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The Role of Sound in Residential Facilities for People With Profound Intellectual and Multiple Disabilities

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Abstract

Attention to the auditory environment of people with profound intellectual and multiple disabilities (PIMD) is limited, both in research and practice. As there is a dynamic interplay between the quality of the auditory environment and well-being, a study was undertaken to test the validity of the theoretical framework regarding the role of sound in homes for people with PIMD. The framework was formulated using techniques from soundscape and emotion research and resulted in a taxonomy of auditory environments, or soundscapes, including an important role for audible safety. A convenience sample of 34 healthcare professionals from various organizational layers volunteered to participate in a focus group study. During this expert meeting their latent knowledge was examined to see if it corresponded to the proposed theoretical framework. The answers given by the participants were grouped in five categories, Influencing behavior, Atmosphere, Clarity, Structure, Safety, and Recognition, showing a strong consistency between the knowledge and experience of the professionals and the theoretical framework. Results suggest the participants working on a strategic level have a less comprehensive understanding of the role of sound in the daily care. The authors' recommended the increase of awareness amongst the staff of organizations caring for people with PIMD of the role of sound in the environment so as to enhance psychological well-being and quality of life and thus reduce the prevalence of behavioral problems.

Keywords: audible safety, auditory environment, intellectual disability, PIMD, soundscapes

Introduction

Research on people with severe or profound intellectual and multiple disabilities (PIMD) has covered a wide range of topics, including the development and evaluation of interventions with a strong focus on sensory stimulation. However, there has been minimal attention to the auditory environment *per se* and its potential (positive or negative) effects on individuals with PIMD (Kingma, 2005). The focus of this paper is to examine and validate a theoretical framework regarding the role of sound in homes for people with PIMD.

Sound plays an important role in informing people about their environment, and as such sounds influence moods, cognition, and behavior. People with PIMD presumably rely more on sound than other people due to a high prevalence of visual impairments (Warburg, 2001). According to studies in the Netherlands (Van Splunder, Stilma, Bernsen, & Evenhuis, 2005), nearly 70% of individuals with severe intellectual disability are visually impaired, which is in most cases is caused by impaired development of the visual cortex in the occipital lobe (cortical blindness). Such cerebral visual impairment (CVI) does not show a consistent pattern among individuals with PIMD. Each individual is impaired in a unique way by CVI and even within individuals the condition may vary depending on environmental factors and time. A complicating factor is that in individuals with severe intellectual disabilities a visual impairment often remains unnoticed (Vlaskamp, 2005) because people with PIMD have greatly diminished capabilities to express themselves. As they do not have the verbal capacity to speak and their body language can be greatly distorted, they may be unable to complain about a loss of vision or symptoms of visual impairment.

With the (partial) loss of one of the senses, people become more dependent on the remaining ones (Occelli, Spence, & Zampini, 2010). For example, in the case of visual impairments, the auditory input becomes more important, compensating the negative effects of degraded eyesight with auditory information (Dufour, Després, & Candas, 2005). Thus, it is likely that many individuals with visual impairments rely more on auditory information to make sense of the world surrounding them.

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One of the assumptions of this article is that this auditory compensation applies equally to people with PIMD, since they seem less often affected by hearing problems than by visual impairment (Evenhuis, Theunissen, Denkers, Verschuure, & Kemme, 2001). The lower prevalence of hearing deficits compared to visual deficits in these populations with PIMD can be explained by a more prominent role of subcortical areas in hearing than in vision (Andringa & Lanser, 2013). Important auditory processing is, to a large extent, subconsciously performed in the midbrain. For example, hearing direction, separating and grouping the signal into separate components, auditory scene analysis (Winkler, Denham, & Nelken, 2009), and probably auditory gist processing (Harding, Cooke, & König, 2007) are midbrain processes that generally seem to be preserved in one of these persons with PIMD. Since people with PIMD are likely to rely more on sound than on vision, it is expected that supportive auditory environments are beneficial for their well-being. Therefore, it is important that the effects of auditory environments on people with PIMD are well understood so that they can be optimized by carers to promote overall well-being and quality of life.

