



Multi-sensory rooms: Comparing effects of the Snoezelen and the Stimulus Preference environment on the behavior of adults with profound mental retardation

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ABSTRACT

The present study examined whether Snoezelen and Stimulus Preference environments have differential effects on disruptive and pro-social behaviors in adults with profound mental retardation and autism. In $N = 27$ adults these target behaviors were recorded for a total of 20 sessions using both multi-sensory rooms. Three comparison groups were created by diagnosis and motor respective linguistic abilities. Each client was exposed to only one multi-sensory room. Results showed that Snoezelen intervention decreased disruptive behaviors only in individuals with autism, while Stimulus Preference increased pro-social behaviors only in participants with profound mental retardation with co-occurring poor motor and linguistic abilities.

Furthermore, several trend analyses of the improved behaviors were conducted throughout all sessions toward short and mid term effects of the multi-sensory room applications.

These findings support both the prudence of using the Snoezelen room in individuals with developmental disabilities and the importance of using a Stimulus Preference assessment in multi-sensory environments in clients with profound mental retardation.

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A multi-sensory environment (MSE) is an environment designed to stimulate the senses through light, sound, touch and smell. Essentially, it aims to create a feeling of safety, and to provide novel sensations, with stimulation under the user's control. The MSE is both a physical space and a process. The physical space may assume a variety of different figure-ground relationship forms or prototypes, each designed for a different set of purposes. Stimuli can be presented in isolation or in combination, intensified or reduced and shaped for passive or active interaction. Stimulation can therefore be planned to fit the unstable sense ability requirements of an individual with debilitating perceptual difficulties and/or profound disabilities, whether these are progressive, fluctuating, stable or regressive (Pagliano, 1999). The MSE as a process becomes an individualized behavior scaffold, specifically designed to match the user's current motivation, interest, leisure, relaxation, therapeutic and/or educational needs (Pagliano, 2007). Although many multi-sensory gardens and pools exist (Kinross & Thomas, 2006; Lavie, Shapiro, & Julius, 2005), the most used MSE is the room, mostly located in centre or institutes for people with intellectual disability.

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Since the 1970s two therapists, Hulsege and Verheul (1987), applied an approach called Snoezelen in the multi-sensory rooms. Snoezelen is a combination of two Dutch words “snuffelen”, meaning to seek out or explore, and “doezelen”, which means to relax.

The philosophy of Snoezelen is based on non-directive and non-threatening approaches; every implementation in the Snoezelen room should be based on relaxation; here is just, care, and free choice has to be encouraged. However, the appropriate decision regarding differential application of MSE affects the choice of contents, methods as well as forms of organization which leads to ongoing discussions in this field (Hogg & Cavet, 1995).

Recently, the Snoezelen have been applied to people with developmental disabilities (Ashby, Broxholme, Pitcaithly, & Lindsay, 1995; Cuvo, May, & Post, 2001; Shapiro, Parush, Green, & Roth, 1997), to individuals with autism (Kaplan, Clopton, Kaplan, Messbauer, & McPherson, 2006; Mckee, Harris, Rice, & Silk, 2007), to children with brain injuries (Hotz et al., 2006) as well as to people with chronic pain (Schofield, 2000).

Most of the aforementioned literature demonstrates a wide range of positive outcomes when Snoezelen *versus* non-Snoezelen environments are compared, though there is little evidence that these positive effects were carried over outside the Snoezelen environment, even following immediate post-Snoezelen evaluations (Ashby et al., 1995; Shapiro et al., 1997).

Moreover, other studies do yield entirely negative outcomes (Mckee et al., 2007). Mckee et al. used a strong experimental ABAB reversal design in which they evaluated ecologically targeted behaviors using inter-observer agreement among different raters. The results showed no decrease in disruptive behaviors and no increase of pro-social behaviors while the subjects were in the Snoezelen compared to the baseline. These findings suggest that many methodological aspects should be considered before claiming of any supposed significant effect of the multi-sensory rooms.

Indeed, many studies showed positive results of the Snoezelen intervention based only on qualitative data reported by caregivers after the sessions, without previous definition of target behaviors (DeBunsen, 1994; Hagger & Hutchinson, 1991; Hope, 1998). Certainly, this research approach enhances the interdependence of these measures by subjective judgments.

Furthermore, in accordance with Lancioni, Cuvo, and O'Reilly (2002) an important aspect which has not been adequately considered concerns the fact that the relationship between caregivers and clients was not controlled both during the control condition and the Snoezelen session. The difference in terms of time spent together and the quality of this relation might affect the effectiveness of this multi-sensory treatment on people with profound mental retardation (Baker, Dowling, Wareing, Dawson, & Assey, 1997; van Lankveld, 1992). Another important aspect to be considered is the low number of subjects observed and the frequency of the Snoezelen sessions that were not sufficient to demonstrate any significant effects of the Snoezelen treatment (Fagny, 1998; Holtkamp, Kerkstra, Ooms, van Campen, & Ribbe, 2001; Long & Haig, 1992).

Moreover, in various studies an individual preference assessment for the sensory stimuli in the Snoezelen sessions was not examined. This is a fundamental point to consider in order to allow the caregivers to expose the subjects towards the stimuli which create pleasure and are more coherent with their clinical condition. This approach could prevent or decrease some challenging behaviors that occur while individuals are in the Snoezelen room (Ashby et al., 1995).

Recently, the necessity of performing a functional assessment of the challenging behaviors before any intervention was demonstrated (Ager & O'May, 2001).

