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THE EFFICACY OF THE "SNOEZELEN" IN THE MANAGEMENT OF CHILDREN WITH MENTAL RETARDATION WHO EXHIBIT MALADAPTIVE BEHAVIOURS

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Introduction

Children who have severe or moderate mental retardation may find their immediate environment chaotic, frightening, confusing and unstimulating (Hutchinson, 1994). They may respond to this situation with behavioural disturbances, which could be due to either sensory restriction or sensory overload (Lovaas *et al.*, 1987). According to Carr (1987), stereotypic self-stimulating behaviour (SSB) may be a means for a person to provide himself/herself with sensory stimulation. This behaviour is a characteristic maladaptive feature exhibited by many people who have mental retardation (King, 1993). SSB can be initiated by several different functions (Reisman, 1993). One explanation is that they often fill a sensory need (Iwasaki and Holm, 1989). Other reasons for these maladaptive behaviours could be a desire for social attention, or escape from aversive situations such as task demands (Lovaas *et al.*, 1987). The lack of appropriate stimulation, together with dependency upon others for involvement in daily activity can induce considerable stress in people with severe mental retardation (Hutchinson, 1994).

Reduction of SSB has proven to be resistant to treatment attempts particularly in children with severe mental retardation (Mason and Iwata, 1990). On the other hand, some investigators have

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found that when SSBs are suppressed, one can observe dramatic improvement in the child's appropriate behaviours (Holmes, 1993; Reisman, 1993). Smith (1986) suggested that providing more acceptable activities with sensory consequences, similar to those experienced during maladaptive behaviour, should be considered as part of a treatment regimen.

The stimulation provided should be very basic and non-threatening, and the environment must be suited to the child's needs. If the child finds the environment acceptable then he/she may be motivated to explore the surroundings (Kielhofner, 1985; Ruskin *et al.*, 1994).

In recent years a growing body of knowledge has accumulated showing that certain children with learning disabilities and children with severe mental retardation can benefit from sensory input (Ayres, 1979; Ayres and Tickle, 1980; Hutchinson, 1991; McClure and Hotz-Yotz, 1991; Sharpton and West, 1992). Nevertheless, no single method has been proven to be effective in reducing maladaptive behaviours and facilitating adaptive behaviours (Mason and Iwata, 1990). The use of sensory integration treatment in the population of people with severe mental retardation has been controversial (Arndt *et al.*, 1988). Mixed results have been reported in the literature for the effectiveness of sensory or vestibular stimulation in the reduction of self-injurious behaviour and SSB (Dave, 1992; Dura *et al.*, 1988; Holmes, 1993). If a clinical decision is made to use sensory stimulation or sensory integration, it is very important that the treatment effect is carefully monitored, since there are reports of subjects whose self-injurious and SSB have increased with sensory stimulation (Mason and Iwata, 1990). According to Ottenbacher and Altman (1984) multisensory treatment strategies, not sensory integration, have been found to be useful in decreasing self-stimulatory behaviours in children with severe mental retardation.

One of the treatment approaches available to this population is the provision of sensory stimulation by means of the "Snoezelen". This stimulation invokes environmental manipulation to effect internal change in the child, decreasing the maladaptive behaviour, reducing stress and producing more adaptive behaviour (King, 1993). The "Snoezelen" method of intervention was established in Holland in 1979 by Hulsegge and Verheul (Hulsegge and Verheul, 1987) and has spread to other countries of the world. The name "Snoezelen" is a combination of two Dutch words for doze and smell, seeking to capture the notion of sensations and emotion (Hutchinson, 1991). The "Snoezelen" concept believes that people with profound mental retardation interact with their environment primarily through the sensory and motor modalities of sight, hearing, touch, smell and taste (Cunningham *et al.*, 1991). The method involves the use of a specially adapted sensory room together with an "enabling" non-directive approach to therapy (Hutchinson, 1991). Hulsegge and Verheul (1987) recognise that this environment could motivate the child to investigate and explore the surroundings. The "Snoezelen" method attempts to provide the person with mental retardation a sense of well-being (Hulsegge and Verheul, 1897).

The purpose of the study was to determine the short-term efficacy of the

"Snoezelen" in the management of children with severe or moderate mental retardation (DSM-III-R, 1989) who exhibit maladaptive behaviours. We postulated three hypotheses: the first was that there would be a greater decrease in number and duration of SSBs when the children are in the "Snoezelen" as compared to the playroom; the second that there would be a greater increase in the number and duration of adaptive behaviours when the children are in the "Snoezelen" as compared to the playroom; and the third that there would be a greater change in ambulatory heart rate, from pre-treatment to treatment and from treatment to post-treatment, in the "Snoezelen" as compared to the playroom.

Method

Study design

The research, which was approved by the Human Subjects Committee of Lowenstein Hospital, utilised an experimental cross-over design (i.e. the same treatment approach was tested between the two groups) in order to determine whether the sequence of the two place settings affected the results of the study.

