

*Full-length article***Establishing healing soundscapes through musical soundscape interventions in hospitals**Jan Sonntag¹, Pia Preißler², Johannes Treß³, Eckhard Weymann⁴¹ Medical School Hamburg, Department of Arts, Society and Health² Center for Music Medicine and Music Therapy Heart and Vascular Center & Center for Psychosocial Medicine, University Medical Center Hamburg-Eppendorf,³ University of Hamburg, Institute of Systematic Musicology,⁴ University of Music and Drama Hamburg, Institute of Music Therapy**Abstract**

The question of how hospital environments can be aesthetically improved with the goal of supporting healing in a holistic way is increasingly subject to interdisciplinary research and practice development. In this report, coming from the perspective of Musical Soundscape Intervention (MSI), the Healing Soundscapes Project (HSS) is presented with its theoretical framework, practical implementation, which is based on previous research. The article first introduces the concepts of a Healing Environment, Soundscapes and Atmosphere, Ambient Music and Environmental Music Therapy (EMT). Then the concept and history of HSS is displayed, focussing on sound interventions for specific spaces in hospitals to affect the atmosphere positively. Accompanying research within HSS previous research is summarised and two examples of current subprojects described (HSS in operation theatres and HSS *live*). Finally further development is outlined and the essence of the report resumed.

Key Words: *Sound performance, sound installation, healing environments, soundscape, atmosphere, music therapy, generative music*

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Introduction

Due to its versatile effects, music is increasingly recognized as an effective psychosocial and rehabilitative intervention in the health care system [1]. In this article, we will approach the subject through a broad frame, contextualizing music within the sonic environment of the hospital. We will report on an interdisciplinary project entitled 'Healing Soundscapes (HSS)' which has been conducted by a collaboration of academic and health institutions in Hamburg since 2014. The article first introduces the concepts of a Healing Environment, its Soundscape and Atmosphere, Ambient Music and the potential of Environmental Music Therapy (EMT). On this theoretical basis, the concept and history of HSS is presented, focusing on sound interventions for specific spaces in hospitals to positively affect the atmosphere. Accompanying research is summarized and two examples of current subprojects are described: HSS in operation theatres and HSS *live*.

Theoretical Framework of Healing Soundscapes*Hospital as Healing Environment*

Hospitals are increasingly attracting public attention as places of health promotion. The influence of aesthetic qualities of space (colors, light, air, acoustics, etc.), as well as social, psychological, and organizational factors of entire institutions on patients, relatives, and employees, are topics that contribute to the interdisciplinary concept of Healing Environments [2,3].

The auditory environmental factors in hospitals do not always seem to promote health. For example, high noise exposure levels in various hospital settings are reported worldwide, with noise levels exceeding WHO-recommended levels [4,5,6]. Several studies highlight the possible negative effects of noise as a stressor on patients and medical staff [7,8]. Music therapy researchers have made efforts to address noise in hospitals and test appropriate countermeasures. For example, the effects of music played through headphones for patients [9], an individual solution that leads to a "separation" of the individual person and the environment.

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In our view as well, application of specific selected music as the composition of a consciously designed, noise-reduced environment is essential to consider in addressing various goals and settings within the hospital. Subsequently, we will introduce several core concepts that theoretically inform our research.

Soundscape

Soundscape is a core term defined in interdisciplinary research that has been conducted in sound, composition, acoustic design, acoustic ecology, music therapy, among other topics and disciplines. The term was conceptually elaborated by the Canadian composer R. Murray Schafer [10]. Today, an ISO definition refers to the "acoustic environment perceived, experienced and/or comprehended by a person or by a group of people in context"[11].

Atmosphere

The aesthetic concept of *Atmosphere* provides an appropriate theoretical framework for improving hospital environments. Grounded in recent phenomenology, *Atmosphere* describes how people feel in relation to their sensually perceptible environment [12]. As a general theory of perception, the concept is well integrated across disciplines and thus open enough to serve as a reference for the disciplines involved in the design of sound environments in hospitals (medicine, music therapy, composition, music psychology, and engineering, to name only the most important).

Environmental Music therapy

For *Environmental Music Therapy* (EMT), the influence on the environment is also central. It can be characterized as: "The use of live music in a dynamic process using attunement to an environment and entrainment to its constituents to provide a soundtrack for that environment that modulates the perception of the meaning of space and its soundscape." [13].

Ambient Music

In history, we find numerous examples and concepts of how music evolves from pure stage art "into space". In the 1970s, the rock musician, music producer, and composer Brian Eno experimented with *Ambient Music*. Under this term, he intended to use music like a tint or a scent. In the booklet accompanying his album "Music for Airports", he defines his approach as follows: "Ambient music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting" [14]. For a hospital environment, where music

is not allowed to be an additional disturbing stimulus, such music with low performativity and low attention demand seems suitable to modify the atmosphere subtly.

