

Snoezelen® as Multisensory Stimulation to Promote Healthy Ageing

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Summary

Worldwide the population of elderly people is increasing rapidly and with this demographic change, interest for their societal, scientific and economic value rises. The experienced older brain contains a great deal of crystallized intelligence, so measures to keep it vital are of significant importance. A harmless non-pharmacologic intervention known from therapeutic application in different pathologies is multisensory stimulation, which stimulates the nervous system through the different senses and creates alertness. Developed as Snoezelen® therapy, patients spend time in a specific room full of different visual, tactile, olfactory, auditory and gustatory stimuli. In this study, I seek to find key aspects of beneficial effects caused by Snoezelen® therapy applied in different pathologic conditions, which reveal possible implications for applying this therapy to healthy ageing individuals undergoing normal cognitive decline. Most applied in care institutions for people with dementia, Snoezelen® sessions increase happiness, interest, and calmness while reducing agitation. The effects increase when a person is institutionalized, a living environment normally perceived as impoverished, relative to living among family members. Beneficial effects on mood and behaviour are highest when a person is in discomfort and experiences high agitational levels, as regularly seen in people with Rett Syndrome or Intellectual Disability Disorders. Studies with brain-injured patients revealed Snoezelen® therapy affects the central nervous system by inducing a slowing of EEG oscillatory activity and a decrease in EEG complexity and irregularity, stimulating a state of relaxation. Any positive effects so far measured have been short-term and decreased over time. This thesis reveals the difficulty of drawing an overall conclusion in relation to the most beneficial effects of multisensory stimulation used in Snoezelen® therapy. More high quality detailed quantitative research is recommended, especially focusing on amplifying a substantial collection of long-term evidence-based practice. If well-grounded evidence for the so far seemingly beneficial effects on mood and behaviour for institutionalized older people were to be gathered, Snoezelen® therapy would implicate an easy and harmless non-pharmacological tool for maintaining a healthy ageing vital brain.

Introduction

Worldwide the population of elderly people is increasing rapidly. By the end of 2050 the number of elderly people will be over 2 billion (United Nations, 2015). The concept of ageing tends to go hand in hand with the overall idea of decay, old people are becoming less useful to society as their physical and cognitive decline impedes their abilities. An example for this are ageing employees who get less chances for work, as they are considered to have more difficulty learning. But with the continuously growing 'grey' population, interest for their societal, scientific and economical value rises as well. It would be a waste to ignore these people's abilities, since they own a valuable collection of cultural history gathered over the years. Old people could be called social experience experts as they own a great deal of crystallized intelligence (De Coninck, 2008).

With this view on ageing as a positive factor for our changing society, comes the need for measures to keep the older brain vital. The older brain is still very plastic. Brain development does not stop once we reach our thirties, it undergoes a reorganization from middle-age. During aging, changes in cognitive skills occur. These changes are positive and help with keeping the older brain vital. Cognitive skills undergo a new structural and functional description. Most functional changes occur in the so called ageing hot spots, an important one being the shift from subregion 1 to subregion 2 in the hippocampus. Subregion 1 receives input from other parts of the brain and sends it to subregion 2, where the balance is made between known facts or needing to start up a new learning process. With ageing, subregion 1 loses neurons and synapses causing a gradual loss of function, while subregion 2 enhances in strength. Therefore the brain makes more use of previously stored information and less of new stimuli and needs a stronger stimulus to start the learning process. The older brain needs an extra push to change from resting mode to alertness (Van der Zee, 2012).

With ageing, the senses take more time processing stimuli, which linger in the nervous system. This process is called 'stimulus persistence'. As a result, older people have more difficulty suppressing irrelevant information. The stimulation process takes more time and effort (De Coninck, 2008). The functioning of the observational power cannot be disconnected from the functioning of the nervous system. A disturbed observation can affect the level of alertness. Being able to maintain the alertness is the best way to handle incentives correctly (Kranowitz, 2005). Cognitive decline associated with ageing is caused by deterioration of the neural network, characterized by inflammatory, vascular, metabolic and oxidative changes. Detrimental to these pathophysiological changes in the neural network is a sedentary lifestyle. When older persons (both healthy and demented) stimulate their cognition and physique on a regular basis, these damages can be delayed (De Oliveira et al., 2014). With this in mind, sensory stimuli could be seen as the food of the brain. Protective measures and social isolation can lead to its malnutrition.

