JOURNAL OF INTELLECTUAL & DEVELOPMENTAL DISABILITY, 2015
http://dx.doi.org/10.3109/13668250.2015.1114077

Routledge
Taylor & Francis Group

ORIGINAL ARTICLE

Examining relationships between staff attributions of soundscapes and core affect in people with severe or profound intellectual and visual disabilities

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ABSTRACT

Background People with profound intellectual disability experience a high prevalence of visual disability, making them more dependent on sound. However, research addressing the influence of the auditory environment is scarce.

Method Observations of the auditory environments (soundscapes) and moods of people with profound intellectual and visual disabilities, in terms of core affect, were conducted in residential facilities by direct support personnel. Appraisals of soundscape and core affect dimensions were combined and analysed by means of multilevel linear regression.

Results Findings endorse a positive relationship between the observed pleasantness and eventfulness of soundscapes and core affect of people with profound intellectual and visual disabilities.

Conclusion Based on the results of this study we suggest a relationship between soundscapes and moods of people with profound intellectual and visual disabilities, as judged by staff members engaged in their environments. These findings give reason to believe that improved soundscapes could ameliorate the moods of the residents.

KEYWORDS
soundscapes; auditory environment; core affect; visual disability; profound intellectual disability; mood

Introduction

People with intellectual disability often experience visual disability. The prevalence of visual disability increases with the severity of the intellectual disability, with an estimated 78% of people with a profound intellectual disability experiencing visual disorders (van Splunder, Stilma, Bernsen, & Evenhuis, 2006; Warburg, 2001). Auditory problems, although common, appear to be less prevalent (Evenhuis, Theunissen, Denkers, Verschuure, & Kemme, 2001). As a result, many people with profound intellectual disability may depend more on sound to interpret their surroundings than people without intellectual disability, which is supported by research indicating that people with a visual disability alone compensate for their visual deficit by relying more on auditory information (Dufour, Després, & Candas, 2005). It is, however, not yet clear to what extent this auditory compensation holds for people with severe or profound intellectual disability.

Despite the situation previously described, research addressing the influence of the auditory environment on the wellbeing of people with intellectual and visual disabilities is limited (Kingma, 2005). Because people with intellectual and visual disabilities will probably rely more on audition, it is important to know the role of sound for them. Normally, sound informs people what is going on around them because particular sound sources produce particular sounds (Gaver, 1993; Plomp, 2002). People without disability can reason where the sounds come from and to what event they are related to, so that they might not need to feel unease. Also, they can detect and recognise a known sound source quickly, thus interpreting and acting on events in their environment (Andringa & Pals, 2009). Andringa and Pals (2009) conducted an experiment to study sound detection and recognition. They found that people use prior knowledge and expectations to analyse and interpret what they hear, but it also works the other way around: what people hear can be used to generate hypotheses about their environment (Winkler, Denham, & Nelken, 2009). Van den Bosch, Andringa, and Vlaskamp (2013) suggest that this also holds for people with profound intellectual disability; however, their disability causes difficulties in analysing their environment and choosing optimal behaviour and, therefore, in regulating emotions and moods (Evenhuis et al., 2001).

The heightened risk of having visual disability in people with severe or profound intellectual disability,

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as compared with the general population, has important implications for their living environment (Evenhuis et al., 2001). Many residential facilities for people with intellectual disability, either small scale or large scale, have unfavourable acoustic conditions, and due to the lack of research and therefore knowledge regarding the influence of auditory environments, these seem to have not been sufficiently taken into account. Consequently, it can be assumed that these auditory environments are not explicitly adapted to the needs of people with profound intellectual and visual disabilities. For these people, who already have reduced cognitive functioning, as defined by their intellectual disability, the constant processing of auditory information in unfavourable conditions and accompanying arousal may dominate their cognitive resources (Van den Bosch, Andringa, Baskent, & Vlaskamp, in press). The resulting (prolonged) stress and arousal may deteriorate their overall psychological wellbeing and quality of life (Petry, Maes, & Vlaskamp, 2005).

