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BRIEF REPORT

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# A comparison of natural and non-natural soundscapes on people with severe or profound intellectual and multiple disabilities

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**ABSTRACT**

*Background* Previous research indicates that there is a relationship between the auditory environment and the core affects (or mood) of people with severe or profound intellectual disability. We conducted a systematic study to further explore this relationship.

*Method* Thirteen participants with severe or profound intellectual disability and challenging behaviour were presented with 5 different soundscapes (Beach, Forest, Urban, Music, and Silence) in a dedicated room. Direct support professionals made core affect observations before and after each trial.

*Results* A trend was visible in the core affect observations, with a prominent and consistent increase in the frequency of observations of a Relaxed core affect across conditions. However, a greater increase in the frequency of observations of a Relaxed core affect and a greater decrease in the frequency of observations of an Interested core affect were associated with the natural conditions (Forest and Beach) rather than the non-natural conditions (Urban and Music).

*Conclusion* This pilot study could serve an important role in raising awareness and stimulating further research regarding the auditory environments of people with severe or profound intellectual disability.

**KEYWORDS**
soundscapes; core affect; mood; intellectual disability; challenging behaviour; PIMD

## Introduction

The sounds that fill our living environment play an important role in our physical and psychological well-being (World Health Organization, 2011). How all these sounds are perceived conjointly is also referred to as the soundscape, which is defined as "an environment of sound (or sonic environment) with emphasis on the way it is perceived and understood by the individual, or by a society" (Truax, 1999/1978, p. 126). Thus, rather than addressing sounds in terms of acoustics (e.g., loudness or reverberation time), the soundscape approach focuses on subjective appraisal.

Soundscape appraisal has two main underlying dimensions: pleasantness and eventfulness (Axelsson, Nilsson, & Berglund, 2010; Bradley & Lang, 2000; Cain, Jennings, & Poxon, 2013). These dimensions closely resemble those of mood, in terms of core affect (e.g., pleasantness and arousal; Russell, 2003), reflecting the close relationship between the two. This relationship has been substantiated by research showing a dynamic relationship between how people (without disability) appraise their auditory surroundings and how they describe their mood (Kuppens, Champagne, & Tuerlinckx, 2012; Russell, 2003). It is, for example, difficult or sometimes even impossible to relax in an unpleasant auditory environment, and, consequently, people actively seek quiet and pleasant environments to recover from stress (Kaplan, 1995).

It has been proposed that natural environments are ideally suited for relaxation because they are tranquil, give people a sense of harmony (Booi & van den Berg, 2012), and are rich in detail, while not demanding directed attention (Kaplan, 1995). This is supported by findings that indicate that pleasant auditory environments are often associated with natural sounds and unpleasant ones with mechanical or human-made sounds (Andringa & Lanser, 2013; Axelsson et al., 2010; Kaplan, 1995; Pheasant, Fisher, Watts, Whitaker, & Horoshenkov, 2010; Schafer, 1977). We believe this is due to the high redundancy of easily processed indications of audible safety in natural environments (van den Bosch, Andringa, Başkent, & Vlaskamp, 2016).

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Despite the strong relationship between soundscape quality and wellbeing, research on soundscapes within special needs care is limited. One in-situ study by van den Bosch, Vlaskamp, Andringa, Post, and Ruijssenaars (2016) indicated that there is also a relationship between soundscapes and core affects in people with severe or profound intellectual and multiple disabilities. There is also a possibility that it is even more pronounced in their case due to their cognitive limitations, a high prevalence of visual impairment (Warburg, 2001), and challenging behaviour (Poppes, van der Putten, & Vlaskamp, 2010). To better adjust the soundscapes of people with severe or profound intellectual and multiple disabilities to their needs and abilities, more information is needed about the effects of certain types of sounds on their wellbeing. Therefore, this pilot study aimed to investigate the effect of natural and non-natural soundscapes on the core affects of people with severe or profound intellectual and multiple disabilities.