Functional assessment refers to a variety of approaches used to gather information about the cause of problematic behaviors to enable the design of effective treatments. It is vital to use stimuli that are highly preferred and functions as reinforcements if these interventions have to be effective. A systematic approach typically involves a Stimulus Preference assessment and a reinforcement assessment. A Stimulus Preference assessment attempts to set preference and predict the reinforcing effects of the stimuli while a reinforcement assessment tests the reinforcing effects of the same stimuli by measuring induced changes in the behavior's rate (Fisher, Piazza, Hagopian, Bowman, & Toole, 1996).

Since it is well known that individuals with profound developmental disabilities rarely live within a single setting, therefore, interventions should be provided across settings and the stimuli assessed should be maintained and used within multiple settings (Cannella, O'Really, & Lancioni, 2005; Matson, Bamburg, & Smalls, 2004). Stimuli identified in preference assessments could be applied to a variety of different behaviors both in natural and in MSE in order to observe the extent of their reinforcing effects and to verify whether these effects change as response effort and complexity increase.

With regard to the aforementioned points, in the current study we performed an analysis both in a naturalistic setting (living room) where the participants used to spend most of their time and in two different multi-sensory rooms. The first room, was inspired by the Snoezelen approach following the concept of non-directive and non-threatening approach. The second one, called Stimulus Preference, a set of sensory stimuli, previously assessed as preferred by each individual, was used as the main source of interaction between clients and caregivers.

Our experiment was aimed to investigate whether the Snoezelen environment and the Stimulus Preference environment have differential effects on disruptive behavior and pro-social behaviors of adults with profound mental retardation. Additionally, we examined whether any positive effects due to multi-sensory room exposures would continue in an ecological environment (such as in the Institute's living room) either after each session and/or at the end of the treatment. Any behavioral improvement in this naturalistic environment was the main purpose of our study.

Lastly, since Menditto (2002) demonstrated that person-centered planning treatment based on items and activities preferred by individuals with profound disabilities could increase social skills, starting from learning specific skills up to their generalization into a more naturalistic environment. It was hypothesized that the Stimulus Preference room, allowing an increase of social and interactive behaviors, could be more effective than the Snoezelen room.

1. Method

1.1. Settings

The study took place in three different settings at the participants' residential Institute: the living room, the Snoezelen room and the Stimulus Preference room.

The living room (5 m × 6 m), contained chairs, tables, a stereo, a television and two cabinets with leisure materials and manipulative objects (e.g., puzzles, games, markers, and balls). Some of the objects in this environment were present also in both multi-sensory rooms. Each participant had the possibility to interact freely with other patients and caregivers. This environment was considered by us as a place where the clients could improve their social behaviors either towards stimuli or towards other patients and caregivers; this experience could result in reduction of the negative behaviors such as aggressive and stereotyped behaviors.

The Snoezelen room (9 m × 7.50 m) had white walls, a carpeted floor, as well as commercially purchased visual, tactile, auditory, olfactory, and vestibular sensory equipment. It included a rocking chair, vibrating pillow, kaleidoscope-like color wheel, rotating electric colored lights ball, magna light (lava lamp), color carousel ball with flashing lights, bubble column, bean bags, tactile panel with different texture tile, tactile books with textures, rotating projector (abstract shapes, planet, clouds, stars), rain stick, a fiber-optic, auditory melody disks, and aroma therapy oils. Most of the stimuli had interactive and functional features meaning that, for instance, some visual stimuli could start only after they had been touched by the client. Furthermore, the stimuli were distributed in the room without any specific rules and the client, supported by the caregiver, could interact in a free way and own timing with each of different stimuli. In this multi-sensory room, the concept of availability of sensory stimulation was encouraged in order to create a relaxing and safe atmosphere. The caregivers provided the patients with various stimuli in different sensory modalities allowing the preference at the moment without any rules and structured steps to be followed in order to both create a sort of empathy with the patient and taking into consideration her/his needs at that precise moment.

The Stimulus Preference room is similar in size and general structure to the Snoezelen room but with some differences. The differences reside in what the patients can do inside and in the relationship between them and their caregivers. The main important difference was that the stimuli had already been selected by the patient in the preliminary preference assessment using a scientific preference assessment method which will be described in Section 1.5. In this room, the concept of sensory reinforcement is emphasized and the patients can interact during this multi-sensory treatment exclusively with their preferred items. Moreover, the caregiver follows a more structured approach, using verbal and physical prompts with regard to the behaviors learned by each client toward both their preferred stimuli and toward themselves using the same stimuli as reinforcement. Consequently, in this multi-sensory room the environment was slightly different for each patient. Unlike the Snoezelen room, the stimuli were distributed regarding specific sensory modality. Each corner of the room was coupled only with stimuli performing to one sensory modality in order to allow a more specific interaction between caregiver and patient.

In addition, for each sensory modality, the client had a fixed timing to interact, roughly 5 min, which could have been extended for another 2 min in case of an appropriate and active behavior with the stimuli. However, all four sensory modalities (visual, tactile, olfactory and hearing) had to be covered during each session in this multi-sensory setting in order to respect the purpose of re-sensitizing these individuals to different sensory functions

1.2. Participants

The participants were 27 adults in a Institute for individuals with intellectual disability. Their age ranged from 30 to 48 years (MEAN 37.8 years). Everyone evinced profound mental retardation. Nine subjects had a diagnosis of autism. 18 out of the 27 subjects had good motor abilities, while nine had poor motor abilities. Nine clients had basic language abilities and twelve had very poor language abilities. Thus, taking into account these variables, we divided the sample in three groups as follows:

- Nine individuals with autism (AUT) with good motor abilities (Mw) and poor linguistic abilities (Lwo).
- Nine individuals with profound mental retardation (PMRw) with good motor abilities (Mw) and good linguistic abilities (Lw).
- Nine individuals with profound and severe mental retardation (PMRwo) with poor motor abilities (Mwo) and poor linguistic abilities (Lwo).

