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“EAR OPENING”: CONCEPTUALIZING AUDITORY REPRESENTATIONS IN SERVICE DESIGN

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ABSTRACT
Many design practices rely heavily on visual and enacted representations, and service design is no exception. Sounds are an inevitable part of a service. As an integral part of a servicescape, they provide cues for action and signal how we interact with the environment. This study explores how auditory representations can be used for the purpose of developing a more holistic and nuanced understanding of service experience through a conceptual exploration that integrates literature with empirical insights. The study contributes to the growing knowledge about service design by suggesting that auditory representations can be approached from the perspectives of sense-making, design work practices and creating auditory representations. It is also argued that these perspectives are implicated by and have implications for ontological, epistemological, and methodological dimensions in service design.

INTRODUCTION
Design is a predominantly visual discipline. This is particularly evident in service design, where using visual representations throughout the design process (Segelström, 2009) is indispensable in designing for many intangible aspects of service experience. Visual representations are often used to communicate and articulate insights, and maintain empathy during the design process, whether they are summarizing the current or proposing the future service (Blomkvist and Segelström, 2014). They also play an important role in co-design activities where designers, users and other stakeholders participate in exploring, ideating and prototyping future service (Steen et al., 2011). Thus, they have a valuable function of supporting the various stages of the design process by evidencing the intangible aspects of service and enabling shared understanding and communication among the different actors involved (Diana et al., 2009). However, relying predominantly on visualization can not only become exclusive but is often reductive to understanding the overall experience, especially in service where all senses play the part in its constitution and evidencing (Shostack, 1982). Although simulating embodied and multisensory service experience through performative approaches such as theatre (Fragnière et al., 2012; Laurel, 1991) and techniques such as bodystorming (dos Santos et al., 2018; Oulasvirta et al., 2003) can be beneficial, a critical reflection about the dominance of the visual and its limits in representing and evidencing the service experience remains understudied.

With these challenges as a backdrop, our study seeks to explore the role of sound in service design. Specifically, we our research question is “how can sonic representations be conceptualized to inform designers’ understanding of service experience?” Sounds are an inevitable part of a servicescape; whether they are there with a purpose, such as background music in a cafe, or as a consequential sound, such as a hissing of a coffee machine under operation, they provide cues for action and contribute to the overall experience (Morin et al., 2007). Also, people experience sounds in relation to its temporal and spatial dimensions (Fonseca, 2014), which is distinctly compatible with the emergence of the experience in servicescapes (Woermann and Rocka, 2014).
2015). Drawing on the interconnectedness between the two, we argue that representations in service design can benefit from being extended into the auditory sphere. Following an empirical exploration of sonic representations in 3 different empirical settings, we provide an overview for conceptualization of auditory representations in service design.

LITERATURE REVIEW

REPRESENTATIONS IN SERVICE DESIGN

Service design has been cited as a highly visual design discipline (Holmlid, 2007). Visual tools such as service blueprints (Shostack, 1982, 1984) have been known and adapted over time. While there is an emerging body of research on visualizations, the development of and discourse on visual representations in practice is thriving. Several books and digital repositories have an extensive listing of visual representations amongst others (see e.g., Miettinen, & Koivisto, 2009; Stickdorn et al., 2011; Stickdorn et al., 2018). Given this emphasis on the visual, it comes as no surprise that visual aesthetics should be a significant part of the service design skillset (Roxburgh & Irvin, 2018). One of the goals of visualization is to make services tangible and visible (Kimbell, 2009). Visualizations support articulation and communication of insights from data, help maintain empathy and capture the customer experience (Segelström, 2009, 2010). They may also be used to represent current and future states, facilitate explorative and evaluative learning, and to create shareable items of thought (Blomkvist & Segelström, 2014). Visual representations are often used in various parts of the design process although some research claims such methods may be most suited to the exploration stage of the design process (Li et al. 2016).

