Experiencing Sound Installations: A conceptual framework

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We propose a conceptual framework for describing and documenting sound installations from a visitor's point of view. In the form of a taxonomy, the framework includes four complementary perspectives: sound sources, sound design approaches, visiting modalities and visual aspects. Its elaboration was informed by a review of contemporary sound installations in Quebec as well as a literature review on conceptual and theoretical frameworks on sound art and sound installations. Compared with existing frameworks, the taxonomy is useful for describing and comparing sound installations across meaningful perspectives from a visitor's stance. To illustrate the potential benefits of the taxonomy and the diversity of installations it can portray, we provide a comparative analysis of four contemporary sound installations from different perspectives. We conclude with the use of this taxonomy for documentation purposes.

1. INTRODUCTION

Defining and categorising sound installations raises several challenges given their wide range of approaches, practices and contexts. Furthermore, few sound artists identify with established disciplinary fields such as music or visual arts, and rather define themselves in-between fields (Canonne and Fryberger 2020). As such, it is difficult to compare and position sound installations within existing frameworks. However, many sound installations share common features including considerations of space and time. This article aims to propose a conceptual framework for describing and comparing sound installations based on similarities and differences in terms of design from a neutral point of view.

Sound installation is defined here as 'a place, which has been articulated spatially with sounding elements for the purpose of listening over a long-time span' (Bandt 2006: 353). Sound installations are closely related to an approach for sound art as an aesthetic category, allowing the introduction of any sound as potential material (LaBelle 2006; Landy 2007). Sound installation art emerged along with the development of sound art, performance and installation art as artistic mediums in the mid-century (LaBelle 2006). According to Kihm (2020), the appearance of sound installations as its own artistic field and its democratisation to broader audiences started in the 1980s. Since the 2000s, the number of gallery exhibitions devoted to sound art rapidly increased in galleries and museums (Džuverović 2020).

Sound installations differ from more linear musical performances and concerts in multiple aspects, including their relationship with time and space. Temporally unlimited, they seldom have a clear beginning or an end, the duration of the engagement being defined by the visitor (Tittel 2009). On the other hand, space is a crucial element for sound installation design and composition. As the pioneer of sound installation art Max Neuhaus suggested, music differs from sound installations as in the latter sounds are 'placed in space rather than in time' (quoted in Ouzounian 2008: 115). Unlike a traditional concert situation with a predefined temporality and often dedicated spatial arrangements, listeners can mould their relationship with a sound installation over time and space and can experience it individually or collectively (Bandt 2006: 353). These specificities of sound installation require dedicated documentation frameworks.

Our research builds upon previous theoretical frameworks and formal reviews of sound art and other relevant sound-based practices. Landy established a thorough theoretical framework for describing sound-based artworks (Landy 2007). Together with the Electro-Acoustic Resource Site project (EARS 2020), it aims at providing an extensive bibliographical tool for positioning various aspects of electroacoustic composition. Concerning sound installations specifically, Bandt reviewed various installations in Australia and proposed guidelines for public sound installation design (Bandt 2005). Following an inductive analysis across several publicly situated sound installations, Lacey proposed a conceptual framework for approaching sound installations (Lacey 2016). Brost proposed a documentation framework for sound in time-based media installation art (Brost 2018). More recently, Goudarzi presented a taxonomy for situating participatory sound art (Goudarzi 2021) while Fraisse, Wanderley and

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Guastavino proposed a framework for describing interactive sound installations based on a systematic review of academic publications (Fraisse, Wanderley and Guastavino 2021). Efforts to document sound installations are also present outside the academic realm. For instance, Cerwén created a detailed webpage listing various outdoor sound installations across the world (Cerwén 2018). Furthermore, in a musical context, Birnbaum and colleagues defined a dimension space to characterise musical devices (Birnbaum, Fiebrink, Malloch and Wanderley 2005), and other frameworks have been proposed to situate collaborative musical devices and feedback musical systems (e.g., Blaine and Fels 2003; Hattwick and Wanderley 2012; Sanfilippo and Valle 2013; Morreale, De Angeli and Modhrain 2014). While these frameworks do not address sound installations directly, they describe interaction processes also found in the context of sound art and provide a basis for characterising interaction within the proposed taxonomy. Reconciling previous endeavours and extending the investigation to contemporary sound installations in Quebec, we developed a conceptual framework dedicated to an in-depth description of sound installations, in terms of the proposed categories of sound sources, sound design approaches and visiting modalities, each of which will be examined in the subsequent sections of this article.

The present work is part of the Sound Art Documentation: Spatial Audio and Significant Knowledge (SAD-SASK) research project. The documentation of new media art is a notoriously complex issue if we are to preserve it, where, according to Laurenson and Noordegraaf, a core challenge is to keep the balance 'between allowing for evolution while still paying attention to the integrity of the work', which impacts the model of documentation (Laurenson and Noordegraaf 2013: 285). The goal of the project is to investigate new means to document the sensory experience of sound installations with spatial audio technology and to identify the significant elements of these experiences for multiple stakeholders (sound artists, curators, conservators and sound engineers; see Boutard et al. 2022 for further description). As part of the first phase of this project, we propose to reconcile and extend previous attempts, in relation to a visitor's point of view, to systematically describe sound installations along multiple perspectives in the form of a taxonomy. Together with a review of contemporary sound installations in Quebec in a forthcoming publication (Boutard et al. 2022), the taxonomy will serve as a conceptual framework to provide an overview of current practices and to inform the selection of a subset of sound installations for further investigation. This article is focused on a description of the framework and an illustration of its applications.

2. METHOD

2.1. Review of sound installations in Quebec

As part of the SAD-SASK project, we reviewed 75 contemporary sound installations deployed in Quebec, through written and audiovisual information publicly available on the web (Boutard et al. 2022). Documentation included artists' statements, personal web pages, galleries archives and promotional material. The aim of the review was to study a limited yet diverse selection of contrasting works to develop a taxonomy describing the many perspectives of sound installations relevant to the documentation process, with a focus on their relationship with space. The selection process relied on theoretical sampling from grounded theory: works were retrieved according to emerging categories of the taxonomy to cover a wide range of practices.

We used the following inclusion criteria: sounds installations presented in Quebec over the past ten years, with publicly available documentation, in the form of textual information, pictures, audio excerpts and/or video clips. The review of practices is presented and described in detail in (Boutard et al. 2022). We report here on a taxonomy for describing sound installations, used as a conceptual framework along with the review to account for the diversity of practices.