1.3. Target behaviors

In accordance with previous studies (Cuvo et al., 2001; Mckee et al., 2007), both disruptive and pro-social behaviors were taken into account. Operational definitions of these behaviors were considered as dependent measures and are shown in Table 1. The caregivers were instructed to interact kindly with the individuals in order to facilitate the onset of any client's pro-social behaviors and to contain aggressive and stereotyped behaviors.

All target behaviors were scored using the records of the sessions, by three "blind" observers who did not know the purpose of the experiment and were not familiar with the participants. The raters were two certified occupational therapists

Table 1
Target behavior definitions.

Target behavior	Definition
Disruptive behaviors	
Aggressive behaviors	
Hitting	Any attempted or completed striking of another person with any part of a client's body.
Overturning furniture	Any attempted or completed pushing over of chairs or tables.
Banging head	Forceful contact of the head with a stationary object or forceful contact of the hand with the head or face.
Spitting	Purposeful ejection of saliva from the mouth towards another person.
Threatening	Verbal threat of aggression or a gesture of pointing and frowning at another person.
Stereotyped behaviors	
Body rocking	Moving the torso forwards then back to an upright position.
Body swaying	Moving the torso right or left, then back to the midline position.
Picking	Grasping an object between thumb and index finger, or dragging finger on surface until the finger was lifted.
Mouthing of hand or object	A lick or placement of lips on hand or object (e.g., game pieces, clothing, strings, buttons, walls, chairs), or placement of an object in mouth.
Vocal behaviors	
	Repetitive yell operated without any specific require.
Pro-social behavior	
Active behaviors toward sensorial stimuli	
Glances	Looking and making eye contact with any kind of stimuli for more than 3 s.
Smiles	Looking and smiling at any kind of stimuli for more than 3 s.
Body and arm movements	Any movements with meaningful approach towards sensory stimulation for more than 3 s.
Social behaviors toward caregiver	
Approaching behaviors	
	Any behavior considered as an interactive behavior with the caregiver such as movements of body and/or vocal requirement in order to make a contact with the caregiver.
Request of social contact	
	Any behavior who explicitly shows the need to be approached by the caregivers, such as shaking head or doing anything to keep the attention of the caregiver.

and one behavioral psychologist. All target behaviors were scored indicating the frequency following the operational definition shown in Table 1.

Inter-observer agreement by intra-class correlation coefficient was calculated in order to ensure that their level of agreement remained above 80% for all of these measurements. For all target behaviors and all subjects a good reliability were demonstrated as follows: for individuals with autism (AUT) was $K = 0.86$, for individuals with profound mental retardation and good motor and linguistic abilities (PMRw) was $K = 0.87$, and for individuals with profound mental retardation and poor motor and linguistic abilities (PMRwo) was $K = 0.81$.

1.4. Design

As shown in Table 2, the sample was divided into three groups (AUT; PMRwo; PMRw) and three conditions (living room; Snoezelen; Stimulus Preference). Each subject attended only one of the three experimental conditions, three times a week for seven weeks (20 sessions in total). Each session had the same length (25 min). In accordance with different activity levels and sensitiveness to the environment showed by most of the individuals with profound mental retardation during the day, we distributed the sessions in three different times, as follows: sessions in the morning (9 a.m.), sessions at lunch time (12 a.m.), and sessions in the afternoon (4 p.m.).

Lastly, we controlled the relation between subjects and caregivers who were accompanying them in all sessions. Consequently, a permanent shift of operators was maintained in order to keep this variable constant, allowing a reduction of other influences on the client's behaviors besides the multi-sensory session effect.

1.5. Procedure

Target behaviors of individuals who attended either the Snoezelen or Stimulus Preference condition were recorded at five different times, while subjects belonging to the control group were measured only three times as follows:

Table 2
Experimental design.

	Groups		
	AUT (Mw;Lwo)	PMR (Mw;Lw)	PMR (Mwo;Lwo)
Condition			
Snoezelen	3	3	3
Stimulus Preference	3	3	3
Control (living room)	3	3	3

Baseline: measurement of all target behaviors for all subjects, obtained by medium value of three recorded sessions in the living room before both multi-sensory room intervention began.

Pre-session: measurement made just before both Snoezelen and Stimulus Preference sessions only for subjects who attended one of these sessions (recorded in the living room).

Dur-session: measurement made during the Snoezelen and Stimulus Preference sessions.

Post-session: measurement made just after Snoezelen and Stimulus Preference sessions only for subjects who attended one of these sessions (recorded in the living room).

Baseline: measurement of all target behaviors for all subjects, obtained by medium value of three records in the living room after the end of both multi-sensory interventions.

All experimental conditions were recorded by two cameras. One was fixed and located in the corner of each room capturing the general view of the ambient. The other camera was mobile and moved by an experienced operator focusing on individual features of the client's behaviors while remaining outside from the visual field of the client.

