related to the implementation of multi-sensory environments with these populations have been identified such as increased concentration, mental and physical relaxation, improved social relations and communication, decreased behaviors, pain relief, and heightened awareness (Fava & Strauss, 2010; Baker et al., 2001; Chan et al., 2005; Hill et al., 2012). The use of multi-sensory

environments is thought to be particularly beneficial to populations such as ASD and dementia, that experience repetitive patterns of behavior (Hill, Trusler, Frederick & Giulio 2012).

Most of the research on MSEs with adults has included a variety of populations and diagnoses or focused specifically on individuals with dementia. Overall, many studies have determined that multi-sensory therapy sessions help individuals with intellectual disabilities display more positive behaviors. There is no strong evidence that suggests MSE will help reduce challenging behaviors or stereotypic self-stimulating behaviors (Chan et al., 2010).

Kwok and colleagues (2003) explored the use of MSE on adults with learning disabilities in a psychiatric setting. This study involved 96 individuals who attended four 1-hour sessions of MSE over a four-week period. Many individuals who participated in the study had a history of aggression toward others. The study concluded that self-injurious behaviors had a mild to moderate decrease after the intervention, supporting the short term effects of MSE.

Slevin and McClelland (1999) explored the effectiveness of multi-sensory therapy for relaxation. One male with intellectual disabilities was chosen for a twelve week study. The study determined that there was no reduction in incidents per week and no reduction in challenging behavior. The study concluded that the MSE can provide a therapeutic environment, promote relaxation, and can be implemented with people who have intellectual disabilities and display challenging behaviors.

Less research is available about the effects of a MSE on individuals, particularly adults or those approaching adulthood, with ASD. Hill, Trusler, Frederick, and Giulio (2012) investigated the effects of the MSE equipment and level of non-contingent social contact on behaviors maintained by automatic reinforcement in this environment among individuals with ASD. Only two participants were included in this study: a 14-year old female with ASD and a diagnosis of a

severe intellectual disability, and an 18-year-old male with ASD and a diagnosis of a severe intellectual disability. Both participants were observed in the living room of their residence as well as the MSE. For both participants, stereotypical behaviors were significantly lower in the MSE irrespective of the level of caregiver attention received, while levels of engagement were significantly greater under conditions of high caregiver attention in both environments. These findings suggest that there are significant short-term behavior changes among individuals who participate in multi-sensory environment.

Chan, Yuen Fun, Wai Tong, and Thompson (2005) evaluated the impact of multi-sensory environment therapy on participants' emotional state, level of relaxation, challenging behaviors, stereotypic self-stimulating behaviors and adaptive behaviors. There were 89 participants with developmental disabilities with an age range from 11 to 70 in this study, and they were randomly assigned to an experimental or a control group. MSE sessions were completed with the experimental group, and an activity session was completed with the control group for a duration of 12 weeks. There were significant improvements immediately following the MSE intervention in the participants' relaxation levels, increases in positive mood with a reduction in negative mood, and a reduction in neutral mood. However, there was no significant reduction in the individuals' pulse rate after participating in the MSE sessions.

Fava and Strauss (2010) investigated whether a multi-sensory environment and stimulus preferred environments had differential effects on the disruptive behavior and prosocial behaviors of 27 adults with profound intellectual disabilities or ASD. The group exposed to the multi-sensory environment had a significant decrease in aggressive and stereotyped behaviors, that carried over to the control environment (i.e., common area in the group homes). Specifically, there was a significant decrease in stereotyped behaviors among the clients with profound

intellectual disabilities who had limited motor and linguistic abilities when they engaged in this environment. The researchers concluded that the multi-sensory approach should be intense and frequent (e.g., three times a week for seven weeks) to lead to significant changes in behavior.

Researchers have also investigated the carry-over effect of the multi-sensory environment once clients return to their usual setting. Kaplan, Clopton, Kaplan, Messbauer, and McPherson (2006) examined whether observed changes in engagement carried over to a post-session activity, and if there was a reduction in the occurrence of behaviors participants exhibited during the hours/days following their multi-sensory sessions. This study included three adults with diagnoses of ASD, moderate/severe intellectual disability, and severe challenging behaviors. Experiment 1 investigated whether there was generalization of the observed changes to the post-session activity immediately following the Snoezelen session. Experiment 2 went further to determine if these results had a longer effect and affected their behavior the rest of the day and/or week. Two out of the three participants had a significant change in engagement level immediately following the Snoezelen-based sessions that was evident in the post-session activity.

There are also some studies that report no significant change among participants in multi-sensory environments. McKee, Harris, Rice, and Silk (2006) investigated the effects of exposure to a MSE room on the aggressive and destructive behavior of three adult clients with severe developmental disabilities. They found that all three participants had different responses to the room, but none of them showed a decrease in disruptive behaviors while in the multi-sensory room compared to baseline.

### **Current Study**

Given that some studies have reported no significant changes among individuals participating in MSEs, and the minimal research on the use of this approach with adult clients

with ASD, the purpose of this study was to investigate whether engagement in MSEs decreases repetitive behaviors in adults with ASD. The study hypotheses were: (1) The occurrence (i.e., levels) of repetitive behaviors will decrease when adults engage in the multi-sensory environment compared to the baseline condition, and (2) There will be a trend of decreasing repetitive behaviors across the sessions when adults engage in the multi-sensory environment.

## **SECTION III: EXTENDED METHOD, RESULTS, & DISCUSSION**

### **Extended Method**

#### **Research Design**

A single-subject ABA withdrawal design was used to study the effect of the MSE intervention on repetitive behaviors. In this study, A<sub>1</sub> represented the baseline condition, B represented the MSE intervention, and A<sub>2</sub> represented the follow-up condition. The ABA research design was chosen because behaviors can be specifically analyzed while other extraneous variables are controlled at the greatest extent possible in an applied setting. The design also allows participants to begin the study at different times and has individuals serve as their own controls in the study (Dattilo, Gast, Loy, & Malley, 2000). Thus, using an ABA withdrawal design allowed the researcher to examine the effects of the intervention on each individual participant and adjust to their specific needs.

Using the ABA design and reintroducing the baseline condition (i.e., A<sub>2</sub>), allows for a more powerful demonstration of experiment control and change of effect (Tawney & Gast, 1984). In the baseline observation (A<sub>1</sub>) for this study, the researcher first observed participants in the controlled environment (i.e., multi-sensory room) with no sensory stimulation equipment turned on while each participant interacted with a puzzle activity for 15 minutes. Because MSE activities require a level of interaction between the participant and an object, it was deemed necessary to also include some activity interaction (i.e., puzzle play) during the baseline conditions to control for the diversionary or interaction characteristics within the MSE activities (Tawney & Gast, 1984). Thus, the puzzle activity took place at a small table and chair set up within the multi-sensory room during the two baseline conditions.

**Puzzle condition.** In the baseline (A<sub>1</sub>) and follow-up conditions (A<sub>2</sub>), puzzles were provided to each participant. The MSE room was arranged with a table and chair and none of the MSE equipment was turned on. The participant entered the room with their staff member, and the researcher instructed them to sit at the table in the chairs that were already set up. Four puzzle activities were provided to the individuals. The researcher explained the process to the staff member of the participant who then engaged in 15 minutes of structured puzzle activities. The staff member sat with the participant and helped the individual as needed. The researcher and second observer were located across the room from the participant and staff and observed the session. The researcher informed the participant and staff member when they were halfway through the 15 minutes session. If the staff member was not assisting the participant, the researcher made a comment to help the staff member engage the participant in the activities provided.