The "Snoezelen" is a partially lit room with special curtaining which does not allow the sunlight in. The walls and floor are padded with soft white mattresses. There are visual stimuli projecting coloured lights onto the walls of the room, moving in a predictable sequence. Sessions in the "Snoezelen" are child centred and consist of a flexible sequence. The treatment includes: deep pressure, tactile stimuli (including vibration), aromas and soft music. The Playroom with sensory integration equipment is a free play approach which is child initiated and provides both sensory and motor stimulation. The setting for this approach was in a regular room with no special lighting effects: neither music, aromas nor vibrating equipment.

The question arose, was there a difference when testing the children first in the "Snoezelen" and then in the "Playroom" (S $\rightarrow$P) or first in the "Playroom" and then in the "Snoezelen" (P $\rightarrow$S)? As no difference was found, the two groups were combined.

Subjects

Twenty children between 5 and 10 years of age (n = 20) with moderate or severe mental retardation and stereotypic behaviours participated in the study. All the subjects were from a sample institution, Beit Issie Shapiro, the location of the "Snoezelen" (see TABLE I for distribution of age, sex, degree of mental retardation and verbal communication skill).

The sample size was computed to detect a duration of at least three minutes difference in maladaptive behaviours between the two settings, with $\alpha = 0.05$, and $\beta = 0.20$ (i.e. a power of 80%). According to this calculation, a sample size of 16 was necessary. In order to allow for possible drop-outs, 20 children were included in the study.

Evaluation Procedure

The Behaviour Checklist (BC)

The BC was developed by the research team over a period of twelve

TABLE I
Distribution study subjects by age, sex, degree of mental retardation and verbal communication skill

Mean Age	7.5 years (range 5.0 years - 10.4 years)	
Sex ratio F : M	5 : 15	
Moderate Mental Retardation	8/20	(40%)
Severe Mental Retardation	12/20	(60%)
Verbal Communication	0/20	(0%)

TABLE II
Results of the inter-rater reliability tests expressed as Pearson's correlation coefficients

	Stereotypic Behaviour	Adaptive Behaviour
Rater 1 versus Rater 2	r = 0.976	r = 0.974
Rater 1 versus Professional	r = 0.972	r = 0.860
Rater 2 versus Professional	r = 0.966	r = 0.966

months prior to the start of the research (Appendix A), by reporting repertoires of behaviours while directly observing "Snoezelen" treatment sessions of approximately fifty children with moderate and severe mental retardation. It comprises 22 behaviours: 16 stereotypic behaviours such as rocking or hand flapping and 6 adaptive behaviours such as smiling or verbalising, all of which occurred during previous sessions in the "Snoezelen".

To ensure inter-rater reliability of the Behaviour Checklist, training was provided to three coders (two assistants and one professional) by the researcher. After a two month training period the coders were asked to view 10 videotapes, each of which was 20 minutes long (5 videotapes in the "Snoezelen" and 5 in the Playroom). The number of behaviours was recorded and the duration of the behaviours was measured by means of a stopwatch. The coders viewed the videotapes separately in order to prevent discussion of comparisons. The children taped were randomly chosen. Results of the inter-rater reliability are presented in TABLE II.

Measurement of ambulatory heart rate

A Holter (electrocardiogram monitor) was used to measure heart rate changes. A Holter consists of an electronic device, the size of a Walkman, with 4 electrodes. It was fitted securely into a vest which was adapted especially for this purpose. The 4 electrodes were attached to the child's chest. Each child was monitored for the prescribed period of time by the research team. The Holter tapes were analysed on computer by the research staff.

Procedures

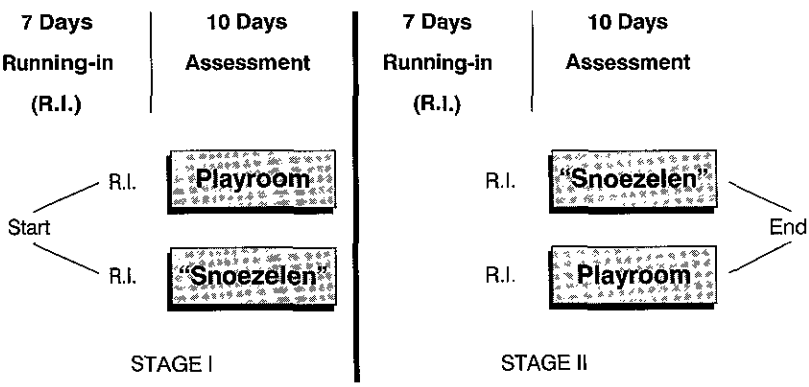
Prior to proceeding with the research, parents of the 20 children were shown the Holter, given an explanation of the study and asked to sign their consent to have their child participate in the research. The 20 subjects were randomly divided into 2 groups, Group A (n = 10) and Group B (n = 10). Group A commenced intervention in the "Snoezelen" during the first stage and crossed over for the second stage of intervention to the Playroom (S →P). Group B commenced intervention in the Playroom during the first stage and crossed over to the "Snoezelen" for the second stage of intervention (P →S). See FIGURE 1 for design of the study.