Purposely, observations in the living room were conducted during regularly scheduled activity times under typical conditions. The activities included watching television, listening to the stereo, looking at magazines, playing games, putting together puzzles and interacting with various objects. The participants were allowed to engage freely in whatever activity they chose during this time. Caregivers only occasionally attempted to engage individuals in activities. During the living room sessions roughly five clients and three caregivers were present and recorded.

Conversely, in the Snoezelen environment, participants attended each session individually. There was just one caregiver who followed and kept non-directed contact with the client. The caregiver led the participants moving around the Snoezelen room in a counterclockwise manner during each session, while naming each stimulus and guiding the participant to activate or to use appropriately the equipment (e.g., manipulate the music instruments, turn on electrically operated stimuli). If the participant refused the manual guidance, the caregiver turned on the electrical equipment or placed the sensory stimuli in a preferred place like on the table or on the mat. Regarding the non-directive approach, the participants were allowed to manipulate or look at whatever item for all the time they wanted. After all stimuli were introduced, the participants were free to move around the room and interact with the sensory equipment at their own pace. No interaction occurred between caregiver and participant unless requested by the participants or if they attempted to use the equipment inappropriately. In the case that the participants did not engage with any of the Snoezelen equipment for more than 4 min, the caregiver was supposed to interact with the clients and offer them either to play with or to look at any sensory stimuli in the room.

Similar to the Snoezelen room, in the Stimulus Preferences several sensory stimuli were present and the participants attended each session individually. However, as mentioned before, differing from the Snoezelen room, the Stimulus Preference room was always adapted to individual choice in terms of the client's most favorite stimuli. The preferred stimuli were firstly listed by the caregiver for each participant, and then to these pre-selected items, a scientific preference assessment methodology was applied as follows.

We referred to a multiple stimulus assessment with replacement (MSW; Windsor, Piche, & Locke, 1994) where an assortment of items are presented at the same time, allowing the individual to choose one item from the array and involving the ability to replace an item after it had been chosen so that all items are present for each trial.

Additionally, we considered also the second version of this method introduced by DeLeon and Iwata (1996), called multiple stimulus assessment without replacement (MSWO) where an array of items is presented simultaneously as in the MSW assessment.

Conversely, after an item is chosen it is removed from the group and the individual chooses another item. This continues until all items are selected or the individual no longer selects an item. Thus, this method without replacement requires the individual to discriminate between stimuli, which may yield more differential responding and may give a more sensitive measure of preference than one with replacement.

These features are comparable with the Paired Stimulus presentation (Ivancic, 2000), where stimuli are presented in pairs and the individual has to choose one. This method seems to be the most accurate one for assessing preferred stimuli and predicting reinforcement effectiveness. However, Carr, Nicolson, and Higbee (2000) suggested to use the Multiple Stimulus assessments in people with profound mental retardation, since it is efficient while consuming less time than the Paired Stimulus assessment and is very accurate to identify preferred stimuli, at the same time.

Therefore, we decided to use a combination of MSW and MSWO, applying the preference assessment only to participants who attended the Stimulus Preference Condition; each participant was placed in front of some objects of different sensory modalities. This record was repeated few times and a selection percentage was calculated by dividing the number of times an item was chosen by the number of trials it was available. These percentages were then used to rank-order the items by preference and each preferred stimulus was put in a "Sensory Category", which were subsequently used by the caregivers in the Stimulus Preference room, for motivating the subject's to interact with stimuli in different sensory modalities.

For assessing the preference assessment each client was submitted to four experimental sessions, two with Replacement (MSW) and two without Replacement (MSWO). Nonetheless, in accordance with Zhou, Iwata, Goff, and Shore (2001), who argued that it is necessary to repeat a preference assessment during long experiments with people with mental retardation since the individual preferences can vary across time and situation, we repeated these four experimental sessions after ten sessions, when half of the experimental trials were already performed.

Furthermore, the caregiver led the participant going around the Stimulus Preference room focusing his/her attention to interact with his/her preferred stimuli. The caregiver promoted during all sessions in this environment, the similar kind of interaction with their preferred stimuli, correcting only if they used the equipment inappropriately. In the case that participants did not engage with any of the stimuli preferred for more than 2 min, the caregiver asked if they wanted either to play with or look at something else in the room. Those changes were recorded by the caregiver in order to take note of a possibility that the patient could have changed their preference. For three patients some preferred stimuli were changed over the treatment.

2. Results

Firstly, we computed medium frequencies value for all target behaviors for each experimental group in the living room, creating either Baseline pre- and post-treatment, in order to compare the groups who attended multi-sensory conditions with the control group.

Variance analysis were conducted for each group using pairwise comparisons and univariate tests focused on condition and pathology as parameters both for disruptive and pro-social behaviors.

With regard to disruptive behaviors significant effects emerged only for two groups who attended the Snoezelen condition (Figs. 1 and 2). Fig. 1 shows that the frequency of aggressive behaviors decreased significantly ($F = 35.361$; $p = 0.00014$) after treatment only for individuals with autism (AUT) who attended the Snoezelen condition.

Fig. 2 displays the frequency of stereotyped behaviors which decreased significantly after treatment either for individuals with autism (AUT) ($F = 29.047$; $p = 0.003$) and for individuals with profound mental retardation without motor and linguistic abilities (PMRwo) ($F = 25.293$; $p = 0.004$) who attended the Snoezelen condition, compared to other conditions and groups ($F = 35.361$; $p = 0.00014$), but without a significant difference between each other.