**Multi-sensory environment condition.** In the intervention (B), the participant and staff member came to the sensory room specifically for multi-sensory stimulation. When the participant and staff member arrived during their designated time, the researcher greeted them and explained that they would be engaging in the multi-sensory environment for this session. The researcher then showed them into the room, which was dark with only a dim light on. The researcher slowly started to turn on various items in the multi-sensory room. First the black lights were turned on, then the fiberoptics, bubble column, and background noise. The researcher was always aware of the emotions or responses of the participant while turning on various items. There was also a water bed (which vibrated to any base noise), a sensory board, bean bag chairs, a swing, and bouncing chair in the room. The participant was given the freedom and autonomy to engage in any items of their choosing. The staff member stood by to provide assistance as

needed to the participant. The researcher and second observer sat off to the side to actively observe the participant's behavior and interactions. The researcher only intervened if an item needed to be turned on/off or moved during this session.

**Stability in behaviors and changing conditions.** In the ABA design, stability in behavior is defined as a consistency in scores over at least three data points in a row in a treatment or condition (Tawney & Gast, 1984). Once the target behavior (i.e., repetitive behaviors) demonstrated stability within the baseline condition ( $A_1$ ) the participant transitioned from the puzzle activity to the intervention/treatment condition (B). When the participant demonstrated stability in the MSE condition (B), the baseline condition ( $A_2$ ) was reintroduced to determine if behaviors reverted back to prior levels evident during the  $A_1$  condition. A return to  $A_1$  baseline levels during the  $A_2$  condition would provide support for the effect of the MSE intervention (Tawney & Gast, 1984). Throughout the study, the researcher documented the occurrence of repetitive behaviors demonstrated in each session and visually depicted these in a graph form. Stability in the participants' repetitive behaviors during each of the conditions was determined by reviewing the graphs of the individual's data after each session to evaluate whether there was consistency in the level (i.e., numbers of observation recorded) and/or trend (i.e., increased, decreased, stayed the same) of their behaviors (Tawney & Gast, 1984).

### **Limitations in the ABA Design**

There are a few limitations related to the ABA research design that need to be taken into consideration. First, the introduction and withdrawal of the independent variable coincides with the cycle variations of target behaviors (Tawney & Gast, 1984). This can be a threat to the internal validity, but can best be controlled by increasing or decreasing the number of observation periods in the second baseline ( $A_2$ ) and reintroducing the intervention ( $B_2$ ) (Tawney

& Gast, 1984) Second, there is a chance the A<sub>1</sub> dependent variable levels will not be fully regained in A<sub>2</sub> (Tawney & Gast, 1984). The dependent variable level of behavior should be approximated, but this may be difficult with the specific population of participants in this study. Many individuals exhibit different repetitive behaviors each day, and it could be difficult to approximate. Third, the ABA design is not appropriate for behaviors that are difficult or impossible to reverse (Tawney & Gast, 1984). Some examples of this include social behaviors, which could be repetitive, such as greeting responses, question asking, walking appropriately, and hand gestures.. And fourth, there are ethical and practical problems that are associated with discontinuing a study during a baseline condition (Tawney & Gast, 1984). Thus, it might be necessary to introduce the treatment condition to the participant before stability is reached if there is concern that this individual may be responding poorly to the study conditions and considering withdrawal from the study.

One major issue when using this design is that many clinicians are more concerned with assessing the individual's habitual skills than their actual abilities (Tawney & Gast, 1984). In addition, in order to build a strong case for using ABA, there needs to be several inter-subject direct replications that occur simultaneously (Tawney & Gast, 1984). This study aimed to recruit at least four participants to address this and allow for the possibility of attrition; however, only three individuals were able to be recruited and only two completed the study during the designated period.

### **Study Participants**

The study took place at a residential facility in the southeastern United States for adults with intellectual disabilities. This facility provides services and supports for individuals with intellectual disabilities and developmental disabilities, complex behavioral issues and/or medical

conditions that exceed the level of care the community can provide. To be included in this study, individuals must have met the following criteria: (a) reside at the facility, (b) be 18 years of age or older and diagnosed with an intellectual disability, (c) have a diagnosis of autism, (d) experience consistent patterns of behaviors as determined by staff and physician notes, and (e) have informed consent to participate in the study by their guardian. Participants were excluded from the study if the physician or treatment team determined that the intervention would be potentially harmful or stressful to the individual.

A non-probability, purposive sampling technique was used in this study. The sampling frame included all individuals at the residential facility that had a diagnosis of ASD and who had documented experiences of repetitive patterns of behaviors in addition to the other inclusion criteria stated above. Two units on campus were identified as having the highest population of individuals with ASD, and this was where the participants were recruited from for this study. The researcher met with staff on the units to present details of the study and the criteria for individuals to participate. The team members within these homes then discussed which individuals would be the most appropriate and chose three individuals to participate. The individuals selected had a high occurrence of repetitive behaviors and met all of the inclusion criteria for the study. It should be noted that the primary researcher in this study was also a recreational therapist employed by the cooperating agency and knew of the staff and selected participants.

### **Study Variables**

The independent variable in this study was the different study conditions – the puzzle condition (A<sub>1</sub> and A<sub>2</sub>) and the multi-sensory environment (B). The multi-sensory room was set up prior to the intervention with various sensory stimulation items in the room including a ball

bath, bean bag chair, various lights, fiber optic lights, tactile mats, and a sound machine. The participant chose what to engage in throughout the session. The dependent variable was measured as the occurrence of individuals' repetitive patterns of behaviors such as body rocking/swaying, head movements hand flapping, twirling objects, self-injurious behaviors (SIB), obsessive compulsive disorder (OCD), and picking (The National Autistic Society, 2016).

**Repetitive behaviors.** All individuals in this study experienced repetitive behaviors, although which types of repetitive behaviors varied by participant. For the purpose of this study, repetitive behaviors were conceptualized and defined as a composite of categories and domains identified as described in the Repetitive Behavior Scale-Revised (RBS-R) (Bodfish, Symon, & Lewis, 1999). This included Stereotyped Behaviors (Part I), Self-injurious Behaviors (Part II), and Compulsive Behaviors (Part III). The RBS-R is a 43-item observation questionnaire that is rated on a four-point Likert scale. The measure is scored as 0 (behavior does not occur), 1 (behavior occurs and is a mild problem), 2 (behavior occurs and is a moderate problem), and 3 (behaviors occurs and is a severe problem). For the purposes of measuring the target behavior in this study, *repetitive behavior* was operationalized as:

stereotyped, self-injurious, and compulsive behaviors that include whole body rocking or swaying for at least 3 seconds; nodding, rolling, or turning head continuously for 5 seconds; hits or slaps own head, face, or other body part at least two times; hits or bands head or other body part against a surface for at least two times; rubs or scratches on arms, leg, face; or arranging certain objects in a particular pattern; repeatedly checking doors, windows, drawers, or other objects; and counting items or objects to a certain number or certain way (adapted from Bodfish et al., 1999).