2.2. Analysis method

The conception of the present conceptual framework was two-sided and involved a combination of deductive and inductive analyses. The deductive analysis was informed by the literature review on conceptual and theoretical frameworks related to sound art and sound installations presented in the introduction. The inductive analysis was based on a review of contemporary sound art installations in Quebec in the context of the SAD-SASK project (Boutard et al. 2022). While the taxonomy builds upon existing theoretical and conceptual frameworks and guidelines on sound art and sound installations, new perspectives emerged from the inductive analysis of the documents. These additional features were integrated to provide a comprehensive framework for describing significant features from a visitor's point of view, such as those related to visiting modalities and visual aspects.

In the first phase, although research results were shared regularly, two independent taxonomies were developed by the first two authors from the deductive and inductive analyses, respectively. In an attempt to identify relevant categories for spatial audio documentation, aspects that may influence a visitor's experience of the works were considered. How does one physically access the work? Are there visible aspects that indicate the presence of the work? Do

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the sound sources envelop the visitor, or is it more of a frontal auditory display? The coding process started with a small set of installations and categories defined by the research members. For each of these categories, information regarding the associated installation was coded. As the works went through review, new categories were added to the taxonomy to account for the features of each installation. New installations were selected and added to cover a wide range of practices and reach a stable coding scheme. In a second phase, a single shared taxonomy was created, integrating the results of the inductive method into the analytical framework of the deductive approach. The resulting merged taxonomy was reviewed and refined with the researchers of SAD-SASK and then used to re-categorise systematically all the works previously coded inductively.

3. A TAXONOMY FOR SITUATING SOUND INSTALLATIONS

A taxonomy in the sense of Bailey's definition was elaborated to situate sound installations (Bailey 1994), with an emphasis on the visitor's perspective, as opposed to a conservation perspective. As such, it does not emphasise work production processes such as sound recording and medium (Brost 2018) or a thorough analysis of the works (Landy 2007). Rather, it focuses on the documentation of installations from the point of view of the visitor by identifying features that shape the relationship with the sound installation. While the taxonomy derives from the identification of features that appear significant from the visitor's stance, we did not make inferences on the way works may be received or on the creative process. Rather, the taxonomy provides a neutral reference point for further analysis and documentation. The taxonomy was developed in the context of the SAD-SASK project, in which the documentation process is characterised by the use of spatial audio recording and the absence of visual materials. Particular attention is therefore given to aspects related to spatial auditory perception, while information related to visual aspects remains concise.

The taxonomy is ordered hierarchically, from general to specific. Specific categories were first identified and later grouped into more general, broader themes. At the more abstract level of the taxonomy, perspectives relate to general aspects for enduring sound installations, such as sound design approaches or visiting modalities. At an intermediary level of abstraction, themes situate specific aspects from the perspectives in which they are embedded, such as material and process related to sound design approaches. At the most concrete level, taxa describe specific features and applications of the installation, such as the use of sonification. Most of the taxa are not mutually exclusive, meaning that several taxa from a single theme can be associated with a given work.

An overview of the taxonomy's perspectives and themes is provided in the following sections. For each perspective, a hypertree visualisation is proposed to represent the various taxa and their hierarchical relation. On these visualisations, the hierarchy between sections is emphasised by the colour of the sections from black (top-level categories, perspectives) to white (bottom-level categories, taxa) as well as the size of the link between nodes, proportional to the hierarchy level. Nodes are of different sizes only to provide adequate room for the categories' names. A detailed definition of every taxon is provided in the Appendix.

3.1. Sound Source

Sound Source relates to a sound installation's sound source(s), as shown in Figure 1. It is inspired by Lacey's three approaches to creating sound installations (Lacey 2016): *electro-acoustic* (loudspeakers/playback), *resonant* (use of resonant properties of tubes/pipes or structural vibrations; not architectural[1]) and *elemental* (installations driven by the elements, or those that use elements to generate sounds such as aeolian harps). However, speakers are considered in a separate taxon due to their common occurrence.

3.2. Sound Design Approaches

The Sound Design Approaches perspective relates to all the contextual and system design features related to the sound environment generated or transformed by the installation (Figure 2). It concerns both the generated sound contents in terms of materials and involved processes and the diffusion features such as spatialisation and site-specific imperatives.

3.2.1. Material and Process

While Material refers to the source and properties of the contents that constitute the broadcasted sound extracts, Process refers to all the processes involved by the installation to generate or alter sound contents. Most of the taxa related to Material and Process come from Landy's framework for sound-based Art and associated Electro Acoustic Resource Site project (Landy 2007; EARS 2020). Across this typology, a division of sound objects through an *abstract/referential* dichotomy is proposed: *abstract sounds* cannot be ascribed to any real or imaginary provenance whereas *referential sounds* are recorded sounds that 'suggest or at least do not hide the source to which they belong' (EARS 2020). Pre-existing materials are also included

[1]Spatial resonance is ubiquitous and every installation would be categorised as resonant if we accounted for it.

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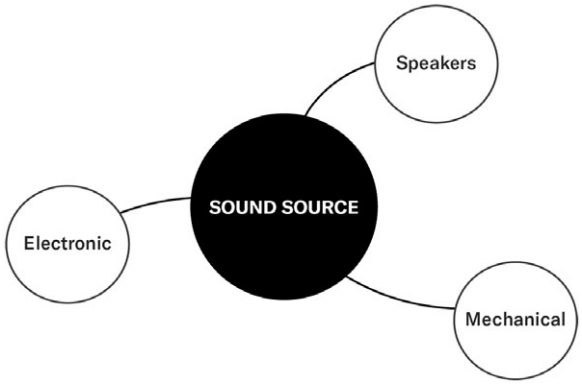

Figure 1. Sound Sources.

in the EARS typology as *samples*, as well as *sonification*. It also occurs to creators to make use of recordings from the surrounding environment (Tittel 2009), artificial feedback generation (van Eck 2013), or almost unnoticeable sounds (Roads 2004).

3.2.2. Spatialisation

With the development of sound installations and the free motion of participants, space became the centre of perception, and installations required a contextualisation that goes beyond the mere spatial characteristics such as acoustics or architectonics (Klein 2009; Kihm 2020). Hence, sound artists and designers carefully consider the intersection between space and time through the intentional placement of the sound sources, and spatialisation features are compulsory for situating sound installations (Bandt 2006). Spatialisation relates to the number, position, orientation and diffusion parameters of an installation's sound sources. Motion and paths accessible to a visitor are described in the Visiting Modalities perspective.