Furthermore, concerning the pro-social behaviors significant results were found only for two groups who attended the Stimulus Preference condition (Figs. 3 and 4). Fig. 3 showed that the frequency of active behaviors towards stimuli increased significantly ($F = 12.861$; $p = 0.002$) after treatment only for the individuals with profound mental retardation without motor and linguistic abilities (PMRwo) who attended the Stimulus Preference condition compared to other condition and groups ($F = 35.361$; $p = 0.00014$), representing on average.

Fig. 4 displays the frequency of pro-social behaviors which increased significantly after treatment only for individuals with profound mental retardation with basic motor and linguistic abilities (PMRw) ($F = 9.141$; $p = 0.004$), who attended the Stimulus Preference condition compared to other conditions and groups ($F = 18.732$; $p = 0.0016$).

In addition, trend analyses of the significant effects of both multi-sensory treatments, specific for different groups, were conducted. As aforementioned, we collected data during the sessions as well as before and after in the living room, in order to demonstrate a possible short term effect of either Snoezelen and/or Stimulus Preference on target behaviors.

Fig. 5 shows several trend analyses over 20 sessions, comparing graphically the medium values of a target behavior for each group who attended a specific condition.

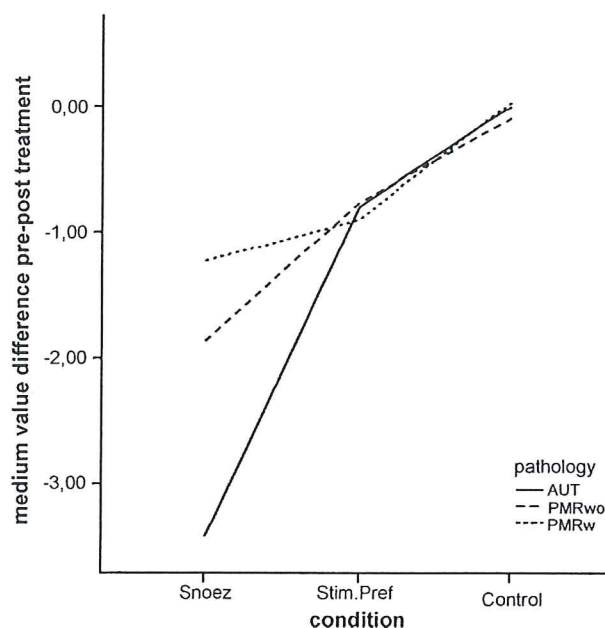


Fig. 1. Post-pre-treatment differences for aggressive behaviors.

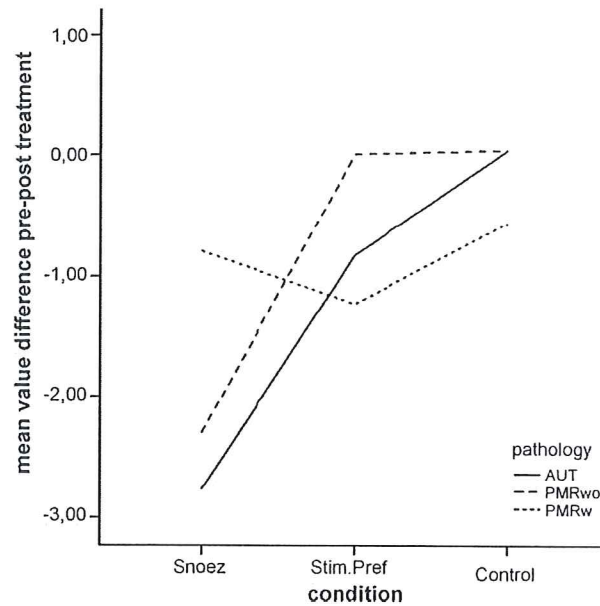


Fig. 2. Post-pre-treatment differences for stereotyped behaviors.

In the first graph (Fig. 5a) the trend frequencies development of aggressive behaviors for the AUT group who attended the Snoezelen sessions, regarding three different times of measurement (PRE, DUR and POST session) is displayed. It is shown that in the first eight sessions all frequencies tended to decrease without any evident differences in all three times of measurement, while starting from the tenth session, those differences between the pre-sessions and the post-sessions values, became noteworthy.

In the second and third graph (Fig. 5b; c), the trend frequencies of stereotyped behaviors both for individuals with autism (Fig. 5b) and with profound mental retardation without motor and basic abilities (Fig. 5c) are represented. In both graphs the decrease of the stereotyped behaviors is evident between post- and pre-sessions, although this finding is more pronounced for the AUT group (Fig. 5b) than for the PMRwo group (Fig. 5c). Furthermore this development is continuous only for the AUT group while the improvements within the PMRwo group clearly ceased at the 12th session.

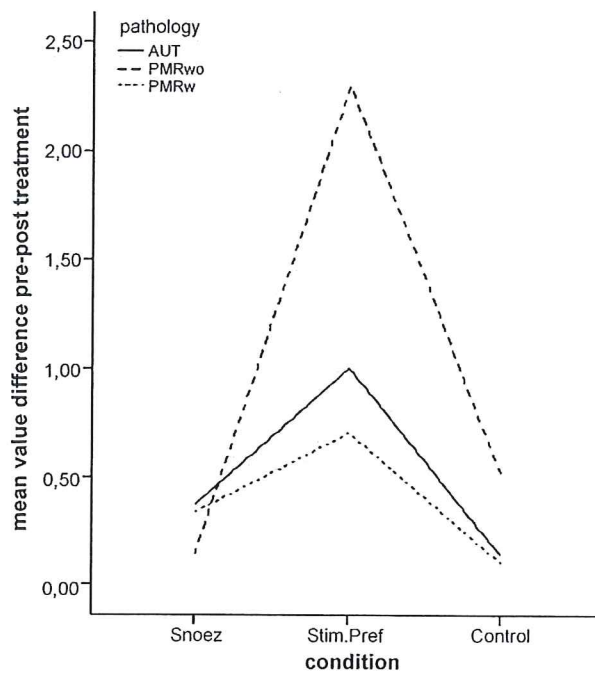


Fig. 3. Post-pre-treatment differences for active behavior toward stimuli.