One way of approaching auditory environments and the effect thereof on people is the soundscape approach. Soundscapes are 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. It thus depends on the relationship between the individual and any such environment" (Truax, 1999, p. 126). Soundscapes therefore represent more than just a sound signal and include the auditory environment as perceived and understood by people in a specific context. Axelsson, Nilsson, and Berglund (2010) developed a model to measure the quality of soundscapes. The results of their study suggest that soundscape perception can be described in terms of two main basic components: pleasantness and eventfulness. For most people without disability, an exciting soundscape is pleasant and eventful, a calm soundscape is pleasant and uneventful, a chaotic soundscape is unpleasant and eventful, and a monotonous soundscape is unpleasant and uneventful. These associations, which have been observed with groups, may vary depending on the individual, and may vary even more for people with intellectual disability. Research further shows that suboptimal soundscapes can induce a wide range of detrimental effects on the welfare of people (Andringa & Lanser, 2013; CALM, 2004). When a soundscape is perceived as unpleasant, people experience annoyance, and the adverse effects may range from relatively harmless problems with concentration to serious problems related to general health, wellbeing, and quality of life (Berglund, Lindvall, & Schwela, 2000).

It thus seems that there is a connection between how people feel and the state of the auditory world surrounding them. One important concept concerning how people feel is "core affect" (Russell, 2003). Core affect concerns basic moods and consists of two dimensions: pleasantness and activation or arousal. These resemble the dimensions of soundscape appraisal. Pleasantness is, in this context, more than just "niceness": it depends also on the degree of perceived control people have over their environment. Russell's (2003) model shows that interactions with the environment can change a person's mood, which is supported by in vivo research showing that people's appraisal of their environments reflects their mood, and vice versa (Kuppens, Champagne, & Tuerlinckx, 2012). It is, for example, difficult or impossible to relax in an unpleasant and unsafe environment, and therefore people actively seek a quiet and pleasant environment to recover from stress (Kaplan, 1995).

People with severe or profound intellectual disability require support to meet their needs and therefore to maintain their quality of life (Petry et al., 2005). They have limited control over their own situation and have few opportunities to make adaptive choices regarding everyday activities and major life events (Maes, Lambrechts, Hostyn, & Petry, 2007). According to Russell's (2003) model, this means that people with profound intellectual disability could experience structurally less positive moods in terms of core affect, kindled by unfavourable soundscapes.

Therefore, the aim of this exploratory study was to provide an initial examination of the relationship between staff attributions of the quality of soundscapes and staff attributions of the moods of people with severe to profound intellectual and visual disabilities in terms of core affect. As a first step, the method of Axelsson et al. (2010) was used to describe the auditory environment of people with severe or profound intellectual and visual disabilities. As a next step, core affect was used to describe how they are influenced by their environment (Kuppens et al., 2012). If we know how people with profound intellectual and visual disabilities are influenced by different auditory environments, we can eventually determine how to improve their (auditory) living environment and increase their quality of life.

Method

Participants

This study was conducted within a consortium consisting of the University of Groningen and four healthcare organisations in the Netherlands. The healthcare institutions informed parents and legal representatives about the aim of the study. Informed written consent was obtained for all participants. The organisations selected participants based on the following inclusion criteria:

(1) A developmental age not exceeding 36 months.
(2) A severe visual disability.
(3) No significant hearing loss.

All further information regarding age and intellectual and sensory disabilities was obtained from personal files. In total, 36 participants were included: 11 women and 25 men. The mean chronological age of the participants was 49.7 years ($SD = 12.2$), with ages ranging from 20 to 70 years. Developmental age was provided from file information; however, how this measurement was obtained was not always specified. Based on the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000), 14 participants were reported to have a severe intellectual disability (39%), and 19 participants to have a profound intellectual disability (53%). File information revealed that for three participants there was no up-to-date assessment with regard to the level of intellectual disability; however, special education experts on site appraised them as meeting the inclusion criteria. The mean reported developmental age of the participants was 24.3 months ($SD = 16.3$).

According to the personal files, all participants were reported to have a severe visual disability, with visual acuity < 0.3 Log-MAR (or so-called 20/40 vision, based on the criteria of the WHO; Waddell & Heseltine, 2007). The degree of reported visual disability can be divided into six categories: 13 participants (39%) were at least functionally blind or had only light perception; five participants (14%) had visual acuity up to 0.1; six participants (17%) had visual acuity from 0.1 to 0.2; seven participants (19%) had visual acuity from 0.2 to 0.3, and three participants (8%) had other visual disabilities (e.g., nystagmus). For two participants, there was no current assessment with regard to the degree of visual disability specified in the file; they were included nonetheless based on reports from the direct support personnel indicating that these participants met the inclusion criteria. All participants clearly reacted to sound, and there was no significant hearing loss, as evidenced by the reports of specialised audiology centres and evaluations from members of the direct support personnel.