3.2.3. Site-specific

Unlike conventional music that can theoretically be displayed everywhere or at least at any performance hall, sound installations are often significantly connected to the site on which they are standing, and their design is commonly considered with respect to the architectonic, sociological, historical and other contextual information, gathered under the term *site-specificity* (Tittel 2009), or *situations* (Groth and Samson 2017). Overall, it is reasonable to claim that the musicality of an urban sound installation emerges from a creator's thought to form a site-specific listening relationship, such that a sound installation feels like a natural expression of the site. Further, architectural understandings can be pervasive in the approach to sound art and urban design (Lacey 2016).

The present theme combines contextual features related to those aspects. Of course, the relation to the site is radically different between a publicly situated sound installation and a gallery installation, and most of the present theme's taxa are not pertinent for gallery installations. For example, Lacey evokes the imperative for an urban installation to be non-disruptive, as well as the depersonalisation of the sound artist, both features that may not apply in museum settings (Lacey 2016), although it is argued that the requirement for non-disruptivity may also be applied in gallery settings (Seay 2014).

Livingston introduced a taxonomic division of introduced sounds that are borrowed in the present taxonomy: *integrated/site-specific/background* where added sounds subtly merge with the existing sound environment, versus *oppositional/borrowed/foreground* where added sounds clearly distinguish themselves from the sound environment (Livingston 2016).

3.3. Visiting Modalities

Unlike other listening experiences, which are usually from a fixed point, sound installations invite visitors to move in and around them and to define their own path of listening (Bandt 2006). Installations may additionally require interaction with visitors, which may significantly affect their experience (Mugnier and Ho 2012; Fraisse et al. 2021). Overall, cases range from situations in which visitors have frontal access to the work to situations in which the visitor can walk around the work or enter inside it. The Visiting Modalities perspective aims at situating this relationship between a visitor and a sound installation, through themes related to spatial features and physical accessibility (access, dimension and listening position) and interaction (Figure 3).

3.3.1. Dimension, Access and Listening Spot

All three themes, Dimension, Access and Listening Spot, relate to the spatial relationship a visitor can mould with an installation through its own motion. Dimension refers to the scale of an installation relative to the human scale. Access relates to the modalities of approach to the work, whether inside or around. The Listening Spot refers to the available motion to the visitor, corresponding either to a specified pathway, an ideal, or a dynamic listening spot, as well as the required distance for the installation to be audible, that is, the minimal distance at which the listener can hear it as intended by its creator. Notably, Bandt's introduced notion of sound pathway is applied where visitors are intended to follow a specific path (Bandt 2006).

3.3.2. Interaction

In museal settings, installations can sometimes require interaction with visitors to generate audio, visual or

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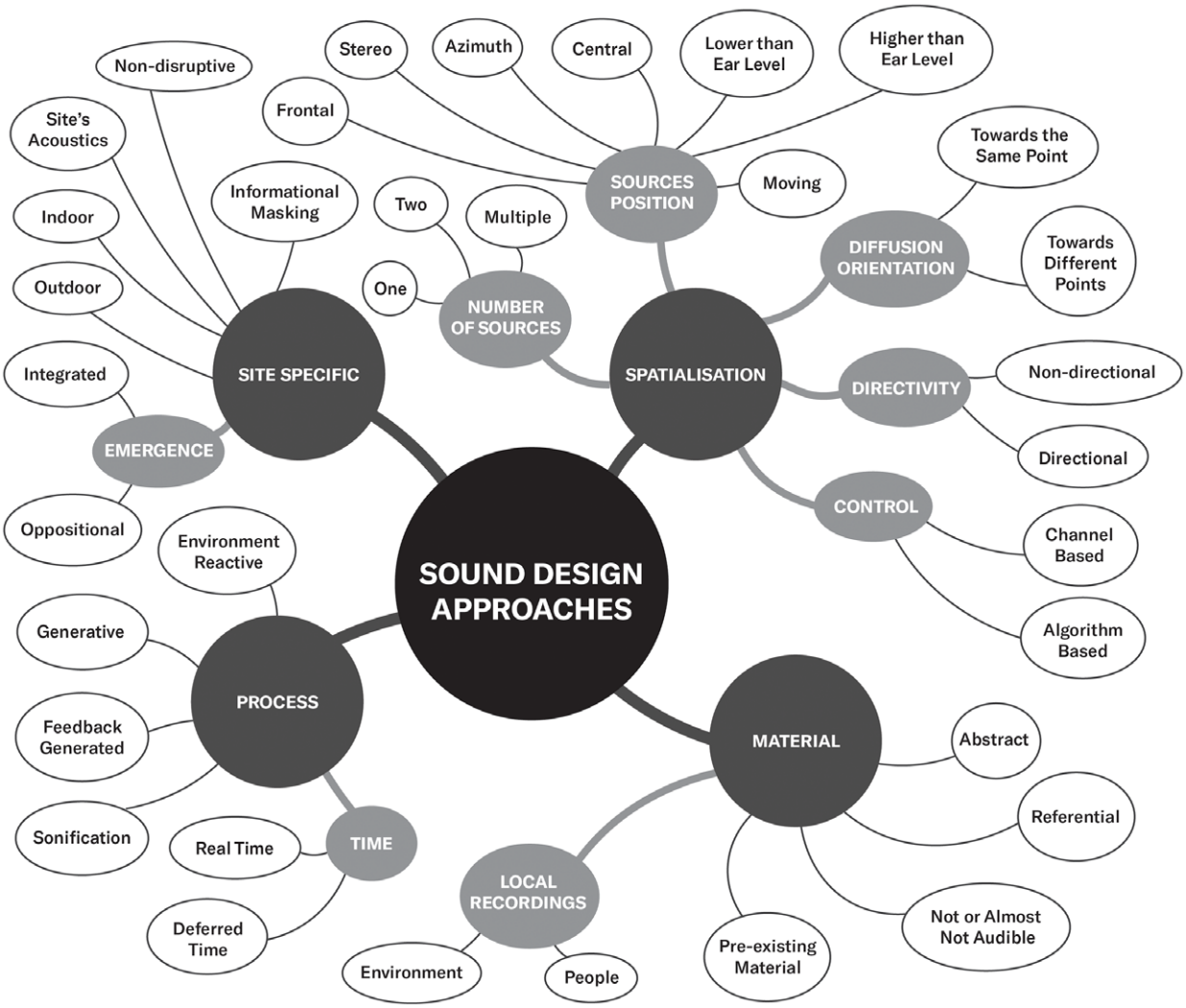

Figure 2. Sound Design Approaches.

even haptic feedback. Interaction is understood here as 'a reciprocal action between several actors of the same system … resulting in a modification of the state of the implied actors' (Mugnier and Ho 2012). To classify those interactive installations, the typology includes a categorisation derived from Birnbaum's dimension space for musical devices (Birnbaum et al. 2005) and is also informed by a theoretical framework proposed by Fraisse and colleagues for describing interactive sound installations (Fraisse et al. 2021). It aims both at characterising the type of interaction and control a user or the surrounding environment can have as well as the type of feedback provided by the installation.