The use of a specific type of visualization is to a considerable extent dictated by the nature of user data and the intended audience (Segelström, 2010). By externalizing ideas, visualization methods can overcome some of the challenges of designing collaboratively. Using a visual language when collaborating can facilitate conversations and development of shared understanding if the communicative meaning is assigned by those who use it (Overkamp & Ruijs, 2017). Based on the level of iconicity (abstract vs. realistic) and their relation to time (synchronic vs. diachronic), design researchers have proposed four visual archetypes – maps, flows, images, and narratives (Diana et al., 2009) with reference to their purposes, features, and languages. This distinction also underscores the balance in using abstractions to support the description of complexity versus realistic representations to make more intangible aspects like atmosphere and experience visible. However, visual tools are limited in capturing the diversity and richness of service experiences, since they are often focused on making specific details accessible and tangible. Diana and colleagues (2009) critique the inability of visual representations to fully capture what a service is in a unique, synthesized view, the aesthetic dimensions of a service experience and human behaviors. However, inclusion of different modalities that support and inform visual representations in service design has been limited (Aguirre-Ulloa and Paulsen, 2017).

Some of these shortcomings may be addressed by other design methods and tools. Kimbell (2011, p.300) calls for a shift towards “situated, embodied material practices”. Using material and generative tools can help uncover tacit and latent knowledge (Sanders & Stappers, 2012), and support embodied cognitive processes (Clatworthy, 2011). Using other making approaches such as cultural probes (Gaver, Dunne & Pacenti, 1999) and generative toolkits allow participants to draw their own interpretations and create expressive artefacts (Sanders & Stappers, 2014). Others have also explored the use of materials for a multi-sensory approach to understanding relationships and creating a shared language around these relationships (Aguirre-Ulloa and Paulsen, 2017). Design researchers have also called for development of methods that draw on embodied cognition (Christensen, 2017; Lindgaard, & Wesselius, 2017). Ongoing methods such as bodystorming, service walkthroughs, and roleplays are interactive, constantly changing depending on participation, and increase immersion and experience (Blomkvist, 2016). They allow for the exploration and knowledge generation of how whole services should be implemented including the connections between touchpoints, composition, continuity, and consistency of services (ibid). Embodied methods can also spark aesthetic disruption, “a sensory experience that challenges actors’ existing assumptions about a situation, as a central catalyst for changing habitual action” (Wetter-Edman et al., 2017, p. 6). Aesthetics and aesthetic knowledge play an important role in design methods and practice (Stephens & Boland, 2014; Tonkinwise, 2011). Aesthetic knowledge is “what we know about a problem or a situation through our bodily senses of sight, sound, taste, touch, and smell” (Stephens & Boland, 2014, p. 2). However, while the embodied material methods and tools mentioned leverage aesthetic knowledge, they often emphasize touch and other bodily aspects. The discussion of sound as a sensory, aesthetic mode of knowing is almost absent in service design. This is curious since sound in some form finds itself present in service as an integral part that provides cues for action e.g., ringing a bell to gain the cashier’s attention or as ambient noise e.g., music played in a coffee shop. Given the role that sound can play in the servicescape, it is important that designers tap into this modality to inform their problem-solving and framing efforts. While service designers need not be expert sound designers to acknowledge and
understand the importance of sound in service experience, exploring sound in relation to service offers opportunities for alternative ways of constructing meaning. For this, developing aesthetic and critical listening skills (Fowler, 2013) is vital.

SOUND IN DESIGN PROCESS

While its use in service design is limited, sound is an important part of design artifacts and contexts of use including products, interactive systems, services and urban environments. Increasingly, design researchers argue for new approaches aiming to include different modalities in the design process to complement the dominance of the visual, and they often entail multidisciplinary knowledge. In the product design domain, a multi-sensory design approach is concerned with product development where sensory immersion and knowledge informs design decisions throughout the design process (Schifferstein, 2011). The aim is to create new ways of contributing to the overall user experience through appropriate sensory stimulation (Godoy Cortés et al. 2018, Moussette and Fallman, 2009, Schifferstein and Desmet, 2008). In that sense, multi-sensory design approach is concerned not only with integrating sounds as a function of the product, but also with using sound for reflective purposes during the design process. Another design discipline closely related to the auditory sphere is sonic interaction design. Drawing on multidisciplinary knowledge such as human perception, cognition, and computing the focus is on the auditory aspect of interaction design including how sounds can be designed to moderate interactions with the environment and create cues for action (Rocchesso and Serafin, 2009). These approaches are often focused on the instrumental character of the sound and its functional qualities. However sonic interaction design is also developing methods exploring interaction guided by sound that is interconnected with embodied cognition and has consequence for both individual and social experience (Caramiaux et al., 2015). This is in line with Delle Monache and colleagues’ (2018) recent call for a shift towards a sound-driven design practice that would reflect its human-centered and embodied nature in extending the creative possibilities for design solutions. This also includes exploring sound as a representation.