In this article, we present a theoretical framework using techniques from soundscape and emotion research that can quantify such effects, like core affect, and present a taxonomy of four types of auditory environments, or soundscapes, in which the concept of audible safety plays an important role. Using a focus group study methodology, the latent knowledge of 34 healthcare professionals was elicited, to examine whether this complied with our theoretical framework. In addition we determined the implicit knowledge of carers about the role of the auditory environment, so that we could translate our scientific knowledge and insights into the daily practice of working with persons with an intellectual disability. Our ultimate goal was to assess soundscape quality and contribute to guidelines for policies to optimize living environments for people with PIMD so as to enhance psychological well-being and quality of life and to minimize the prevalence of behavioral problems.

Theoretical Framework

Audible Safety

The capacity to hear and listen—audition—has an evolutionary rationale (Hester, 2005). One important function of audition, from an evolutionary perspective, is to "warn." If the safety of an environment can be estimated (heard) it allows an individual to relax or attend to other matters instead of being vigilant. Audible safety indicators do not so much indicate safety, as they do normalness. In fact, the most pleasant sounds are also profoundly "normal" (De Coensel & Botteldooren, 2006; Guastavino, 2006). Humans tend to like the songs of birds, the soft sounds of domesticated animals, children playing, the neighbor cleaning their house, the murmur of a quiet conversation on the street, and their child singing in the room. These sounds share one common characteristic, namely that they all are examples of activities that one typically engages in when feeling safe. Consequently we use the judgment of other individuals (including individuals of other species) to inform us about the safety of the environment (Andringa & Lanser, 2013).

We argue that auditory information normally contributes to forming a "sense of place," which provides clarity about the current location and situation and as such allows an individual to generate expectations (Morgan, 2010; Tuan, 1975). Following the dual pathway model of auditory signal processing (Wang, Wu, & Li, 2008), which suggests two auditory streams of cortical processing, namely, a ventral "What" and a dorsal "Where" pathway, we propose that this sense of place arises from the answers to two questions: "Where am I?" and "What's happening?" Based on this sense of place, one can form expectations and anticipate what is to come. An absent, confused, or unstable sense of place can lead to uncertainty and a sense of insecurity because it becomes difficult or impossible to generate situationally appropriate behavior. We hypothesize that for people with PIMD, the process of forming a sense of place relies more on recognition of certain situations than for people without PIMD, due to reduced cognitive capabilities. Therefore, we propose that for people with PIMD, the main question answered by audition is "Am I in a safe place?" This question consists of two components: (1) "Do I know this place?" and (2) "Is this place safe in its current state?"

Only very recently in evolution has audition been used for speech and even more recently for non-natural sounds (Andringa & Van den Bosch, 2013). Non-natural sources, like ventilator, traffic, or other machine sounds, act as distractors that make it more difficult for people to establish audible safety and they contribute, for that reason, to sound annoyance. For sound annoyance to occur, it is not necessary that the sound source has particularly annoying acoustic properties. The simple fact that a machine sound obscures more pleasant (safety-indicating) sounds is enough to be experienced as an annoying intrusion (Andringa & Lanser, 2013). For example, the sound of traffic is often not particularly unpleasant; it may even resemble the sound of the ocean, which people typically like to hear. But traffic sounds can also mask subtle environmental sounds indicative of safety. As a result, the main effect of the blanket of non-natural sounds that covers our daily living environments is to further disconnect individuals from their (natural) environment. Unfortunately, this means that, in such situations, it may be even more difficult to determine whether one is in a safe place. The predictable result is that people become more vigilant, alert, and aroused. Consequently, they are less likely to relax and/or be engaged in an undisturbed activity, and perhaps more likely to be fatigued in the long run (Andringa & Lanser, 2013).

There is a lack of research and knowledge on the effects of the daily auditory environments on people with PIMD. For people with an intellectual disability in a long-term-care situation, such as in a residential facility, the above-mentioned negative consequences could be amplified. For example, if you are unable to ignore a sound and cannot escape it (e.g., cannot leave the corresponding environment because you are wheelchair-bound), you will evaluate the sound as annoying, become more stressed, and appraise the overall situation as unpleasant. This is even more likely for people with minimal or no opportunities to influence their (auditory) environment, such as people with PIMD. According to Kahneman (1973) human cognitive resources are limited, and when processing load for one-task increases (e.g., for establishing audible safety) this will reduce the amount of