3.4. Visual Aspects

Sound installations situate themselves at the intersection of artistic practices by bridging the visual arts with the sonic arts (LaBelle 2006). As such, and while the present taxonomy is focused on sound, the perspective Visual Aspects is proposed to situate a sound installation according to its visible properties (Figure 4). Intervention Visibility describes the extent to which an installation is made visible to the visitor. Visibility relates to the amount of luminance that is available to the visitor. Finally, Static depicts the presence of still visual features, and Dynamic the presence of evolving visual features.

4. COMPARATIVE ANALYSIS OF SELECTED WORKS

The proposed taxonomy was designed as a versatile tool for sound installation description and comparison so that the greatest diversity of installations could be embedded into it. To illustrate its potential benefits, four installations selected from the SAD-SASK

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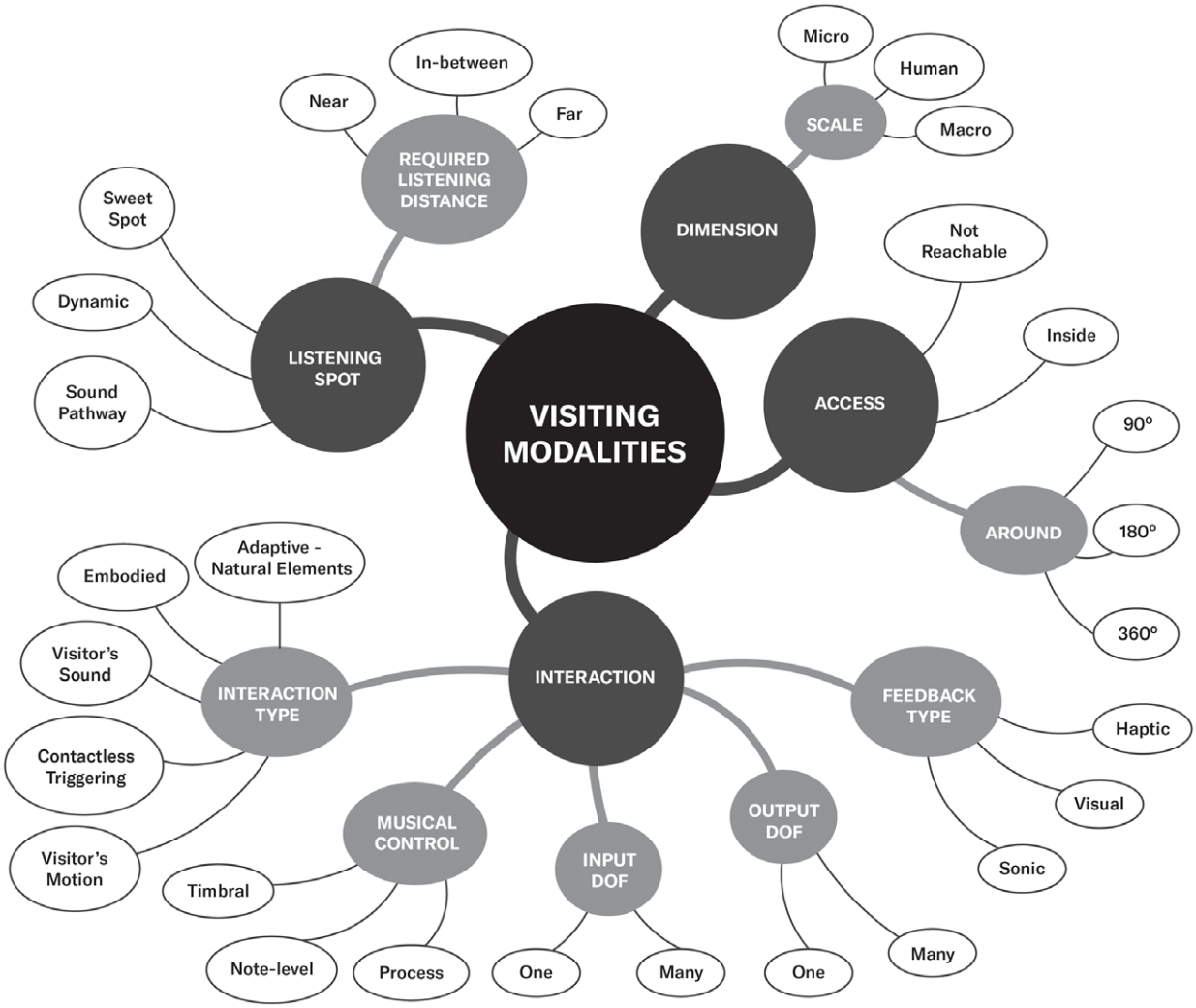

Figure 3. Visiting Modalities.

project's review will be described along with a sample of selected themes for each perspective. The aforementioned description is presented in Table 1 and described in the following section.

Cumulonimbus is a sound installation designed by Kathy Kennedy and Julian Stein (Kennedy 2021). It consists of an interactive environment in which visitors are followed by a rotative, ultrasonic speaker (Figure 5). The composition is based on a background layer of rain and wind on top of which voices whispering excerpts from Shakespeare's *Macbeth* are added. The installation includes two sculptures: bowls filled with money and water.

Cordes is a 'kinetic instrument' created by Martin Leduc (Mongeau 2015). A mobile hangs in the space, based on multiple cylinders on the azimuth plane (Figure 6). On each cylinder is stretched a string, generating sounds thanks to a magnetic field controlled in a pseudo-random way by a stochastic algorithm. The cylinders' motion is controlled by remote fans. *Cordes* is thought of as a continuously evolving sound installation, such that its sonic content is perpetually renewed in spite of its stochastic nature (Poirier 2016).