The participants were residing in residential facilities operated by four organisations, dispersed over six locations throughout the Netherlands. Five of these locations, operated by three organisations (OID1[1,2,3], OID2, and OID3), specialise in care for people with an intellectual disability. The other location, operated by the fourth organisation (OVD1), focuses primarily on care for people with a visual disability. Although these facilities differ in their primary focus with regard to intellectual or visual disability, they are comparable in terms of organisation, provided care (residential and day service), group size, ratio, and daily structure.

The participants were observed by their attending direct support personnel ($N = 41$). Considering people with profound intellectual disability have highly diminished communication options, and may only communicate via (distorted) facial expressions, sounds, movements, body posture, or muscle tension (Vos, de Cock, Petry, van den Noortgate, & Maes, 2010), observers were chosen who could interpret these subtle signs the best, based on their long experience with these clients (Vlaskamp & Cuppen-Fonteine, 2007). Data-collection days were selected randomly across the days of the week, but in such an order to ensure that only observers who had been familiar with them for at least 6 months rated the core affect of participants. The participants were observed an entire day; they therefore were observed by multiple members of the direct support personnel due to working hours.

Ethical procedures were followed, and, for all of the participants, written consent was obtained from their legal representatives after they had been informed about the study via written information. All members of the consortium gave verbal and written consent to conduct research at specified locations. Formal ethical approval to conduct this study was obtained by the institutional review board of the University of Groningen.

Instruments

As demonstrated by Axelsson et al. (2010), people (without disability) assess soundscapes according to the dimensions of pleasantness and eventfulness. In emotion theory, Russell (2003) defines core affect as an integrated mix of the similar dimensions pleasantness and activation. The combined interpretation of the dimensions of core affect and the appraisal of soundscapes yields four qualitatively different perceptual quadrants, which can be considered four different types of core affect and/or soundscapes: Lively, Calm, Boring, and Chaotic (Andringa & Lanser, 2013; Van den Bosch et al., in press). As depicted in Figure 1, these perceptual quadrants can be classified according to their relative pleasantness and eventfulness, as well as according to the complexity of action selection and the content of audible affordances.

A scoresheet was developed for this study to assess the observed soundscapes and core affect (Assessment Auditory Environment; Van den Bosch, Vlaskamp, Andringa,

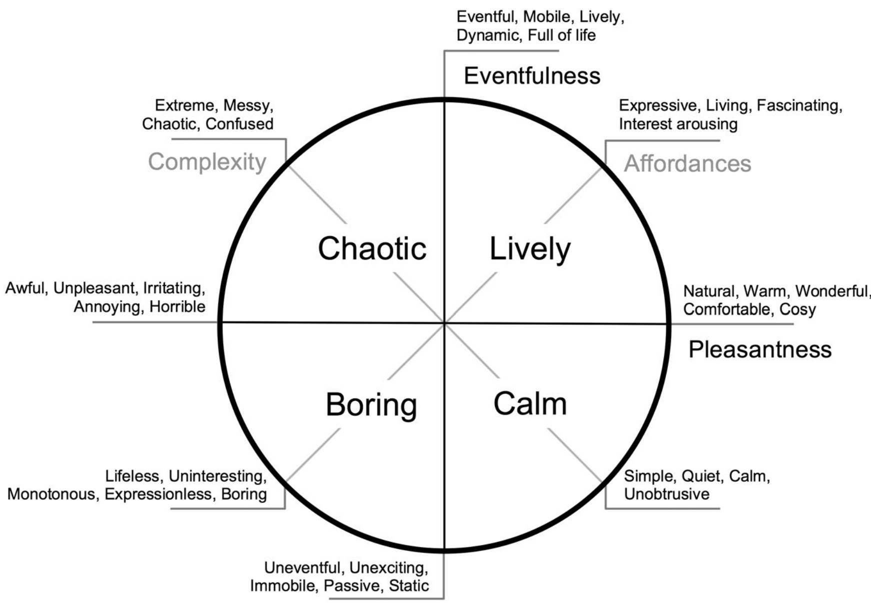

Figure 1. Four perceptual quadrants (Chaotic, Lively, Boring, and Calm) and their basic dimensions (Eventfulness vs. Pleasantness and Affordances vs. Complexity). In the figure, each of these words is positioned at the end of an axis corresponding to a high value on the particular dimension. The other side of the axis corresponds to a low value. This figure also depicts the relative positions of the eight descriptions used on the score sheet.

Baskent, & Ruijssenaars, 2014). The scoresheet is based on the Soundscape-Quality Protocol by Axelsson et al. (2010), a reliable tool to assess a person's appraisal of soundscapes. The scoresheet includes eight descriptions (D1–D8; see Table 2) consisting of terms that, according to the study by Axelsson et al. (2010), correspond to the positions at the ends of the horizontal, vertical, and diagonal axes of soundscape appraisal and core affect (see Figure 1 and Table 1).