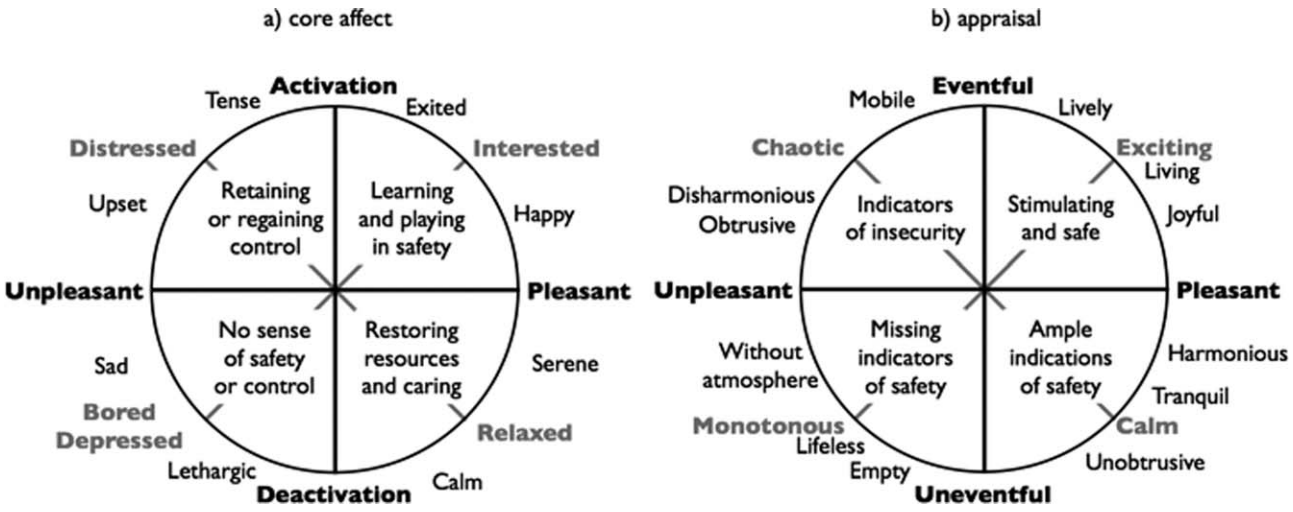

FIGURE 1

Core affect and appraisal of auditory environments (from Andringa & Lanser, 2013).

resources available for other concurrent tasks. For people with PIMD, who already have reduced cognitive functioning as defined by their intellectual disability, the constant processing of a multitude of sounds and determining audible safety in such complex auditory environments could dominate or even exceed their cognitive resources. Therefore, if not paid particular attention, the living environments of people with PIMD could be structurally deprived of useful positive indications of safety. The resulting (prolonged) stress and arousal may well affect their overall psychological well-being and quality of life negatively (Petry, Maes, & Vlaskamp, 2005), also perhaps contributing to behavioral problems.

Assuming audible safety is indeed of such great importance for people with PIMD, we can design for optimized audible indications of safety. These indicators should either be relaxing and reassuring, or encouraging activation. This could be achieved, for example, through providing auditory environments that are pleasant to be in and individual sounds that are fun, casual, and interesting for people with PIMD, such as the sounds of animals or toys. In a safe environment, the probability that people with PIMD might engage in activities and social interactions increases. This can prevent boredom, encouraging them to explore their environments more and thus learn to master the possibilities and limitations of their environment.

Soundscapes

Research focusing on the psychological aspects of auditory perception is conducted in terms of soundscapes. A soundscape is defined as an environment of sound, with an emphasis on how it is perceived by an individual or society (Schafer, 1977). Research shows that suboptimal soundscapes can induce a wide range of detrimental effects on the welfare of people (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, well-being, and quality of life (Berglund, Lindvall, & Schwela, 2000). These negative effects on individuals are not only detrimental for the listener themselves but eventually can contribute to greater social and economic costs to society (Grahn & Stigsdotter, 2003). To reduce the negative impact of unpleasant soundscapes on the welfare of people we need to gain more insight in which soundscapes characteristics elicit these unwanted effects.

A growing body of research indicates that it is not the physical properties of sound (such as loudness), but the message conveyed within the sound (the meaning people attribute to the sound) that has the largest effect on well-being caused by noise (Ising & Kruppa, 2004). Soundscape research showed that for pleasantly appraised sounds, usually no limits need to be imposed on sound level or duration (Booi & van den Berg, 2012). Also, the mere reduction of noise levels does not always lead to more positive perceptions of that environment (Adams et al., 2006; Dubois, Guastavino, & Raimbault, 2006); contrarywise, it can even lead to anxiety (Stockfelt, 1991). We propose this can be explained by the presence or absence of audible safety.