## Method

### Participants

A group of 13 participants with severe or profound intellectual and multiple disabilities were included in this study. The group consisted of five female and eight male participants, with an average age of 43.2 years ($SD = 13.25$, range: 18–56). Based on personal files, 11 participants were reported to have a severe intellectual disability and two were reported to have a profound intellectual disability according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000) classification. Based on criteria established by the World Health Organization (2007), five participants were reported to have a moderate visual impairment (< 0.5 Log-MAR), three were reported to have a severe visual impairment (< 0.3 Log-MAR), and five reportedly had no visual impairment. None of the participants were reported to have an auditory impairment. Eight participants had no expressive verbal communication abilities; the other five participants were reported to display some form of limited verbal communication.

All participants attended a day care service centre in the Netherlands, which specialised in intensive support groups. The participants attended this particular day care centre because they had a long history of challenging behaviour. According to the personal files of the participants, the challenging behaviours included aggressive/destructive behaviour ($n = 10$), stereotypical movements ($n = 4$), self-injury ($n = 7$), withdrawal ($n = 3$), and inappropriate sexual behaviour ($n = 1$). Multiple challenging behaviours were shown by all participants.

### Ethics

The legal representatives of 35 people with severe or profound intellectual and multiple disabilities were contacted and informed about the study in writing. Written informed consent was obtained for 25 of these 35 people. From this group, 12 were excluded due to a milder form of intellectual disability, a lack of essential file information, or because they did not want to enter or stay in the room with the soundscape set-up for more than 1 minute. Ultimately, 13 participants were included. Ethical procedures were followed, with formal ethical approval to conduct this study obtained from the Institutional Review Board of the University of Groningen, the Netherlands.

### Design

This pilot study aimed to explore which soundscape characteristics were desirable for people with severe or profound intellectual and multiple disabilities. We expected that natural soundscapes would have a positive, relaxing effect on the participants, compared to non-natural soundscapes. To test this, we performed a controlled observation study with repeated trials in a descriptive design. The participants were presented with four different soundscapes (Beach, Forest, Urban, and Music). A Silent condition in which no sound was played was also included to serve as a control condition. Each participant took part in 10 trials, two for each of the five conditions (5 conditions x 2 = 10 trials). This occurred on 10 separate days for each participant over the course of 9 weeks. The trials were planned at random moments, depending on the presence and availability of the participants' direct support professional (DSP) and the researcher. The order in which the participants were exposed to the conditions was randomised for each participant. Observations of core affects were made by the DSP. These occurred at the beginning of each trial as a baseline measure, and at the end of each trial as an outcome measure.

### Materials

#### Sounds

Five different conditions were used in this study, with two conditions recreating natural environments (Forest and Beach) and two conditions recreating non-natural environments (an Urban environment and a computer-generated ambient Music recording). As mentioned above, a Silent condition was also included (simply not playing any sound). The sounds were chosen to be either calm or lively (Andringa & Lanser, 2013; van den Bosch, Andringa, et al., 2016). The Forest recording mainly consisted of birds and the sound of wind in the trees. The Beach recording predominantly concerned the sound of waves crashing on a beach. Both recordings were deliberately kept uncluttered to create calm environments. The Urban recording contained sounds from different parts of the city of Groningen in the Netherlands. This recording varied more in its content (e.g., traffic, the market square, and children playing), leading to a livelier environment. The ambient Music recording was a calm and slow tonal composition. It was designed to be tranquil and calm, similar to the two natural recordings but differing from them in having no natural source characteristics. All of the recordings were designed and created by a professional composer.

### Room

A dedicated room was equipped with a six-speaker layout to conduct the study. The day care service centre gave permission to redesign a timeout room that was not in use. Bookshelves filled with insulating material were placed along the walls of the room, and the speakers and other electronics were placed inside the shelves and covered with an acoustically transparent but visibly opaque cloth. Additionally, two chairs and a matching table were brought in to create a welcoming environment and allow the participant and the DSP to sit comfortably during the study.