La résonance des corps is an *in situ* sound installation embedded into the steeple of Saint-Sauveur Church at the Centre Hospitalier de l'Université de Montréal (CHUM) in Quebec, Canada (Béchard and Hudon 2016). It consists of three aluminum sculptures that function as speakers, scattered throughout the height of the church's bell tower (Figure 7). Vibro-tactile transducers transmit the composition through aluminum plates, creating an immersive sound environment thanks to the acoustics of the

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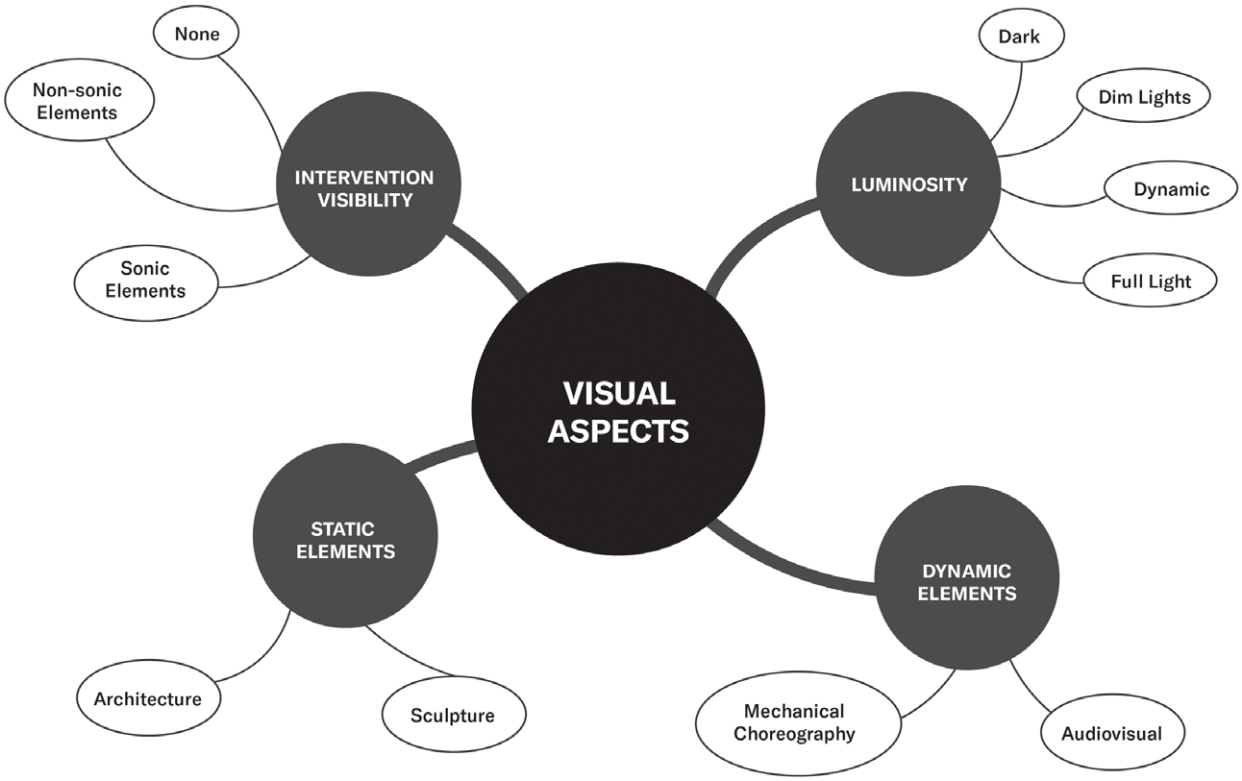

Figure 4. Visual Aspects.

place. Visitors can move through sound and space within a dedicated pathway inside the steeple.

Construire la pluie is a gallery installation that aims at reproducing the sound of the rain, created by Camille Bernard-Gravel (Fortin 2016). A first room is a wide and tall hall containing a series of containers dripping water on successive pierced buckets (Figure 8). The multiple buckets in addition to the stochastic nature of the falling droplets create the first layer of a sound environment mimicking the rain. Inside a second, small room, a plastic bag in permanent rotation is embedded into a soundproof box. The sound contents generated by the two rooms are recorded and mixed together to recreate a rain environment, which can be listened to with the help of headphones made available to visitors.

While *Cumulonimbus* solely makes use of speakers, the three other installations combine two sound sources including speakers, mechanic sources (resonating strings in *Cordes*; structural vibrations in *La résonance des corps*; the sound of a plastic bag in *Construire la pluie*), and natural elements (falling water droplets *in Construire la pluie*).

A great variety of sound design approaches can be observed across all four installations. Regarding the involved material, all can be described across the abstract/referential dichotomy. Interestingly, *Construire la pluie* reproduces sounds referring to the rain, consisting as such in referential sounds of a synthetic origin (EARS 2020). Concerning the involved processes, both *Cordes* and *Construire la pluie* produce sound content in real-time, while *Cordes* involves a generative algorithm. About spatialisation, *Cumulonimbus* makes use of a single sound source while all others combine multiple sound sources. *Cumulonimbus* and *Cordes* involve moving sound source(s) while *La résonance des corps* and *Construire la pluie* dispose of static sources. *Cumulonimbus* makes use of a directional sound source that is oriented towards a unique, moving point (the visitor). All three other installations are diffusing sound towards multiple directions and do not imply any directional source. Regarding site-specificity, only *La résonance des corps* is a site-specific installation, being embedded in a church while exploiting its acoustical properties. The three other works are gallery installations.

The four installations are equally diverse while sharing similarities regarding the Visiting Modalities. *Cordes* can be accessed by moving around the installation while all three others require the visitor to get

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Table 1. Comparative analysis of selected works across the taxonomy

Installation	***Cumulonimbus***	***Cordes***	***La résonance des corps***	***Construire la Pluie***
Artist(s)	Kennedy, Kathy and Stein, Julian	Leduc, Martin	Béchard, Catherine and Hudon, Sabin	Bernard-Gravel, Camille
Sound generation	Speakers	Mechanic; speakers	Mechanic; speakers	Mechanic; natural elements
Material	Abstract; referential	Abstract	Abstract	Referential
Process	—	Generative; real time	—	Real time
Control	Channel based	—	Algorithm based	—
Number	One source	Multiple sources	Multiple sources	Multiple sources
Motion	Moving	Moving	Static	Static
Orientation and directivity	Toward the same point; directional	Toward different points; non-directional	Towards different points; non-directional	Towards the same and different points; non-directional
Site-specific	Indoor	Indoor	Indoor; site's acoustics involvement; integrated	Indoor
Access	Inside; not reachable	Around – 360°	Inside; not reachable	Inside
Scale	Micro and human scale	Macro	Macro	Macro
Listening spot	Dynamic	Dynamic	Sound pathway	Dynamic; sweet spot
Interaction	Visitor's motion; sonic feedback; process	—	Non-contact triggering; sonic feedback; process	—
Visibility	Non-sonic elements	Sonic elements	Sonic elements	Sonic elements
Luminosity	Dark	Dim lights	Full light	Full light
Visual elements	Sculpture	Audiovisual; mechanical choreography	Architecture; sculpture	Sculpture

Note: — = non-applicable taxa.