Ample research on sensory stimulation has been done since the last five decades, which has led to the important development of Snoezelen® therapy in the late 1970s. This multisensory

therapeutic activity, usually taking place in a specialized room enriched with all kinds of stimuli (Fig. 1), is aimed at engaging the five primary senses of sight, hearing, touch, taste and smell (Anderson et al., 2011). The term Snoezelen® is a contraction of the Dutch verbs “snuffelen” (to seek and explore) and “doezelen” (to doze off or relax). The first Snoezelen® room was opened in 1987 in Whittington Hall (UK), a large institution dedicated to serving adults with intellectual disabilities. Snoezelen® has since experienced a fast growth, and can now be found in over 40 countries around the world in a multitude of settings (schools, hospitals, long term care facilities, dementia care units, mental health facilities, churches, community centers, rehabilitation facilities, and in many households). Snoezelen® can aid learning and development, help to relax an agitated person or stimulate and raise alertness levels of a person with sensory processing disorders. It has proven to be useful in helping to improve the quality of life (Rompa Ltd, 2017).



Figure 1. Snoezelen® room in Aptus Treatment Centre, Toronto.

Since the invention of Snoezelen®, the effects of this multisensory stimulation therapy has been tested in cases involving people with many different pathologies. The most extensive application has been for elderly suffering from different stages of dementia, but also Alzheimer’s patients, people with Huntington’s Disease, Rett Syndrome, intellectual disability disorders, psychiatric patients and people suffering from brain injuries and stroke have participated in studies with multisensory stimulating environments (MSSE). Also childbirth has taken place in a Snoezelen® room to test its possible benefits. The specific effect the therapy causes can be different for each pathology, as well as the strength and durability. A typical overall effect of Snoezelen® therapy seems to be creating calmness and relaxation.

Since these features have enormous benefits on healthy ageing (Román et al., 2017), multisensory stimulation could provide a strong positive influence on the course of normal physical and cognitive decline. Snoezelen® therapy could therefore not only be an intervention with beneficial effects for people with physical and/or mental diseases, but also for the healthy elderly experiencing normal ageing. In this study, I seek to find key aspects of beneficial effects caused by Snoezelen® therapy applied in different pathologic conditions, which reveal possible implications for applying this therapy to healthy ageing individuals undergoing normal cognitive decline.

Results

Dementia

Research on multisensory stimulating therapies using the Snoezelen® technique has been conducted for many different pathologies, the most abundant being dementia. As one of the first reviews talks about one of the earliest studies performed by Moffat et al. in 1993, Snoezelen® has a promising effect on mood and behaviour (Finnema, Dröes, Ribbe & Van Tilburg, 2000). The study reported statistically significant increases in patient levels of happiness, interest, and calmness (Moffat et al., 1993). Also found were significant reductions of fear and sadness (Reddon, Hoang, Sehgal & Marjanovic, 2004). The results gathered through different studies have not changed much over time. A more recent review performed by Abraha et al. in 2017, describes similar change in behaviour, measured by Interact. Two behavioural items of this test kept showing significant effects: enjoying oneself and bored/inactive (Baker et al., 2003; Van Weert et al., 2005). One study also showed significant improvement in one mood item of Interact during sessions, as the group undergoing MSSE therapy was happier and more content than the control group (Van Weert et al., 2005). Another review reports half of the seven studies identified reported significant effects for improved behaviour, mainly in reduced agitation (Strøm, Ytrehus & Grov, 2016). None of the studies reported long term treatment effects, as none of the improvements continued after the Snoezelen® session to any significant degree.