Using eight separate Likert scales, observers indicated the extent to which these descriptions suited the observed soundscapes and the observed core affect. A score of 0 was interpreted as not applicable and a score of 100 as entirely appropriate. A result form was used to convert the scores on the individual scales of the scoresheets to a single point for the observed core affect and a single point for the soundscapes. First, the scores were standardised, after which the scores on the two scales representing opposite ends of each axis were added together, and then divided by two (e.g., (D1 + D5)/2). This yielded a single result for each of the four axes, which could then be drawn into a figure on the sheet. Averaging these four points yielded the final score, which could be attributed to one of the four quadrants (Figure 1). This procedure was performed twice: once for the core affect and once for the soundscape.

Behavioural and auditory observations were conducted concurrently, in order to assess the soundscapes, as appraised by the caretakers themselves, and core affect of the participants. This enabled us to investigate possible relationships between these two variables.

To obtain a representative sampling of the course of a day, the observation days were divided into seven intervals of characteristic activities, as depicted in Table 2 (Zijlstra & Vlaskamp, 2005). This daily structure is reflected in all four organisations, thus making the data comparable across organisations. The aim was to observe each of the participants during each of these intervals, for 10 (randomly chosen) consecutive minutes. Therefore, efforts were made to follow participants during a single whole day, thus involving observations in the residential

Table 1. Eight descriptions (D1–D8), as used on the scoresheet for assessing the quality of soundscapes and behaviour.

	Description
D1.	Extreme, Messy, Chaotic, Confused
D2.	Awful, Unpleasant, Irritating, Annoying, Horrible
D3.	Lifeless, Uninteresting, Monotonous, Expressionless, Boring
D4.	Uneventful, Unexciting, Immobile, Passive, Static
D5.	Simple, Quiet, Calm, Unobtrusive
D6.	Natural, Warm, Wonderful, Comfortable, Cosy
D7.	Expressive, Living, Fascinating, Interest arousing
D8.	Eventful, Mobile, Lively, Dynamic, Full of life

Table 2. Daily structure divided into seven intervals.

Interval	Name	Description
1.	Morning	From the moment of getting up to leaving for day service
2.	Morning activity	From arrival at day care until lunch
3.	Lunch	
4.	Afternoon activity	From lunch until time of departure
5.	Afternoon	From arrival at home until dinner
6.	Dinner	
7.	Evening	From dinner until bedtime

locations as well as in the day services setting. All participants received day services at the same healthcare organisations that provided them with residential support.

Procedure

A researcher visited each location for one day of data collection (5 days for five locations), on which all participants from that location were observed. The researcher gave the observers a short briefing on the research and instruction on how to use the scoresheet during the observations. These briefings and instructions took about 30 minutes per location, per shift. It was explained to the observers that the goal of the observations was to rate the mood (or core affect) of the participants, instead of focusing on specific behaviours, and to observe or appraise the soundscapes as the caretakers themselves experienced these. Each observation lasted exactly 10 minutes.

At the first locations (OVD1, OID1[1], and OID1[2]) 18 participants were observed. After this round of data collection, the observers evaluated the period of data collection and the usability of the scoresheet through an unstructured interview with open questions. These evaluations showed that the scoresheet was relatively clear and simple to use. Although it took more time than expected to complete the form (up to 5 minutes per participant), the observers considered that to fall within practical limits.

After this evaluation, data were collected from OID2 and OID1[3]. Following the data collection, the scoresheet was evaluated with the observers. Feedback concerned the difficulty of the instructions and minor errors in the layout of the form. The final version of the result form was corrected in order to improve readability and layout.

The observations at the last location, or OID1[3], were performed twice. During the first observation period, the observers had not been properly informed about the observations, which resulted in a considerable amount of missing data on this day. After consultation, it was decided to conduct these observations again and to exclude the data from the first day of data collection from the analysis.

Finally, data were collected from OID3. The observations were conducted in the same way as with the other organisations.

Analysis

First, an exploratory analysis was performed on the staff attributions of the soundscapes and the observed core affect, using SPSS Version 21. Two variables were used to express the appraisal of the soundscapes: pSound and eSound. The variable pSound is a continuous, standardised variable representing the pleasantness component (see the horizontal axis in Figure 1), and the variable eSound represents the eventfulness component (see the vertical axis in Figure 1). Corresponding variables were used to express the observed core affect in the participants: pBehaviour and eBehaviour. Differences in the relationship between core affect and soundscape between the organisations that focus primarily on caring for people with an intellectual disability and the organisation that focuses primarily on caring for people with a visual disability were also analysed. These exploratory analyses provided input for multilevel analysis.