In order to allow the child to adjust to the new surroundings, each child was treated, depending on the group allocation, during two running-in periods, before commencement of each form of treatment. The running-in was carried out twice during one week for a twenty minute period each time. During this intervention the child wore a Holter (not monitoring) and the photographer, holding the video, was present in the treatment setting (no video was being filmed). This running-in period allowed the children time to adapt to the video and Holter so that when the actual monitoring began, the results would not be hampered by the child's discomfort in an uncertain situation.

After the running-in period, the monitoring period commenced. The children were assessed twice in each setting (four assessments in all; eight if the running-in periods are also included) over a further 20 day period. During these four assessments, the children were filmed with a video and their heart rate was recorded with a Holter monitor in each setting.

Due to considerable day-to-day inconsistency in the children's behaviour, it was decided to monitor each child twice and to take the average of the two for data analysis. During prior observation of "Snoezelen" interventions over a one year period, it was noted that a large percentage of children navigated towards the exit after approximately twenty

FIGURE 1
Design of the Study



minutes. Therefore, a treatment time of twenty minutes was chosen. During the study the Holter monitor was placed on each child for a period of one hour before intervention, during the twenty minute intervention, and for a further hour after intervention (in all eight times). Each child wore the Holter for a total of two hours and twenty minutes during each time period.

A twenty minute video of each child was filmed during each of the four interventions (two in each setting, four videos in all per child). The video was coded according to the Behaviour Checklist using a stopwatch.

Data Analysis

Pearson's correlation coefficients were used to evaluate inter-rater reliability. The paired t-test was applied to compare paired differences between baseline assessment and all post baseline assessments for quantitative parameters. Repeated measures analysis of variance (MANOVA) was used to compare baseline assessment with all post baseline assessments of ambulatory heart rate. Analysis of covariance (ANCOVA) was used to compare the groups controlling for age, sex and diagnosis. Two-way analysis of variance (ANOVA) was applied to examine the difference between the groups. All tests applied were two-tailed, and a value of $p > 0.05$ was considered statistically significant.

Results

One subject was excluded from the heart rate measurements because he exhibited an allergic reaction to the electrodes used to measure heart rate. Thus the total sample was 19 for the heart rate data and 20 for data of SSB and adaptive behaviours. Of the 20 children, fifteen were males and five females. Amongst the 15 males, 8 were children with severe mental retardation and 7 were children with moderate mental retardation. Amongst the 5 females, 4 were children with severe mental retardation and 1 with moderate mental retardation.

The two groups were compared after controlling for age, gender and diagnosis using ANCOVA and no significant differences were found. In this study it was hypothesised that there would be a significantly greater increase in number and duration of adaptive behaviour when the children are in the "Snoezelen" as compared to the playroom. To verify this, number and duration of adaptive behaviours in the two treatment settings were compared.

Behaviour

For both groups A (i.e. S $\rightarrow$P) and B (i.e. P $\rightarrow$S) the mean **number** of adaptive behaviours was significantly higher in the "Snoezelen" than in the "Playroom". In Group A it was 5.0 behaviours versus 2.7 behaviours, $p < 0.001$. In Group B it was 5.1 behaviours versus 4.0 behaviours, $p < 0.001$, by paired t-tests.

The difference in the mean **number** of adaptive behaviours was tested in the two groups (from the cross-over design). In the two way analysis of variance, no statistical difference was found ($F = 6.54$, $p = 0.081$). Since the difference was not statistically significant, the two groups were combined. For the combined

groups, the mean **number** of adaptive behaviours score results was significantly higher in the "Snoezelen" than in the "Playroom" (5.0 versus 3.3, delta = 1.7, F = 7.12, p <0.001). See the results in FIGURE 2.

For both groups A (i.e. S →P) and B (i.e. P →S) the **duration** of adaptive behaviours was significantly higher in the "Snoezelen" than in the "Playroom". In group A it was 19.1 minutes versus 9.4 minutes, p <0.001. In group B it was 17.1 minutes versus 10.2 minutes, p < 0.001, by paired t-tests.

The difference in the **duration** of adaptive behaviours was tested in the two groups (from the cross-over design). In the two-way analysis of variance no statistical difference was found (F = 0.39, p = 0.533). Since the difference was not statistically significant, the two groups were combined. For the combined groups, the **duration** of adaptive behaviours score results were significantly higher in the "Snoezelen" than in the "Playroom" (18.1 versus 9.8, delta = 8.3, F = 72.94, p = <0.001). See the results in TABLE III.