The concept "core affect" allows better understanding of human perception of soundscapes. Core affect originates from emotion theory and refers to mood (Russell, 2003) as relation between the individual and the world (Kuppens, Champagne, & Tuerlinckx, 2012). While emotions often are short-lived and not always present, one can always describe in what kind of mood one is. This always-present feeling is called core affect and can be mainly described by the combination of two features: pleasantness and activation (Figure 1a). To give an example: the corresponding core affect for playful enjoyment can be described as pleasant and active. Vice versa, gloominess can be described as unpleasant and passive.

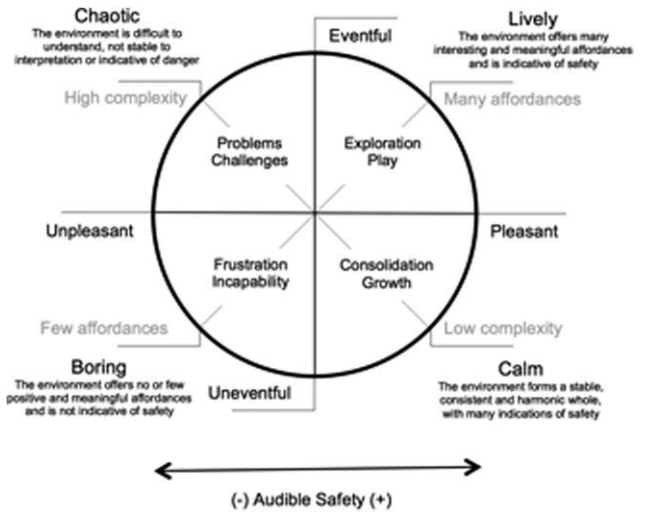

FIGURE 2

Four types of soundscapes (Chaotic, Lively, Boring and Calm) and their basic dimensions (Eventfulness vs. Pleasantness, and Affordances vs. Complexity).

Axelsson, Nilsson, and Berglund (2010) have studied how people appraise auditory environments and showed that such appraisal is commonly based on the pleasantness and eventfulness of the auditory environment (Figure 1b). Therefore, it seems that the way individuals describe their inner state, or mood, is coupled to the way they describe the state of the surrounding world. This idea is supported by research showing that there is a strong, mutual, and continual relationship between moods and how people appraise their surroundings (Andringa & Lanser, 2013; Kuppens et al., 2012).

Taxonomy of Soundscapes

Based on the similarity between how one feels (core affect) and how one appraises their environment, in combination with the assumption of audible safety, researchers proposed (Andringa & Lanser, 2013) to define soundscapes in four categories: Lively, Calm, Boring, and Chaotic (Figure 2).

These types of soundscapes can be classified according to their pleasantness and eventfulness, or complexity and affordances (Andringa & Van den Bosch, 2013). Figure 2 shows these types, with the degree of pleasantness on the horizontal axis and degree of eventfulness on the vertical axis (the location of the labels indicate a high value on this dimension). In contrast to Figure 1, there are also two diagonal axes: bottom left to top right represents increasing affordances and bottom right to top left represents increasing complexity. Affordances indicate the extent to which the environment offers (pleasant) options for self-selected behavior. The complexity of an environment indicates how difficult it is to choose situationally appropriate behavior. Some situations offer rich possibilities for behavioral options while other, potentially dangerous, situations leave few appropriate choices.

A *chaotic* soundscape can be difficult to interpret (e.g., by an abundance of sound-producing activities) or may be indicative of unsafety. This is often caused by the presence of unpleasant sounds in the foreground (e.g., construction work next to a busy street). It is important to realize that the quality of soundscapes and associated behavior are strongly related: it is difficult to stay calm in a chaotic situation. Therefore, a chaotic soundscape makes people feel distressed (upper-left quadrant, Figure 1a).

Boring soundscapes contain little meaningful audible affordances and do not necessarily guarantee safety. Unpleasant background noise and the absence of indicators of safety are characteristics of such environments (e.g., a loud air conditioner). Submission (to environmental influences) is behavior that fits a boring and impoverished soundscape (lower left quadrant). It is neither pleasant nor active, because the environment has nothing interesting to offer. It is a monotonous, dull environment that offers little reassuring. People in this quadrant have no sense of security or control over their environment because they do not have the appropriate behavioral repertoire act. This situation endures as long as the person remains stuck in the impoverished environment. Because of the lack of interesting stimuli that are new and safe, familiar behaviors (often stereotypical ones) will be activated to prevent further deterioration and for self-protection. However, this stereotypical behavior does not help to structurally improve the situation.