Alzheimer's Disease

Many studies performed on patients with dementia also mention having tested the Snoezelen® therapy on patients with Alzheimer's Disease (AD). An evidence-based review on the effectiveness of interventions designed to modify and maintain perceptual abilities in these groups of patients reports about four studies involving Snoezelen® (Letts et al., 2011). Beneficial effects found were reduction in agitation measured by the Agitation Behaviour Mapping Instrument (ABMI), the Cohen-Mansfield Agitation Inventory (CMAI) and heart rate (Van Diepen et al., 2002), short-term benefits in mood and behaviour measured by ABMI, Interact and heart rate (Baillon et al., 2004) and an increase in speech during the intervention (Baker et al., 1997). All benefits were short-lived and deteriorated after the intervention. None of the studies reported statistical significance. The review concluded limited evidence existing for the effectiveness of Snoezelen® on occupational performance outcomes. Similar results were found by a more general review on the effectiveness of environment-based interventions (Padilla, 2011). One review examined by Padilla found some modest effects for depressed, aggressive, and apathetic behaviors of people with dementia, as measured by Interact, REHAB and Behaviour and Mood Disturbance (BMD) Scale (Verkaik, Van Weert & Francke, 2005). Yet another study found no evidence of the efficacy of Snoezelen® on mood or behavior (Chung, 2002). Also Padilla's review reported about finding some positive effects during intervention related to communication. Any significant long-term effects were not reported. Ward-Smith et al. performed a study with multisensory environment-based intervention in a MSSE-room on residents with AD of the special care unit of an extended care facility (Ward-Smith, Llanque & Curran, 2009). They concluded that the intervention appeared to decrease psychotic behaviours

(measured by Psychotic Behavior Assessment Record (BPAR), while the patients were receiving antipsychotic medication. None of the results showed significance or long-term effects.

Huntington's Disease

While commonly thought of as a motor disorder, Huntington's Disease (HD) shows many cognitive symptoms before motor deficits appear (Stout et al., 2011). HD is considered a subcortical form of dementia, characterized by a wide variety of disorders of movement, cognition and/or behaviour (Kirkwood, Su, Conneally & Foroud, 2001). HD patients often show neuropsychiatric symptoms like irritability, depression, anxiety and apathy (Estévez-Fraga, Avilés Olmos, Mañanes Barral & López-Sendón Moreno, 2016). Since relaxation techniques can provide beneficial calming effects on these symptoms, Leng et al. used the multisensory environmental (MSE) technique on people with HD. They observed significant short-term improvements in mood and behaviour during intervention, as measured by Interact, Rehabilitation Evaluation - Hall and Baker (REHAB) and BMD Scale assessments. No long-term effects were measured as the improvements were not sustained between sessions (Leng et al., 2003).

Rett Syndrome

Another group of people that benefit well from relaxing techniques are people with Rett Syndrome (RS) (Lotan & Shapiro, 2005). This neurological disorder caused by an X-linked dominant mutation is characterized by a variety of physical and perceptual disabilities. Patients, mostly young children, experience vast physical challenges and extreme agitation and discomfort, also due to unpleasant, invasive but highly inevitable physical therapy (Lotan, 2006). In search for a novel intervention environment providing a calmer experience, Lotan tested the Snoezelen® room with three case studies. One participant's agitation was diminished strongly after three months of intervention, behaving more relaxed throughout the day with a complete abolishment of tantrums (Fig. 2). The study shows promising results for most of the major difficulties of individuals with RS, as not only mood but also severe motor functions were improved by using the controlled multisensory environment.

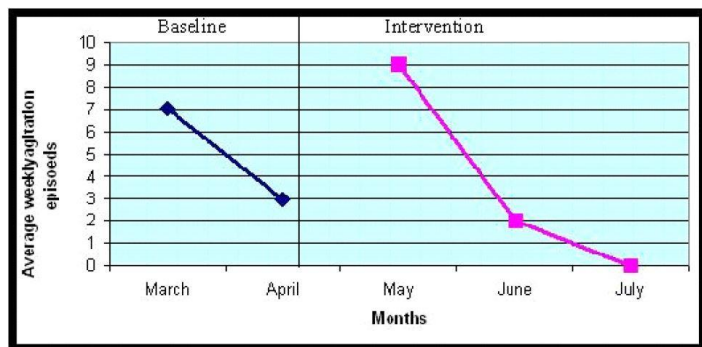


Figure 2.
Changes in agitation behaviour due to Snoezelen® therapy.
Note. Reprinted from "Management of rett syndrome in the controlled multisensory (snoezelen) environment. A review with three case stories", by Lotan, M., 2006, *TheScientificWorldJournal*, 6, p. 791-807.