FIGURE 2
Mean number of adaptive behaviours by group and treatment setting

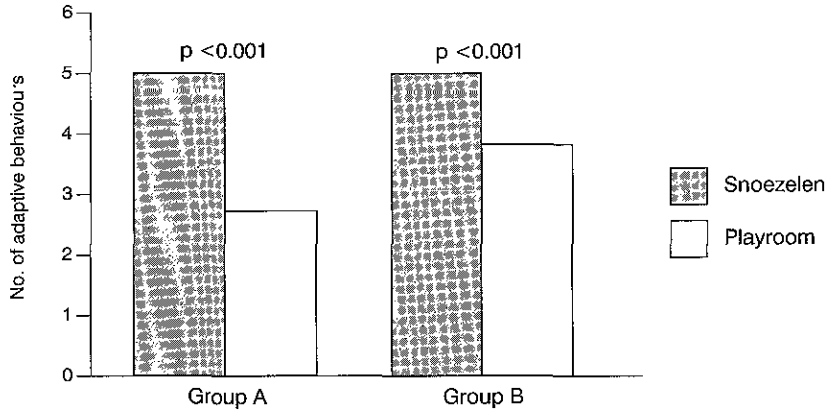


TABLE III
Duration (minutes) of adaptive behaviours by group and treatment setting

	Treatment Setting							
	Snoezelen			Playroom				
Group	n	Mean	S.D.	n	Mean	S.D.	Diff	p
A	10	19.1	1.8	10	9.4	5.4	9.7	<0.001
B	10	17.1	2.4	10	10.2	6.1	6.9	<0.001
Total	20	18.1	2.3	20	9.8	5.7	8.3	<0.001

Note:
1. A = treated first in the "Snoezelen", followed by the "Playroom".
2. B = treated first in the "Playroom", followed by the "Snoezelen".
3. The p-value relates to the paired t-test for the difference between the two settings.
4. The group effect was tested by two-way ANOVA and yielded F = 0.39, p = 0.533.
5. Overall setting effect F = 72.94, p <0.001.

For both groups A (i.e. S →P) and B (i.e. P →S) the mean **number** of maladaptive behaviours was significantly lower in the "Snoezelen" than in the "Playroom". In Group A it was 1.4 behaviours versus 4.7 behaviours, $p<0.001$. In Group B it was 2.0 behaviours versus 3.7 behaviours, $p<0.001$, by paired t-tests.

The difference in the mean **number** of maladaptive behaviours was tested in the two groups (from the cross-over design). In the two-way analysis of variance, no statistical difference was found ($F = 0.18$, $p = 0.669$). Since the difference was not statistically significant, the two groups were combined. For the combined groups, the mean **number** of maladaptive behaviours score results were significantly lower in the "Snoezelen" than in the "Playroom" (1.6 versus 4.2, delta = 2.6, $F = 38.12$, $p<0.001$). See results in FIGURE 3.

For both groups A (i.e. S →P) and B (i.e. P →S) the **duration** of maladaptive behaviours was significantly lower in the "Snoezelen" than in the "Playroom". In group A it was 1.0 minute versus 9.9 minutes, $p<0.001$. In group B, it was 2.9 minutes versus 7.7 minutes, $p<0.001$, by paired t-test.

The difference in the **duration** of maladaptive behaviours was tested in the two groups (from the cross-over design). In the two-way analysis of variance, no statistical difference was found ($F = 0.03$, $p = 0.862$). Since the difference was not statistically significant, the two groups were combined. For the combined groups, the **duration** of maladaptive behaviours score results was significantly lower in the "Snoezelen" than in the "Playroom" (2.0 versus 8.8, delta = 6.8, $F = 56.47$, $p<0.001$). See results in TABLE IV.

Heart Rate

In this study it was hypothesised that there would be greater changes in the rate and variation of ambulatory heart rate when in the "Snoezelen" than in the

FIGURE 3
Mean number of maladaptive behaviours by group and treatment setting

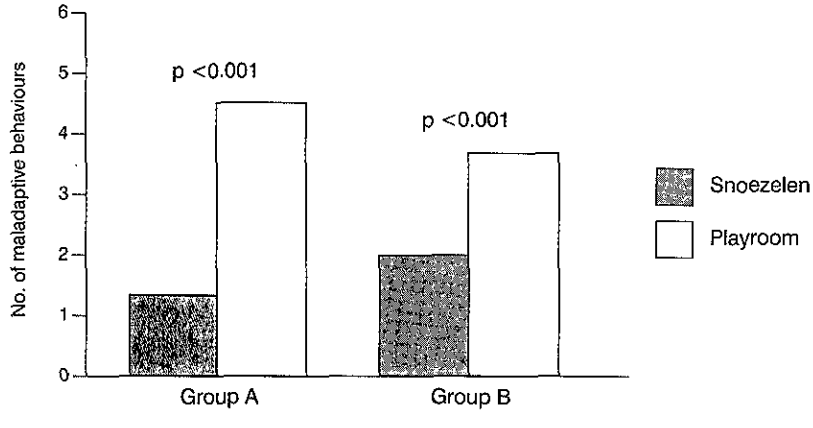


TABLE IV
Duration (minutes) of maladaptive behaviours by group in 20 children and treatment setting