On the pleasant side, a lively soundscape represents many affordances that offer interesting options to attract attention and is indicative of safety. It is a stimulating and safe environment, characterized by the presence of pleasant foreground sounds. Exploration (of the environment) is behavior typically seen in lively soundscapes (upper-right quadrant). A lively soundscape offers many affordances representing interesting options to engage in. In an interesting, fascinating environment, one's curiosity is stimulated, encouraging the person to explore and learn. It is a stimulating and safe environment, characterized by the presence of pleasant foreground sounds.

Lastly, calm soundscapes provide sufficient indications of safety and allow full flexibility to relax and recover after challenges or stress. They are characterized by pleasant background sounds (such as wind in a forest) and few foreground sounds. Relaxation is behavior associated with a calm soundscape (Booi & van den Berg, 2012; Botteldooren & De Coensel, 2006; Shepherd, Welch, Dirks, & McBride, 2013). People look for a park or beach when they want to relax, and people with PIMD do just the same, for example, when they are enjoying a rich garden environment in the company of a trusted carer.

Focus Group Study

To test the validity of our theoretical framework, a focus group study was organized to determine whether the implicit and explicit knowledge of healthcare professionals working with people with PIMD is coherent with the abovementioned ideas.

TABLE 1
The given answers and corresponding categories per focus group.

Answers	Category	Organizational level				
		E1	E2	C1	C2	S1
Masking (of unwanted sounds)	Influencing behavior		X			
Disruptive (disturbing current focus/activities)	Influencing behavior	X				
Relaxing—Activating	Influencing behavior			X		
Influencing behavior and mood	Influencing behavior				X	
Calm	Influencing behavior		X			
Unrest	Influencing behavior			X		
Atmosphere (role of background sounds)	Atmosphere	X	X	X	X	
Clarity (of activities, people)	Clarity	X	X			
Predictability (of activities, people)	Clarity					X
Structure (sounds indicative of daily structure)	Structure		X	X		
Rituals (sounds indicative of daily structure)	Structure		X			
Safety (direct reference to role of safety)	Safety		X	X		
Unsafely (direct reference to role of safety)	Safety			X		
Recognition (of carers)	Recognition				X	X

Method

Participants

A convenience sample of 34 healthcare professionals voluntarily participated in the expert meeting. Focus groups (Acocella, 2011; Fern, 1982) were used to maximize the collection of high-quality information. Participants were recruited from five organizations predominantly from the northern part of the Netherlands that provide residential accommodation to individuals with PIMD. Purposive sampling was employed in initial recruitment to enable specific targeting of information rich cases (Patton, 2002). The number of participants was not predetermined; rather, participation ended when the full range of professional experiences about auditory environment was captured. Both excessively homogeneous and heterogeneous grouping was avoided. Hierarchical positioning was avoided to prevent inhibition during the discussions.

Procedure

Data-gathering procedure started with a presentation explaining the goal of the meeting: namely to acquire the diversity of latent knowledge of these professionals regarding the sonic environment in the homes of people with PIMD. In this presentation, the scope of the research was discussed and the theoretical framework of the study was clarified. This part focused on the mutual influencing of mood (core affect) and the appraisal of the (sonic) environment (Andringa & Lanser, 2013; Kuppens et al., 2012). Consecutively, guidelines for the discussion in the focus groups were given. This phase took about 30 min.

Hereafter, the participants were grouped into five focus groups. The participants were first divided into three levels based on their role in the organization, "executive" including direct support staff (DSP, $N = 12$), "context providing" representing behavioral scientists ($N = 14$) and "strategic" including the management and policy functions ($N = 8$). This resulted in two executive level groups with six participants, two groups of seven participants at the context providing level, and one strategic level group of eight participants.

The groups were presented with the following question: "*What is the role of sound in homes of people with PIMD as seen from your expertise?*" They were given 75 min to brainstorm and orientate on the question. Three skilled moderators were present to facilitate the focus groups. After a lunch (45 min) in which the topic was still discussed actively, the focus groups were given another 60 min to converge on what they have discussed before and to write down the answers to the question on flip charts. It was mentioned multiple times during the day that the aim was not to reach consensus within the groups but to provide a diversity of possible answers covering all available expertise and experience.