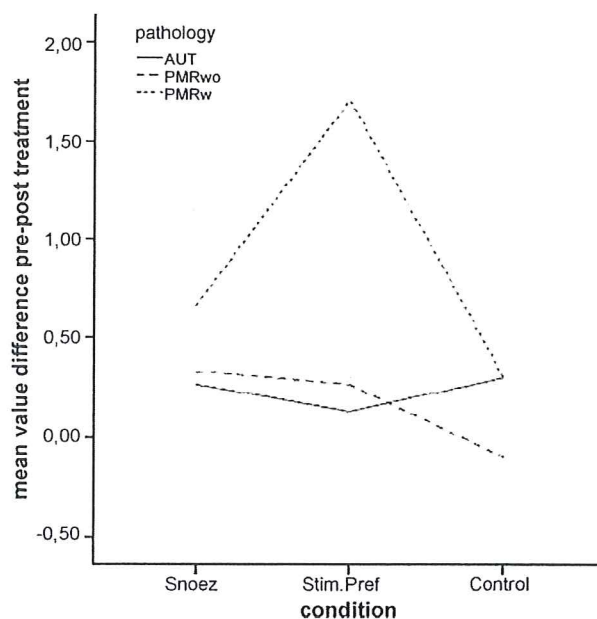


Fig. 4. Post-pre-treatment differences for social behavior.

In addition, the trend analysis of the pro-social behaviors, which were significantly improved in the previous analysis, is shown in the fourth and fifth graphs (Fig. 5d; e). Fig. 5d shows the trend frequencies development of social behaviors toward the caregiver for PMRw who attended the Stimulus Preference condition. No significant increase of frequencies in all three records was revealed in the first ten sessions, while from the eleventh to the fifteenth session such an increase was more pronounced. However, over all 20 sessions there were not any evident differences between pre- and post-measurements. Lastly, in Fig. 5e the trend frequencies of active behaviors toward the stimuli for PMRwo group who attended the Stimulus Preference condition are displayed, showing a linear increase in the first eight sessions for all three times of measurement, but without any important difference, while from the eleventh to the eighteenth session the graph shows a balance of the frequencies. However, in the last four sessions the difference between pre- and post-session values was marked.

3. Discussion

Overall, this study supports the idea that multi-sensory interventions produce partial effect on the behavior of individuals with profound mental retardation and any improvements should be considered in the context of specific groups and target behaviors. The results displayed in Figs. 1 and 2 suggest that the Snoezelen intervention has a positive effect, carried over to the control environment (living room), in decreasing the frequencies of aggressive and stereotyped behaviors mainly for the group with autism. Although a significant decrease in stereotyped behaviors was found for clients with profound mental retardation without motor and linguistic abilities (Fig. 2), trend analyses (Fig. 5a; b) showed that the short term effect of the Snoezelen was more pronounced after ten sessions and maintained until the end of the sessions in the group with autism compared to the other group who showed a slight difference over the session between post- and pre-Snoezelen session (Fig. 5c). This finding suggests that the Snoezelen approach needs to be intense and frequent for being effective (three times a week for seven weeks). It is not clear why the Snoezelen decreased the disruptive behaviors only for people with autism and not for people with profound and severe mental retardation. However, Baker et al. (1997) noted that patients might find the room claustrophobic and became anxious on entry in an environment such a degree of stimulation. Indeed, in our study groups one client from each without autism (PMRw; PMRwo) often expressed both vocally and with disruptive behaviors a distinct dislike for the room.

With regard to the Stimulus Preference condition, Fig. 3 shows that this intervention has significantly increased the frequency of active behaviors for individuals without motor and linguistic abilities. Additionally, as shown in Fig. 4, the Stimulus Preference condition has a significant effect on the social behavior toward caregiver only for patients with motor and linguistic abilities. These different findings might be a result of higher limitations, in terms of mobility and communication with the direct caregiver, for clients without motor and linguistic abilities. Given that, the exposure to their preferred stimuli was effective exclusively for behaviors which concerned the sensorial stimulation itself. Moreover, as shown in Fig. 5e this group showed a short term effect more pronounced in the last four sessions indicating that processes of generalization of such learned behavior toward the stimuli require more time for this specific group.