Table 1 provides a detailed operationalized list of behaviors considered as repetitive behavior outcomes.

Table 1

*Types of Repetitive Patterns of Behaviors*

	Specific Examples
Stereotyped Behaviors	Whole body behaviors (e.g., rocking, swaying) Head behaviors (e.g., rolls head, nods head, turns head) Hand/Finger behaviors (e.g., flaps hands, wiggles fingers, claps hands) Locomotion (e.g., turns in circles, whirls) Object usage (e.g., spins objects, twiddles objects) Sensory (e.g., covers eyes, covers ears, sniffs items)
Self-Injurious Behaviors	Hits self with body parts (e.g., hits or slaps head / body) Hits self against surface or object (e.g., hits or bangs head or other body part on object) Bites self (e.g., bites hand, wrist, arms, lips, or tongue) Pulls on self (e.g., pulls hair or skin) Rubs or scratches self (e.g., rubs or scratches marks on body) Inserts finger or object (e.g., eye-poking, ear-poking) Skin picking (e.g., picks at skin on face, hands, arms, or legs)
Compulsive Behaviors	Arranging/ordering (e.g., arranging objects) Completeness (e.g., must have doors opened or closed) Checking (e.g., checking doors, clocks, drawers) Counting (e.g., counting items, counts to certain number) Repeating (e.g., repeating routine events, in/out door) Touch/tap (e.g., need to touch, tap, or rub items)

***Measurement of repetitive behaviors.*** During the sessions, a time interval application was used to mark down the behaviors each individual exhibited. An electronic device notified the researcher every 30 seconds, and each observation period lasted for 30 seconds. Based on these parameters, 30 observations per session per individual were recorded. All behaviors had to be demonstrated for a minimum of 3 seconds to be recorded in this study (Bodfish et al., 1999). The occurrence of repetitive behaviors observed from each session was recorded and used in the

analysis. A second observer was present during a third of all sessions and inter-rater reliability of the observed behaviors was calculated for the recorded behaviors.

***Inter-observation reliability.*** Interrater agreement was used to examine the reliability of the two observers' measures of repetitive behaviors in this study. Prior to the start of the study, it was determined that the observations of the researcher and second observer should meet at least an 80% agreement rate (Dattilo et al, 2000). One month prior to the research study, three training sessions were set up to examine the consistency in recording for the research and second observer. During this period, a total of three individuals were observed during 10-minute increments in their daily environment, and a 90% agreement rate was achieved over the three sessions. When the research study began, the secondary observer was present for approximately a third (32%) of the sessions to further ensure the reliability of the recorded behaviors. The agreement rate during the study sessions was 82.3%. This was determined by comparing the number of intervals with occurrence and non-occurrence *agreements* between the two observers (237) and dividing it by the total number of intervals (300) observed by both recorders.

### **Intervention Facilitation**

The independent variable in this study was the intervention condition – the puzzle condition or MSE environment. Each of the intervention conditions took place in the MSE room for the participants. The individuals participating in the study were scheduled to attend two sessions per week once beginning the study, with the intent to keep the session times consistent across the study period. These times were chosen based on the individual's personal schedule and when the individual would be most engaged. If an individual was unable to attend a session during their allotted time, the researcher attempted to schedule another time during that week for the individual to make up their session. If this could not be arranged during that week, no data

were collected for that session and it was marked as a missed session; the reason for the missed session was then recorded in the researcher's notes.

**Control variables.** Individuals participating in this study were monitored daily by nursing staff. Changes in the adults' health status was noted during the study period by the researcher in her research log. The effect of any significant changes in the adults' health status was explored in the study and used to better explain changes in target behaviors if the behavior change occurred at the time of any other extraneous changes in the participant's life. Other health conditions or diagnoses of the participant (e.g., Alzheimer's disease or related dementia) that might influence their repetitive behaviors were also identified from the adults' medical chart and examined in this research. During each session, the researcher took observational notes about the individuals' response to the condition provided during the session as well as information about their relationship and interactions with the staff member who accompanied them to the session and wrote these in the researcher log.

### **Data Analysis**

There are several ways to evaluate the effectiveness of an intervention in research utilizing single-subject designs. In general, data are graphed, and an effect is demonstrated when there is a change in participant's performance when they change from one condition to another, and this effect is able to be replicated within and between participants. Four criteria were used to evaluate change in the participants' behaviors: (1) changes in level, (2) changes in trend, (3) changes in variability, and/or (4) a combination of these changes (Holcombe, Wolery, & Gast, 1994). A *change in level* is exhibited when the participant's data demonstrate an immediate change that is either higher or lower on the variable being measured in one condition when compared to the other condition (Holcombe et al., 1994). *Changes in trend* are evident in the

data when the direction of the data – whether the occurrence of the targeted behavior increases or decreases – vary from one condition to the other (Holcombe et al., 1994). When the data for the dependent variable demonstrate inconsistency during measurements within a condition, this is described as a *change in variability* (Holcombe et al., 1994). For the purpose of this study, the data analysis investigated whether there were changes in the participants' level, trend, and variability of repetitive behaviors across the study conditions/phases.

To help interpret the results, the data collected on each participant's repetitive behavior patterns during each of the phases of this study ( $A_1$ , B,  $A_2$ ) were plotted and graphed during the study period. Based on the collected data, the researcher made decisions about when to transition the study participants to the next condition (e.g.,  $A_1$  to B; B to  $A_2$ ). The occurrence of the total repetitive behaviors was plotted and graphed for each participant across the sessions and study conditions using Excel software.

## **Extended Results**

All three participants in this study completed the baseline condition (A<sub>1</sub>); however, only two of the participants completed the intervention (B) and second baseline (A<sub>2</sub>) conditions. The participant who did not complete the study personally advocated to not attend sessions, as demonstrated through nonverbal communication and physical aggravation when the researcher came to take him to the sessions. All participants in this study were male, with an average age of 29. Due to the small sample size in this study, the comprehensive findings for each individual participant were described separately, with the means and occurrence of types of targeted behaviors for the baseline, intervention period, and second baseline periods provided in Table 2.

### **Participant #1 - Tony**

Participant #1, Tony, a male who is over 40 years old. He has lived at the facility for over twenty years and has a diagnosis of bipolar disorder due to seizures, ASD, insomnia, and a profound intellectual disability. In the baseline (A<sub>1</sub>) phase, he demonstrated a high of 16 behaviors during one of the 15-minute sessions, then this decreased to 11 intervals after three additional sessions. When he was introduced to the MSE intervention (B), his behaviors increased to 19 during his second session in the MSE. However, they slowly decreased during subsequent sessions to 16 intervals after the fourth session in the intervention. Tony engaged in three sessions in the second baseline period (A<sub>2</sub>) where his behaviors continued to decrease from 11 to only five intervals in his last session.

Overall, the MSE intervention did not decrease the occurrence of repetitive behaviors exhibited for Tony. In fact, this intervention environment appeared to actually increase the repetitive behaviors that he demonstrated. He also had an increase in behaviors during his first session in the week and his occurrence of behaviors would always decrease the second session.