### Core affect appraisal

Reports on the core affects, or moods, of the participants were obtained using a simplified version of the Assessment Auditory Environment (AAE; van den Bosch, Vlaskamp, et al., 2016). In the original version of the

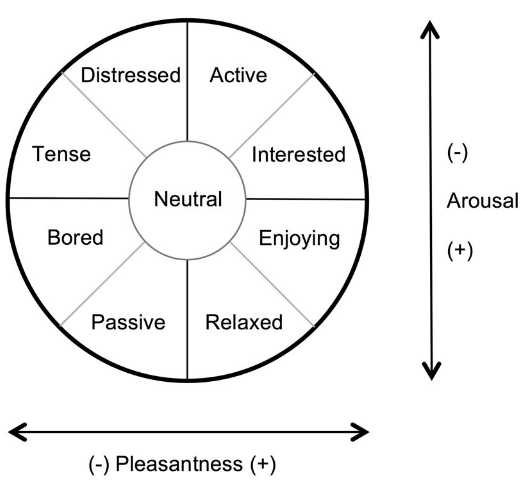


**Figure 1.** Representation of core affect as used in the assessment form.

AAE, consisting of items measured on Likert scales, a DSP could appraise core affects by means of eight descriptors. The scores then had to be standardised, averaged, and then plotted on a graph. For this study, we chose to let the DSPs plot their observations directly onto the graph representing core affects (see Figure 1) to make the assessment more user-friendly and efficient. An additional section was added to account for neutral moods. The DSPs were asked to indicate which of the nine sections of the graph (see Figure 1) best described the mood of the participant at the beginning and at the end of each trial. If the DSP, against instructions, indicated more than one section of the graph, the researcher would explicitly ask which section fitted best. This ensured that only one answer was selected each time.

The DSPs ($N = 33$) making the core affect observations all volunteered to be involved in this study. The group consisted of 11 male and 22 female DSPs, with a mean age of 40 years ($SD = 11{,}43$, range: 23–61; 6 missing). All of the DSPs received vocational training and were familiar with the participants.

### Procedure

A typical trial started with the participant and the DSP being brought together from their group at the day care service centre to the room. Upon entering, one of the five recordings (or conditions) was already audible inside the room and continued to play until after the participants left the room. Thus, only one condition was presented for each trial, and only one trial was held on each data collection day for each participant. The trial continued until the participant indicated they wanted to leave (to avoid coercion) or at a maximum of 20 minutes. During this time, participants were free to move around the room and to behave as they wished, but without becoming preoccupied with a different task. The DSPs were instructed not to initiate interaction, but were allowed to respond to the participants. Furthermore, the DSPs were instructed to observe the behaviour of the participants during the trial and report on the latter's core affect at the start (directly after entering the room) and at the end of the trial (before leaving or directly after leaving the room, depending on the state of the participant).

### Analysis

Considering the explorative nature of this study and the design chosen (which yielded many conditions in combination with a small number of participants), data analysis concerned descriptive statistics of the DSPs' attributions of the core affect of the participants across conditions. For the analysis, the nine sections of the core affect graph were merged into five sections: Interested (Active + Interested), Relaxed (Expressing Enjoyment + Relaxed), Bored (Passive + Bored), Distressed (Tense + Distressed) and Neutral. The reasons for this choice were twofold: first, for many of the original nine sections, the frequency of observations was zero; second, merging the sections into five is in accordance with previous work by van den Bosch, Vlaskamp, et al. (2016) and van den Bosch, Andringa, et al. (2016) on the relationship between soundscape taxonomy and core affects.

## Results

Table 1 presents the results of the core affect observations by the DSPs at the start and end of the trials, divided over the five different conditions (total of 13 participants x 5 conditions x 2 = 130 trials). The table displays the frequencies (the number of times) a certain core affect observation was made under a certain condition.

Figure 2 presents the differences in frequencies of baseline and posttrial core affect observations in all five conditions (Forest, Beach, Urban, Music, and Silent), thus revealing the effects of the different conditions. In this regard, there is a clear trend in the core affect observations. The most striking is the prominent and consistent increase in the frequency of observations of a Relaxed core affect across conditions. This increase was greatest for the Beach and Silent conditions and smallest for the Urban condition. For all conditions, there was a decrease in the frequency of observations of an Interested core affect. This decrease was smallest for the non-natural (Urban and Music) conditions, and greatest for the Silent condition. An increase in the frequency of