Finally, the groups were asked to present their results on flipcharts. Each group had five minutes to do so. These presentations led to a lively session in which many groups discovered important commonalities and, quite often, relevant additions to their own results. This session ensured that an initial consensus among the participants was formed, in which the groups were strengthened in the way they had approached the topic. However, this did not influence the information on the flipcharts that had already be compiled and finalized. Only the information on the flipcharts was used for further analysis.

During the whole day, audio recordings were made and field notes were taken to note narrative summaries and relevant non-verbal data. These were not necessary for this study. The analysis below is based on the information as written by the participants on the flipcharts.

TABLE 2
The answers per category, per organizational level

	Category					
Organizational level	**Influencing behavior**	**Atmosphere**	**Clarity**	**Structure**	**Safety**	**Recognition**
Executive	3	2	2	2	1	
Context providing	3	2		1	2	1
Strategic			1			1

Analysis

The workshop leaders (and authors of this paper) gathered the next day to analyze the collected data on the flipcharts. First, the responses of the participants were written down per group and clarified when needed. The authors discussed the answers given by the five groups in general. Following deliberation, corresponding terms were rephrased in uniform terms and the workshop leaders addressed the frequency, similarities, and diversity in the responses.

The text written on the flip charts were digitized and sent to the members of the respective focus group with the request to check for accuracy and completeness. The feedback obtained clarified some examples given and did not affect the analysis.

Results

As Table 1 shows, the most frequent mentioned roles of sound in homes of people with PIMD were Influencing Behavior ($N = 6$) and Atmosphere ($N = 4$). The participants mentioned all answers under Atmosphere literally, and Influencing Behavior refers to answers suggesting that sounds can have a relaxing or activating effect on behavior. In addition, Clarity ($N = 3$), Structure ($N = 3$) and Safety ($N = 3$) were mentioned. These replies refer to the predictability of the structure of the day and the role of sound in determining whether a situation is safe or not. Finally Recognition ($N = 2$) was mentioned as a role of the auditory environment, which involves the recognition of personnel.

Table 2 shows that the groups on the executive level generated most answers (10, on average 5 per group), the context providing groups generated nine answers (on average 4.5 per group) and the group on the strategic level generated fewest and least diverse answers (2).

Conclusions

It appears that, according to health care professionals, Influencing Behavior is the most prominent role of sound in homes for people with PIMD ($N = 6$, 28.6%). Influencing Behavior entails that sounds can have activating or relaxing effects on the behavior of persons with PIMD. This supports the claim that the sonic environment could affect the behavior of people with PIMD and as such, should be considered more carefully.

The participating professionals also state that sounds, partially, determine the atmosphere (Atmosphere, $N = 4$, 19%). In the introduction it was mentioned that the atmosphere, carried by the subtle background sounds, helps to answer the where-question on a continual basis and, therefore, is crucial in forming and maintain a sense of place. In addition, responses in the categories of Clarity, Structure, and Recognition were mentioned as part of the role of sound. Sounds can indicate, for example, which activities follow or which DSPs are present. This might refer more to the foreground sounds, which help to answer the what-question as discussed in the introduction. Lastly, Safety was mentioned explicitly in 14.3% of the cases ($N = 3$), which implies a clear safety aspect in the role of sound for people with PIMD.

Combined, the categories Atmosphere, Clarity, Structure and Recognition form a majority of the answers provided ($N = 12$; 57.1%). This result provides support for our hypothesis that the auditory environment is indeed crucial in determining a sense of place based on the question "Am I in a safe place?" This implies that the first role of sound is that of an indicator of safety, it is not so much the location, but the safety of the situation. The second role of sound would be to clarify the situation. "What is happening here? What can I expect?" Expectations make it easier to handle the complex world around us. Deviations from expectations in the form of unknown or unexpected noises reduce predictability and elicit a sense of unease. Overall, results showed a high level of consistency between the knowledge of the professionals and our theoretical framework.

Looking at the differences in the answers across the organizational levels, the most remarkable result is that the Strategic level had fewest and least diverse answers. It is also striking that the Strategic level was the only level that mentioned Predictability as the role of sound. The second answer given by the strategic level was Recognition and this is closely related to Predictability. The Strategic level group was also the only group not to mention Safety, Atmosphere, Structure and Influencing behavior as direct roles of sound within the homes of people with PIMD. This might be suggestive of the Strategic level having a less comprehensive understanding of the role of sound in the daily care. This might entail that communication about the role of sound toward management and toward those involved in daily care may not be the same.