To investigate the relationship between the staff attributions of the soundscapes and observed core affect, a multilevel linear regression model was used, with individual participants at the highest level and repeated measurements for each participant at the lowest level, thus considering the dependent observations within each participant, where some were observed by multiple members of the direct support personnel. Multilevel linear regression analysis, also called random effects model, was selected as this gives valid results in case of missing data at random (Little & Rubin, 1987). The dependent variables reflected staff attributions of the observed core affect (pBehaviour and eBehaviour). The independent variables included staff attributions of the soundscapes according to the average (pSound and eSound) and time of day (Interval). To determine whether the observed core affect differed between the two types of organisations, these types were included as explanatory variables (Organisation), as well as interactions between type of organisation and perceived soundscape (both pSound and eSound). Differences in deviance were used to test the significance of the contributions of several nested models. Four models were formulated for the variables pBehaviour and eBehaviour: the Empty model (no explanatory variables), the Interval model (time of day, defined by the aforementioned intervals, as an explanatory variable), the Sound model (various aspects of sound), and the Sound and Organisation model (sound and type of organisation as explanatory variables). Both fixed and random effects were examined. Observed p values less than .05 were considered significant. The analyses were performed in MLwiN 2.23, software specifically designed to carry out multilevel linear regression analysis (Rasbash, Charlton, Browne, Healy, & Cameron, 2011).

Results

In all, 149 behavioural observations were registered. On average, four observations were made for each participant, with only three participants having fewer than three observations. The number of observations in each interval

Table 3. Number of observations per interval.

Interval	Name	Number of observations	Number of observational minutes
1.	Morning	14	140
2.	Morning activity	28	280
3.	Lunch	25	250
4.	Afternoon activity	26	260
5.	Afternoon	20	200
6.	Dinner	18	180
7.	Evening	18	180
	Total:	149	1490

is shown in Table 3, which displays the missing data in especially the morning and evening intervals.

Exploratory analysis

Figure 2 presents the staff attributions of the soundscapes, as observed by direct support personnel. The horizontal axis shows the variable pSound ($M = 0.36$, $SD = 0.33$), and the vertical axis represents the variable eSound ($M = 0.28$, $SD = 0.41$).

Figure 3 presents the staff attributions of core affect, as observed by direct support personnel. The horizontal axis shows the variable pBehaviour ($M = 0.36$, $SD = 0.39$), and the vertical axis represents the variable eBehaviour ($M = 0.16$, $SD = 0.46$).

Figures 2 and 3 also indicate the differences between organisations focused primarily on care for people with an intellectual disability (OID1–3, □) and those focused primarily on care for people with a visual disability (OVD1, +). The averages of the variables for both types of organisations are shown in Table 4.

As suggested by the data in this table, the results were predominantly positive, and higher scores were assigned for all variables in the organisational type focusing primarily on visual disability. This is particularly true for the eventfulness of the observed core affect (eBehaviour).

Multilevel analysis

The results of the multilevel analysis of the four models for the variable pBehaviour are displayed in Table 5. First, we examined whether the time of day, specified in intervals, affected the degree of attributed pleasantness of the observed core affect (pBehaviour) in the Interval model. The results indicate that time of day does not significantly predict staff attributions of the pleasantness of the observed core affect in the participating clients.

Second, analysis of the predictors pSound and eSound on pBehaviour revealed a significant effect (pSound: estimated regression coefficient = 0.569, $SE = 0.086$; eSound: estimated regression coefficient = 0.172, $SE = 0.066$) in the Sound model. This result shows that staff attributed pleasantness and eventfulness of a soundscape are significant predictors of the observed pleasantness of core affect in the participating clients (pBehaviour).