In contrast, the trend analysis (Fig. 5d) of social behaviors for individuals with motor and linguistic abilities shows that the short term effect was marked since the sixth session. It is assumed that the supply of various sensory stimulations and

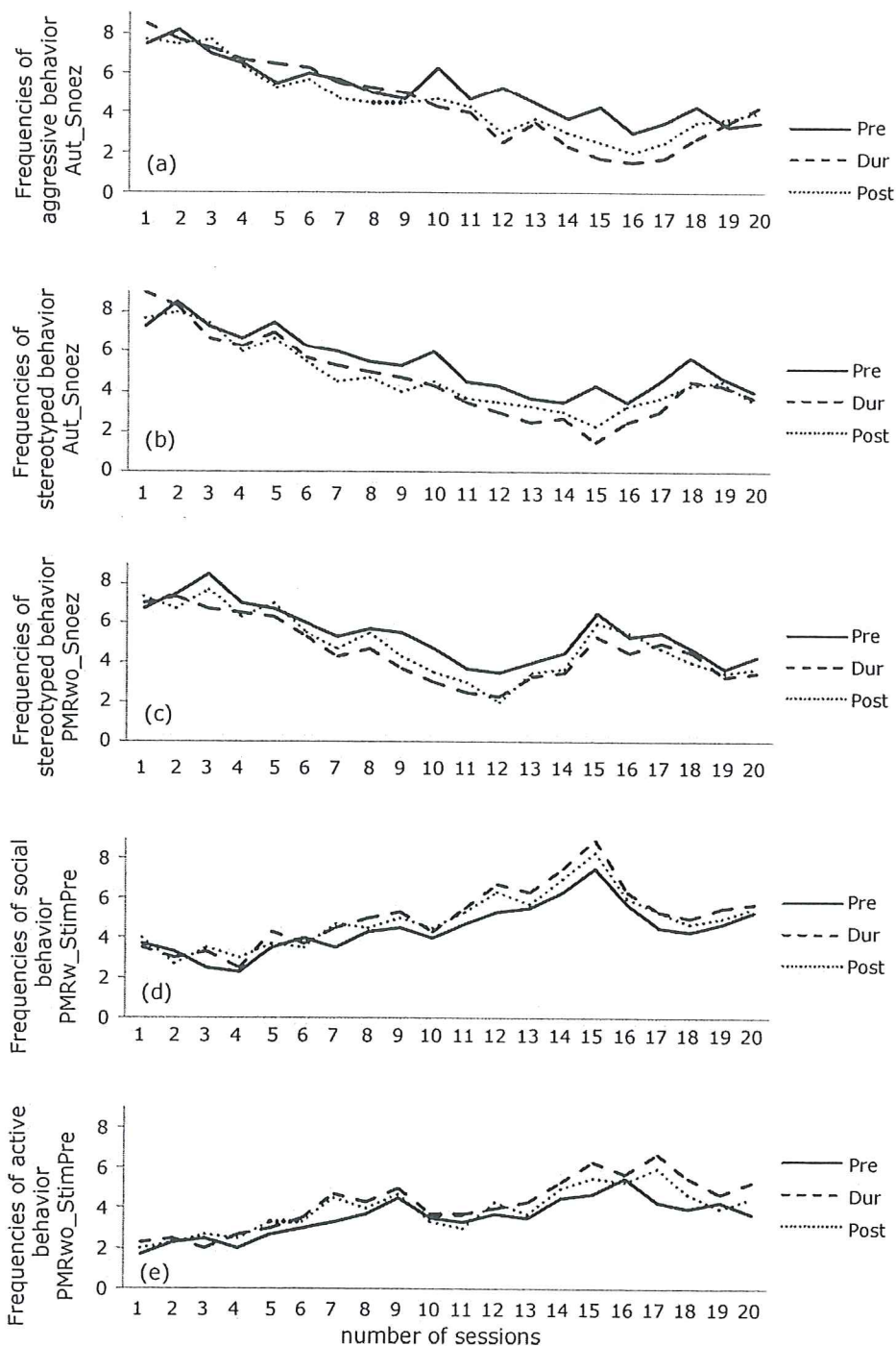


Fig. 5. (a) Trend analysis of pre-session, during and post-session of the aggressive behavior frequency for individuals with autism who attended the Snoezelen condition. (b) Trend analysis of pre-session, during and post-session of the stereotyped behavior frequency for individuals with autism who attended the Snoezelen condition. (c) Trend analysis of pre-session, during and post-session of the stereotyped behavior frequency for individuals with profound mental retardation without motor and linguistic abilities who attended the Snoezelen condition. (d) Trend analysis of pre-session, during and post-session of the social behaviors frequency for individuals with profound mental retardation with basic motor and linguistic abilities who attended the Stimulus Preference condition. (e) Trend analysis of pre-session, during and post-session of the active behaviors toward stimuli frequency for individuals with profound mental retardation without motor and linguistic abilities who attended the Stimulus Preference condition.

the simultaneous possibility to interact with preferred stimuli enhance the awareness of those individuals to be able to play and interact with the environment. These processes can be particularly supported by experiencing contact and receiving positive responses only when showing the appropriate social behavior either with the operator or using the sensory equipment in a positive and intentional manner.

A possible explanation for lacking improvements of individuals with autism in social behaviors might be that this group was frustrated in being exposed only to stimuli carried by the caregiver through the room, following a specific sequence with a fixed order of interaction. It was evident that this frustration was the result of being not completely free to choose at which moment and with which frequency to interact with specific stimuli.

To sum up, the Snoezelen approach was effective on disruptive behaviors of individual with profound mental retardation and autism, while the Stimulus Preference approach was specifically effective only for clients with profound mental retardation without autism. Since significant effects emerged only on single positive behavior such as glances towards stimuli and approaching behaviors, we may conclude that the exclusive use of preferred stimuli in the MSE allows improvements of such pro-social behaviors only for a specific group. In other words, the preferred stimulus assessment was applied in MSE based on the assumption that knowing one's preferences is important for developing social skills, without precluding to provide opportunities for choice (Cannella et al., 2005).