Table 2

*Occurrence of Repetitive Behaviors (N = 3)*

<b>Occurrence of Repetitive Behaviors</b>			
	<b>A<sub>1</sub> (Puzzle)</b>	<b>B<sub>1</sub> (MSE)</b>	<b>A<sub>2</sub> (Puzzle)</b>
<b>Tony</b>			
Session 1	14	10	11
Session 2	No show	19	Medical
Session 3	Aquatic Assessment	Medical	7
Session 4	16	18	5
Session 5	12	16	
Session 6	11		
Mean Behaviors	13.25	15.75	7.67
<b>Ron</b>			
Session 1	13	11	13
Session 2	Campus Lockdown	Refused	Missed
Session 3	19	Canceled	14
Session 4	16	16	
Session 5	19	FT	
Session 6	5	11	
Session 7		8	
Mean Behaviors	14.4	11.5	13.5
<b>Jeff</b>			
Session 1	9	15	
Session 2	13	Biting Staff	
Session 3	Medical	Not enough staff	
Session 4	Refused		
Session 5	Refused		
Session 6	Behavior issue		
Mean Behaviors	11	15	

Note. Medical refers to when a client missed a session due to a health issue and was restricted to the unit. Refused indicates the participant would not attend. Canceled refers to missing a session due to the lack of staff or other environmental aspects within the facility rather than reason associated with the participant.

There was a change in trend from A<sub>1</sub> to B where the interval occurrence of behaviors steadily increased in the multi-sensory environment. Interestingly, after the second session in the A<sub>1</sub> and B conditions, the behaviors decreased for Tony. There was also a decrease in his behaviors from B to A<sub>2</sub>. Throughout A<sub>2</sub>, his intervals gradually decreased during each session. The items and

equipment in the MSE made Tony very excited. This participant attended almost all of his sessions, unless he was restricted from medical due to conjunctivitis and was unable to leave his home. Tony was extremely excited; when he entered the multi-sensory environment he jumped out of his transport wheelchair and layed in the water bed as soon as he arrived. He seemed to enjoy the lights in the MSE, which made his vocalizations louder and more often. There was also a light projector in the room that he followed with his eyes. The engagement in the MSE seemed to be positive for this client and he clearly enjoyed this intervention. See Table 3 for a more detailed description of Tony’s responses and behaviors during each of the study sessions.

Tony reported self-injurious behaviors throughout the study. Figure 7 shows a visual illustration of the self-injurious behaviors demonstrated by Tony during the study. There was a decreasing trend of self-injurious behaviors. Then when introduced to the MSE intervention there was a increase in intervals compared to baseline. Re-introduction to the baseline condition the intervals began to decrease again.

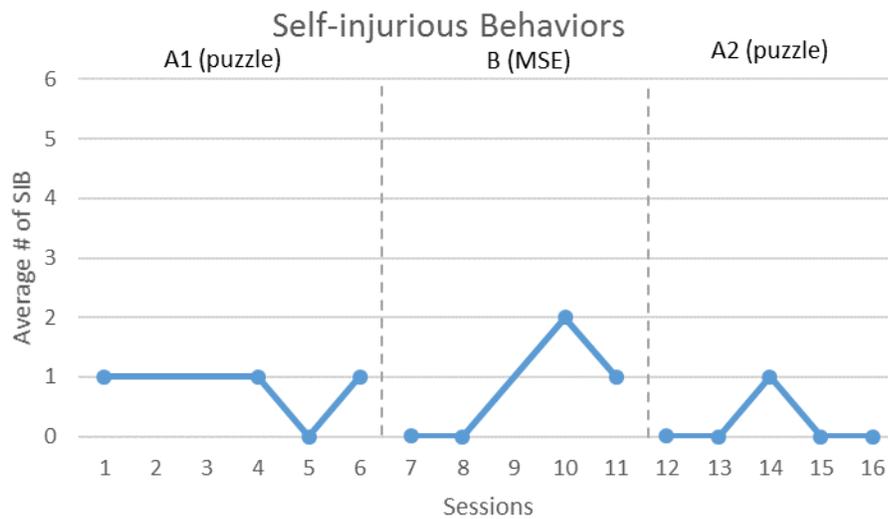


Figure 7. Self-injurious behaviors demonstrated by Tony each session.

## **Participant #2 - Ron**

Participant #2, Ron, was a in his mid-twenties, male, who has resided at this facility for over five years. He is diagnosed with autism spectrum disorder with behavior disorder, intermittent explosive disorder, and a severe intellectual disability. This participant exhibited 13 repetitive behaviors during his first baseline session ( $A_1$ ). These behaviors then increased in subsequent sessions, spiking at 19 a few times before eventually reducing to only 5 behaviors during his fourth session of the baseline condition. Ron should have transitioned the session prior – for the 5<sup>th</sup> session – and had he, his results would demonstrate a stronger effect of the MSE condition. Once he had completed six sessions in the baseline, he transitioned to the MSE intervention (B) for the seventh session. In the MSE, his behaviors increased across his first two sessions to an occurrence of 16 behaviors during his second session; however, they then gradually decreased to 8 behaviors during his fourth session in the sensory room intervention showing a declining trend. When he transitioned back to baseline ( $A_2$ ), his behaviors slowly began to increase again. During  $A_2$ , he only participated in two sessions due to a refusal and the completion of the eight weeks of research study. In general, the occurrence of his repetitive behaviors in the  $A_1$  and B conditions demonstrated change in trend, with an overall trend of increasing behaviors in the puzzle condition and an overall trend of decreasing behaviors in the MSE. He also began to demonstrate a trend of increasing behaviors when he was transitioned back into the puzzle condition at  $A_2$ .

Table 3

*Tony's Response to the Study Conditions*

	<b>Types of Repetitive Behaviors Observed</b>	<b>Researcher's Observations &amp; Comments</b>
<b>Participant 1 (Condition)</b>		
Session #1 (Puzzle)	Vocalizing, Grabbing staff, Rubbing head	Client engaged the majority of the time
Session #4 (Puzzle)	Vocalizing, Grabbing staff	Client mostly antsy, observing things around him
Session #5 (Puzzle)	Vocalizing	Client engaged, staff noted he was tired
Session #6 (Puzzle)	Vocalizing, Wringing fingers	Client kept pushing table away
Session #7 (MSE)	Vocalizing	Client tracked items, engaged
Session #8 (MSE)	Vocalizing	Client engaged a lot with fiberoptics, tried to remove clothing
Session #10 (MSE)	Vocalizing, Grabbing staff, Rubbing head / face	Client very engaged in fiberoptics, very hyperactive, tried to remove clothing
Session #11 (MSE)	Vocalizing, Holding head/ear	Client seemed agitated, sitting in wheelchair most of the time; staff helpful
Session #12 (Puzzle)	Vocalizing	Client focused, initiated involvement to complete a different puzzle; staff good
Session #14 (Puzzle)	Vocalizing	Client out of it and sleepy, kept closing eyes, staff said he could be cycling
Session #15 (Puzzle)	Vocalizing	Client very sleepy but engaged, kept closing eyes, staff good

Overall, it appeared that the MSE decreased the occurrence of repetitive behaviors exhibited for Ron. Throughout the research Ron had various moods during sessions. The type of day he was having and the direct care staff member who brought him to the MSE affected his participation and repetitive behaviors. He also advocated for himself a few times that he did not want to participate in the sessions and chose to leave. His favorite items in the MSE were the

bubble columns, which he always went straight to during the sessions and would engaged with consistently. The direct care member who accompanied him to the intervention seemed to have a strong influence on his response; this participant seemed to have an enjoyable experience in the MSE when he was with a direct care staff member with whom he had a closer relationship. Table 4 provides a detailed account of the behaviors and responses that Ron exhibited during each of the study sessions.