Musical Soundscape Interventions

Informed by these concepts and approaches, the project team 'Healing Soundscapes' has developed the conception of a *Musical Soundscape Intervention* (MSI). The aim is to modify the sound environment of particularly sensitive hospital waiting and working areas through subtle but targeted spatial sound interventions. As an artistically and site-specifically designed (possibly interactive) sound environment, MSI should be developed to improve the atmosphere in a room and, thus, the well-being of those present [15].

For MSI as an electronic sound installation, a computer, is used to play generative music via a surround sound loudspeaker system. Using presets of defined characters, the composer programs framework conditions for sonic processes that constantly "reinvent" themselves based on algorithms. Thus, the sound installation always sounds similar but never the same. The same strategy is pursued by playing sound interventions *live* in form of subtle ensemble performances based on specific improvisation models (see example below). The live version is opted to be practised in wide, open areas of hospitals like waiting areas, foyers etc. In sensitive areas like the Operating Theater, for instance, computer generated music is the medium of choice.

The reference to the chosen room is established prior to the composition process through atmospheric and acoustic analysis and reflections on the auditory "needs" of the space. After the spatial analysis the project interdisciplinary team initiates a "translation process" of the spatial features and requirements into possible musical parameters. The intention is to compose or improvise the sounds based on the idea of *Neutral Music* [16], which is characterized by the following features:

- Disjunction (harmonic, melodic, timbral, and/or spatial)
- Aperiodicity
- Sonic richness ("beauty") of the individual event
- Slow to medium tempo
- Low to medium dynamics

Inspired by the works of John Cage, Morton Feldman, Brian Eno and others, *Neutral Music* is utmost non-idiomatic and can be understood as a kind of "common space" for individual sound events. In scattered discontinuity, the sound events are only vaguely related to one other through the framework of the composition (or the improvisation model), and do not offer much of musical

form to the listener. A sound space is perceived rather than temporal musical progression in the conventional sense. This consequently eliminates the need for evaluation among listeners in terms of their previous musical preferences, since it avoids rising musical expectations. Following this idea HSS aims for maximum acceptance of the MSI by the heterogenous spectrum of people being present in the hospital environments.

In the sense of Ambient Music, it is intended to influence the atmosphere very subtly. As it is created for the specific context of a sensitive hospital environment, the most important guiding principle for a MSI is to align the sounds with the qualities of the space and the needs of the persons present. The persons present should of course not be exposed to continuous sound. Phases of silence need to be part of the MSI, and in addition to this everyone must have the possibility to temporarily switch off the sounds altogether. Patient recovery and work safety are the highest priority and a MSI should not disturb or mask the important sounds in the hospital, such as alarms or communication. It should, however, reduce the subjectively perceived stress caused by hospital noise. The MSI is bound to be composed to integrate distracting and unnecessary background noise and merge into the given environment rather than adding to it. The sound composition should be both relaxing and positively stimulating, which can have a positive effect on the ability to cope with noise and other stressors.

History of the healing Soundscape Project

Around 2014, heart surgeon Sebastian Debus approached his professorial colleagues Georg Hajdu and Eckhard Weymann from the University for Music and Drama Hamburg and Jan Sonntag from the Medical School Hamburg with the idea of improving the atmosphere of rooms in the Heart Centre of the University Clinic Hamburg Eppendorf (UKE) through music.

A complex task requires many resources and should not be approached from just one perspective. Thus, an interdisciplinary, cross-university network came into being to develop the idea of creating sound environments that promote recovery multi-dimensionally.

2016 HSS won the "Excellent Claussen-Simon competition for universities", meanwhile also collaborating with the Institute of Systematic Musicology at the University of Hamburg. Thus, in the following years, the team was able to carry out an interdisciplinary teaching and research project in which students, professors, and other academics from music therapy, musicology, and multimedia departments worked together in an explorative and open frame. During this time, we developed and installed Healing Soundscapes in one of the waiting rooms of the University Heart Centre and the waiting area of the emergency

department. A second funding phase started within the *Ligeti Centre* which builds the larger framework of all papers in this special issue of music & medicine. Within the next five years, Musical Soundscape Interventions will be developed in various areas of a new building of the University Heart Centre at the UKE. These attempts will be optimized in a way that prepares them to be implemented in other hospitals.

Process diagram

Based on previous experience, a process scheme for the development of an MSI could be established: a systematic, step-by-step approach, alternating phases of implementation and evaluation. The result is a sound installation that is carefully adapted to the location and the needs of those present.