Figure 5. *Cumulonimbus*. Photo courtesy of Kathy Kennedy.

inside the installations. *Cumulonimbus* is of a relatively small scale compared with the others that are beyond the human scale. All four installations allow the visitor to move while listening to them. However, *La résonance des corps* implies a specific path, a sound pathway that must be undertaken by the visitor(s) to appreciate it. Ultimately, both *Cumulonimbus* and *La résonance des corps* take use of user interaction: the sound source in *Cumulonimbus* follows the visitor by capturing its motion while *La résonance des corps* is triggered by approaching visitors through a proximity sensor.

Concerning the Visual Aspects, *Cumulonimbus* disposes of non-sonic sculptures that are visible to the visitor(s) in a dark environment while all others allow the visitor(s) to see the sound sources in the form of sculptures with full light in *La résonance des corps* and *Construire la pluie*, and of a mechanical choreography with dim lights in *Cordes*. *Cordes* implies additional audiovisual content (video projections), while *La résonance des corps* is embedded into the surrounding church's architecture.

As shown in Table 1, the proposed taxonomy allows for the identification of similarities and differences along different perspectives. It further highlights sound installations specificities such as, in the preceding examples, the peculiar interaction for *Cumulonimbus* and the site-specific configuration of *La résonance des corps*. This taxonomy can inform both researchers and artists in providing grounds for the identification of trends (e.g., all the preceding installations are located indoors and use of speakers and/or mechanic sound sources), and the exploration of a collection of works along multiple complementary perspectives, including aspects relevant to the visitor's experience.

5. DISCUSSION AND CONCLUSION

Based on a review of 75 contemporary sound installations in Quebec, we propose a taxonomy to describe and establish comparison across sound installations with an emphasis on the visitor's perspective. Given the wide range of practices covered (see Boutard

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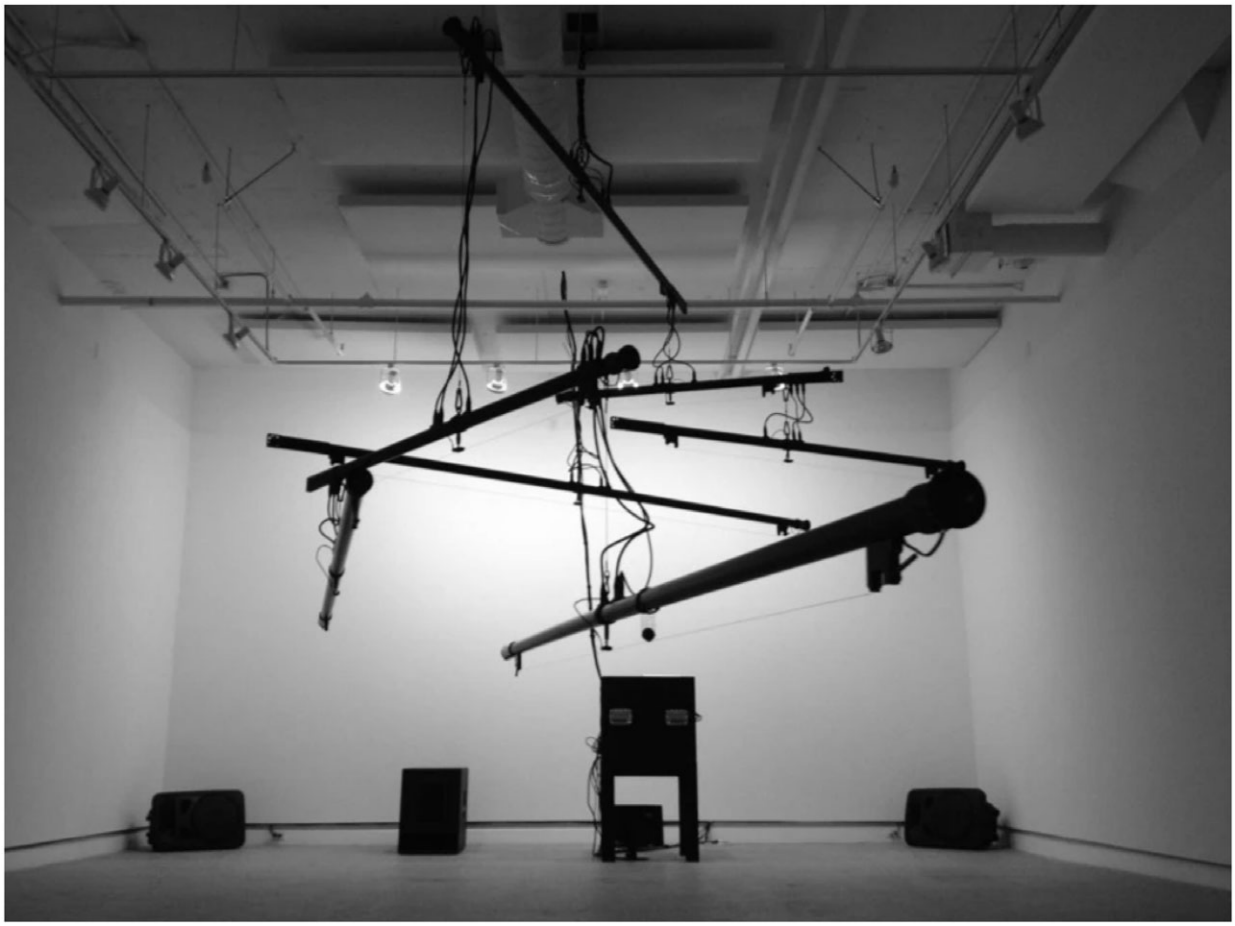

Figure 6. *Cordes*. Photo courtesy of Martin Leduc.

et al. 2022 for further analysis), we believe that the taxonomy would be transferable, to some extent, to other geographical contexts. The perspectives should provide insights into comparative studies of sound installations in a variety of contexts, ranging from sound installations in public spaces to interactive multimedia environments in galleries.