	Treatment Setting							
	Snoezelen			Playroom				
Group	n	Mean	S.D.	n	Mean	S.D.	Diff	p
A	10	1.0	1.8	10	9.9	4.9	8.9	<0.001
B	10	2.9	2.4	10	7.7	5.8	4.8	<0.001
Total	20	20.0	2.3	20	8.8	5.4	6.3	<0.001

Note:
1. A = treated first in the "Snoezelen", followed by the "Playroom".
2. B = treated first in the "Playroom", followed by the "Snoezelen".
3. The p-value relates to the paired t-test for the difference between the two settings.
4. The group effect was tested by two-way ANOVA and yielded F = 0.03, p = 0.862.
5. Overall setting effect F = 56.47, p <0.001.

"Playroom". This was demonstrated by comparing the change in mean heart rate from the pre-treatment to the treatment phase, and from the treatment to the post-treatment phase in the two treatment settings. In addition, the change in variation from the pre-treatment to the treatment phase was compared as was that from the treatment to the post-treatment phase in the two treatment settings.

On inspection of the individual data it appeared that a change in heart rate occurred from pre-treatment to treatment and from treatment to post-treatment in the "Snoezelen" with each individual, suggesting that there was an influence of treatment on the heart rate. However, the direction of the change was not consistent, with some showing an increase in heart rate and others a decrease. In the initial statistical analysis (TABLE V), the mean change in heart rate from pre-treatment in the "Snoezelen" was not significantly different from that in the "Playroom" (p = 0.755). In each setting ("Snoezelen" and "Playroom") there was a significant increase in heart rate in post treatment when compared to treatment, (p = <0.001).

TABLE V
Mean ambulatory heart rate from pre-treatment to treatment and from treatment to post-treatment by period and treatment setting

	Treatment Setting					
	Snoezelen			Playroom		
Period	n	Mean	S.D.	n	Mean	S.D.
Pre-treatment	10	112.9	6.2	10	113.1	6.9
Treatment	10	113.0	11.40		112.3	7.84
Post-treatment	10	116.8	7.11	10	117.8	6.62

Absolute percentage of change in heart rate

We suggest that there could be two groups of children: one which was showing an increase in heart rate and one which was showing a decrease in the heart rate. When the results of the two groups were combined, those who showed a change in a positive direction apparently cancelled out those who showed change in a negative direction. It was therefore decided to analyse the results according to the change in absolute values (in other words, the total percentage of change in heart rate as compared to the previous period regardless of the direction of the change, TABLE VI). The results of this analysis showed that the absolute percentage change in heart rate during "Snoezelen" from pre-treatment to treatment and from treatment to post-treatment were significantly higher in the group that was in the "Snoezelen" (7.23 versus 5.49, $p = 0.0116$), and in treatment to post treatment were (7.68 versus 5.58, $p = 0.0019$).

Discussion

This study demonstrates by means of behavioural and physiological correlates that the "Snoezelen" has a positive short-term effect on children with mental retardation. This is evident from the significant decrease in maladaptive behaviours and from the significant increase in adaptive behaviours that were seen in the "Snoezelen" during treatment. This is also evident from the absolute changes in heart rate during "Snoezelen" from pre-treatment to treatment and from treatment to post-treatment. These changes were higher than the absolute changes in the "Playroom" treatment.

Maladaptive Behaviours

Researchers in the field of mental retardation are accustomed to viewing SSB as behaviourally driven (Reisman, 1993). Ayres (1979) suggested that these behaviours are sensory driven. A major

TABLE VI
Absolute percentage of change in ambulatory heart rate relative to pre-treatment by period and setting

	Treatment Setting								
	Snoezelen			Playroom					
Change	n	Mean	Std	n	Mean	Std	F	df	p
From pre-treatment to treatment	10	7.23	6.76	10	5.49	4.69	6.54	1.37	0.011
From treatment to post-treatment	10	7.68	5.58	10	5.58	4.87	10.06	1.37	0.001

assumption underlying this study was that the "Snoezelen", being an adapted sensory environment, modified incoming sensory stimuli and possibly has some form of impact on the nervous system. Many different kinds of SSBs were noted amongst the children prior to the study. These included: hand-flapping, hand-wringing, spitting and rocking. In the study a reduction of these SSBs was seen in the "Snoezelen", whereas this did not occur in the "Playroom".

In making a contrast between the treatment in the "Snoezelen" and that of the "Playroom", important points are noted: In the "Snoezelen" the stimuli always include a harmonious combination of **all** the senses. The child receives vestibular, tactile and proprioceptive stimuli at the same time as he/she is smelling aromas, seeing contrasting visual stimuli and hearing relaxing music. To the best of our knowledge in no other studies has the combined use of all the senses been investigated. A study investigating paired auditory and vestibular stimuli with severely retarded adults indicated that significant gains were noted due to the pairing (James *et al.*, 1985). The eighth cranial nerve (vestibulocochlear) functions as a dual neural pathway for the auditory and the vestibular systems (Ayres, 1972). This close neurophysiological relationship between the auditory and the vestibular stimuli suggests the importance of intersensory stimulation (Ayres, 1972). Rincover *et al.* (1979) offered toys with proprioceptive, visual and auditory feedback to children with mental retardation in order to increase appropriate toy play and decrease SSB. In the "Playroom" the stimuli are either vestibular, tactile or proprioceptive.