Intellectual Disability Disorders

A large group of disorders, including those in the autism spectrum, characterized by social, cognitive, and adaptive skill deficits are the Intellectual Disabilities (IDD). Challenging behaviors, anxiety, depression and schizophrenia are common problems for individuals with IDD (Matson & Shoemaker, 2009). For severe IDD patients, they often result in aggression and self-injury (McKee, Harris, Rice & Silk, 2007). The soothing effect of Snoezelen® therapy provides an answer to these problems which are often difficult to treat (Fava & Strauss, 2010; Lotan & Gold, 2009). A meta-analysis performed by Lotan & Gold found promising results in significant and large effect size in reducing adaptive behaviours in individuals with IDD, when Snoezelen® was applied as an individual intervention. Similar results were obtained by Fava & Strauss, who showed that Snoezelen® intervention had a positive effect in decreasing the frequency of disruptive behaviour in autism patients during session, but also post-session (Fig. 3).

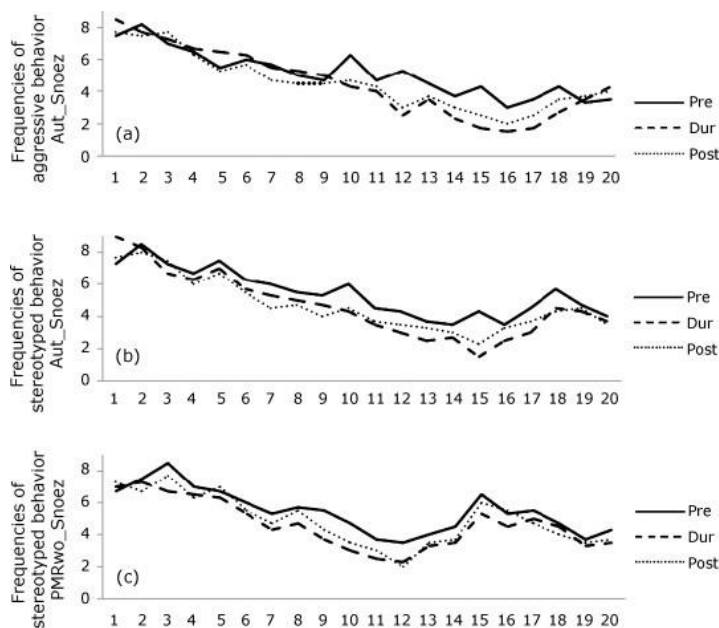


Figure 3.

Trend analysis of 20 sessions' pre-session, during and post-session measured (a) aggressive behavior frequency for individuals with autism (b) stereotyped behavior frequency for individuals with autism and (c) stereotyped behavior frequency for individuals with profound mental retardation without motor and linguistic abilities who attended the Snoezelen® sessions.

Note. Reprinted from "Multi-sensory rooms - comparing effects of the snoezelen and the stimulus preference environment on the behavior of adults with profound mental retardation", by Fava, L., 2010, *Research in Developmental Disabilities*, 31, p. 160-171.

Brain injuries

Previous described results of Snoezelen® therapy alleviating stress and bringing patients in a calmer state of being have so far been mostly quantitatively described by subjective observations. A few studies have attempted to understand the underlying brain dynamics by systematically quantifying EEG changes induced by the therapy. Individuals with brain injury were compared with healthy controls and phenomena were found that are similar in people during relaxation and meditation states. Slow (theta) and fast (beta and gamma) rhythms showed respectively significant increases and decreases of relative power in brain-injured patients. Also low (alpha) and high (beta and gamma) frequency bands showed significant increases and decreases of relative power, respectively. This is an indication of Snoezelen® therapy affecting the central nervous system, by inducing an overall slowing of EEG oscillatory activity, which stimulates a state of relaxation (Poza, Gómez, Gutiérrez, Mendoza & Hornero,

2013). These results show similarities with a previous study on children recovering from severe brain-injury. Hotz et al. showed a beneficial use of Snoezelen® therapy for this group of patients, as agitation levels reduced over time and the overall cognitive outcome measures showed significant improvement, including decreased levels of heart rate and muscle tone (Hotz et al., 2006). When Gómez et al. specified their previous study with a heterogeneous brain-injury group (cerebral palsy and traumatic brain injury patients), their findings supported their previous conclusions of Snoezelen® therapy affecting the central nervous system by inducing a slowing of EEG oscillatory activity. Their results showed diminished values for MF, IAF, SampEn and LZC after Snoezelen® intervention. The main alterations between pre- and post-stimulation conditions were found in occipital and parietal brain areas. Additionally, a diminution of EEG complexity and irregularity was found. These modifications were associated with higher levels of relaxation of the participants (Gómez et al., 2016).