The primary purpose of the present taxonomy is documentation, as it is meant to help identify significant properties, common practice and trends across sound installations' design. The taxonomy remains as neutral as possible to allow for the identification and screening of works without a prior evaluation of the impact they may have on an audience nor on the rationale that led to their creation. It relies on a descriptive categorisation of sound installations' features based on a *neutral* analysis of musical works, rather than *poietic* or *esthesic* analyses (Nattiez 1974), that are beyond the scope of this article. Indeed, the present framework is not oriented towards a detailed analysis of the works, nor does it cover technical details (Landy 2007; Malloch and Wanderley 2017), or necessary information for curation such as sound production parameters and support (Brost 2018). Instead, it focuses on documenting the installation from the underexplored yet critical perspective of the visitor. Documentation frameworks designed for curators such as Brost's typically focus on technical specification and artistic intent (Brost 2018). Here we propose instead to situate all features that may be relevant from a visitor's point of view, regardless of situational and technical parameters. This approach allows a user of the taxonomy to freely explore themes of interest to them, within a broad range of perspectives. Further and as discussed earlier in the introduction, sound installations often have a peculiar relation with time, some of which may significantly evolve across time (such as environmentally adaptative installations, see, for instance, Paine 2003). The taxonomy, however, only allows for the establishment

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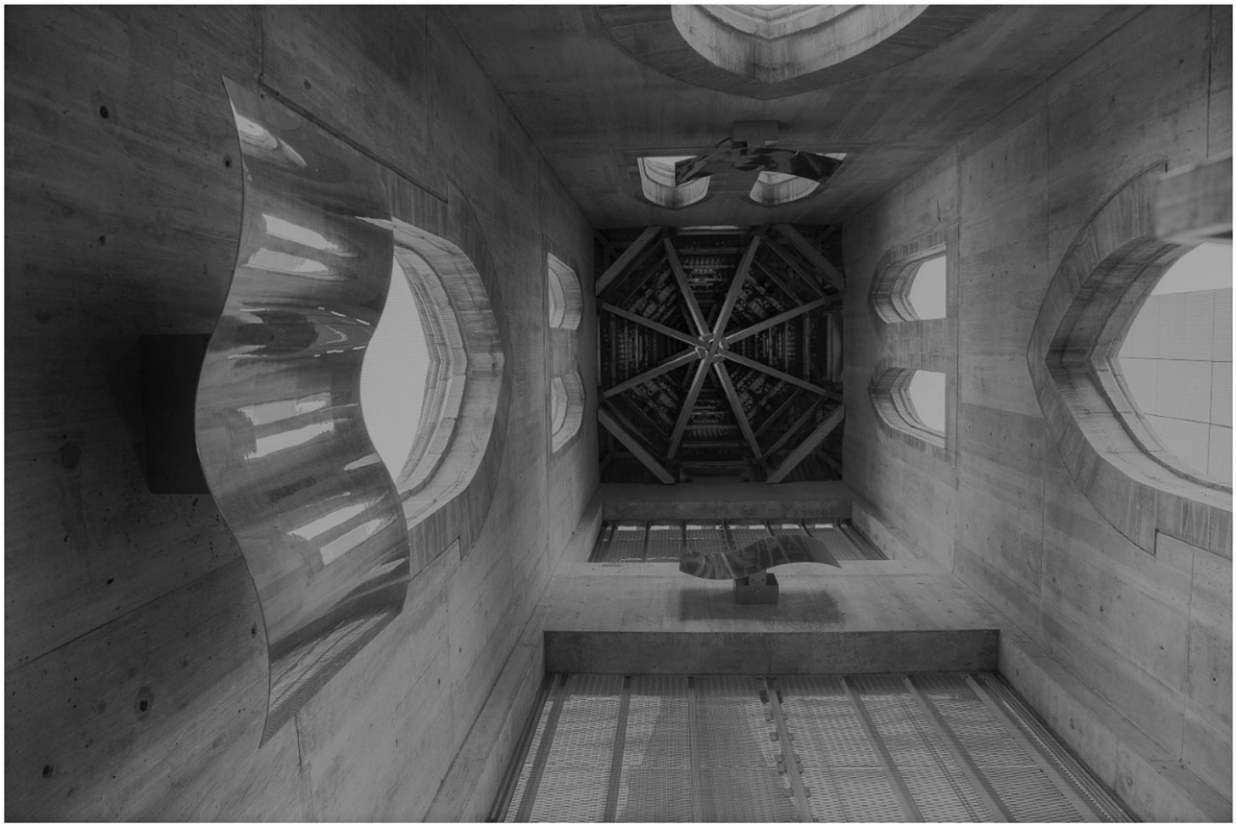

Figure 7. *La résonance des corps*. Photo courtesy of Béchard Hudon.

of a fixed snapshot of installations and cannot account for their temporal evolutions. Ultimately, and given the focus on spatial audio, the description of the visual features is only used to contextualise the works considered. Future directions could extend this line of research to the audiovisual experience of the visitor.

The present work is grounded in the analysis of artists' statements, auto-documentations, and alternative media that come from practical documentation. As such, it is a logical extension of the framework proposed by Fraisse, Wanderley and Guastavino based on a review of 195 sound installations presented in academic publications (Fraisse et al. 2021). Together, these frameworks represent a broad range of practices and contexts, within and outside of the academic realm, in Quebec and beyond. The taxonomy should also be of interest to sound artists to stimulate discussions around sound installation practices.

The comparison of sound installations along the different perspectives of the taxonomy will be used to identify contrasting works for further investigation in a second phase of the SAD-SASK project, which will involve perceptual evaluations of sound installations. Beyond this project, the proposed framework represents a useful tool to describe and compare sound installations across meaningful perspectives from a visitor's point of view. Indeed, this framework could be applied to other types of works in other contexts. For example, it could help consolidate previous lists of installations, such as the one compiled by Cerwén (2018), in an attempt to create a large-scale searchable database of sound installations. Future research is needed to develop visualisation tools for the taxonomy to facilitate database navigation and searching. Such a tool would allow researchers and artists to identify installations through associated keywords, to find related installations and to compare them along the multiple perspectives of the framework.

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Figure 8. *Construire la pluie*. Photo courtesy of Camille Bernard-Gravel.

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Appendix

Table App1 lists all taxa from the taxonomy.