Ron reported self-injurious behaviors throughout the study. Figure 8 shows a visual illustration of the self-injurious behaviors demonstrated by Ron during the study. There was an increasing trend of self-injurious behaviors. Then when introduced to the MSE intervention there was a decrease in intervals compared to baseline. Re-introduction to the baseline condition the intervals began to increase again.

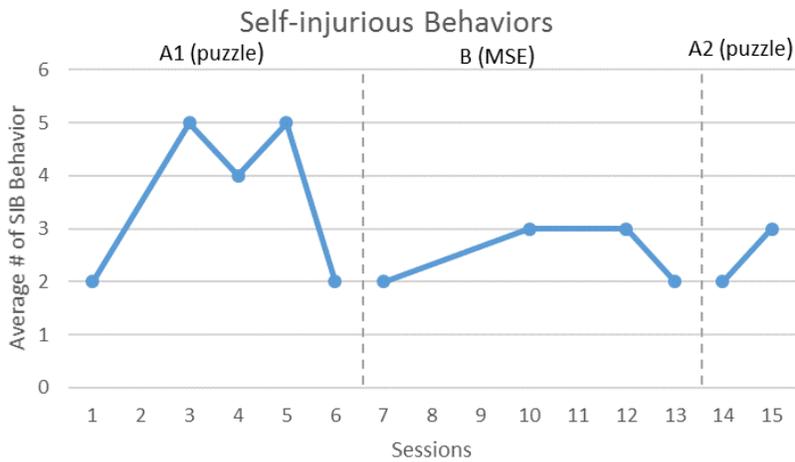


Figure 8. Self-injurious behaviors demonstrated by Ron each session.

Table 4

*Ron's Response to the Study Conditions*

	<b>Types of Repetitive Behaviors Observed</b>	<b>Researcher's Observations &amp; Comments</b>
<b>Participant 2 (Treatment Condition)</b>		
Session #1 (Puzzle)	Bites fingers, smells finger, picks hair	Client impatient and nervous
Session #3 (Puzzle)	Biting finger, picking eyebrows/eyelash, biting nails, biting on items, smelling fingers, repetitively tapping/tapping items	Client impatient and nervous, very engaged with staff
Session #4 (Puzzle)	Picking eyebrow/eyelashes, bit finger, touching staff, chew on items	Very engaged with the staff
Session #5 (Puzzle)	Vocalizing, head tapping, biting items, touching staff, biting finger, rocking	Took a bathroom break for 11 minutes than came back to participate
Session #6 (Puzzle)	Biting finger, pressing on head	Very engaged and interacting
Session #7 (MSE)	Jaw movement, biting finger	Engaged in fibroptics, touched items in a repetitive movement
Session #10 (MSE)	Biting finger, picking eyebrow, smelling finger, hand shaking	Loved mirrors and bubble column
Session #12 (MSE)	Rubbing finger, smelling finger, eyebrow picking, pressing head	Engaged with items
Session #13 (MSE)	Picking eyebrow, picking fingers, smelling hands	Enjoys mirrors and bubble column, stands the whole time
Session #14 (Puzzle)	Biting finger, picking eyebrow, rolling fingers	Wanted the bubble column back on, kept pointing to different items, nervous
Session #16 (Puzzle)	Eyebrow picking, biting finger, scratching items, vocalizing	nervous but was engaged.

**Participant #3 - Jeff**

Participant #3, Jeff, was a male in his early twenties who has resided at this facility for just over a year. He is also diagnosed with autism spectrum disorder, moderate intellectual disability and anxiety. Jeff only completed four sessions throughout this study. Two of the sessions were completed during the baseline condition (A<sub>1</sub>). In this baseline, he exhibited 9

behaviors during the first session, and this increased to 13 in the second session. After these two sessions, Jeff refused to attend the next four sessions. He did come for the seventh scheduled session, where he was transitioned to the MSE intervention (B). While in the MSE, the occurrence of his behaviors increased to as high as 15; however, the behaviors he exhibited were completely different than those he demonstrated in the baseline condition (See Table 5). His behaviors were more excitatory (e.g., twirling, spinning in circles, rocking, laughing) rather than problematic. This participant missed the next two scheduled sessions due to refusals, and then he returned for the 10<sup>th</sup> scheduled session where the occurrence of his behaviors decreased to six. In this 10<sup>th</sup> session, his behaviors were more similar to the those he exhibited at baseline (e.g., turned back to staff, very quiet, head rolling). This participant refused to attend any more sessions.

Overall, Jeff did not participate in many sessions throughout this study. It was determined that the MSE did not decrease the occurrence of his repetitive behaviors. This intervention environment appeared to actually increase the repetitive behaviors that he demonstrated initially at least, although these did decrease to a low of six behaviors in his last session. In session 7, his behaviors were completely different but seemed to be more enjoyable. He was twirling in circles, flapping his hands, smiling, and laughing. However, during the next session, he sat there coldly and turned his back to the researcher and direct care staff. His mood changed often across all of the sessions. The type of day he was having and the direct care staff member who brought him to the MSE appeared to significantly affect his participation and repetitive behaviors. Many times, this participant advocated for himself to not attend MSE sessions. He was physically aggressive toward staff on multiple occasions during the study period. Jeff did not seem to have a specific piece of equipment he enjoyed while in the MSE, but the lowered lights and humming of the

lights and bubble column seemed to calm him down. With a more consistent staff and schedule, he might have had a more stable response to the MSE.

The data for three participants are displayed in Figure 7. This figure shows the behavioral trends, levels, and variability across the study participants. Ron has two depictions on his data. The increasing trend describes the outcomes of the data with an increase of six intervals in session seven. This is what truly happened within the research data. If session six were to be eliminated, there would be a significant decreasing trend of eight intervals.

Table 5

*Jeff's Response to the Study Conditions*

	<b>Types of Repetitive Behaviors Observed</b>	<b>Researcher's Observations &amp; Comments</b>
<b>Participant 3 (Treatment Condition)</b>		
Session #1 (Puzzle)	Humming, smacking lips, touching head, shaking head, itching ears	Very nervous, not very engaged, wanted to leave
Session #2 (Puzzle)	Smacking lips, humming/vocalizing, shaking head	Two staff came with him during this session, nervous and impatient
Session #7 (MSE)	Spun in circles, shaking head, rocking	Standing in the corner, smiling, laughing, twirling
Session #6 (Puzzle)	Vocalizing, Wringing fingers	Client kept pushing table away
Session #7 (MSE)	Vocalizing	Client tracked items, engaged
Session #10 (MSE)	Head rolling, vocalizing, smacking lips	Very flat affect, turned his back to staff, quiet

	Trend			Level		Variability		
	A <sub>1</sub>	B	A <sub>2</sub>	A <sub>1</sub> -B	B-A <sub>2</sub>	A <sub>1</sub>	B	A <sub>2</sub>
Tony				-1	-5	High	High	High
Ron				+6	+5	High	High	NA
Jeff			NA	NA	NA	NA	NA	NA

Figure 9. Behavioral trend, level, and variability across participants.