Normal ageing

No study on Snoezelen® therapy has been performed on normal ageing individuals, without any physical and/or mental disability preventing healthy ageing. There is one research group coming quite close in testing the effects of multisensory stimulation in elderly subjects, but they do not mention the Snoezelen® concept (De Oliveira et al., 2014). Positive useful aspects about this study is that the participants were selected on having no history of head trauma, stroke, primary depression or chronic alcoholism and were considered cognitively healthy with appropriate Mini-Mental State Examination (MMSE) scores. The multisensory interventions, organized as workshops, were accompanied by cognitive stimulation and took place in a recreational room or community center. The workshops consisted of an assortment of recreational and ludic activities, aimed at memory and language impairment prevention. Language and memory were systematically exercised by a number of visual, tactile, olfactory, auditory, gustatory and verbal stimuli. Participants were divided into two groups: institutionalized (I; living in long-term care institutions) and noninstitutionalized (NI; living in communities with their families). The aim of the study was to evaluate the effectiveness and impact of multisensory and cognitive stimulation on improving cognition in elderly persons living in an impoverished (I) and enriched (NI) environment. The effects were examined by MMSE and language tests (Boston Naming Test, SVF, PVF, Cookie Theft test and MEC battery), before stimulation, in the middle (after 24 sessions) and at the end (after 48 sessions) of the stimulation program. The language tests turned out to be the most sensitive and providing the only results showing significant differences. The NI group showed an overall higher performance than group I, but both groups significantly improved their performance after stimulation. The highest improvement rate was for group I, where group NI showed a ceiling effect. Another positive aspect about this study is that the research group performed a 12 months follow-up in which long-term effects were measured (De Macedo et al., 2015). Revaluations with both tests were conducted at five time points after the end of the stimulation program (2, 4, 6, 8 and 12 months). Both groups showed progressive cognitive decline. The first significant reductions in language test scores became apparent after 4 to 6 months for group I, group NI followed after 8 months. MMSE scores showed a first significant reduction after 8 months for the NI group, as group I did not show any significant reduction. The NI group always performed better than the I group (Fig. 4). The researchers

conclude from this that the magnitude and duration of the beneficial effects from multisensory and cognitive stimulation interventions for the elderly are significantly different between institutionalized and noninstitutionalized elderly, associated with a respectively impoverished and enriched environment.