Table App1. Description of the taxonomy: taxa definitions

Category		Name	Definition
Sound Source		*Speakers*	Electro-acoustic transducer and the enclosure to which it is embedded into if there is one.
		Electronic	Electro-acoustic transducer that is not embedded into a speaker enclosure but inside an object that has or used to have a different or additional purpose (e.g., old TV or radio).
		Mechanical	Sound emitted through contact or friction of different materials. Can rely on resonant properties (Lacey 2016).
Sound Design Approaches	**Material**	*Pre-existing Material*	Described as *samples* in Landy's framework (Landy 2007). Sound materials that existed before and were created in a different context.
		Abstract	Sounds that cannot be ascribed to any real or imaginary provenance (Landy 2007).
		Referential	Sounds that suggest or at least do not hide the source to which they belong or that they evoke (Landy 2007).
		Not or Almost Not Audible Sounds	Named as *subsonic intensities* by Roads, sounds to which intensity is too low to be consistently perceived (Roads 2004).
		Local Recordings – People	Recordings from people in the neighbourhood (Tittel 2009).
		Local Recordings – Environment	Recording from local environment, such as local soundmarks (Tittel 2009).
	Process	*Feedback Generated*	Artificial audio feedback (Larsen effect) generated from a combination of loudspeakers and microphones (van Eck 2013).
		Environment Reactive	The installation reacts to the external environment.
		Sonification	Mapping process for representation of non-sonic data through sound (Landy 2007).
		Generative	Sound material generated by an algorithm. The installation can generate new content spontaneously.
		Real Time	Sound is generated in real time.
		Deferred Time	Sound is generated in deferred time.
	Spatialisation	*Number of Sources*	One, two or more. Number of sound-emitting sources belonging to the installation, regardless of their associated sound source.
		Source Position – Frontal	Sources are embedded into a vertical plane.
		Stereophonic	Two sound sources are more or less disposed along an equilateral triangle together with the visitor (Snow 1953).
		Azimuth	Sources are disposed along the azimuthal axis (horizontal plane).
		Lower than Ear Level	Sources are disposed below ear level.
		Higher than Ear Level	Sources are elevated in comparison with the visitor's head.
		Central Position	Sources are situated at the centre of the sound installation.
		Moving Sound Sources	Sources are moving through space.
		Towards the Same Point	The sound is diffused towards a unique point (yet it can be heard from multiple points).
		Towards Different Points	The sound is diffused towards different points.
		Non-directional	Sound source(s) is/are non-directive and are not intended to radiate in a specific area covered by the installation without affecting the others.

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Table App1. (Continued)

Category		Name	Definition
		Directional	Relates, for instance, on parametric loudspeakers and beamforming. More rarely, can be associated with installations that take use of non-directive sources if they are meant to radiate in a specific area covered by the installations without affecting the others.
		Channel-based Control	Panning between sources is made manually or at least does not evolve within a digital algorithm.
		Algorithm-based Control	Playback across sources and panning is digitally implemented with an algorithm. It can refer to Automated Spatialisation System (Landy 2007).
	Site-specific	*Site's Acoustic Involvement*	Installation is thought of in regard to acoustic diffusion properties that are specific to its surroundings (Tittel 2009).
		Non-disruptive	Not relevant for gallery settings. When added sounds are purposely meant to not disrupt or be a nuisance (Lacey 2016).
		Informational Masking	Not relevant for gallery settings. When added sounds are purposely meant to distract the listener's attention (Licitra, Cobianchi and Brusci 2010).
		Indoor	The installation is located indoors.
		Outdoor	The installation is located outdoors.
		Oppositional	Not relevant for gallery settings. Borrowed/foreground sounds that contrast with the surrounding sound environment (Livingston 2016).
		Integrated	Not relevant for gallery settings. Site-specific/ background sounds that 'melt' into the surrounding sound environment, such as in Max Neuhaus's *Time Square* installation (Livingston 2016; Neuhaus, Hug and Balit 2018).
Visiting Modalities	**Access**	*Around*	A visitor can move up to either 90, 180 or 360 degrees around the installation.
		Inside	A visitor can enter inside the installation.
		Not Reachable	A visitor cannot reach the installation's sources.
	Dimension	*Scale – Micro*	The installation is smaller than human scale.
		Scale – Human	The installation is at a human scale.
		Scale – Macro	The installation is bigger than human scale.
	Listening Spot	*Sweet spot*	A visitor does not move when listening to the installation.
		Dynamic	A visitor can freely move when listening to the installation.
		Sound Pathway	A visitor is meant to physically navigate through a specific listening pathway (Bandt 2006).
		Req. Listening Distance – Near	In order to hear sound, a visitor needs to be at least at one meter from the installation.
		Req. Listening. Distance – In-between	The visitor needs to be between 1 and 20 metres from the installation.
		Req. Listening Distance – Far	Sound installation is audible from greater distances (more than 20 metres).
	Interaction	*Interaction Type – Embodied*	Interaction through a physically embodied object or a tangible interface (Goudarzi 2021).
		In. Type – Visitor's Motion	The installation reacts to a visitor's motion (either global movement such as walking pace or specific such as arms' movements).
		In. Type – Non-contact Triggering	The mere presence of the visitor triggers the installation. Can be operated with, for example, an infrared proximity sensor.
		In. Type – Visitor's Sounds	The installation reacts to sound emitted by the visitors, typically through the use of microphones.
		Adaptative – Natural Elements	Source driven by natural elements such as wind or rain (Lacey 2016)

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Table App1. (Continued)

Category		Name	Definition
		Feedback Type	Refers to the output modalities (Birnbaum et al. 2005). Visual, sonic or haptics (both force-feedback and vibrotactile feedback).
		Visitor's Input/Output Degrees of Freedom	Number of input and output modalities related to the interaction available to the visitor(s). Does not represent the number of input and output control such as in Birnbaum et al.'s dimension space (Birnbaum et al. 2005).
		Musical Control – Process	A visitor can trigger complex musical processes. Triggering sound playback is included (Birnbaum et al. 2005).
		Musical Control – Note-level	A visitor can interact with the sound on a discrete, note-level basis.
		Musical Control – Timbral	A visitor can affect sound on a timbral basis.
Visual Aspects	**Visibility**	*None*	The installation remains completely hidden from a visitor's view.
		Non-Sonic Elements	Parts of the installation that do not emit sounds can be clearly seen by a visitor.
		Sonic Elements	Sound emitting devices can be clearly seen by a visitor.
	Luminosity	*Dark*	The installation is in a dark environment (no surrounding light).
		Dim Lights	Some elements from the intervention are illuminated by dim lights, such as static spotlights.
		Dynamic	The surrounding lighting design evolves through time.
		Full Light	The installation is fully illuminated, whether situated indoor or outdoor.
	Static	*Architecture*	The installation is thought in regard with the surrounding place's architecture.
		Sculpture	The installation contains static visual elements.
	Dynamic	*Audiovisual*	The installation involves video diffusion.
		Mechanical Choreography	The installation involves the motion of visible elements.

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