Questions of meaning related to the auditory experience are of central concern in sound related design practices, especially if they act as interfaces. Auditory perception is not only influenced by the temporality of the sound, but also by the spatial and embodied dimension. Gaver (1993) differentiates between musical and everyday listening, where the former is connected to the properties of sounds themselves, and the latter with the sources of sounds in space. These properties are often defined as loudness, timbre, pitch and duration (Taylor and Campbell, 2001). However, interaction with sounds is often characterized by the socio-cultural layer and the extent of their presence in a certain soundscape. For example, Fowler (2013), characterizes soundmarks (culturally significant and unique sounds) and keynote sounds (continuous and frequent, forming a sonic backdrop) in a soundscape as a way to provide analytical categories for mutual understanding of a soundscape, which is a necessary step in being able to design it. This suggests that there are opportunities to become more aware not just about sounds themselves but also their situated nature that can be accessed through critical and attentive listening and shared language.

These considerations are important in the context of designing with sound and using sound as a representation and analytical tool since they can provide a broader space for exploring, understanding, and representing the service experience. Although, sound as a design material might require expert knowledge in how it might be used for visual representation, it also provides space for listening, as a new way of seeing and experiencing. In service design, design material evolved from touchpoints and interfaces to institutional configurations involving many actors (Vink et al., 2021). Service design methods and tools can visualize both static and dynamic service interactions, but the question remains how well they can represent more idiosyncratic qualities of service experience (Diana et al., 2009). While Kustrak Korper et al. (2020) have proposed a systematization of sonic representations, sound has not yet become an established material in service design methods and tools.

METHODOLOGY

To explore the potential of auditory representations in service design, we have used systematic combining as an abductive methodological approach that allows for continuous reflection between theory building and the empirical context (Dubois and Gadde, 2002). Systematic combining is a methodology that is considered appropriate in more generative case study research where “theoretical framework, empirical fieldwork, and case analysis evolve simultaneously” (Dubois and Gadde, 2002, p. 554). Given that our empirical setting for exploring auditory representations was both longitudinal and aimed at exploring different types of representations that would inform our conceptual development we deemed this approach suitable.

Table 1: Summary of the study’s empirical settings

<table>
<thead>
<tr>
<th>Type</th>
<th>Empirical setting 1</th>
<th>Empirical setting 2</th>
<th>Empirical setting 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital workshop</td>
<td></td>
<td>Studio based sessions</td>
<td>On-site workshop</td>
</tr>
</tbody>
</table>
**Aim**

Test and experiment with sonification\(^1\) of visual representations to uncover practice-based insights that can serve as a starting point for building a conceptual framework.

**Dissect different aspects of using sound in service design; continue experimentation and testing to access emerging themes for conceptual framework.**

**Using specific auditory representation(s) to verify categories in conceptual framework.**

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**Table 1**

<table>
<thead>
<tr>
<th><strong>Duration</strong></th>
<th>2 hours</th>
<th>6 x 2 hours</th>
<th>2 hours</th>
</tr>
</thead>
</table>

**Number of participants (excluding facilitators)**

| 13 | 18 | 2 |

**Participant profile**

| Design academics and professionals | Design master students | Design academics |

**Types of representations sonified**

| Blueprint, journey map, storyboard | Sound map, sonic postcard, sound canvas, customer journey, service storyboard, storybraid, desktop walkthrough | Sound map, sonic postcard, journey map, design scenario |

**Data collected**

| Workshop recording | Facilitators’ notes from individual sessions | Recorded sound representation(s) during sessions |
| Textual data from chat | Recorded sound representations during sessions | Students’ reflection essays |

Thus, this approach involves the interplay between the theory, a conceptual framework, empirical context, and a specific case.