### Summary of Findings

For Tony, there was a change in trend from A<sub>1</sub> to B where the occurrence of his behaviors steadily decreased after the second session in each condition. His behaviors increased when he transitioned to the MSE (B) condition. There was also a gradual decrease in his behaviors when he transitioned from B to A<sub>2</sub>. Throughout A<sub>2</sub>, his behaviors continued to decrease during each session. Overall, the intervention environment for Ron led to a slight decrease in his behaviors when he transition from A<sub>1</sub> to B. His repetitive behaviors in B were gradually decreasing and they began to increase again when he transitioned back to the puzzle condition in A<sub>2</sub>. Jeff did not participate in enough sessions throughout this study to accurately determine the effect of the intervention condition on his behaviors. However, it appeared that the MSE condition did not decrease the occurrence of his repetitive behaviors. The intervention environment appeared to actually increase the repetitive behaviors that he demonstrated, initially at least, although these did decrease to a low of six behaviors during his last session.

## **Extended Discussion**

The current study examined whether engagement in MSEs decreases repetitive behaviors in adults with ASD. Neither of the hypotheses for this study were supported. Across all three participants, there was no consistent evidence of the MSE intervention reducing the demonstration of repetitive behaviors compared to the baseline/control conditions. In addition, there was no consistent evidence of a decreased change in level of behaviors when the individuals transitioned into the MSE room. The data also suggested that there were inconsistencies in the participants' responses within the different study conditions. From the findings, it appeared that the MSE intervention was slightly successful in reducing the repetitive behaviors for Ron; however, the repetitive behaviors of Tony increased in the MSE. Jeff was exposed to the MSE, since it is unethical to discontinue a study during baseline if an individual may be responding poorly to a study condition (Tawney & Gast, 1984), but there was not enough data collected on Jeff due to his refusal to attend the intervention to determine how the MSE affected his repetitive behaviors.

Even though each participant in this study was male and diagnosed with ASD and an intellectual disability, they were all very different and had completely different responses to the MSE intervention. This is similar to the findings reported by McKee and colleagues (2006) where all three clients in the study had different responses to MSE. McKee and colleagues (2006) also noted that participants seemed to enjoy the MSE room but daily exposure did not produce lasting changes in the participants' behaviors.

The results of this study were also similar to those noted by Fava and Strauss (2010), who found there was a significant increase in frequency of behaviors for the participants. All participants in the researcher's study increased behaviors when introduced to the MSE. This was

particularly the case for Tony in this study. Fava and Strauss suggested that MSE interventions need to be intense and frequent (i.e. three times a week for seven weeks) to lead to significant change (Fava & Strauss, 2010). The participants in this study were only scheduled for two sessions a week, for a total period of 8 weeks. It is also possible based on Fava and Strauss' (2010) suggestions that a longer duration of exposure to the MSE environment was needed to result in a significant change in repetitive behaviors. Future research should increase the participants' weekly exposure to the MSE environment to at least three times a week to see if this would have an effect on their response.

As stated in the results, the participants seemed to enjoy the MSE, similar to the findings by Kaplan and colleagues (2006). The individuals in this research study had positive facial expressions and different repetitive behaviors that were exhibited in the MSE condition than in the baseline puzzle conditions. These findings suggest that MSEs do have the potential to positively influence behavior and engagement for some adults with ASD, even if it does not result in a significant change in their repetitive behaviors. Future research should consider assessing repetitive behaviors differently. Instead of measuring the occurrence of behaviors, it might be more useful to categorize them by types (e.g., stereotyped, self-injurious, compulsive) as some of the more "negative" types might actually decrease in the MSE, while "positive" or "neutral" behaviors might increase as an excitatory response. A "positive" behavior is more stereotyped and compulsive behaviors such as hand flapping, spinning in circles, counting, tapping items, vocalizing. A "negative" behavior is in the category of self-injurious behaviors which include biting, hitting, picking, hurting oneself.

There were several limitations of this study that need to be taken into consideration. The participants had one direct care staff with them for each session they attended in the study due to

facility policy. This staff member changed multiple times throughout the eight weeks of the study, which may have influenced the participants' response to the different environments. The staff member assisted the participants during the study conditions and played a role in encouraging their engagement in the activities provided. The participants have different relationships with each staff member at the facility, and staff members have different styles of interactions with the residents, and it is likely that this had an effect on their behaviors during this study. If the participant is closer to a direct care staff, they typically exhibit fewer behaviors than if they are with a staff member with whom they do not have as close of a relationship. Procedural reliability would have helped with this limitation in the study. There needed to be consistency in how staff interacted with participants in the study to better control for the potential influence this had on their behaviors and responses during the intervention. More consistent facilitation is necessary so the researcher does not need to come out of the role during the study implementation. Training is important for persons working with individuals who have ASD and intellectual disabilities and an activity engagement training should be administered in facilities to address this need.

Another limitation in this study was the medical status and health of the participants. Multiple sessions had to be canceled for the participants due to mild colds and conjunctivitis. The participants were cleared relatively quickly for participation, but this still may have affected their behaviors during sessions.

There was also a small sample size of only three individuals in this study, and the study participants were chosen randomly by the administrative staff at the facility. The researcher met with two teams on campus to explain the research study and the team members chose individuals to participate in the study. Even though the individuals in this study met criteria, having a larger

sample size or including individuals who had more prominent repetitive behaviors would have been better for the study. With the individuals who were chosen, there was a long process of approval to contact guardians and have all the appropriate paperwork signed. Communication between the facility and guardian took longer than anticipated, and this restricted the study from starting for over a month. In addition, the staff in the two units used for study recruitment had multiple responsibilities, and it is likely that identifying potential study participants and making the initial contact with the guardians was not their priority. This might have contributed to a lower number of participants being enrolled in the study ( $N = 3$ ) than was originally planned. A different sampling strategy might have resulted in more study participants or recruitment of participants who responded more positively to the MSE intervention environment.

During the presentation to the research committee it was determined that the research study would occur over an eight-week study period. The facility wanted the research to stay within this timeframe, which restricted the researcher from completely finishing the study with Ron (he completed only two sessions in the third treatment condition,  $A_2$ ). Extending the study period and having the participants attend at least three sessions during the week may have resulted in different findings that more clearly demonstrated the effect, or lack of effect, of the MSE condition on repetitive behaviors.

Finally, all individuals at the residential facility used in this study have the opportunity to attend multi-sensory interventions on a weekly basis, but attendance is limited due to lifestyle schedules and available direct care staff in the homes. Thus, it is possible that the residents in this study have utilized the multi-sensory room on previous occasions and this may have confounded their response to the MSE during this study period. However, it is unlikely that the

adults have had continuous, structured interactions in this environment similar to their engagement in the MSE for this study.

Anecdotally, the researcher and second observer noted that the participants seemed to enjoy the multi-sensory environment, even though their behaviors did not necessarily decrease. While in the MSE, the participants were typically more engaged with items, smiled, laughed, and explored their surroundings. The findings reported in Tables 3, 4, and 5 demonstrate these responses. This suggests that it might be important for future research to further examine the types of repetitive behaviors that individuals demonstrate, rather than relying solely on the occurrence of these behaviors exhibited by participants.