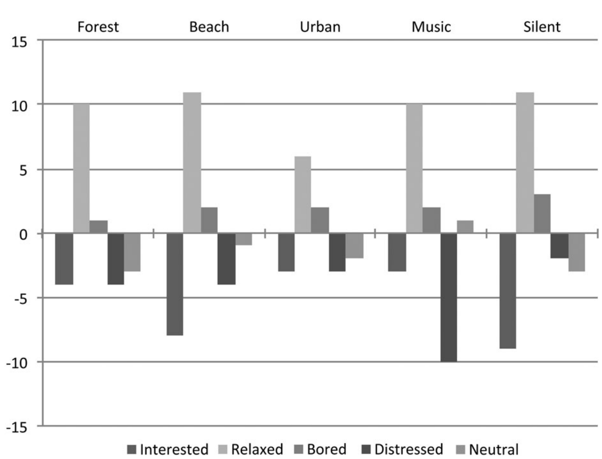


**Figure 2.** Bar chart displaying the difference in frequencies of core affect observations prior to and after the five conditions (Forest, Beach, Urban, Music, and Silent).

observations of a Bored core affect was found under all conditions, and was largest for the Silent condition and smallest for the Forest condition. There was also a consistent decrease in the frequency of observations of a Distressed core affect. This decrease was largest for the Music condition (which also had the highest frequency of pretest observations) and smallest for the Silent condition. Finally, a decrease in the frequency of observations of the Neutral core affect was found for all but the Music condition. Overall, a greater increase in the frequency of observations of a Relaxed core affect and a greater decrease in the frequency of observations of an Interested core affect were associated with the natural conditions (Forest and Beach) rather than the non-natural conditions (Urban and Music).

Concerns were raised that participants might have needed some time to adjust to the room and the new elements involved, leading to the introduction of confounding factors between the first and latter trials. To test this, comparisons of the core affect observations in the first 4 and the last 5 weeks of the study were made, but no significant differences were found. In addition, no significant differences were found in the length of the trials (*M* duration = 15.25 minutes, *SD* = 5.64; range: 3–20) when comparing the different conditions.

## Discussion

The results revealed an increase in the frequency of observations of a Relaxed core affect under all conditions. At first sight, it appeared that the specific condition did not matter, as this effect even occurred in the Silent condition. However, a closer look revealed that the Silent condition was accompanied by the greatest increase in the frequency of observations of a Bored core affect and a decrease in the frequency of observations of an Interested core affect during the trials. The overall trend in the relaxation effect across conditions might also be attributed to similarities between the different conditions in terms of pleasantness and audible safety.

Although the results are not entirely in line with the expectations stated in our introduction, it is apparent that it is possible to create pleasant soundscapes that allow people with a severe or profound intellectual disability – including those who display severe challenging behaviour – to attain a pleasant state of being in terms of core affect. Even the Silent condition, which was expected to be the least preferable (Adams et al., 2006; Dubois, Guastavino, & Raimbault, 2006; Stockfelt, 1991), seems to have provided a soundscape in which the participants were able to relax. This could be an indication that the Silent soundscape was more pleasurable

**Table 1.** Frequency table of core affect observations, before and after each condition.

| | Interested | | Relaxed | | Bored | | Distressed | | Neutral | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Baseline* | *Posttrial* | *Baseline* | *Posttrial* | *Baseline* | *Posttrial* | *Baseline* | *Posttrial* | *Baseline* | *Posttrial* |
| Forest | 8 (30.8%) | 4 (15.4%) | 7 (26.9%) | 17 (65.4%) | 0 | 1 (3.8%) | 7 (26.9%) | 3 (11.5%) | 4 (15.4%) | 1 (3.8%) |
| Beach | 11 (42.3%) | 3 (11.5%) | 4 (15.4%) | 15 (57.7%) | 0 | 2 (7.7%) | 6 (23.1%) | 2 (7.7%) | 5 (19.2%) | 4 (15.4%) |
| Urban | 9 (34.6%) | 6 (23.1%) | 8 (30.8%) | 14 (53.8%) | 1 (3.8%) | 3 (11.5%) | 6 (23.1%) | 3 (11.5%) | 2 (7.7%) | 0 |
| Music | 8 (30.8%) | 5 (19.2%) | 4 (15.4%) | 14 (53.8%) | 0 | 2 (7.7%) | 13 (50.0%) | 3 (11.5%) | 1 (3.8%) | 2 (7.7%) |
| Silent | 11 (42.3%) | 2 (7.7%) | 7 (26.9%) | 18 (69.2%) | 0 | 3 (11.5%) | 4 (15.4%) | 2 (7.7%) | 4 (15.4%) | 1 (3.8%) |

than the one in which they normally reside. This effect may also be attributable to the one-on-one attention the participants received from the DSP during the trials, which is a question often raised in relation to the effectiveness of music therapy (Duffy & Fuller, 2000). However, it may also be an indication that the Silent condition was already an improvement over the normal daily auditory environment.