In the "Snoezelen" the stimuli are **constant, predictable and long-lasting.** This seems to give the child the necessary time to absorb the surroundings. In the "Playroom" the stimuli change without prediction. The nature of the stimulation in the "Snoezelen" is soft with an overriding white colour. This is very different from the multicoloured, multitextured "Playroom". Some of the stimuli in the "Snoezelen" are very basic, such as for example: olfactory stimulation. This is not present in the "Playroom". Whereas the type of stimuli in the "Playroom" is more demanding, like vestibular stimulation, the stimuli in the "Snoezelen" are **not demanding** as they are designed for children who function at a low level and very little is demanded of the child in order for him/her to feel success. The "Snoezelen" is built in such a way that **no harm** can come to the subject. The room is soft and the equipment is secured, and therefore the person feels a sense of security. The importance of music in the "Snoezelen" must be emphasised. Investigators examining the effects of music have claimed both significant behavioural (Logan and Roberts, 1984) and physiological changes in galvanic skin response, muscle tone, heart rate and blood pressure (Hanser, 1985). In the "Playroom", sounds are ambient and not controlled. No music is present. Lighting in the "Snoezelen" is half dimmed and is relaxing, whereas the "Playroom" has neon lighting. Research carried out by Frank *et al.*, (1991) on the light and sound environment of neonatal intensive care units, supports this point. Their study shows the negative effects of harsh neon lighting and disturbing ambient sounds and indicates a variety of measures to control these in neonatal care. In an environment such as the "Snoezelen", where the stimuli are being given at the correct "amplitude" and the person is feeling

safe, he/she does then not "need" the maladative behaviours. These behaviours decrease in frequency and are replaced by adaptive behaviours. It is these adaptive behaviours which pave the way for the initiation of learning skills.

Absolute change in ambulatory heart rate

Heart rate change is one of the commonest physiological measures of stress (Hanser, 1985). Very few researchers have used this measure with children who are severely mentally retarded. Therefore it is difficult to compare our results with other studies. It was interesting to note that, unrelated to the treatment, most of the children exhibited a very high ambulatory heart rate (usually around 120-130 bpm) when normal heart rate is approximately 60-100 bpm. This finding in children who are mentally retarded may have important implications and requires further study. When observing the children's behaviour in the classroom they often appear very stressed and this may explain their elevated heart rate.

Changes in heart rate could occur due to the new experience of wearing the Holter equipment. However, this was controlled by carrying out a running-in period which allowed the children time to adjust to the equipment. Thus the changes observed during the study are most likely due to the treatment effects. One child did show a negative reaction to the Holter and was therefore excluded from this measure of the study. Furthermore, in a number of children there was a decrease in heart rate when they were taken out of their classrooms and were on their way to the treatment settings. This finding is supported by research on heart rate responsivity in childhood by Weber *et al.* (1994), where children's heart rate decelerated in anticipation of significant events. Similarly, almost all the children, whether exhibiting an increase or decrease in heart rate during the treatment, exhibited an increase in heart rate on leaving the treatment setting. This finding may be an indication of the child's dissatisfaction at having to leave the treatment setting, or may be explained by their difficulties in handling change. Dissatisfaction or inflexibility could cause feelings of stress. Barr and Kiernan (1993) state that heart rate increases as a result of stress.

One of our original hypotheses was that there would be a greater decrease in ambulatory heart rate in the "Snoezelen" due to a relaxation effect. A later hypothesis was that children who were usually passive would become more active (showing an increased heart rate) in the "Snoezelen" and that the hyperactive children would become calmer (showing a decrease in heart rate.) The results of the study show that the absolute percentage of changes in heart rate during "Snoezelen" from pre-treatment to treatment and from treatment to post-treatment were higher than the absolute changes in the "Playroom" treatment. In analysing the heart rate of each individual it was noted that in some of the children the heart rate increased and in others it decreased. This may indicate that the "Snoezelen" is not a simple stress response but that it seems to have a regulatory effect on the children's heart rate and on their behaviour. The literature, for example Dave (1992), indicates the paradoxical or regulatory effect of

certain stimuli. He suggests that stereotypic rocking can provide an increased level of stimulation for those individuals unable to process a sufficient amount of environmental stimuli or it can provide a general inhibitory or relaxing effect blocking out an overstimulating environment.