Finally, the type of organisation (primary focus on care for people with an intellectual or visual disability) was assessed as an explanatory variable in the Organisation model. In this model, Organisation was not a

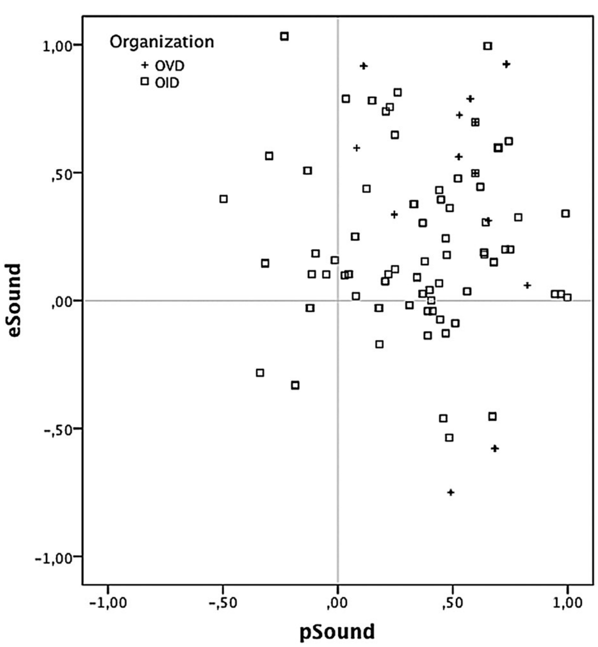

Figure 2. Quality of the observed soundscapes in terms of pleasantness and eventfulness.

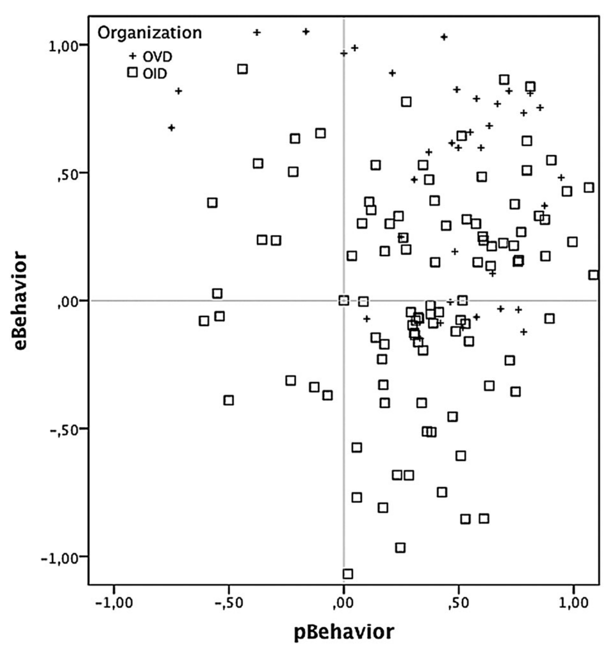

Figure 3. Quality of the observed behaviour in terms of pleasantness and eventfulness.

Table 4. Means and standard deviations for the variables pBehaviour, eBehaviour, pSound, and eSound by type of organisation (primary focus on care for people with an intellectual or visual disability).

	OID1–3		OVD1		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
pBehaviour	0.35	0.39	0.41	0.41	0.36	0.39
eBehaviour	0.04	0.42	0.50	0.40	0.16	0.46
pSound	0.30	0.35	0.52	0.22	0.36	0.33
eSound	0.23	0.35	0.44	0.52	0.28	0.41

significant predictor (estimated regression coefficient = 0.080, $SE = 0.079$).

The best-fitting model was thus the Sound model, in which both sound variables (staff attributed pleasantness and eventfulness of the soundscapes) together provided the largest difference in deviance compared to the Empty model.

The results of the multilevel analysis for the variable eBehaviour are displayed in Table 6, using the same four models previously described for the variable pBehaviour. The first model concerns the repeated measurements and the extent to which the time of day (Interval) affected the degree of attributed pleasantness of the observed core affect (pBehaviour). As with eBehaviour, no significant effect was found in the Interval model.

Analysis of the Sound model reveals that only the variable pSound is a significant predictor for eBehaviour. This result indicates that the staff attributed pleasantness of a soundscape is predictive of the rated eventfulness of core affect (eBehaviour: estimated regression coefficient = 0.396, $SE = 0.113$). The predictive value of eSound on eBehaviour is not significant (estimated regression coefficient = 0.165, $SE = 0.086$). Considering that the effect is in the expected direction with a p value of $< .10$, and in order to maintain the comparability of the models for pBehaviour and eBehaviour, the model with both sound variables is presented.

In contrast to the results for pBehaviour, type of organisation is a significant explanatory variable for eBehaviour (estimated regression coefficient = −0.380, $SE = 0.097$). The results indicate that the core affect of the participants was rated as more eventful in the location focused primarily on caring for people with visual disability. This suggests the Sound and Organisation model to be the best predictive model for the variable eBehaviour.