In this study, we have based our initial research question on the concepts and theories primarily related to visual representations in service design as well as selected literature related to the role of sound in design. This has also informed the initial direction of the conceptual development. In this study different types of representations that are part of the service design toolbox are considered a case, while the empirical context was spanning across three major empirical settings from February 2021 until June 2022. The empirical settings involved two 2-hour long workshops with design professionals and/or academics and six 2-hour studio-based sessions with design master students from a Swedish university. Table 1 summarizes the main aspects of each empirical setting. Picture 1 shows several visual representations that were used in the sonification process.

![Picture 1: Visual representations in sonification process](image)

Although all three empirical setting had specific aims the general purpose was to explore sound as a representation medium, sonification as a method and to spur discussion on knowledge and insights this can elicit in service design. These discussions and reflections have then served as a starting and progression points for further conceptual development along the entire research and analysis process.

It was also important to ensure that in each empirical setting participants were introduced with the main aims of the workshop/sessions. Therefore, since they were mainly exploratory, the sonification process was kept as open and as collaborative as possible to accommodate participants with diverse perceptions of their own musicality and musical expertise. We assumed that exploring sound in such a way might lead to a certain level of discomfort among participants unsure of their own musicality as we did not require any prior formal experience in sound or music making. Thus, our aim was to provide a common ground for understanding sound elements as a design material but leave enough space for improvisation during the sonification.

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\(^{1}\) In this study we use the term sonification more as alayman term that implies soundmaking in general, rather than a *terminus technicus* as it is used in sound design and engineering.
activities. These elements consisted of rhythm, pace, volume, pitch, density, and timbre that participants could combine while sonifying their visual representations. They were treated both as design material as these elements were used in the process of sonification, and as structural properties that enabled participants to analyse, communicate and make sense of auditory information they experienced.

Regarding the structure of empirical settings, it followed the logic of sensitizing, experiencing, and reflecting. Both workshops involved a warmup activity, a central sonification activity and a discussion and reflection part. In the studio-based sessions, activities followed a similar pattern of gradation, but included more representations to be sonified due to structure and allocated timing.

Due to the exploratory nature of this study we have used deductive reasoning as well as a qualitative approach in analyzing our data (Charmaz, 2006, Dubois and Gadde, 2002). The data collected were of various types, but was dominantly focused on facilitators’ workshop notes, recorded auditory representations (that were accompanied with facilitators’ memos) and participants’ reflections. Table 1 provides a detailed summary of data that was collected in each setting that was included in analysis. Regarding the data analysis, first we have coded the textual data using open coding individually between two co-authors. Then in a joint session we have discussed and refined the codes to account for reliability of the data. After that we used axial coding to group and categorize our codes while discussing and reflecting on emerging themes. The results are presented in the following section.

RESULTS

We consider this study a starting point to understand how sound can be understood as a representation in service design. Thus, we consider these results as a preliminary but indispensable step in answering our research question and refining our conceptual framework that can serve as a blueprint for further investigations. Our findings reveal that sound-driven representations evolve around three dominant themes: sense-making, related to the shared understanding of auditory representations; working, related to the practice of building a repertoire of auditory representations, and creating; related to the practice of designing with sound to inform the representations. On a more abstract level these themes connect to different dimensions of this conceptualization, namely the ontological, epistemological, and methodological in service design. They are described in Table 2.

The sense-making theme is connected to the ontological dimension and reflects how sounds are understood and interpreted as well as what kind of meaning they elicit. Our results reveal that sense-making is relational but can be triggered by various cues dependent on situated or cultural context in experiencing sound. These cues can elicit emotional response such as discomfort or fun and create a sense of intimacy or novelty in experiencing the sound. Context specific and cultural perspective seem to also influence how these cues are shaped, while shared language of experiencing representative and ambient sound can create a common ground for sense-making.