The "Snoezelen" has thus been found effective as a therapeutic tool during treatment. Based on these findings, follow-up research needs to be carried out on the use of the "Snoezelen" with children who exhibit developmental difficulties like autism, cerebral palsy, attention deficit disorder and others. It may also have applications in patients with Alzheimer and Senile Dementia - as populations they may benefit from an environment adapted and modified to their needs. The next stage of research is to evaluate whether the improved effects of "Snoezelen" continue after treatment has terminated. It would be of use for the further development of "Snoezelen" to know whether certain stimuli are more effective than others or whether it is the integration of all the stimuli that is so vital.

Appendix A

Behaviour Checklist

A. Stereotypic Behaviour

1. flaps hands ☐
2. twirls, twiddles, rings ☐
3. claps hands ☐
4. hands on ears ☐
5. eats, sucks clothes ☐
6. mouths objects and fingers ☐
7. spits ☐
8. makes peculiar sounds ☐
9. rocks ☐
10. throws objects ☐
11. bangs ☐
12. pulls faces ☐
13. flaps legs ☐
14. tickles feet ☐
15. screams ☐
16. masturbates ☐

Length of time ☐

No. of behaviours ☐

B. Adaptive Behaviours

17. looks in mirror ☐
18. explores, investigates ☐
19. initiates contact ☐
20. chooses activity ☐
21. smiles, laughs ☐
22. verbalises ☐

Length of time ☐

No. of behaviours ☐

Behaviour Checklist Scoring Guide

Stereotypic self-stimulating behaviours

Items	Scoring Criteria
Flaps hands	Continuous rapid waving of hand
Twirls twiddles or wrings	Turns self around or turns objects
Claps hands	Claps hands in any manner
Puts hands on ears	Places hands over or fingers in ears
Sucks clothes	Bites, chews or tugs at clothes leaving them wet
Mouths objects or fingers	Places any objects or fingers in mouth
Spits	Sprays spit constantly
Makes peculiar sounds	Vocalises sounds
Rocks	Continuously rocks forward and backward
Throws objects	Aimlessly throws any object that is held
Bangs	Bangs head/hand/hands on objects
Pulls face	Contorts face
Flaps legs	Moves both legs in waiving movement while sitting
Tickles feet	Tickles own feet constantly
Screams	Screams for no noticeable reason
Masturbates	Masturbates or exposes body parts in public

Adaptive Behaviours

Looks in mirror	Looks into own reflection in the mirror
Explores, investigates	Shows interest by looking, touching, tasting, smelling object
Initiates contact	Tries to communicate with therapist by looking, touching or any other means of attracting attention
Chooses activity	Makes own choice as to what activity will be engaged in
Smiles, laughs	Smiles or laughs
Verbalises	Tries to make contact by babbling or talking

Summary

Statement of the problem: The "Snoezelen", a method of treatment which takes place in a specially adapted harmonious sensory environment, is increasingly being used in the treatment of children who are mentally retarded. Although therapists are impressed by the results achieved, empirical data demonstrating the effectiveness of this treatment method are lacking. In the present study, we investigated the effectiveness of this method in inhibiting maladaptive behaviour such as stereotypic self-stimulating behaviour (SSB), and facilitating adaptive behaviour.

Method: The study was an open, controlled, cross-over design. Twenty children (5-10 years old) moderately or severely developmentally disabled who displayed stereotypic behaviours, received treatment in both the "Snoezelen" (study treatment) and "Playroom" (control treatment) over 4 time periods. During treatment their behaviour was recorded by trained observers, both in writing and by means of a video camera, and their ambulatory heart rate was monitored by means of a portable electrocardiogram recorder (Holter).

Results: Children in the "Snoezelen" showed a significantly greater decrease

in the mean number of stereotypic behaviours (1.6 in the "Snoezelen" versus 4.2 in the "Playroom", $p < 0.001$), a significantly greater increase in adaptive behaviours (5.0 in the "Snoezelen versus 3.3 in the "Playroom", $p < 0.001$), and a significantly greater mean absolute percentage change in heart rate in the "Snoezelen".

Conclusion: The "Snoezelen" is an effective therapeutic setting for short-term reduction of SSB and facilitation of adaptive behaviours in children with moderate to severe mental retardation. Long-term effects need to be studied.

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References

American Psychiatric Association. (1989). *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R). (3rd ed. rev.)* Washington, DC: APA.

Arndt, R. E., MacLean, W. E. and Baumeister, A. A. (1988). Critique of sensory integration therapy and its application to mental retardation. *American Journal of Mental Retardation*, 92, 401-411.

Ayres, J. A. (1972). *Sensory integration and learning disorders.* Los Angeles: Western Psychological Services.

Ayres, J. A. (1979). *Sensory integration and the child.* Los Angeles: Western Psychological Services.

Ayres, J. A. and Tickle, L. S. (1980). Hyperresponsivity to touch and vestibular stimuli as a predictor of positive response to sensory integration procedures by autistic children. *American Journal of Occupational Therapy*, 34, 375-381.