Discussion

The descriptive analysis of staff attributions of the observed pleasantness and eventfulness of soundscapes and moods in terms of core affect displayed by people with profound intellectual and visual disabilities shows that the averages of all four variables (pBehaviour, eBehaviour, pSound, eSound) fall into the upper-right quadrant. This means that, in general, the observers described both soundscapes and core affect as pleasant and eventful. However, considering the explorative nature of this study, these and the following results should be interpreted with caution. With regard to the eventfulness of core affect (eBehaviour), the average was higher at the organisation focused primarily on caring for people with a visual disability. The multilevel linear regression analysis findings endorse a relationship between reported soundscape and reported behaviour observations, which we expected on the basis of the research by Axelsson et al. (2010) in combination with Kuppens et al. (2012). The combination of the pleasantness and the eventfulness of the soundscapes seem to have significant predictive value for both of these elements of core affect. This

Table 5. Results of multilevel analysis for pBehaviour.

		Empty model	Interval model	Sound model	Sound and Organisation model
				Estimation (SE)	
Fixed effects	Intercept	0.361 (0.045)*	0.210 (0.104)*	0.353 (0.034)*	0.294 (0.067)*
Interval	Morning[a]		–		
	Morning activity		0.076 (0.118)		
	Lunch		0.152 (0.122)		
	Afternoon activity		0.215 (0.118)		
	Afternoon		0.188 (0.123)		
	Dinner		0.247 (0.132)		
	Evening		0.152 (0.126)		
Sound	pSound[b]			0.569 (0.086)*	0.593 (0.089)*
	eSound[b]			0.172 (0.066)*	0.184 (0.067)*
Organisation	Visual[a,b]				–
	Intellectual				0.080 (0.079)
Random effects	Between variance	0.043 (0.017)	0.043 (0.017)	0.017 (0.010)	0.015 (0.010)
	Residual variance	0.110 (0.015)	0.104 (0.014)	0.089 (0.012)	0.089 (0.013)
Goodness-of-fit	Deviance	120.299	114.193	76.039	75.065

[a]Reference category.
[b]Compared to the mean.
*$p < .05$.

combination of pleasantness and eventfulness can be described as the “liveliness” of the soundscape.

In addition to the characteristics of the soundscapes, type of organisation appears to be a significant explanatory variable for the eventfulness of core affect (eBehaviour). These results suggest that the core affect of the participants was rated as more eventful in the organisation that focused primarily on the care of people with a visual disability, consistent with the results of the descriptive analysis. This model, a combination of the explanatory variables pSound, eSound, and Organisation, is the best predictive model for eBehaviour. One possible explanation for this difference is that it is conceivable that environmental noise is dealt with differently in these two different types of organisations. In facilities with a primary focus on people with a visual disability, more attention is paid to acoustic aspects than in facilities that primarily focus on people with intellectual disability (e.g., in meeting certain acoustic standards; van den Wildenberg, van Welbergen, & van der Burg, 2002). Facilities with unfavourable acoustical properties may inhibit normal conversation, promote undesirable vocalisations, or create an aversive ambient environment (Egli, Roper, Feurer, & Thompson, 1999). This might cause a less pleasant or eventful core affect in the clients residing in organisations with a primary focus on people with intellectual disability.

The results also indicate that time of day is not a significant predictor of staff attributions of core affect. It could be due to trends in the staff attributions, as opposed to actual core affect in the participants. For example, staff might change their expectations throughout the day and rate core affect after lunch as eventful as before lunch, even though there were less actual indications. Also, the bias towards positive ratings, given the seemingly positive overall ratings, can be due to an inadequacy of the staff in reliably assessing core affect as suggested by research from Hogg, Reeves, Roberts, and Mudford (2001). The participants were observed an entire day, and therefore they were observed by multiple members of the direct support personnel due to working hours. This variation is accounted for by including time as a predictor variable in our analysis. However, the uneven number of observations throughout the day challenges the validity of the assertion of time of day not having a relationship with core affect. Further research into the relationship between the time of day and staff attributions of core affect is recommended.

This is a newly developed assessment procedure, and an exploratory (or pilot) study, in which refinement of the assessment procedure played an important role. Consequently, there is no information regarding the psychometrics of this assessment procedure as yet. The results, however, seem to comply with previous research on soundscapes and the effects thereof on (the moods, behaviour, and health of) people without disability (Andringa & Lanser, 2013; Berglund et al., 2000; CALM, 2004; Kaplan, 1995; Kuppens et al., 2012). Also, the procedure was based on the Soundscape Quality Protocol by Axelsson et al. (2010), a reliable tool to investigate the subjective appraisal of soundscapes, now applied for the first time in healthcare settings for people with profound intellectual disability. The validity of this research (partly) stems from the consistency with previous literature, but further research is needed to confirm this.