## *Limitations*

This study has several limitations. First, the fact that DSP attributions of core affect were used – because it was not possible for the participants to verbally assess their own mood – could diminish the validity of the observations. As the core affect of an individual also influences its appraisal (Kuppens et al., 2012), it is also possible that the DSPs' attributions were influenced by their own core affect. Second, some studies have indicated that DSPs have difficulty in reliably assessing the affect of individuals with profound intellectual disability (Hogg, Reeves, Roberts, & Mudford, 2001). Third, a large team of DSPs collected the data, which might have led to a wide variety of interpretations of the behaviour. Considering this limitation, combined with the explorative nature of this pilot study, the results should be interpreted with caution and should serve the role of raising awareness and stimulating further research, rather than being interpreted as rigorous scientific findings.

Furthermore, the room used for the soundscape setup was originally a timeout room. Although it had not been used for its intended purpose in this particular day care service centre, all rooms of this type look alike. This could have led to feelings of unease in the participants, possibly influencing their responses to the soundscapes, as indicated by the participants who refused to even enter the room and who were thus excluded from the study altogether. However, this apparent limitation could also be viewed as supporting the success of the study: with limited resources we were able to change a room that elicited negative associations into a pleasant room where the participants enjoyed themselves and were even able to fall asleep peacefully.

Further research is needed to unravel the precise effects of different types of soundscapes on the affects of people with severe or profound intellectual and multiple disabilities. We suggest including a larger number of participants and reducing the hierarchical levels of repeated measures to aid inferential statistical analysis. Finally, due to ethical considerations, all of the soundscapes chosen were pleasantly calm or lively to prevent the participants becoming upset. To thoroughly explore the full range of effects, more unpleasant soundscapes, for example, those resembling regular auditory environments in residential facilities, should also be considered as stimuli.

Regarding the auditory stimuli, one more concern should be raised on the importance of the style of music selected and the possible implications on the results. It could very well be that the music did not match some of the participants' musical preferences, with different kinds of impact on their core affect. Even though musical preference is a complex topic, it is worth noting that the results are not a general statement about the effect of music as a soundscape in general.

## *Implications for practice*

Sounds appear to be an important part of life for people with severe or profound intellectual disability considering the high prevalence of visual disorders. Moreover, the use of audiovisual media, such as watching TV or listening to music, is one of the most frequent forms of activity offered to this group (Zijlstra & Vlaskamp, 2005). However, such activities are often introduced without careful consideration, creating potentially chaotic environments. Egli, Roper, Feurer, and Thompson (1999) noted that "the extent to which a setting is perceived to be representative of culturally defined norms can influence judgments about whether behaviour in the settings conforms to expected standards" (p. 63). This entails that if DSPs are unaware of the effects of poor auditory environments on residents with disability, there may be detrimental consequences for their health and wellbeing. Conversely, this also suggests that DSPs should pay close attention to the behaviour of people with severe or profound intellectual and multiple disabilities in order to assess their core affect. Observing the responses of the residents might then lead DSPs to consider changes that need to occur in the environment more generally, and not only to the auditory environment. This especially holds true for the complex settings of residential care, in which multiple residents with different needs and abilities live in groups sharing one environment (generally controlled and designed by others). Therefore, it is important to pay more attention to both the auditory and other aspects of the environment in which these vulnerable individuals find themselves.

Our intervention was not meant as a kind of multisensory environment used for education, therapy, or leisure provisions (Hogg, Cavet, Lambe, & Smeddle, 2001), but rather as a scientific study aiming to gain more insight into the effects of certain soundscape characteristics on people with severe or profound intellectual disability Our aim is to proactively improve the quality of the auditory environment of residential facilities to reduce the occurrence of negative moods and challenging behaviour. The findings of this study should provide a basis on which to continue soundscape research and improve design and policies regarding the auditory environments of people with a severe or profound intellectual disability.

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## Disclosure statement

The authors declare no conflicts of interest.

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