Table 1. *Process scheme MSI*

1	Acoustic and atmospheric spatial analyses Analysis of the needs of the persons present in the room
2	Identifying the goals of the intervention
3	Development of the compositions
4	Installation of the technology
5	Supervised initiation of the MSI
6	Evaluation
7	Modification of the compositions
8	Fixed installation
9	Creation/provision of information about the MSI
10	Selective check and evaluation over time

Accompanying research

Several qualification works were carried out so far, according to the research questions raised in the project and the research interests of participating students. A laboratory investigation on the physiological effects of a soundscape resulted in initial indications that a Healing Soundscape may improve well-being and deepen breathing[17]. There is also a reported tendency for the perceived waiting time to be shorter [18,19]. The three experimental studies could not deliver reliable results due to the small number of participants. As the students chose a laboratory design (listening to an excerpt from one of the soundscape compositions in a separate study room) the factors of room atmosphere and generative music was not involved. Further research should aim to develop a study design which integrates these central aspects.

Within a qualitative study, properties for a Healing Soundscape in the waiting area of the emergency department of the UKE were elaborated through atmospheric and acoustic analyses. The researcher described that the sounds should have a low basic volume with medium dynamic fluctuations. They should not be intrusive but also not monotonous. The harmony of the music should be modal and remain the same for a long time before small changes become perceptible. A very slow, evenly pulsating ostinato surface of low tones could embed high room noises and those waiting could consciously or unconsciously influence the soundscape with small sound accents. What seems necessary is a mixture of long decaying, soft and floating, rather low tones, which convey a feeling of space, and a smaller proportion of sounds in high frequency. This is intended both to embed the tension of those waiting and to counteract a feeling of waiting lethargy. Different listening positions might also be helpful[20].

In a second study in the same waiting area, a sound catalogue was drawn through an acoustic analysis of the same waiting area. 23 types of sounds were recorded and described, for example ambulance beeping outside, chairs creaking, coffee machine purchase, door smashing, newspaper page turning, rattling noise and vending machine humming[21]. These two preparatory works formed a basis for a composition draft for a MSI in this waiting area which has been tested during several weeks. To explore the effect of this test, an evaluation in a mixed methods design was carried out. The results of qualitative interviews with waiting persons (n=18) and a short version of the STATE questionnaire delivered to them (n=71), showed positive tendencies to influence the acute anxiety of waiting people in combination with a positively perceived room atmosphere. It should be noted that the opinion on the sounds varied considerably among the waiting persons[22]. This heterogeneous assessment points to a necessary revision of the MSI being used for this evaluation.

Two examples of current projects within the framework of Healing Soundscapes we will describe in a little more detail:

1 Musical Soundscape Interventions in the operating theatre

During medical surgeries, music is often played without further sensibility for the type of music. Commonly the decision of the music selection lies solely with the operating surgeon. Few studies address the musical needs of healthcare workers during surgery. A better understanding of these needs could help to enrich the working environment of the operating theatre (OT) with music, thus improving the perioperative processes of treatment as well as the team dynamics of the treatment staff. The OT is a heterogeneous environment that requires healthcare workers with different

professional backgrounds, skills, and personalities to work together. For the surgical process to be successful, the operating team must be able to communicate effectively and function as a unit[23].

Previous research showed positive results regarding the effect of music on healthcare workers in the OT. According to Siu et al. listening to music improves surgeons' performance during laparoscopic surgery[24]. Fu et al. found that music has a beneficial influence on the mental workload and the task performance of medical staff[25]. Furthermore, music is associated with reduced autonomic reactivity of Surgeons during laboratory tasks[26]. Lies and Zhang found that music improved the efficiency of wound closure by 10% for senior residents[27]. These outcomes may also translate to healthcare cost savings.

Nevertheless, publications suggest that the surgical process is harmed by adding music to the OT. Some studies suggest that music decreases healthcare workers' concentration and attention during surgery[26, 28]. Miskovic et al. found that Music in the OT may have a distracting effect on novice surgeons performing new tasks[29]. In addition, there is a risk that warning signals might be missed because of the music [30]. Furthermore, the team's communication can be negatively influenced[31,32].

These conflicting results may be explained by the choice of music in the OT. In this context, music must meet high demands, both personally and professionally. Studies showing the positive effects of music often only focus on individual perspectives and self-selected music. Regarding the working environment of the OT, self-selected music is not an option for every individual, as a whole team of healthcare professionals with different musical preferences must work together. Commonly the decision of the music selection lies solely with the operating surgeon[31]. Current studies are often limited to examining preferred genres, overlooking further musical characteristics. Tress conducted an online survey to investigate the attitude of healthcare workers towards music in the operation theatre. The goal of this study was to examine musical needs and to derive underlying factors for the selection of music in the OT in order to draw conclusions towards the parameters of Musical Soundscape Interventions to come. Interestingly it seems that one of the factors that lead to acceptance of the chosen music is that the staff members wish to be part of the decision-making[33].