Recommendations for research and practitioners in recreational therapy based on this study would be to find ways to engage individuals with ASD and intellectual disabilities in multi-sensory environments and other sensory activities. Even though their behaviors may not decrease, based on the finding of this study, the participant's behaviors have the potential to change to be more positive in regard to repetitive behaviors. As long as a repetitive behavior is not injuring the client or others, an increase in their repetitive behavior could indicate their excitement and engagement the MSE. If a facility does not have an MSE available, small sensory activities can easily be made to engage individuals in sensory activities. Many people with ASD have deficits in sensory stimulation and should be provided activities to help them cope with the world around them. Educating the community and families/caregivers of adults with ASD about the effects of these environments would also be beneficial, as this population only continues to grow. In addition, more research on the effects of nonpharmacological interventions with adults with ASD is needed to further understand the most effective treatment approaches and modalities to use with these individuals in recreational therapy practice.

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## APPENDIX A

### Behavior Observation Sheet

Session # \_\_\_\_\_  
Participant #: \_\_\_\_\_  
Date: \_\_\_\_\_

The observation period will be a total of 15 minutes with documentation occurring every 30 seconds. Please put an (X) in the box if a repetitive pattern of behavior, specific to the participant, occurs during the time slot. Examples are provided below.

#### Types of Repetitive Patterns of Behavior

- Each behavior should be displayed continuously for at least 3 seconds.

#### Stereotyped Behaviors (demonstrated at least 3 seconds)

- Whole body (body rocking, body swaying)
- Head (rolls head, nods head, turns head)
- Hand/finger (flaps hands, wiggles fingers, claps hand)
- Locomotion (turns in circles, whirls)
- Object usage ( spins objects, twiddles objects)
- Sensory (covers eyes, covers ears, sniff items)

#### Self-Injurious Behaviors (demonstrated for at least 3 seconds)

- Hits self with body part (hits or slaps, head, body)
- Hits self against surface or object (hits or bands head or other body part on object)
- Bites self (bites hand, wrist , arms, lips, or tongue)
- Pulls on self (pulls hair or skin)
- Rubs or scratches self (rubs or scratches marks on body)
- Inserts finger or object (eye-poking, ear-poking)
- Skin picking (picks at skin on face, hands, arms, legs)

#### Compulsive Behaviors (demonstrated for at least 3 seconds)

- Arranging/ ordering (arranging objects)
- Completeness (must have doors opened or closed)
- Checking (checking doors, clocks, drawers)
- Counting (counting items, counts to certain number)
- Repeating (repeating routine events, in/out door)
- Touch/tap ( ned to touch, tab, or rub items)

Session # \_\_\_\_\_  
 Participant #: \_\_\_\_\_  
 Date: \_\_\_\_\_

	Behavior Occurred
Seconds	
0.30	
1	
1.30	
2	
2.30	
3	
3.5	
4	
4.5	
5	
5.5	
6	
6.5	
7	
7.5	

	Behavior Occurred
Seconds	
8	
8.5	
9	
9.5	
10	
10.5	
11	
11.5	
12	
12.5	
13	
13.5	
14	
14.5	
15	

Type of behavior(s) that occurred:

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Comments/concerns:

---



---

Session # \_\_\_\_\_  
Participant #: \_\_\_\_\_  
Date: \_\_\_\_\_

Age: \_\_\_\_\_

Sex: M F

Changes in health status or behavior during study period? Y N

If yes, what changes were noted in the participants' chart?

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Other medical diagnoses that might affect client's performance (e.g., Alzheimer's disease):

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## APPENDIX B: Informed Consent Form

East Carolina University



### Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Effects of Multi-Sensory Environment on Adults with Autism that Experience Repetitive Patterns of Behavior

Principal Investigator: Samantha Bova

Institution, Department or Division: East Carolina University: Recreation and Leisure Studies

Address: Carol G. Belk Building, 300 Curry Court, Greenville, NC 27858

Telephone #: 704-877-8216

Study Coordinator: Megan Janke, Ph.D., LRT/CTRS

Telephone #: 813-375-2831

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Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

#### **Why is this individual being invited to take part in this research?**

The purpose of this study is to investigate how multi-sensory interventions affect the daily behaviors of adults with autism. This individual is being chosen to take part in this research because they are diagnosed with autism and experience repetitive patterns of behavior. The decision to take part in this research is the guardian's and primary physician's choice. By doing this research, we hope to learn if multi-sensory interventions affect the repetitive behaviors of adults with intellectual disabilities. Approximately 3 to 4 individuals are expected to participate in this study.

#### **Are there reasons an individual should not take part in this research?**

There are no reasons why someone should not participate in this research unless they simply do not wish to participate or the guardian/ physician feels it is not appropriate. This research study will include adults with autism that experience repetitive patterns of behavior.

#### **What other choices does the individual have if they do not take part in this research?**

The guardian can decide that the individual should not participate in the study. This will not affect the services that they receive at [REDACTED] as part of their typical course of treatment.

#### **Where is the research going to take place and how long will it last?**

The research will be conducted at [REDACTED]. The primary researcher (Samantha Bova, LRT/CTRS) is employed with [REDACTED] as a Recreational Therapist. There will also be a secondary observer who is the Recreational Therapy supervisor ([REDACTED]). Additional staff will be provided depending on the individual's specific requirements. This research will be incorporated into the participant's daily life and regular activities. The total amount of time the individual will be asked to participate in this study is twice a week for eight weeks for fifteen minutes each session.

#### **What will the individual be asked to do?**

The individual will be participating in the multi-sensory environment for relaxation purposes. They will be able to choose the sensory items they would like to use in each session while the researcher observes. Each individual will be allotted two fifteen-minute time blocks each week for their multi-sensory intervention to take place. The adults' personal schedules and preferences will be taken into consideration when determining the appropriate time to schedule their intervention, and these times will be consistent across the study. The multi-sensory environment is a 20 x 15 room that is carpeted and has an enhanced ceiling resembling clouds. There are various sensory items that cover the walls and sensory items in room include water beds, bean bags, black lights, fiber optic lights, sound machines, sensory boards, sound machines, tactile trinkets, and other visual stimulants. These items and equipment allow individuals to engage in as much or as little stimulation as they prefer.

**What might the individual experience if they take part in the research?**

We don't know of any risks, or chance of harm, associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if the adults will benefit from taking part in this study. There may not be any personal benefit to them at this time, but the information gained by doing this research may help you and others as well as inform the development of other therapeutic programs to be offered at [REDACTED] in the future.

**Will the individual be paid for taking part in this research?**

We will not be able to pay anyone for their time while participating in this study. This study is being conducted to help others gain the maximum amount of benefit from participating multi-sensory interventions.

**Will it cost the individual anything to take part in this research?**

It will not cost any money to be part of the research.

**Who will know that this individual took part in this research and learn personal information?**

ECU and the people and organizations listed below may know that the individual took part in this research and may see information about them that is normally kept private. With your permission, these people may use the private information to do this research:

- [REDACTED]
- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), [REDACTED], and the Office for Human Research Protections
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing the adults' welfare during this research and may need to see research records that identify them.