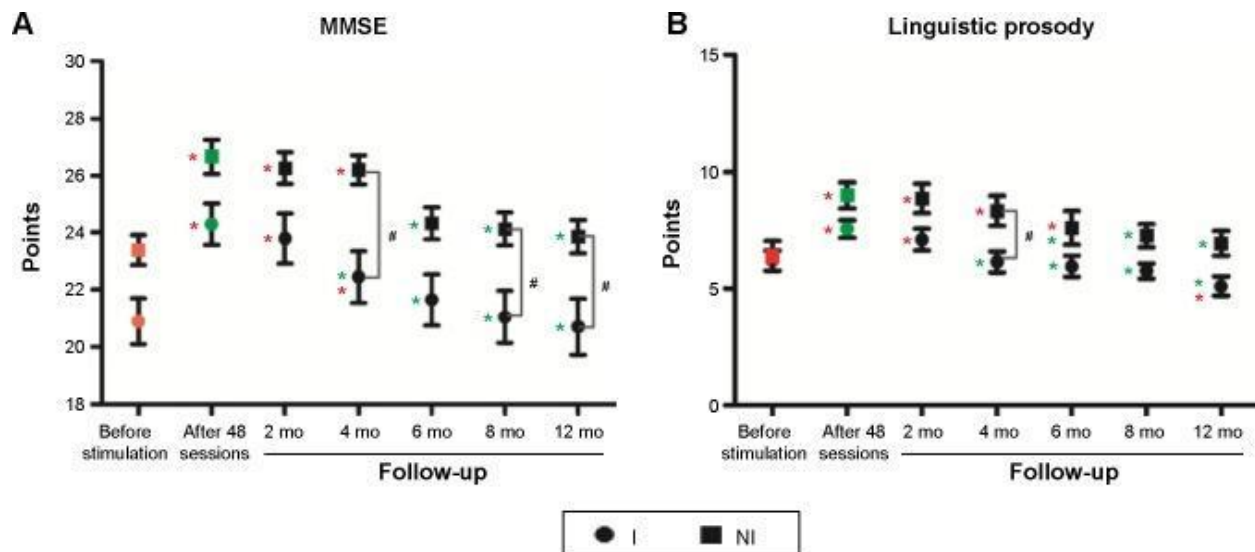


Figure 4. Influence of time and institutionalization on Mini-mental state examination (MMSE) test scores (A) and linguistic prosody test scores (B) in institutionalized (I) and noninstitutionalized (NI) elderly groups before and after Snoezelen® sessions. Mean and standard error are shown. The colors and the position of the symbols indicate the comparisons that were significantly different.

Note. Reprinted from “Beneficial effects of multisensory and cognitive stimulation in institutionalized elderly: 12-months follow-up”, by De Macedo, L., 2015, *Clinical Interventions in Aging*, 10, p. 1351-1360.

Conclusion

Snoezelen® sessions provide a person with a highly stimulating experience for the senses, activating neurons and increasing brain activity. The main effect of Snoezelen® therapy seems to be reducing agitation and bringing a person into a relaxed and calm state of being. The biggest effect is reached when an individual is in the least supportive state when it comes to cognitive balance: with high agitation levels and situated in an impoverished environment. As concluded by de Macedo et al., magnitude and duration of beneficial effects achieved by multisensory stimulation therapy are highest when a person is situated in an impoverished environment. In pathologies where aggressive moods and behaviours are less prone, like the different diseases in the dementia spectrum, beneficial effects from Snoezelen® are also less significant. The studies on Rett Syndrome and IDD patients show long maintained and highly significant improvements on mood and behaviour, since these patients change from extreme agitation and discomfort to a state with complete abolishment of tantrums (Rett Syndrome) and with a clear post-session decrease in frequency of disruptive behaviour (IDD). Any positive effects so far measured have been short-term and decreased over time. When older people without the presence of a disease affecting the course of normal ageing do normally not

experience much stress or high agitation levels, Snoezelen® therapy would not provide much significant beneficial effect on their ageing process. In other cases where this group of elderly does experience much stress which affects their level of agitation and causes discomfort, Snoezelen® therapy might prove beneficial in toning down the stress level and stimulating relaxation. The therapy seems to be most beneficial for elderly experiencing normal ageing living in a care institution, as these environments are considered to be less enriched. Effects would be highest and best maintained when sessions in the Snoezelen® room were to repeat on a regular basis.

Discussion

Given the increasing population size of people over 65 years of age, methods for maintaining a vital brain have gained increasing attention. As this group is becoming of more importance when it comes to financial, social and scientific focus for our society, Healthy Ageing is even one of the leading research subjects in societal themes for our university. This thesis addresses the evidence supporting the efficacy of Snoezelen®, a multisensory stimulation technique commonly used as a non-pharmacological intervention in different pathological settings. This Snoezelen® therapy seems to be of beneficial effect on mood and behaviour of individuals experiencing highly agitated distress, situated in an impoverished environment. As we know from animal studies, hippocampal cognitive dysfunction occurs after living in impoverished environments, causing deficits in learning and spatial memory (Teather & Wurtman, 2005; Iso, Simoda & Matsuyama, 2007). Housing in an enriched environment shows preserved learning and memory (Diniz et al., 2010). As residential care institutions are commonly considered a less enriched environment, a Snoezelen® room would provide a highly stimulating experience for the senses. The functioning of the senses is directly coupled to the functioning of the nervous system. Enhanced observational functioning stimulates alertness, which in turn is the basis for the correct processing of incentives; the brain's food. This would implicate a revival in the usually dull daily routine for not only the diseased institutionalized resident, but also the relatively healthy resident experiencing normal ageing. It would mean a boost for the senses, activating the nerves and keeping the brain vital with the potential of achieving beneficial relaxation.