4. Limitations

Although we addressed in this current study several methodological shortcomings from previous studies, there are limitations left to be considered. First, our work has to be seen as observational study where variables interfere and are not thorough controlled. For instance, individuals with profound mental retardation occasionally show problem behaviors when entering the multi-sensory room. In accordance with Mckee et al. (2007), the sessions were following the time schedules of the Institute. This could have had the unexpected effect of reinforcing patients' negative behaviors. Furthermore, the fact that the room was available only at certain times could have caused frustration to the clients, decreasing the potential effect of following multi-sensory interventions.

Another critical point in our study is the lacking examination of quality and amount of language expressed by the clients during the multi-sensory room sessions. Although, we addressed this point by dividing the group regarding their language skills, we did not collect data on this ability. As verified in certain experiments (Baker et al., 1997; van Weert, van Dulmen, Spreeuwenberg, Ribbe, & Bensing, 2005) this ability should be considered when applying the multi-sensory interventions. Indeed has emerged that some patients' normal speech content and simple sentence structure were highly repetitive and continuous, and that communication was solely inducted by the insistence of the caregiver. Instead within the Snoezelen session, patients started to initiate a two-way interaction conversation about the various attributes of the room, meaning that these multi-sensory environments evoked enough interest to divert clients from usual speech patterns.

Lastly, medications may have affected individuals in the study by reducing disruptive behaviors and increasing active behaviors confounding the effectiveness of both multi-sensory interventions.

5. Conclusion

The current study emphasized the need to use an experimental evaluation in order to avoid false positives in reporting the effect of multi-sensory interventions. It was demonstrated that the effect of the Snoezelen is significant only for individuals in certain target behaviors. Moreover, the importance of applying a Stimulus Preference assessment in the multi-sensory room was verified. Individuals with profound mental retardation are often exposed to a various amount of stimulations that they are not able to select and consequently interact with due to limited cognitive skill. For this reason, we believe that a possible strategy to introduce our clients into the real world would be to start from simple interactions with stimuli and other individuals and to stimulate their-self to be interactive with the environment around. These effects provided by the Stimulus Preference condition might be linked specifically to the role of an individual's preference stimuli included in this MSE.

In addition, referring to our finding in the living room, social validity studies may also be conducted to determine how preference assessments can be modified to make their use more likely in applied settings. This social application is represented in our research by the fact that we measured these target behaviors in the multi-sensory rooms but essentially concentrated more attention on the disruptive and pro-social behaviors showed during the sessions recorded in the living room. This room represents, for the Institute's residents, the most important living setting to spend time during the day and to interact with other people. The multi-sensory room interventions enable caregivers to create situations, where clients can experience with all senses that could hardly be realized otherwise. In accord to Chan, Fung, Tong, and Thompson (2005) we believe that the multi-sensory environment prompts sensorial and emotional exploration by the persons through the constructed intervention. The atmosphere and the equipment of a multi-sensory intervention can have an activating effect which invites the participants to spontaneously explore the space around and seek for such stimulation. Martin, Gaffan, and Williams (1998) further suggested that the critical components of a 'therapeutic' multi-sensory intervention may be related to the nature of the interactions within the therapy. If the ward environment could contain key therapeutic variables in the multi-sensory therapy such as constant environment, increased physical contact, increased tolerance to physical contact as well as overall compliance relaxation and freedom from demands might help to reduce clients' problem behavior.

In addition, according with Singh et al. (2004) the maladaptive behaviors showed by individuals with severe and profound mental retardation such as aggression, self-injury and stereotypy, can constitute avoidance behaviors because they reduce escaping demands. Given this, maladaptive behavior might be expected to occur at lower levels during the Snoezelen

condition than in the skills training conditions; such as the Stimulus Preference condition of our study, where learning demands are essential.

It could be useful to understand the functional timing to administer these multi-sensory interventions. It would be interesting for the same purpose, to analyze and verify the same target behaviors after longer periods; for instance 2 months later, in order to establish the time when this intervention should be repeated in order to maintain the improvements acquired by the patients. Certainly, it will be important to maintain a low level of frequencies and intensity of disruptive behaviors and a relatively high level of positive behaviors in order to increase the quality of life for our clients and for their caregivers.

Still, in accordance with Cannella et al. (2005) it will be important to determine treatment fidelity over an extended period of time as well as administrators' perceptions of the costs and benefits of assessments and interventions which is considered an issue for this multi-sensory application due to relative high cost of implementation both in terms of human resources and in equipment.

Future studies should take into consideration to compare Snoezelen and Stimulus Preferences interventions to other empirically validated treatments, such as Differential Reinforcement of Other (DRO) or with Non-Contingent Reinforcement (NCR; Britton, Carr, Kellum, Dozier, & Weil, 2000). Furthermore, a careful analysis of the function that behaviors have for the client leads naturally to a highly specific individualized treatment plan, and a functional analysis is considered part of best practice for developing effective interventions for problematic behaviors (McCord & Neef, 2005).

Lastly, it would be useful to combine these multi-sensory therapies with a pharmacological therapy, especially with people with psychiatric disorders, evaluating the single and the combined effect of both therapies in order to figure out any possible therapeutic strategy for improving the behaviors of these target populations.

Although with some limitations, this study has provided an original evaluation in examining and in verifying the effect of slightly different multi-sensory environments on the behaviors of people with profound mental retardation; taking into account the essential concept of stimulating autonomy, active sensory seeking and social interaction for individuals who are supported in this way, to make their own choice and to find their own answers.

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