**How will you keep the information you collect about the individual secure? How long will you keep it?**

The information collected on the adult will remain completely confidential throughout the process of the research study. Once the assessment information is collected, it will be kept in password protected electronic files using participants IDs instead of names or other indemnifying information to link the information. This information will be kept on file for six years and then destroyed. The information will also be securely stored in the medical records at [REDACTED].

**What if the individuals decide they don't want to continue in this research?**

They can stop participating at any time after the study has started. There will be no consequences if they stop and they will not be criticized. The individual will not lose any benefits that they normally receive as a result of discontinuing participation in this study.

**Who should I contact if I have questions?**

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 704-877-8216 (days, between 8:00 am – 7:00 pm).

If you have questions about the rights of the adults taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the ORIC, at 252-744-1971.

**I have agreed that said individual can take part in this study. What should I do now?**

The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

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**Name of participant**

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**Guardian Name (PRINT)**

**Signature**

**Date**

**Person Obtaining Informed Consent:** I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

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**Person Obtaining Consent (PRINT)**

**Signature**

**Date**

**APPENDIX C: HIPAA Privacy Authorization**

UMCIRB HIPAA Privacy Authorization

East Carolina University (ECU)/Vidant Medical Center (VMC): Research Participant Authorization to Use and Disclose Protected Health Information for Research

**For use only with the research consent form for UMCIRB#: 17-001048**

**Principal Investigator: Samantha Bova**

**Title: Effects of Multi-Sensory Environments**

**Location where research will be conducted**

The members of the research team will conduct the research study at:

East Carolina University (ECU)  VMC  ECU & VMC  Other [REDACTED]  
[REDACTED]

When taking part in research, protected health information (PHI) is collected, used, and shared with others who are involved in the research. Federal laws require that researchers and health care providers protect your PHI. Also, federal laws require that we get your permission to use collected PHI for the research. This permission is called authorization.

In order to complete the research project in which you have decided to take part, the research team needs to collect and use some of your PHI as described below.

**What types of protected health information (PHI) about me will be used or disclosed?**

(Select all that apply.)

**ECU Health Care Component:**

**Vidant Health Entity:**

ECU Physicians  
 School of Dental Medicine

Entire Vidant Health system  
 Vidant Medical Center

- I.  Speech, Language, and Hearing Clinic  Other Vidant Health Entity
- II.  Human Performance Lab (please list):
- III.  Physical Therapy
- IV.  Student Health
- Other ECU Health Entity

(please list): [REDACTED]

**Type of [REDACTED] Records: Type of Vidant Records:**

Medical/clinic records  Medical/clinic records

- Billing records
- Lab, Pathology and/or Radiology results results
- V.  Mental Health records
- PHI previously collected for research
- Records generated during this study
- Other:

- Billing records
- Lab, Pathology and/or Radiology
- Mental Health records
- PHI previously collected for research
- Records generated during this study
- Other:

**Who will use or disclose my PHI?**

- Principal Investigator
- Other members of the research team
- Other providers involved in your care during research procedures, outpatient/inpatient stays during which research is being performed, or physician office visits during which research is being performed.

**Who will receive my PHI?**

- Sponsor or other funding source to provide oversight for entire research project
- Research investigators to conduct and oversee the research project
- Principal Investigator and research team members to participate in the various research activities
- FDA or other regulatory agencies to provide regulatory oversight
- UMCIRB to provide continuing review of the research project
- Institutional officials in connection with duties for monitoring research activity
- Other providers involved in your care during research procedures, outpatient/inpatient stays during which research is being performed, or physician office visits during which research is being performed.
- Researchers at other sites—List sites:
- Data and Safety Monitoring Board and its staff
- Contract Research Organization and its staff
- Other Medical staff and treatment team members at [REDACTED]

We will share only the PHI listed above with the individuals/agencies listed above. If we need to share other PHI or if we need to send PHI to other individuals/agencies not listed above, we will ask for your permission in writing again

**How my adults' PHI may be released to others:**

ECU and [REDACTED] are required under law to protect your PHI. However, those individuals or agencies who receive your PHI may not be required by the Federal privacy laws to protect it and may share your PHI with others without your permission, if permitted by the laws governing them.

**What if I do not sign this form?**

You will not be eligible to participate in this study if you do not sign this Authorization form.

**How may I revoke (take back) my authorization?**

You have the right to stop sharing your adult's PHI. To revoke (or take back) your authorization, you must give the Principal Investigator your request to revoke (or take back) your authorization in writing. If you request that we stop collecting your PHI for the study, the adult may be removed from the study. If removed from the study, it will not affect the adult's ability to receive standard medical care or affect payment, health plan enrollment or benefit eligibility. PHI collected for the research study prior to revoking (or taking back) the adult's Authorization will continue to be used for the purposes of the research study. Also, the FDA (if involved with your study) can look at your adult's PHI related to the study even if you withdraw this authorization.

**Restrictions on access to my PHI:**

You will not be able to see your adult's PHI in their medical record related to this study until the study is complete. If it is necessary for your care, your adult's PHI will be provided to you or your physician.

**How long may the PHI about me be used or disclosed for this study?**

Research information continues to be looked at after the study is finished so it is difficult to say when use of your adult's PHI will stop. There is not an expiration date for this authorization to use and disclose your adult's PHI for this study.

If you have questions about the sharing of PHI related to this research study, call the principal investigator Samantha Bova at phone number 252-208-3841 . Also, you may telephone the University and Medical Center Institutional Review Board at 252-744-2914. In addition, if you have concerns about confidentiality and privacy rights, you may phone the Privacy Officer at East Carolina University at 252-744-5200.

**Authorization**

To authorize the use and disclosure of your adult's PHI for this study in the way that has been described in this form, please sign below and date when you signed this form. A signed copy of this Authorization will be given to you for your records.

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Name of Participant or Authorized Representative (print)	Signature	Date
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**If an Authorized Representative has signed on behalf of a Participant please print on the line above the authority of the Legal Representative to do so (*such as parent, court-appointed guardian, or power of attorney*).**

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Person Obtaining Authorization	Signature	Date
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## APPENDIX D: IRB APPROVAL



**EAST CAROLINA UNIVERSITY**  
**University & Medical Center Institutional Review Board**  
4N-64 Brody Medical Sciences Building · Mail Stop 682  
600 Moye Boulevard · Greenville, NC 27834  
Office 252-744-2914 · Fax 252-744-2284  
[www.ecu.edu/ORIC/irb](http://www.ecu.edu/ORIC/irb)

### Notification of Initial Approval: Expedited

From: Biomedical IRB  
To: [Samantha Bova](#)  
CC: [Megan Janke](#)  
Date: 11/14/2017  
Re: [UMCIRB 17-001048](#)  
Effects of Multi-Sensory Environment on Adults with Autism that Experience Repetitive Patterns of Behavior

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 11/13/2017 to 11/12/2018. The research study is eligible for review under expedited category #4,5. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Consent	Consent Forms
Effects of Multi-Sensory Environment on Adults with Autism that Experience Repetitive Patterns of Behavior	Study Protocol or Grant Application
HIPAA	HIPAA Authorization
HIPPA	Additional Items
MD approval	Additional Items

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