This study is subject to several limitations, such as the choice not to control for individual differences (e.g., level of intellectual or of visual disability) in making the statistical comparisons. This choice was based on the nature of the target group and the facilities in which they reside. In these residential facilities a number of people with profound intellectual and visual disabilities are placed together, forming heterogeneous groups. The aim of

Table 6. Results of multilevel analysis for eBehaviour.

		Empty model	Interval model	Sound model	Sound and Organisation model
				Estimation (SE)	
Fixed effects	Intercept	0.164 (0.054)*	0.128 (0.123)*	0.158 (0.048)*	0.435 (0.082)*
Interval	Morning[a]		–		
	Morning activity		0.002 (0.139)		
	Lunch		−0.012 (0.143)		
	Afternoon activity		0.059 (0.139)		
	Afternoon		0.023 (0.145)		
	Dinner		0.095 (0.155)		
	Evening		0.120 (0.147)		
Sound	pSound[b]			0.396 (0.113)*	0.317 (0.110)*
	eSound[b]			0.165 (0.086)	0.126 (0.084)
Organisation	Visual[a,b]				–
	Intellectual				−0.380 (0.097)*
Random effects[a]	Between variance	0.066 (0.025)	0.066 (0.025)	0.040 (0.019)	0.021 (0.014)
	Residual variance	0.145 (0.020)	0.143 (0.020)	0.146 (0.020)	0.141(0.020)
Goodness-of-fit	Deviance	162.905	161.077	148.618	135.009

[a]Reference category.
[b]Compared to the mean.
*$p < .05$.

this study was to make a first assessment of the staff attributions of soundscapes in these groups and so to ultimately optimise these soundscapes to improve the quality of life of heterogeneous groups of people with profound intellectual and visual disabilities. In future studies, individual differences need to be included in the study design. Also, follow-up study involving simultaneous observations by two members of the direct support personnel, or other groups of observers such as researchers or family members, could allow analysis regarding inter-rater reliability and further psychometric analysis to validate the assessment procedure introduced in this paper. The amount of missing data does not necessarily have to be considered a limitation of this study, as the missing data arose due to logistic reasons, such as a higher workload for the observers in the mornings and evenings. Because the missing data did not arise due to factors related to the dependent variables, and can be considered missing at random, the results from the multilevel analysis are expected to be valid (Little & Rubin, 1987).

One important question that remains is how people with profound intellectual and visual disabilities actually perceive soundscapes. Given their profound disabilities, it is likely that they process sound in a different way compared to people without disability. That is the main reason why the caretakers in this study were asked to observe and appraise the soundscapes as they themselves experienced these environments. At this point, it is unfeasible to make correct judgements on how people with profound intellectual and visual disabilities experience soundscapes. For example, people without intellectual and visual disabilities can distinguish the importance of sounds but people with these disabilities might be able do this poorly, more slowly, or not at all. All sounds may appear equally important to them, because prioritising might be difficult and they may have difficulties in attending to the sources optimally. Also, our data does not allow any conclusions regarding the rotation of axes representing core affect, pleasantness and eventfulness, for people with profound intellectual disability. For example, people without disability might perceive a particular environment as lively, whereas those with profound disability might perceive it as chaotic and overwhelming. If this is the case, the axis should be rotated in a counterclockwise direction. Only by researching how people with profound intellectual and visual disabilities react to different kind of soundscapes will we be able to unravel the actual perceptual processes of people with profound intellectual and visual disabilities.

The ability of people with disability to interact with their environments depends in part upon the sounds within these environments, and people with such disability might not have the cognitive capacity to comprehend many contemporary soundscapes (Van den Bosch et al, in press). It is therefore important to investigate how the auditory environment can be optimised for people with both intellectual and visual disabilities in order to make these people feel safer and more comfortable in their living environment. Because these people cannot adapt optimally to their environment, they need well-tuned conditions to flourish. This may already be accomplished by investigating how people with intellectual and visual disabilities react to sounds and by making simple changes to their environment like adding pleasant background noise and using acoustically damping materials. As a result, the interactions between people with intellectual and visual disabilities and their direct caregivers will be more efficient and effective because there will be less miscommunication and negative attention, increasing the probability of people with these disabilities experiencing positive moods.

Conflicts of interest

None.

Funding

This work was supported by The Netherlands Organisation for Health Research and Development under Grant 94308003. The funding body poses no restrictions on the access or publication of the research data.

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