The working theme is connected to the epistemological dimension and the way we choose to work with sounds in the design processes. This theme is connected to the shared understanding and sense-making in using sounds, but it is more closely concerned with the questions of the nature and scope of the sound in relation to personal capabilities in engaging with the sound. In that sense it assumes an existence of established understanding and agreement about the possible roles sound might play in representing service experience; namely in expressing and eliciting emotions, supporting shared understanding, giving service cues, and creating conditions for action.

The creating theme seemingly resembles the working theme, but this one refers closely to the methodological considerations of auditory representations, such as making the shared repertoire of tools and methods that support the design process based on how we decide to use the auditory representations. This theme consolidates different dimensions of sounds that are being used as an auditory material for representations (e.g., using objects to produce sound elements such as rhythm and pace in sonifying a customer journey) or as representations in their own right (e.g., recorded ambient sound of a hospital waiting area).

DISCUSSION

Our findings show there are several implications related to the sense-making, working, and creating with sound. These implications are interconnected, and this study only provides an initial delineation for the three. First, there is a need for a common language and understanding of sound as a design material that can serve as a representation or an analytical tool. Experiencing sound is an embodied action, whether it refers to listening or producing sounds.
Table 2: Conceptual framework with illustrative quotes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Dimension</th>
<th>Guiding questions and description</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense-making</td>
<td>Ontological</td>
<td>How might sound make visible or help surface latent or tacit aspects of experience? What kind of aesthetic disruption might sound elicit? Related to meaning making. Allows one to distinguish between sounds that are integral to the service experience versus organic and/or ambient sounds. Understanding could be subjective or shared depending on the situated or cultural context.</td>
<td>“I've found it to sort of zooming out on the process because the process of sonification is like completely new to me, in this way. And we didn't necessarily have shared... and nor did we need, but we didn't have shared understanding on that. It's like one of those rare moments where you're like Oh my God this must be what it’s like when we get people to do it... when I get people to do a journey map for the first time ever, right?” P7</td>
</tr>
<tr>
<td>Working</td>
<td>Epistemological</td>
<td>How might sound help us interpret and understand people’s experience? How can the use of sound in design processes translate to better experiences? How do we decide what sounds should be included in the service and the sonified experience? Allows us to use sounds to express and elicit emotions, support understanding, give service cues and create conditions for action. Working with sounds requires a spectrum of knowledge depending on how it is being used.</td>
<td>“So, all work I do is and with age, care and health and so you know that being of machines and the sound of of cooks and cleaning and things, how can that be designed in a certain way that becomes a lot more pleasant for a person in a residential aged care.” P12</td>
</tr>
<tr>
<td>Creating</td>
<td>Methodological</td>
<td>How do we make the sounds? How do we decide what sounds should be included in the sonification? Creating a vocabulary or shared language for making sound. This could be supported by specific tools and methods that enable making. Making is related to the methodological level. It is about knowing how to use sound to describe different parts of the service or experience— e.g., tempo, pace, density, texture, etc.</td>
<td>“There's also a pace that we’re also thinking about as well and what it means at least and how that runs for two different people in two different times of the day at the same time. I think when a member of the team brought up an interesting point around the different heartbeats between a very young person and a very old person which are different beats and a percussion, you’re hearing at the back sort of represents that in some ways if we're tying that back to elderly and well-being as well” P5</td>
</tr>
</tbody>
</table>
Additionally, meaning of sounds is socially and culturally negotiated and constructed which requires service designers to become not only aware of the auditory sphere, but also critical of their own assumptions in facilitating meanings. Participants in the empirical settings have brought up the socio-cultural aspect of sounds very early in the discussions about shared understanding of sounds. This suggests that because sounds are so fundamentally connected to how people experience their environment, but also have a distinct aesthetic and cultural dimension, they can serve as a gateway for a more connected and inclusive understanding of other peoples’ experience.