Discussion

We propose that the quality of soundscapes is best understood in terms of how we appraise these soundscapes with regard

to safety and pleasantness (and not in terms of acoustic properties, such as loudness). The framework we propose may explain why certain loud sounds may not necessarily lead to experiencing discomfort, when one consciously chooses to be exposed to those sounds, such as attending a concert or a party. It may also explain why the subtle sound of a mosquito at night can be greatly irritating, despite being a very soft one. People with PIMD could offer us a unique window on basic human sound processing due to a reduced influence of higher cognitive (culturally biased) processing. The information provided by the DSPs support our conviction that the main role of audition (throughout evolution) is to provide and maintain a sense of place. Insufficient indicators of safety arouse and motivate individuals to restore a sense of basic (audible) safety.

There are several limitations to this study. First, we cannot guarantee that our sample was representative. Considering that the participants registered voluntarily, thus showing an interest in the topic, and the diversity of the professions in the group, it is likely that they have an interest in the topic. Second, using focus groups creates a social situation in which certain participants might feel inhibited from fully participating. They may provide socially desirable answers or no answers at all. We tried to minimize this by emphasizing that we were not looking for consensus, rather for the full range of possible answers. In addition we observed very lively interactions where everyone seemed to participate in. Further research is needed, experimental or observational, to test the claims of this framework, and its usefulness for people with PIMD.

In today's industrial society, it is difficult to prevent the environment becoming filled with unwanted sounds. The monotonous "blanket" of unnatural sounds promotes people to stay alert and they may not be able to properly relax. However, a potential solution is to create enough diversity in soundscapes so that an escape from these unnatural sounds is possible. When there are enough opportunities to experience pleasant environments, with calm or lively soundscapes, people with or without PIMD can relax and escape from the hectic soundscapes. A bad mood, a negative core affect, reflects a negative evaluation of the person about his or her environment (and the challenges and opportunities it provides). Especially for people with PIMD living in a residential facility, chances are that such an environment could lead to structural challenging behavior (unintended, as support staff would not deliberately promoted such a negative core affect). This behavior should be seen as a sign of active resistance against an unsafe or otherwise suboptimal living environment.

As described in previous sections, sounds inform people about their surroundings and as such influence moods, thoughts, behavior, and well-being. Indicating safety could be an important mediating factor in this process and, therefore, a high-quality soundscape should help to continually confirm audible safety. If the overall situation is clearly indicative of safety through audible activities, even quiet distinctive and unpleasant sounds may not be so disturbing because they occur in a reassuring environment. But if there are few indications of safety (e.g., through masking sounds of air conditioning systems), or if there are indicators of unsafety (e.g., the sounds of anxious people or loud machines), then everyone (PIMD or not) is forced to be alert and pay attention to (the negative aspects of) the soundscape. To acknowledge the role of audible safety and translating—on the basis of experience and common sense—one's own relation to good and bad soundscapes toward the needs and wishes of people with PIMD will be a first and important step toward offering audible safety to them.

Our main recommendation, therefore, is to increase awareness of the role of sound in our environment amongst the staff of organizations caring for people with PIMD. We must pay close attention to the design and maintenance of positive soundscapes, avoid noise pollution by reducing the volume and quantity of unwanted sounds, and provide ample audible safety, to contribute to a higher quality of life for individuals with PIMD. When reflecting on the environment, and keeping the effects of a stressful auditory environment in mind, staff will cope better with the everyday sounds that fill the soundscapes of people with PIMD. In future work we hope to provide guidelines on how (audible) safety can be enhanced and how this can be observed from the behavior of the clients. Increased awareness, not only among the direct support staff but also in all layers of the organization, seems to be the necessary first step to structurally improve the soundscapes of people with PIMD and with that improve their quality of life. We should be aware of the fact that people with PIMD are less autonomous. They often cannot ask if the radio can be turned down, or leave when a soundscape is unpleasant. It is the task of the daily support personnel to recognize what is good for their clients and to act appropriately. It is the task of the management to promote this. Yet the focus study suggests that, in particular, management may not be fully aware of the role and importance of sound in the day-to-day care.

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