The body of evidence concerning multisensory stimulating interventions is hard to tackle, especially when focusing on the Snoezelen® therapy. The Snoezelen® concept is not uniformly described, but categorized by the developers and promoters as a safe, nonthreatening environment providing the discoverer gentle stimulation of the primary senses of touch, taste, vision, sound and smell. A person in the Snoezelen® room is free to explore without a desired response or purpose, leaving the experience open to a wide variety of possibilities. This means that the design of the room and intervention technique can be different for every individual. As a result of this, limited descriptions of the treatment characteristics are provided by the different studies on Snoezelen® therapy, which makes it challenging to draw general conclusions on their approaches. Length of sessions were also often not clearly described and if they were, they showed a wide variety between studies. Intervention periods were often short, which made

it difficult to draw any conclusions on short- and long-term effects. Other methodological issues such as small sample sizes and heterogeneity of the research subjects makes it difficult to compare the studies, if detailed participant characteristics are mentioned at all. Another obstruction for good comparison are the many different baseline and outcome measures used. There are many different ways for indicating mood levels, behaviour and cognitive state to make an estimate of the effect acquired by the Snoezelen® intervention, not to mention observer bias if the person implementing the intervention is the same as measuring the outcome. All these limitations aside, there is also the fact that almost all of the studies performed on Snoezelen® therapy so far have described qualitative effects which rely on generally subjective observations (either by the researcher or the subject self). This thesis reveals the difficulty of drawing an overall conclusion in relation to the most beneficial effects of multisensory stimulation used in Snoezelen® therapy. More high quality detailed quantitative research is recommended, especially focusing on amplifying a substantial collection of long-term evidence-based practice. If well-grounded evidence for the so far seemingly beneficial effects on mood and behaviour for institutionalized older people were to be gathered, Snoezelen® therapy would implicate an easy and harmless non-pharmacological tool for maintaining a healthy ageing vital brain.

Epilogue

In my research on Snoezelen® therapy, many questions arose about this seemingly ludic multisensory stimulating technique. Aside from questions about the diverse approach and interpretation of the measured effects, I also started to see different problems and concepts hidden underneath the surface. One of the first things provoked by the studies on dementia was the obvious lack of engagement between staff and residents, but also family members and residential care. It was almost shocking to see how surprised some of the staff or family members reacted to the sudden increase in bond with residents after one or two Snoezelen® sessions, which they apparently never experienced before. I started to question if the improvement in mood and agitated behaviour in residents after a session could only be attributed to the multisensory stimulation in Snoezelen® therapy, and not also an effect of the increased social interaction. Another factor coming into play with this is the motivational factor of the supervisor guiding the resident in the Snoezelen® session. If the bond between the two is not good, I can imagine the participant will not be stimulated to the fullest extent and might even counteract any beneficial effect. Acting from an inner drive is very important for sensory integration and will induce more plastic changes than trying to fulfill a meaningless or neutral task. The therapy is very sensitive for intrinsic motivation, and with that also for external influence. Influencing cognitions is very important for the course and effect of a treatment. Expectation influences perception. No matter how strong the stimulus, it will always be subordinate to certain expectations. Therefore, it is important that the supervisor tries to avert any negative thoughts in the resident in order to achieve the best possible effect. A different risk for this therapy I encountered in my research, is the ease of recurrence. Once a Snoezelen® room is established within an institution, the setup will most probably not undergo many major changes. Changing the room will take expensive time and money, items which are

not very abundant in a regular care institution. As a result of this, a Snoezelen® experience will probably be sort of the same for every session. The danger in this is the experience becoming a routine, which makes improvements less possible due to a practice effect. When a task is routinely controlled, it requires less brain activity. Snoezelen® sessions would therefore need to be guarded for evoking a new experience on a regular basis.

Nonetheless I am very much in favor of adapting Snoezelen® therapy in care facilities where both diseased and normal ageing older people reside. A happy state of mind free from any stress is beneficial for any person's health. A positive aspect of the therapy I came across is that while being in the multisensory stimulating environment, a person can do nothing wrong. Any choice made is neither good nor bad and it will always lead to a new lesson learned or experience gained. In my opinion, this can be a positive contribution to the almost continuous mourning process an older person can go through. While ageing, an older person experiences continuous decline of the physical and mental condition causing loss of autonomy, while also having to face a decrease in familiar environment and social network. When working with elderly, it is a good thing to minimize the sense of loss and address a person's autonomy as much as possible. This will make the person feel strengthened. The positive experiences of Snoezelen® contribute to this philosophy by having zero expectations of any achievement and by letting a person make its own choices, providing a sense of autonomy.

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