Consequently, we will create an approach to find out more about supporting sound qualities. We plan to develop Musical Soundscape Interventions in a collaborative process with the staff of the operating theatre. The staff is to be involved in identifying their needs in their workspace and translating these parameters into appropriate sounds. In this co-creative participating approach, the team will literally be the composer. In this way, we want to achieve the most

significant possible acceptance and benefit of a musical soundscape regarding job satisfaction and quality of work. We must keep in mind of course that the team constellations can change in the course of time. There should be recurring updates in which the soundscape can be adapted to new conditions and modified accordingly.

2. Healing Soundscapes live

Healing Soundscapes was initially concerned primarily with electronic sound installations. Since the beginning of 2023 we have been developing parallel models of improvised site-specific sound performances, which we are testing as *live-MSI* with trained musicians at various locations.

A first improvisation model was developed within the framework of an interdisciplinary module at the Medical School Hamburg following principles of Neutral Music as well as characteristics of Therapeutic Atmospheres like friendliness or unobtrusiveness[34]. The model called Sonic Brightness derives from the high complexity of the research carried out so far in the HSS project. It essentially combines long-lasting low and high bell tones with a bright trickle. Aesthetic qualities of wideness and brightness dominate the sound, which blends into non-musical environments in contrasting and balancing ways. In the words of one of the students involved: a friendly resonance that accompanies you for a while.

Methodologically, the model was developed through a circular process in which professional input, practical experience and reflection alternated, accompanied by literature study on the effect of the auditory. To cultivate an exploratory, investigative, reflexive mindset throughout, there were always phases of writing, thinking and discussing. We discussed the selection of instruments, the exploration of forms of play and performative aspects of the improvisation. We paid special attention to the spaces we selected for the practical tests by systematically exploring them auditorily using specifically developed observation sheets to be able to relate to them in a playful way [16].

The series of practical tests in which Sonic Brightness as *live-MSI* was created culminated in a sound intervention in the entrance hall of the UKE, which was realized under data protection regulations. The large entrance hall, which extends over several floors, appears open and transparent with its surrounding galleries and bright lighting. At the same time, countless signs, markings and branching corridors reveal the intricate complexity of the large hospital. People are predominantly on the move, looking for orientation (mostly visitors and patients) or seem goal-focused (mostly hospital staff). In any case, with a few exceptions (seating area, reception desk), the hall seems to be an impersonal place that wants to be left behind.

In this large, multi-layered space, the ensemble spread out, discreetly, listening, finally playing: sounds that did not compete with the sounds of the environment, but contrasted them, filled their gaps. Tones formed continuing or answering patterns and successive intervals, but no coherent melodies or harmonies.

As far as could be observed, the reactions of patients, visitors and hospital staff were positive. The performers noticed how people looked for the source of the sounds, how glances met. A group of young men, sitting at a table in the background, appeared on the railing of the gallery, fingers pointed at the players. The employee of a cleaning company stepped out of a corridor onto the arena-like ground floor, stopped, ran back and reappeared a short time later with a colleague, whom he laughingly drew attention to the musical activity. The players were approached, received feedback and a mother-daughter couple – one visitor, the other patient – tried out one of the instruments themselves. For a while, the diversity of people present seemed to be part of a friendly community.

This experience encouraged the team to further develop and study the potential of *Healing Soundscapes live*. In a Master thesis project at the Medical School Hamburg *Healing Soundscapes live* is currently further investigated by methods of design-based research.

Conclusion

Many areas in hospitals are sensitive environments where medical treatment staff with different professional backgrounds, skills, and personalities work together for the sake of the patients who are equally exposed to many kinds of atmospheres. Music and sound should be added cautiously into this context. Many types of interventions are possible and being tested in various projects worldwide, from individually chosen music or to composed new music, from sound and music by speakers or headphones to live music and sound improvisations. And despite the strict ethic parameters that must be considered there's certainly not only one solution that suits all possible situations and target groups. We presented the *Healing Soundscape* approach, which aims to create new sound environments that are opt to meet the needs of staff, visitors and patients in hospitals. Whether there can be appropriate music or soundscapes to fit in many situations and locations will undoubtedly challenge and inspire more research and practice attempts. Having in mind the enormous powers music and sound have in respect to promote health and wellbeing it is certainly worth the effort.

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Biographical Statement

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