Barr, M. L. and Kiernan, J. A. (1993). *The Human Nervous System. An Anatomical Viewpoint* (6th ed.). Philadelphia: J. B. Lippincott Company.

Carr, E. G. (1987). The motivation of self-injurious behaviour: A review of some hypotheses. *Psychological Bulletin*, 84, 800-816.

Cunningham, C. C., Hutchinson, R. and Kewin, J. (1991). Recreation for people with profound and severe learning disabilities: The Whittington Hall "Snoezelen" project. In: Hutchinson, R. (Ed.). *The Whittington Hall "Snoezelen" project: a report from inception to the end of the year.* Chesterfield: North Derbyshire Health Authority.

Dave, C. A. (1992). Effects of linear vestibular stimulation on body-rocking behaviour in adults with profound mental retardation. *American Journal of Occupational Therapy*, 46, 910-915.

Dura, J. R., Mulnick, J. A. and Hammer, D. (1988). Rapid clinical evaluation of sensory integrative therapy on self-injurious behaviour. *Mental Retardation*, 26, 83-87.

Frank, A., Maurer, P. and Shepherd, J. (1991). Light and sound environment: A survey of neonatal intensive care units. *Physical & Occupational Therapy in Paediatrics*, 11, 27-43.

Hanser, S. B. (1985). Music therapy and stress reduction research. *Journal of Music Therapy*, XXII, 193 - 206.

Holmes, T. L. (1993). Sensory integration or sensory stimulation for clients with mental retardation. *Sensory Integration Quaterly*, Fall, 8.

Hulsegge, J. and Verheul, A. (1987). *"Snoezelen" Another World.* England: Rompa.

Hutchinson, R. (1991). *Sensory Environments.* Whittington Hall Hospital. Chesterfield: North Derbyshire Health Authority.

Hutchinson, R. (1994). Sensory environments and experiences - some ideas for application. In: R. Hutchinson and J. Kewin (Eds.). *Sensations and disability.* London: Rompa.

Iwasaki, K. and Holm, M. B. (1989). Sensory treatment for the reduction of stereotypic behaviours in persons with severe multiple disabilities. *The Occupational Therapy Journal of Research,* 9, 170-182.

James, M. R., Weaver, A. L., Clemens, P. D. and Plaster, G. A. (1985). Influence of paired auditory and vestibular stimulation on levels of motor skill development in a mentally retarded population. *Journal of Music Therapy,* XXII (1), 22-34.

Kielhofner, G. (1985). *A model of human occupation: Theory and application.* Baltimore, MD: Williams & Wilkins.

King, B. H. (1993). Self-injury by people with mental retardation: a compulsive behaviour hypothesis. *American Journal of Mental Retardation,* 98, 93-112.

Logan, T. G. and Roberts, A. R. (1984). The effects of different types of relaxation music on tension level. *Journal of Music Therapy,* XXI, 177-183.

Lovass, I., Newsom, C. and Hickman, C. (1987). Self-stimulatory behaviour and perceptual reinforcement. *Journal of Applied Behaviour Analysis,* 20, 45-68.

Mason, S. A and Iwata, B. A. (1990). Artifactual evidence of sensory integrative therapy on self-injurious behaviour. *Journal of Applied Behaviour Analysis,* 23, 361-370

McClure, M. K. and Holtz-Yotz, M. (1991). Case report - The effects of sensory stimulatory treatment on an autistic child. *American Journal of Occupational Therapy,* 45, 1138-1142.

Ottenbacher, K. and Altman, A. (1984). Effects of vibratory, edible and social reinforcement on performance of institutionalized mentally retarded individuals. *American Journal of Mental Deficiency,* 89, 201-204.

Reisman, J. (1993). Using a sensory integrative approach to treat self-injurious behaviour in an adult with profound mental retardation. *American Journal of Occupational Therapy,* 47, 403-411.

Rincover, A., Cook, R., Peoples, A. and Packard, D. (1979). Sensory extinction and sensory reinforcement principles for planning multiple adaptive behaviour change. *Journal of Applied Behaviour Analysis,* 12, 221-233.

Ruskin, E. M., Mundy, P., Kasari, C. and Sigman, M. (1994). Object mastery motivation of children with Downs Syndrome. *American Journal on Mental Retardation,* 98, 499-509.

Sharpton, W. R. and West, M. D. (1992). Profound and severe retardation. In: P. J. McLaughlin and P. Wehman (Eds.). *Developmental disabilities: A handbook for best practices.* Stoneham, MA: Butterworth-Heinemann.

Smith, M. D. (1986). Use of similar sensory stimuli in the community-based treatment of self-stimulatory behaviour in an adult disabled by autism. *Journal of Behaviour Therapy and Experimental Psychiatry,* 17, 121-125.

Weber, E. J. M., Van Der Molen, M. W. and Molenaar, P. C. M. (1994) Heart rate and sustained attention during childhood: age changes in anticipatory heart rate, primary bradycardia, and respiratory sinus arrhythmia. *Psychophysiology,* 31, 164-174.