Our findings also show there is creative tension when working with sound. It spurs creativity though play and experimentation, but it can also create tension. This tension stems from feelings of discomfort and intimacy while working with sound as an unexpected and new, unfamiliar design material. While designers have been taught visualization skills and are comfortable working with this medium, participants often expressed hesitancy in sonifying the visual representations. It also creates the notion that a certain level of capability and expert confidence is necessary to be able to engage in sonification activities, especially if they are collaborative. Therefore, service designers would need to not only hone their critical listening skills but also plan and practice their experimentation with auditory representations. This also has implications for design pedagogy. Educators could consider introducing auditory explorations within design studies and allow students to exercise their aural imaginations. Service design project courses could further trial techniques like sound diary and soundwalks as a means for activating new vocabularies and languages that incorporate sound qualities and sounding environments (Fowler, 2013). This will also develop students’ critical listening skills. Although this was not the main focus of our second empirical setting, generative design experiments can be conducted together with students to explore how auditory representations might enact aesthetic disruption.

Our findings show that as with visual representations working with sound would benefit from the development of a shared language by those using it. This is particularly relevant in co-design situations where designers and non-designers work collaboratively. Introducing sonification to the co-design process may also enable those who do not rely on visuals to participate in the creative process. At the very least, it provides a springboard to develop more inclusive tools and methods when designing. Participants discussed how the use of sound might be used to capture and convey emotions. They also brought up how they paid more attention to the mood of the visual to sonify it. As a form of representation, it would then be possible to communicate insights related to emotions and experiences as well as maintain empathy.

Soundbites or sound postcards can be recorded from existing service locations to represent the current soundscape. Similarly, designers could create soundboards as auditory equivalents of moodboards to delve into soundscapes and the auditory experience they wish to create in future services. From this study, it is still unclear how auditory representations may facilitate evaluative learning. However, four participants specifically mentioned that switching to a different form of representation acted as a “circuit breaker” that nudged them out of “patterned thinking”. This can be viewed as a form of aesthetic disruption that allows participants to question their own assumptions.

When discussing how they approached the actual creation, participants also reflected on the temporal aspects that could be captured through sonification. In comparison to visual representations, time is represented differently through auditory modality as it is at no point static in the way visualizations are. As one participant emphasized, being attuned to sound can create a space for a deeper critical reflection on what it means to be efficient when designing for a service. Using sound elements such as pace, rhythm and density, the sense of temporality can be translated both to the individual experience and systemic structure of the service. Moreover, temporality of sound enables simultaneous representation of experiences that can uncover tensions in synchronicity. Additionally, sound and music elements might also vividly represent relational rigidities such as difference in pace or rhythm related to the individual service experience or more or less harmonious outcomes of service interactions. All these tensions are usually unattainable in visual representations and might go unnoticed. Aesthetic auditory knowledge can allow for iconicity of representation. For instance, one of the groups in empirical setting 1 used fast and slow heartbeats to denote the different timelines for a young and old person respectively and coupled this with their wellbeing.

While this study presents a novel take on auditory representations in service design it is not without limitations and challenges. The ability to create sounds was contingent on the affordability of objects that participants had at hand and their own motivation to participate. In all participant settings participants were given or instructed on visual representations that they then had to sonify. The translation aspects in this study might be more salient due to this aspect since participants did not produce the initial representation themselves. Future research could investigate how sound might be used independently to create a representation. While all participants were familiar with or had some background with service design the same cannot be said for their musical skills. Some participants were better equipped to understand the more technical aspects of sonification due to their background in music.
or sound engineering. This could have impacted the sonification process and group dynamics foregrounding the expert-novice capability discussion.

**CONCLUSION**

This study presents the results of a study spanning across three empirical settings and brings fresh insights on the ramifications of using sound in service design for sensemaking, design work practices and creating auditory representations. The theoretical contributions of this work lie in the demarcation of the ontological, epistemological and methodological dimensions related to using sound in service design. The value of this paper lies in conceptualizing auditory representations by connecting usage of sound and auditory experience in other design disciplines to service design. In doing so, it responds to calls for the utilization of aesthetic knowledge in design practice and methods. We hope that it will inspire designers, researchers, and educators to experiment with and make sonification and auditory representations a part of the service designers’ repertoire.

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